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Mahalingam Sundhararajan

Balaguru Karthik

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Preface

We are delighted to introduce the proceedings of the International Conference on Computing, Communication And Control System (i3cac2021). This conference has brought researchers, developers and practitioners around the world who are leveraging and developing People are using computers to perform different tasks quickly and easily. Along with time and effort it mainly reduces the overall cost to complete a particular task. Computer communications, a process in which two or more computers or devices transfer data, instructions, and information. International Conference on Computing, Communication And Control System.

The technical program of i3cac2021 consisted of 413 full papers, including 8 invited papers in oral presentation sessions at the main conference tracks. The conference tracks were: Track 1 – Computer Networks; Track 2 – Advanced internet technology; Track 3 – Control theory design and applications; and Track 4 – Computer architecture and embedded system . Aside from the high quality technical paper presentations, the technical program also featured two keynote speeches, one invited talk and two technical workshops.

Coordination with the chairman Dr.Sandeep Anand, Bharath University and Vice-Chancellor Dr. Prof. K. Vijaya Bhaskar Raju**,** Vice Chancellor, Bharath University was essential for the success of the conference. We sincerely appreciate their constant support and guidance. It was also a great pleasure to work with such an excellent organizing committee team for their hard work in organizing and supporting the conference. In particular, the Technical Program Committee, led by our TPC Co-Chairs.

We strongly believe that i3cac2021 conference provides a good forum for all researcher, developers and practitioners to discuss all science and technology aspects that are relevant to communication and control systems. We also expect that the future i3cac2021 conference will be as successful and stimulating, as indicated by the contributions presented in this volume.

Dr. Sundhararajan Mahalingam , Pro-Vice Chancellor (Academics)

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Storage Capabilities in Underwater Wireless Sensor Networks for Energy Balancing and Channel Alignment

K Sureshkumar[1], Murugananth Gopal Raj[2], M Selvi[3], D Karunkuzhali[4], B Meenakshi[5]

{m.k.sureshkumar@kluniversity.in[1], gmuruganantth@gmail.com[2], selmanju2005@gmail.com[3], karunkuzhali@gmail.com[4], meenakshi.eee@sairam.edu.in[5]}

[1]Assistant Professor, Department of Electronics and Communication Engineering, Koneru Lakshmaiah Education Foundation, Andhra Pradesh, India., [2]Professor & Head, Department of Electrical and Electronics Engineering, Ahalia School of Engineering and Technology, Palakkad, Kerala, India., [3]Assistant Professor, Department of Computer Science and Engineering, Sathyabama Institute of Science and Technology, Chennai, Tamilnadu, India., [4]Professor, Department of Information Technology, Panimalar Engineering College, Chennai, Tamilnadu, India., [5]Professor, Department of Electrical and Electronics Engineering, Sri Sairam Engineering College, Chennai, Tamilnadu, India.

Abstract. Underwater sensor node overflow occurs when large amount of sensory data is already stored and it is unavailable to obtain new data when an event happens. This misalignment tends to partitioning of individual node from networks in reporting information to sink. Resilience of individual node to recover from overflow considering channel and storage capabilities is needed. This work tries to avoid unnecessary transmission of the overloaded node. The contemporaneous work of storage and transmission is stated to improve energy efficiency in the desired work using DBR Bayesian network. Two slice Bayesian network is constructed for every node for calculating conditional probability distribution to resurrect links. Number of transmission is being improved considering the facilitation of nodes storage and transit duration reducing the overall energy consumption of a node by constraining unnecessary transmissions.

Keywords: Underwater Sensor Node Storage Capacity, Bayesian Network, Energy Cost.

1 Introduction

Categorizing underwater sensor networks coarsely divided into “lab level” (used for initial testing), “short term” (provides easy transition to emulation, real time test beds) and “long term” (deployed for real time test beds with access control) [2]. This work focuses on lab level works for simulation using aquasim [4] with NS2 simulator. Fixed retransmission timeout implemented in underwater sensor nodes fails due to difference in round trip times which results in failure affecting the network throughput. The process of predicting the retransmission time via “Bayesian algorithm” increases the throughput performance [3]. The impact of changing distance due to sensor mobility and its transmission load which imbalances the node energy is investigated. The work focuses on triangulation to impose

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proper networking in recovering the new location coordinates of sensor with its two nearest neighbours [9]. However, accurate information transfer is difficult if its storage capacity exceeds before channel acquisition resulting in losses. In [10] link factor indicator which judges the transmission path based on threshold values assigned with connectivity is discussed. The work ensures hop link with the astute energy and its time coordinates using link grain metrics. Significance of link resurrection with minimal energy and matching shaky link the higher energy for transmission is dealt. The depth based routing (DBR) [1], comprises of the communicating sensor to choose another sensor for forwarding packet considering the closest distance to sink. In addition, other terminologies such as buffer to avoid same repeated forwarding of same packet are present. However, the protocol does not characterize the forwarding node storage capacity, the independence of the node to other nodes associated via the same communication range. In [13] works of DBR has been extended to ensure energy balance in two hop neighbours. In the proposed work "Bayesian network" which upholds the variable factors in predicting the edges are taken for probabilistic method in calculating channel offset. The proposed work discovers the full joint probability of nodes via directed edges. Thus portioning of nodes which are not associated in forwarding has not been contributing to the conditional probability.

Organization of this research paper has been denoted as follows. Section 2 deals with the related discussions on the resource and its overhead to establish networking in underwater. Section 3 denotes algorithm for constructing wireless underwater communication. Section 4 deals with results of simulation via aquasim and NS2. Section 5 concludes the work.

2 Related Works

Message dissemination algorithms discussion states that the possibilities of newer packets to be lost when compared to older ones. The dissemination probabilities with and without storage overflow has been discussed [5]. The algorithm in [5] states that nodes are perfectly synchronized and mobility alone is discussed with dissemination process. However, there may be losses which occurs when mismatch in time occur during dissemination process. Dual modules of quantum key sharing and acoustic communication for networking has been discussed with measurement basis. The protocol preserves for network security attacks with quantum states [6]. The simulation with wireless multi-hop communication using acoustic and quantum leads to entangling increased the overhead.

Predicting the energy consumption for sensor nodes [17-20] by making a non stationary signal to a stationary form is being done with Auto Regressive Integrated Moving Average [7]. The estimation is done posterior to calculations of data transfer where relationship which influence the fluctuations such as channel response, back off time are not considered and only statistical characteristics are alone inferred. In [8] discussion on the influence of misalignment with optical communication has been studied considered beam divergence in transmitter. The maximum allowable offset calculation has also been done in varying in underwater channel via simulations to validate the bandwidth and its corresponding distance of transmission.

Topological discovery process states that MAC layer takes time to acquire network wide topological coordinates which results in initial packet losses. Hence, the algorithm in [11]

incorporates two timers: namely transmission timers and wait timers to ensure minimal packet losses occur. However, the results are achieved for half duplex communication. Sink based reservation using SQ- MAC has been stated in [12]. It ensures the uplink from mobile and static sensors achieves increased access probability and reduced access delay using Ant colony optimization techniques. The discussion of error prone channel has not been considered in SQMAC. In [14], Triangle Formation has been proposed to achieve reduction in measurement errors using rigid graph structure. Compensation error with distance coordinates and periodical synchronization provides appropriate. However, time slice in forwarding is pivotal for networked data transfer. Funnelling effect of one hop neighbour node of the sink with focus on failure and repair times has been discussed using "Weibull metrics" [15]. The discussion of event and its transit duration is not been focused and it considers only delay bound on event reporting. In [16], the physical feature of discriminating the successful transmission from channel error and collision with feedback based approach is discussed. However, calculating channel error probabilities of all nodes may increase the latency of sensor data.

2.1 Problem Definition

Initial storage capacity of a node varies in the process of forwarding sensory data and occurrence of an event. So as the data transit takes place retrieving the resources as time evolves provides lesser retransmission, faster access. The conventional process incurs lot of overhead to minimize the collision, underwater medium access. The process of analysing the interdependence between nodes associated for data transit is needed to bridge the gap.

3 Research Methodology

3.1 Algorithm applied Depth Based Routing-Bayesian Network

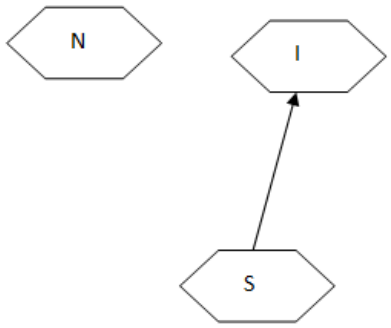

Fig. 1. Source and interlinking forwarder scenario

A scenario for source node (S) and its two forwarder the not eligible forwarder is denoted (N) and eligible forwarder denoted using (I). Since, both are in communication range this has been written as in equation 1.

$$P(N,S,I) = P(N)P(S)P(I|S) \quad (1)$$

Variability of multiple forwarders at the interlinking node I and its connectivity to sink has been shown in figure 2. The sink is denoted using K and the other channel to the interlinking node is denoted by using (C) from another sensor.

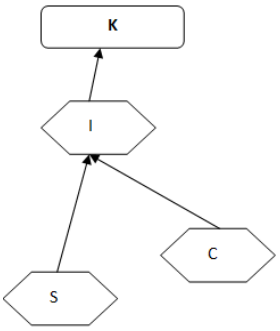

Fig. 2. Source node, interlinking forwarder and sink scenario

The equation 2 denotes the criteria of forwarding based on interlinking node receives packets either from S or C noted as below.

$$P(S,I,K,C) = P(S)P(C)P(I|S,C)P(K|I) \tag{2}$$

Inference of the unknown storage capacity of interlinking node (I) fails due to the temporal mismatch since nodes do not estimate the variable as time changes. Hence, measure time at discrete intervals and forwarding is needed. This is modelled by equation 3 as below.

$$P\left(A^{(0,T)}\right) = P\left(A^{(0)}\right) \prod_{t=0}^{T-1} P\left(A^{(t+1)}\middle|A^{(0:t)}\right) \tag{3}$$

In equation 3 the chain rule of probabilities is used where the chain rule of probabilities is represented as present step of link is the only factor which determines the next step of link. This has been written using equation 4 where in $A^{(t)}$ denotes present step.

$$P\left(A^{(0,T)}\right) = P\left(A^{(0)}\right) \prod_{t=0}^{T-1} P\left(A^{(t+1)}\middle|A^{(t)}\right) \tag{4}$$

There are two time slices associated in forwarding in figure 2 the first is communicating links between S and C to I named as “Inter time slice” and the second is “intra time slice” also known as the computational time in forwarding to sink node.

Every node checks the number of neighbours associated along with the ingress and egress channel. The storage capacity of a sensor node is fixed. The ingress of channel from source node is modelled with fully conditional joint probability distribution at the forwarding node as in equation 2 and its associated time slice as in equation 3. Then depending on the present state of node the process of transit or refrain of packets is done as in equation 4.

4 Results and Discussion

The result of constructed algorithm is simulated via software NS2 enabled with Aquasim patch [4]. Discrete event simulator time slices are preset assuming there is no nodal mobility. The aquasim consists of inbuilt depth based routing protocol.

Table 1. Parameters used for simulation in NS2.

Parameter	Values
Deployment Area	600 × 600 m^2
Maximum number of sensor nodes	200
Initial Energy of sensor	5 J
Initial Energy of sink	10J
Transmit power of sensor	1 W
Receive power of sensor	0.30 W
Nodes Storage capacity	150 KB to 250 KB
Total simulation duration	1500 s

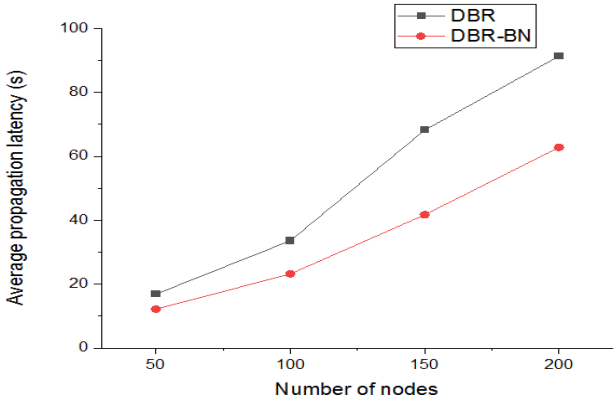

Fig. 3. Average propagation latency versus number of nodes.

In figure 3, the average propagation latency is plotted against the scalability of nodes. Since the intra computational time of storage capacity and the inter communication time of channel access is improved in DBR-BN the protocol has reduced average propagation latency.

$$Total\ energy\ cost = Total\ Intial\ energy\ of\ sensor\ nodes - Total\ Residual\ energy\ of\ sensor\ nodes \quad (5)$$

In figure 4, the DBR-BN protocol energy cost is calculated with varying storage capacity of 150 KB, 200 KB and 250 KB. It states there is a considerable energy cost is reduced is sufficient storage capacity is available. However, certain nodes nearer to event, sink suffer from overflow so the diverse storage and its influence of energy in measured for DBR-BN.

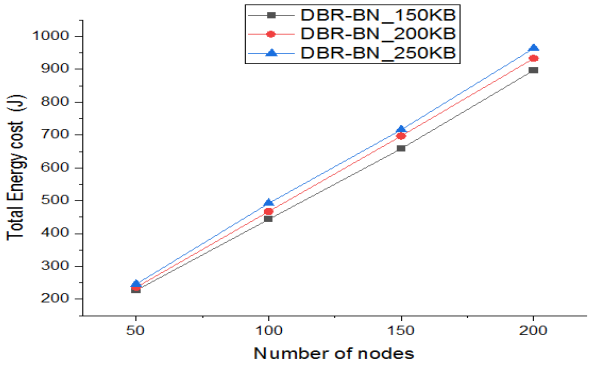

Fig. 4. Total Energy cost versus number of nodes

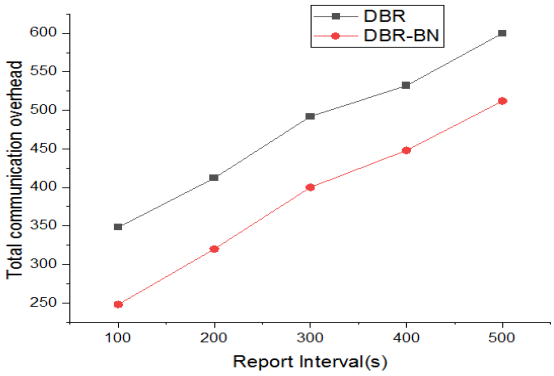

Fig. 5. Total Communication overhead versus Report Interval

In figure 5, the consolidated communication overhead by sensors and sink is calculated in for the proposed DBR-BN and existing protocol. The results states the unnecessary and untimely transfer of control packets is alleviated in DBR-BN.

5 Conclusion

Thus the evolving traffic flow of data was matched using the conditions of two time slices ensuring maximum utility of sensors across the network. DBR-BN the time dependant nature of sensor node its link and storage capacity is improved in quicker recognition time. The intra computation time for nodes storage and inter computation time for transit reduces the retransmission which preserves the total energy cost. In addition, the average channel access using full conditional probability reduces the average propagation latency without much overhead packet exchange. Future work will deal in resilience of a network to communication partitioning and response time of sink in balancing overflow.

References

[1] Yan, H., Shi, Z. J., & Cui, J. H. (2008, May). DBR: depth-based routing for underwater sensor networks. In International conference on research in networking (pp. 72-86). Springer, Berlin, Heidelberg

[2] Luo, H., Wu, K., Ruby, R., Hong, F., Guo, Z., & Ni, L. M. (2017). Simulation and experimentation platforms for underwater acoustic sensor networks: Advancements and challenges. ACM Computing Surveys (CSUR), 50(2), 1-44.

[3] Chen, Y., Ji, F., Guan, Q., Wang, Y., Chen, F., & Yu, H. (2018). Adaptive RTO for handshaking-based MAC protocols in underwater acoustic networks. Future Generation Computer Systems, 86, 1185-1192.

[4] Xie, P., Zhou, Z., Peng, Z., Yan, H., Hu, T., Cui, J. H., ... & Zhou, S. (2009, October). Aqua-Sim: An NS-2 based simulator for underwater sensor networks. In OCEANS 2009 (pp. 1-7). IEEE.

[5] Liu, L., Wang, R., Xiao, G., & Guo, D. (2020). On the throughput optimization for message dissemination in opportunistic underwater sensor networks. Computer Networks, 169, 107097.

[6] Ma, H., Teng, J., Hu, T., Shi, P., & Wang, S. (2020). Co-communication Protocol of Underwater Sensor Networks with Quantum and Acoustic Communication Capabilities. *Wireless Personal Communications*, 1-11.

[7] Anand, J. V., & Titus, S. (2017). Energy efficiency analysis of effective hydrocast for underwater communication. International Journal of Acoustics & Vibration, 22(1), 44-50.

[8] Khalil, R. A., Babar, M. I., Saeed, N., Jan, T., & Cho, H. S. (2020). Effect of Link Misalignment in the Optical-Internet of Underwater Things. Electronics, 9(4), 646.

[9] Anand, J. V., & Titus, S. (2014, October). Regression based analysis of effective hydrocast in underwater environment. In TENCON 2014-2014 IEEE Region 10 Conference (pp. 1-6). IEEE.

[10] Ashraf, S., Raza, A., Aslam, Z., Naeem, H., & Ahmed, T. (2020). Underwater Resurrection Routing Synergy using Astucious Energy Pods. Journal of Robotics and Control (JRC), 1(5), 173-184.

[11] Zhao, R., Liu, Y., Dobre, O. A., Wang, H., & Shen, X. (2020). An Efficient Topology Discovery Protocol with Node ID Assignment Based on Layered Model for Underwater Acoustic Networks. Sensors, 20(22), 6601.

[12] Huang, J., Chi, C., Wang, W., & Huang, H. (2020). A Sequence-Scheduled and Query-Based MAC Protocol for Underwater Acoustic Networks with a Mobile Node. Journal of Communications and Information Networks, 5(2), 150-159.

[13] Zhang, M., & Cai, W. (2020). Energy-efficient Depth based Probabilistic Routing within 2-Hop Neighborhood for Underwater Sensor Networks. IEEE Sensors Letters.

[14] Wu, H., Yang, Z., Cao, J., & Lai, L. (2020). TRiForm: Formation Control for Underwater Sensor Networks with Measurement Errors. IEEE Transactions on Vehicular Technology 69(7), 7679-7691.

[15] Anand, J. V., & Sivanesan, P. (2019). Certain investigations of underwater wireless sensors synchronization and funneling effect. International Journal of Computers and Applications, 1-8.

[16] Shin, H., Kim, Y., Baek, S., & Song, Y. (2020). Distributed Learning for Dynamic Channel Access in Underwater Sensor Networks. Entropy, 22(9), 992.

[17] Vijayan, K., Ramprabu, G., Selvakumara Samy, S., Rajeswari, M. Cascading Model in Underwater Wireless Sensors using Routing Policy for State Transitions, Microprocessors and Microsystems, 2020, 79, 103298.

[18] Suganya, J., Selvi, G.T., Ohmsakthi Vel, R., Karunkuzhali, D., Ramprabu, G. A queuing theory based efficient approach for fair networking capabilities in underwater sensor nodes, Journal of Green Engineering, 2020, 10(10), pp. 8825–8837.

[19] Sivasakthi, T., Subashini, V., Nagaraju, V., Kumar, S.K.N., Ramprabu, G. An efficient energy conservative protocol in wireless sensor network, Journal of Green Engineering, 2020, 10(10), pp. 9933–9943.

[20] Premkumar, R., Balasubramaniyan, S., Pushgara Rani, D., Gnanasekar, A.K., Ramprabu, G. Efficient and safe application for facial transfer with deep generative adversarial network, Journal of Green Engineering, 2020, 10(10), pp. 8798–8812.

[21] Kiran Kumar, T.V.U., Karthik, B., Improving network life time using static cluster routing for wireless sensor networks, Indian Journal of Science and Technology, 2013, 6(SUPPL5), pp. 4642–4647

[22] Thamarai, P., Karthik, B., Kumaran, E.B., Optimizing 2:1 MUX for low power design using adiabatic logic, Middle - East Journal of Scientific Research, 2014, 20(10), pp. 1322–1326

A comprehensive study on Mental Health Problems caused by Online Social Networks.

R Vidhya[1], Nysa P Ginu[2], Rishma Mitra Dhar[3]
{vidhyar@srmist.edu.in[1], nysapginu111@gmail.com[2], rishmadhar45@gmail.com[3]}

School of Computing, SRM Institute of Science and Technology, Kattankulathur, Chennai, 603203 Tamil Nadu, India.[1,2,3]

Abstract. With the explosive rise in the development and popularization of social networking apps, Online Social Networks (OSNs) have now become a cornerstone of everyone's daily lives. Although OSNs tend to broaden the capacity of their users to increase social interactions, they may actually reduce users' real-world person-to-person dialogue. This decrease in the actual interaction can cause many mental health problems like Nomophobia, Phubbing, etc. In this paper, we try to learn about all the efforts made in this field to detect these mental health disorders. We review various literature available regarding the Mental Health Problems caused by Online Social networks and the methods used to detect them using Data Mining. These research works have utilized Regression Techniques, Support Vector Machine, Naive Bayes, etc to predict the outcomes. We further investigate their pre-processing, feature extraction, and classification processes throughout this paper.

Keywords: Mental Health, Online Social Networks, Data Mining.

1 Introduction

In the modern world where technology is expanding in an unprecedented way making our lives easier and coining new terms like "A global village" to describe the world which is brought together by the internet or other communication mediums. But as a coin has two sides, with this ease comes an ever-increasing issue of mental health which was not a major problem in yesteryears. The exponential rise in social networking adulation has led to troublesome use.

Studies point out that there could be heavy consumption, depression, isolation, and a myriad of other adverse ramifications of these psychiatric illnesses. These signs are essential components of diagnostic criteria which, resulting in delayed medical interventions, are typically passively observed today. Symptoms include (not limited to) excessive use of social networking sites or applications, typically characterized by loss of time perception or disregard of simple drives, and detachment when computer apps are unavailable. Today, the recognition of these possible mental disorders often passively lies in the hands of supervisors such as parents or educators. However, as there are only a few notable physical risk factors, medical or psychological services are not actively pursued by patients. Therefore, only when their symptoms become serious can patients seek therapeutic intervention.

This paper explores various research works and conference papers to expand our knowledge about the topics surrounding it and also the help that data mining and machine learning can

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provide to it. The technology and models relating to the detection and classification are further discussed. Our main aim is to understand the concepts which are implemented in the research works and gather the required information out of this topic.

2 Review of Literature

We looked up some of the studies done in order to explain the various models used in the prediction, identification, and classification of mental health issues triggered by online social networking sites.

Logistic Regression was used to understand the connection between suicidality and Internet addiction and behaviors in Taiwanese young adults. 9510 adolescent students chosen in Taiwan, with the help of the stratified random sampling strategy, were surveyed by I-Hsuan Lin et al [1]. Their proposal was to use the Chen Internet Addiction Scale to track the internet interactions of the participating students and assess their internet addiction, and then use logistic regression to moderate the impact of demographic attributes, parental support, depression, and self-esteem in order to figure out the correlation between suicidal thoughts and internet compulsion and actions. This research has shown that young adults with internet compulsion are more prone to having suicidal thoughts and actions and various types of internet behaviors often have different suicidal connections. Like online games, chatting, etc elevate the chances of having suicidal ideations while watching online news decreases it. The study had some drawbacks, such as the cross-sectional study design could not validate the causative link between suicidal behavior and internet addiction. Besides, the suicide assessment was based only on what the participants' reported.

Young Min Baek et al. [2] tested the effects of the usage of Social Media Platforms on the psychological health of its users'. Concerning subjective isolation, mutual trust, and SNS addictions, this psychological well-being was measured. They used the Korean national representative survey data to test this. To evaluate the psychological well-being of the users, they used the UCLA loneliness scale, Rotter's interpersonal trust scale, and the Korean Internet addiction scale - all updated and shortened for the SNS scope in Korea. On two forms of Social Media association as well as seven statistical controls, the outcome of the three parameters was regressed. This study distinguished reciprocal relationships from unidirectional ones. It also showed that greater dependence on parasocial SNS relationships is positively linked to isolation and mistrust, which are negatively related to dependence on social relationships. This also indicates that it is simplistic and impractical to take a homogenous view of the consequences of SNSs. This research did not have a psychological state of mediation between reliance on SNS interactions and psychological well-being measures and failed to implement causal terms.

Dhivya Karmegam et al.[3] discussed the practicality of using data obtained from SNS for psychological well-being monitoring as well as the methods used during disasters to deduce that. The Natural Language Processing methods were used for retrieving features in SOCIALmetrics and EMOTIVEmetrics. Moreover, the Multinomial Naive Bayes model was used to classify emotions from texts, and the Support Vector Machine was used to classify sentiments. The study had a few shortcomings. The first is that the entire population is not

reflected by the information collected from social media. Secondly, only a sample of tweets was collected due to the rules of Twitter API. Thirdly, the possibility that the place where the disaster happened and the person who tweeted have no connection cannot be ruled out.

A study that concentrated on understanding the different methodologies, ML algorithms, data outlets of Online Social Networks, and types of languages used to identify psychological health in Social Network Apps was presented by Rohizah Abd Rahman et al. [4]. It could be seen that the majority of the studies used Machine Learning Algorithms followed by questionnaires as the methods. Out of all the Machine learning, Naive Bayes, Linear Regression, Support Vector Machine, Random Forest, Decision Tree, Deep Neural Networks were the used machine learning algorithms out of which a vast majority used Support Vector Machine for mental health prediction. It was seen that most studies used the Twitter API as a type of data source and English as the medium used for the prediction of mental health. It was concluded that it has great potential for early mental health identification. The extraction of data from OSNs was difficult due to the account privacy policy enforced by most of the OSNs. This limited the available data for the research.

Thilagavathi P et al.[5] proposed a method for defining the mental stress states of consumers from their social network data on a weekly basis, using the content of tweets and their social interaction. To train the model, they employed Sentiment Analysis. Using real-world social media evidence, they analyzed the connection between psychological stress states and social engagement behaviors.

Quan Guo et al. [6] examined the issue of feature learning at the element and aggressive topic (AS) level for cross-media social data. They implemented CAE to study uniform modality-invariant attributes and suggested phases of At and PT to exploit large samples of cross-media data and train CAE to work on cross-modality correlation in social aspect of cross-media. Furthermore, they used CCAE, which is centered on the CNN system together with the social AS management CAE filters. The learned AS level features and local connection patches in CNN were found to be much less sensitive to outliers. It had a set of drawbacks which included abnormal data, empirical raw features, and unreliable labeling.

Huijie Lin et al.[7] suggested a method for automatically detecting stress using cross-media data from microblogs. To draw up the issue, they created a three-level architecture. Firstly, they rummaged through tweets to get a bunch of low-level characteristics. Then, using psychological and artistic theories, they created middle-level representations. Ultimately, a Deep Sparse Neural Network was developed to understand the stress types that integrate the cross-media properties. For stress detection, this framework was found to be very feasible and effective. This suggested approach can be used to identify psychological stress from virtual communities automatically. The downside was that it was not possible to fully examine the social correlations of psychological stress.

Chun-Hao Chang et al. [8] proposed a data gathering system for gathering patient and non-patient datasets called Subconscious Crowdsourcing. To train classifiers to diagnose mental illnesses, they developed their own linguistic and behavioral characteristics. They collected data from Twitter REST API and gathered the self-reported users. Three groups were then explicitly created for these users: Patient, Expert and Non-related. For pre-processing the data, Sentiment Analysis and Emotion Classifier are applied. Using TF-IDF, LIWC, and PLF,

feature extraction is carried out. They selected the Random Forest Classifier quantitatively to be the primary learning model. They found that to achieve reasonable results in the data collection process, a fusion of physical and automated work is required. The immediate drawback of this is that the tweet language chosen is limited to only English and followers are only limited to the self-reported ones i.e. a vast majority of the undetected ones are still left out.

Budhaditya Saha et al.[9] demonstrated that the mental state and involvement of groups related to mental health can potentially be captured by the linguistic characteristics and subjects discussed among online communities. The topics discussed using Bayesian LDA were extracted and the top 50 topics discussed were chosen. With the subject characteristics as the input and the twelve classes as results, they trained the model and then used the LIWC characteristics as the input and 12 interest categories as outputs, and then eventually merged the topic characteristics and LIWC characteristics into one feature set and repeated the procedure. The model's effectiveness against Single-Task Logistic Regression (STL) and Multi-Task Learning System has been assessed (MTL). Both the compared models were outperformed by the proposed model. This demonstrated the value of networking sites and virtual audiences with an interest in depression in the advanced diagnosis and tracking of mental-health-related issues.

Adrian B. R. Shatte et al.[10] extracted machine learning literature and mental health Big Data applications. For publications on the above-mentioned scope, they examined 8 health and information technology research databases. Data on the application of mental health, ML methodology, form of data, and results of the study were collected. With four major application domains, 300 papers were described - identification & diagnosis, prognosis, care & assistance, public welfare, and study & clinical management. The study was found to focus primarily on the identification and projection of psychological health disorders, including depression, Alzheimer's disease, and schizophrenia. In clinical and scientific procedures and produce fresh perspectives into mental health and well-being, ML has shown promise. It had a few limitations. First was some relevant articles may have been missed due to the restrictions in the search methods. Secondly, the effectiveness of ML techniques was not examined for each mental health application.

A research to determine the link between the use of social networking sites and mental health among adolescents has been carried out by Chloe Berryman et al. [11]. A questionnaire was submitted by 471 undergraduate students. The results associated with overall mental health symptoms (BSI), thoughts of suicide, social distress, isolation, and anxiety were all subjected to distinct regression studies. It was inferred that variables from online networking sites were weak determinants of negative effects. An exception to that, which marginally predicted depression and suicidal feelings, maybe Vaguebooking. Time people spend online and the value of social media was not a predictor of any outcome. It was discovered that, in terms of mental health, how people use networking sites is much more important than how much hours they spend on it.

3 Result

After reading so many great works done in this field, we have accumulated knowledge regarding the mental health issues caused by online social media networks. We were able to understand the importance of such models and their application in the real world.

3.1 General Architecture of Mental Health Prediction

Several methods for mental health prediction in OSN have been used in various research studies. According to the researcher, this general architecture will be a common step in implementation for future studies in mental health prediction. Social network analysis, keyword-based data acquisition, data pre-processing, feature collection, machine learning algorithm-based data classification, evaluation, and early mental health detection are all part of the common structure for mental health prediction. The steps corresponding to the input-process-output model of information systems are depicted in Figure 1.

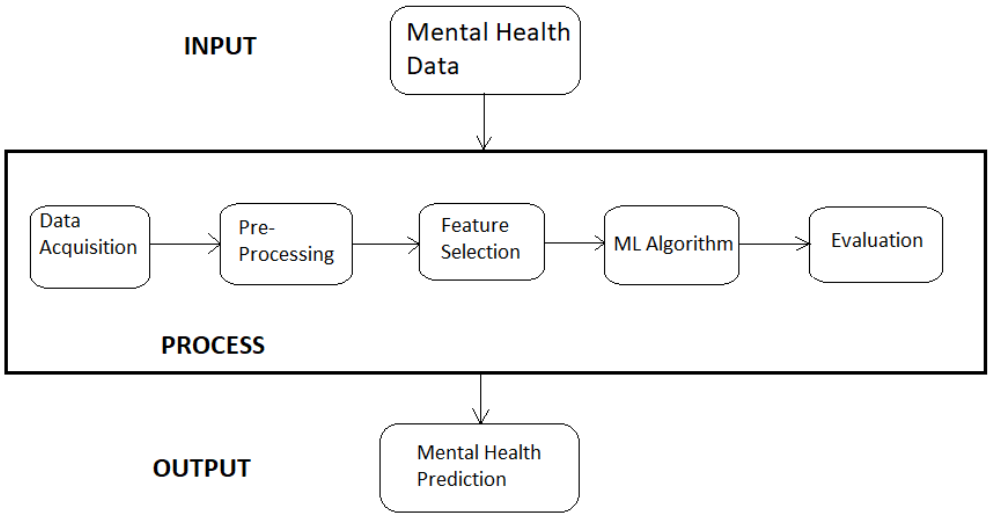

Fig. 1. Common Structure of Mental Health Prediction.

From the studies reviewed above, it could be seen that the Input Mental Health Data was taken from majorly two sources, namely, Questionnaires and Online Social Network APIs (Such as Twitter, Weibo, etc.) with the latter being a more popular choice than the former. After which, for the method, a few steps were introduced, such as keyword-based data acquisition. Before moving on to the feature selection step, it must be pre-processed to eliminate outliers. As a final stage, the data is modeled using a machine learning technique.

3.2 Analysis of Methods used in the Prediction of Mental Health

Table 1. Methods used in the prediction and detection of Mental Health.

Study	Author	Year	Method			
			Machine Learning Algorithm	Hybrid Algorithm	New Method	Natural Language Processing
[1]	I-Hsuan Lin	2014		√		
[2]	Young Min Baek	2013			√	
[3]	Dhivya Karmegam	2020	√	√		√
[4]	Rohizah Abd Rahman	2018	√	√	√	√
[5]	Thilagavathi. P	2018				√
[6]	Quan Guo	2016	√		√	√
[7]	Huijie Lin	2014	√		√	
[8]	Chun-Hao Chang	2016		√		√
[9]	Budhaditya Saha	2016	√		√	
[11]	Chloe Berryman	2018	√	√	√	

Table 1 lists research that has been conducted using various techniques for detecting mental illness. Most of these studies are aimed at highlighting different machine learning algorithms in order to demonstrate a superior technique [1], [3], [4], [6]-[9], [11]. Some researchers used Hybrid Algorithm for prediction [1], [3], [4], [8], [11], while many have created a new method altogether with the help of machine learning algorithms [4], [6], [7], [9], [11]. Natural Language Process also gave very promising results [3]-[6], [8].

4 Conclusion

From the above works, it can be concluded that Mental Health problems caused by social media can be predicted using the data available through their APIs efficiently. This can help in early detection which in turn results in early clinical intervention. A spectrum of different machine learning algorithms was seen that had good accuracies but still had some room left for improvement. For future work, we propose to develop a Social Network Mental Disorder Detection Framework using various machine learning models and validate it using the 10-Fold Cross-Validation to evaluate the precision and recall of each model.

References

[1] **Journal article**: I-Hsuan Lin, Chih-Hung Ko, Yu-Ping Chang, Tai-Ling Liua, Peng-Wei Wang, Huang-Chi Lin, Mei-Feng Huang, Yi-Chun Yeh, Wen-Jiun Chouf, Cheng-Fang Yen. The association between suicidality and Internet Addiction and activities in Taiwanese adolescents. Comprehensive Psychiatry. 2014; 55(3):504-510

[2] **Journal article**: Young Min Baek, Young Bae, Hyunmi Jang. Social and Parasocial Relationships on Social Network Sites and Their Differential Relationship with Users' Psychological Well-being. Cyberpsychology, Behaviour and Social Networking. 2013; 16(7):512-7.

[3] **Journal article**: Dhivya Karmegam, Thilagavathi Ramamoorthy, Bagavandas Mappillairajan. A Systematic Review of Techniques Employed for Determining Mental Health Using Social Media in Psychological Surveillance During Disasters. Disaster Med Public Health Prep. 2020; 14(2):265-272.

[4] **Journal article**: Rohizah Abd Rahman, Khairuddin Omar, Shahrul Azman Mohd Noah, Mohd Shahrul Nizam Mohd Danuri. A Survey on Mental Health Detection in Online Social Network. IJASEIT. 2018; 8(4-2):1431.

[5] **Journal article**: Thilagavathi. P, Suresh Kumar. A, Pushkala K, Yamini. P. Detecting Stress Based on Social Interactions in Social Network. IJERT. 2018; 6(8):page numbers

[6] **Journal article**: Quan Guo, Jia Jia, Guangyao Shen, Lei Zhanga, Lianhong Cai, Zhang Y. Learning robust uniform features for cross-media social data by using cross autoencoders. Knowledge-Based Systems. 2016; 102:64-75.

[7] **Conference proceedings paper**: Huijie Lin. Psychological Stress Detection from Cross-Media Microblog Data using Deep Sparse Neural Network. Proceedings of the *2014 IEEE International Conference on Multimedia and Expo (ICME)*; 14-18 July 2014, Chengdu, China. Place of publication: IEEE; 2014. p. 1-6.

[8] **Conference proceedings paper**: Chun-Hao Chang. Subconscious Crowdsourcing: A Feasible Data Collection Mechanism for Mental Disorder Detection on Social Media. Proceedings of *2016 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM)*; 18-21 Aug. 2016; San Francisco, CA, USA. Place of publication: IEEE; 2016. p. 374-379.

[9] **Journal article**: Budhaditya Saha, Thin Nguyen, Dinh Phung, Svetha Venkatesh. A Framework for Classifying Online Mental Health Related Communities with an Interest in Depression. IEEE J Biomed Health Inform. 2016; 20(4): 1008-15.

[10] **Journal article**: Adrian B. R. Shatte, Delyse M. Hutchinson, Samantha J. Teague. Machine learning in mental health: a scoping review of methods and applications. Psychological Medicine. 2019; 49(9):1426-1448.

[11] **Journal article**: Chloe Berryman, Christopher J. Ferguson, Charles Negy. Social Media Use and Mental Health among Young Adults. Psychiatr Q. 2018; 89(2):307-314.

Classification Of Covid19 Using Deep Neural Network

K.Thaiyalnayaki[1]
{thaiyalk@srmist.edu.in[1]}
Department of Electronics and Communication Engineering,
SRM Institute of science and Technology, Ramapuram

Abstract. The ongoing logical researches are applying AI and machine learning in the field of clinical pneumonia and Covid in X-ray beam arrangement. A Deep CNN based model can distinguish the COVID-19 cases at a quicker speed by identifying the features of infected patients. The trainset consists of chest xrayof 80 healthy people and 80 covid people.The test set include 20 normal people and 20 covid affected chest xrays.Keras sequential Deep CNN classifier is constructed with convolution1,pooling1, convolution2,pooling2, flattening and dense fully connected net.The input shape of 2D convolution layer is of size 64x64x3 with a 3x3 mask and ReLu activation function. Max pooling mask size is 2x2.Conolution layer2 and max pool layer2 utilize the mask 3x3 and 2x2.After straightening, the completely connected layer comprises of 128 neurons with Relu activation function and one sigmoid neuron.Binary cross entropy loss function and Adam optimizer are used in CNN. The fully connected output layer consists of 129 neurons , out of which 128 are relu activation with 8,02,944 trainable parameters with accuracy obtained is 97%, which can be improved by increasing the dataset.This model act as an automatic classification of covid 19 and normal subjects.

Keywords: COVID 19, Deep CNN, X ray , automatic classifier.

1 Introduction

The novel Covid in the wake of take up through the respiratory tract of human, influences the lungs of the individual basically, give rise to positions like and extreme than the familiar Pneumonia. The lungs begin to be loaded up with liquid, get aroused and create patches called ground Glass Opacity. Since a great deal of exertion are happening for uncovering the compelling prescription of Covid-19 however upto now the main successful path for security is social removing and lockdown of different urban areas in the nation. Along these lines, it is obligatory to set up a wellbeing center framework dependent on Artificial Intelligence which identify the cases quick and precisely to forestall this regular pandemic. X-beam machines give reasonable and quicker outcomes to examining of different vital internal organs in the medical clinics. The understanding of different X-beams pictures is normally accomplished physically by specialist radiologists. As information researcher, in the event that it is trained by those caught images with the criticalness of profound discovering that will be an extraordinary guide to clinical specialists for recognizing the COVID-19 sufferers. This will succour creating things in which the X-beam facility is accessible yet the accessibility of a specialist is as yet a fantasy. In measure of scope, it is expected to build up a deep neural

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network (DNN)that can dissect the X-beam pictures of lungs and identify if the individual tests positive for the infection or not. Convolutional Neural Networks (CNN) have proved to be extremely successful in PC vision and clinical picture examination function, amidst other deep learning classifiers. The aftereffects of CNN have demonstrated its cogency in planning of picture information to an exact and anticipated yield. Since the lungs are the essential objective of the infection, dissecting their progressions can give an unequivocal aftereffect of quality of the infection. A CNN based model, can prepare the pictures of Covid tainted lungs and such types of sound lungs. The model will differentiate COVID-19 situations more rapidly by defining the highlights of infected patients in X-ray images of the lungs as dim or shadowy patches. [1].

Traditional classification of image can be partitioned into three principle stages: picture pre processing, include extraction and highlight order. Another work used a ConvNet model trained from scratch on datasets to group and indicate the presence of pneumonia in a group of chest X-ray image samples. The training accuracy achieved is of order 95.31%.Some even introduced an early conclusion concept based on Xception and VGG16 from Pneumonia chest X-beam images. Kermany et al provided an information base containing almost 5000 frontal chest X-beam pictures in the Kermany X-beam data collection, 1500 normal cases, 4100 strange pneumonia occurrences in this investigation. The preliminary results indicated that VGG-16 organization superior than X-ception network with a grouping pace of 87%. X-ception network is more apt for grouping X-beam pictures than VGG-16 organization. Varshni et al. suggested highlight extractors (VGG-16, Xception, Res50, Dense-121, and Dense) to be used in conjunction with various classifiers such as SVM, Random Forest, k-nearest neighbours, and Nave Bayes to determine the location of normal and abnormal pneumonia. [2]

To recognize the Pneumonia instances from chest X-beams, a viable CNN calculation is registered with the 121-layered convolutional neuralnetwork. The framework is prepared on an informational collection restrining more than 10000 images giving frontal perspective on lung X-beam and depicts 14 sorts of infirmities given by Rajpurkar et al. Additionally, in the present situation of COVID-19, a CNN based methodology has been pertained to the X-beam pictures of the chest, since it makes comparative indications Pneumonia. Alqudah et al. have suggested a mechanised COVID-19 technique. They used AI classifiers such as the Support Vector Machine (SVM), irregular backwoods, K-Nearest Neighbor (KNN), and CNN with soft-max to aid in identification with a 98 % accuracy rate. [3]

To assist clinical doctors, compressed sensing (CS) with a deep exchange learning model was used to programme the order of pneumonia on X-beam images. The dataset used in this study consisted of approximately 5800 X-beam data from Kaggle, divided into two classes: abnormal and typical. According to extensive simulation findings, the recommended solution correctly classifies pneumonia as unusual/ordinary with just 2.66 percent misclassification.

2 Deep Convolutional Neural Network (DNN)

Deep learning strategies are used to discover the explanatory index features, also incl uding images and videos, that were hidden in the original informationset. The framework mod el is focused on the application of deep learning based CNN. It comprises of 20 layers.The main layer displays the information layer and has a fixed size of 256 x 256 x 3 pixe ls,rendering it an RGB image. The following 19 layers are the mix of 2D Convolution, activation ReLU and MaxPooling layers.Such layers are essential for the VGG16 Models

pretrained
situationand were created using the ImageNet dataset.VGG16 had the choice of achieving 92. 7 percent exactness on ImageNet, which includes about 15 million explained images from 22, 100 different categories.[4] Along these lines, VGG16 model is utilized for including extraction as a base model. At that point an transfer learning model is applied utilizing the 6 unique layers and created the conceptual model on the COVID-19 tuple. The principal layer is an Average Pooling 2D layer with a pool size of 4x4, and these 6 layers are a fundamental feature of the imaging system. The standard estimate of the apparent multitude of pixels in the cluster is chosen in standard pooling, but the maximum value is chosen in maxpooling.

A flatten layer whose task is to smooth the tensor changing over the twodimensional lattice ofhighlights into a vector that can be handled by a fully associated classificationalgorith m.After changing thevector, it contributes to a fully deep associatedlayer with a dimension of 64 components and a ReLU enactment feature.Dropout is appliedwith 0.4 limit at
that stage. Taking into account the limit value, the dropout layereffectively ignores a fewneuro ns units. Finally, a yield layer with just two units. The Adam analyser[5] is usedtostreamline t he model. Adaptable moment estimation, also known as Adam, is a timesaving approximation that replaces the standard stochastic gradient drop.DNNs can remove insight from a dataset, resulting insuperhuman displays in a multitude of scenarios. Furthermore, effective DNN design combination has recentlybeen investigated. These models are not only accurate in forecasting, but they are also computationallyeffective. As a result, for COVID-19, analysts chose to use DNNs as AI analysis estimates.

To build such a classifier, several works combine preprepared Convolution Neural Network(CNN)design with transfer learning on the chest xray dataset .As a result,experts started collecting CT and chest Xray image datasets and making them publicly available.Analyzed are deeplearning methodologies for determining and recognising COVID 19 in included
patients.Two AIbased strategies for characterization and finding of patients andtypical individ uals lung images, are presented to address the conclusion problem. The primarystrategy is bas ed on ANN and
fractaltechniques for arrangement and highlight extraction.The methodology's exactness and c ognizance were dissected in the second phase usingconventional CNN techniques

2.1 Deep convolutional neural network Layers

Convolutional neural networks (CNN) are a form of deep learning technique in which a few layers are efficiently instructed. To reduce preprocessing, CNN employs a variety of m ultilayered perspectives. A CNN is made up of three basic layers: the convolutional layer, thep ooling layer, the flatten information layer, and the fully associated layer, with each layerperfor ming a different role. There aretwo phases of preparation in any design: forward andback propagation. The input moves from the hidden layer to the yield layer in the forwardprogressio n and the data simply moves forward.The input would be sent to the hidden layer by the information layer and then output is generated .When a neural organisation is characterised the collected image is passed onto the network in the main stage by backpropagation.The estimation of the network error is calculated when the output is reachedt his value is then given to the network alongside the cost work graph to refresh the network weights.CNN has several types of hidden sublayers, which are mentioned below.The convolut ion layer is at the core of the convolution network, and its output is a threedimensional heap of

neurons.In simple terms, this layer's output is a threedimensional heap. The CNN network, lik e the featuremaps, uses various parts to convolve the input images in these layers.
.
The algorithm for classifying the covid -19 with a chest X-ray using DNN is given below.
1.Input data: Chest X-ray Images of Healthy and Patients.
2: Output data: COVID-19 Chest X-ray image is detected as the transfer model .
3: Steps for Pre-processing
4: The X-ray input is resized to 512 x 512 pixels in height and width.
5: Show X-ray images
6: Every X-ray data input should be mean normalised.
7: Z = Alexnet, Googlenet, Resnet18 download and reuse transfer models
8: The last layer of each model is replaced by transfer model with 4x1 layer dimension.
9:The output value is given between 1 and -1 by hyperbolic tangent function .
10:Throughout the subtracting sampling task, Max and Average pooling, accumulating in the CNN is used to outline the feature.
11:Convolutional neural network (CNN) conceptual architecture and training for the division of tainted tissue in pulmonary images.

Confusion matrix, in which evaluation standards are analyzed in a grid is a network used to portray the presentation of a classification model on a lot of trial information for which the genuine values are known.The outcomes shows the loss worth and precision as a component of preparing emphases. The plots are portrayed while preparing the network and the cycle was ended subsequent to acquiring the best outcomes with higher precision and lower network loss for 300 iterationsThe last prepared model was evaluated on both the train and test sets. The model accurately predicts 190 cases out of 204 instances in the test set, according to the confusion matrices of these forecasts. As a result, the test set's precision is 93.1 percent. The model achieves a false negative rate of 2% for COVID-19 positive cases, demonstrating its adequacy in raising alerts for COVID-19 cases. Other assessment metrics for this order function include a 2% miss rate and a 9.4 percent result on the test sample. This number is significantly higher than DNN's potential for discovery. CNN, on the other han d, is a leader in the grouping of images due to its higher accuracy. Different aspects are also beneficial to CNN techniques. Drop out for DNN strategies, for example, indicates the strategylevel of misdiagnosis. This importance is almost unheard of when it comes to CNN estimates. However, it isn't insignificant in terms of DNN techniques. As a result of the discov ery, the provided CNN calculation high potential can be used to analyse COVID19 patients' X -Rays.

The
true positive rate versus false positive rate is plotted on receiver operating characteristic (RO C) curve. For each image in the segmentation calculation, this basis is exceptional.
Regardless of whether plots with a higher true positive rate and a lower false positive rateprov e that the image cycle is superior, the results show that the most extreme number of ROC bend is a basically high proficiency. For understanding the ROC bend with solid qualities, zone under the bend is considered ,AUC esteem. This model whether to get esteems near one, shows superior preprocessed ground truth picture for the out put layer. For preparing information, 70% of images were utilized and the remainder of the images utilized for approval of the introduced design.

3. Deep CNN Architecture

Figure 1 depicts the Deep CNN architecture. The constructed work, Deep CNN mode l has 7 layers and requires a 64x64x3 input image. In all framework, the underlying learning ra te is 2e-4.The model is picked on account of its capacity of simple streamlining, combines quicker, and improvement in the precision with expanded profundity .However, time utilization is enlarged with an expansion in layers of each network. At that point the convolution layer makes a component guide to foresee the class probabilities for each element map got. The part of the main convolution layer, i.e., conv1 is to give low-level highlights like shading, edges, and inclination activity, and so forth. The more deeper convolution layer gives significant level highlights in Xray pictures and also restricted in the more deeper layer.The down sampled spatial size of convolution features are utilized. There are three types of pooling layers: maximum pooling, normal pooling, and global pooling.

The pooling layer acquires the most important features, such as positional invariant a nd rotational one.The completely connected layer gets the pooling layer's straightened output a nd acts as a feedforwardnetwork. The softmax layer keeps the yield in the [0, 1] range. As a re sultthe softmax layer forecasts the probability of the knowledge vector in a scolarly class .The number of yields is equal to the number of parallel classes in the chest xray image dataset used to construct the model. The number of outputs in the proposed work would be two.

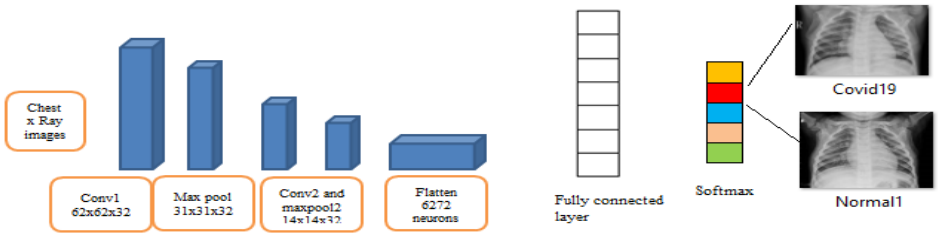

Fig.1 Architecture of Deep CNN

The architecture uses a skip association to include the output from a previous layer in to a subsequent layer, ensuring that data is not corrupted from the primary layer to a deeper la yer. In CNN models, theRectified Linear Unit (ReLU) is a type of enactment function.TheCN Nbased models are actualized by skipping the twofold or triple layer with nonlinearities (ReL U) and using an extra weight structure to familiarise themselves with the weights.This aids de ep learning groups in resolving the vanishing gradient problem. The remaining network gradually reestablishes the skipped layers as it learns the component space. The featur es map is generated using the first convolutional layer (conv1) and the deeper layer from the preprepared transfer learning model. The first convolutional layer is use d to test low levelfeatures such as texture, colour, and edges (conv 1).The output activation is obtained byp

assing the testing image (a positive chest Xray image from Covid19) through the bestaccompli shing network. Furthermore, all activations are scaled to a range of [0 1], where '0' represents t he lowest activation and '1' represents the highest activation. Conv2 and the pooling layer are t wo of the model'sdeeper layers. Feature maps reflect the highlights learned by themodel on the chest Xray datasets used in these layers. Furthermore, the most grounded activation channel is used to obtain the features essential for irregularity limitation in COVID-19 positive chest Xrays.

4.**Experimental Results**

The dataset is downloaded from kaggle for healthy people chest xray and covid19 affected chest xray. The trainset consists of 80 healthy people and 80 normal people chest xray. The test set include 20 normal people and 20 covid affected chest xrays.Keras sequential Deep CNN classifier is constructed as convolution1,pooling1, convolution2,pooling2, flattening and dense fully connected net.The input shape of 2D convolution layer is of size 64x64x3 with a 3x3 mask and ReLu activation function.Max pooling mask size is 2x2.Conolution layer2 and max pool layer2 utilize the mask 3x3 and 2x2.After straightening, the completely connected layer comprises of 128 neurons with Relu activation function and one sigmoid neuron.Binary cross entropy loss function and Adam optimizer are used in CNN.As there are less number of covid samples, image augmentation is implemented with rescale = 1./255,shear_range = 0.2,zoom_range = 0.2 with horizontal_flip.For a binary classifier , 64x64 targetsize and batchsize of 32 is chosen.Test set is chosen as validation data and the classifier is run for 25 epochs.

The accuracy obtained is 97% and the corresponding validation accuracy is 97.5%.The total trainable parameters are 813, 217.With training of 8 lakh parameters in CNN ,the time taken is comparably less. The convolution layer1 consists of 62x62 with 32 filter outputs.Max pooling 1 consists of 31x31x32 and the second convolution layer output size is 29x29x32.The max pooling layer2 is 14x14 with 32 filters.Once the 2D data is converted to single dimension there are 6272 neurons. The fully connected output layer consists of 129 neurons , out of which 128 are relu activation with 8,02,944 trainable parameters as given in table 1.

Table 1. Sequential classifier model parameters

.No. of Layer	Output size	Parameters
2D Convolution	62, 62, 32	896
2D Maxpooling	31, 31, 32	0
Conv2D-2	29, 29, 32	9248
2D Maxpooling-2	14, 14, 32	0
Flatten	6272	0
Dense	128	802,944
Dense 1	1	129

5.Results and Discussion

The training and validation accuracy are plotted with the number of epochs, The training accuracy reaches 97% . The number of training set and test need to be increased to increase the training accuracy. The training and validation loss is shown in figure2 and 3.This network can also be used to help treat patients by separating the infected areafrom their

lung images. This discovery can also be used to test and manage patients that aredeveloping ta inted regions. There are various works that use artificial intelligence consciousness to divide a nd classify patients, such as diagnosing brain tumours, illness, and cellular cancer in the lungs. Nonetheless, the implementation of these methodologies nearly is quiet. These methodologies nearly utilized in a wearable monitoring framework for conclusion of infection, checking, and moving to specific doctors. Coronavirus pandemic shows that science has a drawn out future point of view. The time has come to execute artificial intelligence reasoning techniques in medication to help specialist's conclusion better and at the earliest opportunity.

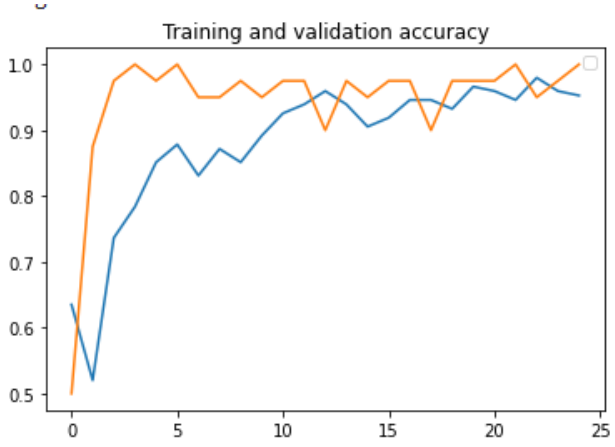

Fig. 2. Training and validation accuracy

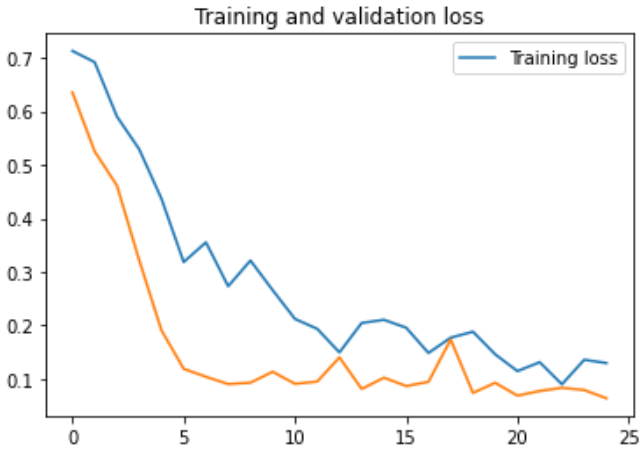

Fig.3.Training and validation loss.

Later on, the proposed framework's output can be used to examine clinically obtained Chest X rayimages with COVID19 disease. Furthermore, the proposed technique should be tested on a wider group of patients with COVID-19 positive Chest Xray and CT scan images.

References

[1] Application of deep learning for fast detection of COVID-19 in X-Rays using nCOVnet, Harsh Panwar , P.K. Gupta , Mohammad Khubeb Siddiqui , Ruben Morales-Menendez , Vaishnavi Singh 2020, Chaos, Solitons and Fractals , vol.138 ,pp1-8

[2] Diagnosis and detection of infected tissue of COVID-19 patients based on lung x-ray image using convolutional neural network approaches , Shayan Hassantabar , Mohsen Ahmadi , Abbas Sharifi, 2020, Chaos, Solitons and Fractals, vol. 140

[3] Hybrid deep learning for detecting lung diseases from X-ray images, Subrato Bharati , Prajoy Podder, M. Rubaiyat Hossain Mondal , 2020, Informatics in Medicine Unlocked , vol.20

[4] COVID faster R–CNN: A novel framework to Diagnose Novel Coronavirus Disease (COVID-19) in X-Ray images, Kabid Hassan Shibly , Samrat Kumar Dey, Md Tahzib-Ul Islam, Md Mahbubur Rahman,2020, Informatics in Medicine Unlocked , vol. 20

[5] A combined deep CNN-LSTM network for the detection of novel coronavirus (COVID-19) using X-ray images, 2020, Informatics in Medicine Unlocked 20, 100412

[6] Deep Learning System to Screen Coronavirus Disease, Pneumonia,,Xiaowei Xu1 et al,2019.

[7] Online COVID-19 diagnosis with chest CT images:Lesion-attention deep neural networks, Bin Liu et al., MedRxiv, 2020

[8] Deep transfer learning-based automated detection of COVID-19 from lung CT scan slices, Sakshi Ahuja · Bijaya Ketan Panigrahi · Nilanjan Dey · Venkatesan Rajinikanth · Tapan Kumar Gandhi, Applied Intelligence, 2020.

An Efficient Fault Tolerant Routing Interconnect System for Neural NOC

Dr.A.Pradeep kumar[1], Y. Devendar Reddy [2], Dr.T.Srinivas Reddy [3], K. Jamal [4]
{pradeepkumar@mrec.ac.in[1], devender_reddy03@rediffmail.com[2], srinivasreddy.14@mrec.ac.in[3], kjamal24@gmail.com[4]}

Professor, Mallareddy Engineering College (A), Hyderabad, Telangana, India[1], Associate Professor, Nalla Narasimha Reddy Education Society's Group of Institutions, Hyderabad, Telangana, India[2], Professor, Mallareddy Engineering College (A), Hyderabad, Telangana, India[3], Assistant Professor, GRIET(A), Hyderabad, Telangana, India[4]

Abstract. Large scale Neural Network (NN) accelerators typically have multiple processing nodes that can be implemented as a multi-core chip, and can be organized on a network of chips (noise) corresponding to neurons with heavy traffic. Portions of several NoC-based NN chip-to-chip interconnect networks are linked to further enhance overall nerve amplification capacity. Large volumes of multicast on-chip or cross-chip can further complicate the construction of a cross-link network and create a NN barrier of device capacity and resources. In this paper, this refer to inter-chip and inter-chip communication strategies known as neuron connection for NN accelerators. Interconnect for powerful fault-tolerant routing system neural NoC is implemented in this paper. Regarding intra-chip communication, this recommend crossbar arbitrage placement, virtual interrupt and path-based parallelization strategies for virtual channel routing, leading to higher NoC output with lower hardware costs. For multicast-based traffic. Regarding inter-chip communication, this propose a lightweight NoC compatible chip-to-chip interconnection scheme to allow efficient interconnection for NoC-based NN chips. In addition, this will test the proposed methods with four Field Programmable Gate Arrays (FPGAs) on four hardwired Deep Neural Network (DNN) chips. The experimental results show that the proposed interconnection network can effectively handle data traffic with high throughput and low DNN through advanced links.

Keywords: Chip-to-chip interconnection, Deep Neural Network (DNN), Hardware Accelerator, Interconnection Architecture, Network-On-chip (NoC).

1 Introduction

Technology can combine more and more logic circuits into a single chip. Therefore, the chips characters became more powerful. Processing units that work with different clock frequencies are integrated in a single chip [1] [2]. Traditionally, processing units have to interconnect the various sections of the SoC using bus structures.

However, bus SoCs are key connectivity schemes because their scalability is too low [1]. Network on a chip has been suggested as a possible candidate for reduced scalability and poor connectivity efficiency issues presented in the previous system on a chip. NoC uses network connectivity instead of bus systems to provide Globally Asynchronous and Locally

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Synchronous data transfer (GALS), which ensures that NoCs have increased the reliability of network connectivity and power usage by on-chip logic and device complexity [2].

The continuous increase in the size and complexity of the NoC interconnect infrastructure presents major challenges to the time-tested initiative of the architecture [3]. Chips up to 100 cores today rely on a wide range of NoC connectivity. In addition, active interconnecting architectures are being implemented to provide better efficiency and power utilization. This increasing maturity is obvious when one explores the growing concerts of features integrated into the router architecture, including complex arbitration processes, speculation and adaptive routing [4].

There is also the added difficulty of adopting advanced routing protocols, custom power and plug devices and dynamic overlay communication protocols. This high design complexity represents a large design area that cannot be fully implemented and verified during the design review phase. As a result, interconnect designs can be sold in some unconfirmed versions with hidden defects in the corners.

NoC is similar to the traditional embedded network used in parallel multiprocessor computers. However, unlike parallel computers, NoC has unique characteristics. The important variations between NoC and parallel computers are energy use restricted design specialization and the area and variety of materials used. Most of the applications used in battery-operated NoCs are locked in by power consumption. The low power consumption of the device is the main objective of the NoC structure.

In addition, NoC can be designed for separate and separate applications from parallel computer network for a variety of unknown applications. In addition to memory and processors, a variety of modules can be assigned to a single nose and include Digital Signal Processing (DSP) and Field Programmable Gate Array (FPGA) architecture, making noise more extensible. Applications implemented in NoC designs usually have limited configuration tools and strict performance characteristics. The main challenge for NoC architecture is how to meet application performance benchmarks with minimal capital. Capital constraints require more appropriate algorithms and more expensive NOCs [5].

As a result, the critical routing algorithm is now the primary routing algorithm for NoCs. With the level of NoC increasing, the growing debate over data transfer calls for expansion of the cache capacity of routers will increase. As a result, artificial channel models are installed in the router. Multiple data packets are stored in separate storage by setting physical storage partition to reduce router buffer load on chip. How to help reduce friction is an important way to improve router efficiency.

The buffer size on the NoC router needs to be reduced, which can be solved using virtual channels. The main challenge of the NoC architecture is how to meet application performance standards using minimal capital. Capital constraints require more appropriate algorithms and more expensive NOCs. As a result, the decisive routing algorithm has now become the primary routing algorithm for NoC. With the reduction of NoC, the growing debate about data transfer requires expanding the buffer capacity of routers.

As a result, synthetic channel models are installed in the router. Multiple data packets are stored in a separate memory by setting the physical memory partition to reduce the buffer load of the on-chip router. The rest of the data fits are tracked by the header flip in a pipeline manner. If the header blocks flight, the rest of the flight will also stop on simulation channels. Since packets need to be fixed in a single virtual channel instead of the entire buffer, routers can be configured with some default channel buffers for each terminal. Digital channels can also be used to reach higher channel capacity at lower cost.

2 Related Work

NN's hardware acceleration has attracted tremendous attention in recent years However, DNN-based interconnection networks have very few contributions. New- hub proposes a hybrid ring mesh for neuromorphic systems designed to accelerate the multilayer perception. In new-NoC, single-layer neurons are connected to a ring and single-ring neurons share the same data for multicast traffic. These local circuits are connected to each other through the NoC mesh to influence data movements between different layers. The ring topology is often affected by output and delay. Proposes a closed topology-based indirect interconnection network customized for close NN feed-forward NNs. This overcomes the narrow bending bandwidth of the tree and the large diameter of the mesh topology, which shows the reliability of the power supply in handling multicast traffic. However, the structure suffers from the physical limitations of the cable.

Eyeriss offers a Hierarchically Overlapping Network (HM-NoC) for DNNs. Processing Elements (PES) and Global Buffer (GLB) are grouped and linked by HM-NoC. NoC can be configured in several circuit-switched routing modes depending on the type of data transmitted. With enhanced NoC, different types of data (input activation, partial weights and volumes), from high bandwidth to high data reuse, can be exchanged between PEs and GLBs. The large tree topology was used for internal and network communication over Hyper Transport 2.0 to monitor data traffic between chips in large-scale NN architectures. However, advanced intra-chip and inter-chip architectures do not fully accept multicast DNN traffic, which can deter network amplification systems.

3 Literature Survey

Hierarchical agent architecture is suggested to provide on-line management capabilities for NoC-based applications. Unit structures are optimally maintained by agents at each construction level based on the circuit conditions monitored during runtime. This paper explores the monitoring relationship between the level of the agent and focuses on the alternatives for system optimization to be handled at various levels of the agent. They recommend the hierarchical configuration of the agent with the appropriate monitoring services. This architecture introduces a level of control into the NoC network hierarchy.

This layer provides the scalability and increased flexibility of large-scale NoC systems designed to maximize device performance by balancing all of the chip resources. Hierarchical approaches is used for multi-capacity management services and fault tolerance management.

The hierarchical agent simulation approach is excellent at achieving self-conscious and parallel computing in a scalable manner. A hierarchical agent that controls device status during runtime and re-configures components to boost performance in the event of an error.

The method of manufacturing a complex device, such as a chip network, will trigger several failures. Inexpensive routing algorithms are used in NoC to support permanent fault connections. Use appropriate simulation and synthesis to measure efficiency, power consumption and area overhead to see the effect of these algorithms. Proposed error-tolerant routing algorithms that can be reconstructed which make decisions based on local error information stored at each node and in the current and destination node configuration register which is obtained [6].

The first routing algorithm (FT XY) tolerates a fault link. (FT XY2) & (FT XY3) is an extension (FT XY) to find two other defective links, considering the hardware overhead gap. According to simulation and synthesis, the proposed routing algorithm does not enable VCs to have minimal overhead and overhead capability. The Fault-on-Neighbor (FoN) routing algorithm for NoC is proposed in clause, which sets out the routing decision on the basis of the connection status of the neighboring switches within 2 hops in order to prevent incorrect connections and switches. Diversion routing is a compatible routing algorithm that is essentially implemented to hardware, which ensures that packet buffers are not used while shipping. Fault – on - Neighbor (FoN) conscious variance routing algorithm based on the distribution of incorrect information in 2 zones to prevent defective links and switches and to preserve clear convex and concave error zones without blocking or blocking existence.

Fault-tolerant routing can be divided into two classes: random and critical. It transmits unwanted packets over various channels to stop random communication errors. The critical algorithm is used NoC architectural redundancy to transport packages to the destination through various means to achieve fault tolerance. The decision to route Forced Wormhole Routing (FWR) is based on the buffer state of the routing table and neighboring keys. Use first level packet as visibility to check queue and adjacent key buffer status. This section specifies the NoC fault-tolerant elastic routing algorithm based on the turn model.

When ensuring proper service, the switch can be rebuilt around broken components without the use of virtual networks. A fault-based positive deflection routing algorithm has been proposed that allows decision-making on cost-function-based routing. The switch implements an online troubleshooting approach and makes a routing decision based on a cost function that takes root duration and local fault status into account. Not only can it handle connecting and turning errors, but it can also handle crossbar errors. Since routing decisions are based solely on inaccurate knowledge of the current transfer, the packet hop count region can be easily overwhelmed by some faulty versions.

The geometry of the NoC is based on Nostrum NoC, a 2D mesh topology. It varies from a typical 2D network in that the limit output is attached to the same switch input and the packet sent in that direction is returned to the same switch. It can be used as a buffer for packets. Distraction routing is used to make a routing decision depending on the priority packet and the next network load voltage varies over the last 4 cycles. The two incoming packets are chosen on the basis of their hop count, which shows the number of hop packets. The packet with the

largest number of hops shall have the highest preference. Requires high to low priority routing alternatives for packet relocation.

Device configurations are favorably controlled by agents at each construction level based on circuit conditions tracked at runtime. Device configurations provide periodically configured resource consumption and power supply. This technology provides a comprehensive approach to the design of VLSI (Very Large Scale Integration) circuits under the control of variations and strict power limits.

By implementing a bio-induced agent-based hierarchical modeling approach bio-induced system architecture, the design framework NoC proposed for hierarchical agent monitoring. Bio-induced approach-agent mechanisms have appealing network implementation characteristics such as scalability and compatibility, bio-induced system architecture divides conventional control resources across different agent layers and is more scalable than traditional systems.

They propose a hierarchical control factor based on an engineering approach, shaped by the joint efforts of hierarchical intelligent agents to plan, manage and fine-tune the NoC system at various operational levels, including system outputs, energy efficiency, fault tolerance and diversity. Provides high-level capture of concurrent control functions through distributed networks. Here, each stage of the agents carries out special controls on the basis of their detail. The monitoring process and tasks are distinguished by an unmistakable fixed structure of the system.

4 Fault Tolerant Routing Interconnect System For Neural NoC

The below figure (1) shows the architecture of fault tolerant routing interconnect system for neural NoC. A new routing strategy is being implemented to address imbalanced data-dependent network loads on multiple virtual networks. It has an eastern port, a western port, a northern port, a southern port and a domestic port. Each terminal has four simulation channels. An escape network can be set up by gently creating one channel for each router. The third default channel for each router is not accessible at the start of the transmission. The data packet is sent to the third virtual channel only when the queue time limit of other channels is reached and the other channels are sent to the destination without access.

The basic Y-X routing strategy is discarded in order to avoid competition at the exit ports. The leak network is used to pass packets from the usual channel to the leak channel only after data packets have been waiting for a long time in the simulation channel. However, data packets using X-Y routing in the normal channel and packets in the loss network must be transmitted simultaneously, since data packets in the normal channel and data packets in the loss channel which vary from the same output channel.

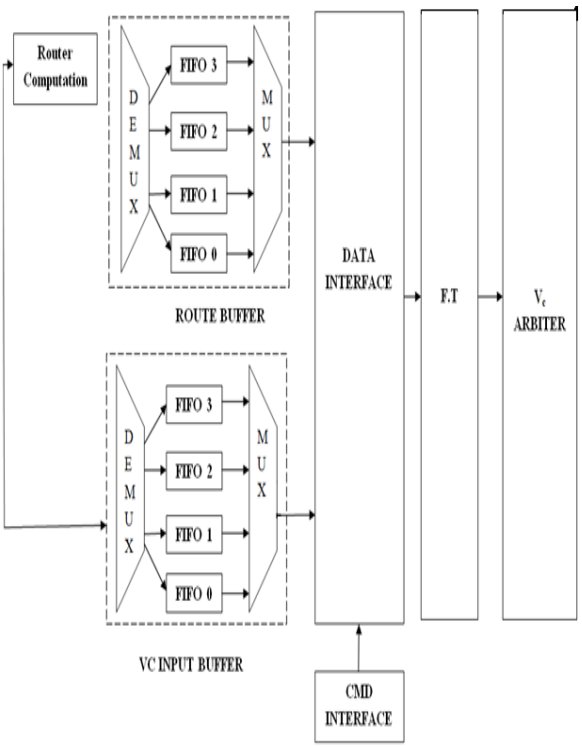

Fig. 1. Architecture Of Fault Tolerant Routing Interconnect System For Neural NoC

When NoC runs at a lower data injection rate, NoC's delay is greater than that of traditional mesh-based NoC. The condition is changing as the pace of data injection rises. This is because the data packets buffered in the virtual channel do not wait long when NoC has a lower data injection rate. The waiting time, however, does not reach the limit. It provides control and retrieval function for the reception and distribution of data to the entire arbitration system. Statements of VCs (Version Control systems) are mediated according to the credit of the target VC and the preference of the local VC.

In addition, it is responsible for sending and analyzing instructions. The credit synchronization system is used here to prevent overloading the RX handle. This module sends a request for a credit update based on the RX level and receives a credit order from another chip to change the local credit. If the credit is reduced to 0, the goal on the RX side means that the VC is complete.

For convenience, this has just mentioned five types of commands. When an error occurs, the data link layer sends a credit synchronization order only. In most instances, the machine sends good data instead of a command. Compared to PCI's (Personal Computer Interconnects) packet redundancy in the network connection layer, this architecture has fewer overheads and is likely to improve efficiency substantially.

5 Results

The below figure (2) shows the comparison of delay in fault tolerant routing interconnect system for neural NoC and routing interconnect system for neural NoC. From this figure it can observe that the fault tolerant routing interconnect system for neural NoC reduces the delay very effectively.

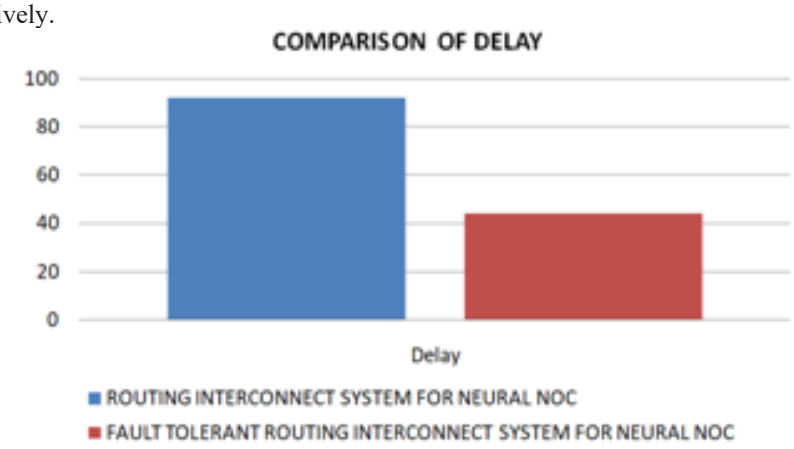

Fig. 2. Delay Comparison

The below figure (3) shows the comparison of accuracy of in fault tolerant routing interconnect system for neural NoC and routing interconnect system for neural NoC. In fault tolerant routing interconnect system for neural NoC accuracy is very high. It gives effective output and reduces the fault very efficiently.

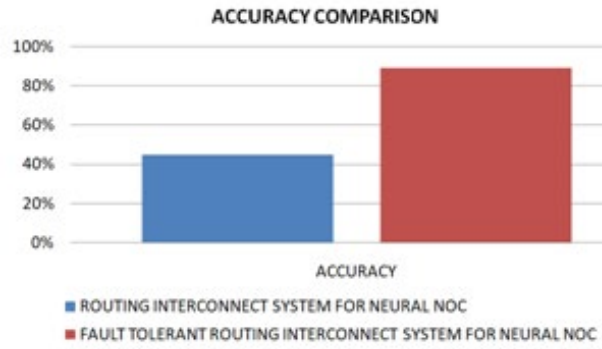

Fig. 3. Accuracy Comparison

The below figure (4) shows the comparison of reduction of number of faults in fault tolerant routing interconnect system for neural NoC and routing interconnect system for neural NoC. Compared to both number of faults are reduced in fault tolerant routing interconnect system for neural NoC.

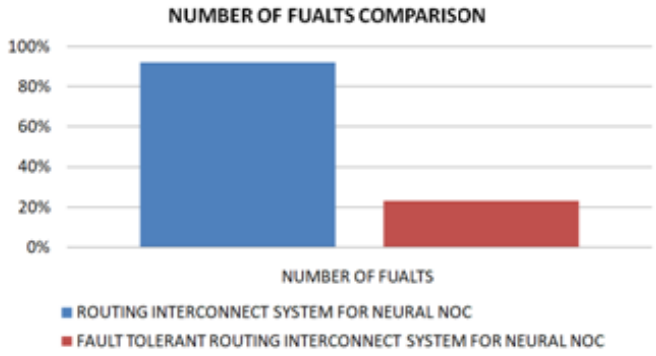

Fig. 4. Number of Faults

The below figure (5) shows the comparison of efficiency of fault tolerant routing interconnect system for neural NoC and routing interconnect system for neural NoC.

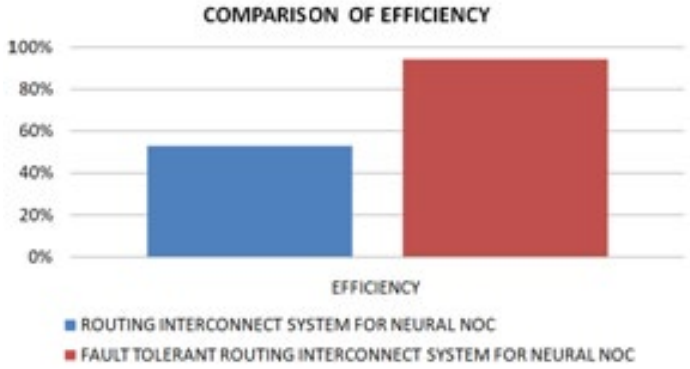

Fig. 5. Efficiency

6 Conclusion

Hence in this paper, this has suggested an efficient fault-tolerant interconnecting mechanism for neural NoC. Interconnection to handle the tremendous amount of multicast-based traffic in DNN accelerators effectively. The interconnection shall be thoroughly tested using the RTL (Register Transfer Level) time consistency model. It is also interconnected with four hardware systems focused on FPGA (Field Programmed Gate Array). From results it can observe that it occupies less area, reduces the delay and increases the accuracy of system.

References

[1] S. Yin et al., “An energy-efficient reconfigurable processor for binaryand ternary-weight neural networks with flexible data bit width,” IEEE J. Solid-State Circuits, vol. 54, no. 4, pp. 1120–1136, Apr. 2019.

[2] Y.-H. Chen, T.-J. Yang, J. S. Emer, and V. Sze, “Eyeriss v2: A flexible accelerator for emerging deep neural networks on mobile devices,” IEEE J. Emerg. Sel. Topics Circuits Syst., vol. 9, no. 2, pp. 292–308, Jun. 2019.
[3] K. Bhardwaj and S. M. Nowick, “A continuous-time replication strategy for efficient multicast in asynchronous NoCs,” IEEE Trans. Very Large Scale Integration. (VLSI) System, vol. 27, no. 2, pp. 350–363, Feb. 2019.
[4] M. F. Reza and P. Ampadu, “Energy-efficient and high-performance NoC architecture and mapping solution for deep neural networks,” in Proc. 13th IEEE/ACM Int. Symp. Netw.-Chip, Oct. 2019, pp. 1–8.
[5] X. Zhou et al., “Cambricon-S: Addressing irregularity in sparse neural networks through a cooperative software/hardware approach,” in Proc. 51st Annu. IEEE/ACM Int. Symp. Micro architecture (MICRO), Oct. 2018, pp. 15–28.
[6] Kwon, A. Samajdar, and T. Krishna, “MAERI: Enabling flexible dataflow mapping over DNN accelerators via reconfigurable interconnects,” in Proc. 23rd Int. Conf. Archit. Support Program. Lang. Oper. Syst. (ASPLOS), Mar. 2018, pp. 461–475.
[7] A. Firuzan, M. Modarressi, M. Daneshtalab, and M. Reshadi, “Reconfigurable network-on-chip for 3D neural network accelerators,” in Proc. 12th IEEE/ACM Int. Symp. Netw.-Chip (NOCS), Oct. 2018, pp. 1–8.
[8] B. Bohnenstiehl et al., “KiloCore: A 32-nm 1000-processor computational array,” IEEE J. Solid-State Circuits, vol. 52, no. 4, pp. 891–902, Apr. 2017.
[9] K. He, X. Zhang, S. Ren, and J. Sun, “Identity mappings in deep residual networks,” in Proc. Eur. Conf. Compute. Vis. (ECCV), Oct. 2016, pp. 630–645.
[10] C. Zhang, P. Li, G. Sun, Y. Guan, B. Xiao, and J. Cong, “Optimizing FPGA-based accelerator design for deep convolution neural networks,” in Proc. ACM/SIGDA Int. Symp. Field-Program. Gate Arrays (FPGA), Feb. 2015, pp. 161–170.
[11] S. Gupta, A. Agrawal, K. Gopalakrishnan, and P. Narayanan, “Deep learning with limited numerical precision,” in Proc. Int. Conf. Mach. Learn. (ICML), Jul. 2015, pp. 1737–1746.
[12] A. Touzene, “On all-to-all broadcast in dense Gaussian network onchip,” IEEE Trans. Parallel Distrib. Syst., vol. 26, no. 4, pp. 1085–1095, Apr. 2015.
[13] R. Girshick, J. Donahue, T. Darrell, and J. Malik, “Rich feature hierarchies for accurate object detection and semantic segmentation,” in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2014, pp. 580–587.
[14] P. Ou et al., “A 65 nm 39 GOPS/W 24-core processor with 11Tb/s/W packet-controlled circuit-switched double-layer network-on-chip and heterogeneous execution array,” in IEEE Int. Solid-State Circuits Conf. (ISSCC) Dig. Tech. Papers, Feb. 2013, pp. 56–57.
[15] G. Hinton et al., “Deep neural networks for acoustic modeling in speech recognition: The shared views of four research groups,” IEEE Signal Process. Mag., vol. 29, no. 6, pp. 82–97, Nov. 2012.

QoS constraint Enhanced AODV in Cognitive Radio Ad Hoc Network

Shobana M[1], Vijayanand M[2], SanthiyaM[3], Bharathiraja N[4]
{shobanam@srmist.edu.in[1],vijaydeepi1212@gmail.com[2], santhiyamunusamy@gmail.com[3], rajamesoft@gmail.com[4]}

Assistant Professor, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Kattankulathur[1], Professor, Department of Computer Science and Engineering, Saveetha Engineering College, Chennai[2], Assistant Professor, Department of Computer Science and Engineering, Rajalakshmi Engineering College, Chennai[3], Assistant Professor, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Ramapuram[4]

Abstract. More range is needed for data communication due to distributed computing, versatility, and the Internet of Things. Regrettably, that range has become a limited resource that is underplayed among licensed clients although these unauthorized selections are overflowing. Intellectual communication creativity is emerged as a potential solution to the range's underutilization. This investigation aims to solve the guiding problem by upgrading the DSR consensus using Quality of Service (QoS) criteria. This investigation determines how such variables affecting QoS could be referred to and in terms with related research. The test employs QoS criteria to improve DSR's display and then evaluate its effectiveness in resolving that steering problem. The proposed plot Q-DSR is compared to the DSR, which is currently in use. NS2 is used to lead reproductions. In terms of speed, temporary suspension, and bundle conveyance ratio, the proposed conspire outperforms the DSR agreement. The strategy worked out how to solve the steering problem yet has gradually reduced the factors that influence QoS. This same disadvantage of said proposed conspiracy is because there is no part to repair disrupted communications after a link break that is being addressed through our future studies.

Keywords: Dynamic Source Routing, Cognitive Radio Ad-hoc Network, Quality of Service.

1 Introduction

The cognitive radio ad hoc network (CRAHN) is an organization that can adjust and identify naturally the accessible channels. Intellectual radios are fit for changing their arrangements to adjust to the changing condition [1][2]. There are different radio ranges, for example, the worldwide framework for versatile (GSM), TV, remote neighborhood, defense environment, and extended haul advancement as portrayed in figure 1. Some of it is underutilized, while the open classes were overcrowded [3]. The Television and Defense spectrum classes were underutilized to a large extent.

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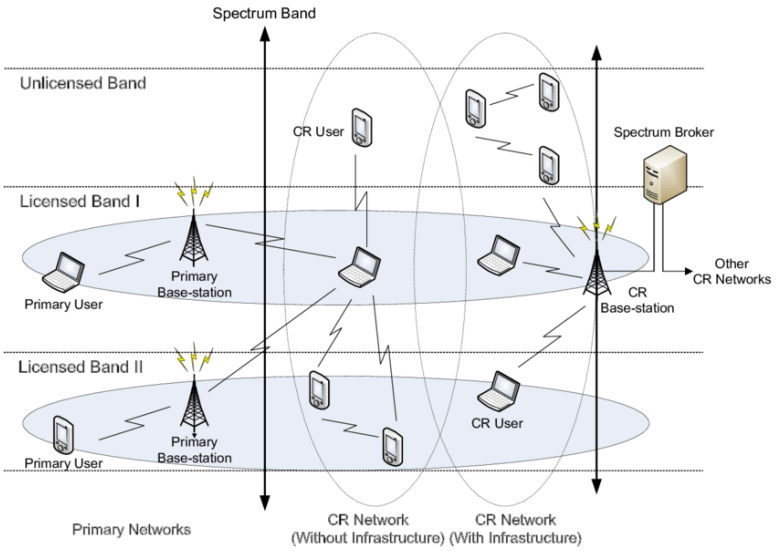

Figure 1: The diagram depicts the distribution of bands among numerous uses.

Cognitive communication may emerge as a potential solution to the problem of underutilized spectrum that can be used by unauthorized clients because when necessary clients remain inactive. Be that as it may, if the PU needs to utilize its range, the optional clients ought to abandon the range without intruding on the PUs exercises. The nature of administration (QoS) in the directing of CRAHNs ought to be thought about given the ever-expanding remote gadgets requiring range which brings about range blockage. The breakage of connections and continuous requirement for course disclosure to fix the courses or to find new courses is a test that influences the exhibition of CRN. Nonetheless, in several-bounce organizations, selecting hand-off hubs for high lingering energy enhances this essence between steering. Specially appointed organizations are utilized broadly in a debacles, salvage, vehicular organizations, battle, uneven regions, fire episodes, quakes, and in acoustic submerged organizations as portrayed in figure 2. Booking methods intended to improve the QoS in impromptu organizations are utilized in this investigation to directing proficiency. A decent booking procedure treats the different streams reasonably. This examination considers a few booking methods intended to improve QoS, for example, the FIFO lining, need lining, and weighted reasonable queueing.

Figure 2: Applications that use cognitive radio networks

2 Literature Review

QoS relay nodes look for pathways with enough resources to meet the flow's QoS constraints. Routing protocols that are conscious of QoS should choose routes that are resource-efficient [4]. [5] Looks at certain route selection criteria that are subject to QoS specifications. [6] Proposes a method for auto repairing and enhancing routedesignin ad hoc organization.

In [7], the receptive steering norms are picked because of limited control overheads and expandability yet they experience standard way breakdowns due to expanded relocation of the hubs. For limiting the association breakdowns and to secure a steady way a new responsive directing standard is planned dependent on progressive system based relocations. The expected relocation and scope mindfully appointed on request distance vector steering practice support to resolve the removals including scale highlights over its impromptu organizations. The DDC – AODV coordinates the way distinguishing proof and way affirmation dependent on the uprooting of the contributing hubs and their sizes.

In article[8], authors Shahenda Sarhan and Shadia Sarhan proposed energy effective steering convention dependent on the notable Ad Hoc On-Demand Multipath Distance Vector (AOMDV) directing convention and a bio-motivated calculation called Elephant Herding Optimization (EHO). Inside the suggested EHO-AOMDV, hubs' overall consumed energy is increased by categorizing them within two categories, and routes were found again from group of a best fitted hubs having sufficient power for communication to reduce the probability of way dissatisfaction as well as the growing number of casualties hubs due to increased information loads. After each transmission round, the EHO refreshing administrator refreshes skills based upon on isolating administrator's assessment of hubs based on power consumption.

Authors Srinivas Sethi and Sangita Pal discuss that CRAHN is a consuming innovation in the remote correspondence region and has the high level highlights such as self-recuperating, self-arranging and strength with low arrangement cost. In this climate steering has a

significant job to build up the way and send the information from source hub to objective hub. As a result, cutting-edge analysis on effective and efficient course creation in organizations is gaining traction.Picking the right peer hub besides sending those bundles will lead to a productive and powerful path.The successful course has been set up in journal [9], using fluffy reasoning based on hub's power and antenna sign power of a hub for greater selection the executives that are major limitations to steering their parcels.

In [10], Thong Nhat Tran etal., proposed a profound support learning-based nature of-administration steering convention to build up the best course with least start to finish lining postpone subject to the quantity of jumps requirement in psychological versatile impromptu organizations (CRAHNs). In sending RREQ measure, in light of the proposed profound support learning system, the DQR convention route the RREQ bundle to the peered hub with least expense esteem that would save control outgoings, lining lag, and guiding postponement, it stays away from the critical client's influenced location.

Steering in CRAHN is a difficult undertaking because of restricted range accessibility. To defeat this issue a few scientists have proposed different directing plans dependent on QoS and range accessibility. This plans choose a method that provides the highest level of QoS and range, ignoring the required Fault tolerance rate for such a particular function, that might not be on highest quality. In the work, Hardik Dhingra et al suggested an eight-category coordinated support model [11] for CRAHN to imagine confirmation monitoring across Primary User (PU) hubs, thus reducing burden on Secondary Users (SU) for diverse products. To assist Elastic and Real Time Frameworks through (SU) hubs, the PU hub first inspects their range accessibility and then examines that they got package can be enabled client explicit Quality of Service (QoS) or not. The suggested plot correlation with the Cognitive Ad hoc On-request Distance Vector or the most restricted range conscious way guiding scheme was completed to demonstrate the effectiveness of the suggested plot correlation. The outcome displays that elite rate for great dependability, low inactivity and high throughput with reasonable burden appropriation among every one of the hubs of the organization.

In [12], creators introduced a postponement and energy-based (DEB) directing convention for the intellectual radio specially appointed organizations. In this work, a bunching approach is considered to partition the organization, where the group arrangement depends on spatial varieties of the range accessibility. When the bunch based organization is framed, the proposed convention empowers any source hub to look and set up a productive course to the objective hub. Characterized as a weighted diagram issue, the proposed DEB steering convention believes postponement and energy to be the directing measurement. In this way, a connection weight is estimated through exchanging and lining deferral of the hubs alongside their remaining energy. It is expected that the proposed convention chooses stable ways while guaranteeing quick information conveyance. The exhibition of the DEB convention has been evaluated through reproduction and contrasted the outcomes and existing conventions. It is seen that DEB displays better execution by outperforming different conventions.

Psychological Radio is indeed a Wi-Fi communicational system which allows clients to communicate with others without being restricted to a specific wireless spectrum. Cognitive Wireless Networks are experiencing difficulties with steering, which is among the important understanding. Specially designated organizations are non-brought together Wi-Fi systems which can be created, and no prior foundation is required for such organizations. Each point will act mostly as switch in this situation. The makers have explained the Radio Resource Technologies which are gaining so much acclaim, with the primary focus on the one-of-a-kind endeavor through streams to remote gadgets. Psychological radio organizations are principally engaged. These days, practically every one of the organizations depends on fixed distributed

organizations in an affirmed or unapproved recurrence gathering. In [13], Lolita Singh and Nitul Dutta writing assesses related to CRN and an advancement calculation to upgrade the general presentation of TE under CRN has been talked about. Multitude insight method is utilized in the work. The multitude solution involves unmistakably a combination of decentralized and centralized characteristics in order to obtain magnificent and rational arrangements. Nature provides more motivation than non-standard blueprints on a daily basis.Cat swarm is one of the feasible methods that is often used to secure exorbitant precision and low blunder rates, increasing the organization's life expectancy.The results were analyzed using Cat Swarm Optimization, and boundaries such as power use, blockage, workload usage, and the quantity of steering laws have been used to analyze the overall presentation of a calculation.

Among the most challenging challenges in CRAHNs is increasing throughput in an environment with limited range assets and part of foreign.By using adaptive steering calculation thus achieving Simulated Primary Path, clever range usage will reduce throughput corruption. The Simulated Primary Path[14] targets tracking down the most solid way for multi-bounce correspondence between SU within the sight of PU and other meddling Secondary Users. Virtual Path Routing selects the path that ensures optimal link throughput with the least amount of obstruction by combining mutual steering and diverse range exposure with impedance evasion. Two functionality capacities for guiding intellectual organizations are proposed in this section. The primary power supply combines the probabilistic Transceiver Ratio, the PU effect, and the route choice time delay. The second proposed benefit is based on restricting force use in order to extend life of the battery. In terms of speed, Bit Error Rate, and Packet Arrival Latency, the Simulated Path Routing execution is compared to that of other notable works. Automatically Send Routing, according to the findings, improves bit transfer speed, BER, and PAD by avoiding PU zones and mitigating the impedance effects of neighboring SUs. It can be seen that when a force mitigation strategy, such as water-filling, is used, the Simulated Path Routing increases performance. In comparison to the recently recommended programme, such as Gymkhana with proficient force utilization, the BER for Virtual Path Routing with water-filling is also lower.

In paper [15], Khalid A. Darabkh and Oswa M. Amro considered non-time opened psychological radio specially appointed organizations to directing convention without a typical control channel, in this manner clinging to common sense. The control bundles are sent out in multi - hop and unicast modes to accomplish this.

This convention's exhibition is compared to another significant and ongoing convention, Predictive and Knowable Path Selection (PDPS), which uses an exceptional test method, built on the PDPS test system.Thus using all of the directs in the company, the PDPS convention creates two paths between both the source and the target. Strangely, their outcomes are promising regarding throughput. Then again, our convention works whatever number ways as could be expected under the circumstances between the source and objective. Moreover, in our convention, we utilize every one of the directs in the organization. The presentation metric considered is the throughput while our outcomes are far and away superior to those of PDPS convention.

Psychological Radio innovation has been acquainted with tackle the issues of range underutilization and range shortage brought about by inappropriate range the executives strategies. In CRAHNs, the work not unified framework uphold, information directing experiences different difficulties including successive geography changes, heterogeneous range accessibility, and discontinuous availability brought about withexercises of PU. On this work [16], Zamree Che-aron et al alluded to the Robustness Aware Cognitive Ad-hoc Routing

Protocol, is introduced by a plan that gives strong way to information conveyance. The Expected Path Delay steering parameter utilized on way choice by presenting that applied in the convention. The measurement assesses the connection delay and the impact of bundle misfortune on remote connections. Besides, the convention tries not to make a communication way which utilizes PU divert in PU districts to balance the effect of PU exercises this could basically aim correspondence interferences. The convention likewise together adventures way with wide variation in steering measure to several hop and various-channel courses with end goal of quick course recuperation.

3 Issues with Routing

The range accessibility issue emerges because of the static range assignment strategy. With the headway of innovation and the expanding cell phones, the interest for range is expanding. There is likewise a need to streamline, alter, and to configuration new directing conventions to deliver the steering issue to utilize the range adequately while improving the organization execution. The inaccessibility of organization assets, stable courses, and regular connection breakages debases network execution.

In CRAHNs, a need to resolve solution for guiding problem. Continuous link breaks are caused by hubs and range mobility, which corrupts the presentation of guiding conventions. Whenever the course fails, unenforceable packages accumulate within cushions over extended periods of time, causing them to be lost. We recommend that the CRAHN guiding problem be solved by updating the AODV steering convention and implementing QoS imperatives to ensure that only the courses that fulfill the QoS requirements are prioritized.

4 Routing Methodology

QoS steering is an essential feature of CRAHNs. QoS guiding is indeed a form of steering that is based upon that availability of necessary assets such as QoS essentials. The three destinations for QoS guiding are as follows:

- Find an achievable way among source and objective. A way with sufficient assets like battery life, quick organization access, transfer speed, and range to fulfill the QoS prerequisites.
- Optimize the utilization of organization data transmission and assets.
- Adapt to arrange blockage, and choke data transfer capacity for lower-need traffic.

4.1 Summary of service approaches quality

Bundles from different streams show up at a switch for the handling which requires reasonableness. This reasonableness can be accomplished through the execution of good planning methods. Moreover, strategies intended to improve the QoS, for example, traffic forming isnecessary. Traffic molding is the instrument which control the sum and pace of route flow shipped off in organization like cracked and token container, affirmation control component utilized by the switch to acknowledge or dismiss a stream dependent on predefined boundaries and asset reservation. Assets like cushion, transmission capacity, computation time, and schedule openings. The QoS has been improvised by these assets which held in advance. QoS directing in the specially appointed organization is a test because of organization geography which changes habitually which makes the steering data be flat . A

QoS mindful steering convention ought to be improved for the postponement, data transmission, jitter, cost, and misfortune proportion.

4.2 Phase of Route Discovery

The control bundles in the recommended QoS-AODV are modified to provide nitty gritty QoS detail.The jump search is used to determine which path is the shortest.The RREQ and RREP packages provide details of available QoS related assets in order to meet the best QoS requirements.The course disclosure as well as area measurement are depicted in Figure 3.

The objective hub piggybacks data around a few bounces, the grouping number, and assets accessible on every way on the RREP bundle. At the point, initial bundle generator hubreceives RREP parcels that verify the data with respect to the most brief way, asset accessibility, and soundness of the connection prior to choosing the best course regarding its capacity to meet the QoS necessities. On the off chance that a course doesn't meet QoS prerequisites, other potential courses are assessed. Just the course meets the QoS necessities is chosen.

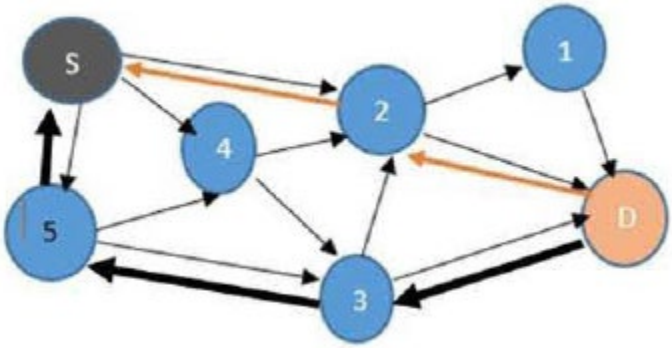

Fig 3: Shows the way revelation measure and the converse way of the proposed plot structure the source hub to the objective hub.

5 Simulation Metric

The investigation considered organization geography conveyed in a 1000 x 1000 m lattice. The implemented work plot QoS-AODV is assessed and contrasted with the CAODV;this is extended augmentation of AODV directing convention. Table I represents the reenactment boundariesparameter to assess conventions.

The two directing conventions were assessed by difficulties saw in the writing identifying with QoS requirements. The proposed QoS-AODV steering convention QoS mindful. The communication speed was set to run for 100 recreation seconds and the most extreme parcel capacity is set to 100 for support the executives.

Table I displays the parameters that augmentedto compare routing protocols.

Parameters	**Values**
Simulator	NS 2.35
Routing protocols	QoS-AODV, CAODV
Simulation time (sec)	500
Simulation area	1000 * 1000

Traffic type	CBR/TCP
Number of mobile nodes	10, 20, 50, 80, 100
Transmission Range	250m
MAC Type	802.11
Channel Type	Wireless Channel
Antenna Model	Omni
Packet Size	512 bytes
Interface Queue Type, length	Drop Tail/PriQueue, 50
Radio Propagation Model	TwoWayGround
Data payload	512 bytes

6 Experimental Solution

Figure 4 presents the relative normal start to finish postpone results. The outcomes presents the proposed plot has a minimal delay when contrasted with the CAODV convention. The exhibition of QoS-AODV was debased by the expansion in the quantity of hubs. Be that as it may, in comparison to the situation with 100 hubs, its display enhanced for all the number of hubs groups.If a link fails, the CAODV must find alternative methods to avoid prolonged latency issues.

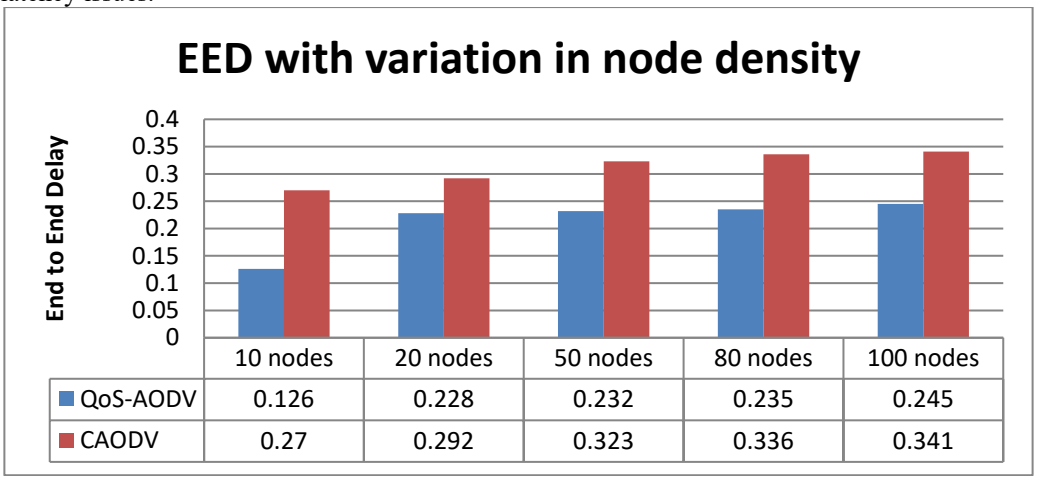

Fig 4: end-to-end delay measures of CAODV compared with QoS-AODV

The presentation of both the guiding conventions for the quantity of fallen parcels is depicted in Figure 5.The results demonstrate that the proposed QoS-AODV plot outperforms the CAODV convention.In any case, the presentation of the two projects in a scenario of 100 hubs is bad, though the QoS-AODV were probably better.The majority of parcels are lost as a result of increased rush hour gridlock with the need to support several bundles over long periods, causing latency issues.Several parcels can be dropped as a result of these deferrals. The QoS prerequisites are in this manner influenced by the quantity of connection breakages that happen as often as possible.

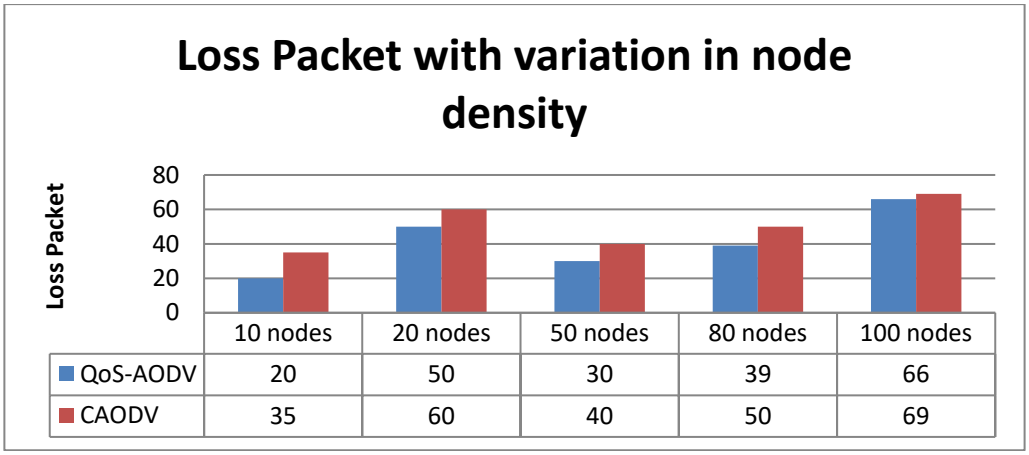

Fig 5: loss Packet delay measures of CAODV compared with QoS-AODV

Figure 6 depicts that conventions' evaluation based on PDR. The QoS-AODV convention outflanked the CAODV convention in terms of parcel conveyance proportion (PDR). The CAODV plot isn't far along in terms of course upkeep.

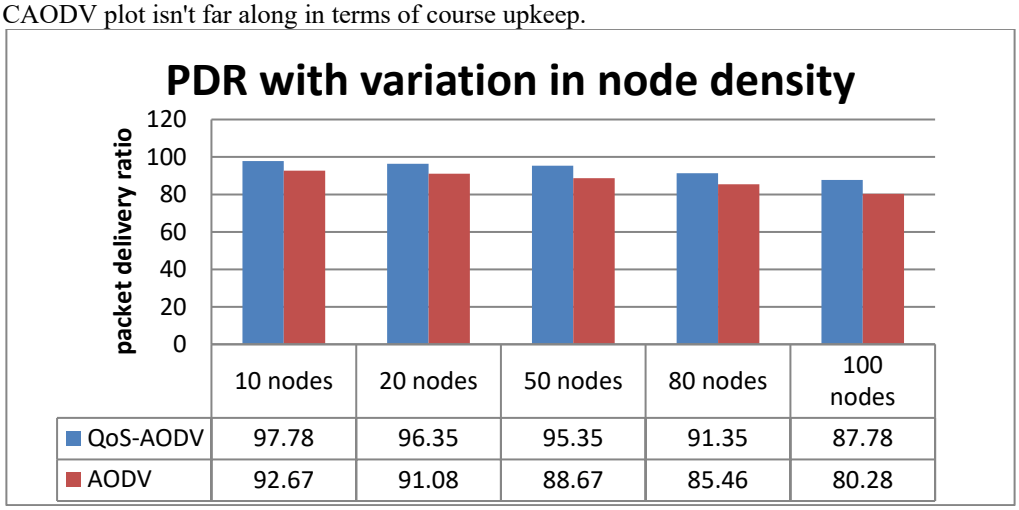

Fig 6: Packet Delivery Ratio measures of CAODV compared with QoS-AODV

Figure 7 examines Throughput and considered as one of the assessment measurements. The similar outcomes show that the feasible throughput of the two conventions expanded with the expansion in the quantity of hubs Notwithstanding. The exhibition of the QAODV convention was prevalent. For a situation with 10 hubs, the QoS-AODV could perform better, and for a situation with 100 hubs, the CAODV organized the results. The QoS-AODV outflanked the CAODV in a variety of cases. The results show that the QoS-AODV convention is successful in determining the best path based on QoS requirements.

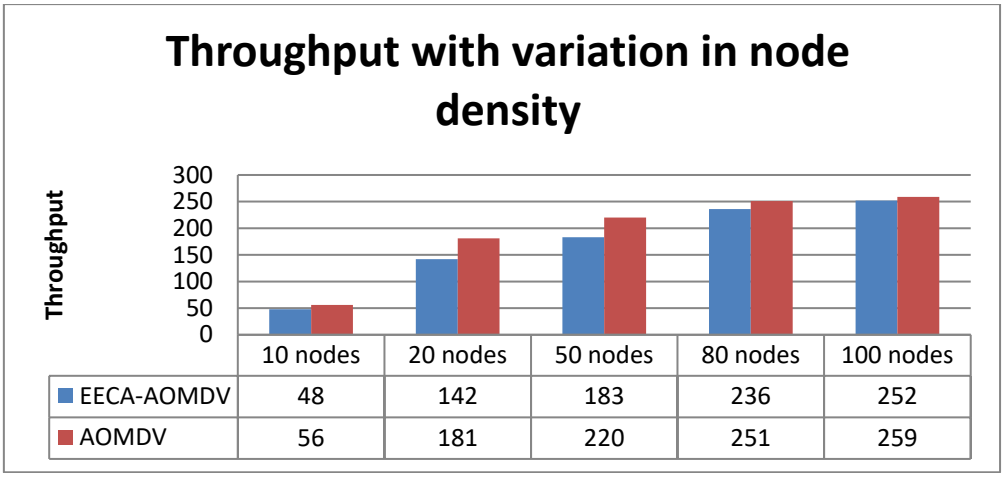

Fig 8: Throughput measures of CAODV compared with QoS-AODV

Conclusion

The proposed plot has clearly beaten the CAODV steering convention, based on the reenactment results. The plan was improved to reveal secure courses with adequate force that meet the SUs' QoS requirements. This same recreation results showed that the proposal had the potential to overcome the CRAHN steering problem. The NS2 evaluation method was used to evaluate the two conventions' presentations. The steering convention may be changed in the future to aid multiple transmissions. It corrupts in its current structure when exposed to various transmissions. It should be tweaked so that a hub can deal with multiple sources.

References

[1] S. Kulkarni and S. Markande, "Comparative study of routing protocols in Cognitive Radio Networks," 2015 International Conference on Pervasive Computing (ICPC), Pune, India, 2015, pp. 1-5, doi: 10.1109/PERVASIVE.2015.7087073.

[2] S. Sengupta and K. P. Subbalakshmi, "Open research issues in multi-hop cognitive radio networks," in IEEE Communications Magazine, vol. 51, no. 4, pp. 168-176, April 2013, doi: 10.1109/MCOM.2013.6495776.

[3] "IEEE Standard - Information Technology-Telecommunications and information exchange between systems-Wireless Regional Area Networks-Specific requirements-Part 22: Cognitive Wireless RAN MAC and PHY specifications: Policies and Procedures for Operation in the Bands that Allow Spectrum Sharing where the Communications Devices May Opportunistically Operate in the Spectrum of Primary Service," in IEEE Std 802.22-2019 (Revision of IEEE Std 802.22-2011) , vol., no., pp.1-1465, 5 May 2020, doi: 10.1109/IEEESTD.2020.9086951.

[4] A. A. Junnarkar, Y. P. Singh and V. S. Deshpande, "SQMAA: Security, QoS and Mobility Aware ACO Based Opportunistic Routing Protocol for MANET," 2018 4th International Conference for Convergence in Technology (I2CT), Mangalore, India, 2018, pp. 1-6, doi: 10.1109/I2CT42659.2018.9058022.

[5] S. Jabbehdari, M. Shamaei and A. Darehshoorzadeh, "IQoS-ODMRP: A novel routing protocol considering QoS parameter in MANET," 2010 IEEE Symposium on Industrial Electronics and Applications (ISIEA), Penang, Malaysia, 2010, pp. 126-130, doi: 10.1109/ISIEA.2010.5679484.

[6] W. Luo, "A quantum genetic algorithm based QoS routing protocol for wireless sensor networks," 2010 IEEE International Conference on Software Engineering and Service Sciences, Beijing, China, 2010, pp. 37-40, doi: 10.1109/ICSESS.2010.5552333.

[7] Saravanan, T., Nithya, N.S. Modeling Displacement and Direction Aware Ad Hoc On-Demand Distance Vector Routing Standard for Mobile Ad Hoc Networks. Mobile Netw Appl24, 1804–1813 (2019). https://doi.org/10.1007/s11036-019-01390-9

[8] S. Sarhan and S. Sarhan, "Elephant Herding Optimization Ad Hoc On-Demand Multipath Distance Vector Routing Protocol for MANET," in IEEE Access, doi: 10.1109/ACCESS.2021.3065288.

[9] Sethi S., Pal S. (2014) Effective Routing Protocol in Cognitive Radio Ad Hoc Network Using Fuzzy-Based Reliable Communication Neighbor Node Selection. In: Satapathy S., Udgata S., Biswal B. (eds) Proceedings of the International Conference on Frontiers of Intelligent Computing: Theory and Applications (FICTA) 2013. Advances in Intelligent Systems and Computing, vol 247. Springer, Cham. https://doi.org/10.1007/978-3-319-02931-3_3

[10] T. N. Tran, T. -V. Nguyen, K. Shim and B. An, "DQR: A Deep Reinforcement Learning-based QoS Routing Protocol in Cognitive Radio Mobile Ad Hoc Networks," 2021 International Conference on Electronics, Information, and Communication (ICEIC), Jeju, Korea (South), 2021, pp. 1-4, doi: 10.1109/ICEIC51217.2021.9369756.

[11] Dhingra, H., Dhand, G.D., Chawla, R. et al. An integrated service model to support user specific QoS routing in cognitive radio ad hoc network. Peer-to-Peer Netw. Appl.14, 18–29 (2021). https://doi.org/10.1007/s12083-020-00965-8

[12] Tasmim S., Kamal A.H., Tusher M.O., Mansoor N. (2020) DEB: A Delay and Energy-Based Routing Protocol for Cognitive Radio Ad Hoc Networks. In: Uddin M.S., Bansal J.C. (eds) Proceedings of International Joint Conference on Computational Intelligence. Algorithms for Intelligent Systems. Springer, Singapore. https://doi.org/10.1007/978-981-15-3607-6_51

[13] Singh L., Dutta N. (2020) A Novel Approach for Better QoS in Cognitive Radio Ad Hoc Networks Using Cat Optimization. In: Sharma N., Chakrabarti A., Balas V. (eds) Data Management, Analytics and Innovation. Advances in Intelligent Systems and Computing, vol 1042. Springer, Singapore. https://doi.org/10.1007/978-981-32-9949-8_42

[14] Mahmud F., Minhas Q., Mahmood H., Muhammad Z., Malik H. (2015) Power Aware Virtual Path Routing Protocol for Cognitive Radio Ad Hoc Networks. In: Yang GC., Ao SI., Gelman L. (eds) Transactions on Engineering Technologies. Springer, Dordrecht. https://doi.org/10.1007/978-94-017-9804-4_37

[15] K. A. Darabkh and O. M. Amro, "New Routing Protocol for Half-Duplex Cognitive Radio Ad-Hoc Networks over IoT Environment," 2020 IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS), Vancouver, BC, Canada, 2020, pp. 1-5, doi: 10.1109/IEMTRONICS51293.2020.9216340.

[16] Che-aron Z., Abdalla A.H., Abdullah K., Hassan W.H., Rahman M.A. (2015) A Robust On-Demand Routing Protocol for Cognitive Radio Ad Hoc Networks. In: Kim K., Wattanapongsakorn N. (eds) Mobile and Wireless Technology 2015. Lecture Notes in Electrical Engineering, vol 310. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-662-47669-7_4

Exertion of WSN and UAV for Performance Measurements in Railway Bridges

G.Saravanan[1], P.Saravanan [2], S.Prasath Kumar[3], R.Lakshmidevi[4], D.Pushgara Rani[5]
{saravanang.ece@sairamit.edu.in[1], saravanan.ece@sairamit.edu.in[2], prasathkumar.ece@sairamit.edu.in[3], lakshmidevi.ece@sairamit.edu.in[4], pushgararani.ece@sairamit.edu.in[5]}
[1,2]Associate Professor, Department of Electronics and Communication Engineering, Sri Sai Ram Institute of Technology, Chennai, India
[3,4,5]Assistant Professor, Department of Electronics and Communication Engineering, Sri Sai Ram Institute of Technology, Chennai, India

Abstract. The growth of information technologies had its tardiest step in the field of construction industry. With the advancements of technologies in various fields, adoption of the latest technologies is fostering the growth of construction management. The title "Construction 4.0" was framed from "Industry 4.0" a fundamental which is described as the fourth industrial reformation. The "Industry 4.0" is an innovative modification in the production sector that permits the collaboration of many advanced technologies. Specifically, it's the Engineering and Construction industry's generation of Industry 4.0, a movement towards greater digitization. It encapsulates the scientific advancement stuffs such as automation, model pre fabrication, 3D printing, unmanned flights, virtual reality, robots, and sensor nodes used to configure the construction industry with better solutions. This paper focuses only on the utilization of sensor and UAV which are used in railway bridges to monitor bridge deflections and bridge performance measurements.

Keywords: Construction 4.0, Sensor, UAV, Bridge deflections, bridge performance measurements.

1 Introduction

Bridges are passages that are constructed to commute from one place to another without disturbing the passageway beneath. They can be constructed over canals, valleys, rivers, streams and etc. Bridges are also called as flyovers or grade separators. There are many different types of bridges which serve various purposes. Designs of bridges also vary according to the function of the bridge, place where the bridge is going to be constructed, the material used and the funds available to build it.Stepping stones and fallen trees were used as bridges in the early days. Bridges are classified into many types. They are listed in the table given below.

Table1: Classification of Bridges

Sl.No	Main Classification	Sub Classification
1.	Function	Foot: Road; Railway; Road-cum-Rail; Pipe line; Water conveying(adequate); Jetty(Port)
2.	Material	Stone; Brick; stone; Timber; Steel;

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		Concrete; composite; Aluminium; Fibre
3.	Form	Slab; Beam; Arch; Truss; Suspension; Cable supported
4.	Type of Support	Simply supported; continuous; Cantilever
5.	Position of floor/deck	Deck; through; semi through
6.	Usage	Temporary; Permanent; Service(Army)
7.	With respect to water level	Causeway; Submersible; High level (normal Case)
8.	Grade separators	Road-over; Road under(sub Way) ;Fly over(Road over road)
9.	With respect to connections(Type of joining)	Pin jointed; riveted/bolted; Welded
10.	Movable bridges(over navigation channels)	Bascule,(Plate 1.14) Lifting, Swing (Plate 1.15)
11.	Temporary bridges	Pontoon, Bailey, Callender - Hamilton, Light alloy portable bridges developed by the army

However, due to predicament situations, there are lots of mishaps occurring in bridges. There are several deterioration mechanisms that can impact the integrity of the bridge structures. One of the most common damages incurred in bridges is corrosion, low cycle fatigue which is caused by plastic deformation, high cycle fatigue which is caused due to elastic deformation especially in railway bridges, small breaks in connecting elements, deformitiesin connections and permanent deformation such as bending and bucklingetc.

Deformation can also occur in the substructure elements, such as the basement, supports and pillars, and the retaining walls. The below earthelementscan infer the same deformationmechanism as explainedin the above the surface components. Concrete columns and supportscan infer deformationas a result of corrosion occurred due to recycled steel bar, freeze and thaw cycles, and silica – alkali reactions. These elementscan also experience degradation intheir performance. These problems are really a concern for the structural engineers and it is also practically not possible for humans to inspect the bridges on a periodic basis. So, incorporation of technologies such as sensors and drones for bridge monitoring will eradicate the problems incurred in the railway bridges. Railway bridges are important as it carries a huge load of passengers and goods. So, railway bridges have to be monitored in such a way that it periodically sends alert to supervisors by which effective action can be taken immediately in predicament situations.

A Sensor is a subsystem whose work is to observe the environment and notify the user if there are any unusual changes in the environment in which it is acting. Therefore, deploying sensors in railway bridges which can monitor the bridge performance factors eases the job of the concerned person. If a railway bridge is being operated in rivers, canals and seas, it is impossible for a person to inspect theunderneath condition and also the different side angles of

the bridge. So, deploying a UAV which can capture all the angles of the bridges will prove to be an effective method in monitoring the railway bridgeconditions.

1.1Different Stages of Construction of Bridge

The step by step procedures that are employed in the planning of construction of bridge are:

- Survey on necessity for bridge
- Assessment of Traffic density
- Study of Location
- Study of Reconnaissance
    - ❖ Study of alternative arrangements
    - ❖ Alternative study on feasibility
- Preliminary study of Engineering
    - ❖ Plan development
    - ❖ Basic design and costing
    - ❖ Analytical evaluation of alternatives, risk analysis, and final decision
- Detailed analysis of Project Report
- Project implementation

2. Literature Survey

Themodern technologies were adopted in the civil industry among professionals of building construction, toenhance the overall fulfillment of thesector in South Africa. This approach considers that construction 4.0 will be enforced by the requirement tobuild a smart building construction area, as well as adopt tools which are required for simulation and virtual mode of operations for building constructionworks. (Temidayo et.al., 2018).

Secondly, there is focus on the functional description of the instrument and solution for the transfer of data. It mainly focuses on the data management, (Peter Furtner and DaniloDellaca , 2013) control room devices in which via a system user can monitor the information and results from any region and in any available time.

The combination of sensors and ZigBee modulesbeing deployed in bridges and it is kept as ubiquitous-node(u-node) which sends the data to the u- gateway and that sends data to the management Centre wirelesslyover CDMA technology (Chae M.J et.al., 2006).

The unmannedaerial vehicles(UAVs) which have evolved asprecious resources for placing sensing instrument where it is either more tedious to measure or poses a risk to human safety. UAVs have the capacity to promote theprocess of optical based measurement system, provide more accessibility, and decrease the overlapping of local traffic. In this paper, an autonomous vehicle is interfaced with 3D DIC which was designedfor monitoringbridges. The key features ofthe proposed model are explained in both laboratory testing andinformationgatheredfrom bridges that are currently on use. (Daniel Reagan et.al., 2016).

The railway tracks were introduced and bridge observation method with the aid of WSnetworks based on the ARM basedcontrollers. The system is modeled includingthe arrangement of sensor nodes, gatheringinformation, propagation method and signal processing techniques ofthe ad hoc wireless sensor network.

The proposed method (Vinodbolle and Santhoshkumarbanoth, 2016) overcome the human interventions which aggregate and transfer the data. The objectiveof the proposed model is to observethe arrangements to reduce the accidentsand itssafety.

The existing experimental and analytical research on vehicle-bridge interaction, performance under collision, impact and seismic loading, vibration reduction and suppression techniques and fatigue life estimation of railway bridges (Anurag Krishna et.al., 2017).

3. PROPOSED MODEL

In this proposed model, we are deploying strain gauge sensors and UAV for bridge performance measurements and bridge monitoring. Strain gauge or Strain gage sensors are those that measure strain values. It can also be defined as whose electrical resistance varies with applied force. Therefore, strain gauge sensors are attached to (say plate girder bridge model). Now,interfacing is being done between Arduino UnoR3, HX711 (load cell amplifier) and the strain gaugesensor.

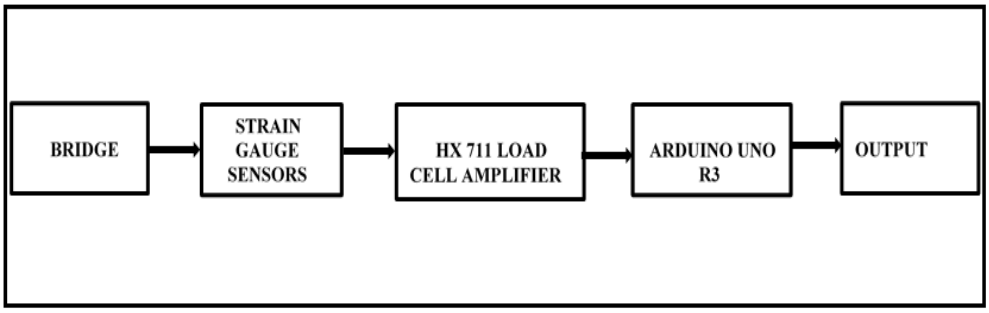

Fig1: Block diagram of proposed model

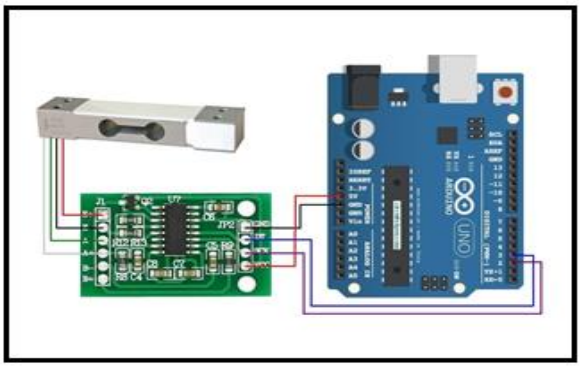

Fig2: Load cell interface with Arduino

3.1 Applications Of Sensors And Drones In Bridges

Due to the aging factor of infrastructure of the major bridges that is more than half century, the with an aging infrastructure and major bridges that are more than 50 years old, the

force is applied on structural engineers to analyze our transit operation is ever increasing. Country wide lawneedseach bridge over a 20ft wide to be checked every other year. In the present scenario, monitoring of bridge does not have to dependsspecifically on regular inspections of human but can depend instead on electronic observation a bridge's life, which could display a structural integrity issue well advance it would be noticed by a conventional bridge investigation.

The structural designers who have authority of keeping the framework sound should become known of sensor components exists that provides them in evaluating framework condition. Particularly, there are three types of sensors involved for monitoring of bridges. Strain gauge is a device that computes stress loads in bridge components that can be observed as micro movements, inclinometers computes gravity-referenced adjustments like tilt, bending, or twisting, and sensors that are positioned as linear arrangements computes macro displacements of bridge components like rocker bearings and trusses gusset plates. Buckling of the gusset plates has been described as one of the most important structural issues in older bridges.Because the sensor network required by bridge observation systems has to workfor a long period in extremely abusive situations, not all position sensors are capable for these inflexible applications.

The Alliance Sensors Group's LV-45 series is utilized in the Metro Rail safe structure and the linear position is also one of its group and inductive linear position sensors is one of them. All the sensor devices are connected to a bridges and its associated column to compute displacement of the bridge related to the pillar and rockers in all three directions over ambient temperature and time. The outputs are analysed by informationstoring method that update in regular interval an off-site observatory centre by mobile phone network based transmissions. Unmanned Aircraft Systems (UAS) or drones are employed to observe the railway for regular inspection or following an event. Small flights are a cost effective solution for closed observations that are difficult to monitor structures such as building ceilings, bridges, overhead wires and communication masts.Thedrones that aggregate information's such as images and videos of railway framework with high – tech equipment, so the conclusion can be derived what the nature of the problem is and what kind of repairs are required.

The required code is being written in Arduino IDE platform that describes the following conditions:

i) If there exists an overload condition on the bridge, strain gauge sensor should immediately sense it and send an alert to the requiredperson.
ii) If the load is normal, it should periodically sense it and send the data to the required person. Thus, the periodic performance of the bridge can beachieved.

In real time, a series of strain gauge sensors can be deployed in railway bridges that can transmit the information wirelessly to the user. This data can be used as reference data before planning to construct another railway bridge, thereby, knowing the bridge capacity and restricting the number of bridge mishaps.

It is impossible for a person to inspect the bridge on a regular basis. Even if he/she does so, it is impossible for them to inspect every nook and corner of the bridge. Therefore, UAVs can help them ease their job. UAVs can be brought into action wherever there is a possibility of risk for humans to inspect. UAVs can be made to fly across the bridges that can totally capture the bridge structure. With the help of software such as Autodesk Inventor, the drone captured images can be designed, visualized and product ideas can be tested. Inventor allows fabricating the prototypes that exactly simulatethe stress, weight and friction, driving loads,

and variety of products and their basic components in a simulated3 dimensional platform. This can also serve as an edifice in bringing future advancements in bridges.

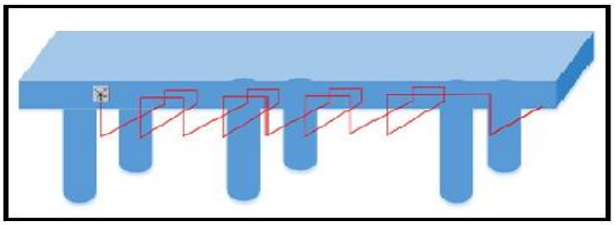

Fig 3: UAV based crack identified bridge model

The hardware unit of UAV system consists of inertial measurement Unit, Infrared sensing device, Ultrasonic and obstacle avoidance camera with a remote control and a display device. The infrared sensors and obstacle avoidance cameras and they are used to measure the vertical and parallel obstacle distances, alternatively. The remote control is employed to conduct bridges' lateral sides and underside observation, as shown in Fig.3, we use to keep the height of UAV and keeps it flying around bridges. If the UAV system is very near to obstacles, the display device will show the warning distance and give motion suggestions. There are three steps for our UAV-based crack inspection system.

- ***Flight mission and data collection:*** With the aid of obstacle avoidance unit and remote control, the UAV will fly around the underside and lateral sides of the bridge. High resolution images that are collected with the aid of HD camera at different locations. The information about the image can be stored in the storage card.
- ***UAV images processing:*** In this process a large scale map of the bridge is prepared in the form of panorama. It provides the relationship between every single image and the global map. This processing method includes distortion reduction, motion blur removal and image stitching.
- ***Crack detection:*** Cracks will be identified by a rapidly arranged learning framework that is based on random decision forests. The crack map on global basis will be produced by the superposition of crack map and the panorama.

The proposed system works according to Fig. 4. It provides a focus on developing the overall solution for UAV-based crack inspection system.

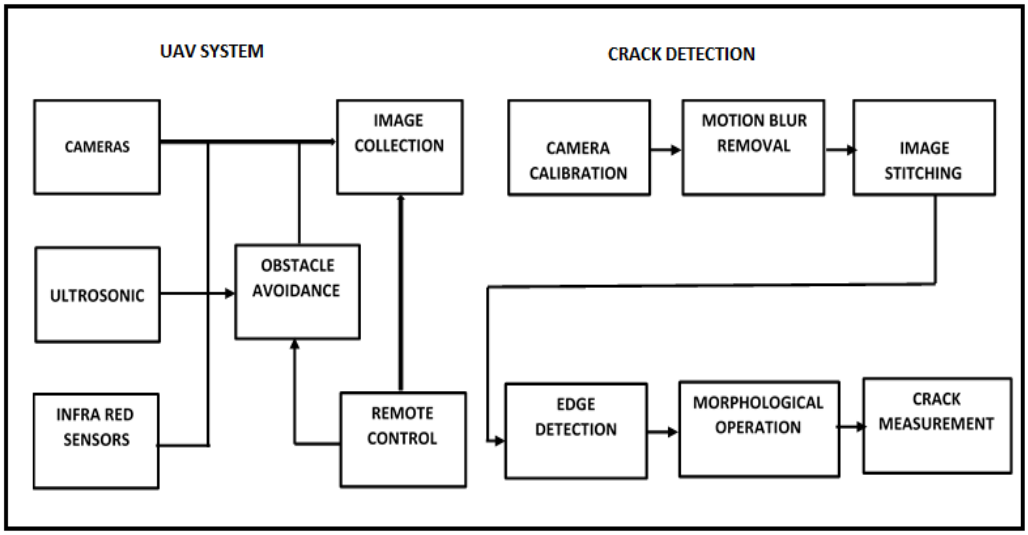

Fig.4: Solution for UAV based system

4. RESULT ANALYSIS

This model measures the deflection values with the help of strain gauge sensors which is been deployed in the bridge. The amount of deflections produced in the bridge is directly proportional to the amount of load applied to the bridge. Deflection values can be easily plotted or viewed in a graph. With the help of UAV, we can view the images of bridge structures and defects produced in the bridges via certain modeling

software which cannot be identified by human inspections. Thus, drones can replace human inspections.

Table 2: Load acting on bridge Vs Calibration

Serial Number	Calibration Factor	Readings (kgs)
1.	6500	2
2.	7000	3
3.	7500	4
4.	8000	4.896
5.	8500	5.1

According to the calibration factor we set, the load output varies. Thus, if an overload is detected in bridge, it'll be notified to the concerned person periodically.

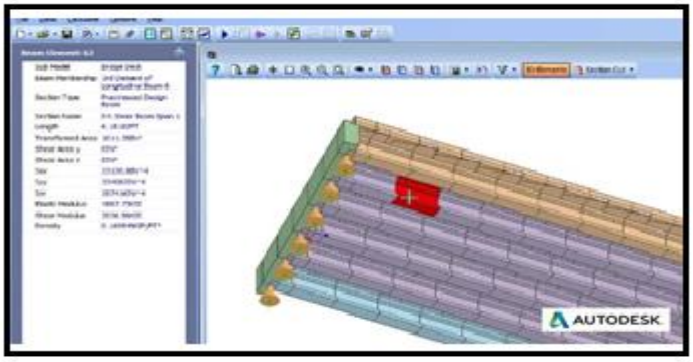

Fig.5: Crack identification graphical tracing

5. Conclusion

In this article, we have presented a novel strategy for grouping WSNs and adaptively scheduling missions for UAVs in order to collect sensor data. Compared to current approaches, the proposed ideawith the help of UAV, the images of bridge structures and defects produced in the bridges via certainModelingsoftware can be viewedwhich could not be identified by human inspections**.**The results demonstrate that UAV outperforms current methods in terms of accurate fault detection. Therefore, the adoption of technological advancements can foster the growth of civil industry and also restrict the number of accidents that occur due to bridge failures. Further research and discussion need to be carried out in bridge engineering.

References

[1] Victoria J. Hodge, Simon O'Keefe, Michael Weeks, and Anthony Moulds," Wireless Sensor Networks for Condition Monitoring in the Railway Industry: A Survey", IEEE Transactions On Intelligent Transportation Systems, Vol. 16, No. 3, June 2015.

[2] Sattar Dorafshan,Marc Maguire, "Bridge inspection: human performance, unmanned aerial systems and automation",The Journal of Civil Structural Health Monitoring (JCSHM),2009.

[3] E. Aboelela, W. Edberg, C. Papakonstantinou, and V. Vokkarane, "Wireless sensor network based model for secure railway operations," in Proc. 25th IEEE Int. Perform., Computer Commun. Conf., Phoenix, AZ, USA, 2006, pp. 1–6.

[4] P. Baronti et al., "Wireless sensor networks: A survey on the state of the art and the 802.15.4 and ZigBee standards," Comput. Commun., vol. 30, no. 7, pp. 1655–1695, May 2007

[5] P. Bennett et al., "Wireless sensor networks for underground railway applications: Case studies in Prague and London," Smart Struct. Syst., vol. 6, no. 5/6, pp. 619–639, 2010.

[6] T.Hay, "Wireless Remote Structural Integrity Monitoring for Railway Bridges," Transportation Research Board, Washington, DC, DC, USA, Tech. Rep. no. HSR-IDEA Project 54, 2007.

[7] Hui-Ru Cao, Zhi Yang, Xue-Jun Yue and Yong-Xin Liu,An optimization method to improve the performance of unmanned aerial vehicle wireless sensor networks," International Journal of Distributed Sensor Networks 2017, Vol. 13(4),2017.

[8] https://waset.org/publications/10008621/construction-4.0-the-future-of-the-construction-industry-in-South- Africa.
[9] Fernando Moreu,Robin Eunju Kim,Billie F. Spencer," Railroad bridge monitoring using wireless smart sensors: Railroad Bridge Monitoring Using Wireless Smart Sensors", Structural Control and Health Monitoring,January 2016.
[10] F.Moreu, R E. Kim, B.F. Spencer. "Railroad bridge monitoring using wireless smart sensors", Journal of Structural Control and Health Monitoring, Feb 2017.

RFID Systems Composed of Multiband Antenna with Fractal Geometry

Chitra Varadhan[1], Dr.S.Arulselvi [2]
{chitralaya@gmail.com[1], arulselvi2003@gmail.com[2]}

Research Scholar, Departmentof ECE, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India - 600 073[1],
Associate Professor, Departmentof ECE, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India - 600 073[2]

Abstract. Two tri-band RFID tag and reader antennas are proposed in this paper. The primary aim of the proposed work isto achieve multi-band antennas by implementing fractal designs as radiating elements. The RFID reader antenna is createdby using modified fractal tree structure; the operating frequencies are 3.6 GHz, 5.8 GHz, and 8.2 GHz. The recursive rectangular is implemented in RFID tag antenna operates at 3.9 GHz, 5.9 GHz, and 8.2 GHz for the RFID applications of goods management, traffic toll fee collection, telemetry respectively. The proposed reader antenna achieved a highest read range of 87.5 cm and tag antenna accomplished 85.6cm.

Keywords: Multiband, Fractals, Radio Frequency Identification (RFID), Co-planar Wave Guide (CPW), Antenna.

1 Introduction

The Radio Frequency Identification (RFID) is an essential technology in a real world scenario. RFID is availed in Inventory Tracking, Attendee tracking and recording, Materials management, i.e., keeping tracking of goods, logistics transportation, and traffic toll fee collection [1]. The design of antenna is usually the bottleneck of a RFID reader and tag systems. It is operated at a variety of radio frequencies. Each and every country follows distinct frequencies for various applications. Different stages of antenna design, requires attention to issues like miniaturization of size, reduction in cost and performance improvisation. Therefore, design and implementation of a compact single antenna operating at multiple frequencies is a great challenge.

The aim of this antenna design is to managing the RFID reader applications. Next antenna is especially made for RFID tag application. The construction of reader and tag antennas are deployed from binary fractal tree structure and recursive rectangles respectively. The paper describes the design of fractal iteration in forthcoming modules. The RFID reader antenna design is fundamentally a dipole antenna, with few modifications. The proposed fractal antennas operate in SHF (Super High Frequency) range i.e., 3 GHz to 30 GHz, predominately used for high speed detection. As per theory, when frequency increases, the travel time for the signal decreases proportionally. From the literature survey, it is observed that the SHF RFID object moves at a maximum up to 145Km/h speed [2]. Therefore, essentially it is required in RFID goods management, RFID traffic toll fee collection and RFID telemetry purpose, where

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the collection of data is required while object are in move and also the size of antenna is small and sufficient to affix on logistics goods as well as attachable onto employee ID cards. The proposed antenna for the tag operation is also of unique construction with fractal design.

Fractal structures used in RFID systems are proposed for implementation based on space filling and self-similarity properties. Self-similarity property is to increase the electrical length of material that can transmit or receive the electromagnetic emission within a stipulated volume. By designing multiple numbers of dipole arms at a single surface, certain classes of fractal antennas can be used to operate effectively at different frequency bands (multiband). In fractal structures, the space-filling property is implemented for reducing the antenna size, while increasing the perimeter of the antenna within the given area.

This paper provides antenna design details and explores the RFID antenna simulation results in transient solver using EM design software. The attained results are compared with frequency domain solver and fabricated after obtaining adequate results. The fabricated prototype performance is measured with Vector Network Analyzer subsequently; the measured results are analyzed with simulated results.

2. Proposed Fractal Structure

Fractals are obtained by surface transformation such that it can be used as radiating elements. The fractal design is acquired from the elemental transformation of structures [3]. These may be a line, or surface or a volume of material and fractal structure can be derived.

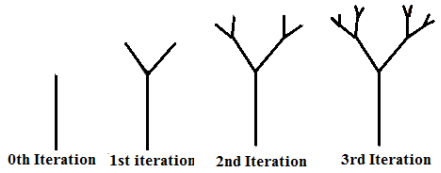


Figure. 1. Proposed antenna design stages of RFID Reader
(a) 0^{th} Iteration (b) 1^{st}Iteration(c) 2^{nd}Iteration(d) 3^{rd}Iteration

The various design stages of a binary fractal tree as depicted by Figure 1, are commonly made such that the angle encompassed between the twigs of all the stem is a constant. A modified binary fractal tree structure is proposed (Figure 1(a)), with the angle between the bifurcating twigs reduced by half in every iteration, resulting in miniaturization of fractal geometries that contain increased electrical lengths in a definite physical area. Further conformal, multi-band and low profile with broadband antennas are achieved for RFID system [4,5].Recursive rectangular configuration is proposed for the second antenna applicable in RFID tag operation. Figure 2 indicates proposed design iterations of the RFID tag antenna.

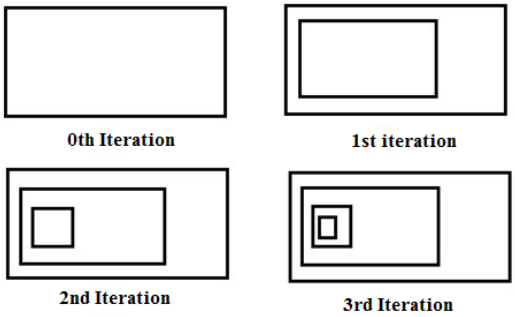


Figure. 2. Proposed Antenna Design for RFID Tag
(a) 0thIteration (b) 1stIteration(c) 3rdIteration(d) 4thIteration

3 Design of RFID Antennas

a) RFID Reader antenna

The literature survey details the integrations of multi-band in to a single plane using Co-Planar Waveguide Structure (CPW)[6 &7]. The outcome of introducing a secondary strip or slot, produces an additional band and good electrical properties are obtained by fractal design. The diagrammatic representation of the proposed RFID reader antenna is demonstrated in Figure 3.

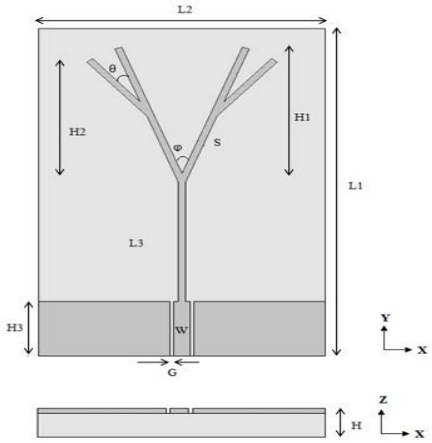


Figure. 3. Proposed RFID reader antenna using modified fractal tree structure, with CPW feed.

The reader antenna is designed on a substrate (FR4 lossy) with a 1.6mm thickness (loss tangent = 0.025and relative dielectric constant = 4.3) and is fed by 50 Ω coaxial connector. The complete substrate dimension is 40 mm x 60 mm. The designed resonating three frequencies of the antenna are f_1 = 3.6 GHz, f_2 = 5.7 GHz, and f_3 = 8.2 GHz. The dimensions of the antenna are H=1.6mm, H_1=23mm, H_2=21mm, H_3=10mm, L_1=60mm, L_2=40mm, L_3=22mm, S=1mm, W=2.2mm, G=0.5mm $\theta = 20^0$, $\varphi = 40^0$

b) RFID Tag Antenna

The proposed RFID tag antenna geometry is illustrated in Figure 4. A 50 Ω coaxial connector is fed on a designed FR4 substrate with 1.6mm thickness. The dimension of the antenna substrate is measured as 90 mm x 30 mm. In the RFID tag the feeding structure is the critical design part. The CPW feeding method [8] provides the freedom to use either the SMA connector orchip based and further tested via a VNA. The designed operating frequencies of the tag antenna are f_1=3.9GHz, f_2 = 5.9 GHz and f_3=8.2GHz respectively. The antenna dimensions are S_1=1.6 mm, S = 1 mm, W=2.4 mm, L_1=90 mm, L_2 = 30 mm, L_3=10 mm, G = 1mm. Figure 4 demonstrates the parameters corresponding to the measurements of the designed antenna.

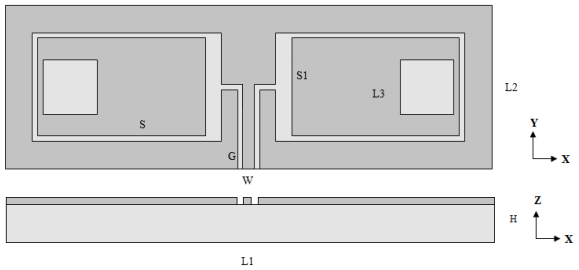


Figure. 4. Proposed RFID Tag antenna using recursive rectangular structure, with CPW feed

4 Results and Discussions

a) Reader antenna

The simulated results of S_{11}characteristics in time and frequency domain solvers of reader antenna are compared in Figure 5. The experimental results of the antenna operate at three different frequencies f_1, f_2, and f_3. The first frequency f_1 operates at 3.6 GHz, whose return loss value (S_{11}) is -19.41dB and the corresponding bandwidth is (-10dB) obtained at 248MHz and thepercentage bandwidth is 6.89. The subsequent occurrence is 5.7GHz and detectedS_{11} value of -20.38dB, the bandwidth (-10dB) obtained at 398MHz with a7.1 percentage bandwidth. The final frequency is falls in 8.2GHz, an S_{11}parameter of -20.63dB with a bandwidth (-10dB) at 405MHz and the corresponding bandwidth percentage is 4.96.

The obtained VSWR (measured @ VSWR=2) is given as 336 MHz for f_1, 423 MHz for $f_2$and 433MHz at $f_3$and the corresponding E and H plane field pattern of the reader antenna is exhibited in Figure 6.

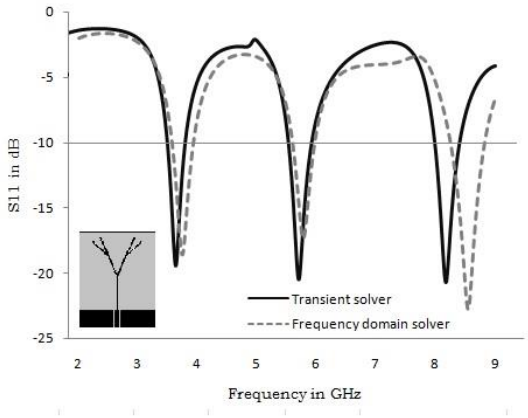
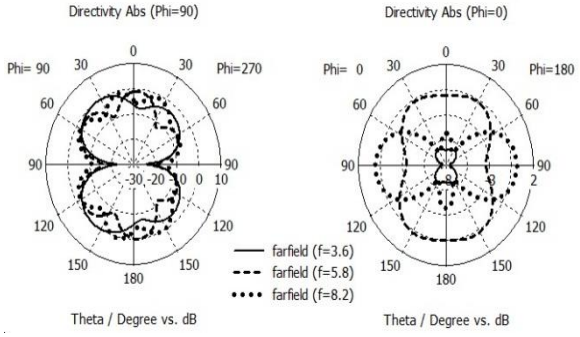


Figure. 5. Simulated S_{11} vs. Frequency graph of reader antenna based on transient and frequency domain solver



(a) (b)

Figure 6. Radiation results of RFID Reader.
(a) H field (b) E field b) Tag antenna

The simulated result of S_{11} vs. frequency chart of tag antenna is presented in Figure 7. First frequency is f_1 3.9 GHz, whose S_{11}occurs at -17.12 dB and obtained bandwidth (-10dB) at 238MHz and bandwidth percentage of 6.1.The next frequency is 5.9 GHz, S_{11}falls with -19.69 dB and the corresponding bandwidth is 181 MHz with bandwidth percentageof 3. The last frequency is giving S_{11} value of -20.31 dB with a bandwidth (-10 dB) of 310 MHz and 3.7 bandwidth percentage. The Figure 7 shows the simulated results of transient domain solver and frequency domain solvers encompassing high association with each other results.

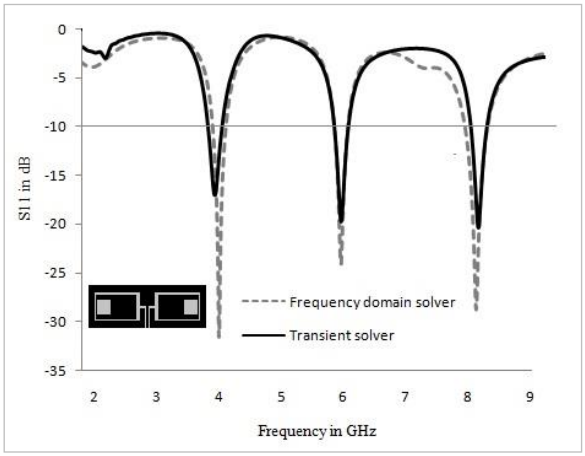
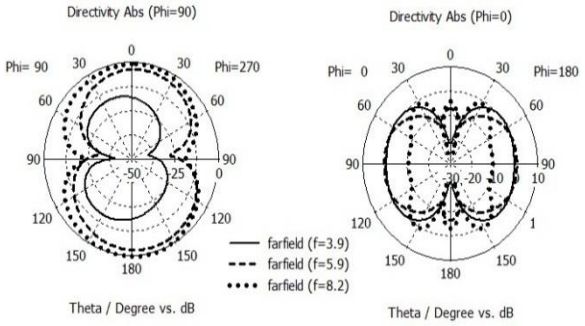


Figure. 7. Simulated S_{11} vs. Frequency graph of tag antenna based on transient and frequency domain solver

The tag antenna VSWR bandwidth (measured at VSWR=2) is given as 255MHz atf_1, 230 MHz f_2 and 285 MHz at f_3 and the corresponding E and H plane pattern is presented in Figure 8.



(a) (b)

Figure 8. Radiation results of RFID Tag antenna.
(a) H field (b) E field

5. Fabrication and Measurement of prototype

Prototype of Reader and Tag antenna

The RFID Reader and Tag antenna was fabricated post simulation and analysis, with FR-4 material as substrate. The authors preferred a chip-less design and testing. The simulation was carried out in transient solver and frequency domain solvers based on waveguide port. Practically, the SMA connectors were connected to the edge of the antennas and excitation was provided. The measurement of S_{11} characteristics was executed by Agilent E8363B VNA. The prototype of both reader and tag antenna are shown in the Figures 9. Figure 10& 11, indicating the comparison result of measurement and simulated S_{11} characteristics of reader antenna.

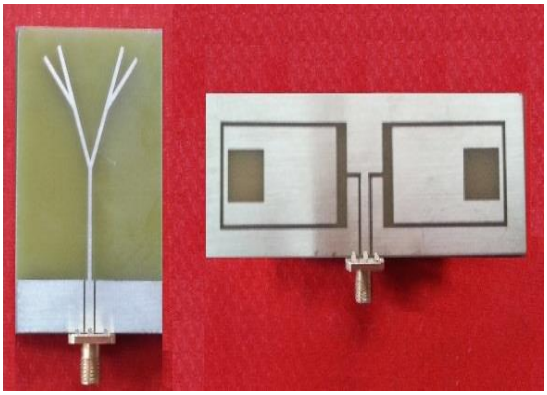


Figure 9. Fabricated prototypes of RFID Reader and Tag

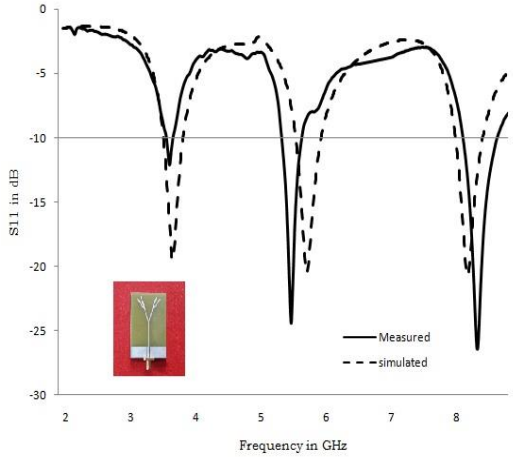


Figure. 10. Measured result and Simulated results of S_{11} vs. Frequency graph of reader

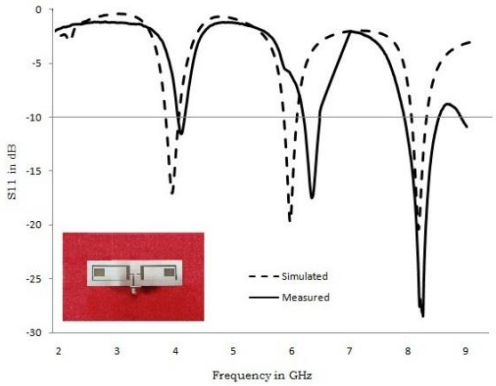


Figure. 11. Measured result and Simulated results of S_{11} vs. Frequency graph of tag

Measured results and simulated S_{11} characteristics arecompared andindicatedin Figures 10 and 11. The advantage of the CPW structure is that, at the same plane both ground and conductors are fabricated. It is used as a feeder element for antennas.

Calculation of Read range

The Friis Transmission Equation is used to evaluate the antenna parameters encompassing the gain of reader and tag antenna, received and transmitted powerP_R and P_T, operating frequency f_c,wavelength λ,read range R, velocity of light c, the gain of receiver and transmitter antenna $G_r$and G_t.

Power Density can be calculated from

$$p = \frac{P_T}{4\pi R^2} \quad (1)$$

Considering the transmit antenna gain G_t, then the power density becomes

$$p = \frac{P_T}{4\pi R^2} G_t \quad (2)$$

Assume the Effective Aperture of the antenna then the received power becomes

$$P_R = \frac{P_T G_t G_r \lambda^2}{(4\pi R)^2} \quad (3)$$

The read range can be calculated by above Friis Transmission equation

The reader and tag antenna read range is calculated by keeping3dBi gain as a reference, 4W as the transmitting powerand1mW as detectable least power. The calculated read range of both reader and tag antenna for various operating frequency is indicated in Table 1.

Table 1. Read Range Chart

Operating Frequency (GHz)	Type of Antenna	Antenna gain (dBi)	Calculated Read range (cm)
3.6	Reader	3.4	87.5
3.9	Tag	3.9	85.6
5.8	Reader	2.7	50.1
5.9	Tag	3.0	51.02
8.2	Reader	2.6	35.06
8.2	Tag	2.2	33.48

6. Conclusion

Fractal antennas are designed to conserve low profile, attain multiband and be miniature in size. In this publication RFID Reader and Tag antennas are introduced using fractal geometry. At -10 dB bandwidth, the obtained results of RFID tag antenna of 238 MHz @ 3.9GHz, 181MHz @ 5.9GHz, 310 MHz @ 8.2 GHz. Similarly, the results of the reader antenna of 248 MHz @ 3.6GHz, 398 MHz @ 5.8GHz, 405 MHz @ 8.2 GHzat -10 dB bandwidth. The highest RFID reader antenna read range is 87.5 cm and similarly, obtained maximum read range is 85.6cm by the tag antenna

References

[1] Hui Li, Le Kang, Feng Wei, Yuan-Ming Cai, and YingZeng Yin, "A Low-Profile Dual-Polarized Microstrip AntennaArray for Dual-Mode OAM Applications," IEEE Antennas and Wireless Propagation Letters, Vol. 16, pp. 3022-3025, 2017
[2] Zhao Zhou;Zhaohui Wei;Zhaoyang Tang;Yingzeng Yin, "Design and Analysis of a Wideband Multiple-Microstrip Dipole Antenna with High Isolation, " IEEE Antennas and Wireless Propagation Letters, Volume: 18, Issue: 4, pp. 722 - 726, 2019.
[3] O. Hussein, K. Al Shamaileh, A. Sahu, B. Keneni, and V. Devabhaktuni, "Optimization of Miniaturized Single-and Multi - band CPW - based Matching Transformers for RF Circuitry on LCP Substrates," no. 1, pp. 8–10, 2017.
[4] D. Inserra, W. Hu, G. Wen, and S. Member, "Antenna Array Synthesis for RFID-based Electronic Toll Collection," IEEE Trans. Antennas Propag., vol.66, Issue 9, pp 4596 - 4605, 2018
[5] Zijian Shao and Yue Ping Zhang, "Miniaturization of Differentially-Driven Microstrip Planar Inverted F Antenna", IEEE Transactions on Antennas and Propagation, Volume: 67, Issue: 2, pp. 1280 - 1283, 2018
[6] E. Pazmi, V. Juan, J. Rosero, and D. Pozo, "Passive Chipless RFID Tag Using Fractals : A Design Based Simulation", 2017 IEEE Second Ecuador Technical Chapters Meeting (ETCM), Electronic ISBN:978-1-5386-3894-1, 2017
[7] M. M. Sharma, P. Kaith, M. Jangid, and S. Singhal, "Decagonal Sierpinski UWB Fractal Antenna with Asymmetric CPW-Feed and ModifiedGround," 2019 IEEE Indian Conference on Antennas and Propogation (InCAP), DOI:10.1109/InCAP47789.2019.9134647, 2019.
[8] H. Sun and S. Sun, "A Novel Reconfigurable Feeding Network for Quad-Polarization-Agile Antenna Design," , IEEE Trans. Antennas Propag., , doi: 10.1109/TAP.2015.2497350, vol. 64, no. 1, pp. 311–316, 2016.
[9] Constantine A. Balanis, "Antenna Theory", Second Edition, Wiley student edition.

Author Bibliography

Mrs. ChitraVaradhan, received Bachelor degree in Electronics and Communication Engineering from Regional Engineering College (NIT- affiliated with Bharathidhasan University) Trichy in 1996 and completed Master of Engineering in College of Engineering, Anna University, Guindy, Chennai in 2008. Currently pursuing PhD in Fractal Antennas in BIHER [Bharath Institute of Higher Education & Research] Chennai, Tamil Nadu, India.

Dr S. Arulselvi, working as an Associate Professor, in BIHER [Bharath Institute of Higher Education & Research] Chennai, Tamil Nadu, India. Areas of specialization include Networking and communications. Currently guiding Mrs ChitraVaradhan in the area of Fractal Antennas.

Consensus based Data Transfer in Wireless Sensor Network for Reliability Interpretation

R Jaichandran[1], P ShyamalaBharathi[2], D Pushgara Rani[3], V K G Kalaiselvi[4], Sujesh P Lal[5]
{rjaichandran@gmail.com[1], shyamalabharathip.sse@saveetha.com[2], pushgararani.ece@sairamit.edu.in[3], kalaiselvi.it@sairam.edu.in4, sujeshlal@gmail.com[5]}

Professor, Department of Computer Science and Engineering,Aarupadai Veedu Institute of Technology,Vinayaka Mission's Research Foundation (Deemed to be University), Chengalpattu, India[1],
Assistant Professor, Department of Electronics and Communication Engineering,Saveetha School of Engineering, Chennai, India[2]
Assistant Professor, Department of Electronics and Communication Engineering,Sri Sai Ram Institute of Technology, Chennai, India[3]
Assistant Professor, Department of Information Technology,Sri Sai Ram Engineering College, Chennai, India[4]
Assistant Professor (Special Grade), Department of Computer Applications,Federal Institute of Science and Technology, Ernakulam, India[4]

Abstract. Resilience of a network varies in an adaptive manner and consensus has to be reached involving the resources available. The internal consistency is a governing factor which is taken using Coefficient Alpha value as series of composite values across each path from source sensor to the sink. The deviations below the threshold limit indicate the path is not appropriate and source sensor has to isolate the interconnected sensor by proper scheduling.Thus the steady state stability to associate with scalability and link metrics is proposed in this work. Simulation platform has been used to validate the performance of flow level analysis across convergence time using Network Simulator-2.

Keywords: Route reliability, Convergence time,WSN.

1 Introduction

Distributed Least Mean Square algorithm states that fault assessment of sensors vary along with spatial deployments and collaboration among them is needed to reduce errors. In single hop communication which occurs in a bidirectional manner calculating suitable step size variation provides network adaptability [1]. This is difficult in the case of multi hop where step size varies drastically. The Channel impulse properties of coherence time is used in determining the convergence time and rate for global decision of consensus. The convergence time derivative along the power limits is determined for each state. Thus the significance of state along its propagation parameter and interface for inter-node interaction is justified [5]. The influence of latency compensation between the old sensory data to be forwarded and the new aggregation data has been discussed. It states that a weight matrix has been used to describe the state of system with a multiplication factor [8]. Predominantly unit disc model has been used for communication which is subjected to intermittent connectivity. So in this work a propose dependant and independent set of sensors deployed within a topology to find the

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virtual path. This is achieved by using a Cronbach's alpha also known as coefficient alpha where the threshold limit of each path is measured upon routes to check feasibility. An alternate path is assigned or a forwarder node is removed once the reliability metric decreases.

Structure of the paper is as follows. Section 2 deals with literature survey of sensors of consensus algorithm and problem statement. Section 3 proposes an algorithm for construction of consensus. Section 4 deals results of proposed work. Section 5 concludes the overall work.

2. Literature survey

Spectral radius of a network with its upper bound upon growth rate including noise coefficients and failed transmissions has been discussed [2]. However, sensor nodes collision in transmissions is inevitable in upper bounds of growth rates which drift the actual calculations used. The discussion in [3], states that instead of transferring large chunk of sensory data from highly loaded sensor to less loaded sensor parallel transaction has been involved. The relationship between nodes in interpreting the local threshold for mutual transaction must be lesser than global threshold divided by network diameter. The limitation in [3] lies in establishing a suitable global threshold with resource failure at appropriate time is difficult. An uncorrelated model to denote the accuracy of fading and random media access is discussed [4]. It states that outage correlation function of a transmission point and a reception point is a discrimination of covariance from expectation. It uses half duplex communication for short range fading coefficients. The problem behind this approach is achieving network wide time slot for slotted aloha communication is difficult.

Possibility of network operation relaying on specific sensor nodes which are being resourcefully healthy and alleviating the non health sensors incorporating "Byzantine sensing" is discussed. The extended time of operation is achieved by considering distance and offset time which provides more flexibility [6]. Average consensus based on the demands of computation and communication is discussed with mobile wireless sensor nodes. The weight matrix ensures the convergence time matching with the topological requirements. Weight matrix is achieved by considering the best constant of weight which occurs within the convergence time [7]. The purpose of predicting the resources of energy in relation to its reporting time has been done in [11]. The inferential test has been obtained for smaller duration of time without distinction of sensors which do not constitute a virtual path towards the sink. On the air agreement to overcome capture effect has been discussed in [12]. It states that the process of voting followed by 2 phase and 3 phase commit provides superior measure on the air reducing the chaos. "Reverse time synchronization" protocol has been discussed in [14]. The approach chooses appropriate normal node without offset compensation are elected as cluster heads. Thus computational error is reduced in the scenario of reverse time stamp incorporating a medium access layer level and its time recording measurements.

2.1 Problem Definition

Repartition in a network occurs post deployment due to excessive resource usage where in individual node might or might not associate in consensus. Complex network solution lies in individual node at that instant of time to correlate whether it is involved or not to routing progress. In [9], discussion which exploits the "time event graph" in a synchronous manner has been stated with shared and unshared resources using Max algebra, Petri Nets.

Incorporating Consensus in wireless network [10] has been stated with the theme of "Asynchronous time model". In the model a node randomly chooses and broadcast its state of time to its neighbours. The other nodes in its communication range update to synchronous the broadcasted node time coordinates based on the distance. The remaining nodes within the terrain do not alter its state values. However, the work is applicable for unidirectional model and is applicable for small or medium scale networks. In [13], multi hop controller determines the consensus based on time of convergence, accuracy and clock offset values. The work relies on switching to single hop communication when consensus is achieved where route determination is not done. The discussion of accumulation of synchronization errors to reduce clock skew is stated with optimal reference time across hops [14]. However ranking the nodes with hops and reinitiating the monitoring process leads to increase in overhead.

3. Proposed system

In section 3 the inter route reliability is examined with static sink positioned. The proposed approach indicates the combination of consensus and its time interval for quicker converge of reporting data with valid routes.

3.1 Route estimation based on coefficient alpha in wireless sensor networks (RECAWSN)

Initially, each set of sensors are grouped within its terrain and after a report interval the flow level analysis is measured. The flow level analysis measure has been stated with equation 1 as below.

$$\alpha = \frac{N \times \overline{co}}{\overline{av} + (N-1) \times \overline{ac}} \qquad (1)$$

Notations for equation 1

The "N" denotes the number of nodes the average covariance between a pair of nodes is denoted as $\overline{co}$ and the average variance is $\overline{av}$.

Thus for each data transfer from sensors is calculated and rated once the value states decreasing an alternate route is preferred by transferring control packets.

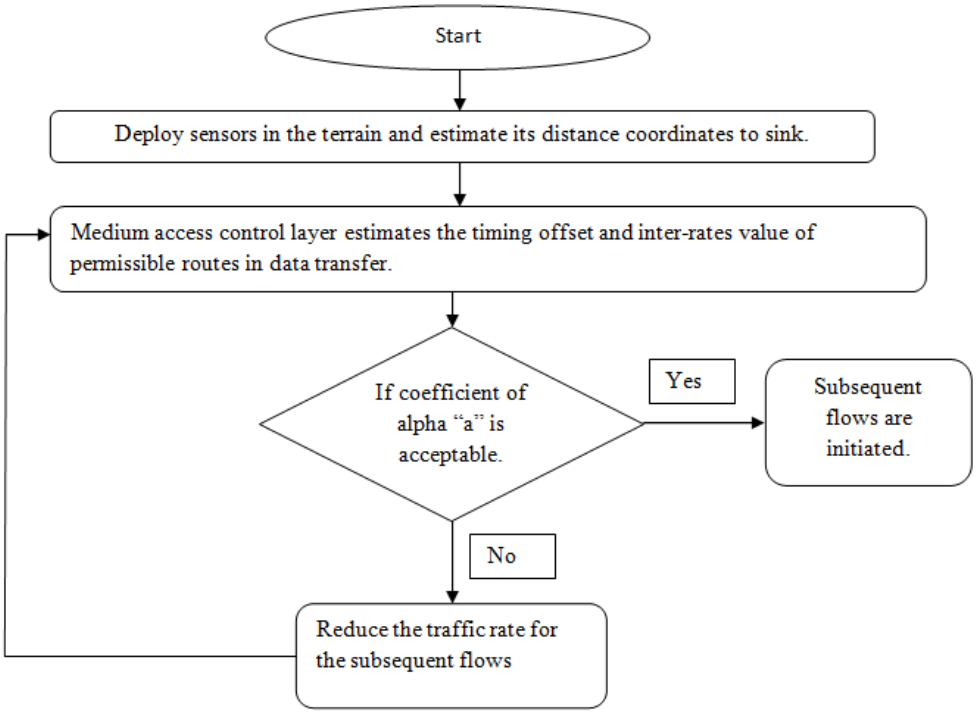

Figure.1 The Functional diagram is shown for proposed work in coefficient alpha

The figure 1 shows the estimation of routes with reliability factor associated with the timing offset and traffic rate determination in RECAWSN.

Figure.2 Flow of Routing

The three types of nodes are source (S), interlinking node (ILN) and penultimate node (PN) to sink. This is shown in figure 2. The flow within the route is being described in four levels. The first between source and interlinking node, second between interlinking nodes and third between interlinking node and penultimate node.MAC level timers interrogates and finds alternate path if the "coefficient alpha" decreases altering the source and interlinking node traffic rates.

4. Simulation Results

The proposed work calculates the connectivity of a node if the communicating distance between them is less than 70 meters.

Table.1 Parameters incorporated for simulation study

Parameter used	**Value**
Total area of Deployed sensors	700 × 700 m^2
Total Count of sensors	100 to 200

Total Count of sink	4
Position coordinates of sink	(100,100) (200,200) (300,300), (400,400) and (500,500)
Antenna	Omni-directional Antenna
Total simulation duration	1500 s

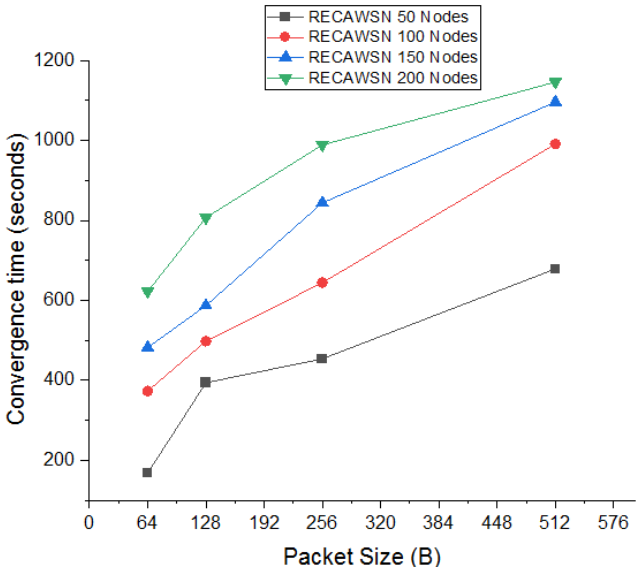

Fig.3 Packet size versus Convergence time

The figure 3 shows the convergence time versus packet size the protocol scalability has been examined by increasing the count from 50 to 200.

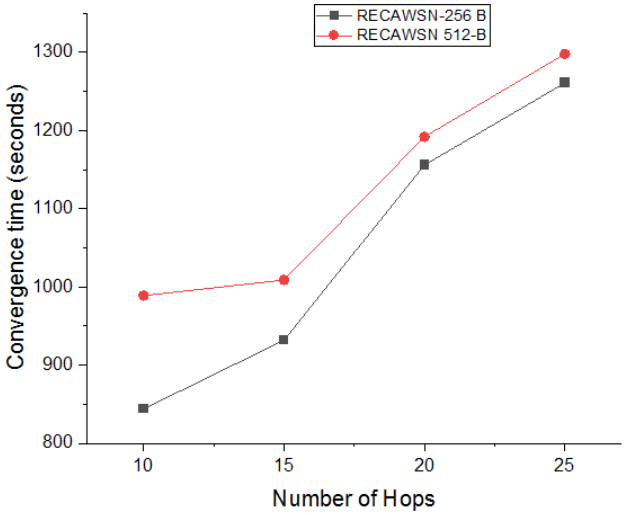

Fig.4 Number of hops versus Convergence time

The entire simulation duration all sensors have the same holding time. However, the allocation of bigger packets may not appropriate for all flows. Hence inter relating packet size to convergence time is done in Figure 4.

5. Conclusion

In RECAWSN the function of source in forwarding and diverging across optimal in wireless environment is associated with a reliability and MAC layer timer. RECAWSN segregates the channels according to the flow and alter the traffic to converge according to match with reliability value. Thus the steady state stability of a route in deterring the next flow is done once the reliability metric becomes less than the defined threshold. The limitation of this work is incorporated in homogenous sensors without mobility and Cronbach‘s is confined to only unidimensional analysis. Further research would incorporate works involving heterogeneous sensors with mobility models.

References

[1] Mateos, G., Schizas, I. D., &Giannakis, G. B. (2009, January). Closed-form MSE performance of the distributed LMS algorithm. In 2009 IEEE 13th Digital Signal Processing Workshop and 5th IEEE Signal Processing Education Workshop (pp. 66-71). IEEE.

[2] Muniraju, G., Tepedelenlioglu, C., &Spanias, A. (2019). Analysis and design of robust max consensus for wireless sensor networks. IEEE Transactions on Signal and Information Processing over Networks, 5(4), 779-791.

[3] Guyeux, C., Haddad, M., Hakem, M., &Lagacherie, M. (2020). Efficient distributed average consensus in wireless sensor networks. Computer Communications, 150, 115-121.

[4] Schneider, D., & Frey, H. (2020, July). Analytical Derivation of Outage Correlation in Random Media Access with Application to Average Consensus in Wireless Networks. In 2020 IEEE 31st Annual International Symposium on Personal, Indoor and Mobile Radio Communications (pp. 1-7). IEEE.

[5] Scutari, G., & Barbarossa, S. (2008). Distributed consensus over wireless sensor networks affected by multipath fading. IEEE Transactions on Signal Processing, 56(8), 4100-4106.

[6] Chang, J., & Liu, F. (2021). A Byzantine Sensing Network Based on Majority-Consensus Data Aggregation Mechanism. Sensors, 21(1), 248.

[7] Kenyeres, M., &Kenyeres, J. (2020). Average consensus over mobile wireless sensor networks: weight matrix guaranteeing convergence without reconfiguration of edge weights. Sensors, 20(13), 3677.

[8] Adachi, R., Yamashita, Y., & Kobayashi, K. (2020). Distributed estimation based on weighted data aggregation over delayed sensor networks. IFAC Journal of Systems and Control, 14, 100109.

[9] Baccelli, F., Cohen, G., Olsder, G. J., & Quadrat, J. P. (1992). Synchronization and linearity: an algebra for discrete event systems.

[10] Aysal, T. C., Sarwate, A. D., &Dimakis, A. G. (2009, October). Reaching consensus in wireless networks with probabilistic broadcast. In 2009 47th Annual Allerton Conference on Communication, Control, and Computing (Allerton) (pp. 732-739). IEEE.

[11] Anand, J. V., & Titus, S. (2017). Energy efficiency analysis of effective hydrocast for underwater communication. International Journal of Acoustics & Vibration, 22(1), 44-50.

[12] Al Nahas, B., Duquennoy, S., &Landsiedel, O. (2017, November). Network-wide consensus utilizing the capture effect in low-power wireless networks. In Proceedings of the 15th ACM Conference on Embedded Network Sensor Systems (pp. 1-14).
[13] Shi, F., Tuo, X., Ran, L., Ren, Z., & Yang, S. X. (2019). Fast convergence time synchronization in wireless sensor networks based on average consensus. IEEE Transactions on Industrial Informatics, 16(2), 1120-1129.
[14] Zhang, D., Yuan, Y., & Bi, Y. (2020). A Design of a Time Synchronization Protocol Based on Dynamic Route and Forwarding Certification. Sensors, 20(18), 5061.

A Smart Vision Based Single Handed Gesture Recognition system using deep neural networks

Suguna R[1], Rupavathy N[2], Asmetha Jeyarani R[3]
{drsuguna@veltech.edu.in[1], rupavathy@veltech.edu.in[2], rasmethajeyarani@veltech.edu.in[3]}

[1]Professor, Department of Computer Science and Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, (Tamil Nadu), India
[2,3] Assistant Professor, Department of Computer Science and Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, (Tamil Nadu), India

Abstract. The primary and expressive mode of human communications are gestures. Human can interact with machines using body postures and finger pointing. Advancements in human-computer interaction (HCI) has presented new innovations in technology making the users to communicate with computers in an instinctual manner. Evidences clearly state that future living space will be dominated by sensor-based devices and hence an efficient human-computer interfaces are required to exchange information. Hand gesture interfaces have been employed in multiple domains and has won social acceptance. System requirements for gesture recognition vary with the intended application areas. Responsiveness, Learnability, Cost and Accuracy are major drivers for success of hand gesture recognition systems. This paper suggest a HCI design that requires no wearable markers or gloves. A noninvasive vision based framework has been suggested for human-machine interface. Deep Neural Networks have provided promising results in vision based tasks. Convolutional Neural Networks (CNN) are claimed for image recognition problems as they learn features from images gradually and automatically. An optimal CNN architecture has been proposed to recognize single handed gestures. The images of hand gestures convey a numerical representation of ten digits. Image augmentation has been performed to increase the size of training data for deep learning. Depending on application, the interpretation of gesture can be customized. The classification performance has been analyzed with metrics reported by confusion matrix. The proposed architecture performs well both in training and testing reporting the accuracy of 98.2% and 96.2% respectively. Tuning the hyper parameter has improved test accuracy.

Keywords: Human-Computer Interface, Gestures, Hand gesture recognition, Deep Learning, Convolutional Neural Network (CNN).

1 Introduction

Gestures are a form of non-verbal communication usually involving body parts. Gesture recognition plays with the goal that human gestures can be interpreted by applying mathematical algorithms. Gestures can be of different types which include hand gesture, face gesture and other body gestures. Any body part contributes to gesture, but most commonly gestures are obtained from face or hand. Nowadays, hand gesture recognition research is gaining more importance as it can interact with machines in a more intuitive way.

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Hand gesture recognition can be implemented using vision-based and sensor-based methods. In vision-based method bare hand is used as input whereas in sensor-based method data gloves or sensors are attached to detect the gestures. Vision based hand gesture recognition is classified into two types- 3D hand model-based approach which uses volumetric or skeletal model & appearance-based model which utilizes skin color images. Hand gesture recognition consists of mainly four different stages as shown in Figure 1. The first stage is image capture and pre-processing of the input images. Next stage is the image segmentation, third stage is feature extraction and the last stage is classification. Image capture is usually done using web cameras and Kinect sensor-based cameras. Mainly in pre-processing stage image enhancement and noise filtering process too will happen. Segmentation stage consists of segmenting the hand gesture from the background of the image and the region of interest is segmented as well. Different algorithms contribute in extracting the features from the image and the obtained features are further classified by using different classification algorithms.

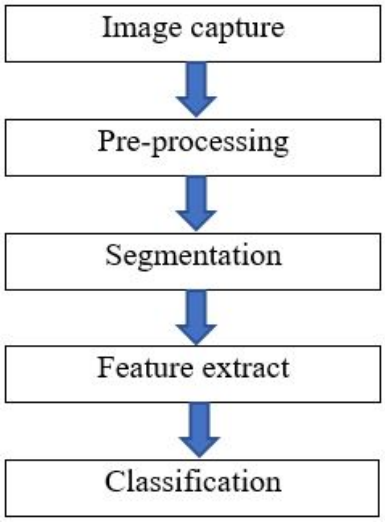

Fig 1: Phases in hand gesture recognition system.

Hand gesture recognition system has many applications like medical, gaming controls, home appliances, car driving, sign language representation, interacting with computer and numerous other communication purposes.

a. Sign Language Recognition

Sign language is the language used by deaf and dumb people. With the help of sign language, they can communicate with the outer world. American sign language (ASL), Taiwan sign language (TSL), Spanish sign language, Indian sign language, British sign language (BSL) etc. are the well-known sign languages used. Indian people have ISL language and different parts of the country it has different signs, but grammar is same throughout the country. Normal people use different sign language but differently abled persons use this sign language for communication.

b. Gaming Control

Gaming control uses augmented reality with 3D modeling in which 3D characteristics are controlled by hand gestures. It uses virtual controlled hand movement which provides efficient and user-friendly interface.

c. Medical Applications

Wearable hand gesture recognition system is used in the field of medical application and healthcare. Hand gestures are used to enable remote control of medical devices, navigation of contactless MRI and X- ray devices. In medical data visualization environment vision-based hand gesture recognition system is used to interpret user gestures in real time.

d. Controlling home appliances

Hand gesture recognition system is used for controlling home appliances like TV, music player etc. Television can be controlled by using hand gestures. Hand gestures are used to turn ON and OFF control of TV, increasing the volume and changing the channels. It is also used to control music player operations like rewind, fast forward etc.

e. Robot Control

One of the most interesting application of gestures is to control the robot action. Gestures are used to control robot by giving instructions to move forward, stop, do actions etc. Different finger authoring gestures are used for controlling them.

f. Graphic editor control

Graphic editor control system uses hand gesture recognition system for tracking and locating preprocessing operations for drawing and editing graphic system. For drawing the shapes like rectangle, oval, circle etc. and for drawing lines like vertical and horizontal, for editing commands like copy, delete, move, swap etc. gestures are used.

2 Related Works

(Ozcan&Basturk, 2019) used 165 different finger images for gesture recognition. The representation of finger print images have been performed by different classifiers like support vector machine, k-nearest neighbors, Naive-Bayes, decision tree learning, and deep neural networks. They obtained recognition rate of 96.73%, 95.77%, 61.94%, 52.73% and 98.31% respectively. (Wang et al., 2017) in his work, used Kinect- based algorithms for hand gesture analysis and evaluated CSG- EMD based hand gesture recognition system. They used KNN classification and obtained an accuracy of 99.7%.

(Jiang et al., 2020) used sensor-based hand gesture recognition system with EMG and FMG waveform and obtained accuracy of 81.5% for EMG, 80.6% for FMG and 91.6% for EMG-FMG. (Dong et al., 2018) used CNN and DCCNN for hand gesture recognition. DCCNN extracts richer features for training and obtained higher accuracy than CNN. For the number of iterations of 20000 they have obtained 71.41% accuracy for CNN and 76.38% for DCCNN. When the number of iterations is reduced from 20000 to 10000 the accuracy improved to 76.56% for CNN and 81.25% for DCCNN. (Abdal&Rasel, 2019) proposed HOG and SVM in two different datasets. For dataset 1 they obtain an accuracy of 97.5% and for dataset 2 the accuracy was 97.4%. (Han et al., 2016) proposed CNN based hand gesture recognition system. They used a dataset which consist of 76000 frames and obtained an accuracy of 95.8% and used joint tracking framerate of 11 fps. They used convolutional pose machines (CPM) hand tracking system.

(Hu & Wang, 2020) used CNN based hand gesture recognition system and obtained an accuracy of 90% when the batch size is bigger and obtained an average accuracy of 93%. They used five fully connected layers with raw data and scaled data and obtained accuracy of about 97%. (Yang et al., 2016) used hand gesture recognition for smart glass application in IoMTW and they compared it with dynamic gesture recognition system and obtained good

classification rate. (Mahmood &Abdulazeez, 2019) created a dataset by digital camera that uses threshold to extract the feature of hand gesture and applies to neural network and obtained accuracy of 90%. They enhanced the filter to extract 50 features and successfully obtained accuracy of 98%. (Alom et al., 2019) worked on ASL dataset and used deep CNN architecture. They have used combination of CNN and SVM and obtained and accuracy of 98.2%. (Kalbhor& Deshpande, 2018) proposed CNN based hand gesture recognition for two different sign languages ASL and SLD and obtained an accuracy of about 100% and 98.3% respectively. (Zhang et al., 2020) proposed hand pose classifier based on FGMM fussy gaussian mixture model and obtained 91.11% accuracy with SVM, 88.33% with MLP and 98.06% with CPM.

(Murugeswari&Veluchamy, 2015) proposed SIFT algorithm to extract key points from each hand gesture image and used different classification algorithms like HMM, ANN and SVM. They have obtained 97% accuracy with SVM, 86% with ANN and 79% with HMM model. (Nyirarugira et al., 2016) proposed particle swarm optimization method with three different classifiers HMM, LCS and PSO. Obtained 93.3% accuracy with HMM model, 94% with LCS and 94.2% with PSO. (Sahoo et al., 2019) proposed PCA based reduced deep CNN feature for static hand gesture recognition. PCA dimension reduction technique is used to reduce the redundant features in their feature vector. They used ASL digits and alphabets and obtained an accuracy of about 95% with ASL digit and 92.6% with ASL alphabets.

(Mirehi et al., 2019) used hand gesture descriptor based GNG graph method for 2170 images with 31 gestures and classified by using LDA and obtained an accuracy of about 90%. (Neethu et al., 2020) proposed CNN based hand gesture recognition system with connected component analysis algorithm and obtained an accuracy of about 96.2%. (Khan et al., 2017) proposed robust algorithm for hand gesture recognition used in electronic equipment inside vehicles and obtained detection accuracy of about 100%. (Suguna& S, 2017) used k-means clustering algorithm to classify hand gesture recognition by extracting shape features.

(Han et al., 2016) used skin model and background subtraction algorithm and given this to two stage CNN classifiers. They have taken 10 gestures with 10-fold cross validation on the system, given 10000 trained images and 2000 testing images and obtained an accuracy of about 93.8%. (Bheda&Radpour, 2017) used deep learning convolutional neural network for American sign language (ASL) and obtained an accuracy of about 82.5%. (Ozcan&Basturk, 2019) used CNN to recognize human actions and tested on sign language digits for two different datasets like sign language digit dataset and Thomas Moeslund's gesture recognition dataset and obtained and accuracy of about 98.09% and 94.33% respectively. N S (Sreekanth& Narayanan, 2017) proposed convex hull algorithm for American Sign Language (ASL) with different digits from 0-9 and obtained an accuracy of 89% to 98%. (Rady et al., 2019) proposed enhanced automatic model for hand gesture recognition using CNN method. They used both depth and color information with Kinect sensor and applied to three different datasets and obtained an accuracy of 84.67%, 99.5% and 99.85%.

(Kalam et al., 2019) proposed two-layer CNN using residual learning for 7000 rotated images and obtained an accuracy of about 97.28%. (Bhavsar& Trivedi, 2017) conducted review on sign language recognition system. They considered different feature extraction methods and taken accuracy which is done on different signs, numbers, alphabets and words. (Ghosh & Ari, 2016) proposed LCS feature set with block-based feature and is applied for 24 static ASL Hand Alphabet and obtained 82% accuracy. (Sharma &Verma, 2015) used hand gesture shapes and positions recognition system and obtained an accuracy of 95.44%.

3 Materials and Methods

The dataset for the proposed work has been downloaded from web resource *https://github.com/ardamavi/Sign-Language-Digits-Dataset.git*. The dataset consists of 2089 images with 10 classes, each image is single handed representing a digit ranging from 0 to 9. Sample images from the dataset are shown in Figure 2.

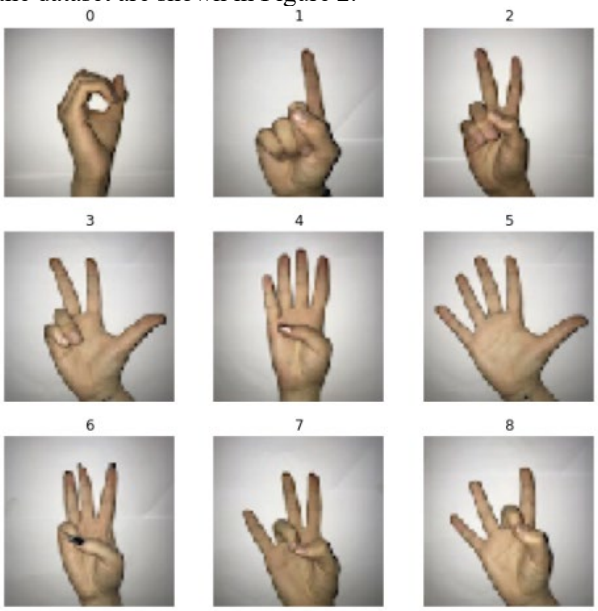

Fig 2: Sample hand gesture images

Data Augmentation

Deep Neural Networks require a huge training data to attain good output results. Image augmentation is a technique that helps in building efficient image classifier with minimum training data and enhances the performance of deep neural networks. Image augmentation artificially generates images by applying different processing techniques such as shifting, sheering, flips and rotations. Hence it increases the number of training samples to make the deep network to perform learning efficiently. The training sample size has been improved by performing data augmentation.

Convolution Neural Network

Computer Vision has been perceiving immense growth with the advent of deep learning. One of the algorithm, Convolutional Neural Network have been producing promising results in image based classification tasks.

Convolutional Neural Network (CNN) is deep learning algorithm that accepts image as input, learns various aspects of image through filters and able to discriminate its class with other. It is a multilayer neural network capable of analyzing visual features in the given input image. CNN is able to capture the spatial and temporal dependencies in the image through application of appropriate filters. CNN comprises of two main parts:

Feature Learning : Convolution tool that recognizes various features in images

Classification / Prediction : A fully connected layer that collects input from convolutional layer to predict image description.

The architecture of CNN is composed of different kinds of layers

Convolutional layer: This layer convolves the image with filters and creates a feature map by examining few pixels at a time. Convolution operation helps in extracting features such as edges, color and gradient orientation. With additional convolutional layers high level features of image are identified. The convolved output layer results in reduced dimensionality with valid padding or dimensionality is increased / retained by applying same padding.

Pooling layer: The role of this layer is to down sample image into a form that are easy for processing while preserving the significant information for better prediction. Pooling layer reduces the spatial size of the convolved layer. This leads to reduction in computational power to process the data. Particularly it facilitates the extraction of dominant features that are invariant to position and rotation. There are two types of pooling: Max pooling and Average pooling. Both differ in type of computation made over the portion of image prescribed by the kernel. Max pooling retrieves the maximum value of the scanned region while average pooling return the mean of the values in the region. Max pooling acts as a noise suppressor. It removes noise activations along with dimensionality reduction.

Fully connected input layer: This layer flattens the outputs of the preceding layer and converts them into single dimension vector.

Fully connected layer: This layer comprises of feed forward neural network and back propagation algorithm is employed to train the model. With relevant weights and activation function, this layer learns the nonlinear combination of high level feature represented by previous layer. Over a series of epochs, the model is able to map the input to target output.

Fully connected output layer: Uses soft max classification technique to generate probabilities for determining the class of the image.

CNN Architecture

The architecture used for hand gesture recognition is shown in Figure 3 with number of parameters used during each layer is listed in Table 1.

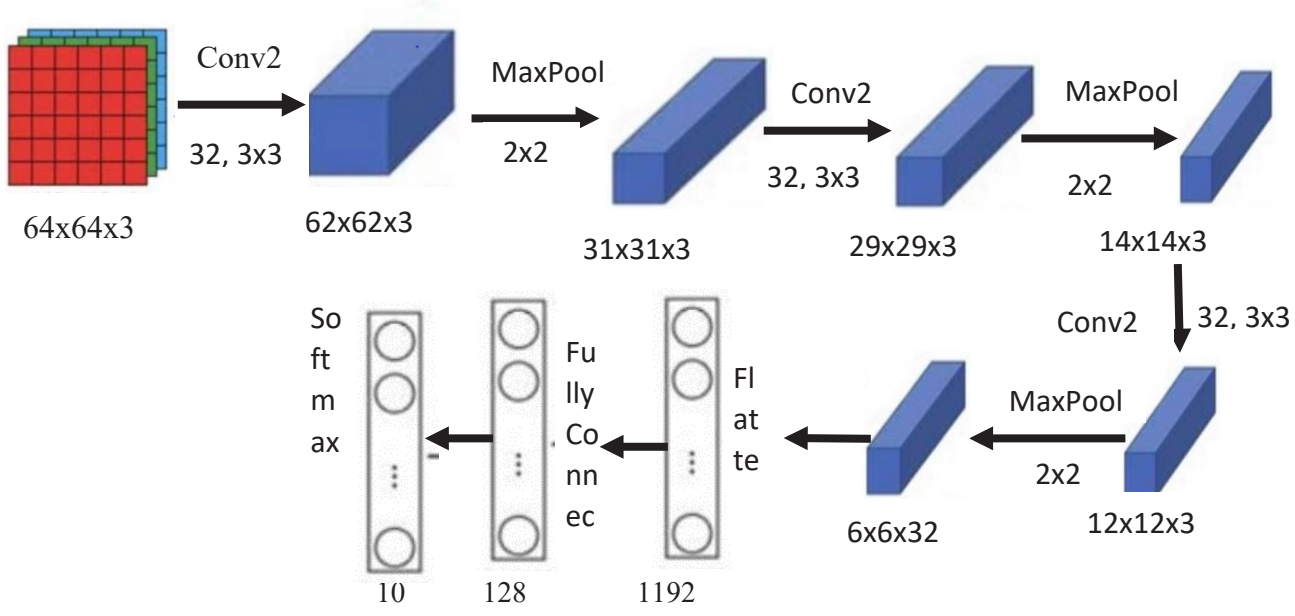

Figure 3 : Proposed CNN architecture for Sign Digit Prediction

Table 1: CNN Layers Design and parameter details

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 62, 62, 32)        896
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 31, 31, 32)        0
_________________________________________________________________
dropout (Dropout)            (None, 31, 31, 32)        0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 29, 29, 32)        9248
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 14, 14, 32)        0
_________________________________________________________________
dropout_1 (Dropout)          (None, 14, 14, 32)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 12, 12, 32)        9248
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 6, 6, 32)          0
_________________________________________________________________
dropout_2 (Dropout)          (None, 6, 6, 32)          0
_________________________________________________________________
flatten (Flatten)            (None, 1152)              0
_________________________________________________________________
dense (Dense)                (None, 128)               147584
_________________________________________________________________
dense_1 (Dense)              (None, 10)                1290
=================================================================
Total params: 168,266
Trainable params: 168,266
Non-trainable params: 0
```

RELU activation function was applied to every output of convolution and fully connected layer except the output soft max layer. After building the model the performance on test data was evaluated and the accuracy score of 96.17%.

4 Results and discussion

The classifier was trained with 100 epochs and the performance of the model with training and validation datasets are shown in Figure 4. Similarly as the epochs increased the loss has considerably reduced during training phase and validation test as seen in Figure 5.

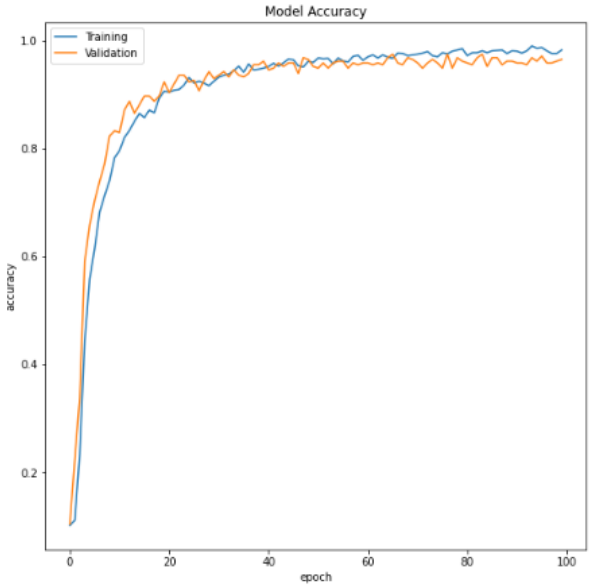

Fig 4: Model Accuracy on Training and Validation dataset

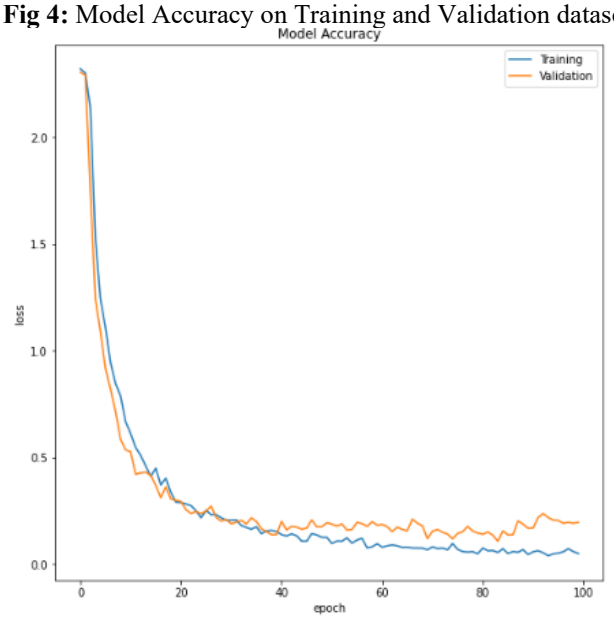

Fig 5 : Loss incurred during training and validation phase

To assess the prediction rate of each class confusion matrix on test data are examined and the classification reports are depicted in Table 2.

Table 2 : Confusion Matrix showing the misclassified class in test data

	Predicted Class										
Actual Class		0	1	2	3	4	5	6	7	8	9
	0	31	0	0	0	0	0	0	0	0	0
	1	0	31	0	0	0	0	0	0	0	0

	2	0	2	28	0	0	0	1	0	0	0
	3	0	0	0	29	0	0	0	0	1	1
	4	0	0	0	0	30	1	0	0	0	1
	5	0	0	0	0	1	31	0	0	0	0
	6	1	0	1	1	4	0	25	0	0	0
	7	1	1	1	6	0	0	0	20	2	0
	8	0	1	0	0	1	0	0	1	29	0
	9	0	0	1	0	0	0	0	0	0	30

The accuracy rate of each class has been analyzed and shown in Table 3.

Table 3: Prediction rate of classifier on Test data

Class	Accuracy in %
0	100
1	100
2	90.3
3	93.75
4	93.75
5	96.9
6	78.1
7	64.5
8	93.5
9	96.77

Class 6 and class 7 has lower prediction rates compared to other classes. Class 6 and class 7 are erroneously recognized as class 4 and class 3 respectively. The comparison of performance metrics such as precision, recall and f1-score are shown in Figure 6.

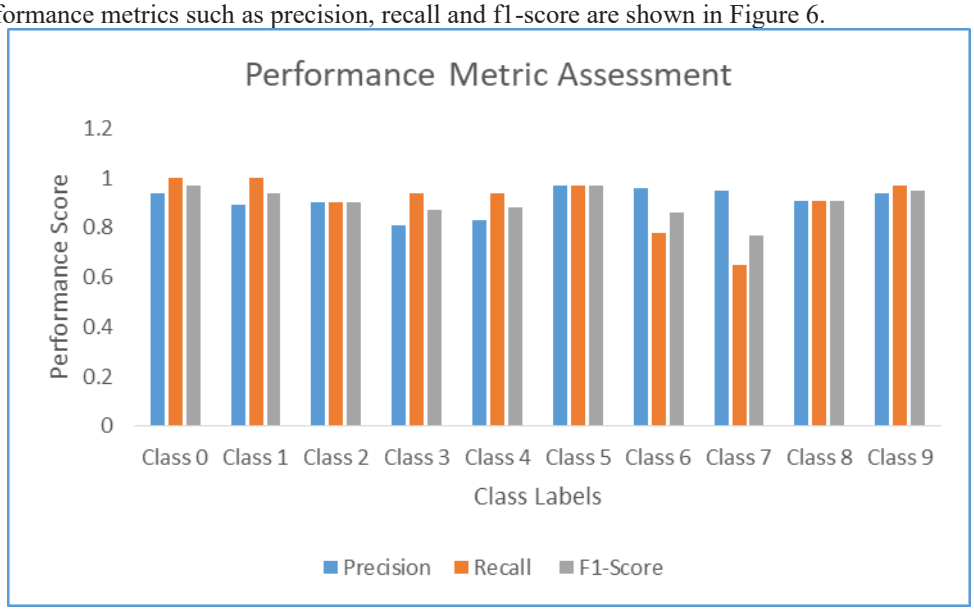

Fig 6: Comparison of performance metrics among classes

Sample results of test data predictions are shown in Figure 7

Fig 7: Sample output of test data predictions

Tuning of Hyper parameters

To improve the performance number of filers used in Convolution layers are increased and tested. The increase in filters have shown considerable improvements in both training and testing phases. Figure 8 shows the test accuracy with varied number of filters.

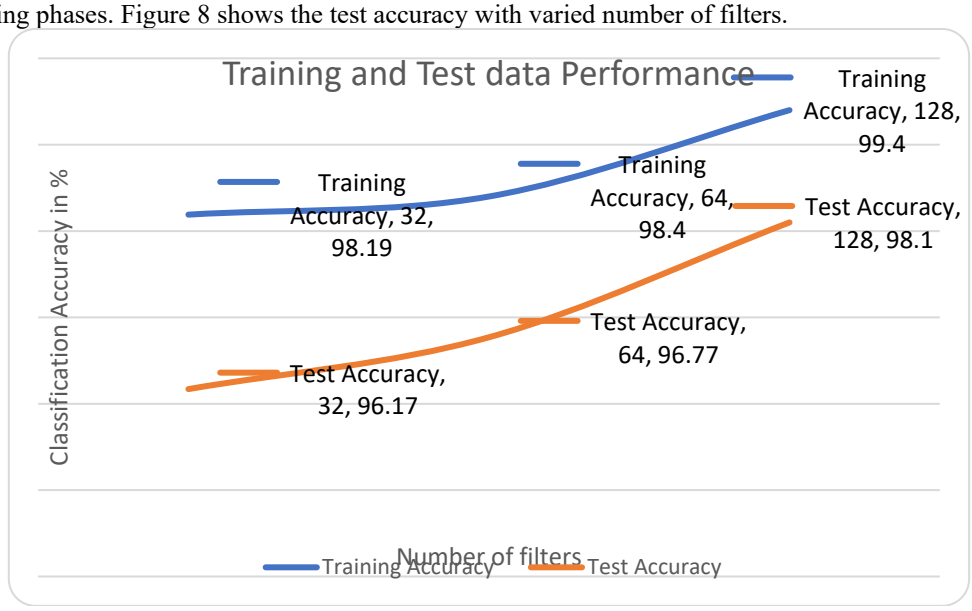

Fig 8: Performance Analysis with tuning hyper parameter

Conclusion

A vision based noninvasive and cost effective hand gesture recognition system has been proposed in this work. Several research works have been carried out on different datasets. The proposed CNN architecture performs well with minimum filters and layers. The simplicity in design reduces the response time during testing. Analyzing the misclassified samples and improving the training size may enhance the recognition rate. By tuning the hyper parameter the recognition rate has improved yielding an accuracy score of 98.1% in test dataset

References

[1] Abdal, A., &Rasel, S. (2019). An Efficient Framework for Hand Gesture Recognition based on Histogram of Oriented Gradients and Support Vector Machine. December. https://doi.org/10.5815/ijitcs.2019.12.05

[2] Alom, M. S., Hasan, M. J., & Wahid, M. F. (2019). Digit recognition in sign language based on convolutional neural network and support vector machine. 2019 International Conference on Sustainable Technologies for Industry 4.0, STI 2019, 0, 24–25. https://doi.org/10.1109/STI47673.2019.9067999

[3] Bhavsar, H., & Trivedi, J. (2017). Review on Feature Extraction methods of Image based Sign Language Recognition system. Indian Journal of Computer Science and Engineering (IJCSE), 8(3), 249–259. https://doi.org/10.1016/j.clinph.2005.11.003

[4] Bheda, V., &Radpour, D. (2017). Using Deep Convolutional Networks for Gesture Recognition in American Sign Language. http://arxiv.org/abs/1710.06836

[5] Dong, X., Xu, Y., Xu, Z., Huang, J., Lu, J., Zhang, C., & Lu, L. (2018). A static hand gesture recognition model based on the improved centroid watershed algorithm and a dual-channel CNN. ICAC 2018 - 2018 24th IEEE International Conference on Automation and Computing: Improving Productivity through Automation and Computing. https://doi.org/10.23919/IConAC.2018.8749063

[6] Ghosh, D. K., & Ari, S. (2016). On an algorithm for Vision-based hand gesture recognition. Signal, Image and Video Processing, 10(4), 655–662. https://doi.org/10.1007/s11760-015-0790-4

[7] Han, M., Chen, J., Li, L., & Chang, Y. (2016). Visual hand gesture recognition with convolution neural network. 2016 IEEE/ACIS 17th International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing, SNPD 2016, 287–291. https://doi.org/10.1109/SNPD.2016.7515915

[8] Hu, B., & Wang, J. (2020). Deep Learning Based Hand Gesture Recognition and UAV Flight Controls. International Journal of Automation and Computing, 17(1), 17–29. https://doi.org/10.1007/s11633-019-1194-7

[9] Jiang, S., Gao, Q., Liu, H., & Shull, P. B. (2020). A novel, co-located EMG-FMG-sensing wearable armband for hand gesture recognition. Sensors and Actuators, A: Physical, 301, 111738. https://doi.org/10.1016/j.sna.2019.111738

[10] Kalam, M. A., Mondal, M. N. I., & Ahmed, B. (2019). Rotation Independent Digit Recognition in Sign Language. 2nd International Conference on Electrical, Computer and Communication Engineering, ECCE 2019, 1–5. https://doi.org/10.1109/ECACE.2019.8679172

[11] Kalbhor, S. R., & Deshpande, A. M. (2018). Digit Recognition Using Machine Learning and Convolutional Neural Network. Proceedings of the 2nd International Conference on Trends in Electronics and Informatics, ICOEI 2018, 604–609. https://doi.org/10.1109/ICOEI.2018.8553954

[12] Khan, F., Leem, S., & Cho, S. H. (2017). Hand-based gesture recognition for vehicular applications using IR-UWB radar. Sensors (Switzerland), 17(4). https://doi.org/10.3390/s17040833

[13] Mahmood, M. R., &Abdulazeez, A. M. (2019). Different Model for Hand Gesture Recognition with a Novel Line Feature Extraction. 2019 International Conference on Advanced Science and Engineering, ICOASE 2019, 2018, 52–57 . https://doi.org/10.1109/ ICOASE.2019. 8723731

[14] Mirehi, N., Tahmasbi, M., &Targhi, A. T. (2019). Hand gesture recognition using topological features. Multimedia Tools and Applications, January. https://doi.org/10.1007/s11042-019-7269-1

[15] Murugeswari, M., &Veluchamy, S. (2015). Hand gesture recognition system for real-time application. Proceedings of 2014 IEEE International Conference on Advanced Communication, Control and Computing Technologies, ICACCCT 2014, 978, 1220–1225. https://doi.org/10.1109/ICACCCT.2014.7019293

[16] Neethu, P. S., Suguna, R., &Sathish, D. (2020). An efficient method for human hand gesture detection and recognition using deep learning convolutional neural networks. Soft Computing. https://doi.org/10.1007/s00500-020-04860-5

[17] Nyirarugira, C., Choi, H. R., & Kim, T. (2016). Hand gesture recognition using particle swarm movement. Mathematical Problems in Engineering, 2016. https://doi.org/10.1155/2016/1919824

[18] Ozcan, T., &Basturk, A. (2019). Transfer learning-based convolutional neural networks with heuristic optimization for hand gesture recognition. Neural Computing and Applications, 31(12), 8955–8970. https://doi.org/10.1007/s00521-019-04427-y

[19] Rady, M. A., Youssef, S. M., & Fayed, S. F. (2019). Smart gesture-based control in human computer interaction applications for special-need people. NILES 2019 - Novel Intelligent and Leading Emerging Sciences Conference, 1, 244–248. https://doi.org/10.1109/NILES.2019.8909324

[20] Sahoo, J. P., Ari, S., & Patra, S. K. (2019). Hand gesture recognition using PCA based deep CNN reduced features and SVM classifier. Proceedings - 2019 IEEE International Symposium on Smart Electronic Systems, ISES 2019, 221–224. https://doi.org/10.1109/iSES47678.2019.00056

[21] Sharma, R. P., &Verma, G. K. (2015). Human Computer Interaction using Hand Gesture. Procedia Computer Science, 54, 721–727. https://doi.org/10.1016/j.procs.2015.06.085

[22] Sreekanth, N. S., & Narayanan, N. K. (2017). Static hand gesture recognition using mon-vision based techniques. International Journal of Innovative Computer Science & Engineering, 4(2), 33–41. www.ijicse.in

[23] Suguna, R., & S, N. P. (2017). Hand Gesture Recognition Using Shape Features. 117(8), 51–54. https://doi.org/10.12732/ijpam.v117i8.11

[24] Wang, C., Liu, Z., Zhu, M., Zhao, J., & Chan, S. C. (2017). A hand gesture recognition system based on canonical superpixel-graph. Signal Processing: Image Communication, 58, 87–98. https://doi.org/10.1016/j.image.2017.06.015

[25] Yang, A., Park, D., Chun, S., Kim, J., Yang, A., Park, D., Chun, S., & Kim, J. (2016). Detection of Hand Gesture and its Description for Wearable Applications in IoMTW International Conference on Advanced Communication Technology, ICACT 598–601.

[26] Zhang, T., Lin, H., Ju, Z., & Yang, C. (2020). Hand Gesture Recognition in Complex Background Based on Convolutional Pose Machine and Fuzzy Gaussian Mixture Models. International Journal of Fuzzy Systems, 22(4), 1330–1341. https://doi.org/10.1007/s40815-020-00825-w

Cluster Head Based Intrusion Detection System for Black Hole Attacks in Wireless Ad Hoc Networks using 2 Level Fuzzy Logic System

Christeena Joseph[1], P.C.Kishoreraja[2], Radhika Baskar[3]
{christeena003@gmail.com[1], pckishoreraja@gmail.com[2], radhikabaskr@gmail.com[3]}

Department of Electronics & Communication Engineering,SRM Institute of Science and Technology, Ramapuram Campus,Chennai[1],Department of Electronics Communication Engineering,SRM University, Delhi-NCR, Sonepat, Haryana[2],Department of Electronics & Communication Engineering,Saveetha School of Engineering, Saveetha Institute of Medical & Technical Sciences[3]

Abstract. Ad hoc networks are autonomous and infrastructure-less wireless systems where nodes act as routers and hosts. Security is the primary issue for the functionality of these networks. Security for ad hoc networks can be incorporated by prevention and detection mechanisms. This research work focuses on a two-level fuzzy-based intrusion detection system for identifying black hole attacks in ad hoc networks. This method can reduce the complexity of the rule base of the fuzzy inference system. To reduce the complexity of detection, communication overhead and to make the detection scheme energy efficient, further, a cluster-head-based intrusion detection system is designed and implemented. The impact on network performance with no attack, with black hole attack, and with intrusion detection scheme deployed in all nodes and cluster heads are analyzed. The proposed cluster-based 2 level fuzzy logic intrusion detection mechanism was able to achieve the detection rate and accuracy to a maximum of 100%,false alarm rate to 0% and detection delay to in varying attacker scenario.

Keywords: Adhoc Networks, Blackhole attacks, Cluster head, IDS, Fuzzy Logic.

1 Introduction

In ad hoc wireless networks nodes cooperate among themselves to carry out all the functions in the network. Adhoc networks are prone to safety hazards due to the open medium,from malicious nodes inside the network, lack of infrastructure, restricted power supply, dynamic topology, and cooperative algorithms. These attacks range from passive eavesdropping to active Denial of service attacks[12][13].The security solutions for ad hoc networks involve proactive solutions which incorporate measures to prevent host or network-based attacks. Reactive solutions like intrusion detection system is an effective method to monitor identify and isolate these attacks. This paper analyses the impact of the black hole intrusion in the network and the effectiveness of the intrusion detection system in identifying, isolating the black hole attack, and improving the performance of the network[14]. The proposed work focuses on a two-level fuzzy-based intrusion detection system for identifying black hole attacks in ad hoc networks. This method can reduce the complexity of the rule base in the fuzzy inference system. To reduce the complexity in detection, communication overhead, and to make the detection scheme energy efficient, further, a cluster head-based IDS

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is implemented. The impact on network performance with no attack, with black hole attack, and with IDS Scheme deployed in all nodes and cluster heads are analyzed for varying number of attacks.

2.Literature Survey

Debdutta and Nabendu Chaki [2] proposed a 2 layered cluster network in which the node with the lowest node id is selected as cluster head. The function of the cluster head at layer 1 is to collect the route information of the nodes. It monitors the false routes generated by a node, detects the intrusion, and alerts the corresponding layer 2 cluster head.The cluster head of the outer layer informs the nodes in the outer cluster about the intruder. This method was able to reduce the processing and communication overhead between the cluster heads at layers 1 and 2.This IDS considered only a single network parameter to detect black holes, though the PDR rate is improved. Barman Roy and Rituparna Chaki [1] present a cluster-based intrusion detection algorithm that detects blackhole attacks in a MANET based on the trustworthiness of the nodes. The network is layered and the cluster head of each layer is responsible for the members of its cluster and communicates with the cluster head of layer 2. The selection of cluster head is based on three parameters battery power, mobility, and trust value of a node in the cluster. The IDS deployed in the cluster heads detects black hole attacks with a destination sequence number. This work analyzed the network performance but failed to analyze detection performance. Monita Wahengbam and Ningrinla Marchang [3] proposed a method for black hole and gray hole attacks using a fuzzy logic system based on 2 threshold values threshold and dest threshold Though the attacks are detected the maximum detection rate is 80%.Deepa Krishnan [6] proposed an IDS scheme with a lightweight, low overhead mounted on programmable mobile agents. The behavior-based approach is modeled with efficient fuzzy logic to significantly reduce the false positives and increase detection rates. Though the method claims to have improved detection rate no experimental results are given in the paper. Ajanta Konar and R.C. Joshi [5] proposed a Self-Organizing Map to isolate unknown patterns and predict their malicious nature from neighboring map units. A small fuzzy model is implemented in every map unit to achieve improved classification. The small fuzzy rule-base corresponding to the selected map unit will be updated if a new attack occurs, thereby reducing the processing overhead. It gives a high detection rate in KDD 99 cup dataset with a very low false-positive rate but failed to show improvement in network performance and classify attack types. Balan et al [4] proposed a robust fuzzy logic technique to detect black hole and gray hole attacks based on packet drop.Though the network performance is analyzed, the method failed to analyze detection performance. Kulbushan et al in [7] discuss IDS based on fuzzy logic to detect black hole attacks on AODV protocol. The fuzzy-based IDS implemented on each node consists of four modules. The fuzzy parameter extraction module extracts the parameters like forwarding packed ratio and average sequence number from the network traffic. This is given to a fuzzy computation module that works on fuzzy rules to compute the fidelity level. The fidelity level is then compared with a threshold value in the fuzzy verification module to check the behavior of the node. If in case a malicious activity is noted alarm module broadcast an alarm packet with the IP address of the black hole node and the system isolates it. The results show improved performance for the parameters false positive alarm, detection rate, packet delivery ratio, average end to end delay, routing overhead as compared to AODV with the black hole. Abhijit Deodhar and Ritesh Gujarathi

[9] in their paper highlight the clustered approach as the single point of failure. This scheme protects from a situation where the cluster head is compromised. A backup cluster which is a replica of the cluster head monitors the cluster head and provides additional security by operating a backup intrusion detection algorithm. Though the load balancing is done, the paper fails to discuss the IDS deployed in cluster heads and the performance improvement. Alka Chaudhary et al [10] developed an anomaly intrusion detection system based on a Sugeno-type fuzzy inference system to detect the packet dropping attack in mobile ad hoc networks with minimal resources. The proposed system was capable to detect the packet dropping attack with a high detection rate and low false alarms at different mobility levels.

3.Blackhole attack & its impact on network performance

3.1 Blackhole attack

A black hole attacks the network layer by claiming that it has a fresh route to the destination and eventually absorbs the packets forwarded to the destination [3]. Figure 1 illustrates the operation of a black hole attack. When source node 1 wants to send the packets to the destination node 3,it initiates the route discovery process by broadcasting the route request RREQ. Nodes 2, 4, and B receive it. The node B which is a black hole intruder immediately forges and sends a Route Reply RREP packet to 1 with the highest destination sequence number and minimum hop counts to the destination. Hence claiming it has the shortest and fresh path to node 3. Node 1 receives the RREP packet from B, assuming it to be the shortest route, starts sending the packets to 3 through B. Malicious node B being a black hole absorbs all the data packets without forwarding them to the destination[10]

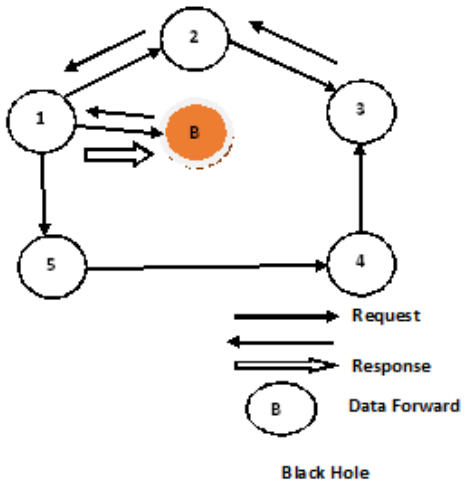

Figure 1 Black Hole Attack

3.2 Simulation of network with no attack & black hole attacks

An analysis is carried out to understand the performance degradation in the network under blackhole attacks. Simulations are done in NS 2 by varying the size of black hole attackers to analyze the effect of the black hole attack on the network parameters. The simulation profile is

given in Table1.All nodes including the black hole nodes are randomly placed. The network performance metrics like Packet Delivery Ratio(PDR), delay, throughput, control overhead, Normalized Routing Head (NORH),and energy are analyzed.

Table 1. Simulation Parameters

Simulation Parameter	Value
Simulation Area	1000*1000 m
Routing Protocol	AODV
Traffic Source	CBR
Number of nodes	150
Size of the data packet	512
Node Placement	Random
Simulation time	200s
Connection time	25s
Speed	0 m/s
Number of flows	3
Number of black hole nodes	1-5

3.3 Performance analysis of the network with varying black hole attacks

The simulated output of black hole attacks in the network is shown in Figure 2.Table 2. shows the performance of the network with no attack and an increasing number of black hole attacks.The performance degradation w.r.t PDR under blackhole attacks is shown in Figure 3.

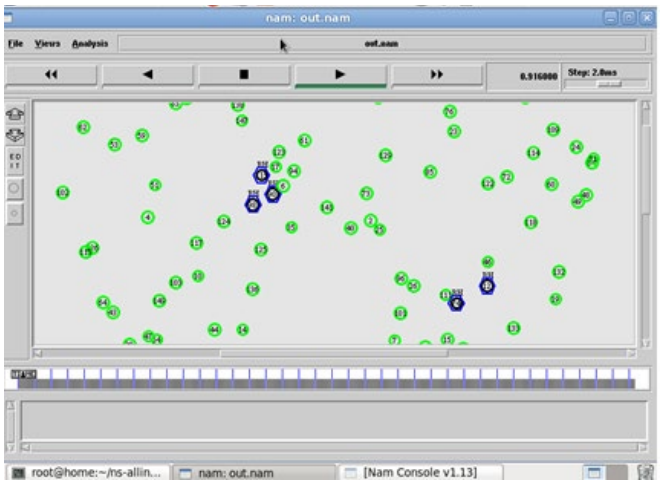

Figure 2. Network with Black Holes

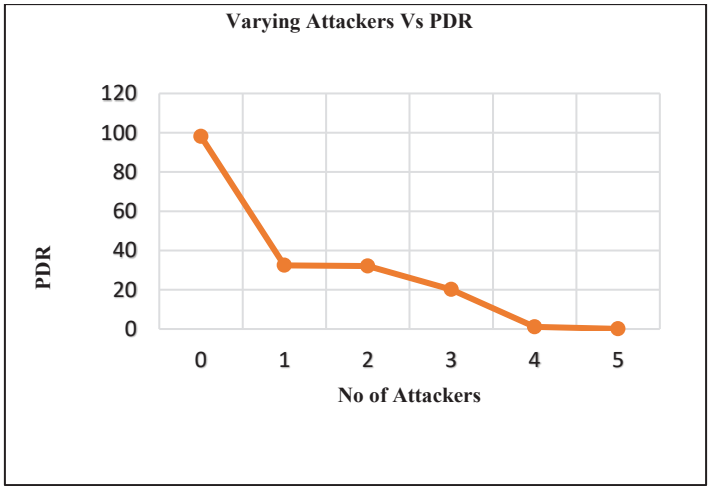

Figure 3.packet delivery ratio withvarying attackers

It is evident from the graphs that with black hole attacks, the Packet Delivery Ratio (PDR) and throughput decreases. With an increasing number of attacks, the PDR and throughput reduce and is almost close to zero with 5 attacks. The black hole attracts and consumes most of the packets routed to the destination and only a few packets manage to reach the destination. Energy consumption reduces with an attack than with no attack, as the black hole does not any perform route discovery and sends the RREP to the source. The black hole attack drops the packets which also results in a decrease of end-to-end delay. The overall delay also varies based on the attacker's position, the time it takes to attack the network and divert the traffic towards itself. Control overhead decreases with an attack than compared to no attack. In case of no attack, more packets are sent to find the route to the destination.With a black-hole attack, fewer control packets are sent in the network as the black hole fakes the RREP and sends it to the source. The NROH also increases with black holes as fewer packets reach the destination.

Table 2. Performance of the network with varying black hole attacks

Network parameter	**No of Black Hole Attacks**					
	0	**1**	**2**	**3**	**4**	**5**
PDR	**98.06**	**32.44**	**32.04**	**20.12**	**1.07**	**0.07**
TpT	**120482**	**32809**	**32000**	**19884**	**1065**	**71.01**
COH	**4149**	**3863**	**3853**	**3897**	**3928**	**3787**
NROH	**3.70**	**8.36**	**8.33**	**15.70**	**261**	**3787**
Delay	**0.37**	**0.018**	**0.045**	**0.0839**	**0.089**	**0.09**
Energy	**6.38**	**3.79**	**4.50**	**4.57**	**3.72**	**3.59**

4.Proposed method

4.1Overview of the proposed intrusion detection system

Fuzzy logic is a computational model that deals with uncertainty and the imprecision of human reasoning with mathematical tools [3].The unique feature to showcase knowledge linguistically makes fuzzy systems the better choice for applications including intrusion detection. This research work focuses on a cluster head-based fuzzy logic intrusion detection system for detecting black hole attacks using the fuzzy logic method[31][32]. As observed from the related work, most of the IDS schemes have taken few parameters in detecting the black hole attacks. In this work, the fuzzy logic system is modified as a two-level fuzzy inference system. Mamdani fuzzy inference model is used in this work. This work incorporates a feature set from the network layer to profile the normal pattern of the ad hoc network. More the features extracted from the network layer to profile the normal pattern, the higher will be the accuracy in detecting the intrusion. The proposed two-level fuzzy inference system reduces the number of rules written into the rule base and the level of computations involved. In this work, the IDS is employed in cluster heads which monitors and collects the network parameters from its members thereby reducing the processing and communication overhead incurred than when all the nodes are deployed with IDS. The nodes in the network monitor the neighbourhood nodes by an overhearing mechanism and store the network parameters in the monitor table maintained in the node with the node id. In the case of cluster-based IDS, the cluster head monitors the behavior of the member nodes in promiscuous mode and stores the parameters in the monitor table. When the IDS is deployed, the feature set is extracted from the monitor table in both cases. The Two-level Fuzzy logic checks for the intrusions. When the Black Hole attacks are detected the current node or the cluster head updates the node id of the black hole in the Blackhole table. The node or the cluster head broadcasts an alarm packet with a black hole id to the members of the cluster or the one-hop neighborhood in case of nodes deployed with IDS. The nodes which receive the alarm messages remove the black hole node entry from the routing table. Figure 4. shows the cluster-based IDS method for black hole detection using fuzzy logic

Algorithm for cluster based IDS using fuzzy logic

Step 1: Network is partitioned into clusters

Step 2: Cluster head is selected by the mechanism of connectivity

Step 3: The cluster head is selected as IDS agent

Step 4: The fuzzy module is incorporated into IDS agent for detection with the following components

- *Fuzzy parameter extraction*
- *Fuzzy computation using if-then rules*
- *Fuzzy output module*

Step 5: Alarm packet generation in case black hole is detected

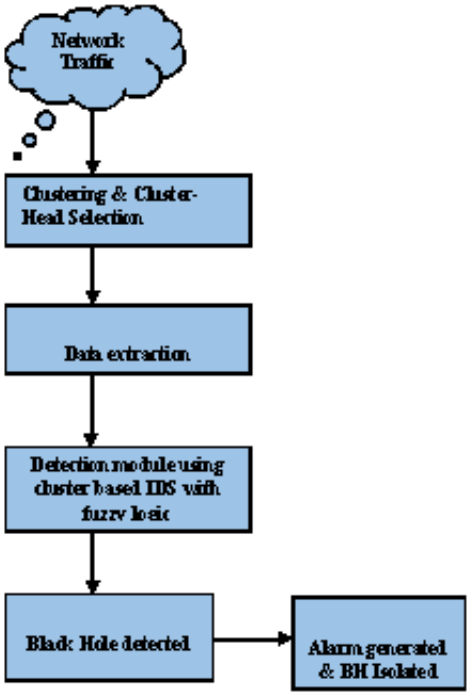

Figure 4. Cluster-based IDS method for black hole detection using fuzzy logic

4.2 Algorithm for clustering and cluster head selection

Cluster-head-based IDS employ cluster heads to monitor and collect the network parameters from its cluster members thereby reducing the processing and communication overhead incurred when the nodes are deployed with IDS.

All Nodes are assigned with the unique Node ID
Network Area Partitioned into N Grid with X_Region, Y_Region
Each Grid is identified by Grid_ID
All the nodes in the Grid send hello message to neighbours
Node_id, Residual_Energy, Nb_count , Grid_ID,Cluster_Head_ID_X_pos, and Y_position
Node Receives Hello Message Update their Neighbour Table
If Nb_count > Highest Nb_Count in Neighbour Table
    Node Selected as Cluster Head
    Set CH=1
    Send CH_Announcement to neighbour in their grid
Node receives CH_Announcement
    If node Grid_ID == CH Grid_ID
        Set CM=1
        Set CH_ID=Sender Node ID
        Send Cluster_Join Message to CH_ID
Node receives Cluster_Join Message
    Update CM in Member Table

4.3Two level fuzzy inference system for black hole detection

In this work, a total of 8 features is extracted from the network. The proposed two-level fuzzy inference system reduces the number of rules written into the rule base and the level of computations involved. Each feature is given five linguistic values such as low, moderate, normal, high, and very high. The membership function of each linguistic variable is given by dividing each attribute into triangular fuzzy sets.

Many *"if-then rules"* to be created in the rule base is $N=x^n$ where x is the number of linguistic variables and n is the number of attributes selected. Belarbiet al.[11][18]. The total number of fuzzy if-then rules to be written into the fuzzy rule base with 8 network parameters and 5 linguistic variables are 58. It is impossible to create a single fuzzy if-then rule base when the attributes or the network parameters are large i.e. n=8 which is more than 300000 rules in the rule base. Such a rule base would result in high computational complexity; more run time and may fail to predict the required output. In the two-level fuzzy inference system for black hole detection, the feature set which consists of 8 parameters from the network layer is partitioned into two sets of 4 parameters. The rule base required for each fuzzy inference in level 1 is then 54 =625 and the number of rules in the level 2 rule base is 52 = 25.With the two-level fuzzy logic method, the total number of rules to be written in to rule base can be reduced to 1275. Figure 5.shows the 2 level fuzzy inference IDS for black hole detection.

4.3.1Feature set description

Forwarded Data packet Ratio (FPR): Ratio of the packets forwarded to the packets received by the node.

Delay: ∑(packet received time-packet sent time)/ number of packets received

Sequence number(Seq_Num): sequence number of the packet sent.

Average Sequence number (Avg_Seq_Num): average of the sequence number of the packet received by the node.

Packets Sent (PS): number of the packets sent by the node.

Packets Received (PR): number of the packets received by the node.

Throughput (Tpt): number of bits received by the node in a given amount of time. It is measured in kbps.Tpt =(Number of packets received*packetsize*8)/connection duration

Data Packet Drop Ratio (DPR): Ratio of number of packets dropped to the number of packets received

4.3.2Algorithm for two level fuzzy inference system

IDS Agent monitor and collect features periodically
All features are stored in the monitor table
Forward Packet ratio (FPR), Delay, Destination SeqNo (Seq_Num),
Average Sequence No(Avg_Seq_Num) Number of Packet Sent(PS),
Number of Packet Received(PR), Data Packet Drop Ratio(DR), Throughput(Tpt)
If (Detection ==Start)
for each node in the parameter table
Perform Level-1 fuzzy logic computation
Select features FPR,Delay, Seq_Num, Avg_Seq_Num
Do Fuzzification
Apply Fuzzy Rule
Collect the output1 from the fuzzy engine
Select features PS,PR,DR,Tpt
Do Fuzzification

Apply Fuzzy Rule
Collect the output2 from the fuzzy engine
Perform Level-2 fuzzy logic computation
Select output1 and output2 as Input
Apply Fuzzy Rule
Collect the output3 from the fuzzy engine
If (output3 ==LOW)
Node declared as an attacker
Node Id added into the block list
Alarm Packet Sent to all neighbours

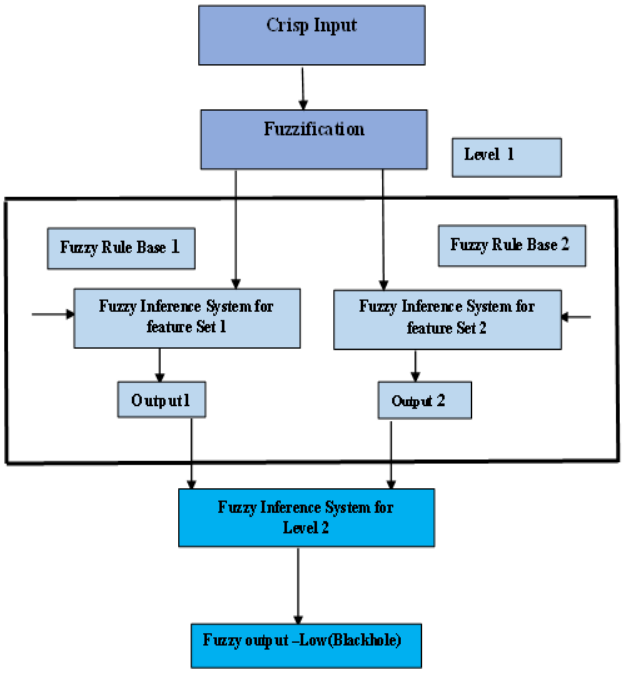

Figure 5. 2 level fuzzy inference IDS for black hole detection.

5. Experimental results

The simulation of two level fuzzy based intrusion detection system for detecting theblack hole attacks is carried out in Network Simulator (NS2) for the following cases with varying black hole nodes.

1..Detection with Fuzzy Logic-based IDS deployed in all nodes (without cluster head) in the network (DWOCH).

2..Detection with Fuzzy Logic-based IDS deployed in the cluster Heads (DWCH).

The performance and comparative analysis are carried out for the IDS Schemes. The efficiency of the proposed method with the existing methods is also analyzed.

Detection performance parameters:The standard performance evaluation parameters are used to investigate the results of Fuzzy logic-based IDS.In the proposed method, the abnormal behavior is shown as positive and normal events as negative.

True Positive (TP): intrusions correctly identified as intrusions

False Positive (FP): normal events being identified as intrusions

True Negative (TN): normal events correctly identified as normal

False Negative (FN): intrusions incorrectly identified as normal [33]

Detection Rate (DR) $DR = \frac{TP}{(FN+TP)}$ (1)

False Alarm Rate (FAR) $FAR = \frac{FP}{(FP+TP)}$ (2)

$\text{Accuracy} = \frac{(TP+TN)}{(TP+FP+TN+FN)}$ (3)

Average Detection Delay(DD) $DD = \frac{\sum(\text{Detection start time} - \text{Attacker Detect time})}{\text{Total number of attackers}}$ (4)

5.1 Simulation

The simulation is done using NS-2 to create the network and hence to cluster and select the cluster head for the clusters. The simulation of a wireless ad hoc network with 2 level fuzzy logic IDS deployed in all the nodes, random nodes, and cluster heads is done for the varying black hole attackers. The simulation profile of Table 1 is followed. Figure 6. and Figure 7. show the formation of cluster and cluster heads.

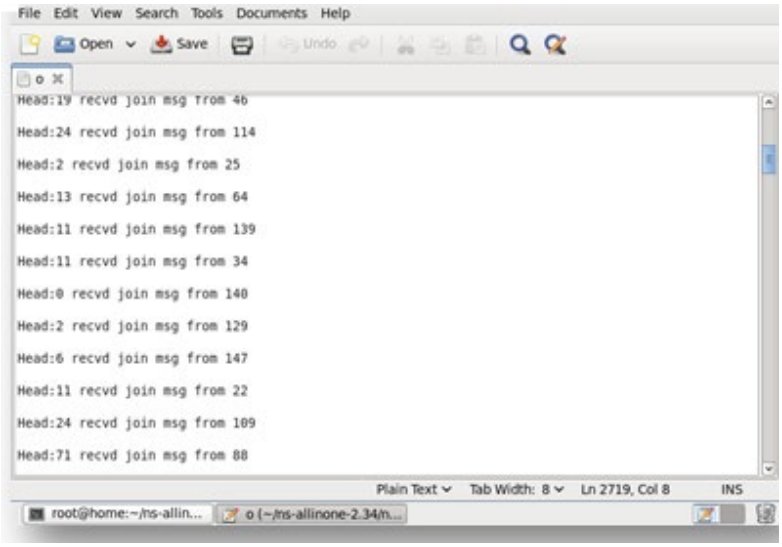

Figure 6. Formation of cluster

5.2 Performance analysis of 2 level fuzzy IDS with varying attackers

The simulations are done for the scenarios with i) Fuzzy logic IDS deployed in cluster head ii) Fuzzy logic IDS deployed in all nodes.The performance of the network concerning PDR, delay, throughput, control overhead, Normalized control overhead, and energy are analyzed. The detection parameters are also analyzed to study the efficiency of the DWOCH and DWCH IDS deployment methods.Table 3. shows the network performances forDWOCH and DWCH IDS schemes.Figure 8. Shows the improvement in the PDR after implementing IDS.Figure 9. shows the variations in the parameters of both the detection schemes compared

to black hole attackers. The parameters PDR and throughput are improved to 81% then blackhole attacks. This is because after the detection and isolation of black hole attacks the packets are routed in an optimum path to the destination. The delay is increased compared to the black hole attack as the drop ratio is decreased considerably and maximum packets reach the destination and also it is less than no attack condition.It is increased by 31.4% with DWOCH and 8.7% higher with DWCH. In detection schemes, the control overhead is increased compared to black hole attacks as it involves more exchange of control packets for detection and isolation

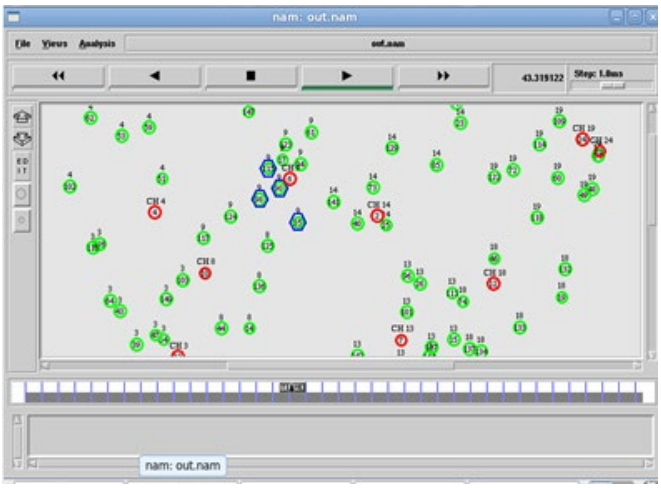

Figure 7. Cluster Heads and Attackers

The total average energy consumption is also increased to 41% and 30.8% in DWCH and DWOCH as more packets are recovered and sent to the destination. The Normalized routing Overhead is reduced to 99% compared to a black hole attack as more packets are delivered at the destination. The average variation in the network parameter results shows that DWCH is better than DWOCH in improving the performance of the network after detecting and isolating the black hole attack.

Figure 10. shows the improvement in network parameters with DWCH IDS than DWOCH IDS for varying attackers. The delay, control overhead, and energy consumed is less in the DWCH method than DWOCH as only cluster heads are involved in the detection. The control packets for detection, alarm generation are less in this case. Similarly, the energy consumed and delayare higher in DWOCH as all the nodes in the network are involved in the detection. The PDR, Throughput is improved as more packets are delivered at the destination in the shortest path, and also the detection is accurate with cluster head as it covers all the regions. For the same reason, the NROH is reduced in DWCH compared to DWOCH. In the Network parameters,the maximum improvement is in the end-to-end delay which is 34%.This is because the cluster head-based fuzzy IDS covers the area and detects the blackhole attacks in its cluster and blocks it less time than the all node-based fuzzy IDS and hence reducing end-to-end delay.Table 4.shows the detection performance of the 2 level fuzzy logic IDS schemeemployed in cluster heads and all nodes. The detection parameters accuracy is higher with less number of attacks and reduces with an increasing number of attackers. Detection delay increases with more attacks. The average detection performance of DWCH is better than

DWOCH. The false alarm rate varies between 0 and 0.5.All the detection parameters show improved performance in DWCH compared to DWOCH.

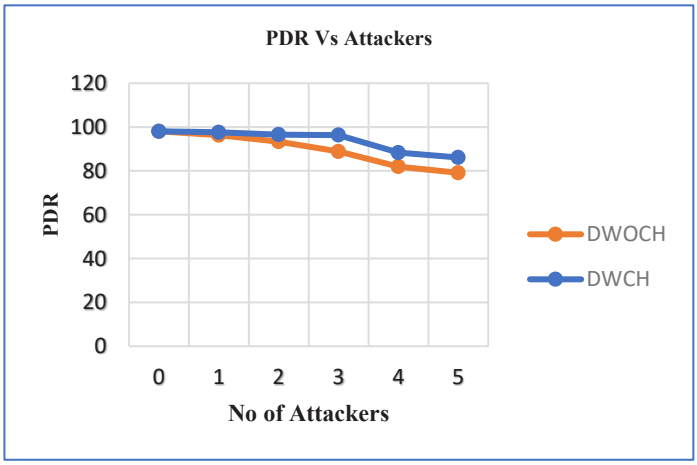

Figure 8. Packet Delivery Ratio with DWOCH and DWCH for varying attackers

From the literature survey, the results of the existing methods for detecting black hole attacks are analyzed. AikateriniMitrokotsa et al (2008)[20] IDS using Classifiers: MLP, Linear classifier, Bayesian Classifier, SVM got DR of 0.85-0.38 and PDR of 0.47. Huike Li Dagum et al (2009) Novel IDS using SVM & fuzzy network achieved DR of 0.98-0.93[21]. Farhan Abdul Fattah et al(2010)[22] Conformal Prediction K Nearest Neighbour& Distance-based Outlier Detection(black hole attacks) were able to get TPR of 0.99-0.96, FPR of 0.01-.001, and Accuracy of 0.99-0.97. Kulbhushan et al (2011) IDS with Fuzzy level with Thresholding (black hole attacks) achieved DR of 0.91-.87, FPR of 0.06-.08, and PDR of 0.9-1[24]. Ming Yang Su (2011) IDS with Anti Black Hole Mechanism using a threshold for suspicious value(black hole attacks) achieved TPR 1, FPR of 0.06-.08, and PDR of 0.65-0.9[25].MonitaWahenngham et al (2012)[3] IDS with Fuzzy level with Thresholding(black hole attacks) could achieve DR of 0.8-0.2. Chundong Se et al(2013)[26] IDS using Path-based and Collision based using dynamic thresholding (black hole attacks) got DR of 1-0.85. Nadeem et al (2014)[27] Intrusion detection & adaptive response mechanism (black hole attacks got DR of 0.92-0.8. AnujRana et al (2015)[28] Enhanced AODV modified method achieved DR of 0.95-0.9. BasanthSubbu et al (2016)[29] IDS using Bayesian Game Formulation was able to get DR of 0.995 FPR of 0.654-.0165 and PDR of 0.97. Heerendra et al (2018)[30] Agent-based detection mechanism achieved a PDR of 94% and Moudnia et al (2019)[31] using fuzzy-based IDS was able to get DR of 0.998.

Table 3. Network performance with DWOCH and DWCH IDS schemes for varying Attackers

Network parameters	No of Attackers 1		2		3		4		5	
	DWOCH	DWCH	DWOCH	DWCH	DWOCH	DWCH	DWOCH	DWCH	DWOCH	DWCH
PDR	96.27	97.61	93.32	96.56	88.85	96.33	81.96	88.35	79.15	86.12
Tpt	97363	98712	94380	97647	87776	95161	81087	87278	78188	85077
COH	4079	3731	5240	4209	4779	4127	5485	4592	5465	4583
NROH	2.975	2.684	3.942	3.061	3.381	3.079	5.479	3.736	5.263	3.825
Delay	0.040	0.023	0.068	0.036	0.123	0.089	0.122	0.098	0.135	0.119
Energy	7.001	5.763	8.395	6.455	6.502	5.873	6.250	5.827	6.012	5.267

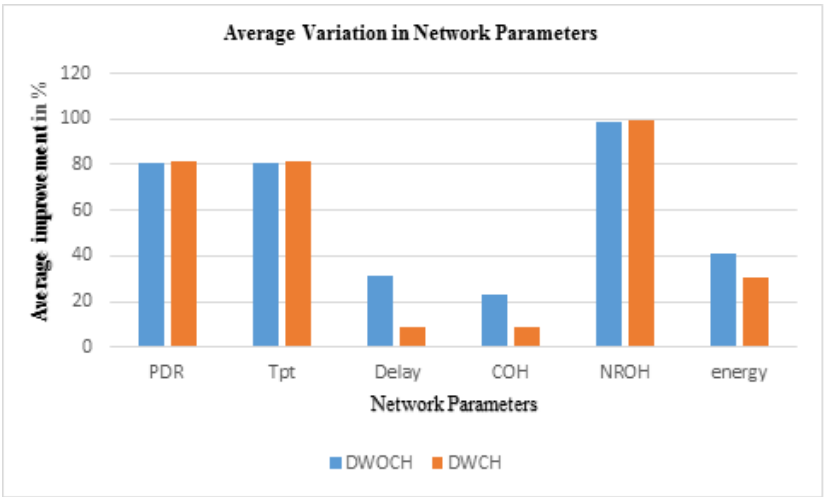

Figure 9 Variations in the parameters of both the detection schemes compared to black hole attackers.

The 2 level fuzzy logic-based IDS implemented in detecting black holes were able to reduce the no of rules in the rule base to 99.6% for the extracted network feature set. It is evident from the experimental results that the proposed method was able to improve the detection rate and accuracy to a maximum of 100%. The false alarm rate was reduced to 0%. The results show that the 2 level fuzzy IDS for detecting black hole attacks is reliable and scalable.

Table 4. Detection parameters with 2 level fuzzy logic-based IDS deployed in all nodes(DWOCH) and Cluster heads(DWCH)

Detection parameter	No of Attackers									
	1		2		3		4		5	
	DWOCH	DWCH	DWOCH	DWCH	DWOCH	DWCH	DWOCH	DWCH	DWOCH	DWCH
DR	1	1	1	1	0.666	1	0.75	0.75	0.8	0.8
Accuracy	0.993	1	0.993	0.993	0.98	0.993	0.980	0.986	0.973	0.98
FAR	0.5	0	0.333	0.333	0.5	0.25	0.4	0.25	0.428	0.33
DD	0.1	0.1	2.6	1.3	2.667	1.67	3.34	3	3.8	3

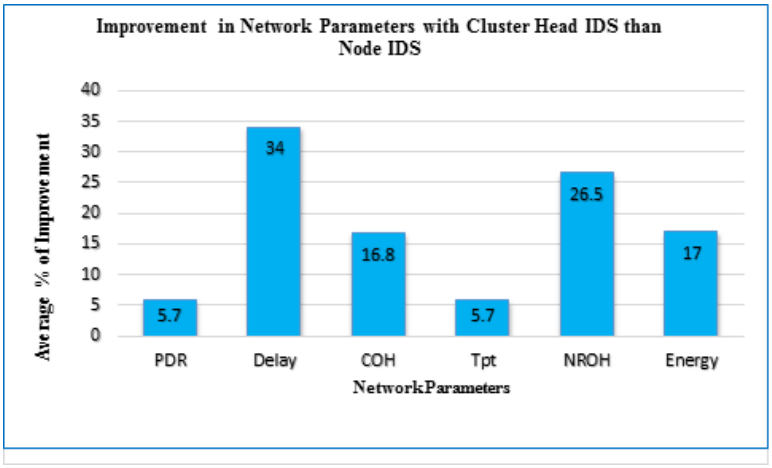

Figure 10. Improvement in network parameters with DWCH IDS than DWOCH IDS for varying attackers

6 Conclusion & Future Work

An intrusion detection system is a security system that monitors the nodes and network traffic and there is a great scope for designing an IDS system. This work addressed the impact of a black hole attack in a wireless ad hoc network and a 2 level fuzzy-based IDS to identify and isolate the attacks. Simulations are carried for 2 level Fuzzy based IDS for varying numbers of attackers. A comparative study of the network performance and detection parameters of 2 level fuzzy-based IDS deployed on cluster-based and all nodes are also carried out in this work. With the 2 level fuzzy logic IDS, the IDS performance parameters are

improved. The cluster head based fuzzy logic IDS shows improved performance than the node-based fuzzy logic IDS. The main goal of the proposed IDS is to minimize the false alarm rate, improve the detection rate, accuracy, and detection delay and increase the network performance which is achieved through this research work and is evident in the results. In the future, adaptive Techniques can be developed to change the rule base based on network dynamics and multi-level fuzzy logic can be designed to detect multiple network attacks.

References

[1] Debdutta Barman Roy,NingrinlaMarchang. MCBHIDS Modified layered cluster based algorithm for black hole IDS India Conference (INDICON), Annual IEEE India Conference (INDICON); 2013.1 – 6

[2] Debdutta Barman Roy,NabenduChaki and RituparnaChaki, BHIDS: A New Cluster Based Algorithm For Black Hole IDS, Security And Communication Networks,Security Comm. Networks.2010; 3:278–288

[3] MonitaWahengbam&NingrinlaMarchang (2012) Intrusion Detection in MANET using Fuzzy Logic.3rd National Conference on Emerging Trends and Applications in Computer Science.2012; 978-1-4577-0748

[4] Vishnu Balan. E, Gokulnath C, Priyan M K, Prof. Usha Devi G. Fuzzy Based Intrusion Detection Systems in MANET. ELSEVIER Procedia Computer Science. 2015; 50: 109 – 114

[5] Ajanta Konar and Ramesh Joshi C. An Efficient Intrusion Detection System Using Clustering Combined with Fuzzy Logic.Contemporary Computing, of the series Communications in Computer and Information Science.2010; 94: 218-228.

[6] Deepa Krishnan. A Distributed Self-Adaptive Intrusion Detection System for Mobile Ad-hoc Networks using Tamper Evident Mobile Agents. International Conference on Information and Communication Technologies ELSEVIER, Procedia Computer Science, 2015;46 :1203 – 1208

[7] Kulbhushan and Jagpreet SinghFuzzy Logic Based Intrusion Detection System AgainstBlackhole Attack on AODV in MANET. IJCA Special Issue on Network Security and Cryptography NSC.2011;28-35

[8] AlkaChaudhary, Vivekananda Tiwari and Anil Kumar. A Novel Intrusion Detection System for Ad Hoc Flooding Attack Using Fuzzy Logic in Mobile AdHoc Networks, IEEE International Conference on Recent Advances and Innovations in Engineering. 2014; 1-4

[9] Christeena Joseph, P. C. Kishoreraja, RadhikaBaskar ,M. Reji.Performance Evaluation of MANETS under Black Hole Attack for Different Network Scenarios. Indian Journal of Science and Technology. 2015;Vol 8(29).1-10

[10] AbhijitDeodhar ,RiteshGujarathi.A Cluster Based Intrusion Detection System for Mobile Ad Hoc Networks.citeseer ,1-15

[11] K. Belarbi, F. Titel, W. Bourebia, K. Benmahammed. Design of Mamdani fuzzy logic controllers with rule baseminimisation using genetic algorithm. Engineering Applications of Artificial Intelligence 2005; 18 875–880

[12] Praveen Joshi.Security issues in routing protocols in MANETs at network layer.Elsevier Procedia Computer Science 2011,3:954–960

[13] Satyabrata Chakrabarti and Amitabh Mishra.QoS Issues in Adhoc Wireless Networks. IEEE Communication Magazine. 2001;142-148

[14] Raman Singha, Harish Kumar.B and Singla.R.KAn intrusion detection system using network traffic profiling and online sequential extreme learning machine, Expert Systems with Applications,2015; 42:8609-8624

[15] Tayde K.S and Sahu.A.M.Challenges and Future Directions in Ad Hoc Networking-Review, International Journal of Advanced Research in Computer Science.2013;4:180-186.

[16] Sanjay Dhurandher.K, Isaac Woungang, RaveenaMathur, and PrashantKurana, GAODV: A

Modified AODV Against Single and Collaborative Blackhole Attacks in MANETS. 27th International Conference on Advanced Information Networking and Application workshops.2013;357-362

[17] Sergio Pastrana, Aikaterini Mitrokotsa, Agustin Orfila and Pedro PerisLopez,. Evaluation of classification algorithms for intrusion detection in MANETS Elseiver Knowledge-Based Systems 36:2012;217–225

[18] Vydeki, D, Bhuvaneswaran.R.S Effect of Clustering in Designing A Fuzzy Based Hybrid Intrusion Detection System For Mobile AdHocNetworks.Journal of Computer Science 9 2013;(4): 521-525.

[19] Maryam Fathi Ahmadsaraei and Abolfazl Toroghi Haghighat.A New Intrusion Detection System to deal with Black Hole Attacks in Mobile Ad Hoc Networks. Journal of Computer & Robotics 2013;6:7-14

[20] Aikaterini Mitrokotsa, Manolis Tsagkaris and Christos Douligeris 8. Intrusion Detection in Mobile Ad Hoc Networks Using Classification Algorithms. IFIP International Federation f'or Information Processing,Advances in Ad Hoc Networking.2008;265:133-144.

[21] Huike Li, Daquan Gu. A Novel Intrusion Detection Scheme Using Support Vector Machine Fuzzy Network for Mobile Adhoc Networks.IEEE Second Pacific Asia Conference on Web Mining and Web based Application.2009

[22] Farhan Abdel-Fattah, Zulkhairi Md.Dahalin and Shaidah Jusoh .Dynamic Intrusion Detection Method for Mobile Adhoc network Using CPDOD Algorithm.IJCA Mobile Adhoc Networks2010;.22-29.

[23] Kulbhushan and Jagpreet Singh.Fuzzy Logic Based Intrusion Detection System Against Blackhole Attack on AODV in MANET. IJCA Special Issue on Network Security and Cryptography.2011; NSC. 28-35

[24] Ming Yang S.U. Prevention of Selective Black hole Attacks on Mobile Adhoc Networks Through Intrusion detection systems. Elsevier computer Communications.2011;34:107-117

[25] Chundong She , Ping Yi , Junfeng Wang, Hongshen Yang.(2013)Intrusion Detection for Black Hole and Gray Hole in MANETs. KSII Transactions on Internet And Information Systems 2013;.7:1721-1736

[26] Adnan Nadeem and Michael Howarth. An Intrusion Detection & Adaptive Response Mechanism for MANETS. Elsevier Adhoc Networks.2014;13:368-380

[27] Anuj Ranaa, Vinay Ranab and Sandeep Gupta EMAODV: Technique To Prevent Collaborative Attacks in MANETS 4th International Conference on Eco-friendly Computing and Communication Systems, ICECCS2015, ELSEIVER Procedia Computer Science 2015;70: 137 –142

[28] Basant Subba, Santosh Biswas and Sushanta Karmakar. Intrusion detection in Mobile Ad-hoc Networks: Bayesian Game Formulation. Elsevier Engineering Science and Technology, an International Journal 2016;19:782–799

[29] Heerendra Mahore, Ratish Agrawal, Roopam Gupta. Agent Based Black Hole Detection Technique in AODV Routing Protocol.2018 International Conference on Advanced Computation and Telecommunication (ICACAT),Bhopal, India

[30] HoudaMoudnia, Mohamed Er-rouidib, HichamMouncifc, Benachir El Hadadi .Black Hole attack Detection using Fuzzy based Intrusion Detection Systems in MANET. Procedia Computer Science 2019;151 1176–1181

[31] Ansam Khraisat, Iqbal Gondal, Peter Vamplew and Joarder Kamruzzaman. Survey of intrusion detection systems:techniques, datasets and challenges. Cybersecurity.2019; 2:20

[32] Hongyu Liu and Bo Lang. Machine Learning and Deep Learning Methods for Intrusion Detection Systems: A Survey.Applied Sciences.2019; 9, 4396.1-28

[33] Husain Shahnawaz And Gupta S.C. Black Hole Attack In AODV & Friend Features1 Unique Extraction To Design Detection Engine For Intrusion Detection System In Mobile Adhoc Network. Journal of Engineering Science and Technology.2012;7: 623 – 634.

Energy Aware Balanced Work Load Distribution Algorithm For Wireless Sensor Networks

Laxmaiah.Kocharla [1], Dr.B.Veeramallu[2]
{ hello.laxman12358@gmail.com [1] , bvmallu@kluniversity.in [2]}

Department of Computer Science and Engineering, KL Deemed to be University,Green Field, Vaddeswaram, Guntur Dt, A.P, India [1,2]

Abstract. Various vitality mindful steering figurings and traditions have been proposed for Wireless sensor organizes as of late to achieve focuses like least vitality use, intensified system lifetime, diminished correspondence inactivity and overhead et cetera. The issue of hotspot can't be all around tended to under many steering calculations since a couple of hubs which are on the most short path or close to the base station tend to deplete their vitality quickly and hence cause arrange section. In this approach, we propose a Ring-based Energy Aware Routing (REAR) figuring for remote sensor systems which can achieve both vitality modifying and vitality capability for all sensor hubs. Our estimation considers the jump number and partition and additionally the extra vitality of the accompanying next bounce plays out some other coordinating figurings in the parts of vitality use and framework lifetime et cetera.

Keywords: Remote sensor systems, bounce number, vitality effectiveness, vitality adjusting, arrange lifetime.

1 Introduction

Since, the progress in Wireless the project is based on sensor nodes. So, here we will explain about the sensor nodes. Our main aim was to create the sensor nodes which will include less energy[28] consume modules also will required less power[20] to access its functionalities of analog and digital signals[14]. After fulfilment of all these criteria one major issue arises that includes the finance issue-it includes those countries which provides good amount in return of good sensor nodes.

The features which are provided by the sensor nodes are- less power[20] as intake by the sensor nodes are-less power as intake[20], average price and accurate results and a new technology invented whenever we combine these small sensor nodes in large number that is called as a wireless sensor networks (WSN) [1] [2].

WSN provide the reliability of activities in various fields of application, including the monitoring of the environment, health surveillance, tracking system for military vehicles, the monitoring and seismic monitoring [3]. Although it has several uses in many fields but it do not have access to energy supply limited also little of calculation with exchange of messages capabilities. The limits must taken into account in the energy consumption[23][25] has a major issue in this era that tends to reduce the natural sources. So, for this some major steps mustbe taken to overcome this major issue to save natural resources of energy, there are some default interruptions which arises in the routing protocols in between the communication.

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These protocols which we have applied in this need to reduce the bandwidth. The process of transferring the sensor of a edges to the ground said as flood. Under it exchange of messages spreads widely from all the edges also basic nodes. Heinzelman introduced that the protocols have been spreading information all over is spin to spread it, Network base.

However, the data of the operation of rotation, advertising is not guarantees delivery of data. In this regard, routing protocols multi-promised benefits[27].The use of multiple database improves life for the WSN[27]. Straight broadcast used to the routing[27] method several ways. So, the straight broadcast will not agree to those who require applications for monitoring of data transfers periodicals.

Fig. 1. Wireless Sensor Networks Applications

Applications of wireless sensor networks

A. Landslide Detection

A torrential slide disclosure system impacts use of a distant sensor to arrange to perceive the slight advancements of soil and changes in various boundaries that may happen beforehand or in the midst of a torrential slide. Through the data collected it very well may be possible to know the moving toward occasion of torrential slides a long time before it truly occurs.

B. Water Quality Monitoring

Water quality noticing incorporates researching water properties in dams, streams, lakes and oceans, and furthermore underground water holds. The use of various distant scattered sensors enables the development of a more precise guide of the water status, and licenses the unchanging association of noticing stations in territories of problematic access, without the need of manual data recuperation.

C. Natural Disaster Prevention

Far off sensor frameworks can suitably act to keep the results of cataclysmic occasions, like floods. Distant center points have adequately been passed on in streams where changes of the water levels should be noticed continuously.

D. Machine Health Monitoring

Distant sensor frameworks have been delivered for equipment condition-based help (CBM) as they offer basic expense reserves and enable new value. Distant sensors can be placed in regions inconvenient or hard to reach with a wired structure, for instance, turning mechanical assembly and untethered vehicles.

E. Data Center Monitoring

Due to the high thickness of workers racks in a worker ranch, consistently cabling and IP addresses are an issue. To overcome that issue a consistently expanding number of racks are fitted out with distant temperature sensors to screen the affirmation and outtake temperatures of racks. As ASHRAE recommends up to 6 temperature sensors for each rack, agreed distant temperature advancement gives influence stood out from standard cabled sensors.

F. Data Logging

Distant sensor frameworks are moreover used for the amassing of data for checking of characteristic information; this can be just about as fundamental as the seeing of the temperature in a cooler to the degree of water in flood tanks in nuclear force plants. The quantifiable information would then have the option to be used to show how systems have been working. The advantage of WSNs over customary loggers is the "live" data feed that is possible.

G. Water/Waste Water Monitoring

Noticing the quality and level of water fuses various activities, for instance, checking the idea of underground or surface water and ensuring a country's water system for the benefit of both human and animal. It very well may be used to guarantee the wastage of water.

H. Structural Health Monitoring

Remote sensor frameworks can be used to screen the condition of basic system and related geo-actual methodology close to continuous, and over broad stretches through data logging, using appropriately interfaced sensors.

I. Wine Production

Distant sensor frameworks are used to screen wine age, both in the field and the storm cellar.

2 Literature Review

Dynamic coordinating conventions are amazingly sensible for WSNs since they can give incredible flexibility and perform data blend by each group head. Filter [6] can attract out system lifetime to 8-wrinkle more than other customary steering conventions. In any case, 5% of bundle head hubs are discretionarily picked and bunch head hubs use facilitate transmission. PEGASIS [7] is viewed as an upgraded form of LEACH. It is a chain based steering convention which can save more vitality stood out from LEACH. Notice [8] considers the extra vitality the fundamental parameter and a helper parameter like hub's degree et cetera. Time resembles amid bunch setup arrange while vitality modifying is refined amid aggregate[26] head connection organize since each hub picks its gathering head with most

outrageous extra vitality. DHAC gives an essential six-propel base up bundling methodology rather than customary best down procedures with better framework lifetime execution. The creator endeavored to scatter vitality stack among all sensors remembering the true objective to achieve both vitality capability and lifetime boost.

An enhanced version of LEACH is exhibited in [9] to enhance energy proficiency and framework dependability by utilizing hereditary calculation (GA) during the determination of group heads. In , each swarm operator can convey and trade the leftover energy data during route choice procedure to expand arrange lifetime in specially appointed and sensor systems. In , an enhanced ant colony optimization (ACO) strategy[22] is connected to the correspondence arrange directing issue with better execution as far as hop number. A energy adjusted unequal clustering protocol is proposed with molecule swarm improvement strategy with the goal that the problem area issue is stayed away from and organize lifetime is drawn out.

M. R. Alagheband and M. R. Aref [10] proposed dynamic key organization framework which relies upon round twist cryptography and signcryption technique for heterogeneous WSNs. The proposed planning as association adaptability and sensor center point conveyability in the liquid conditions. The proposed design had less correspondence overhead and worked better similar to count and key accumulating.

X. He, M. Niedermeier, and H. de Meer [11] made the assessment on the uncommon necessities of dynamic key organization in sensor conditions and introduced a couple of fundamental evaluation estimations ,moreover explained that resource constrained nature of sensor center points disappoint the usage of dynamic key organization plans. Media perception sensor associations. Distant video sensor associations will be made out of interconnected, battery-energized more modest than ordinary camcorders, each packaged with a low-power[19][17][20] far off handset that is good for taking care of, sending, and getting data. Video and sound sensors will be used to improve and enhance existing perception systems against bad behavior and manipulator attacks. Immense degree associations of video sensors can grow the limit of law execution workplaces to screen zones, public events, private properties and lines [12].

Fifth time adaptable constructions show is all-IP based model for removed and advantageous systems interoperability The All-IP Network (AIPN) is capable to satisfy expanding sales of the cell trades include. It is a common stage for all radio access progressions. The AIPN utilizes bundle exchanging and its anticipated progression gives updated execution and cost. In fifth period Network Architecture contain a client terminal (which has a principal part in the new planning) and distinctive free, self-supervising radio access headways (RAT). In 5G Network Architecture all IP based versatile applications and associations, for example, Mobile entries, Mobile trade, Mobile human organizations, Mobile government, Mobile keeping money and others, are offered through Cloud Computing Resources (CCR).

In this work creator has proposed a Dynamic organizations Mobility of sensor hubs is empowered by powerful WSNs. This kind of organizations encourages more extensive organization inclusion and more exact assistance than static WSNs. Thusly, dynamic WSNs are as a rule quickly received in checking applications, for example, target following in war zone observation, medical services frameworks, traffic stream and vehicle status checking, dairy cows wellbeing observing [13]. The unique organization cutting idea offers an approach to upgrade WSN to address all 5G cases productively.

In this methodology creator proposed Static organizations this kind of WSNs makes out of static sensor hubs and a static sink is put inside the checking territory. In such an arrangement, the significant energy customer is the correspondence module of every hub. Practically speaking, multi-jump correspondence is needed for sending information from sources to sink hubs.

In [10][24], the enlistment relies on the correspondence cost and creator chooses the bunch part by considering the most limit transmission power of the hubs. It doesn't consider the recuperation in this technique reinforcement. Based on the part and the leftover energy and bunch head, in paper, creator upgrades the choice of the group part by utilizing thorough weight esteem made out of division. it uses improvement esteem to remaining the heap irregularity. Stack leveling is introduced for developing the changed group the computation considers.

In this work bunch communication [24] layered methodology is used by creator. tantamount organization will think about the calculation. In this work [11], framework lifetime really appropriated bunch heads. to change the groups that considering the amount of general hubs in the group and the amount of group heads, the bunch heads used the transmission run reconfiguration. fruitful data assortment is obtained from this calculation.

In this methodology [12], using hubs the data is send based on the ideal planning calculation. This will decides the timetable opportunity for sending the parcels for the hubs. Data is passed to the all hubs using uniform bundle misfortune likelihood. For ideal booking the calculation uses changed expense target work.

In this work [13], a decentralized coordinating computation, known as a game hypothetical energy balance steering protocol. It is planned to develop the framework lifetime through changing energy[28] usage in a greater framework zone[16] with geographical steering conventions. The target of the proposed show is to make sensor hubs diminishes their energy at around a comparable time, which is master by watching out for the heap change issue at both the area and hub levels. In the region level, groundbreaking game speculation (EGT) is used to change the movement burden to the available sub locale. In the hub level, customary game speculation (CGT) is used to pick the best hub to change the hub in the picked sub area. The mix of transformative and traditional game-hypothetical with topographical steering is demonstrated to be viable improvement in lifetime of the organization. The calculations.

In this investigation approach we research the heap adjusting techniques that relies upon energy[21][28] usage of hubs and region thickness, group size, put together development, etc. It has been found that the heap adjusting can be used to broaden the lifetime of a sensor organization. Burden changing using bunching can moreover assemble coordinate flexibility. Regardless, it don't good for ceaseless application. Concerning energy necessities, a constant energy viable multi-bounce directing protocol[11] is prerequisite for sensor frameworks.

3 Problem Identification

Today is regular in excess high-accessibility PC frameworks that approaching organization traffic is disseminated on network level by utilizing one of every now and again utilized organization load balancing[21] calculations (like: arbitrary portion, cooperative assignment, weighted cooperative distribution, and so forth) These calculations use only organization boundaries of approaching traffic to decide. where to advance traffic, with no

data from different parts of PC framework, similar to current heap of utilization or information base workers.

4 Proposed Methodology

In the proposed philosophy we will clarify about the LOAD DISTRIBUTION ALGORITHM which we have utilized in our undertaking so to get the security[15] up to certain levels that can defeat the issue of the past strategies. Let the network C at first be filled in with zeros. We alter the framework as Cl,k = 1 if k < Kl and l = arg minj Kj . Thusly, the calculation will put L number if "1"- s in the framework at the principal L advances. One may see, that in each progression that particular hub is chosen, which has the littlest excess life expectancy. After L advances the calculation steps to the furthest limit of the framework and the past advances this development system is rehashed. Note that this calculation won't ever put "1" in where the requirements preclude it (Xj < Kj). The calculation ends when all the recommended Xj , j = 1, ..., J number of bundles are planned. This technique named LBS calculation (Algorithm 1) can officially be portrayed as follows:

Algorithm 1: LB algorithm
Require: ∀i = 1...J: Ki, Xi
L ← maxj Kj
C ← 0J×L
S ←Pj Xj
while S > 0 do {Number of unscheduled packets}
for l ← L to 1 do
Find arg mini Ki where (l < Ki) ∧ (Xi > 0)
S ← S − 1
Xi ← Xi − 1
Ci,l ← 1
end for
end while

The algorithm is divided into four phases

i. Introduction Phase

1. Select the CH as indicated by the abilities of the hubs.
2. Select the coveted number of CH as indicated by their area.
3. Define the scope of CH.
4. CH sends enrollment ask for message to every one of the hubs in its range and demand to answer with their present vitality status.
5. The hubs with high leftover vitality and preparing force will be distinguished and they are made to rest. They turn into the reinforcement hubs.
6. The hubs which are not in the scope of group head, will attempt to join the bunch by sending the message to the closest bunch part.

ii. State Phase

1. The bunch individuals sends the detected information to the CH in the dispensed time utilizing TDMA plan.

2. The non bunch individuals will send the detected information to the group head through the halfway group part.

iii. Last Phase

1. CH will total the information from every one of the hubs in its group.
2. CH will transmit the information to the base station.

iv. Reconfiguration Phase

1. The CH will consign its obligation to the reinforcement hub and will make the hub the bunch head.
2. The CH will transmit the new CH data to every other hub in the bunch.
3. The CH will transmit the new CH data to all other CH too.
4. The old CH will turn into the general hub.

5 Results

To evaluate the performance of existing method local and global image segmentation use MATLAB software 17 with a variety of dataset used for experimental task. This research use the various tools and functions from MATLAB 2017b [4][5]. Script generation for thresholding and feature extraction is also get performed using the MATLAB scripting tool.

MATLAB is the mathematical laboratory and a powerful tool for processing the image and other values. It is well developed and highly potential tool having the multiple feature tools in it. It is a multi-feature programming tool. It contains the section such as Math, Graphical user interface and finally the programming functions. It is first appear in 1970s and University on new Mexico is main inventor of this powerful tool. It is the tool which is built very professionally, highly tested and finally a good documentation of the feature, its development, library and its implementation usage is shown. This feature help in building complex algorithm. It enable the scaling, working with GPU and other cloud cluster units effectively. These is a matrix library and build on the top of multiple language combination such as C, C#, C++ and other cutting edge programming. It is widely used by more than a million users in academic and industrial purpose.

To accomplish load adjusting bury group correspondence and gauge next layer bunch range, BS first gauges energy utilization of CH of group range with Rmax for transmission its information to CH of group range with Rmax-1 as follows:

$$E(Rmax+Rmax\text{-}1) \geq (lRmax+lRmax\text{-}1)\ x$$
$$((Eelec + Eamp\ x(Rmax\text{-}1+Rmax\text{-}2)\ 2\ ) + Erecx\ lRmax$$
$$Rmax\text{-}2 \geq Rmin \qquad (1)$$

- Comparative Performance Evaluation

Execution Time :

The execution time is computed which is taken by algorithm to process the input image. The time difference between the initial and completed time is shown.

Syntax:-
Computation time:
tic
{
Algorithm;
}
toc;

Accuracy: Accuracy=TP+TNTP+TN+FP+FN (2)

TPR: TPR=TPTP+FN (3)

- Comparative Performance Graph

This section discuss about the observed result graphically, an analysis using the bar graph shows the outcome comparison and efficiency of proposed algorithm.

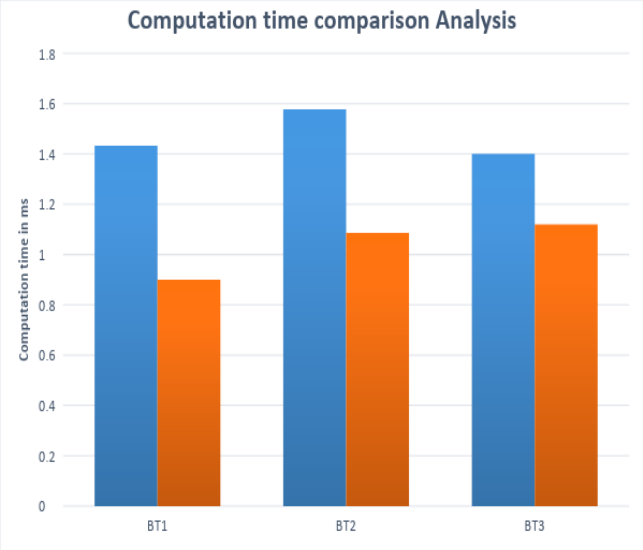

Fig. 2 . Comparative result graph for the value of execution time in seconds.

An execution with the given dataset and processing with the proposed algorithm shows the advantage in computation while comparing with traditional approach. The execution shows the low computation time.

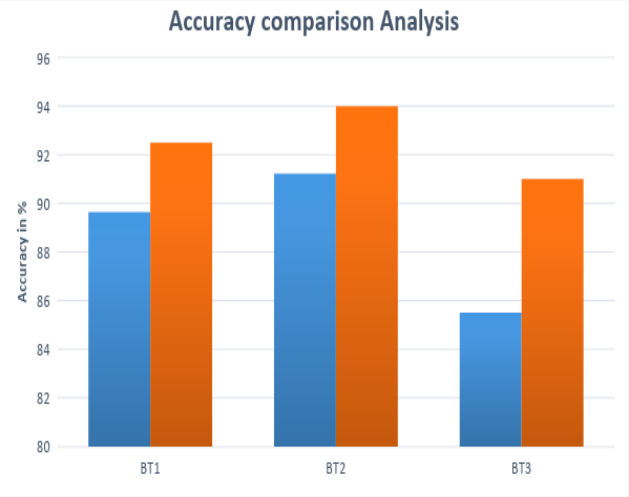

Fig. 3. Comparative result graph finds the value of accuracy in %.

Thus, from the above result section it can understand the better results.

6 Conclusion

By using the requirements of energy, in this paper we examined the load balancing algorithms. Basically, the most valuable resource is energy in wireless sensor networks. Compared to conventional algorithms, this algorithm will improve the performance and outcomes. But few of the work is there to be done. The elimination of overhead of cluster head selection process and cluster member selection process is done by using optimal clustering using energy efficiency. Hence, to improve the network life time, re-clustering is introduced. So, for a sensor network, load balance multi hop routing is concluded.

A further work be done working toward using some other parameters like improve the network lifetime, load balancingand efficiency[28] can be derived over the network. A further enhancement in the load balanceing with respect to energy requirements at each step and its action alert system is left for future work. I further plan to conduct more intensive experiments to assess the effectiveness of our approach

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References

[1] Akyildiz, I.F., Su, W., Sankarasubramaniam, Y., Cayirci, E.: Wireless sensor networks: A survey. Comput. Netw. Vol. 38, 393-422. (2002).
[2] Akkaya, K., Younis, M.: A Survey of Routing Protocols in Wireless Sensor Networks. In Elsevier Ad Hoc Network, Vol. 3 (3), 325-349. (2005).

[3] Intanagonwiwat C., Govindan R., Estrin D.: Directed diffusion: A scalable and robust communication paradigm for sensor networks. In Proceedings of the 6thInternational Conference on Mobile Computing and Networking, 56-67. (2000).
[4] Jie Cui a , Lei Xua , Steven L. Bressler b , Mingzhou Ding c , Hualou Liang a,∗, BSMART: A Matlab/C toolbox for analysis of multichannel neural time series, 2008 Special Issue.
[5] Sagir Lawan and CL Wamdeo, IMAGE RECOGNITION USING MATLAB SIMULINK BLOCKSET, International Journal of Computer Science, Engineering and Applications (IJCSEA) Vol. 7, No. 2, April 17.
[6] Heinzelman W., Chandrakasan A., Balakrishnan H.: Energy-efficient communication protocol for wireless microsensor networks. In Proceeding of the Hawaii International Con-ference System Sciences, 8020-8026. (2000).
[7] Lindsey S., Raghavendra C. S.: PEGASIS: Power Efficient GAthering in Sensor Infor-mation Systems. In Proceedings of the IEEE Aerospace Conference. (2002) .
[8] Younis, O., Fahmy, S.: HEED: A Hybrid, Energy-Efficient, Distributed Clustering Approach for Ad hoc Sensor Networks. IEEE Trans. on Mobile Comput., 366- 379. (2004).
[9] Li, X., Xu, L., Wang, H., Song, J., Yang, S.X.: A Differential Evolution-Based Routing Algorithm for Environmental Monitoring Wireless Sensor Networks. Sensors, Vol. 10, 5425-5442. (2010).
[10] G. Gupta and M. Younis, "Load-balanced clustering of wireless sensor networks," in Communications, 2003. ICC'03. IEEE International Conference on, vol. 3, pp. 1848–1852, IEEE, 2003.
[11] N. Israr and I. Awan, "Multi-hop clustering algo. for load balancing in wsn," International Journal of SIMULATION, vol. 8, no. 1, 2006.
[12] E. Laszl ´ o, K. Tornai, G. Trepl ´ an, and J. Levendovszky, "Novel load ´ balancing scheduling algorithms for wireless sensor networks," in The Fourth Int. Conf. on Communication Theory, Reliability, and Quality of Service, Budapest, pp. 54–49, 2011.
[13] M. A. Abd, S. F. M. Al-Rubeaai, B. K. Singh, K. E. Tepe, and R. Benlamri, "Extending wireless sensor network lifetime with global energy balance," IEEE Sensors Journal, vol. 15, no. 9, pp. 5053–5063, 2015.
[14] Laxmaiah.Kocharla and 2Dr. Raghava Rao, K "An Efficient Energy Lifetime enhancement Using Node Balancing Approach",International Journal of Engineering & Technology, 7 (x) (2018) xxx-xxx.
[15] Laxmaiah.Kocharla and 2Dr. Raghava Rao, K "Secure Data Packet transmission over Wireless Sensor Network using security Architecture", Jour of Adv Research in Dynamical & Control Systems, Vol. 10, 02-Special Issue, 2018.
[16] Venkateshwar Rao M,and 2Dr. Srinivas Malladi, "Secure Energy Efficient Attack Resilient Routing Technique for Zone based Wireless Sensor Network", (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 11, No. 12, 2020.
[17] Rahul C. Shah and Jan M. Rabaey" Energy Aware Routing for Low Energy Ad Hoc Sensor Networks"F29601-99- 1- 0169 entitled, "Communication/Computation Pico nodes for Sensor Networks".
[18] YI Gao & Wei Dong "COPE: Improving Energy Efficiency with Coded Preambles in Low Power Sensor Networks" 2015, IEEE Transaction and Industrial Informatics.
[19] N. Kumar and Dr. C. Suresh Gnana Dhass "Power Aware Routing Protocols in Mobile Adhoc Networks, 2012 IJARCSSE. Lindsey S., Raghavendra C. S.: PEGASIS: Power Efficient GAthering in Sensor Infor-mation Systems. In Proceedings of the IEEE Aerospace Conference..
[20] F.Boudabdallah,N.Boudabdalah,R.Boutab a,On balancing Energy consumption in Wireless Sensor Networks,IEEE Transactions on Vehicular Technology,vol.58,Issue 6, 2009,2909-2924.
[21] Zhang Y., Kuhn L., Fromherz M. Improvements on Ant Routing for Sensor Networks. Ants 2004, Workshop on Ant Colony Optimization and Swarm Intelligence. 2004:154–165.

[22] S. Rani, J. Malhotra, R. Talwar, "EEICCP-Energy Efficient Protocol for Wireless Sensor Networks", Wireless Sensor Network, vol. 5, no. 7, pp. 127-136, 2013.
[23] Blanza, F., and L. Materum. "Joint Identification of the Clustering and Cardinality of Wireless Propagation Multipaths." International Journal of Emerging Trends in Engineering Research 7.12 (2019): 762-767.
[24] Arage Chetan, S., & Satyanarayana, K. V. V. “Novel routing protocol for secure data transmission in wireless ad hoc networks.” International Journal of Innovative Technology and Exploring Engineering, 8(4S2) (2019)., 101-108.
[25] Kandukuri, Somasekhar, et al. "Energy-efficient data aggregation techniques for exploiting spatio-temporal correlations in wireless sensor networks." 2016 Wireless Telecommunications Symposium (WTS). IEEE, 2016.
[26] Robinson, Y. Harold, and M. Rajaram. "Energy-aware multipath routing scheme based on particle swarm optimization in mobile ad hoc networks." The Scientific World Journal 2015 (2015).
[27] Ahvar, Ehsan, et al. "An energy-aware routing protocol for query-based applications in wireless sensor networks." The Scientific World Journal 2014 (2014).
[28] Nikolidakis, Stefanos A., et al. "Energy efficient routing in wireless sensor networks through balanced clustering." Algorithms 6.1 (2013): 29-42.

Certificateless Effective Key Management Protocol (CL-EKM) Authentication for Multicast IoT Sensor Network

P. Manjula[1], Dr. S. Bagavathipriya [2]
{manjula.arunraj@gmail.com[1], baghavathipriya.s@rajalakshmi.edu.in[2]}

Assistant Professor/IT, Veltech Multi-tech Engineering College[1], Professor/CSE, Rajalakshmi Engineering College[2]

Abstract. IoT has a huge issue of security and protection because of its dynamic and heterogeneous nature. In the IoT environment, authentication is one of the most testing security prerequisites. Because a client can straightforwardly access data from the devices, given the mutual validation among client and device occurs. The research includes a CL-EKM and verified key establishment scheme has been proposed for secure communication in the IoT environment. Proposed system utilizing a multicast verification procedure which improves the adaptability of CL-EKM by empowering a delivery message from BS to an enormous cluster head hub with an acceptable delay and cost. Also, the proposed framework is contrasted with the current unicast and broadcast strategies which would cause a serious negative effect on the performance when a network size increases or when quantity of data to be communicated for a time given is enormous. The proposed results examined for security and is additionally implemented utilizing a simulator.

Keywords: IoT, Certificateless effective key management protocol, Key establishment, Multicast transmission.

1 Introduction

IoT includes an arrangement of physical items that are associated to gather information over the web. The items were equipped with an adequate communication and processing capacities and has locatable IP address. Proposed system is in need to incorporate frameworks based on PCs and also presents with economic advantage and for improving efficiency and exactness while lessening human association.

Utilizations of IoT is assorted comprising of framework administration for high-hazard situations, disaster management following ecological monitoring by offering distant administrations of medical care. IoT, offers widening to access, also comes a colossal danger to security as well as protection because of its dynamic and heterogeneous nature. Utilizing powerful security practices, particularly validation and key administration plans to ensure obscurity and protection, is required. Since cryptographic methods are needed to ensure the security benefits, a viable administration of cryptographic keys is constantly needed in an organization. Hence for addressing the security concerns, the ECM methods were presented in the earlier research as well dependent on symmetric key encryption [1], [2], [3]. This type of encryption was suitable for the sensor nodes as a result of its restricted energy and processing

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ability. Be that as it may, it shows high communication overhead which also needs enormous memory space for storing shared pairwise keys. It was additionally not adaptable and not tough in contradiction of any compromises, and unfit to help node mobility. Asymmetric key based public key cryptography or "Identity-Based Public Key Cryptography" (ID-PKC) for simplifying the establishment of key and authentication have been proposed [4], [5], [6], [7], [27], [10], [15], [18], [25].

In any case, it was discovered that the security shortcomings of the preen ECC based plans [5], [10], [25] that such methodologies were quite helpless against forgery message, attacks and key compromise. Such ECC-based plans with authentications when straightforwardly applied experience the ill effects of certificate management overhead. Subsequently, we utilize certificateless successful key management (CL-EKM) technique. In CL-PKC [12], The private key of the customer is a combination of the KGC: "Key Generation Center" unfinished private key with the hidden value of the customer. The Public/Private Key Pair together removes the credential condition and thus resolves the key problem by removing liability for the private Key of the customer.

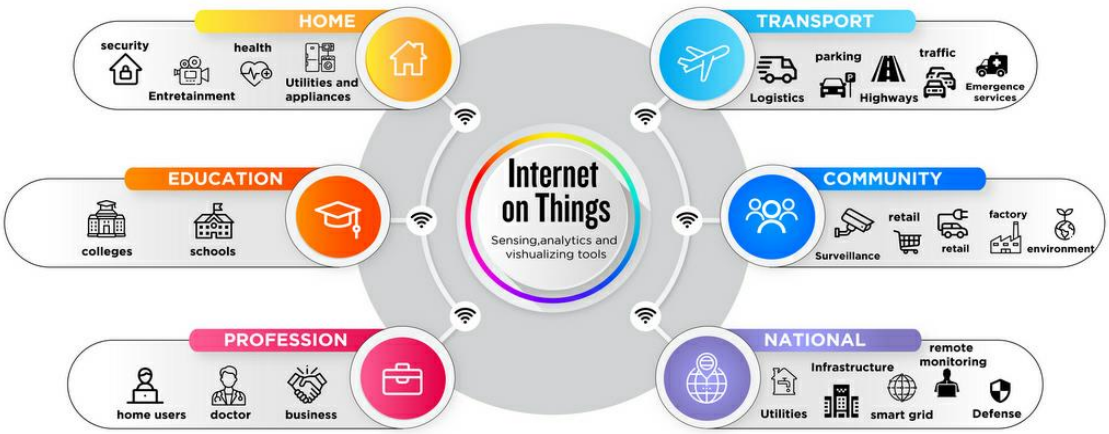
Regardless of indicating various advantages, this method shows some basic constraints as demonstrated in [R4] One of the limitations is to use the unicast mode to relay messages from the BS to all clustering heads. Since it has high cost of communication and computation and doesn't addresses a scalability prerequisite of the protected group of communication and when a system grows or in case the messages to be communicated on a time is huge, it will cause serious negative effect on its performance. Anyway, the authors in [R4] have demonstrated that broadcast transmission mode is viable and scalable to enable conveyance of messages from BS to an enormous group heads with an acceptable delay, with a satisfactory communication and computation energy, delay, data transfer capacity related with the interchanges between the BS and all its head.

This work addresses the security issues presenting multi-cast IoT application that is dissemination of information via the services of multi-cast networks, where its reliability is guaranteed for different clients. Since multicast [11] is one of the main administrations which is needed to be upheld in IoT [12, 13]. Wireless multicast [15] is one of the main services which gives profoundly productive methods for sending messages from single different source receivers [16].

In IoT [14] applications, the sending hub must have the option to affirm that this message is received by every individual from a multicast group, where at the same time guaranteeing security. In IoT applications, a significant issue is contrasted with conventional multi-cast frameworks is that it upholds the devices of end-users, yet additionally includes "Large-Scale Machine-Type Communications" (MTC) with low-power gadgets [12]. In this manner, the multi-cast needs of IoT limits the obliging of various types of gadgets and managing higher speed rates or ejected overhead.

Inclusive of all the points of interest, the multicast communication additionally has the accompanying downsides. It has higher data transfer capacity use in numerous applications and overhead of retransmission where it also grows up rapidly as a quantity of multicast objects increments [19]. In any case, the fundamental issue in the multicast system is ensuring reliable and secure transfer under different services. In this manner, the proposed framework guarantees security in the multicast transmission through the certificateless powerful key management protocol (CL-EKM) and the scheme of authenticated key network for secure communication and the experimentation is completed in an IoT network. Th rest of the research was organized under in the sectin2.

2 System Model



We think of four different scenarios in the IoT model, i.e. home, transport, communities and national ones, as seen in Fig. 1. Smart machines, for example, cameras and actuators are available for all of these scenarios. These gadgets help people to live on a daily basis. In these circumstances, any intelligent computer is linked to the internet through the Gate-way Network (GWNs). Different types of customers can access information about major IoT devices through the GWN. Customer and system authentication through GWN allow the customer to receive details [2].

Communication among the elements is carried out on a public channel. The adversary would then be able to have the occasion to snoop, adjust or erase the sent messages. It was additionally accepted that an adversary could hold at least one detecting device in IoT, and can remove all the sensitive data utilizing the power analysis attacks [4], [5].

Multicast Communication

Since accessibility and worldwide availability are the critical prerequisites of every application of IoT, this expands the accessible possibility of any risk. A heterogeneous idea of IoT raises intricacy in deploying the security methods. A wireless idea of included substances and its restricted limit were additionally a constraint. Conceivable transient and arbitrary failures are weaknesses that attackers could misuse.

ECC based Multicasting

To accomplish energy efficient secured multicasting, we propose to utilize an ECC based Multicast model. This methodology includes following issues:

- Node Deployment
- Node Scheduling based Secured Multicast model

Sensor nodes are arbitrarily deployed over the coverage area. They are self-configurable and work with a restricted energy source. For instance, to screen the war zone, a gathering of sensors can be tossed from a low-flying plane. These nodes will design themselves to frame a communication network.

In this methodology, nodes are framed into clusters of inconsistent length. A Cluster Head (CH) will lead each group. The Clusters close by the base station will have less competition range contrasted and faraway ones. CHs close to the base station need to deal with information

originating from its cluster members just as from different groups on the way to the base station. With unequal grouping, as the cluster length is less, the CH close to the base station will deal with less intra group traffic evading quick drain out of energy. Thus, the problem area issue is disposed of.

In a clustered environment, every sensor hub will detect information ceaselessly and advance it to the CH. CH will enhance information by accumulating detected information and sending it to the base station through intermediate CH nodes. To save energy, the NSSM plot works in duty cycle mode where every hub works in two modes: dynamic and static modes. Initially, the quantity of nodes adequate to cover the cluster zone are chosen and kept in dynamic mode. The excess nodes will be in static mode.

The Duty-cycle based methodologies can be synchronous or asynchronous. In Synchronous mode, nodes will be in dynamic or static mode dependent on the exchange made inside a frame. Synchronous protocols were clarified in [16-18]. In asynchronous mode, preface testing procedures are utilized to intermittently awaken nodes for a short term as clarified in [19-20].

In Proposed approach, a Tree-based multicast model is utilized. To guarantee secure communication, the Group key is created utilizing light-weight Elliptic Curve Cryptography (ECC) based calculation. ECC is most appropriate for resource constrained conditions. It is expressed that, for 128-bit message security, ECC needs a 256-bit key contrasted and 3072 bits key in RSA. A Binary tree is developed for each group, established from the cluster head. A Tree Vector (TV) is built putting away the level-wise way from root to leaf nodes. During this methodology, a secured cluster key's produced in an exceptionally conducive manner and distributed among all the individuals.

3 Key Management in Multicast Communication

For better communication, the information ought to be encoded using an assistance of a private key which is then validated. The distribution method and the key administration used in the network of safe application should give better adaptability, integrity, authenticity, as well as higher confidentiality. A single key that was shared in WSN communication is not secure as an adversary could be as it is able to undoubtedly distinguish among different key. Thus, sensors utilize diverse key administration strategies for securing a communication. In recently created key management schemes, Researchers proposed different plans such as the bilinear matching in “Dynamic Key Management” (DKM), key administration based on jobs, “Identity Based Key Management” (IBKM), “Random Seed Distribution with Transitory Master Key” (RSDTMK), irregular key circulation [11-16].

In the present research, CL-EKM: “Certificateless Key Management” plot which underpins the foundation of 4-kinds of keys. The plan likewise uses fundamental calculations of CL-HSC method [13] in determining certificateless private/public as well as the pairwise keys.

Working of Certificateless Key Management Scheme

Certificateless Public/Private Key:

1. KGC at the BS was used to generate certificateless unique public-private pair of keys which are stored in a node, before the deployment of node. Authenticated pairwise key is mutually generated.

2. Every node has its own unique key with the Base station. For instance, an L-sensor makes use of an individual key for encrypting an alert message for sending it to the BS, in case it is unable to link with the H-sensor. An H-sensor makes use of their individual key for encrypting this message which correspond to any changes in a cluster.
3. A BS could make use of a key for encrypting any type of sensitive data, like the information in a node or in the command.

Pairwise key:

Each node offers a distinctive pair-wise keys with every neighboring node to secure the communication and verification of the basestation. In case, in arrange to connect one cluster, with L-sensor ought to provide a pair-wise key with an H-sensor. At that point, it could safely disperse the cluster-key to an L-sensor with the help of a pairwise key. When using a strong Wireless Sensor network, an L-sensor could utilize a pair-wise key for safely transferring detected information to the H-sensor. Every node could powerfully set up pair-wise key with another hub and itself utilizing some particular private/public certificateless key sets.

Cluster key:

Every node connected in a cluster makes use of a key known as the cluster key. A cluster key is basically utilized to secure the cluster broadcast messages, example, the delicate commands or altering the status of the member in a cluster. As it were a cluster head could upgrade the key in case the L-sensor clears out or is joined with a cluster.

Aim of this approach is reduction in energy and delay in communications. Consider chunks holding the messages multicast from one base station to the sensor heads. This method does not follow any of the asymmetric key encryption algorithms to ensure security in the chunk as these key operation methods consume more energy. Hence, authentication in the chunk is achieved by using the individual keys of the base station and sensor heads for the encryption operation. Post this authentication, the messages could be multi-casted. The below explained algorithm depicts the process of achieving the certificateless key management during the multicast in detail.

Algorithm

Step 1: Creation of Sub-Chunks

To create a chunk, partition the n multicast messages into N sub-chunks s_1, s_2, s_3……...s_N. Every subchunk s_i with $1 \leq i \leq N$ holds m multicast messages represented as mN.

Step 2: Creation of Chunks

2.1: Concatenation

Concatenate the multi-casted messages in every sub chunk.

$s_{i(con)} = mN_{(i-1)\,(n+1)}||\ldots\ldots\ldots||mN_{i.n}$ for $1 \leq i \leq N$ (1)

2.2: Padding

Pad the concatenated messages with the authenticator. Authenticator denotes the digest which is calculated by the collision resistant hashing function such as SHA or MD5. Thus pad the concatenated message with the digest as shown in equation (2).

$P(s_{i(con)}) = s_{i(con)}||\ digest$ for $1 \leq i \leq N$ (2)

2.3: Hashing

Hash the padded message in step 2.2 using any hash function.

$digest_{i+1} = H(P(s_{i(con)}))$ for $1 \leq i \leq N-1$ (3)

Therefore, every concatenated chunk s_N should be padded with the random string $digest_{N+1}$.

2.4: Message Chunk

Decryption of every digest in the subchunk is achieved using an individual key. Subchunk s_i and the $digest_{i+1}$ form the chunk S_i.

$S_i = [s_i, digest_{i+1}]$ when $1 \leq i \leq N$

Step 3: Chunk Multicasting

Multicasting the chunk is important because every chunk waits for the authenticator (digest) from its previous chunks. Therefore, this process should follow the sequential multicast mechanism.

Step 4: Authentication of Chunks

According to step 3, the first chunk S_0reaches the receiver initially. Thus, the receiver authenticates the digest in the chunk S_0 using its individual authentication key A_{k0} for decryption of the chunk S_0. Similarly, authentication of other chunks can be performed using the hash functions such as SHA and MD5. Since, the digest of S_0 reaches initially in advance, it can also be used to authenticate S_i. Therefore, to conclude that S_i is authentic, the hashed value of the multi-casted messages and the authenticator $mN_{(i-1)\,(n+1)}||\ldots\ldots\ldots||mN_{i.n}||digest_{i+1}$ should be equivalent to the digest value $digest_{i+1}$.

4. Multicast Authentication of the nodes

Another feature of security is the Authentication which comes with a guarantee that the transmitted messages are from an authenticated source. Four kinds of authentication methods exist which can be used in the process: (a) Implicit authentication; (b) Three-way authentication; (c) Mutual or Two-way authentication; and the (d) One-way authentication.

The following authentication steps are carried out between the source and the destination.

Source Authentication

Consider a message *M* being multi-casted by a user *A* with an identity *I*.

Step 1:

The user generates a signature *S* on the message *M.*

***1.1*:** User selects a private key *R* and chooses a timestamp *T*.

1.2 - Following the sign algorithm of MR-IBS, the user generates a signature and transmits the message to the destined device. When $||M||T|| \leq$ key, the user *A* issues a signature *S* on the message $M_s = (S\,, I\,, T)$ which is further transmitted to the destination.

If $||M||T|| \geq$ key, then the user divides the message *M* into $M_1||M_2$ and generates the signature by performing the sign algorithm of PMR-IBS. In this situation, the user transmits $M_s = (S, I, M, T)$ to the destination.

Destination Authentication

On the receipt of the message, the device at the destination generates a signature S_D using the sign MR-IBS (or) PNR-IBS algorithm and transmits the message $M_D = (S_D\,, I_D\,, T_D)$ or $M_D = (M_D^1, S_D\,, I_D\,, T_D)$.

NOTE: The device receiving the messages, authenticates the signature following the MR-IBS (or) PMR-IBS algorithm. Upon verification, the algorithm either transmits (or) drops the message.

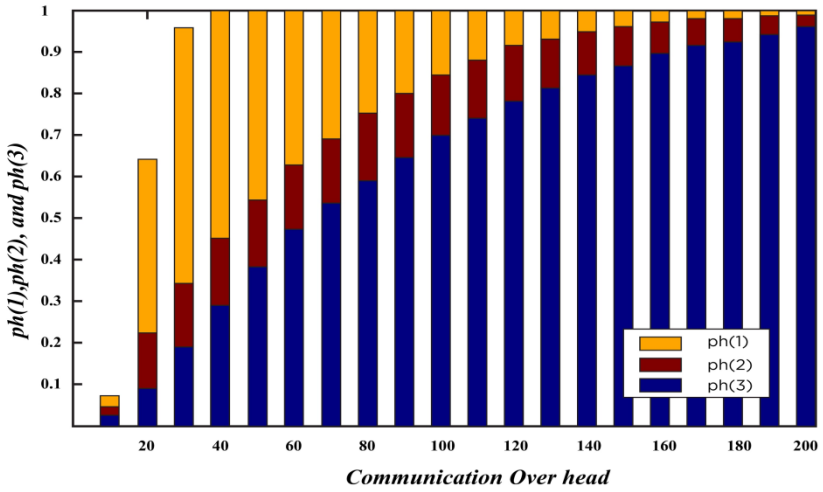
5. Performance Analysis and Results

The primary aim of the present research the performance analysis of the novel scheme proposed here. The following section includes both the simulation results and the analytical functioning. The following metrics are used to evaluate the performance.

Communication Overhead

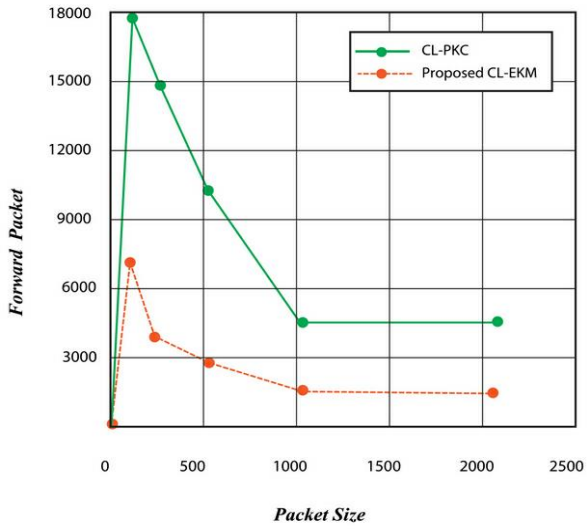
As the transmission is the major source of the battery consumption, communication required by a key management scheme must be small. In addition, transmitting the secret information over the air increases the security threats. Hence, a key management scheme should not incur high overhead during the communication. A possibility that two same neighbor nodes might share a single key is lesser than 1, when two nodes are not associated straightforwardly it ought to discover a course within the key-sharing chart to associate to one another.

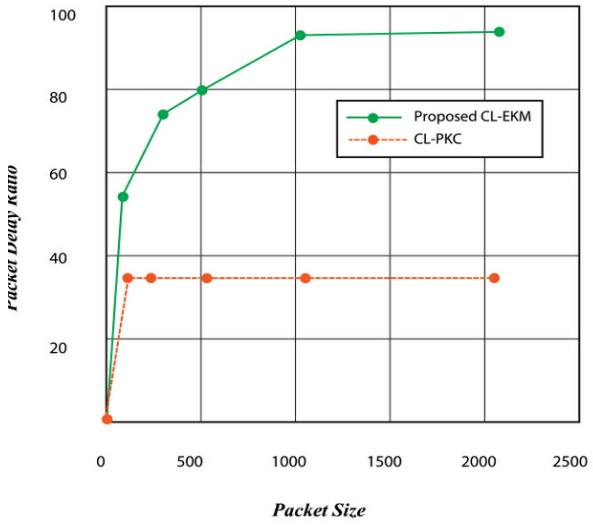
The numbers of jumps are estimates as per the requirement of this course. Clearly, if two neighbors are associated specifically, number of required bounces is 1. In case more number of jumps is required to put through a pair of nodes neighboring to each other, the overhead in the communication of setting a security affiliation among the two hub is high. The probability of lesser hops required is denoted with ph(1) which is used to connect the two nodes, and is equal to 1. Here ph(1) is equal to plocal, the local connectivity.



Connectivity

Secure connectivity shows the ratio of securely connected links to all links in the network. For a key management scheme, higher secure connectivity can be achieved by either having a large number of node pairs that share a secret key or offering an efficient and secure path key establishment method.

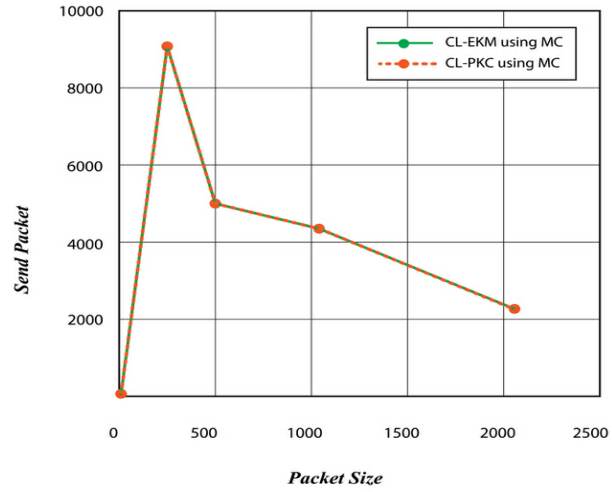


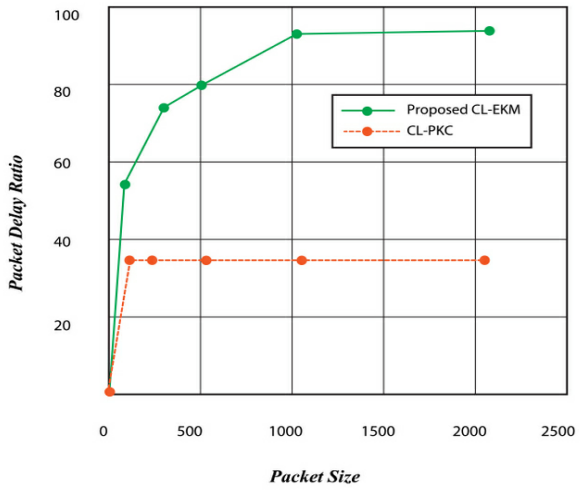


We utilize worldwide network to allude the proportion nodes within large separated elements within the final chart for measuring the total arrange. On the off chance that the proportion breaks even with 99%, it implies that maxim sensory nodes were associated, where rest of the nodes were inaccessible from biggest disconnected elements. Hence, the worldwide network metric demonstrates a rate of nodes which is squandered due its unreachability. Both local and global connectivity is affected with this scheme of pre key-distribution.

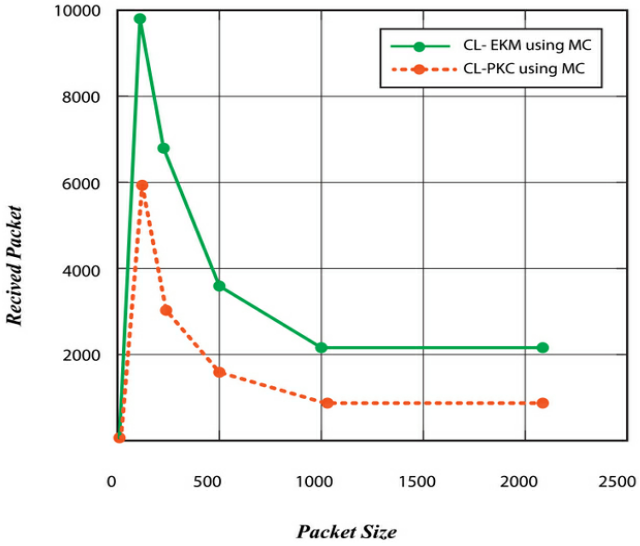
Memory overhead

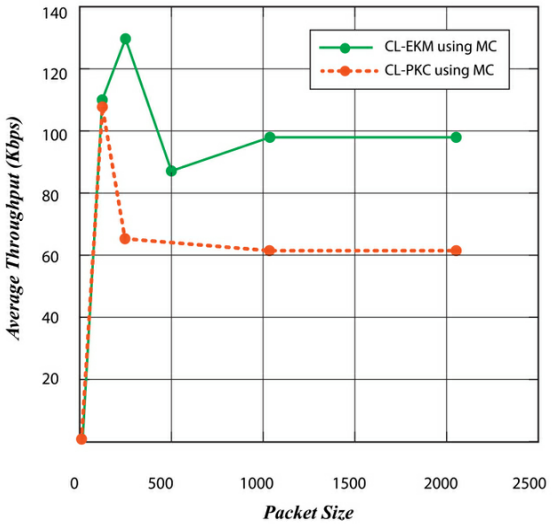
Since memory of sensor nodes is mainly occupied by operating systems and application programs, the remaining part should be used carefully. Hence, a key management scheme should be as efficient. As possible in terms of the numbers of keys that have to be stored in a sensor node.

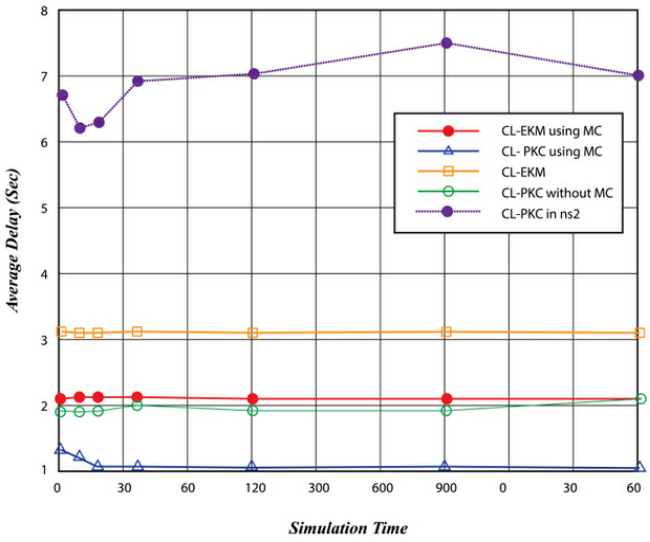

10000
8000
6000
4000
2000
Send Packet
CL-EKM using MC
CL-PKC using MC
0
500
1000
1500
2000
2500
Packet Size


100
80
60
40
20
Packet Delay Ratio
Proposed CL-EKM
CL-PKC
0
500
1000
1500
2000
2500
Packet Size

Energy and Delay Assessment







6. Conclusion

Our Proposed scheme significantly reduces the energy overhead due to the Base-station communication reaching to all the nodes of cluster head, which significantly helps making a protocol more efficient for delay, scalability as well as offers high flexibility. The proposed method provides effectiveness in terms of computation and communication when compared to other techniques used. More features of functionality, communication costs, efficient computation and high security are the few advantages of proposed technique that are suitable in IoT applications into a practical environment in comparison with other techniques.

References

[1] Anil Kumar Sutrala1, Saru Kumari2, Vanga Odelu3, Mohammad Wazid and Xiong Li4 “An efficient multi-gateway-based three-factor user authentication and key agreement scheme in hierarchical wireless sensor networks”Security Comm. Networks (2016) Published online in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/sec.1464

[2] Dieynaba Mall1 , Karim Konaté1 , and Al-Sakib Khan ECL-EKM: “An Enhanced Certificateless Effective Key Management Protocol for Dynamic WSN” NSysS 2017Department of CSE, BUET. 5-8 January, 2017

[3] Wu chunying , Li shundong , Zhang yiying , “Key Management scheme based on secret sharing for Wireless Sensor Network” 2013 Fourth International Conference on Emerging Intelligent Data and Web Technologies

[4] Amit Kumar Gautam, Rakesh Kumar. "A Comparative Study of Recently Proposed Key 8 3% 9 2% 10 1% 11 1% 12 < 10 words Management Schemes in Wireless Sensor Network" , 2018 International Conference on Computing, Power and Communication Technologies (GUCON), 2018.

[5] Suman Bala ,Gaurav Sharma and Anil K.Varma“A Survey and taxonomy of symmetric key management schemes for wireless sensor networks” Proceedings of the CUBE International Information Technology Conference ,September 2012.
[6] Sravani Challa, Mohammad Wazid, Ashok Kumar Das, Neeraj Kumar, Alavalapati Goutham Reddy, Eun-Jun Yoon, Kee-Young Yoo. "Secure Signature-Based Authenticated Key Establishment Scheme for Future IoT Applications" , IEEE Access, 2017.
[7] Ms. NimishaChunilalChaudhari , “Key Management in Wireless Sensor NetworkA Survey”, International Journal of Application or Innovation in Engineering & Management Volume 2, Issue 2, February 2013.
[8] S. Wander, N. Gura, H. Eberle, V. Gupta and S. C. Shantz, "Energy analysis of public-key cryptography for wireless sensor networks," Third IEEE International Conference on Pervasive Computing and Communications, Kauai Island, HI, 2005, pp. 324-328, doi: 10.1109/PERCOM.2005.18.
[9] Shraddha Deshmukh, Prof. A. R. Bhagat Patil, and Harshad Nakade, "Implementation of Effective Key Management Strategy with Secure Data Aggregation in Dynamic Wireless Sensor Network," International Journal of Scientific Research in Computer Science, Engineering and Information Technology, vol.4, no. 2, pp. 358-364, 2018.
[10] Laxmi, B. Prathusha, and A. Chilambuchelvan. "GSR: Geographic Secured Routing using SHA-3 algorithm for node and message authentication in wireless sensor networks." in Future Generation Computer Systems, vol.76, pp 98-105, 2017
[11] Athmani, Samir, Azeddine Bilami, and Djallel Eddine Boubiche, "EDAK: An Efficient Dynamic Authentication and Key Management Mechanism for heterogeneous WSNs," in Future Generation Computer Systems, November 2017.
[12] Ayaz Hassan Moon, Ummer Iqbal, G. Mohiuddin Bhat” Authenticated key exchange protocol for Wireless Sensor Networks” International Journal of Applied Engineering Research ISSN 0973-4562 Volume 11, Number 6 (2016) pp 4280-4287.
[13] Saraswathi, R. Vijaya, L. Padma Sree, and K. Anuradha, "Dynamic and probabilistic key management for distributed wireless sensor networks," proceedings of IEEE International Conference on Computational Intelligence and Computing Research, pp. 1-6, 2016
[14] J. S. Pan, S. C. Chu, T. K. Dao, and V. C. Do. “Improved Performance of Wireless Sensor Network Based on FuzzyLogic for Clustering Scheme.” In International Conference on Smart Vehicular Technology, Transportation, Communication and Applications, Springer, pp. 104-113, Cham, 2019.
[15] J. Wang, J. Niu, K. Wang, and W. Liu. “An energy efficient fuzzy cluster head selection algorithm for WSNs.” In 2018International Workshop on Advanced Image Technology (IWAIT), IEEE, pp. 1-4, 2018.
[16] H. AA Al-Kashoash, Z. SA Rahman, and E. Alhamdawee. “Energy and RSSI based fuzzy inference system for clusterhead selection in wireless sensor networks.” In Proceedings of the International Conference on Information andCommunication Technology, pp. 102-105. ACM, 2019.
[17] Challa, Sravani, Ashok Kumar Das, Vanga Odelu, Neeraj Kumar, Saru Kumari, Muhammad Khurram Khan, and Athanasios V. Vasilakos, "An efficient ECC-based provably secure three-factor user authentication and key agreement protocol for wireless healthcare sensor networks," Computers & Electrical Engineering, 2017.
[18] Zhongyuan Qin, Xinshuai Zhang, Kerong Feng, Qunfang Zhang, Jie Huang “An Efficient Key Management Scheme Based on ECC and AVL Tree for Large Scale Wireless Sensor Networks” International Journal of Distributed Sensor Networks, vol. 11, 9, First Published September 17, 2015.
[19] H. El Alami and A. Najid, "CFFL: Cluster formation using fuzzy logic for wireless sensor networks," 2015 IEEE/ACS 12th International Conference of Computer Systems and Applications (AICCSA), Marrakech, 2015, pp. 1-6, doi: 10.1109/AICCSA.2015.7507248.

[20] N. Saqib and U. Iqbal, "Security in wireless sensor networks using ECC," 2016 IEEE International Conference on Advances in Computer Applications (ICACA), Coimbatore, 2016, pp. 270-274, doi: 10.1109/ICACA.2016.7887964.
[21] W. Wei-hong, L. Yu-bing and C. Tie-ming, "The study and application of elliptic curve cryptography library on wireless sensor network," 2008 11th IEEE International Conference on Communication Technology, Hangzhou, 2008, pp. 785-788, doi: 10.1109/ICCT.2008.4716252.
[22] Qing Chang, Y. Zhang and Lin-lin Qin, "A node authentication protocol based on ECC in WSN," 2010 International Conference On Computer Design and Applications, Qinhuangdao, 2010, pp. V2-606-V2-609, doi: 10.1109/ICCDA.2010.5541288.
[23] M.Selvi, C.Nandhini, K.Thangaramya, K.Kulothungan, A.Kannan, “HBO Based Clustering and Energy Optimized Routing Algorithm for WSN,”in 2016 IEEE Eighth International Conference on Advanced Computing (ICoAC), 2017, pp.89-92.
[24] K. Johny Elma, Dr. S. Meenakshi, “Energy Efficient Clustering for Lifetime Maximization and Routing in WSN”, International Journal of Applied Engineering Research, 2018.

Study of 5G Technology Support in Smart Vehicle System

D. Karunkuzhali[1], P. Saravanan[2], R. Ohmsakthi Vel[3], B. Muthuvel[4], K. Latha[5]
{karunkuzhali@gmail.com[1], saravanan.ece@sairamit.edu.in[2], ohmohms@gmail.com[3], muthuvel.bmv7@yahoo.co.in[4], klathasn@gmail.com[5]}

[1]Professor, Department of Information Technology, Panimalar Engineering College, Chennai, India, [2]Associate Professor, Department of Electronics and Communication Engineering, Sri Sairam Institute of Technology, Chennai, India, [3]Assistant Professor, Department of Mechatronics Engineering, Agni College of Technology, Chennai, India, [4]Professor, Department of Electrical and Electronics Engineering, Bonam Venkata Chalamayya Institute of Technology and Science, Amalapuram, India, [5]Assistant Professor, Department of Computer Science and Engineering, Sri Sairam Engineering College, Chennai, India

Abstract. The projected exploration study uncovers the significant jobs of 5G advances for the keen vehicle framework. 5G innovations will empower transport vehicles to associate with the organize and speak with one another, guaranteeing super high unwavering quality and low idleness. Empowering this sort of network will profit by a troublesome new application that will permit to improve driving proficiency and accelerate street security. The primary fundamental aftereffects of the information demonstrate the transformation of 5G innovations to the savvy vehicle framework in various nations. Additionally, a business viewpoint is given, where the change of the car area because of 5G is talked about. 5G will give the essential framework to establish a savvy web of vehicle climate, which will push the activity and limit necessities of the vehicle organization to their limits. The momentum inexact exploration study incorporates different calculations for V2X and the Nivebase multinomial calculation is about 82.72%. The estimating research paper additionally recorded 5G innovative executions in various nations.

Keywords: Algorithm, 5G Technol, G, V2X, Simulation, Chipsets.

1 Introduction

Self-governing and trend setting innovation in vehicles is as of now changing the auto business. The effect of future vehicle advances has been seriously anticipated and development is sprouting in research-related spaces. Expanding street wellbeing, smoothed out movement time, altered offices, energy the board and stopping lessen social advantages. A significant benefit of auto tommation of Om tomobiles is the improvement in security, which normally comes when we eliminate the foundation of most traffic occurrences: human conduct out and about. Meeting wellbeing necessities and settling on choices for multi-f optim streamlined driving is upheld by sensors that are inside the vehicle or that live in the climate (counting different vehicles). Moreover, data is traded with the vehicle's computerized twin, as it might contain extra data identified with traffic street C, street work, climate and different conditions.

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Correspondence between the vehicle and any remaining outside bodies is upheld by remote correspondence advances, one of the main of which is 5G, which ensures administration at the last stage.

2 Related work

Propaganda channel is a major performance factor that affects any communication system. The fast speed of the vehicles, the dynamic surroundings always get messed upFixed and mobile scatter, and low antenna ights height V2X poses challenges for communications that are unique compared to other communication systems. Moreover, the various 2 of the application have the notion that the 5G V2X system is intendedSupport - From basic safety applications [1 - 1-3] to high precision radio positioning, to advanced cooperative automated driving applications (e.g., platooning, cooperative intersection control, etc.) - results in significantly different requirements.

3 In terms of channel modeling.

Most of the leading examples of GBD models Dello are based on ray tracing / ray launching, while GP G.P. The model adopted by [-6--6], which is based on the development of the WINNER framework, is the most widely used GBD model. However, so far, []] in 3 G.P.P. Some of the models do not implementConsidering the effect of dual mobility on key V2X features, such as fast fading parameters (required for V2V), they consider V2X-specific synergies (highway, street-level urban, road unit-to-vehicle, V2V). Don't take, and don't. Considered V2X-Spacey-C antenna.

4 Research Methods

This section presents the content and methods of this inferential research work. Dataset for 5G technology implementation G implementation is taken from Statistia.com. In this study, various algorithms and networks have been used for the analysis of 5G technology in smart vehicle systems.

The Weka 3.8.9 has implemented to get the optimal solution of the above dataset. The below approaches have implemented and got optimal solution.

- BayesNet:Bayes
- NaiveBayes:
- NaiveBayesMultinomial:
- NaiveBayesMultinomialText:
- NaiveBayesMultinomialUpdateable:

Integrated Moving Networks

The purpose of mobile base stations is to effectively provide low latency services to vehicle users, data rates and modern, well-insulated vehicles with low loss of carrier frequency (in 25 dB). Millimeter-waves (G 100 GHz)

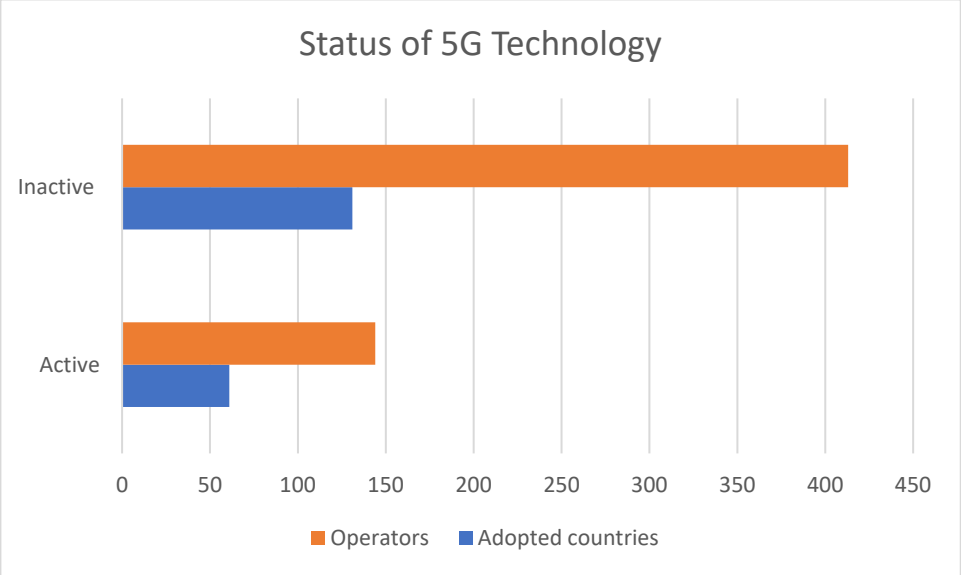
Table 1. Basic details of 5G technology in smart vehicle system

Locality	Rural	Urban	Highway
Link Type (V2X)	V2P V2V V2I	V2P V2V V2I	V2P V2V V2I

5 Results And Discussion

The analysis results indicate the active and inactive 5g technology implementation in various countries. Technology adopted countries is about 61 and 131 countries, active and inactive respectively

Figure 1. Status of 5G Technology



Advanced V2X channel models have been developed that cover a wide range of scenarios and fields based on data analysis and analysis. [Species -] Two recent studies of this species are available. Given the number of cases, locations and classification of models w.r.t. Modeling methods (Figures 1 and 2), can be thousandsCombination, which makes it difficult to make the right choice of model parameters. The use of channel models with wireless system design materials to create sensitivities orSimulating end-to-end system performance when chipsets rating, collecting performance statistics, and evaluating protocol applications.

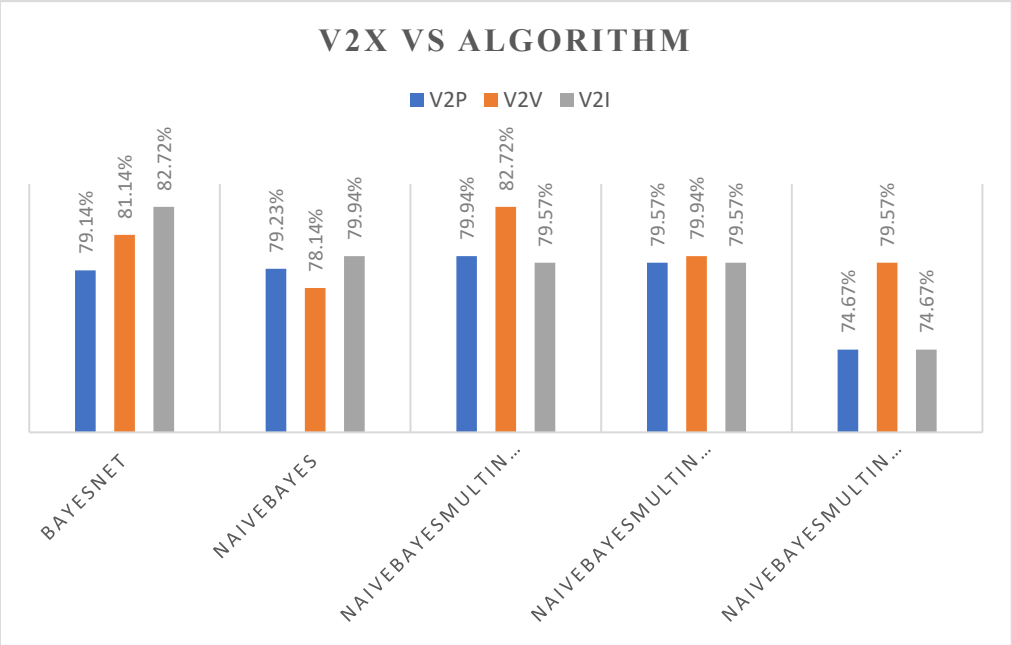
A detailed, informative recipeTo enable programmers to select the appropriate V2X channel model is not explicitly available in textbooks. I gave you such a recipe, this section summarizes

The main components for selecting the right channel models dales, which are the beginning of a more detailed section, distance analysis and additional measurements and modeling that you will5GCAR is built within the project.

Table 2. Algorithm used in smart vehicle system

Algorithm	**V2P**	**V2V**	**V2I**
BayesNet	79.14%	81.14%	82.72%
NaiveBayes	79.23%	78.14%	79.94%
NaiveBayesMultinomial	79.94%	82.72%	79.57%
NaiveBayesMultinomialText	79.57%	79.94%	79.57%
NaiveBayesMultinomialUpdateable	74.67%	79.57%	74.67%

Figure 2. Algorithm used in smart vehicle system



The table 2 above clearly shows the correct call rates for various methods namely BayesNet, NaiveBayes, NaiveBayes Multinomial, NaiveBayesMultinomialText, NaiveBayes Multinomial Updateable and NaiveBayesUpdateabl. All of these algorithms belong to the Bayes program. The diagram above represents that BayesNet produces V2P - 79.14%, V2V- 81.14%, V2I - 82.74%, NaiveBayes owns V2P - 79.24%, V2V- 78.14%, V2I - 79.94%, NaiveBayesMultinomial 7 -14 , V2V - 81.14%, V2I - 82.74%, NaivBayesMultinomialText gives V2P value - 79.94%, V2V- 82.72%, V2I - 79.57%, NaiveBayesMultinomialUpdateable gives V2P - 79.59%, V2P - 79.57% . All leading Bayes categories have produced an accuracy rate of more than 74% and the highest accuracy rate is 82.72% generated by the NaivebayesMultinomial algorithm.

A key feature of 5G in smart automotive system, user data rate, Latency, Coverage, Capacity, cost of data types and sensor devices used, of which GNSS is the Global Navigation

Satellite System, and IMU is Inertial Measurement Unit. The shows themselves were successful with 5G-based communication working effectively on a live network. Self-driving vehicles interact with its Digital Twin and successfully perform scheduled SCiL tests, e.g., fastening the brakes in front of visible and real pedestrians, tracking, and avoiding real and real vehicles [8-10].

The expansion of this exhibition took place on the M86 highway, where cars run at different speeds and perform different functions — and every stop related to RSU details was recorded. To support future SciL experiments, this sensor data can also be played to insert the Digital Twin into the visual space of the M86 [11 - 12].

To test the current power of 5G in real-life situations, we have developed a series of 5G NSA 3.X architecture options, targeting the Round-Trip-Time distribution and the Inter-Arrival Time package. This helped to identify the latency capacity of the current 5G NSA network. We found that a variety of V2X scenarios — from planning to integration data integration and much more - are already out of support based on standard requirements. Advantages of 5G connectivity, in the new concept of Automotive Internet during low latency, extremely high bandwidth and reliability [13 - 15].

6 Conclusion

Smart technology has important points in achieving a 5G compatible car. The main theme is the attributes of the basic V2X channels. In addition, we have introduced the building squares for the V2X cell layout. Flexible organizational engineering has been introduced all together to help the ongoing management of V2X. We have further investigated the potential for use of vehicles as portable power stations as part of that flexible engineering. The fog detection was introduced in relation to the corresponding vehicle, and finally, a biological system that included a compatible vehicle was investigated. Using 5G technology can reduce delays that will improve access to smart car technology. We assess and highlight the problems and shortcomings of current mobile technologies in relation to these operating conditions and identify how 5G will overcome those shortcomings. We also identified open research problems and provided future indicators to deal with those problems.

References

[1] Feddes, G.; Kuipers, J. Software Driving License; Intertraffic: Amsterdam, The Netherlands, 2018.

[2] ZalaZONE. Where Innovation Leads. Available online: https://zalazone.hu/en/ (accessed on 18 December 2020).

[3] Szalay, Z.; Hamar, Z.; Nyerges, A. Novel design concept for an automotive proving ground supporting multilevel CAV development. Int. J. Veh. Des. 2019, 80, 1–22.

[4] Horváth, M.; Lu, Q.; Tettamanti, T.; Török, A.; Szalay, Z. Vehicle-In-The-Loop (VIL) and Scenario-In-The-Loop (SCIL) Automotive Simulation Concepts from the Perspectives of Traffic Simulation and Traffic Control. Transp. Telecommun. J. 2020, 20, 153–161.

[5] Tihanyi, V.; Szalay, Z. Autonomous vehicle platform for demonstration purposes. In Proceedings of the Advanced Manufacturing and Repairing Technologies in Vehicle Industry, Visegrad, Hungary, 17–19 May 2017; pp. 144–148.

[6] Kozma, D.; Soos, G.; Ficzere, D.; Varga, P. Communication Challenges and Solutions between Heterogeneous Industrial IoT Systems. In Proceedings of the 2019 15th International

Conference on Network and Service Management (CNSM), Halifax, NS, Canada, 21–25 October 2019.
[7] Németh, H.; Háry, A.; Szalay, Z.; Tihanyi, V.; Tóth, B. Proving Ground Test Scenarios in Mixed Virtual and Real Environment for Highly Automated Driving. In Mobilität in Zeiten der Veränderung: Technische und BetriebswirtschaftlicheAspekte; Proff, H., Ed.; Springer: Wiesbaden, Germany, 2019; pp. 199–210.
[8] Heineke, K.; Ménard, A.; Södergren, F.; Wrulich, M. Development in the Mobility Technology Ecosystem—How Can 5G Help? McKinsey and Company. 2019. Available online: https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/development-inthe-\mobility-technology-ecosystem-how-can-5g-help (accessed on 18 December 2020).
[9] Ge, X. Ultra-Reliable Low-Latency Communications in Autonomous Vehicular Networks. IEEE Trans. Veh. Technol. 2019, 68, 5005–5016.
[10] Varga, P.; Peto, J.; Frankó, A.; Balla, D.; Haja, D.; Janky, F.; Soos, G.; Ficzere, D.; Maliosz, M.; Toka, L. 5G support for Industrial IoT Applications—Challenges, Solutions, and Predicted research gaps. Sensors 2020, 20, 828.
[11] Soós, G.; Ficzere, D.; Varga, P.; Szalay, Z. Practical 5G KPI Measurement Results on a Non-Standalone Architecture. In Proceedings of the NOMS 2020—2020 IEEE/IFIP Network Operations and Management Symposium, Budapest, Hungary, 20–24 April 2020; pp. 1–5.
[12] 3GPP. Service Requirements for the 5G System; TS 22.261 v17.0.1; 3rd Generation Partnership Project: Valbonne, France, 2019.
[13] 3GPP. Service Requirements for Cyber-Physical Control Applications in Vertical Domains; TS 22.104 v17.2.0; 3rd Generation Partnership Project: Valbonne, France, 2019.
[14] 3GPP. Service Requirements for Enhanced V2X Scenarios; TS 22.186 v16.2.0; 3rd Generation Partnership Project: Valbonne, France, 2019.
[15] 3GPP. Mobile Communication System for Railways; TS 22.289 v16.1.0; 3rd Generation Partnership Project: Valbonne, France, 2019.

Advanced Computer Network for Healthcare Sector – Liver Function Diagnosis

Kedri Janardhana[1], P. Rajasekar[2], A. Shali[3], M. Vijayaragavan[4], D. Stalin David[5]
{janardhankedri@dei.ac.in[1], rajasekp@srmist.edu.in[2], shali.cse@sairam.edu.in[3],
mrvijay.ragavan@gmail.com[4], sdstalindavid707@gmail.com[5]}

[1]Assistant Professor (Senior Grade), Department of Electrical Engineering, Faculty of Engineering, Dayalbagh Educational Institute (Deemed to be University), Agra, India,[2]Assistant Professor, Department of Information Technology, S.R.M Institute of Science and Technology,[3]Assistant Professor, Department of Computer Science and Engineering, Sri Sairam Engineering College, Chennai, India,[4]Assistant Professor, Department of Electrical and Electronics Engineering, Mailam Engineering College, Mailam, India,[5]Assistant Professor, Department of Computer Science and Engineering, IFET College of Engineering, Villupuram, India

Abstract. Innovation technology has been implemented in different field, especially in life science, for example, genome sequencing, hereditary printing, proteomic and metabolomic examination, electronic clinical records, and patient-revealed wellbeing information have delivered a wide scope of information, from an assortment of people, cell types, and problems (huge information). Notwithstanding, this information should be incorporated and dissected in the event that it is to deliver models or ideas about physiological working or pathogenesis components. The majority of this information is freely accessible, which permits specialists anyplace to look for side effects of explicit biologic cycles or helpful targets for explicit infections or sorts of patients. We are evaluating ongoing advances in the field of computational and foundational science, and featuring the prospects of analysts utilizing enormous informational collections in the fields of gastroenterology and hepatology, to supplement conventional techniques for demonstrative and restorative access. We present and look at two AI calculations, which naturally create choice trees from research facility information. TheBayesNet classifier gives that the highest accuracy level which is 82.68%, and the highest precision value is 79.94% which is produced by NaivebayesMultinomial algorithm. This system recommends that the BayesNet classifier and NaivebayesMultinomial approaches. It produce the optimal result compare with other classifiers.

Keywords: Classifier, Big data, Precision, Accuracy, algorithm, Recall.

1 Introduction

These days world appears to base upon PCs in each part of regular day to day existence. Medical services is one of the areas where computerization by executing IT arrangements is important to work with crafted by its associations. The enormous number of records containing the wellbeing data of many patients requests an efficient construction and probability of electronic information trade to improve the data the executives and in this manner the foundation the board. It is crucial for structure a framework to orchestrate and incorporating guidelines that will meet clinical and business needs for dividing data between associations and frameworks. This would mean carrying out enormous scope incorporated IT

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arrangements in medical services. The board of an essential medical services establishment now and again can be alluded to as the administration of little/medium endeavor (SME). This is an exceptionally significant issue because of the reality, that SMEs are right now driving the entire european economy. The point of this paper is to momentarily introduce the possibility of an organization for an essential medical services foundation, including numerous useful highlights making the work in this sort of an establishment simpler and more viable, empowering better data the executives.

In this portion uncovers the presence of this investigation of examination work. Logical pathways rely upon ace standards ("expecting… by then… else"), which can be imagined as the choice trees [1-5]. Utilizing input data from a conveyed report on hepatitis C patients, we show that the two calculations are definitely not hard to apply and make possible choice trees [6-8]. These calculations attest normal data about the power of examination office testing to distinguish liver fibrosis and cirrhosis. In clinical practice, characteristic pathways address "savvy test profiles", which are followed just to where an illustrative decision can be made Machine learning estimations may be used to either favor the choice trees set up by human trained professionals or to suggest anticipated new trees, if rules are not available[9-16].

In this paper, we present and survey "party unit", a quantifiable programming apparatus [17-22], which normally makes decision trees from veritable exploration office data. But such PC driven approaches have been pursued for some time[23-26], applications for lab diagnostics have been sparse so far[27].In this paper presents region 2 of this paper explains the detail on the associated works. In portion 3 presents the materials and strategies embraced and territory 4 presents the nuances of the examinations and discussions. Finally section 5 wraps up the paper by sharing our derivations and likely game plans.

2 Materials And Methods

In this section presents the materials and methods of this research work. The dataset collected from UCI repository. The data set contains laboratory values of blood donors and Hepatitis C patients and demographic values like age. The below information have given about the list of the attributes.

S.No	**Attribute**
1	X (Patient ID/No.)
2	Category (0=Blood Donor, 0s=suspect Blood Donor, 1=Hepatitis, 2=Fibrosis, 3=Cirrhosis)
3	Age
4	Sex (female/male)
5	Alanine transaminase (ALT)
6	Aspartate aminotransferase (AST)
7	Alkaline phosphatase (ALP)
8	Albumin
9	Bilirubin

10	alpha-fetoprotein
11	agglutinin-reactive AFP
12	PIVKA-II
13	ɣ–glutamyltranspedtidase

The Weka 3.8.9 has implemented to get the optimal solution of the above dataset. The below approaches have implemented and got optimal solution.

- BayesNet:Bayes
- NaiveBayes:
- NaiveBayesMultinomial:
- NaiveBayesMultinomialText:
- NaiveBayesMultinomialUpdateable:
- NaiveBayesUpdateable:

3 Results And Discussions

In this section focuses the results and discussions of this research work. The below table clearly demonstrates that the Accuracy levels of all approaches namely BayesNet, NaiveBayes, NaiveBayesMultinomial, NaiveBayesMultinomialText, NaiveBayesMultinomialUpdateableandNaiveBayesUpdateabl. All of these algorithms belong to Bayes classifier.

Table 1: List of Bayes Classifiers with their metrics

S.No	Algorithm	Accuracy
1	BayesNet	75.86%
2	NaiveBayes	72.51%
3	NaiveBayesMultinomial	65.19%
4	NaiveBayesMultinomialText	81.43%
5	NaiveBayesMultinomialUpdateable	78.69%

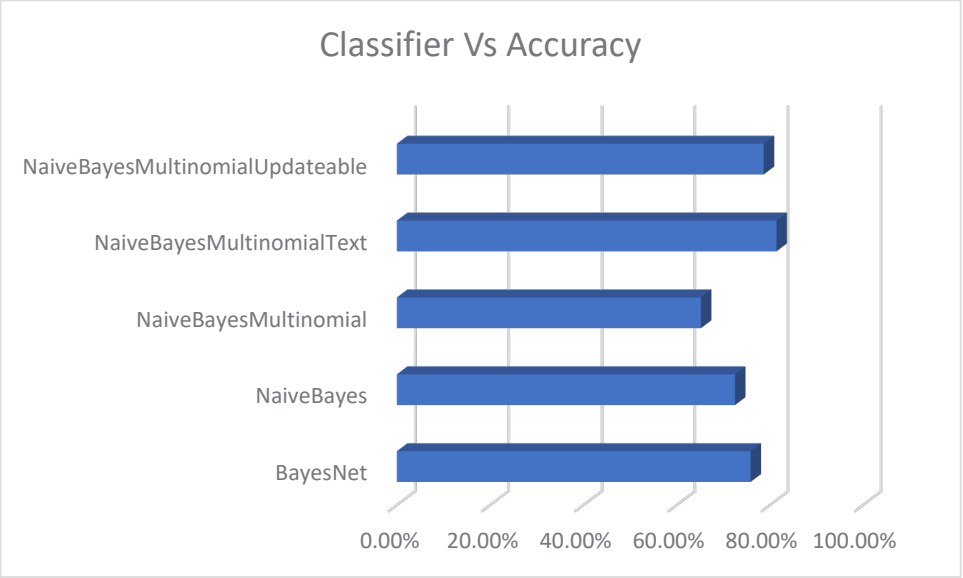

Figure 1: Classifier VsAlgorithm Accuracy

This above diagram clearly represents that the BayesNet produces 75.86 % of accuracy level , NaiveBayes holds 72.51% accuracy level, NaiveBayesMultinomial is holding 65.19% accuracy level, NaivBayesMultinomialText gives the accuracy level is 81.43% , NaiveBayesMultinomialUpdateable gives that 78.69% accuracy level. All the leading Bayes classifiers have produce the accuracy level is 65% and the highest accuracy level is 81.43%.

NaiveBayesMultinomial, NaivBayesMultinomialText, NaiveBayesMultinomialUpdateable and NaiveBayes have hold above 72% to 77% of accuracy level. The BayesNet classifier gives that the highest accuracy level which is 81.43%.

Table 2: List of Bayes Classifiers with Precision Value

S.No	Algorithm	Precision
1	BayesNet	79.14%
2	NaiveBayes	79.23%
3	NaiveBayesMultinomial	79.94%
4	NaiveBayesMultinomialText	79.57%
5	NaiveBayesMultinomialUpdateable	74.67%

The above table clearly demonstrates that the precision call values of various approaches namely BayesNet, NaiveBayes, NaiveBayesMultinomial, NaiveBayesMultinomialText, NaiveBayesMultinomialUpdateableandNaiveBayesUpdateabl. All of these algorithms belong to Bayes classifier.

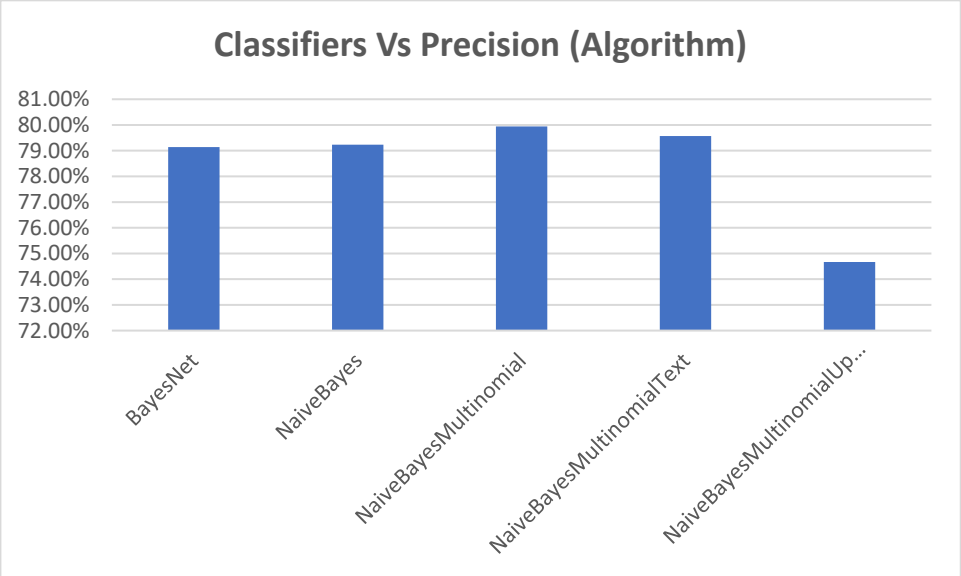

Figure 2: Classifiers Vs Precision (Algorithm)

The above diagram represents that the BayesNet produces 79.14 % of precision value, NaiveBayes holds 79.23% precision value, NaiveBayesMultinomial is holding 79.94% precision value, NaivBayesMultinomialText gives the precision value is 79.57% , NaiveBayesMultinomialUpdateable gives that 74.67% precision value and NaiveBayes has 74.54% of precision value. All the leading Bayes classifiers have produce the precision value is above 74% and the highest precision value is 79.94% which is produced by NaivebayesMultinomial algorithm.BayesNet, NaiveBayesMultinomial, NaivBayesMultinomialText, NaiveBayesMultinomialUpdateable and NaiveBayes have hold the precision value from 74% to 80%.

The below table clearly represents that the recall call values of various approaches namely BayesNet, NaiveBayes, NaiveBayesMultinomial, NaiveBayesMultinomialText,NaiveBayesMultinomialUpdateableand NaiveBayesUpdateabl. All are belonging to Bayes classifier.

Table 3: Various Approaches Vs Recall Values

S.No	Algorithm	Recall
1	BayesNet	83.18%
2	NaiveBayes	70.56%
3	NaiveBayesMultinomial	71.57%
4	NaiveBayesMultinomialText	73.76%
5	NaiveBayesMultinomialUpdateable	75.45%

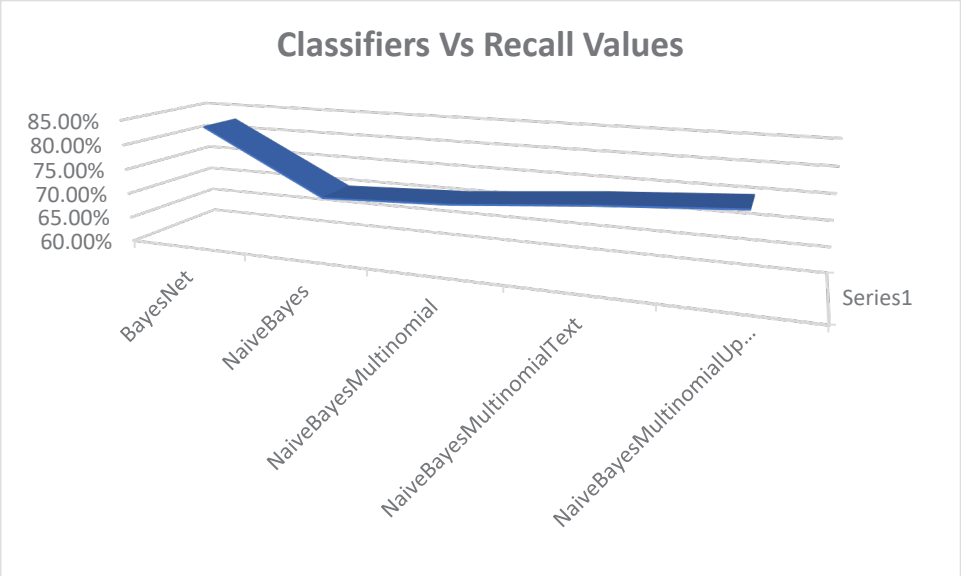

Figure 3: Classifiers Vs Recall Values

The above graph addresses that review esteems have been delivered by utilizing different calculation the BayesNet produces 83.18 % of Recall esteem, NaiveBayes holds 70.56%% of review esteem, NaiveBayesMultinomial is holding 71.57% of review esteem, NaivBayesMultinomialText gives the review esteem is 73.76% , NaiveBayesMultinomialUpdateable gives that 75.45% review esteem and NaiveBayesUpdateable has 75.98% of review esteem. All the main Bayes classifiers have produce the review esteem is above 70% and the most elevated review esteem is 83.18% which is delivered by BayesNet calculation. BayesNet, NaiveBayesMultinomial, NaivBayesMultinomialText, NaiveBayesMultinomialUpdateable and NaiveBayes have hold the review esteem from 70% to 84%.

The above chart addresses that all methodologies have set aside the effort to construct the model like BayesNet sets aside the effort to assemble the model around 0.18 seconds, NaiveBayes requires 0.2 seconds to fabricate the model, NaiveBayesMultinomial sets aside the effort to fabricate the model around 0.48 seconds, NaiveBayesMultinomialText requires 0.24 seconds to fabricate the model, NaiveBayesMultinomialUpdateable methodology requires 0.22 seconds to fabricate the model and NaiveBayesUpdateable requires 0.9 seconds to fabricate the model.

The BayesNet is taking low time utilization to fabricate the model. It requires just 0.18 seconds. It is low time utilization contrast and different methodologies for building the models. NaiveBayes and NaiveBayesMultinomialUpdateable have same time utilization to assemble the model. It require 0.20 seconds to construct the model. NaiveBayesMultinomialText is requiring 0.24 seconds to construct the model, NaiveBayesMultinomial requires 0.48 seconds to fabricate the model lastly, NaivebayesUpdateable requires 0.9 seconds to assemble the new model. This work unmistakably shows that the NaiveBayesUpdateable sets aside more effort to fabricate the model i.e.,0.9 seconds and BayesNet takes less time utilization to assemble the model. The NaiveBayes ,NaiveBayesMultinomialUpdateabl and NiaveBayesMultinomialText are taking

0.2 to 0.24 seconds. The remainder of the methodologies are requiring more than 0.48 seconds.

Conclusion

At long last this work finishes up, The BayesNet classifier gives that the most elevated exactness level which is 82.68%, NaiveBayesMultinomial, NaivBayesMultinomialText, NaiveBayesMultinomialUpdateable and NaiveBayes have hold above 72% to 77% of precision level. . All the main Bayes classifiers have produce the exactness esteem is above 74% and the most noteworthy accuracy esteem is 79.94% which is created by NaivebayesMultinomial calculation. This framework suggests that the BayesNet classifier and NaivebayesMultinomial approaches. It produce the ideal outcome contrast and other classifiers.the most noteworthy review esteem is 83.18% which is created by BayesNet calculation and rest of the BayesNet, NaiveBayesMultinomial, NaivBayesMultinomialText, NaiveBayesMultinomialUpdateable and NaiveBayes have hold the review esteem from 70% to 84%. The BayesNet is taking low time utilization to construct the model. It requires just 0.18 seconds. It is exceptionally low time utilization contrast and different methodologies for building the models.

Albeit numerous standard parts of medical services don't need advance organizations, there are exceptional issues in a scope of medical services claims to fame that require their utilization. Progressed network applications can straightforwardly and in a roundabout way influence wellbeing results. They improve ways the medical services local area can share assets and cooperate with patients, understudies, and each other by giving approaches to appropriate data, team up, and work in a more versatile climate. They additionally present difficulties to engineers, end clients, and organization chairmen in light of the fact that they regularly change how organizations are overseen and medical services is given. Progressed networks are not static, nor are the requirements of medical care.

References

[1] Dua, D. and Graff, C. (2019). UCI Machine Learning Repository [http://archive.ics.uci.edu/ml]. Irvine, CA: University of California, School of Information and Computer Science.

[2] Hoffmann G, Aufenanger J, Foedinger M, et al. Benefits and limitations of laboratory diagnostic pathways. Diagnosis 2014;1:269-76.

[3] Hofmann W, Aufenanger J, Hoffmann G, et al. editors.Laboratory diagnostic pathways. Berlin: De Gruyter, 2016.

[4] Thomas L, Thomas C. Detection of iron restrictioninanaemic and non-anaemic patients: New diagnostic approaches. Eur J Haematol 2017;99:262-8.

[5] Hothorn T, Zeileis A. partykit: A modular toolkit for recursive partytioning in R. J Machine Learning Res 2015;16:3905-9.

[6] Murthy S. Automatic construction of decision trees from data: a multi-disciplinary survey. Data Mining and Knowledge Discovery 1998;2:345-89.

[7] Qu Y, Adam BL, Yasui Y, et al. Boosted decision tree analysis of SELDI mass spectral serum profiles discriminates prostate cancer from noncancer patients. ClinChem 2002;48:1835-43.

[8] Dórea FC, Muckle CA, Kelton D, et al. Exploratory analysis of methods for automated classification of laboratory test orders into syndromic groups in veterinary medicine. PLoS One 2013;8:e57334.

[9] Metthin E, Veen J, Dekhuijzen R, et al. Development of a diagnostic decision tree for obstructive pulmonary diseases base on real-life data. ERJ Open Res 2016;2.
[10] Lichtinghagen R, Pietsch D, Bantel H, et al. The Enhanced Liver Fibrosis (ELF) score: Normal values, influence factors and proposed cut-off values. J Hepatol 2013;59:236-42.
[11] Khan NA, Quan H, Bugar JM, Lemaire JB, Brant R, Ghali WA. Association of postoperative complications with hospital costs and length of stay in a tertiary care center. J Gen Intern Med. 2006;21(2):177–80. Epub 2006/04/12. JGI319 [pii] pmid:16606377
[12] Hobson C, Ozrazgat-Baslanti T, Kuxhausen A, Thottakkara P, Efron PA, Moore FA, et al. Cost and Mortality Associated With Postoperative Acute Kidney Injury. Ann Surg. 2014. Epub 2014/06/03.
[13] Korenkevych D, Ozrazgat-Baslanti T, Thottakkara P, Hobson CE, Pardalos P, Momcilovic P, et al. The Pattern of Longitudinal Change in Serum Creatinine and 90-Day Mortality After Major Surgery. Ann Surg. 2015.
[14] Bihorac A, Brennan M, Ozrazgat-Baslanti T, Bozorgmehri S, Efron PA, Moore FA, et al. National surgical quality improvement program underestimates the risk associated with mild and moderate postoperative acute kidney injury. Crit Care Med. 2013;41(11):2570–83. pmid:23928835
[15] Bihorac A, Yavas S, Subbiah S, Hobson CE, Schold JD, Gabrielli A, et al. Long-term risk of mortality and acute kidney injury during hospitalization after major surgery. Ann Surg. 2009;249(5):851–8. pmid:19387314
[16] Huber M, Ozrazgat-Baslanti T, Thottakkara P, Efron PA, Feezor R, Hobson C, et al. Mortality and Cost of Acute and Chronic Kidney Disease after Vascular Surgery. Annals of vascular surgery. 2015.
[17] Ozrazgat-Baslanti T, Thottakkara P, Huber M, Berg K, Gravenstein N, Tighe P, et al. Acute and chronic kidney disease and cardiovascular morltaity after major surgeyr Annals of Surgery. 2015.
[18] Zarjou A, Agarwal A. Sepsis and acute kidney injury. J Am SocNephrol. 2011;22(6):999–1006. Epub 2011/05/14. ASN.2010050484 [pii]. pmid:21566052
[19] Copeland GP, Jones D, Walters M. POSSUM: a scoring system for surgical audit. Br J Surg. 1991;78(3):355–60. Epub 1991/03/01. pmid:2021856
[20] Lake AP, Williams EG. ASA classification and perioperative variables: graded anaesthesia score? Br J Anaesth. 1997;78(2):228–9. Epub 1997/02/01.
[21] Hobson CE, Singhania G, Bihorac A. Acute kidney injury in the surgical patient. Crit Care Clin. 2015.
[22] Huen SC, Parikh CR. Predicting acute kidney injury after cardiac surgery: a systematic review. Ann Thorac Surg. 2012;93(1):337–47. S0003-4975(11)02155-2 [pii] pmid:22186469
[23] Miyagawa T, Nishida N, Ohashi J, Kimura R, Fujimoto A, Kawashima M, et al. Appropriate data cleaning methods for genome-wide association study. J Hum Genet. 2008;53(10):886–93. Epub 2008/08/13. pmid:18695938
[24] Osborne JW. Is data cleaning and the testing of assumptions relevant in the 21st century? Front Psychol. 2013;4:370. Epub 2013/06/28. pmid:23805118
[25] Van den Broeck J, Cunningham SA, Eeckels R, Herbst K. Data cleaning: detecting, diagnosing, and editing data abnormalities. PLoS Med. 2005;2(10):e267. Epub 2005/09/06. 04-PLME-PF-0256 [pii] pmid:16138788
[26] Paul Thottakkara, TezcanOzrazgat-Baslanti, Bradley B. Hupf, ParisaRashidi, PanosPardalos, PetarMomcilovic, AzraBihorac, Application of Machine Learning Techniques to High-Dimensional Clinical Data to Forecast Postoperative Complications, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0155705
[27] https://pubmed.ncbi.nlm.nih.gov/29323142/

Behaviour-based Relay Strategy on Mobile Ad-hoc Network for Effective Power Consumption

Hemalatha S[1], Shobana M[2], Sindhu G[3], Anand M[4], Anbarasan M[5]
{ pithemalatha@gmail.com[1], shobanam@srmist.edu.in[2], Sindhudhara@gmail.com[3], anandmenscall@gmail.com[4], anbarasan.cse@gmail.com[5]}

Professor, Department of Computer Science and Engineering, Panimalar Institute of Technology, Chennai.[1], Assistant Professor, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Kattankulathur[2], Assistant Professor, Department of Computer Science and Engineering, Saveetha School of Engineering, Saveetha Institute of Medical And Technical Sciences, Chennai[3], Assistant Professor, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Kattankulathur[4], Associate Professor, Department of Computer Science and Engineering, Sri Sairam Institute of Technology, Chennai[5]

Abstract. Flooding is the most basic form of broadcast, in which an approaching signal is retransmitted once by each organization's base. The transmission storm problem is caused by the basic flood system in remote Ad-hoc networks.. Even so, in terms of asset usage, such as transmission capacity and electricity, this approach is inefficient. Another cross-breed scheme is presented in this paper, which incorporates different methods to minimize overhead and track energy consumption. We present a Behaviour-based Relay Strategy that makes use of adjacent radios' 1-bounce results. The use of a purpose of ensuring or position estimation to pinpoint the location of hubs is not needed in this plan. The forthcoming convention, unlike earlier researches, splits the company into separate categories based on their communication-energy ratios. As a result, a Gateway hub is one that receives HELLO messages from different gatherings. This hub is actively interested in adding RREQ parcels, avoiding the need for redundant data transfer. When compared to AODV, the proposed convention's exhibition evaluation indicates a reduction in steering overhead and energy use..

Keywords: AODV, Mobile Ad-hoc Network, Quality of Service, forwarding scheme.

1 Introduction

Versatile impromptu organization is fundamentally a gathering of portable hubs that impart utilizing multi-bounces in a non-framework based arrangement. Because of their enormous potential across both combat and general uses, mobile ad hoc networks have been receiving serious consideration in recent years [1][2][3]. In sending the control packets, the transitional hubs between origin and goal play an important role. This flooding component is basic to the course disclosure measure. Notwithstanding, flooding can be excess and energy burning-through. In this way, various attempts were undertaken to restrict the transmissions in controlling parcels in order to reduce the amount of capturing that was unnecessary.

Flooding is the very often utilized strategy for hubs to trade network data or convey Routing Request messages to an objective. Also, the most straightforward approach to flood an organization is through a strategy called Simple Flooding. When a hub receives the parcel,

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this can unintentionally start broadcasting it to its other one-jump neighbors, resulting in a large number of bundles being rebroadcast. As a result, several bundle crashes occur, particularly if the organization is large. As a result, the primary motivation behind various flooding methods in MANETs is to avoid the significant Transmitted Drainable even more than possible to retain high organization inclusion and low conveyance inertness.

The random Transmit Power values of the adjoining hubs are taken into account in this paper's power proficient behavior-based relay strategy. In view of the hub location, the proposed conspire gradually adjusts the RREQ probability of sending at each hub. However, in a sparsely populated area, this cornerstone is ignored in comparison to a heavily populated district in order to preserve organization availability. Following the receipt of a packet, the decision to advance RREQ bundles is taken in a flash. In this study, hilter kilter radio reaches were taken into account. The new strategy reduces unnecessary excess retransmission while also increasing the reachability of information parcels while also lowering the proportion of dropped bundles and package misfortune. As a result, the overall steering overhead is reduced, and energy utilization is improved. The standard AODV is compared to our work in order to evaluate our strategy.

2 Related Work

Because it’s sort of distributed plot used throughout the organization's presentation is so significant, it must be carefully selected. There are several telecom conventions used in MANETs to achieve effective flooding and prevent excessive repeated retransmission.

All communication transmission across a remote medium in remote organizations is done through natural communication, which is not the same as the Web. Because of the nature of transmission, many opportunities based on catching can be used to increase the information transmission capacity in remote organizations. Ex-OR is the primary practical information sending plan that aims to improve information transmitting capacity by using transmission nature in remote lattice organizations, and pioneering information sending becomes a well-known term used by Ex-OR to describe this type of modern information sending plan. ExOR's central idea has sparked many decisions. However, almost all of these deductions are used for remote cross-section organizations or involve the positioning administration to support crafty data sending in Mobile Ad-hoc Networks. In [4], the developers devised a series of solutions for executing sharp information sending in larger MANETs, dubbed Supportive Opportunistic Routing Scheme in Mobile Ad-hoc Networks through Restricted Scope Retransmission, which allows them to use transmission natures other than ExOR and, in addition, aids them in improving the proficiency and power of shrewd information sending in MANETs.

Instead of program and portfolio directly to the passage/door, the IoT system would be significantly more energy efficient if hubs forward bundles through closest neighbors in multi-bounce ways in the future. To spur the middle of the road hubs to transfer parcels, to compensate for the energy loss in hubs due to package transferring, Avirup Das et al suggested a fresh motivator system [5] for sharing broad band psychological range. The yield demonstrated that the developed plot requires electricity fundamentally and also maintains energy expenditure independent of such hand-off workload with such a negligible increase on testing workload when comparing direct organizations to its speculation for irregular organizations.

In request to improve security, creators proposed the assessment of trustworthiness of hubs is critical. This work attempts to limit overhead through limiting repetitive information conveyance, expectation of connection disappointment and energy-mindful hub determination via looking On-Demand Multicast Routing Protocol plan and the conceivable fluffy improvement. In work [6], aggressor discovery is tried utilizing multi-specialist arrangement to refresh hub's trustworthiness for dynamic.

In article [7] writers guaranteed quality mindful directing and information sending in MANET correspondence, by giving ILR-GTCDW method. Two handling measures are performed by the ILR-GTCDW. Initially, steering was accomplished via entwined device guiding. To reduce steering workload and consider an accurate area of objective in ILR, assumption expansion and probabilistic strategy are used. Furthermore, hereditary geography control information sending is performed through agreeable correspondence. The ideal steering way is picked by utilizing the hereditary calculation based Topology control Data sending procedure that gives both solid information sending and negligible energy utilization.

All together for multicast information parcels to be communicated productively, the multicast information sending is needed at every switch. Inside a wired organization, an organization interface of a hub has a coordinated association with one of the approaching interfaces of different hubs. If a package arriving at an approaching gateway needs to be sent, this is sent to the contrasting make recommendations. Nonetheless, in a portable impromptu organization, by and large every hub has just one organization interface, so the approaching interface is equivalent to the active one and the remote organization interface of a hub has a one-to-numerous association with those of adjoining hubs. This distinction may cause issues, for example, directing circles and parcel duplication. In this paper [8], Youngmin Kim et al proposed a multicast information sending plan which can be utilized in the multi-bounce remote specially appointed organization without causing either directing circles or parcel duplication. A list is specified in this plan to prevent parcel redundancy, which can occur when another leaf multihop steering convention would be used.

3 Behaviour-Based Relay Strategy

The forward hub decision is critical to the proposed calculation's preparation. As a result, we classify the organization's diverse hubs as entry point or Non-entry point in terms of the adjacent Transmission-Power level in this study (PtLevel). Entry point, which have numerous PtLevel upsides in their adjacent table, are obligated to advance RREQ packages. Non- entry point, on the other hand, are hubs that have the same PtLevel advantages in their adjacent table. Every transmission by Non-entry point must be excluded to controlled delivery excessive repetitive data transfer and to reduce steering parcel payload. As a result, the hub location determines whether the hub is an Entry point or a Non-entry point. Portals are hubs that are situated between different gatherings (and receive bundles from various PtLevel upsides); otherwise, they are known as Non-entry point.

The procedure of calculating their various PtLevel advantages is used [3], which involves progressively changing the Communication Cost on every hub that brings the majority of neighbors inside a predetermined force level. The hub's Transmit Power value varies in the actual sheet. The basic idea is that only certain hubs are required to advance the package, which extends to groups of hubs with varying PtLevel. Intuitively, a center with a similar

PtLevel to its neighbors is almost certainly located within the same gathering. As a result, all of your neighbors can receive a transmission package.

However, in order to maintain organization availability, Both for hub that is located in a high-inadequate or opens up the potential area, that foundation for entryway assurance is overlooked (every one of its neighbors has the same PtLevel and there is no hub designated as passage). The PtLevel is then used in the proposed technique to achieve more proficient and heavy flooding.

At the point when the hubs information is utilized to decide whether it ought to take part in RREQ sending, two objectives are accomplished. Above all else, energy that is the fundamental asset of hubs will be saved, in light of the fact that solitary explicit hubs can take an interest in re-sending RREQ parcels. Furthermore, the effect of expanding control overheads and clog in remote organization, which could prompt debasing of the organizations execution, are stayed away from. This section will go over the proposed Relay Strategy in detail.

a. Control Packets

We need to exchange parcels to determine whether the organization's hub is a Portal or otherwise, and instead of inserting new controlling bundles, we alter the existing control bundles in the AODV convention [9] for convey their PtLevel and Status.

HELLO parcel: To exchange data about their transmission-power level and status, all hubs as in suggested convention use the HELLO package of AODV. For collect this information, the HELLO parcel has two new fields: communication-energy scale (PtLevel) or Rank. Each hub creates a neighbor table also with help of the HELLO package, which stores the PtLevel or Rank advantages of each 1-bounce neighbor.

b. Route Discovery

All hubs, including the initial hub, moderate hubs, and objective hub, are subject to the course disclosure measure.

The proposed conspiracy's disclosure period is as shown in:

Initial Hub: The source cycle is like except AODV, in that it occurs if an origin requires a path towards the target. If a origin hub needs to transfer packages to an objective hub but there is no available route, the origin hub can send an RREQ parcel that find another way to the objective.

Transitional Hub: In any halfway hub inside the origin communication region gets the RREQ parcel interestingly, a hub carrying out the proposed system that appeared in Fig. 1.

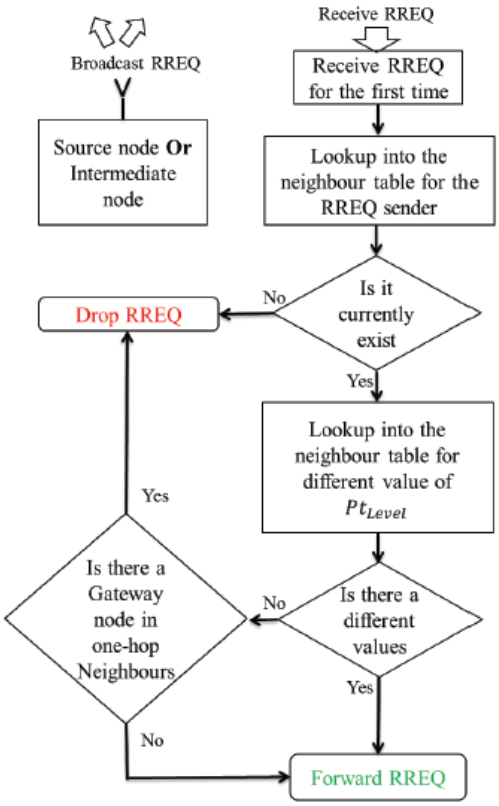

Fig.1 Relay Strategy for RREQ

Objective Node: When the RREQ package arrives at the expected objective or a transitional hub with a new path towards the objective, these single routes a response by transmitting a Route Reply (RREP) parcel all along opposing way developed at moderate hubs in during course disclosure measure. Nonetheless, we noticed an excessive number of information parcels dropped by the directing layer while carrying out the proposed calculation on the Fig.2.

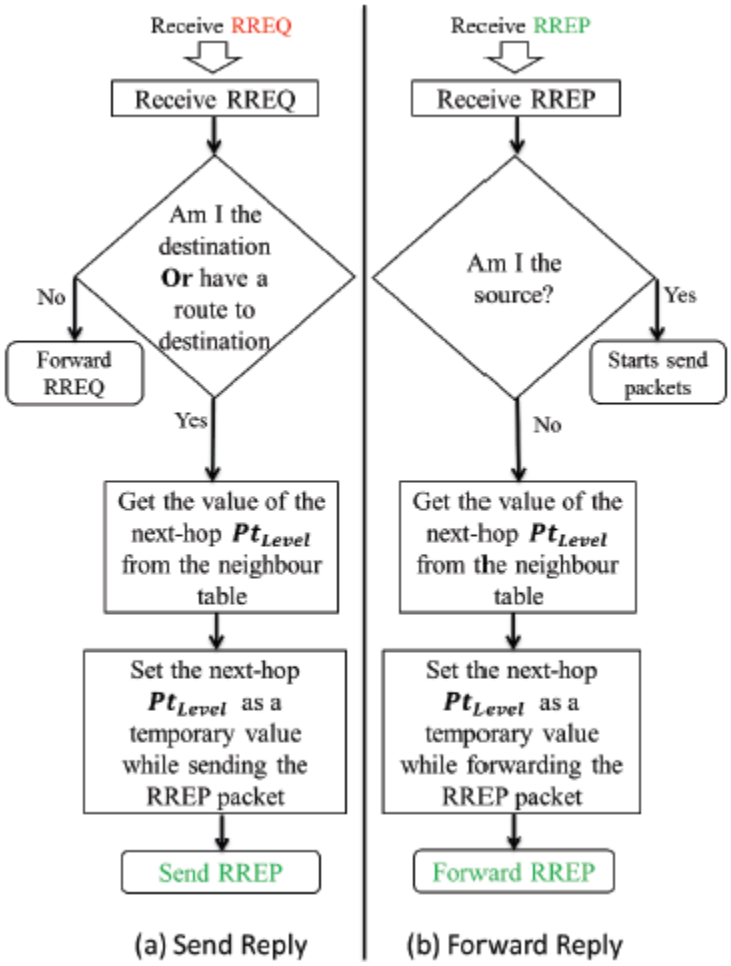

Fig.2 Relay Strategy for RREP

3 Evaluation Metrics And Simulation Parameters

The NS2.35 framework is used for reenactment as well as execution evaluation. The specific reenactment boundaries can be found in Table I. The portability of the hub was achieved by using an arbitrary waypoint models for different speeds and indeed the portability seemed to have no significant effect on execution. The reproduction used the UDP (User Datagram Protocol) including Constant Bit Rate association model (CBR). The assessment is based on the reenactment with various numbers of hubs (20, 40, 60, 80 and 100) that structure an organization across a given bandwidth of 1000m x 1000m. The duration of the replication is set to 100 seconds. Furthermore, the IEEE 802.11 layer was used. This boundary was commonly used in previous studies, allowing the outcomes of this reenactment to be compared to the findings of those studies.

Table I. Simulation Parameters

Mac Layer	IEEE 802.11
Bandwidth	2 Mb/s
Propagation model	Two-ray ground
Antenna model	Omni-Antenna
Simulation area	1000 m x 1000 m
Simulation time	100 (sec)
Number of nodes	75, 100, 150, 200
Node speed	10, 20, 30 (m/s)
Pause time	40 (sec)
Traffic type	CBR
Number of connections	40

To dissect the exhibition of our plan, we contrast our Behavior-based Relay Strategy and AODV, which outflanks AODV in the entirety of our reenactment results shown in Fig. 3,4,5.

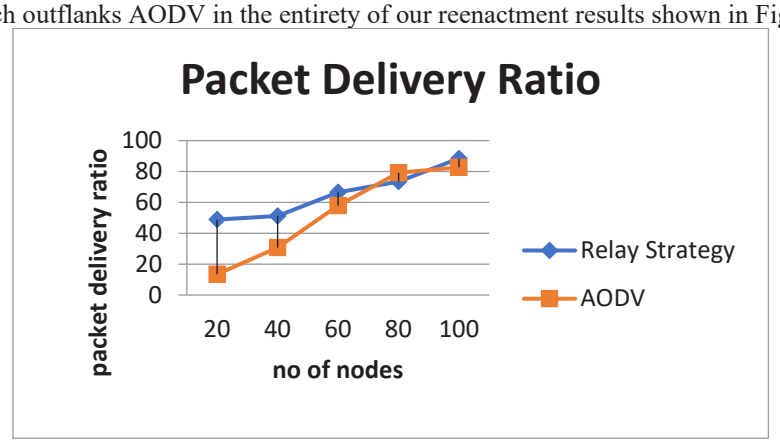

Fig.3 Packet Delivery Ratio

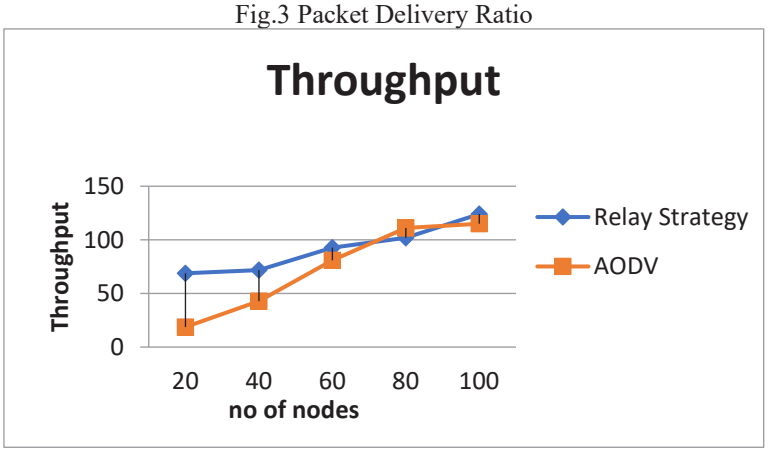

Fig. 4 Throughput

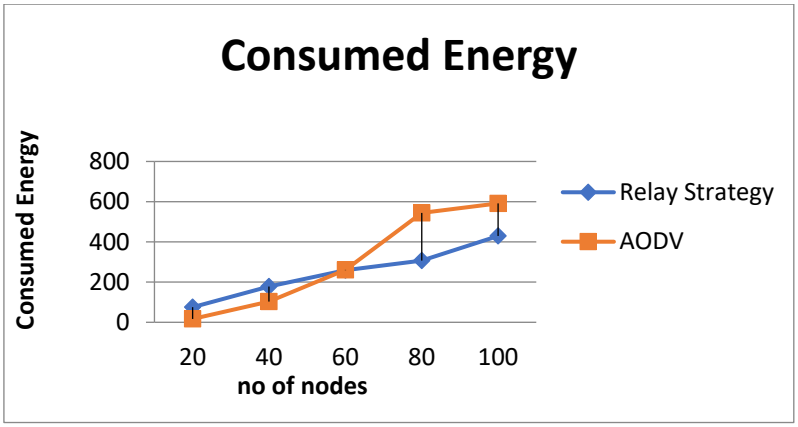

Fig.5 Consumed Energy

4 Conclusion And Future Work

Despite the fact that energy consumption are being reduced just at device scale, at the communication scale, and using an energy guiding convention, this paper proposed a novel crossover scheme that combines multiple procedures that work together to reduce workload and moderate power consumption. The procedures utilized are: 1) Using communication-energy monitoring system to diminish impedance among hubs and increment the throughput in the organization, hence decreasing the general energy utilization. 2) Developing Transmission-Power mindful directing calculation to confine rebroadcast RREQ bundles to keep away from superfluous catching, and choosing the proper force level to convey the RREP parcels to its objective; 3) Avoiding cycles that rely heavily on the Geolocation and distances adding devices that squanders power and calculation assets at gadget scale.

Further enhancement and upgrade for reducing clog and power use will be planned in our future research. For example, when door hub set is resolved, the issue of how to plan those entryway hubs to proficiently advance RREQ parcels requires further investigation.

References

[1] S. Banerjee, A. Ghosh, S. Mahapatra and R. Karmakar, "Performance Survey of MANET Routing Protocols with TCP Congestion Control Algorithms," 2020 IEEE 1st International Conference for Convergence in Engineering (ICCE), Kolkata, India, 2020, pp. 433-438, doi: 10.1109/ICCE50343.2020.9290610.

[2] Anand, M., Sasikala, T. Efficient energy optimization in mobile ad hoc network (MANET) using better-quality AODV protocol. Cluster Comput 22, 12681–12687 (2019). https://doi.org/10.1007/s10586-018-1721-2

[3] M. Anand, N. Balaji, N. Bharathiraja et al., A controlled framework for reliable multicast routing protocol in mobile ad hoc network, Materials Today: Proceedings, https://doi.org/10.1016/j.matpr.2020.10.902

[4] S. S. Kumar and V. Parthasarathy, "A new supportive opportunistic routing scheme in Mobile Ad-hoc Networks," 2013 International Conference on Current Trends in Engineering and Technology (ICCTET), 2013, pp. 174-176, doi: 10.1109/ICCTET.2013.6675938.

[5] A. Das, N. Das, A. Das Barman and S. Dhar, "Energy Incentive for Packet Relay Using Cognitive Radio in IoT Networks," in IEEE Communications Letters, vol. 23, no. 9, pp. 1581-1585, Sept. 2019, doi: 10.1109/LCOMM.2019.2923233.

[6] Gayathri Devi S., Marimuthu A. (2019) Honest Forwarding Node Selection with Less Overhead and Stable Path Formation in MANET. In: Peter J., Alavi A., Javadi B. (eds) Advances in Big Data and Cloud Computing. Advances in Intelligent Systems and Computing, vol 750. Springer, Singapore. https://doi.org/10.1007/978-981-13-1882-5_41

[7] Murugan, K., Anita, R. Interlaced Link Routing and Genetic Topology Control Data Forwarding for Quality Aware MANET Communication. Wireless Pers Commun 102, 3323–3341 (2018). https://doi.org/10.1007/s11277-018-5370-9

[8] Kim Y., Ahn S., Lee J. (2005) An Efficient Multicast Data Forwarding Scheme for Mobile Ad Hoc Networks. In: Kim C. (eds) Information Networking. Convergence in Broadband and Mobile Networking. ICOIN 2005. Lecture Notes in Computer Science, vol 3391. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-30582-8_53

[9] Anand M, Sasikala T, Anbarasan M. Energy efficient channel aware multipath routing protocol formobile ad-hoc network. Concurrency Computat Pract Exper. 2019;31:e4940. https://doi.org/10.1002/cpe.4940

Detection of jamming and interference attacks in wireless communication network using deep learning technique

[1]S.V.Manikanthan, [2]T.Padmapriya
{[1]manikanthan.s.v@gmail.com, [2]padmapriyaa85@pec.edu}

[1]Director, Melange Academic Research Associates, Puducherry, [2]Managing Director, Melange Academic Research Associates, Puducherry
authors

Abstract. The Jamming and interference attacks aim to disable a wireless network, inducing a denial of service. Despite the resilience offered 5G is prone to these regarding the impact to the use of millimetre wave bands. In the last decade, several jamming detection techniques have been developed, including fuzzy logic, game theory, channel surfing, and some others statistical modeling. The plurality of these strategies are inadequate at detecting smart jammers. As a response, efficient and quick jamming and interference high-accuracy detection systems are all still in great demand. The usefulness of many deep learning models in detecting jamming and interference signals is analyzed in this paper. The types of signal features that could be used to diagnose jamming and interference signals are investigated, and a large dataset was created using these parameters. Deep learning algorithms are being kitted, tested, and sorely tested using this dataset. Logistic regression and naïve bayes are representations of these algorithms. The probability of detection, probability of false alarm and accuracy are being used to verify and validate the performance of these algorithms. The simulation results show that a logistic regression algorithm based on jamming detection and interference can detect jammers with perfect seating, a high possibility of detection, and a minimal probability of false alarm.

Keywords: jamming, interference, deep learning, logistic regression, logistic regression, jammers.

1 Introduction

In the near future, 5G is set to transform earlier generations of cellular networks by requiring superior throughput and inferior latency [1], setting the stage for “self-driving” cars, the internet of things, E-health maintenance, augmented worlds, and smart cities. As a result, billions of wireless systems are designed to be associated to the internet. Cyber threats including such jamming [2] and GPS spoofing makes 5G, like all other networks, vulnerable [3, 4]. Cognitive radio can render these risk taking to new attacks [5-8], such as main customer emulation [5] and data falsification through spectrum sensing [6]. As a result, it's crucial to understand the cyber security effects of 5Mobile communications [8,9]. Jammers create an insanely large amount of ignorance of service by overflowing communication channels to radio signals, dropping the SNR of genuine users and interrupting communication. GNU radio

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and universal software radio peripherals are representations of proposed software radio units inexpensive, can be used to launch attacks.

Jammers can readily find any frequency channel at a low cost. [10]. The four essential types of jamming attacks are constant jammers, random jammers, deceptive jammers, and reactive jammers. Constant jammers attack by sweeping a full capacity noise from one channel to the next as seen in a scheme and repeating the process over time. Random jammers operate at random, with no special method for moving from one channel to the next. To keep wireless channels distracted, manipulative jammers send illegitimate packets through them. Reactive jammers keep track of the number Also jam the channels that are used for communication out of all frequency channels [11]. Jammers could also be labeled as standard or smart. Daily jammers don't seem to be capable of distinguishing amongst continuously transmitted signals, so they all play at the same time. Smart jammers are likely to actually to understand, map, and determine how legitimate users transmit their signals, enabling them to develop their attack strategies or communication energy cause serious trouble to legitimate transmission.

The fifth-generation (5G) cellular network period is rapidly approaching. The intensity of research is growing up in the region in readiness for the first suborbital flights. 5G networks are prepared to facilitate the energy sector as well as “vertical industries” such as automated driving, smart factories, and medical care. They will also provide multi-tenancy and micro support, as well as approaches for accelerating customer service delivery and presenting computing and networking modules to service providers [1]. The prime motive is to allow operators to provide vertical service providers with handmade solutions over the same network infrastructure. Beyond these approaches, slicing a 5G network offer a wealth of mobility and support for a variety of different performance criteria. Network functions are modularized and can be installed in a number of different ways achieves this. The network programmability rule can also be extended. Network functions virtualization (NFV) and software defined networking (SDN) are manifestations of enablers [4]. Through the latter, the former enables a flexible logical architecture and versatile location of NFs in the network virtualization of NFs. The figure 1. shows the block diagram of wireless communication.

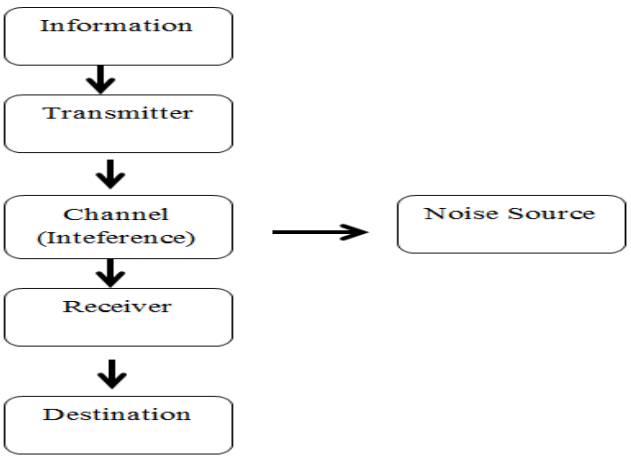

Figure 1. Wireless communication Block diagram

We live in a golden age of technology. Without knowledge, would have been unable to think for a single moment. Science has made our life easier and more relaxed. Because of the advancement of technology, the modern world is being highly compressed. Due to various science and technology, the telecommunications industry has changed significantly over the past few decades. The term "5G" refers to the fifth generation of mobile technology. The use of handheld devices within very high bandwidth has changed thanks to 5G technology. 5G is a high-throughput, wide-coverage packet switched wireless system. 5G technologies use CDMA and BDMA, as well as inch wireless, to endorse seed speeds of more than 100Mbps at full movement and more than 1Gbps at low mobility. Many types of new features were included in the 5G technology, making it the in the near future, the most efficient and in high demand. It's not incredible that such a scientific treasure exists has indeed been squeezed into such a tiny device.

Mobile phone subscribers get more features and performance to 5G technology. Many types of new features should be included in 5G technology, make it the most efficient and in high demand. It's not common with such a wide selection of technology to arise has also been jammed into such a tiny device. Mobile phone customers get even more features and performance to 5G technology. 5G is a new technology that will provide all conceivable devices with just one universal machine whereas interconnecting the majority of recent communication infrastructures. The 5G terminals will be multimode and cognitive radio efficient and portable. Software-defined radio modulation schemes is used. All of the required swappable software can be downloaded on the fly from the internet. The implementation of 5G mobile networks will be focused on the creation of user terminals, that will provide simultaneous access to the several wireless technologies and will consolidate numerous flows from various technologies. Moreover, the terminal will make the final decision among mobile network topology.

Enhanced the role for data and control transport, as well as supporting activities for tools and other technologies networks, help compensate Next generation networks (NGN). In order to provide quality of service, traffic assessment is a basic control function. Moreover, the 5G connectivity program was made with the best service in mind (QoS). The potential of a network to increasing prevalence bandwidth while still dealing quality of service refers to the integration of effective leader elements such as latency, error rate, and uptime (QoS). Setting priorities for different data sources (video, audio, files) on the network enables them to setup and share network resources sometimes component of quality of service. Just QoS corresponds to network traffic developed for video on demand, IPTV, VoIP, streaming media, videoconferencing, and online gaming. Quality of service helps to offer priority to networks by delivering enthusiastic bandwidth, jitter power, low latency, and reduced loss characteristics. Its solutions provide the foundation for emerging campus, wide area network, and service provider networks business applications [12].

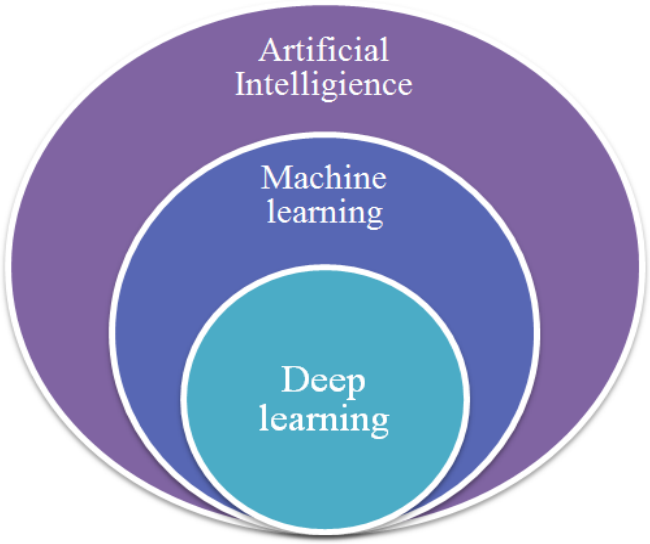

Figure 2.Deep learning in advance

5G networks are digital mobile networks that divide their frequency range into improve road cell membrane units The 5G wireless devices in a cell use radio waves to communicate with a local antenna array and low-power automated transceiver (transmitter and receiver) in the cell. The transceiver allocates frequency channels from a pool of frequencies that are reclaimed in other cells. Local antennas are related to transmission electronics, which are connected to telephone wireless equipment transmission and routers using high-bandwidth multimode or wireless backhaul connections for internet access In other cell networks, a mobile device shifting from one cell to another is seamlessly handed over to the current cell. A million devices per square mile can be enabled by 5G, while 4G can only support a tenth of that [13,14]. Since the new networks use 4G to establish the connect with the cell, and the new 5G wireless devices now have 4G LTE potential in areas where 5G coverage is not available[15]. The frequency range for low-band 5G is 600–850 MHz, which again is close to the one of 4G cellphones, which generates download speeds of 30–250 megabits per second (Mbit/s). Low-band cell towers are similar to 4G towers in respect of range and coverage area. Mid-band 5G uses microwaves between 2.5 and 3.7 GHz to provide speeds of 100 to 900 Mbit/s, with each cell tower reaching multiple miles. This is the most common form of infrastructure, and it should be usable in most large cities by 2020. Because certain low-band is the minimum service tier that regions have yet to introduce. Because, in the future, higher frequencies can be used, high-band 5G uses frequencies of 25–39 GHz, near the bottom of the infrared imaging band. It often experiences download speeds comparable to cable internet gigabit per second (Gbit/s) is a measurement for the faster data transfer. Millimeter waves (mmWave or mmW) have a wider variety, which can necessitate their use the use of several small cells.

2 Related Works:

Yifei, Y., & Longming, Z[16] explained that the increasing growth of mobile internet and the internet of things has motivated the development of 5G wireless communication systems, which are scheduled to be introduced around 2020. (IMT-2020). 5G networks are expected to offer a wide range of application scenarios. As a rule, 54 g would have a wide range of available performance metrics (KPIs), instead of the peak data rate and average/edge spectral emissions standards of previous generations. Multiple technologies can be used individually or in conjunction in each typical scenario to boost transmission quality, reduced costs, and increase the number of connections, among other factors. Huge MIMO, ultra dense application specific techniques, non orthogonal transmission, high frequency communications, and other important enabling technologies are mentioned.

The author Kaloxylos, A[17]described the 5G networks are intended to serve a multitude of vertical industries with varying performance criteria. Network slicing is found to be the major enabler for enhancing cellular networks' efficiency in order to achieve this goal. The theory of network slicing has been studied extensively in past months, and the key performance parameters have been developed. However, network slicing adds a layer of complexity that triggers several problems that are still being studied. This article includes a comprehensive overview of the things proposed by the research community, as well as the legal condition of the 3GPP simulation phase. This research looked at solutions for all network domains (access, transport, and core), as well as network slice management. The paper will also discuss significant issues which need to be resolved in the upcoming months.

According to the author Pedreira, C. E[18] explained that the method for modifying LVQ prototypes that selects a subset of the training data points. The principal goal is to have experiments converge in a more convenient venue, which could eliminate misclassification errors. Nowadays an update range made up of a subset of points that are likely to be captured by another class prototype. In order to describe different levels of importance for the input attributes, they compare the proposed technique with a weighted norm rather than on the euclidean. The method is tested in a probability sample as well as on readily viewable data sets.

Maalouf, M [19] explained that logistic regression (LR) is one of the most famous data mining methods in common and in binary data categorization in particular. This document gives an impression of the main aspects of LR in data analysis, primarily from an algorithmic and machine learning context, and how LR can also be used to analyze the data from imbalanced and irregular events.

According to the author Agiwal, M.,[20] explained that compared to current 4G LTE networks, the vision till next 5G wireless communications is to have extremely high data speeds (typically in the kilobytes per speed range), extremely low latency, a significant rise a significant increase in base station output, and a marked enhancement in perceived service quality (QoS). Established cellular networks are already being stressed by the proliferation of mobile devices, the proliferation of digital multimedia technology, and the explosive growth of wireless data (multimedia) demand and usage. Most mobile phones are anticipated to prosper by 5G wireless events, with increased download speeds, speed, latency, and QoS. In this survey, we explore the wireless evolution toward 5G networks in detail. Will suggest talking about both the latest architectural advances in radio access network (RAN) development, such as air interfaces, smart antennas, cloud, and heterogeneous RAN. Regarding that, go above the new channel model estimation, directional antenna configuration, beam formation algorithms, and large MIMO technologies underlying novel

mm-wave physical layer technologies in detail. The protocols and multiplexing schemes and for MAC layer which might represent this new physical layer are mentioned here effectively are then covered. Analyze the killer apps, who were thought to be the main driving force behind 5G. Highlight in order to further explain the enhanced customer experience, new QoS, QoE, and SON features consistent with the 5G evolution are being introduced. They receive a complete information about energy sensitivity and cost efficiency in order to reduce increased network electricity consumption and capital expenditures. They also address specific understanding the current condition of 5G technology is crucial for its ultimate commercialization, which necessarily involves field trials, drive tests, and simulation studies. Finally, the best previous researches topics were discussed, and future research directions. [20]

Huang, Z[21] described that the foundation of deep neural networks, DLVQ (deep learning vector quantization) is a modern deep learning vector quantization algorithm (DNNs). By using deep learning framework's heavy representation ability and any vector quantization (VQ)method as an initializer, the proposed DLVQ technique in a classification task, is capable of learning a code-constrained codebook and thus outshines standard VQ. When the k-means VQ technique is often used to allow the proposed DLVQ, it achieves a positive outcomes on an activity requiring audio information retrieval A 10.5 percentage point in mean average precision (MAP) is obtained after merging the k-means and DLVQ data.

According to the author Jover, R. P, et al..,[22] explained that the on a tasks requiring audio information retrieval A 10.5 percentile rank in mean average precision (MAP) is obtained after merging the k-means and DLVQ data added platform that allows additional mobility and coverage for follow new networks, which are factor loading increased traffic and the ever bandwidth criteria This new cellular communication system, which uses an orthogonal frequency division multiple access (OFDMA) modulation and is based on a revised physical layer, functions well here in multipath environments and increases the wireless channel's system efficiency in terms of bits per second per Hertz (bps/Hz). Nonetheless, LTE is vulnerable to radio jamming attacks, as are all wireless systems. Such threats prove to be dangerous, especially for based on LTE networks, next-generation emergency response communication systems.

His proof-of-concept study sets out a bunch of short major attacks (smart jamming) that broaden the range and effectiveness of radio network jamming. Focused on these new risks, a number of new possible safety research directions are suggested, with the intent of enhancing the resiliency of LTE networks against such attacks. The primary downlink broadcast channels are spread-spectrum controlled, with the uplink control channels' radio resource allocation distorted and a standard cryptographic scheme for process information messages. Despite the challenges of incorporating these technologies on commercial networks, which would necessarily require their inclusion in future LTE standard launches, the technology solutions have the potential to significantly improve the performance of LTE-based national emergency response communication systems.

3 Proposed Work:

Many other types of artificial neural networks, supervised or unsupervised learning techniques (ANNs), are being used in deep technologies to learn hierarchical embodiments. There are a range of DL architectures that have been made up largely of several layers of processing. Each layer can create non-linear responses based on the data from its input layer.

Human structures emulate DL's usability. Signal process is done by the brain and tissues. In relation to other previous techniques to machine learning, DL architecture has gained more attention in recent years. DL Architectures are treated as shallow-structured forms of such approaches (i.e. a small subset). While ANNs have had a considerable rise in previous centuries, DNNs beginning in 2006, when. presented the emergence with networks of deep ideologies. This technology's state-of-the-art quality was extensively documented. Image recognition, image recognition, retrieval of search engines and information, and natural language translation are all areas of AI. Training data was another contributor to collinearity on the miniature scale. The implementation of successful deeper exploration was prohibited in those days with FNNs due to action and computer production capacity.

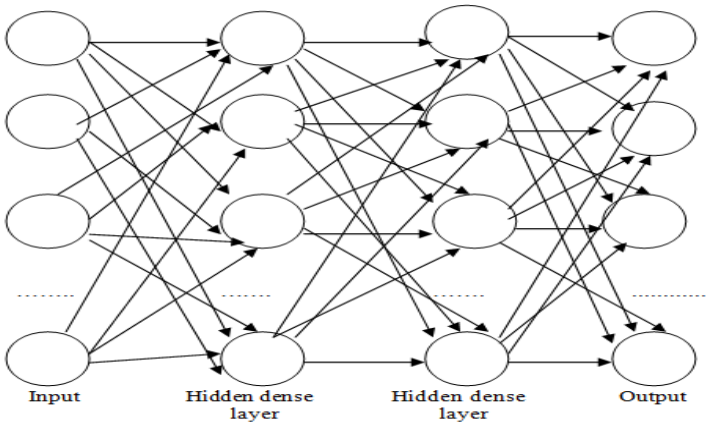

Figure 3. The overall mechanism of deep learning

The systematic propagation radio jamming the use of radio signals to disturb communications by decreasing the SNR of the received signal. This assault generally requires sending a persistent high-power signal through the entire target band of the system being assaulted. This attack is largely viewed as a transparent and simple method of disrupting a wireless network, and it has been thoroughly studied in the literature in the environments of wireless local area networks (WLAN)[4], sensor networks, and cellular networks. Detecting and countering the hacker, despite the attack's simplicity, is often the only alternative, particular when the device's entire band is jammed. More advanced schemes to jam cellular networks are being proposed, spite of the fact that the huge portion of transmitted power destroys stealthiness. When the attacker is aware of the target signal, a regular barrage jamming attack has been shown to be the most powerful jamming method. Downlink smart jamming head straight forth malicious radio signals to impede the processing of vital downlink control channels. A new study discusses the social ramifications of jamming LTE networks' PBCH. The central contention built on the questions in the study. This attack, can be used on this channel is approached by both 2G and 3G networks although its designated PRBs are established long in advance and are always mapped to the central 72 subcarriers of the OFDMA signal, as mentioned. Attributed to the reason that this channel has been used to configure and operate the other channels in the cell, this jamming attack seems to have a low duty cycle and bandwidth. The figure 2. shows the mechanism of the deep learning.

In this case, the jammer's range is still very reduced, with a very limited effect. To deny treatment to non-cell edge users, the PBCH's Through this, transmission and modulation features necessarily require a largish interfering signal. Remember that the attacker's potential to out power the legitimate signal is constrained by the e Node B's large transmitted power and the jamming device's potentially low transmitted power. Smart jamming with low power goes a step further by jamming uplink control channels that really are essential to the platform's service. An uplink smart jamming attack has a greater variety, cover the entire cell or business. Although the hacker jams the UL systems node B seems unable to accept important UL transmitting messages needed for the cell's correct functioning. The attacker actually blocks the by overwhelming reception at the e node B with a jamming signal, the base station is blocked from interacting with any UE in the cell, increase the the attack's range looks at the entire cell. Furthermore, the attacker is constrained not by the high power of the downlink signals by Node B (which are often in the 48 dBm range), but by the maximum power that a legal UE can transmit, which is set to 23 dBm in the case of LTE. An offender sitting opposite node B and transmitting at the same power level as any legitimate smartphone can possibly jam all of the UEs in a cell or sector's uplink control messages in this circumstance. Furthermore, the attacker that decide to use an extremely targeted antenna guided at the node B to substantially boost the attack's effectiveness.

After the first data exchange on this channel helps the UE to organize in the uplink, radio resources can be allocated to the UE after the initial delivery results. A hacker will have to understand the precise PRBs per each LTE uplink control channel at the PHY layer in order to target it. Readily viewable information can also be used to obtain this PRB assignment. Yet the, even when the simply raise of the these though data about radio resource assignment could not have been got from the SIB unprotected data’s carried by the PBCH and PDSCH although signals in the time-frequency LTE frame was unpredictable or scrambled, data about radio resource assignment could still be gained from the SIB unprotected messages handled by the PBCH and PDSCH.

In the SIB-1 text, the MCC and MNC of an e node B are also encoded, which is important to note in the background of a sophisticated and extremely targeted attack. If this information is obtained, a hacker may, for example, target base stations from a various biological network operator with the jamming cost. Though far more efficient than straightforward jamming or downlink smart jamming, uplink smart jamming is a further complex operation. To selectively jam the PRBs delegated to, say, the RACH channel, an intruder must've been perfectly time and frequency compatible with the LTE signal. Thirdly, the attacker must of been able to decrypt and decode MIB and SIB messages in order to take out the actual RACH PRB allocation information. A professional attacker and reasonable progress work on software-defined radio, for example, may be used as a response, will be necessary.

4 Logistic Regression:

The the probability of assigning observation x to prototype j, p (j | x), is equivalent to their (Euclidean) size, which is the starting point for Regression LVQ (RLVQ) algorithms. Assume that a mixture model could describe the probability density b (x) of x.

$b(x) = \sum_{i=0,1,2.3}^{a} p(x|k)$ (b(i)) (1)

where b(i) is the conditional probability that component j generates particular data point x, and is the prior probability that a data point is generated by a single component.

Should use the condensed exponential form to reflect the conditional density function p (x | k).

$p(x|k)$ = K(i). exp (f(x, y_j)) (2)

and even a Gaussian mixture of K (j) = (2 p 2)1/2 and f (x, mj) = (x mj)2 / 2p2. Component j is absolutely described in this case by its mean mj and standard deviation p. As a response, component j can be identified as prototype j, and I will proceed to use such a convention in the journal. It's worth mentioning that the standard deviation (width) of all concepts was presumed to be the same. Assume whether p(j) = 1/P is the same for all designs. Given this, the assignment probability can be reported using the Bayes law.

P (x | k) = exp(-(z - y_j)^2 / 2δ2$_m$) (3)

Let X∈R^{n*d} be a data matrix for n instances (examples), d features (parameters or attributes), and y a binary outcome vector either y_i = 1 or y_i = 0 is the output. Within each instance x_k∈ Rd (a row vector in X), where I = 1...n, y_k = 1 or y_p = 0 is the result. Let instances with yk = 1 be positive (an event happens), and instances with yp = 0 be negative (an event doesn't really occur) (non-occurrence of an event). The step is to predict whether xi is a positive or negative example. A case can be thought of as a Bernoulli trial (the random component) with an expected value E[yk] or probability pi. In able to fix such a problem, the systems approach will be used in a linear regression model.

$M = X\gamma + \tau$, (4)

Where τ is the error vector,

$$Z = \begin{pmatrix} x1 \\ x2 \\ x3 \\ \vdots \\ xn \end{pmatrix} \quad (5)$$

$$L = \begin{bmatrix} y11 & y12 \ldots. & y1d \\ y21 & y22 \ldots.. & y2d \\ yn1 & yn2 \ldots. & ynd \end{bmatrix} \quad (6)$$

$$\alpha = \begin{pmatrix} \alpha1 \\ \alpha2 \\ \alpha3 \\ \vdots \\ \alpha d \end{pmatrix} \quad (7)$$

$$\sigma = \begin{pmatrix} \sigma 1 \\ \sigma 2 \\ \sigma 3 \\ \vdots \\ \sigma d \end{pmatrix} \quad (8)$$

The vector is a range of unknown parameters only with parameters xi← [1,xi]. From now on, the intercept will be believed to be implemented into to the vector Now, since y is a Bernoulli random variable with a probability distribution, now let us peek at it, let's peek at it.

$$P(b_i) = \begin{Bmatrix} Gi, \text{if } yi = 1 \\ 1 - b, \text{if } yi = 0 \end{Bmatrix} \quad (9)$$

the response's expected value is then

$$E[k_i] = 1(g_i) + 1(5-p_i) = g_i = x_i\omega, \quad (10)$$

with a variance,

$$V(y_i) = k_i(1-k_i) \quad (11)$$

It follows from the linear model

$$x_i = x_i\alpha + \varepsilon_i \quad (12)$$

that

$$\beta i = \begin{cases} 1 - pi - 1; \text{ if } yi = 0 \text{ with probability pi} \\ -pi; \text{ if } yi = 0 \text{ with probability } 1 - pi \end{cases} \quad (13)$$

As a function, ∈I has a binomial distribution with an investor participation.

$$E[\gamma i] = (1-a_i)(b_i + (-b_i)(1-a_i) = 0, \quad (14)$$

$$V(\varepsilon i) = E[\varepsilon^2 i] - E[\alpha i] = (1-bi)^2(pi) + (-bi)^2(1-pi) - (0) = ai(1-bi) \quad (15)$$

The least squares solution should be used since the obtained value and variance of the result and error are not constant (heteroskedastic), and the errors are not normally distributed After this, since $y_i = 0,1$, a linear regression model can give results that are above or below zero. The logistic response function is a function that helps you to quickly respond to, as shown in figure 2, is the acceptable one when the response vector is binary.

5 Attack complexity:

To selectively jam the RACH, the attacker would need total correlation in time and frequency with the LTE signal, per the characteristics of UL smart jamming. In relation to DL smart jamming, this enhances the attack's sophistication. However, there are a range of the off

and open-access resources which could be used in this scenario. By jamming the central 1.08 MHz of any LTE signal, an attacker may deny service to all UEs in its vicinity. As a rule, it's critical to improve the primary broadcast channels' PHY layer stability. The objective is to counteract the jammer's advantage in bandwidth and transmitted power in the form of the LTE limitation. New LTE networks employ a completely revamped modulation scheme that greatly enhances the wireless channel's overall performance of bits per second per Hertz (bps/Hz).

6 The Proposed Basic Jamming Detection Method:

In this method, in order to build an application, machine actions are listed. Abnormalities in the sensor network and the introduce unique profile. By comparing later profiles, you'll be able to figure out what they're doing. During setup process, the initial parameter levels (PDR, BPR, and ECA) are sampled, and it is expected that no jammer will disturb the sensor network. The threshold levels all of which were sampled and documented are later used to indicate the existence of any jammer. The threshold concentrations were assessed using the 6-Sigma procedure, which is a simple and effective calculation technique. By using arithmetic mean and standard deviation values, the UCL (Upper Control Limit) and LCL (Lower Control Limit) limits of normally distributed samples can be determined. The arithmetic mean is represented by and the standard deviation is represented by 99.999660 % of the data in normally distributed outputs is between the UCL and LCL limits. The balance of the data set is marked as normal as it falls just below LCL or approaches the UCL. PDR threshold parameters are compared to use the LCL, although BPR and ECA threshold levels are estimated using the UCL. The pseudo codes for the basic jamming detection mechanism, which compares documented parameter threshold values to periodic measures of these parameters. Five-branched if-else terms are also used to classify attacks and fault events. Each branch is aligned for one or more attack styles or fault circumstances. When instant PDR is lower than the threshold value (PDR) The, instant ECA is higher than the threshold, and instant BPR is higher than the threshold, a sensor node is admitted under attack in the first request city code.

When sensitive or inaccurate threshold samples are used, the detection mechanism may deliver inaccurate results. As a results, under these abnormal and unexpected network conditions, the basic jamming detection mechanism will lead to lower detection quality and increased false positive rates. There are also instances if an attack or a failure in the sensor network cannot be easily remedied. Node-A (the boundary node) is not openly threatened by a jammer, but it is influenced indirectly by nearest neighbours. In this case, and although PDR decreases, the ECA and BPR values can be maintained within reasonable parameters. This issue may also emerge as a result of neighborhood node failures. As a rule, the attack and fault cases in the boundary nodes cannot be removed easily in the specific detection mechanism.

7 The Proposed Advanced Jamming Detection Method:

Because of the limitations of the basic detection mechanism listed above, an advanced jamming detection mechanism is required. Another supplementary approach is needed to help threshold technique in order to achieve higher detection rates with lower false positive rates.

In the advanced mechanism, the parameters used in the standard jamming detection method are paired with additional network query packets to construct a query-based jamming detection method. The advanced detection methodology uses not only the relationship amongst sampled parameters within the same node, but also the parameters of neighbouring nodes. When abnormal network parameters (($PDRPDR_{The}$ && $ECA>ECA_{The}$) || ($PDRPDR_{The}$ && $BPR>BPR_{The}$)) are sampled, it is centered on exchanging QUERY and REPLY packets between nearest neighbors. When a sensor node is in a suspicious state, it sends out QUERY packets with the ALARM flag set to sense the amount of an attack. The nodes that receive the QUERY packets analyze their network parameters and set or clear the If any variations are identified, an ALARM flag is set in the REPLY packet. In the QUERY-REPLY, the Alert flags packets can be used for the nodes to indicate the existence of a possible attack. The tabulation 2 and 3 shows the probability values using logistic regression and nave Bayes algorithm

S.No	Probability of detection	Probability of false alarm	Probability of accuracy
1.	185	150	110
2.	170	182	150
3.	135	147	163
4.	149	151	189

Table 1. The values of probability using logistics regression

S.No	Probability of detection	Probability of false alarm	Probability of accuracy
1.	142	166	179
2.	139	147	154
3.	99	120	167
4.	180	110	128

Table 2. The values of probability using Naïve Bayes

Algorithm-2, which is shown below, introduces the advanced detection. Every sampling cycle, the device is called query based jamming detection Algorithm, and it requires use of such external variables flags to evaluate how or not an attack occurs. When an abnormality is identified, a QUERY procedure is initiated. To mitigate QUERY-REPLY packet traffic between nodes in the same community, the node receives a QUERY packet could indeed postpone sending the before sending the QUERY packet, wait for the REPLY project to finish before sending it. If the number of REPLY data packets is less than planned, the node sends a QUERY packet. Otherwise, the node does not send a QUERY packet but instead focuses on received REPLY packets to indicate the location of an attack. By implementing the contention protocol rules, the node that hasn't really received a QUERY packet before sending the QUERY packet must send the QUERY packet in three sampling times. If the node becomes unable to send any QUERY parcels and within specified it is believed that the channel is operated by during that time persistent or malicious jammers. The node that carries out the

QUERY packet waits for the REPLY packets to arrive within a certain length of time. When the QUERY-REPLY tournament starts, the nodes inspect the REPLY packets to see whether there is any indication of an attack. The presence of a jammer is decided by nodes.

//Called upon each sampling period
Query based jamming detection algorithm(){
if ((PDR<PDR_{Thr} **AND** ECA>ECA_{Thr}) **OR** (PDR<PDR_{Thr} and BPR>BPR_{Thr})) *//Abnormality*
if(Rcvd query=**FALSE AND** waiting reply for other nodes=**TRUE**)
set reply timer(Now+5*sampling period)
Waiting reply for others=**FALSE**
else if (waiting reply for others=**FALSE AND** query timer overflow=**TRUE**
Evaluate reply packets();
else if(rcvd query=**TRUE AND** waiting reply For other nodes=**TRUE**)
if (Trying to send query=**FALSE**)
try to send query packet();
Set query timer(now+2*Sampling Period)
trying to send query=**TRUE**
else if(query timer overflow=**TRUE AND** query was sent=**TRUE**)
Cancel Query Timer()
set reply timer(Now+3*Sampling Period)
else if (Query timer overflow=**FALSE AND** Query was sent=**FALSE**)
JAMMING=FALSE;
if(Number Forced Query<3)
Send forced query(now+ random time)
Forced query was Sent=**TRUE**
Number forced Query++
end if
else if(Reply timer overflow=**TRUE**)
Evaluate reply packets();
else if (PDR<PDR_{Thr} **AND** BPR<BPR_{Thr} **AND** ECAn<ECA_{Thr} **AND** Rcvd forced query=**FALSE**) *// Boundary Nodes*
JAMMING=TRUE;
else if(PDR<PDR_{Thr} **AND** BPR<$BPRT_{hr}$ **AND** ECA<ECA_{Thr})
FAULT=TRUE;
else
JAMMING=TRUE;
end if
end if
end if
}

Some special properties are needed for boundary nodes in the detection to jamming under constant, listen interval, and control interval jammers. For boundary nodes, which are located on the outside of a jammer's coverage area, the PDR, BPR, and ECA parameter levels will be low. Neighbor node failures also may allow these parameter levels to appear. As a practice, it's easy to blend up an intrusion scenario and a fault scenario. The nodes use FORCED QUERY packets to solve this limitation in the proposed advanced detection phase. If a node can't even send out any QUERY packages in that amount of time, it considers itself jammed and waits

for a random time to send out a FORCED QUERY packet, ignoring contention protocol rules. As a rule, the boundary nodes receiving the FORCED QUERY packet are better able to distinguish between fault and jamming instances.

8 Naïve Bayes:

Have a hypothesis in Bayesian classification that the given data belongs to a specific class. The possibility of the hypothesis proving valid is then measured. For some types of problems, this is one of the most practical solutions. The method only generally requires a standard scan of the entire data. Thirdly, if additional training data are available at any level, each training example will incrementally increase or lessen the probability that a hypothesis is accurate. As a response, a Bayesian network is used to model an unpredictable domain. Evaluate the probability of an end result given multiple relevant data variables in this model. The probability of the end result, and the probability of the data variables occurring if the end result occurs, is encoded in the model. The likelihood of one evidence variable happening in the existence of the end result is assumed to be independent of the probability of other evidence variables occurring in the absence of the end result. Now we'll use a nave Bayes classifier to look at the alarm example.

Assume have a series of examples that monitor things like whether it's raining, whether an earthquake has occurred, etc. The nave Bayes classifier is premised on the idea of strong independence. This indicates that the likelihood of one attribute has really no bearing on the significance of the other. The nave Bayes classifier creates 2n from a range of n attributes! assumptions that really are irrelevant. Nonetheless, the nave Bayes classifier's tests are often correct. The study discussed in explores why and under what situations the nave Bayes classifier performs well. The error is caused by three factors, according to the report: noise, bias, and variation in training data. The best way to reduce training data noise is by using good training data. The machine learning algorithm must divide the training data into two groups. Bias is the error characterized by increased groupings in the training results. And variance is the error induced by the small groupings.

9 Results:

The results The detection rates and false positive rates of the proposed advanced jamming detection algorithm, which has been adopted, are evaluated. The tracking rates for different types of jammers and different periods of jammed nodes. The first and most significant thing to note from the data is that, while the detection rates appear to be high, they are not yet at 100%. As a result, the jamming detection method in query cycles cannot be run for all six time intervals. The second interesting issue is that as the amount of jammed nodes increases, so too does the rate of detection. This situation is exacerbated by a decrease in the number of boundary nodes. Another essential thing to consider is that in the case of complicated relations, higher detection rates are likely (lossy connections, congested or faulty sensor nodes). The rate of QUERY-REPLY packet corruption rises, and it will have a beneficial affect on the detecting rate achievement. Checking and pulse jammer scenarios had lower detection rates than the others. This is attributed to the reason that they are not successful

enough to totally occupy the communication channel, and they assault the sensor network at unexpected times. The figure 2 and 3 shows the graphical representation of jamming and interference using logistics regression and nave Bayees algorithm.

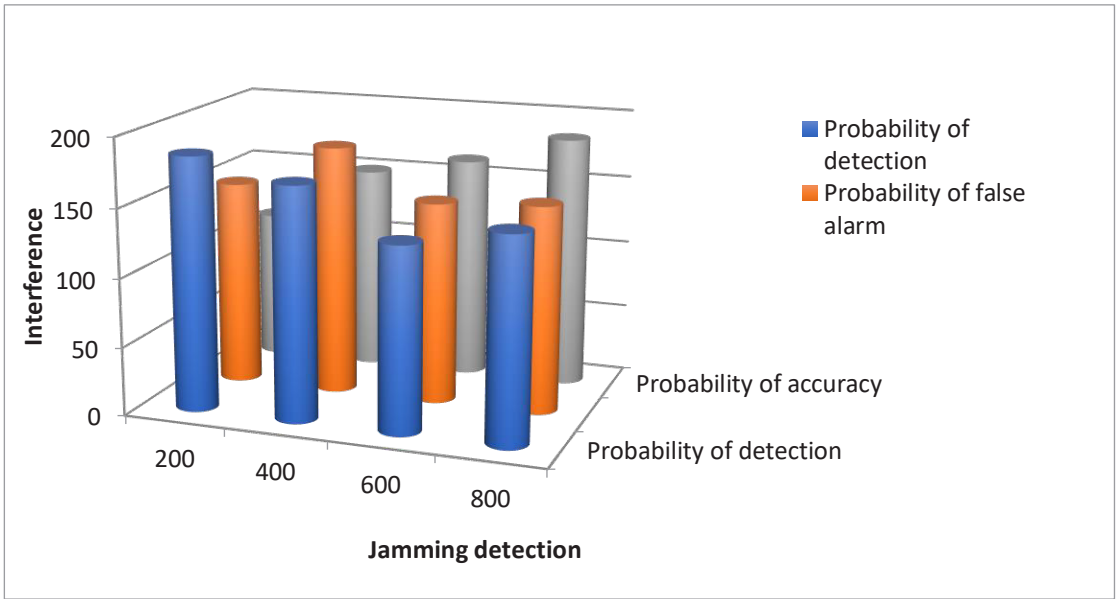

Figure 2. Graphical representation of Jamming detection and interference using logistics regression algorithm

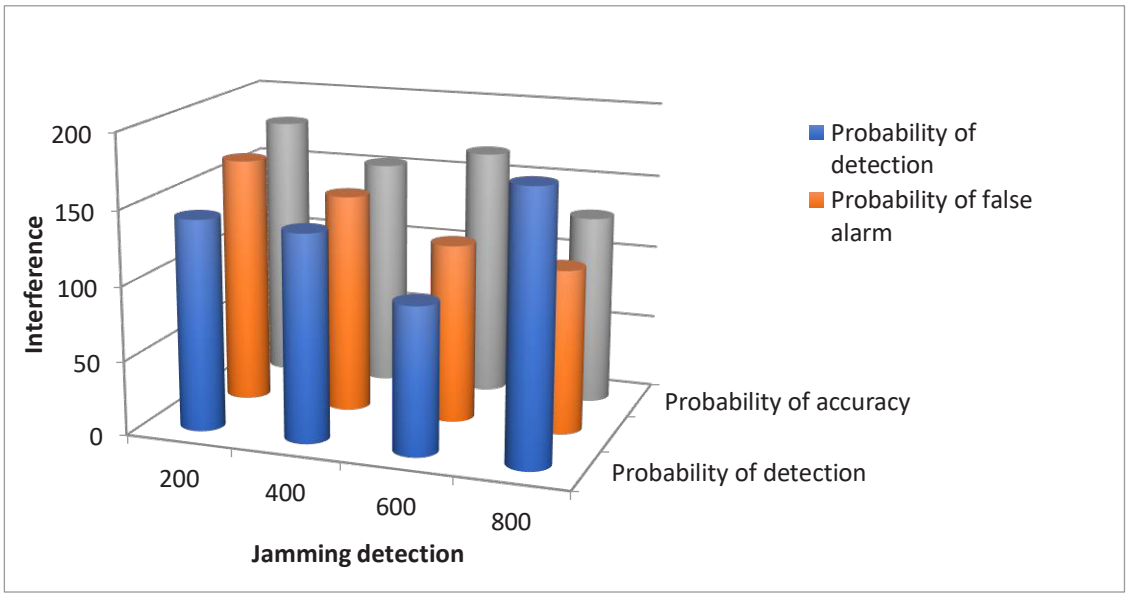

Figure 3. Graphical representation of Jamming detection and interference using Naïve Bayes algoirthm

The rates of true reports for various forms of jammers with different speeds of jammed nodes. As compared to traditional network conditions in a bad communication condition, higher positive rates can be achieved. The objective of this situation is to decrease the PDR and, on the other arm, raise the BPR. Furthermore, defective nodes in the sensor network may increase the false positive rate. Another important thought is that as the coverage area grows, the frequency of exploitable vulnerabilities decreases. The number of nodes detecting false positive conditions decreases as the number of specifically jammed gets larger. If the Jammed Node Ratio (JNR) is zero, the network doesn't even have a jammer. As a result, the false positive rates in four various graphs are comparable. Unreliable attack detections sampled from non-jammed nodes can be accepted with false positive rates sampled at nonzero JNR values.

Conclusion:

One of the most common methods of security attacks that mobility networks face is jamming. This hazard is intrinsic in the wireless devices used in this kind of network, and there is no method to deter a suspect from sending a high-power intrusive signal on a viable frequency band in its purest terms (barrage jamming). Despite the fact that jamming attacks are famous and have been carefully investigated in the literature, no actual security or mitigating measures have been enforced techniques to improve the resiliency of mobility networks against jamming attacks have been introduced. As a result, a list of latest tapping sophisticated DoS attacks against cellular networks concepts is increasing significantly. However, for the newly announced LTE advanced updates, proper settings did not list any anti-jamming recommendations or standards. Nonetheless, since LTE-based systems are expected to be enough to introduce national disaster response networks, LTE's reliability and security criteria are essential. Utilizing ideas from spread spectrum modulation, a proposed strengthening of the major DL broadcast channels' anti-jamming properties protect the wireless interface from a smart jamming attack aimed at such control channels.

References

[1] Y. Wu, A. Khisti, C. Xiao, G. Caire, K. Wong, X. Gao, “A survey of physical layer security technique for 5G wireless networks and challenges ahead,” IEEE J. Selected Areas Commun., vol. 36, no. 4, pp. 679-695, 2018.

[2] D. Karas, G. Karagiannidis, R. Schober, “Neural network based PHY-layer key exchange for wireless communication,” IEEE Int. Symposium Personal, Indoor and Mobile Radio Commun., pp. 1233- 1238, 2011.

[3] P. Sinha, V. Jha, A. Rai, B. Bhushan, “Security vulnerabilities, attacks and countermeasures in wireless sensor networks at various layers of OSI reference model: A Survey,” Int. Conf. Signal Proc. Commun., pp. 288-293, 2017.

[4] J. Heo, J. Kim, J. Paek, S. Bahk, “Mitigating stealthy jamming attacks in lowpower and lossy wireless networks,” J. Commun. Netw., pp. 219-230, 2018.

[5] M. Bouabdellah, E. Ghribi, and N. Kaabouch. "RSS-Based Localization with Maximum Likelihood Estimation for PUE Attacker Detection in Cognitive Radio Networks." IEEE International Conference on Electro Information Technology (EIT), pp. 1-6, 2019.

[6] I. Ngomane, M. Velempini, S. Dlamini, “The detection of the spectrum sensing data falsification attack in cognitive radio ad hoc networks,” Info. Commun. Techn. Society Conf., pp. 1-5, 2018.

[7] M. Bouabdellah, N. Kaabouch, F. El Bouanani, and H. Ben-Azza, "Network layer attacks and countermeasures in cognitive radio networks: A survey." Journal of information security and applications 38 (2018): 40-49.
[8] W. Alhakami, A. Mansour, G. Safdar, “Spectrum sharing security and attacks in CRNs: A review,” Int. J. Advanced Comput. Sci., vol. 5, no. 1, pp. 76–87, 2014.
[9] F. Salahdine, N. Kaabouch, “Social Engineering Attacks: A Survey,” Future Internet J., Vol. 11, No. 89, pp. 1-17, 2019.
[10] D. Fang, Y. Qian, R. Hu, “Security for 5G mobile wireless networks,” IEEE Access, vol-6, pp. 4850-4874, 2017.
[11] R. Pietro, G. Oligeri, “Jamming mitigation in cognitive radio networks,” IEEE Netw., vol. 27, no. 3, pp. 10–15, 2013.
[12] Hossain, S. (2013). 5G wireless communication systems. American Journal of Engineering Research (AJER), 2(10), 344-353.
[13] Shatrughan Singh (March 16, 2018). "Eight Reasons Why 5G Is Better Than 4G". Altran. Archived from the original on May 25, 2019. Retrieved May 25,2019.
[14] Forum, C. L. X. (June 13, 2019). "1 Million IoT Devices per Square Km – Are We Ready for the 5G Transformation?". Medium. Archived from the original on July 12, 2019. Retrieved July 12, 2019.
[15] Segan, Sascha (December 14, 2018). "What is 5G?". PC Magazine online. Ziff-Davis. Archived from the original on January 23, 2019. Retrieved January 23,2019.
[16] Yifei, Y., & Longming, Z. (2014). Application scenarios and enabling technologies of 5G. China Communications, 11(11), 69-79.
[17] Kaloxylos, A. (2018). A survey and an analysis of network slicing in 5G networks. IEEE Communications Standards Magazine, 2(1), 60-65.
[18] Pedreira, C. E. (2005). Learning vector quantization with training data selection. IEEE Transactions on Pattern Analysis and Machine Intelligence, 28(1), 157-162.
[19] Maalouf, M. (2011). Logistic regression in data analysis: an overview. International Journal of Data Analysis Techniques and Strategies, 3(3), 281-299.
[20] Agiwal, M., Roy, A., & Saxena, N. (2016). Next generation 5G wireless networks: A comprehensive survey. IEEE Communications Surveys & Tutorials, 18(3), 1617-1655.
[21] Huang, Z., Weng, C., Li, K., Cheng, Y. C., & Lee, C. H. (2014, May). Deep learning vector quantization for acoustic information retrieval. In 2014 IEEE international conference on acoustics, speech and signal processing (ICASSP) (pp. 1350-1354). IEEE.
[22] Jover, R. P., Lackey, J., & Raghavan, A. (2014). Enhancing the security of LTE networks against jamming attacks. EURASIP Journal on Information Security, 2014(1), 1-14.

Peer to Peer Communication Between the Autonomous Vehicles Using Virtual Private Network

Guruprasad Y K[1], Dr. Nageswara Guptha M[2], Dr. Hema M S[3]
{guruprasad.yk@gmail.com[1], mnguptha@yahoo.com[2], ghema_shri@yahoo.co.in[3]}

Research Scholar, SVCE, Bengaluru[1], Associate Professor Senior Grade 2, VIT Bhopal University, Sehore[2], Associate Professor, Anurag University, Hyderabad[3]

Abstract. Autonomous Vehicles based transportation system is the next generation transportation system in each and every country. All the developing and developed countries are very much interested in developing autonomous vehicle based transportation system to avoid the accidents. As per the statistics taken by the road transportation authorities in USA on an average of 60% of the accident are happening purely due to the mistakes of drivers. It is almost same in each and every country. Though strict rules and fines imposed still the problems are growing not reducing. The research on autonomous vehicles transportation system has been initiated almost 10 years back still the results are not found fruitful. As the concept of autonomous vehicles is the combination of both Software and Hardware. Though the Hardware Industry is growing day by day with many latest hardware components which includes IC's, Sensors, and IOT Devices etc.., to develop latest hard ware components. The possibility of manufacturing autonomous vehicles is improved a lot further, Countries like China, Singapore, USA already started running the trail autonomous transportation system along with driver assistance, but the biggest challenge faced by this autonomous vehicle transport system is with respect to software. Though the software industry growing day by day with many of the latest technologies like Artificial Intelligence, Machine Learning, Data Science, Big Data etc..,. But the biggest challenge with respect to autonomous vehicles lies in data communication between the vehicles and also identifying the natural disasters. The proposed research mainly concentrated on the cleaning of the collected data from the vehicles, so that the autonomous vehicles Can easily communicate with each other without any delay.

Keywords: Artificial Intelligence, Autonomous Vehicles, Big Data, Data Science, IOT, Machine Learning..

1 Introduction

Autonomous Vehicles are the next generation vehicles which make life of the people so simple. They not only reduce the burden of the driver it also gives freedom to the people while they travel between the long distances. The Concept of Autonomous Vehicles has been started in the research labs way back almost like 10 Years. The Autonomous vehicles are the combination of both hardware and software. There should be a good understanding between the hardware and software in order to build a very good autonomous vehicle. Consider an example while building autonomous vehicle if the sensor connected to guide the root along with Google Maps. Let's consider if both of them not communicating properly to each other

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obviously the autonomous vehicle either will stop or go further to hit the objects in the road. So that means the coordination between hardware and software is very important in order to build the autonomous vehicle.

The researchers are working parallel to build the best Hard Ware and Software solutions for building the best autonomous vehicles. The major research going on in the field of producing autonomous vehicle based transportation system. The Countries like China, Singapore, Brazil and USA already started doing first level testing on the autonomous vehicle transportation along with driver assistance. Though they are not providing the full fledge autonomous transportation, at least in the areas where there is less traffic, very few signals, Limited Stops along with assistance of the driver who will be handling the vehicle after certain distance by converting it into manual mode. It is clearly understood that building the autonomous vehicles by taking the existing vehicles is not big challenge. Because few companies, are building the autonomous vehicles from the existing vehicles just by adding some additional features and hardware. When the researchers are ready to build autonomous vehicles with existing system and also the software's to communicate with hard ware and software internally built. The major challenges faced by the researchers while building the autonomous vehicle based transportation system is:[3]

- Effective Preparation of Geospatial Data to understand by the Autonomous Vehicles.
- Performing Analytics in the Geospatial Data Received for Decision Making.
- Communicating between the autonomous vehicles for the better transportation.

These are the three major issues which need to be still addressed before making sure that the normal vehicles get replaced with autonomous vehicles for public transport.[4]

2 Literature Survey

In this paper , the understanding of what are the possibilities for single vehicle accidents has been studied for future reference.[4]

This paper gave an idea how best the vehicle to vehicle infrastructure can be built for proper communication of data between the vehicles.[5]

In this paper the understanding of Wireless Communication and how fuzzy logic will help in this is understood.[6]

From this paper how the dynamism will be applied between the vehicles for timely delivery of messages will be understood. Which is very much essential for the proper communication between the autonomous vehicles. [7]

This paper gave deep insight on the how intelligent infrastructure will be built amongst the vehicles for proper communication of information and which avoids accidents, [8]

This paper gave a clear idea on how continuous communication can made between the vehicles for proper communication between the vehicles [10]

The main intake from this paper is how inter vehicular communication will be made for proper communication amongst the vehicles for smooth moving on the roads. [14]

This paper gave insight on the how the proper intersection will be made for vehicles to cross each other by communicating to avoid accidents and also unnecessary congestions. [19]

3 Illustration

By considering all above mentioned scenarios and also the research made in the field of autonomous vehicles, it is very clear that there is a need of working on geo spatial data in order to provide the best service in the field of Autonomous Vehicles [14]

And it is very clear that the major problem faced is

- Processing, analyzing and visualizing the geo spatial data.
- Communicating the Data with autonomous vehicles for better transportation.

In this proposed research the major concentrate will be on the how best the geo spatial data can be communicated with the next available vehicles for better transportation. [5]

4 Geo Spatial Data

Geo Spatial data is data about the object that lies on the surface of the earth which are either static or dynamic in nature.

In this scenario the vehicles data will be recorded and shared for further use. In day to day world huge geo spatial data is getting generated as so many objects are either dynamic or static. With respect to autonomous transportation system huge geo spatial data is required and which is already captured for further huge. But the biggest challenge is how this data can be understood by the autonomous vehicle for further use

How Geo Spatial Data will help autonomous vehicles?

The Geo Spatial data will help the autonomous vehicles to identify the shortest path, identify the objects, and communicate the geo spatial data to the next available autonomous vehicle. [8]

In the proposed methodology initially the entire geo spatial data will be collected from the existing resources like woldclim, terafly, usgc etc.., the data which is collected may be structured or un-structured or semi -structured.[24] Once the data has been received then the data will be store in the required format. Along with geo spatial data the help of Google maps will be taken into consideration to provide the required information for the autonomous vehicles.

5 Proposed Method

In the proposed methodology, the geospatial information of the vehicles will be recorded in live with respect to all the vehicles. And this data will be further used for peer to peer communication between the autonomous vehicles for better transportation and delay tolerance. In vehicular adhoc networks making vehicle to reach the destination is not important , the main thing here is how best the route has been selected to avoid traffic, natural disasters, unnecessary delays etc.., [6]

In the proposed research main concentration has been given based on the existing technologies, let us consider an example if an autonomous vehicle is passing between the source and destination like A & B. Most of the autonomous vehicles will follow Google Maps where the longitude and latitude information will be stored in the database. Same will be given access to autonomous vehicles to travel between the source and destination A & B. Here the

biggest problem is if an autonomous vehicle is travelling between the source and destination, if there is a huge traffic or some natural disaster happened in that way, it has to be communicated to the all autonomous vehicles coming in the same direction. More than this all autonomous vehicles should fall under one umbrella to communicate with each other for better transportation.[7]

6 Proposed Research

In the proposed research one virtual private network has been created with all autonomous vehicles which are travelling in a particular cluster. [2] Here each and every city will be treated as one cluster. If a new autonomous vehicles enters into this cluster it has to be approved by the admin which can be done automatically how a user joins new Wi-Fi network. Once it is approved the vehicle will be tracked till it leaves that particular cluster.[9-12]

Clustering Algorithm:

- Start
- Create Virtual Private Network
- Create Clusters based on the Longitude and Latitude of the City Limits in VPN.[2]
- Identify the default autonomous vehicles under this cluster.
- If New vehicle enters into this cluster
    - Check is it Genuine Vehicles based on default parameters.
    - If it is true
    - Allow vehicle to join the cluster
    - Start Tracking

Else

    - Disconnect the vehicles and send suspected information to nearby officials to take the action.

- Track each and every autonomous vehicle which is moving in the cluster
- Share the required information to the vehicles.
- Repeat the above steps every time till the autonomous vehicles reaches destination.
- Stop

So the above clustering algorithm helps the user to create cluster and identify the autonomous vehicles moving in that particular cluster.[2]

Each and every activity performed by the autonomous vehicle will be tracked from the server side which is connected with in VPN.[13-15] The VPN server has access to communicate with each and every vehicle. Say for example if an vehicles is moving between the Source and Destination , if there is a huge traffic at particular point or some natural disaster happened , if there is slow moving of traffic same information will be shared by the autonomous vehicle to the VPN server and same will be published to the all vehicles in that particular cluster . With this information the autonomous vehicles can opt for different path to reach the destination.[1]

Autonomous Vehicle Communication Algorithm

- Start
- Joined to Virtual Private Network of particular cluster.
- Travel towards the Destination.

- If Found Any Disturbance in the path
    - Communicate information to VPN server

  Else
    - Reach the Destination.
- Each and Every Vehicle is tracked in the cluster.
- End

Here the biggest challenge is how fast the autonomous vehicle will communicate to the Server and same will be published to the other vehicles.[21-23]

And how best the autonomous vehicles will understand the message, as they don't have IQ to understand.[1]

In order to avoid this issue the proposed research will follow some mnemonics to communicate effectively between the autonomous vehicles. These default mnemonics will be pre stored in each and every vehicle for comparison to take decision.[16-19]

Mnemonics:

Mnemonics are nothing but short codes used for the proper understanding and the fast communication.

Along with this mnemonics the longitude and latitude information will be passed to the vehicles. [20]

Mnemonic	**Description**	**Longitude**	**Latitude**

Table 1. Structure of Mnemonics

Instead of sending the entire data, just send only mnemonic code for easy understanding of the vehicles. Based on mnemonic code the final decision will be taken by the vehicles.[1]

Mnemonic	**Description**	**Longitude**	**Latitude**
M1	Huge Traffic	64.20001	64.3330
M2	Moderate Traffic	64.23123	65.0232
M3	Natural Disaster	62.03231	63.0202

Table 2. Sample Mnemonic

By considering all the above algorithms, it will be created as a protocol for better communication and reduce the delay in communicating between the vehicles. The all algorithms and mnemonics will be collected to create protocol for better communication between the vehicles.

Conclusion

Here in this proposed method the system will be built such a way that the autonomous vehicles will communicate with each other for better transportation. The vehicles will communicate with each other using VPN. The VPN plays vital role while communication information to the different vehicles.

Future Enhancement

In future the camera will be fixed for all the autonomous vehicles which would rotate 360^0 when there is a mnemonic received from particular vehicles immediately the live scenario will be observed from this camera to understand the scenario.

Word document can be used as a template for papers to be published in EAI Core Proceedings. Follow the text for further instructions on text formating, tables, figures, citations and references.

References

[1] Pampapathi, B.M., Nageswara Guptha, M. & Hema, M.S. Data distribution and secure data transmission using IANFIS and MECC in IoT. J Ambient Intell Human Comput (2021). https://doi.org/10.1007/s12652-020-02792-4

[2] Maheshprabhu R, Hema,Srilatha Chepure, Nageswara Guptha, M. Logistics Optimization in Supply Chain Management using Clustering Algorithms Scalable Computing : Practice and Experience 2020,21,107-114

[3] D. Schrank, B. Eisele, and T. Lomax, "TTI's 2012 urban mobility report," Texas A&M Transportation Institute The Texas A&M University System, December 2012 (Web Link)

[4] G. Yannis et al., "Traffic safety basic facts 2012: Single Vehicle accidents," European Commission, European Road Safety Observation, Brussels, Belgium, 2013 (Web Link)

[5] J. Miller, "Vehicle-to-Vehicle-to-Infrastructure (V2V2I) intelligent transportation system architecture," in Proceedings of IEEE Intelligent Vehicle Symposium, 2008, pp. 715–720. (Conference)

[6] V. Milanés, J. Pérez, E. Onieva, and C. González, "Controller for urban intersections based on wireless communications and fuzzy logic," IEEE Intelligent Transportation Systems, vol. 11, no. 1, pp. 243–248, Mar. 2010 (Journal)

[7] K. Liu and V. Lee, "Adaptive data dissemination for time-constrained messages in dynamic vehicular networks," Transportation Research Part C: Emerging Technology, vol. 21, no. 1, pp. 214–229, Apr. 2012. (Journal)

[8] S. D. Gupta, Y. P. Fallah, and S. E. Shladover, "Sharing Vehicle and infrastructure intelligence for assisted intersection safety," in Proceedings of 2011 IEEE 22nd International Symposium on Personal, Indoor and Mobile Radio Communications, pp. 767–771. (Conference)

[9] J. A. Misener and S. E. Shladover, "Path investigations in Vehicle-roadside cooperation and safety: A foundation for safety and Vehicle-infrastructure integration research," Proceedings of the IEEE Intelligent Transportation Systems Conference 2006 Pages 9–16. (Conference)

[10] M. Khabazian, M. Mehmet-Ali, and S. Aissa, "Analysis of continuous communication availability in vehicular ad hoc networks," IEEE System Journal, vol. 7, no. 1, pp. 137–150, Mar. 2013. (Journal)

[11] P. Mirchandani and F.-Y. Wang, "RHODES to intelligent transportation systems," IEEE Intelligent System, vol. 20, no. 1, pp. 10–15, Jan/Feb. 2005. (Journal)

[12] "First electric traffic signal installed," History.com. [Online]. Available: (Web Link)

[13] K. M. Dresner and P. Stone, "A multiagent approach to autonomous intersection management," Journal of Artificial Intelligence Research, vol. 31, no. 1, pp. 591–656, Mar. 2008. (Journal)

[14] L. Li and F.-Y. Wang, "Cooperative driving at blind crossings using interVehicle communication," IEEE Transaction Vehicluar. Technology, vol. 55, no. 6, pp. 1712–1724, Nov. 2006. (Journal)

[15] M. R. Hafner, D. Cunningham, L. Caminiti, and D. Del Vecchio, "Cooperative collision avoidance at intersections: Algorithms and experiments," IEEE Transaction Intelligent Transportation Systems, vol. 14, no. 3, pp. 1162–1175, Sep. 2013. (Journal)

[16] M. R. Hafner and D. Del Vecchio, “Computational tools for the safety control of a class of piecewise continuous systems with imperfect information on a partial order,” SIAM Journal on Control and Optimization, vol. 49, no. 6, pp. 2463–2493, Nov. 2011. (Journal)
[17] H. Kowshik, D. Caveney, and P. Kumar, “Provable systemwide safety in intelligent intersections,” IEEE Transactions on Vehicular Technology, VOL. 60, NO. 3, MARCH 2011. (Journal)
[18] Jia Wu, A. Abbas-Turki, and A. El Moudni, “Cooperative driving: An ant colony system for autonomous intersection management,” Applied Intelligence, vol. 37, no. 2, pp. 207–222, Sep. 2012. (Journal)
[19] J. Lee and B. Park, “Development and evaluation of a cooperative vehicle intersection control algorithm under the connected vehicles environment,” IEEE Transaction Intelligent Transportation System, vol. 13, no. 1, pp. 81–90, Mar. 2012. (Journal)
[20] J. Lee, B. B. Park, K. Malakorn, and J. J. So, “Sustainability assessments of cooperative Vehicle intersection control at an urban corridor,” Transportation Research Part C: Emerging Technology, Vol. 32, July 2013, Pages 193-206. (Journal)
[21] L. Makarem and D. Gillet, “Model predictive coordination of autonomous Vehicle crossing intersections,” Proceedings of the 16th International IEEE Annual Conference on Intelligent Transportation Systems (ITSC 2013), The Hague, The Netherlands, October 6-9, 2013. (Conference)
[22] M. Kamal, J. Imura, T. Hayakawa, A. Ohata, and K. Aihara, “A Vehicle intersection coordination scheme for smooth flows of traffic without using traffic lights,” IEEE Transaction Intelligent Transportation Systems, VOL. 16, NO. 3, JUNE 2015. (Journal)
[23] Junqing Wei, John M. Dolan and Bakhtiar Litkouhi. “Autonomous Vehicle Social Behavior for Highway Entrance Ramp Management,” 2013 IEEE Intelligent Vehicles Symposium (IV) June 23-26, 2013, Gold Coast, Australia (Journal)
[24] Junko Yoshida. 2016. Autopilot: Flying vs. Driving. Can lessons learned from aviation apply to cars? EE Times. Retrieved December 10, 2016 from (Web Link)

Energy-Efficient and Lossless Routing Scheme for Fire Detection in Wireless Sensor Networks

B.Padmavathi[1], N.kapileswar[2], Devalla pravista sai teja[3], Vijayakumar serena rajam[4], Dr.Polasi Phani kumar[5]
{padhmavb@srmist.edu.in[1], kapilesn@srmist.edu.in[2], ds7324@srmist.edu.in[3], vr3206@srmist.edu.in[4], phanikup@srmist.edu.in[5]}

Department of Electronics and Communication Engineering, SRM Institute of Science & Technology, Chennai, Tamilnadu, India.[1-5]

Abstract. A fire detection system is one of the primary needs in forests, commercial and residential buildings. Fire detection is done using either wire-based systems or Wireless Sensor Networks (WSNs). In general, the Wireless Sensor Networks are preferred as they are faster and more accurate than the wire based fire detection systems. In Wireless Sensor Networks the fire detection can be done using various routing systems like the Wireless Fidelity (Wi-Fi), Low Power Wide Area Network (LPWAN), Wireless Metal Insulator Transition (MIT) network etc. We have adopted the Node centric lossless routing scheme which increases the load balance and minimizes the delay of relay data over the sensors to the base station using an Energy-Efficient Multilevel and Distance aware Clustering (EEMDC) for Wireless Sensor Networks. Generally, it is done using Hybrid Energy Efficient Distributive (HEED) protocol and Low-Energy Adaptive Clustering Hierarchy (LEACH) protocols. It has drawbacks with the energy levels and relaying of data. The proposed technique involves lossless and energy efficient schemes for data transmission. It uses General Self-Organized Tree-based Energy Balance (GSTEB) routing protocol, which can alter the root and renew the routing tree with a bit of delay and with consumption of less energy. Distance-Energy Cluster Structure Algorithm (DECSA) has the ability to reduce the communication complexities. Therefore, a stable and balanced load is achieved than LEACH and HEED protocols.

Keywords: Wireless Sensor Network, Fire Detection, General Self-Organized Tree-based Energy Balance (GSTEB), Loss rate, Efficiency, Delay, Throughput, Efficient Low Duty Cycle (ELDC)..

1 Introduction

This

Fire accident is one of the most dangerous and biggest disasters. It is frequent and a powerful debacle. It obliterates properties and imperils individuals' lives. Thus, detecting a fire and putting it off is very important. This is where the fire detection system plays a major role. The traditional fire detection systems are wired based and thus have limited cable transmission distance. They also have problems in installation, construction, expansion and maintenance costs [1]. Wireless communication provides resolution to these above cited problems.

Wireless Sensor Networks (WSNs) are being used in almost all the industry these days. They are widely used in places where wired cables are ineffective and in open spaces. For

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example, monitoring a residential area or an open space for fire or smoke, medical industry, traffic control, automation, etc. They have higher mobility, flexibility and easier to install and maintain [2]. It records the environmental data with the help of small and cheap sensing nodes in it [3]. The main problem with WSN are the energy consumption and delay in relaying of data. This becomes complicated as we move on to the higher number of nodes. In WSN the energy efficiency plays a vital role as most of the sensor networks have this limitation. Increasing the performance of energy usage and extending the network life of such networks have been a long-time problem [4]. WSN with a good routing protocol will help in decreasing the consumption of node energy as its energy efficiency is limited [5]. WSN is very eminent in collecting data in collaborative method, like the embedded system and sensors are integrated foe collaborative data collection. This mainly depends on network's energy efficiency, lifespan and how balanced the network is. If the nodes have low energy the data collection and dissemination cannot be carried out. Improving the residual energy can improve the network [6].

Our proposed system overcomes all these drawbacks as it is energy efficient and has a robust routing system. This network is highly reliable and adjusting to the environment. The problem is that the sensor nodes cannot be charged again so its durability/ longevity should be high. Monitoring industrial areas require higher number of nodes as the area is usually large. The more the number of nodes higher is the accuracy of the fire detection and prevention. Surveys have proved that group networks are beneficial like the cluster networks [7]. Cluster networks play a vital role in WSNs as they make the network energy efficiency and expand the lifetime of the network. Basically, nodes are mainly two types, Low Energy Sensor Nodes (LESN) and Higher Energy Sensor Nodes (HESN). Based on the type of nodes, it will contain HESN [8]. The communication takes place by dividing the clusters into groups [9, 10]. It has three phases that are Cluster Setup Phase, Cluster Head Selection and Phase Communication Phase.

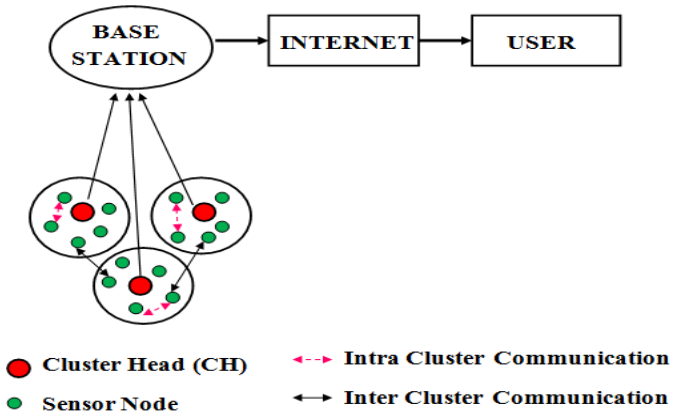

Fig. 1. Communication of cluster networks

Fig. 1 interprets the general communication of the cluster network that is the communication between the CH, sensor node, base station, intra and inter cluster communication. Group networks have their unique ID and the middle node is selected. Each node keeps transferring the data towards the target node. The nodes at the border help communicate with the other groups. Routing protocols might differ grouped to the group.

Communication takes place from base station to other clusters through cluster head. The selection of cluster head is done by looking at the left out residual energy [11]. In this the Energy Hole Problem arises as the cluster head is closer to the base head and it loses its energy faster due to heavy traffic there. This problem can be overcome by developing an intelligent [12] and highly efficient device that can overcome these problems and work accurately in all conditions [13].

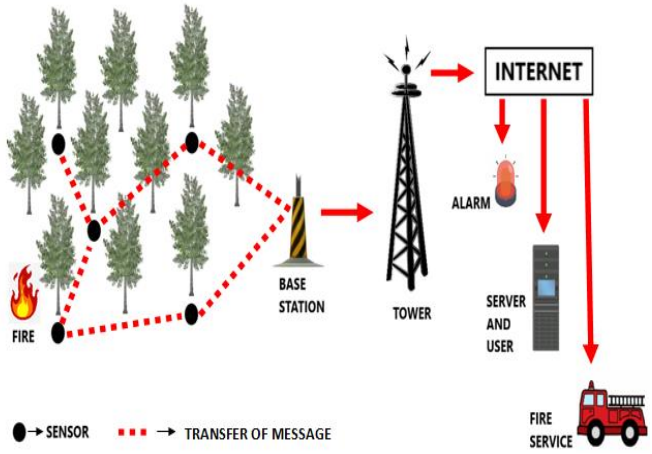

Fig. 2. Fire detection through WSNs

Fig. 2 depicts the general fire detection process through WSNs. We have proposed and implemented Energy Efficient Unequal Clustering (EEUC). This has no cluster heads and the sensor nodes of the duty cycle are changed in order to save energy. This technique works based on the pair of queues.

The rest of the paper is organized as follows. Section II provides the review of related works. Section III describes the proposed protocol and designed steps in the flow chart. Section IV inflicts the experimental results and discussions. Section V concludes the paper and references are mentioned at the end.

2 Related Works

The related works mentioned below depicts the Wireless Sensor Networks (WSN) and fire detection systems using different protocols which has enhanced Accuracy rate, Response time, Safety measures, Algorithms and other factors involved.

Adnan, et.al, [14] proposed a LoRa mesh network based forest fire detector. It was designed using DHT 11 and MQ2 sensor, Arduino Uno and LoRa modules. This device was able to transfer information to about 500m and the RSSI received was -136dbm in a closed space, but was able to transfer the data only partially in an open space. This model was able to cover about 10 hectares with only 4 LoRa modules along with 4 nodes to avoid data collisions. Dyan Quel. R, et.al, [15] developed a fire detection system for outdoor residential areas. The system was constructed by using ionization smoke sensors, GPS module [16], GSM module, Zig Bee module, ATmega328P and temperature sensor. It works within the area it has been programmed and sends alert messages to the concerned people on the detection of smoke or fire. Apart from this it also records the details of the fire accident automatically in excel file.

Alexander [17] built a model for crown fire, which is more severe than the surface fire. The device would first detect the type of fire, that is, if its surface or crown fire, if its surface fire there is an increase in amplitude to lower frequency and if its crown fire a Gaussian trend line is formed and its frequency is from 250 to 450 Hz. In the same way for the other types of fire a unique trend line is formed. Through this device totally 9 types of forest fires can be detected based on its unique trend line. Spectral analysis was done with 15 records and was found to be successful. This system adds on as a feather to the existing fire detection WSN system.

P.J.Y. Piera [18] developed a model for fire detection and alarm system (FDAS) to overcome the drawbacks of existing wired FDAS. It was built using a fire alarm control panel, detection and fire alarm node. They built a wireless transceiver using XBee, which makes the device flexible and has an automatic mesh network. Lab View is its control panel and it is controlled by an algorithm. A network of nodes connect and work within the programmed range and also cluster-tree automatically. LabView based GUI detects fire and takes care of the alarm. It was implemented successfully and the response time was under 10 seconds, the fastest being 0.8985 seconds and slowest being 5.018 seconds.

K. Pandey [19] suggested a WSN for early detection of fire based on Boolean-Poisson model. They worked on Poisson point process (PPP), sensor density and also the effect of wind velocity on it. The implementation and result of this model proved that the wind doesn't necessarily interrupt the fire detection, but the fire detection probability in fact increases because of wind. Shuxin Zhong [20] proposed a device for fire detection and alarm system called Wi-Fire for closed environment. This model overcomes the resultant phase and amplitude difference of Channel State Information (CSI) due to the wireless signal transmission. The CSI of RF signal was used in enhancing and improving Wi-Fire. This detects fire through radio propagation. This is carried on by data processing and extraction. This was implemented and tested, the accuracy rate was found to be 96.97%.

Ferry [21] proposed a WSN based model for fire detection and home monitoring. It was built using Carbon Monoxide, temperature, humidity, air and smoke sensors. This is completely based on fire accident probability detection. If the fire accident probability goes high it automatically sends messages to the concerned person, turns on the alarm and also unlocks the house doors automatically. This was implemented, tried and tested. It was found to be quite accurate, though it had an error of only 0.3% in probability detection. Apart from this it had a problem with the algorithm and it gets restricted in open space.

E. S. Sasmita [22] proposed a model for early fire detection. It was based on Flame Sensor Module, which detects fire and it was integrated with GPS HAT which uses radio frequency to transmit data along with LoRa module. These all were further integrated with Raspberry pi. This was made as a prototype for fire detection. Information exchange for the fire detection was done through data coordinates of GPS and was sent to LoRa module. This model can also be used in disaster recovery as well. This was found to be useful, but the drawbacks being inability to send the digital location and the area of coverage.

Jimin Son [23] endeavored a Wireless Metal Insulator Transition (MIT) Fire and Alarm System to overcome the problem of high power consumption. The main components used were Critical Temperature Switch (CTS), Bluetooth low energy beacons and Microcontroller Unit (MCU). The key element being the CTS in the module. If the fire is detected CTS is shifted to low resistance and it further controls the MCU for the alarm. As the CTS activates MCU only when the fire is detected, this leads to a saving a huge amount of energy. This differentiates it from the present WSN fire detectors. Its working is completely monitored by the web pages.

Oxsy Giandi [24] proposed a method to detect the fire and its appearance. Prediction and detection were made by the concentration of the gas leak. Data from LPG was used to detect and predict fire based on the concentration of the gas leak and the alarm would be sounded accordingly. For the fire type detection fuzzy system was used to fuse the smoke and CO data with the help of humidity and temperature sensor. The drawback of this system was MFC was not for real time use as it was slow in reading the data sent to it.

S. R. Vijayalakshmi [25] developed a system which scans the input video data and detects the fire. The main principle used was Digital Image Processing and Programming and embedded vision [26]. In the video first the frame is detected and frame conversion takes place, then the colour detection of smoke and fire takes place, then motion detection is followed by special analysis. The fake fire regions are also removed. If the fire is detected and the time interval is more than the threshold, then the alarm is activated. This method is faster to detect fire and also fully automatic in closed open space. The drawback being a bit of accuracy.

S. Wilson [27] conducted a survey on the accidents caused due to fire and its effects. They proposed a vision based fire detection system as it was found to be more accurate while the existing fire detectors, smoke detectors and wired detectors were found to be inaccurate and high false alarm rate. The vision-based fire detection system helps real-time fire detection due to the analyses of the live video footage. HSV and YCbCr have been used for fire color detection apart from this texture, shape, intensity and motion are also detected by it. This method when stimulated was found to be more effective than the existing system.

Shixiao Wu [28] proposed a method for forest fire detection called as a classical objective detection. They analyzed three methods of forest fire, namely R-CNN, SSD and YOLO. Out of these three methods SSD was found to be accurate and better than the other two. It had higher accuracy of fire detection and had lesser chances of false alarms. The fire was detected using 4 coordinates of SSD. Using these coordinates the frame interval is calculated and fire is detected. Muhammad. S [29] proposed a rescue system for fire accident detection. This system was designed with Arduino microcontroller, camera, smoke sensor and buzzer. In this proposed method data is collected from the camera and smoke sensors. These data are forwarded to the monitoring system which is a wireless system. This technique accurately predicts the fire and the rescue operation can be done at the earliest. Additionally, it also provides images of the accident site with the help of the image sensor.

S. Vancin [30] compared the algorithm of SEED (sleep-wake energy balanced distributed) with the existing homogeneous and heterogeneous clustering networks like LEACH, SEP, PEGASIS, CEEC, DEEC and mod-LEACH. The comparison and survey were done based on the alive nodes and their communication with the base station. This was done to check which clustering method was more accurate, energy-efficient, reliable and robust than the other clustering methods. All these methods were stimulated and compared in MATLAB. The results suggested that SEED had its peak when compared to the other methods. SEED proved to be advantageous due to its prolonged lifetime and less energy consumption.

Xu Jia [31] proposed a WSN based hierarchical software clustering algorithm. The cluster heads of each group along with the base heads are standardized. Metric algorithms are programmed at nodes for cluster security and accuracy. Stimulation analysis checked the rationality and accuracy. It was done with traditional algorithm and the newly designed algorithm along with the environmental parameters. The error rate, change in frequency of cluster head cluster, detection time and safety of algorithms is compared and the output graph is drawn. The error in tradition method was found to be between 40%-90%, while that the newly designed software method was found to be 15%-30%. Thus, this analysis proved that

the WSN based hierarchical software clustering algorithm is more effective, accurate and can work better than the traditional algorithm. This leads to better performance of the network operation along with high safety.

S. K. M. Yendamuri [32] proposed for a three layer clustering approach rather than the existing two layers clustering approach to enhance the system and to overcome the drawbacks. For head selection at a lower level a dispersed hierarchical approach was deployed. Additionally, grid nodes were deployed for the communication with the base heads and the sensor nodes. This method was an extended version of LEACH called as EHCA. By default the GH were initialized. The second layer of GH played a vital role in transmitting messages to the first layer of CH and the second layer of base heads. This process reduced the total energy required, thus saving the energy. This leads to increased lifetime of the network. Therefore the stimulation proved to be successful for large networks, making them efficient and accurate along with the increased life.

M. Z. Masoud [33] proposed a Hybrid Clustering Routing Protocol (HCP) which consists of power module of LEACH and the cluster head selection protocol. It is a two phase protocol. The first phase selects the cluster heads and the second phase is responsible for clearing the traffic towards the target according to the threshold energy. In this process some end up forming clusters while some don't form clusters. This HCP uses the new proposed algorithm CoN for calculating the threshold value. HCP, LEACH and LEACH-T protocols were stimulated in MATLAB and their results were compared. The results proved that the proposed HCP is better than the LEACH and LEACH-T protocol as it increased the life span by 30% and reduced the energy consumption.

Jie Huang [34] proposed a multi cluster head routing system based algorithm. This method works by dividing the WSNs into clusters where the integration of data is carried out by the assistant cluster head node. It enhances the energy efficiency, which decreases the number of death nodes, hence increasing the lifespan of the network. It is a good method for realization too. For routing algorithm, it stimulates and analyzes the cluster head system. Stimulation is done based on the number of live nodes and the time of the network. The experimental analyzes and results proved that this multi cluster head algorithm was able to balance the energy with the number of nodes better. It made the network balanced, energy efficient [35] and stable.

3 Proposed Methodology

We proposed a protocol that is advanced to improve efficiency in broadcasting the signal to the target station. This protocol increases the network lifetime and less output delay in balancing load. The overview of the proposed protocol has been provided below.

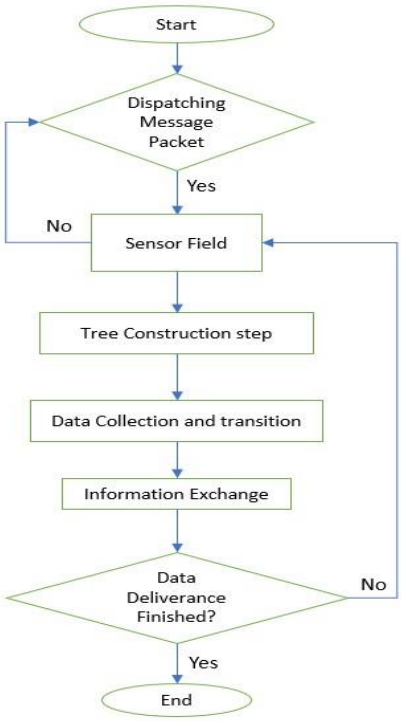

Fig. 3. Flow procedure for fire detection using GSTEB protocol

The primary goal of General Self-Organized Tree-based Energy Balance routing protocol (GSTEB) is to attain a high abundant network lifetime for different applications. It can mitigate the root and causes slight delay and modest energy utilization by remodeling the routing tree. Thus a well-balanced load is achieved distinguished with the protocols like HEED, LEACH. So, GSTEB is a self-assembled protocol that utilizes a small extent of energy.

General Self-Organized Tree-Based Energy-Balance (GSTEB) Routing Protocol is used for Wireless Sensor Networks (WSN). It can lower the whole vitality consumption and stabilize the load on WNS. In this protocol, Data Fusion takes place as individual node transmit uniform data instead of how much data gathered from its sub branches. By using this protocol, the lifetime can be increased and finally the data will be sent to the Base Station (BS).

Fig. 3 explicates that at the beginning, the cluster heads start rotating. The message packets dispatch into the sensor field. The sensor nodes accumulate the data from the base station. In the tree construction stage, the nodes start subdividing into groups and extend themselves to transfer the data. The groups comprise of message packet and collect the data from nodes, thereby information will be exchanged. Thus, the data will be passed to the required target station. If the data deliverance is not effectuated in between the medium, it turns back to the sensor field. So, it completes the entire process and reaches to destination with better throughput and packet delivery.

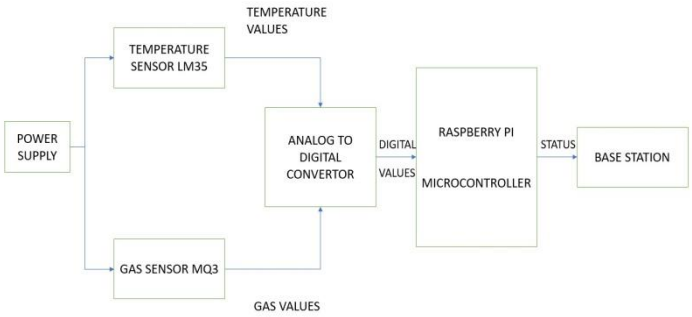

Fig. 4. Fire Detection using WSN

The above diagram Fig. 4 explains the process flow of the proposed protocol. The power supply sends the current to the temperature sensor and gas sensor. Mainly the gas sensor detects the gas and generates an emf by changing resistance. The temperature sensor identifies the temperature present in the atmosphere and converts the data into binary form. The values will be measured on analog to digital converter. The digital values are passed into the microcontroller. The Raspberry Pi Microcontroller has a clock frequency of 1.2GHz, which improves the speed and a Processor of 64-bit quad-core ARM Cortex-A53.Hence, the base station current status will be obtained and known.

4 Results and Discussions

We are discussing our protocol in detail by considering the parameters Loss Ratio, Delay, Drop node, Protocol efficiency, Throughput for evaluation. Loss Ratio is usually defined in packets. When one or more packets of information fail to move from end to another end called as Packet Loss. Basically, it happens due to fallacy in transmission of data. This is majorly caused due to Interference in frequencies of signals. If two sources are placed together, one will face heavy loss of data packets. Even in Communication signals there will be lots of packet loss. This is caused by Bit Error Rate (BER).

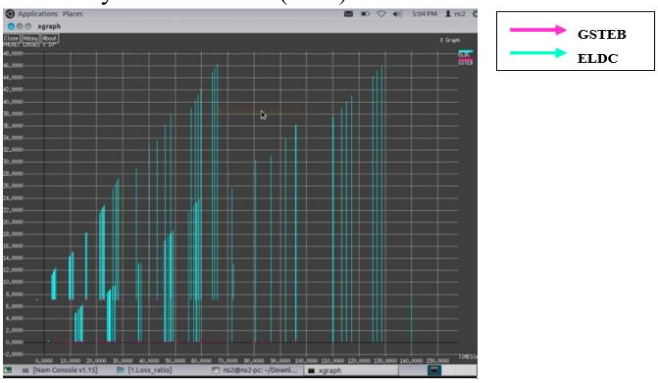

Fig. 5. Loss Ratio Output

The above Fig. 5 shows the relationship between and time and Loss and the difference between loss parameter between the EDLC and GSTEB protocol where the red line indicates

the GSTEB and green line indicates ELDC. It is evident that loss is reduced by using GSTEB protocol.

Delay is the time taken to operate certain packets of data. In depth we can say that the packet travelling from one node to another node and finally gets reset at destination is known as delay (1). There are many types of delays involved in operating the data packets. Loss of data packets depends on the buffer and finally it affects the network performance. Mainly transmission delay plays a major role in transmitting packets to the medium.

$$d_{Nodal} = d_{Proc} + d_{Queue} + d_{Tran} + d_{Prop} \qquad (1)$$

Fig. 6 shows the relationship between and time and delay and difference in the delay parameter between the EDLC and GSTEB protocol where the red line indicates the GSTEB and green line indicates ELDC. It is evident that the delay is reduced by using GSTEB protocol.

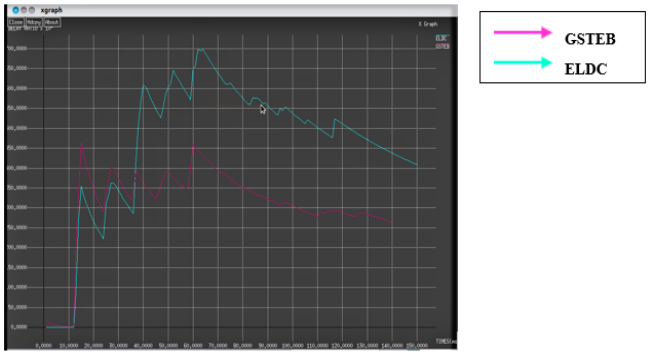

Fig. 6. Delay Output

The corresponding location within the sensors and sink at the end to end delay will be vigorous accompanying with cluster heads 'resource allocations. The data packets are transferred to an extreme delay area unit born in the real-time traffic. The timeline sharing of every CH for native and inter-cluster traffic transmissions are provided. They are associated with nursing analytical model, which are created from entirely different clusters and manifested to search out the dissemination of the end-to-end transmission delay for packets. Thus the packet drop rate is plagiarized from the outcome.

Later, a tentative theme is mapped out to put together notice the timeline allocations of all the CHs during a WSN to realize the minimum and the balanced packet drop rate for traffic originated. Simulation result area unit given to examine and prove the analysis and potency of the designed CH timeline share them.

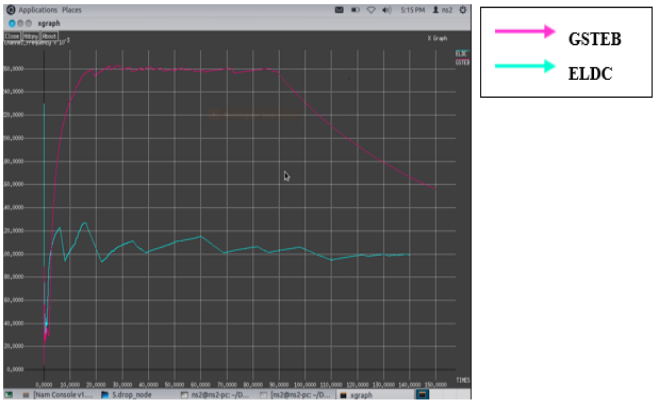

Fig. 7. Drop Node Output

Fig. 7 shows the relationship between and time and drop node parameter and the difference between drop node parameter between the EDLC and GSTEB protocol where the red line indicates the GSTEB and green line indicates ELDC. It is evident that drop node parameter is reduced by using GSTEB protocol.

Efficiency (2) was examined for different packet sizes as well as different transaction setups. Analysis was performed on a transaction base and Substantial humiliation in protocol efficiency. The efficiency calculation based on the below parameters.

$$E_{ff} = \frac{ND}{TrD * NDR} \qquad (2)$$

ND = Amount of Network Data*60, 400- and 1500-bytes Data Packets
TrD = Transaction duration
*DFC (Data-Ack and RTS-CTS-Data-Ack)
*PCF (CF-Poll{+Data}-CF-Ack{+Data})
NDR = Nominal Data Rate
*2Mbps, 11Mbps, 24Mbps and 54Mbps

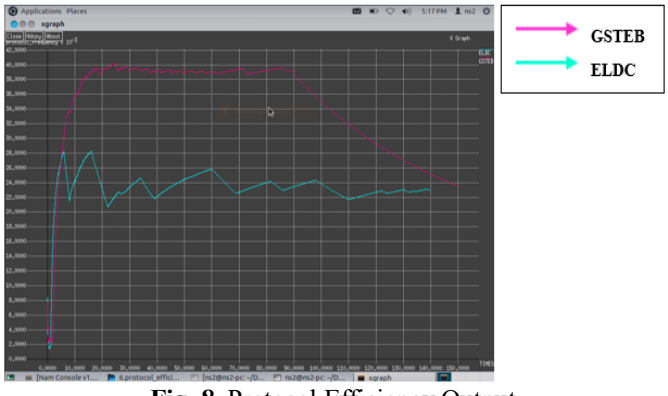

Fig. 8. Protocol Efficiency Output

The above Fig. 8 shows the relationship between and time and protocol efficiency and the difference between protocol efficiency between the EDLC and GSTEB protocol where the red line indicates the GSTEB and green line indicates ELDC. The designed protocol achieves

98.90% efficiency, utilization respectively, over the ELDC. It is evident that protocol efficiency is enhanced by using GSTEB protocol.

Throughput is the rate of the message that is successfully delivered over a communication medium. It is expressed in Bits per Second (bps). It is the data transmitted over a unit of time and data passing through a medium. The estimated maximum throughput will be shorter at the layer above it, because every layer appends a protocol for assigned maximum throughput at a lower layer.

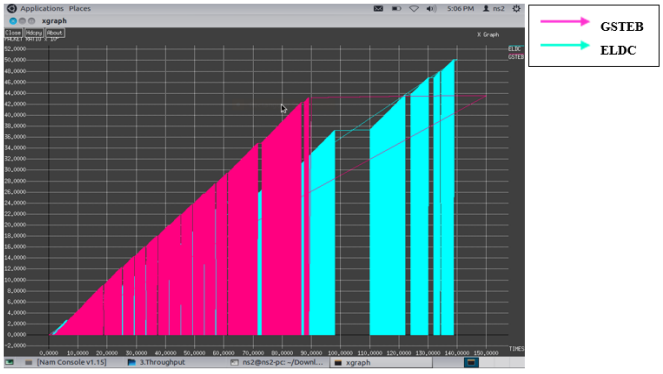

Fig. 9. Throughput Output

Fig. 9 shows the relationship between and time and throughput and difference between throughput between the EDLC and GSTEB protocol where the red line indicates the GSTEB and green line indicates ELDC. The throughput achieved for the GSTEB Protocol is 355.56Kbps over ELDC. It is evident that throughput is enhanced by using GSTEB protocol.

Conclusion

Thus, the system with DECSA protocol along with GSTEB protocol for fire detection based on WSN to overcome the delay of relay data, decreases energy consumption and increases the stability of the system. DECSA decreases the interfacing difficulties and GSTEB protocol enhances the network lifetime and makes the load more balanced. Also, the increased number of nodes enhances the efficiency.

We simulated the GSTEB and ELDC protocol in the software and analyzed the results of the proposed system which proved that the loss ratio, delay and drop node was lower in GSTEB protocol when compared to the ELDC protocol. Also, the GSTEB protocol achieved 98.90% efficiency and 355.56 Kbps throughput over the ELDC protocol. Thus the efficiency and throughput are enhanced in GSTEB protocol. Therefore, the results show that the proposed algorithm and protocol overcomes the drawbacks and proves to be more stable and balanced than LEACH and HEED protocols. However, the results have been stimulated and studied only for the static environment. The dynamic environment will be considered and worked on in the future.

References

[1] L. Huang, H. Chang, C. Chen, and C. Kuo, “A ZigBee-based monitoring and protection system for building electrical safety,” *Elsevier Energy and Buildings,* Vol.43, no.6, pp. 1418-1426, Jun. 2011.

[2] K. Nellore, and G.P. Hancke, "A survey on urban traffic management system using wireless sensor networks," *Sensors*, Vol. 16, no. 2, pp. 1-25, Jan. 2016.

[3] L. Peng, et.al. "Research on data privacy protection algorithm with homomorphism mechanism based on redundant slice technology in wireless sensor networks", *China Communications, Vol. 16, no.5, pp. 158-170, Jun* 2019

[4] J Hao, G. Guan, B. Zhang, and C. Li, "An Energy-Efficient On-Demand Multicast Routing Protocol for Wireless Ad Hoc and Sensor Networks", *IEEE International conference on Global Communications*, pp. 4650-4655, Dec. 2013.

[5] C. Jiang, Y. Ren, Y. Zhou, and H. Zhang, "Low-energy Consumption Uneven Clustering Routing Protocol for Wireless sensor Networks," *8th IEEE International Conference on Intelligent Human-Machine Systems and Cybernetics,* pp.187-190, Aug. 2016.

[6] A. Aalavandhar, and A. Arjunan, "A Comparative Study of Different Cluster Mechanism for Wireless Sensor Networks," *Proceedings of the Third IEEE International Conference on Electronics Communication and Aerospace Technology,* pp. 781-785, Apr. 2019

[7] M. Garcia, S. Sendra, J. Lloret, and A. Canovas, "Saving energy and improving communications using cooperative group-based wireless sensor networks," *Telecommunication Systems*," Vol.52, no.4, pp. 2489-2502, Apr.2013.

[8] S. Misra, and R. Kumar, "A Literature Survey on Various Clustering Approaches in Wireless Sensor Network," *IEEE 2nd International Conference on Communication, Control and Intelligent Systems,* pp.18-22, Mar. 2017.

[9] S. Soniiand, and B. Dey, "Dynamic Selection of Cluster Head in Cluster of Cluster Heads within the Cluster in Heterogeneous Wireless Sensor Network", *IEEE International Conference on Advanced Communication Control and Computing Technologies (ICACCCT),* pp. 877-881, Jan. 2015.

[10] S.K. Gottapu, et.al. "Maximizing cognitive radio networks throughput using limited historical behavior of primary users," *IEEE Access*, Vol. 6, pp. 12252-12259, Mar. 2018.

[11] M. Garcia, S. Sendra, J. Lloret, and A. Canovas, "Saving energy with cooperative group-based wireless sensor networks, International Conference on Cooperative Design", *Cooperative Design, Visualization, and Engineering*, pp. 73-76, 2010.

[12] K. Nellore, and G.P. Hancke, "Traffic management for emergency vehicle priority based on visual sensing," *Sensors,* Vol. 16, no. 11, pp. 1-22, Nov. 2016.

[13] E. Klaoudatou, E. Konstantinou, G. Kambourakis, and S. Gritzalis, "A survey on cluster-based group key agreement protocols for WSNs," *IEEE Communications Surveys & Tutorials*, Vol.13, no.3, pp. 429-44, July. 2010

[14] A.E.U. Salam, A. Arifin, and M. Rizhal, "Forest Fire Detection using LoRa Wireless Mesh Topology", *The 2nd East Indonesia Conference on Computer and Information Technology,* pp. 184-187, Oct. 2019.

[15] D.Q.R Elizalde, R.J.P. Garcia, M.M.S. Mitra, and R.G. Maramba, "Wireless Automated Fire Detection System on Utility Posts Using ATmega328P," *IEEE 10th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM),* pp. 1-5, Mar. 2019.

[16] P. Shivam, et.al, "Socio-medic Drone with Integrated Defibrillator," *In Micro-Electronics and Telecommunication Engineering*, pp. 659-668. Springer, Singapore, 2020.

[17] A.A. Khamukhin, and S. Bertoldo, "Spectral Analysis of Forest Fire Noise for Early Detection using Wireless Sensor Networks", *International Siberian Conference on Control and Communications (SIBCON),* pp. 1-4, Jun.2016

[18] P.J.Y. Piera and J.K.G. Salva, "A Wireless Sensor Network for Fire Detection and Alarm System," *7th International Conference on Information and Communication Technology (ICoICT),* pp. 1-5, Sep.2019.

[19] K. Pandey, and A. Gupta, "Modelling and Analysis of Wildfire Detection using Wireless Sensor Network with Poisson Deployment," *IEEE International Conference on Advanced Networks And Telecommunication Systems (ANTS),* pp. 1-6, 2018.

[20] S. Zhong, Y. Huang, R. Ruby, L. Wang, Y. Qiu, and K. Wu, "Wi-Fire: Device-free Fire Detection using WiFi Networks," *IEEE International Conference on Communications (ICC)*, pp. 1-6, Jul.2017
[21] F. A. Saputra, et.al. "Prototype of Early Fire Detection System for Home Monitoring Based on Wireless Sensor Network," *International Electronics Symposium on Engineering Technology and Applications (IES-ETA),* pp. 39-44, Dec. 2017.
[22] E.S. Sasmita, M. Rosmiati, and M.F. Rizal, "Integrating Forest Fire Detection with Wireless Sensor Network Based on Long Range Radio," *International Conference on Control, Electronics, Renewable Energy and Communications (ICCEREC),* pp. 222-225, May 2019.
[23] J. Son, et.al. "Ultralow Power Wireless-Fire-Alarm-System using a VO2-Based Metal-Insulator-Transition Device," *16th Annual IEEE International Conference on Sensing, Communication, and Networking (SECON),* pp. 1-2, Sep.2019
[24] O. Giandi, and R. Sarno, "Prototype of fire symptom detection", *International Conference on Information and Communications Technology,* pp. 489-494, Mar 2018.
[25] S.R. Vijayalakshmi, and S. Muruganand, "Fire alarm based on spatial temporal analysis of fire in video," *Proceedings of the Second International Conference on Inventive Systems and Control (ICISC 2018),* pp. 104-109, 28 Jun.2018.
[26] B. Akhıl, et al. "A Smartphone Controlled Fertilizing and Plant Watering Garduino," *International Journal of Applied Mathematics Electronics and Computers,* Vol. 8, no. 4, pp. 173-178, Dec 2020.
[27] S. Wilson, et.al. "A Comprehensive Study on Fire Detection", *Proc. IEEE Conference on Emerging Devices and Smart Systems (ICEDSS 2018),* pp. 242-246, Nov. 2018.
[28] S. Wu, and L .Zhang, "Using Popular Object Detection Methods for Real Time Forest Fire Detection," *11th International Symposium on Computational Intelligence and Design*, pp. 280-284, 25 Apr. 2019.
[29] M.S.A. Azmil, et.al. "Wireless Fire Detection Monitoring System for Fire and Rescue Application," *IEEE 11th International Colloquium on Signal Processing & its Applications (CSPA),* pp. 84-89, 27 Aug. 2015.
[30] S. Vancin, and E. Erdem, "Performance Analysis of the Energy Efficient Clustering Models in Wireless Sensor Networks," *24th IEEE International Conference on Electronics, Circuits and Systems (ICECS),* pp. 247-251, 15 Feb. 2018.
[31] X.Jia, and G.Yang, "Research on Hierarchical Software Clustering Algorithm Based on Wireless Network", *International Conference on Computer Network, Electronic and Automation (ICCNEA),* pp. 284-290, 28 Nov.2019.
[32] S.K.M. Yendamuri, et.al. "An Improved Three-Layer Clustering Hierarchy for Wireless Sensor Networks: A Proposed Framework," *9th International Conference on Computing, Communication and Networking Technologies (ICCCNT)*, pp. 1-6, Jul. 2018.
[33] M.Z. Masoud, et.al. "To Cluster or Not to Cluster: A Hybrid Clustering Protocol for WSN," *IEEE Jordan International Joint Conference on Electrical Engineering and Information Technology (JEEIT),* pp. 678-682, May. 2019.
[34] J. Huang, "Research on Balanced Energy Consumption of Wireless Sensor Network Nodes Based on Clustering Algorithm", *International Conference on Computer Network, Electronic and Automation*, pp. 300-304, Dec.2017.
[35] K. Nellore, et.al, "A fast information dissemination system for emergency services over vehicular ad hoc networks," *IEEE International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS),* pp. 236-241, August 2017.

Intrusion Detection In Wsn Using Modified AODV Algorithm

S.Rajesh[1*], M.Sangeetha[2]
{rajeshsports@gmail.com[1], sang_gok@yahoo.com [2]}

Research Scholar, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research Chennai, India.[1]
Professor & Head, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, India.[2]

Abstract. Wireless sensor network plays a major role in recent scientific developments for transmission of information. It comprises of many sensor nodes which are connected virtually to transmit and receive data. But security is the main challenge experienced in the WSN to have a proper data transmission. Hence detection and separation of the attacks created in the sensor network is necessary. In this paper, a scheme for intrusion detection in wireless sensor network is introduced. It is done by using a modified AdhocOn Demand Distance Vector (AODV) algorithm as a routing protocol. Here NS-2 is used for implementing and simulating the proposed protocol and its performance is evaluated and analysed considering various network parameters.

Keywords: Wireless Sensor Network, Intrusion Detection, AODV, Routing, NS -2m.

1 Introduction

Wireless Sensor Networks are employed in various applications like object tracking, process monitoring, home health tracking, traffic monitoring, industrial automation etc., It is a framework of several sensor nodes with limited resources, little power and finite bandwidth. As the WSN are mostly constructed in unmonitored area it is highly prone to attacks from intruder which results in destruction of information. Hence Intrusion Detection System (IDS) is introduced as network security scheme to prevent or minimize loss of information. IDS are a set of tools to recognize, analyze and report malicious activity in the network for securing the data. The intrusions are of two kinds namely signature based detection and anomaly detection. In the first detection, the already executed attack patterns are predefined and the when same method of attack is replicated it will be detected and reported. The drawback of this type is new attacks can't be discovered. In the second type of detection the normal behavior of the nodes are established and monitored for deviations. If any such abnormal behavior is detected it is categorized as intrusion. This often results in false negative rate.

Sensor Network Attacks

In any network secrecy and authentication has to be maintained. But to manipulate the genuineness of a network many types of attacks are created by the intruders. Some of the types are discussed below.

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Denial of Service (DoS) Attacks: This attack is created to crash the network with unusual traffic by flooding unwanted requests into the network. It absorbs the network resources and drains the energy.

Spoofing and Altering of Routing Information: Here the nodes are disguised by the attacker and rerouting of the traffic is done to create traffic.

Selective Forwarding: The intruder makes the vulnerable nodes to randomly drop some packets during transmission from source to destination. The forwarding of packets is decided by the attacker.

Sinkhole Attacks: In this attack the traffic in a particular region is diverted to a compromised node by faking the routing algorithm. This attack is used to initiate other attacks like spoofing or selective forwarding.

Wormholes: It is a brilliant idea where the malicious node entraps the messages between two different regions of network at high speed to make distant nodes look nearer.

The Sybil Attack: The corrupted node will act as many other nodes in the network by acquiring false identity. This is used to confuse and divert the routing protocol.

Black Hole Attack: In this attack the malicious node discards the packets instead of forwarding them. This is done by portraying itself as shortest path to the source by giving Route Reply (RREP) message immediately.

2. Literature Survey

Intrusion Detection plays a predominate role in Wireless Sensor Networks. In this paper, Amrita Goshal et al., 2017 [1] summarizes about various parameters involved in intrusion detection system in terms of the energy consumption. Here the basics of intrusion detection system such as its working model, the challenges faced to maintain high accuracy rate and lower energy value are discussed. Since WSN works with moderate power reserve, limited transmission bandwidth and low memory dimensions the designing of IDS to achieve efficient result becomes complex. Here the various requirements to design energy efficient IDS and the classification of IDS are outlined. Further the various approaches of IDS to protect WSN are discussed and the accomplishment of existing systems in terms of energy utilization is tabulated and studied. It also pointed out the parameters to be considered for upcoming development in this area.

Linlin Li et al., 2018 [2], proposed a model for intrusion detection formulated on Danger Theory for danger perception and to find intrusion with a help of multimode system. Here Projection Pursuit Algorithm is used for danger perception and to control the problem arises due to heavy traffic. It also uses Extreme Learning Machine algorithm to classify the danger and Beta distribution for calculating the trust among the nodes. This paper proves that the danger theory used here shows better performance in terms of energy usage and false negative and positive rate compared to SNS model. The simulations are conducted here on MATLAB platform using KDD CUP99 dataset.

Artificial immune system concept has been adapted in many intrusion detection systems and one among them is negative selection algorithms. Some features of this algorithm are not given much importance while applying in wireless sensor network which results in lower efficiency. Hence Ruirui Zhang et al., 2019 [3], has formulated an improved negative selection algorithm based on spatial division. The dispensation of self- set in real value space is initially evaluated by the algorithm and then divided into many sub spaces. The selves are allotted to

these sub spaces and the NSA is applied to the sub space. The selves in the sub space with the detector only can be put up with the randomly created candidate detector and not all the sub spaces. The antigen detection process is fastened due to this operation. The efficiency of this proposed algorithm is verified both theoretically and experimentally which shows good results in all parameters required for a better intrusion detection system.

Kenneth RodolpheChabiBoni et al., 2020 [4] has proposed a novel innovation in providing security for WSN. Here the intrusion detection system introduced is a device incorporated with the features of sensors. The algorithms required for finding and separating the intruder or the authentic node is computed by this new IDS device. It refines all the data passes through the sensors by constructing a virtual compound around them. This process along with the implementation of Trust Table concept helps in isolation process by keeping record of all the sensors in the network to prove the genuineness of the sensors and also to avoid the breaking of the service. Further this isolation method is also enhanced by bringing in the concept of Feedback Signal to alert the other sensors in the network about the suspicious sensor to avoid further correspondence from the corrupted one. This IDS also involves in data transmission over sensors with other distributed IDS across wide geographical region to detect and eliminate threats.

Rabie .A et al., 2020 [5] has explained about the sinkhole attack in the wireless sensor network and has proposed two algorithms for detection and prevention of this attack. Multipath based Intrusion Detection System (MBIDS) algorithm and Threshold Based Intrusion Detection System (TBIDS) are the two algorithms discussed in this paper. The first algorithm is based on routing where the data message is accompanied by a control message and the second algorithm works by inspecting the threshold values of each cluster head. Further in this paper three recent algorithms namely S-LEACH, MS-LEACH and ABC are compared with these two algorithms and the results obtained shows better performance with the proposed algorithms.

MdAlauddinRezvi et al., 2020 [6] describes about a data mining methodology which is used to examine the intrusion detection system of a wireless sensor network. Here the various Denial of Service attacks like Blackhole, Grayhole, TDMA and flooding are considered and different data mining techniques are applied to these datasets to analyze these attacks. The performance of algorithms like Logistic Regression, KNN, Naïve Bayes, support vector machine (SVM) and ANN algorithms in classifying and analysing the attacks are also evaluated here.

3. Proposed System

The aim of an attacker was to influence the user data in a network directly or by attacking the underlying routing algorithm. The routing protocol defines about how the communication between the nodes takes place and also way by which the data is transmitted. In the proposed system the intrusion done by the attacks like sink hole or black hole is detected and analyzed by a modified version of the Ad hoc On-Demand Distance Vector Routing (AODV) algorithm. This modified protocol also inhibits the features of the existing AODV.

The AODV falls under reactive protocol category. Here the routing is done only when a request arise and hence the name on – demand. When a source wants to send a packet to the destination a Route Request message (RREQ) is broadcasted in the network. The fields in the RREQ are as follows:

Table 1. Route Request field

Source Address	Request ID	Source Sequence Number	Destination Address	Destination Sequence Number	Hop Count

The node which receives this broadcast message checks its routing table for the known route to the destination. If it does not find any matching, it forwards the message to its neighbors. The neighboring nodes or the nodes in the relay in turn checks their routing table and if the destination is not found the cycle is repeated. When a node with the route for destination address or destination itself is found it sends a Route Reply (RREP) to the source which sent the request. The RREP framework is as below:

Table 2. Route Reply field

Source Address	Destination Address	Destination Sequence Number	Hop Count	Life Time

The RREQ message is recognized by the combo of its source address and request ID only. Every time when a new request message is sent by the source the request ID is increased. When a RREQ is received by a node it checks for the combo address of the request message and if it already exists then the new request sent will be discarded. If a node does not find a route for the destination address the Hop Count of the RREQ will be incremented and rebroadcasted to the neighbor nodes. The RREP message will be sent to the source node only if the sequence number of the node with the desired route is equal or greater to the RREQ.

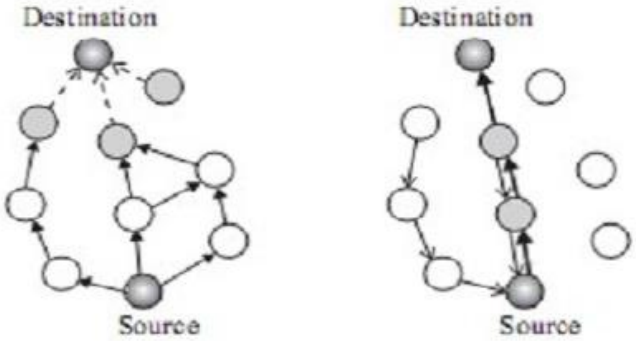

Fig 1. Discovery of route using modified AODV

4. Results And Discussions

NS 2 Simulator is used to analyze the performance of the modified AODV algorithm in the process of detection of intruders. The performance is measured based on the following metrics;

Average End to End Delay: The network delay is the time taken for the transmission of the packet from the source to the destination. The lower the value the efficiency of the protocol is higher.

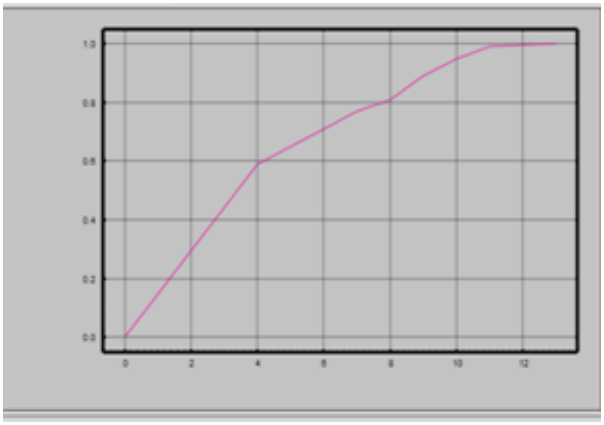

Fig 2. Average End to End Delay Graph

Throughput: It is the total packet size received per unit time and expressed as bytes/sec. This value has to higher to show a better performance.

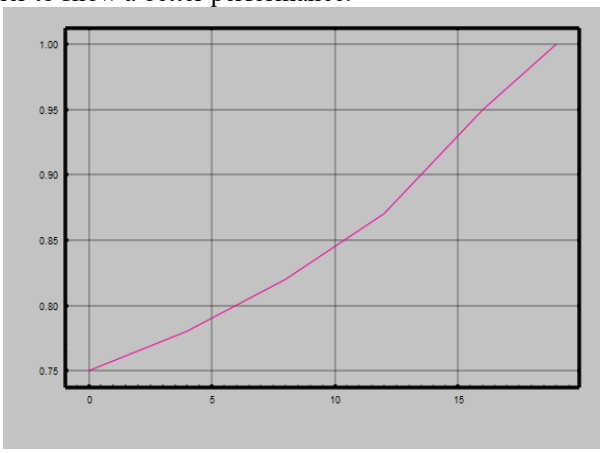

Fig3. Throughput Graph

Conclusion and future work

In this paper a modified Ad hoc On-Demand Distance Vector Routing is proposed for intrusion detection in wireless sensor network. The metrics such as end to end delay and throughput are evaluated by using the simulation results. The results show satisfactory performance with the modified routing protocol. In future the work can be established with higher number of nodes to improve the efficiency of complex network.

Conflicts of interest

- The authors should declare any conflicts of interest exist. If no conflict exists, the authors should state: the authors have no conflicts of interest to declare.

References

[1] Amrita Ghosal, SubirHalder (2017), "A survey on energy efficient intrusion detection in wireless sensor networks", Journal of Ambient Intelligence and Smart Environments, Vol.9 pp. 239–261

[2] Linlin Li, Liangxu Sun, Gang Wang (2018), "An Intrusion Detection Model Based on Danger Theory for Wireless Sensor Networks", International Journal of Online and Biomedical Engineering, Vol. 14, No. 9, eISSN: 2626-8493

[3] Ruirui Zhang, Xin Xiao (2019), "Intrusion Detection in Wireless Sensor Networks with an Improved NSA Based on Space Division" Journal of Sensors, https://doi.org/10.1155/2019/5451263

[4] Kenneth RodolpheChabiBoni, Lizhong Xu, Zhe Chen, Thelma Dede Baddoo (2020), "A Security Concept Based on Scaler Distribution of a Novel Intrusion Detection Device for Wireless Sensor Networks in a Smart Environment", Sensors, doi:10.3390/s20174717

[5] Rabie A, Ramadan (2020), "Effiecient Intrusion Detection Algorithms for smart cities based Wireless Sensing Technologies", Journal of Sensors and Actuator Networks, doi:10.3390/jsan9030039.

[6] MdAlauddinRezvi, SidratulMoontaha, Khadija Akter Trisha, ShamseTasnim Cynthia, Shamim Ripon (2020), "Data mining approach to analyzing intrusion detection of wireless sensor network", Indonesian Journal of Electrical Engineering and Computer Science, Vol. 21, No. 1, pp. 516~523, ISSN: 2502-4752

[7] BinghuaHao, Dan Chang, Zengping Zhang, Hailong Ji (2019), "Performance Analysis of Routing for Wireless Sensor Network", 3rd International Conference on Mechatronics Engineering and Information Technology, Advances in Computer Science Research, volume 87

[8] ItuSnigdh, DevashishGosain (2015), "Analysis of scalability for routing protocols in wireless sensornetworks", Optik - International Journal for Light and Electron Optics, http://dx.doi.org/10.1016/j.ijleo.2015.11.077

[9] Sandeep Sharm, Jaiprakash Nagar (2020), "Intrusion Detection in Mobile Sensor Networks: A Case Study for Different Intrusion Paths ", Wireless Personal Communications, DOI: 10.1007/s11277-020-07697-1

[10] Dilip Kumar AhirwarPrashantVermaJitendra Daksh (2012), "Enhanced AODV Routing Protocol for Wireless Sensor Network Based on ZigBee", International Conference on Computer Science and Information Technology, http://dx.doi.org/10.1007/978-3-642-27299-8_11

[11] Kiran Kumar, T.V.U., Karthik, B., Improving network life time using static cluster routing for wireless sensor networks, Indian Journal of Science and Technology, 2013, 6(SUPPL5), pp. 4642–4647

[12] Thamarai, P., Karthik, B., Kumaran, E.B., Optimizing 2:1 MUX for low power design using adiabatic logic, Middle - East Journal of Scientific Research, 2014, 20(10), pp. 1322–1326

[13] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.

[14] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9

[15] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.

[16] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020

[17] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, “Development of air quality monitoring (AQM) models using different machine learning approaches”, Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2
[18] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, “Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis,” Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.
[19] Vijayan T, Sangeetha M, Karthik B, “Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture,” Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

Bibliography

S.Rajesh, Research Scholar, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research Chennai, India. He has Completed M.E Applied Electronics in Sri Lakshmi Ammal Engineering College-Anna University. His research interests include Wireless Sensor Network, Networking, Cryptography. He is a member of IAENG.Email: *rajeshsports@gmail.com*

Dr.M.Sangeetha received the BE degree from the Bharathidasan university, in 1996, the ME degree from University of Madras, in 1999 and the PhD degree in Electronics and Communication engineering from Anna University in 2010. She is presently Professor of Electronics and Communication engineering, Bharath Institute of higher education and Research. She is also a member of IET and ISTE.Email: sang_gok@yahoo.com

A Fuzzy-GA Based controlling System for Wireless sensor networks

S.Saravana[1], Dr.S.Arulselvi[2]
{selvidurai1975@gmail.com[1], arulselvi2003@gmail.com[2]}

[1]Research Scholar, Department of ECE, Assistant Professor, Bharath Institute of Higher Education and Research, Chennai.
[2]Associate Professor, Department of ECE, Assistant Professor, Bharath Institute of Higher Education and Research, Chennai.

Abstract. In this endeavor, a transportable base station progression control gadget for WSNs is proposed. This system joins padded objective focus gathering, fluffy pack head tendency, and padded reason control (FLC) of the base station headways in the wake of choosing affiliation heads, as per the parcel and vitality of the heads, the base station proceeds ahead a predefined square, triangle, circle, or hexagon formed way. Way and speed of the progressions are restricted with the guide of FLC. Additionally, a molecule swarm improvement (PSO) figuring is trapped to ideally certify the proportion of associations, way shape and check, and the base station's speed vector plentifulness and heading. The proposed philosophy is numerically rehashed for a WSN with unpredictably passed on focuses.

Keywords: Fuzzy Cluster, Optimally Calculate, Fuzzy Logic Control, Distributed Nodes.

1 Introduction

Wireless sensor networks (WSNs) involve sensor center points in order to find and move the properties from the physical condition. All things considered, the sensor center points move snippets of data to an extraordinary center, called hub. The utilization exceptional sink addresses a bottleneck in a framework, especially for applications logically. In this sense, a couple of investigates have guided examinations to the usage of different sinks. The technique proposed by this paper shows the utilization of GFS for the courses in WSNs, to the correspondence of various sensor center points and various sink center points. Cushioned Inference System of Mamdani are used to choose the most appropriate sink center through idea of specific properties of the sensors organize, for instance, imperativeness and number of bobs. Genetic Algorithms are used to get the perfect difference in Mamdani's feathery acceptance. Course assurance was associated by strategies for PC amusements to show the likelihood of the technique executed. The results obtained through reenactments displayed a sensor arrange with an increasingly drawn out tasteful hub for transfer packages to the framework to the best courses.

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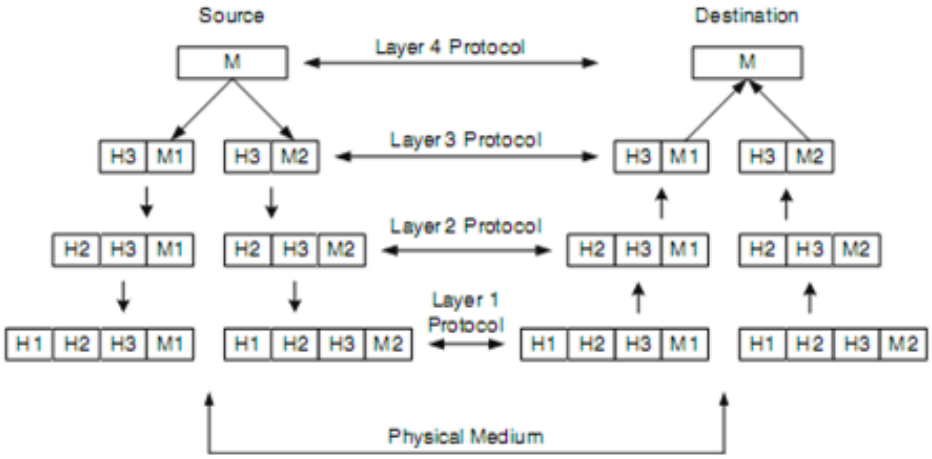

Fig. 1. Flow of data in network architecture layered

II. SYSTEM MODELING

System modeling insinuates a showing of addressing a genuine in a system way basically. Modeling system is basic in the component structure and progression, if truly completed. Even high essentially, changing, if suitably dealt with, extra improvement costs system. Show a Pc, some improving doubts every now and again required. It is fundamental to observe that such an enormous number of assumptions would rework the modeling anyway may provoke an off kilter depiction of the system.

Generally, two modeling: analytical system and reenactment approach.

1. Analytical Approach
2. Simulation Approach

Analytical Approach

The general idea of scientific demonstrating framework is to anyhow concept of a procedure to depict a shape tentatively with the assist of related numerical contraptions, for instance, masking and chance theories, and afterward seek after numerical techniques to pick up notion from the made numerical model. at the issue even as the framework is primary and truly little, valid showing is probably satisfactory (over reenactment). For this factor of reference, the version will in trendy be numerically tractable. The numerical responses for this version basically require mild-weight computational endeavors. inside the event that unequivocally utilized, methodical demonstrating may be fiscally sensible and can supply a theoretical air of mystery at the regions speakme with each different inside the shape. earlier than long, if many improving questions on the shape are made at some stage in the displaying up, illustrative models won't bypass on a specific delineation of the certified framework.

Simulation Approach

Amusement is comprehensively used in system showing for applications running from planning investigation, business examination, manufacturing masterminding, and regular

science experimentation, just to give a few precedents. Appeared differently in relation to illustrative showing, diversion as a general rule requires less appearance in the model (i.e., less unraveling assumptions) since practically every possible detail of the conclusions of the system can be put into the reenactment model to best depict the genuine structure. Exactly when the system is fairly enormous and complex, an unmistakable logical definition may not be reachable. For this circumstance, the reenactment approach is commonly preferred to the interpretive system. In a similar way as informative illustrating, entertainment showing may overlook a couple of nuances, since an unreasonable measure of nuances may result in an unmanageable multiplication and significant figuring effort. It is basic to intentionally consider a measure under idea and not to consolidate immaterial detail into the amusement.

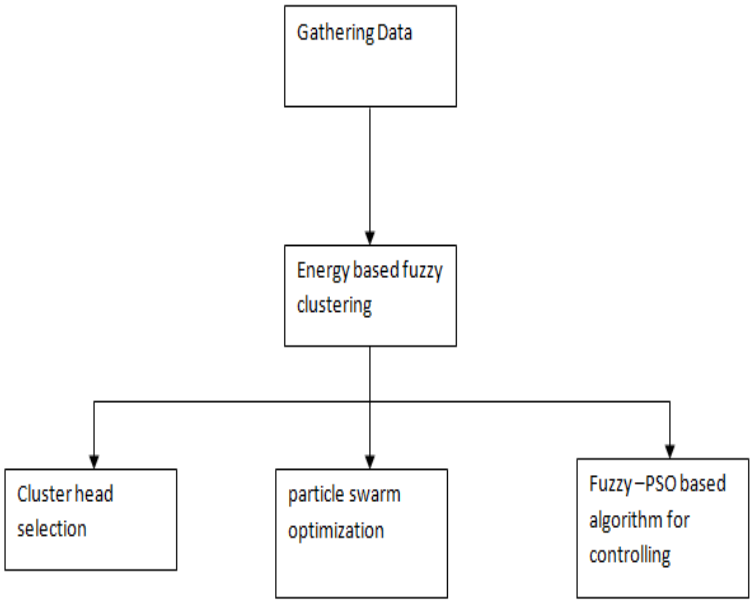

Fig. 2. Block diagram

III. GENETIC ALGORITHM

Genetic algorithms (GA) were first displayed by John Holland during the 1970s (Holland 1975) due to examinations concerning the probability of PC undertakings encountering advancement in the Darwinian sense.

GA is a bit of a progressively broad sensitive figuring perspective known as formative computation. They try to get in contact at perfect plans through a strategy like regular progression. This incorporates following the norms of survival of the fittest, and crossbreeding and change to make better courses of action from a pool of existing game plans.

Genetic algorithms have been seen to be fit for finding answers for a wide grouping of issues for which no commendable algorithmic courses of action exist. The GA procedure is

particularly proper for development, a basic reasoning technique wherein at any rate one by and large incredible courses of action are searched for in an answer

Space including a tremendous number of potential game plans. GA reduce the chase space by interminably surveying the present time of contender courses of action, discarding the ones situated as poor, and conveying another age through crossbreeding and changing those situated as extraordinary. The situating of contender game plans is done using some pre-chosen extent of goodness or wellbeing.

A genetic count is a probabilistic interest methodology that computationally repeats the system of characteristic headway. It mirrors improvement in nature by more than once adjusting a masses of candidate plans until a perfect course of action is found.

The GA transformative cycle starts with a heedlessly picked starting masses. The movements to the masses occur through the systems of decision subject to health, and change using half breed and change. The usage of decision and adjustment prompts a masses with a higher degree of better courses of action.

The formative cycle continues until an attractive course of action is found in the present period of people, or some control parameter, for instance, the amount of ages isoutperformed.

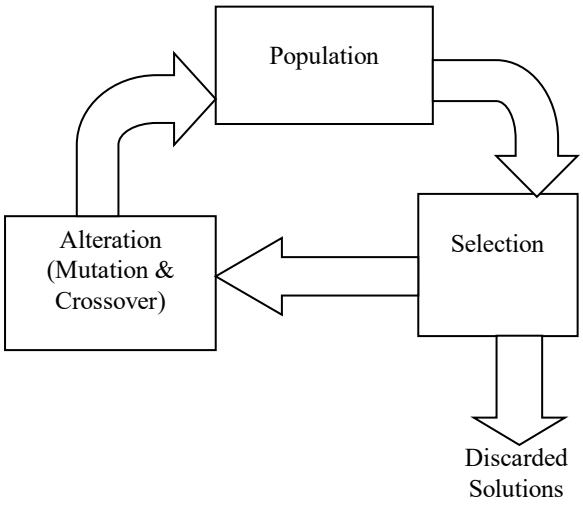

Fig. 3 Genetic algorithm evolutionary cycle.

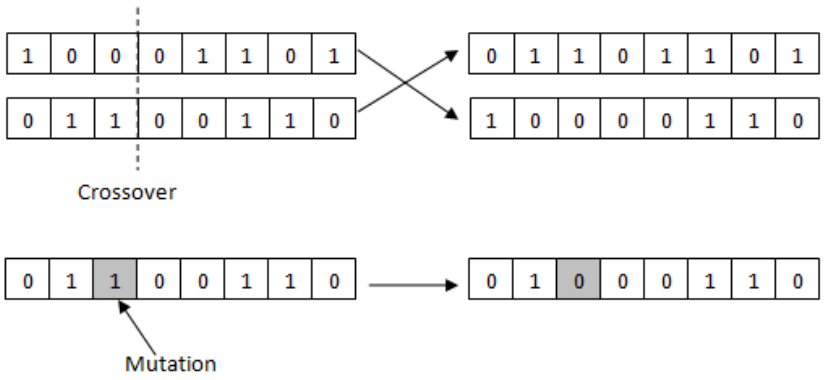

Fig. 4. Cross over and Mutation

IV. BASIC GENETIC ALGORITHM

Genetic estimation is flexible heuristic interest procedure introduced on the transformative considerations of trademark decision and genetics. The basic thought of Genetic Algorithm (GA) is proposed to reenact shapes in normal structures significant for improvement, unequivocally those that seek after the guidelines of survival of the fittest.

It is regularly used in conditions where the request space is reasonably gigantic and can't be crossed gainfully by old style look for techniques. This is generally the situation with issues whose plan requires appraisal and equilibration of various obviously arbitrary components.

In that limit they address a sagacious maltreatment of a discretionary interest space inside a described chase space to deal with an issue. Count plays out the going with advances:

1. Generate a hidden people , discretionarily or heuristically.
2. Figure and extra the status for each individual in the present people.
3. Portray assurance probability for each person with the objective that it is in respect to its wellbeing.
4. Make the accompanying current masses by probabilistically picking the general population from the past current people, to convey descendants by methods for genetic chairmen.

5. Repeat organize 2 until an agreeable course of action is gained.

Flowchart of a basic genetic estimation is given in Figure 5.

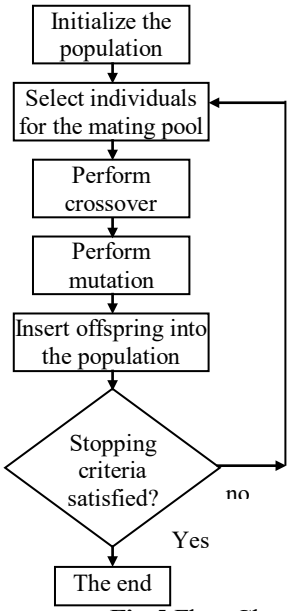

Fig 5 Flow Chart of basic genetic estimation

VI. SIMULATION RESULTS

The need of rectangular-root deduplication is plain from the going with talk. Uniform and Proportional structures were appeared to have equivalent chase territory as seeks after: m: wide assortment of records n

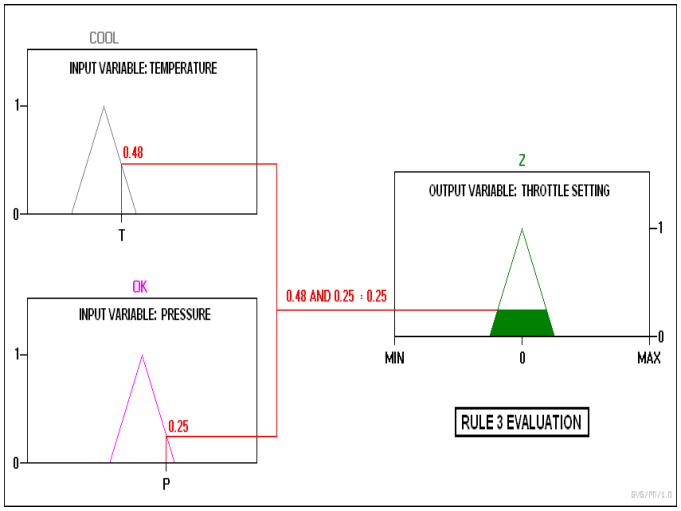

Fig. 6.Defuzzified Through Centroid Defuzzification

VII.CONCLUSION

This paper proposes a fuzzy inherited structure based computation for the selection of courses in WSN with various sinks. Generate a hidden people , discretionarily or heuristically. Genetic algorithms have been seen to be fit for finding answers for a wide grouping of issues for which no commendable algorithmic courses of action exist. They try to get in contact at perfect plans through a strategy like regular progression. This incorporates following the norms of survival of the fittest, and crossbreeding and change to make better courses of action from a pool. The GA procedure is particularly proper for development, a basic reasoning technique wherein at any rate one by and large incredible courses of action are searched for in an answer Space including a tremendous number of potential game plans. GA reduce the chase space by interminably surveying the present time of contender courses of action, discarding the ones situated as poor, and conveying another age through crossbreeding and changing those situated as extraordinary. The situating of contender game plans is done using some pre-chosen extent of goodness or wellbeing. A genetic count is a probabilistic interest methodology that computationally repeats the system of characteristic headway. It mirrors improvement in nature by more than once adjusting a masses of candidate plans until a perfect course of action is found. That experience could be used direct to help the improvement of the models base and the basic importance of the fundamental terms (fuzzy sets) of the etymological components.

References

[1] Y. chee Tseng, Y. chiun Wang, and L. wuYeh, “ipower: An energy conservationsystem for intelligent buildings by wireless sensor networks,” 2009.

[2] A. Mainwaring, D. Culler, J. Polastre, R. Szewczyk, and J. Anderson,“Wireless sensor networks for habitat monitoring,” in WSNA ’02: Proceedings of the 1st ACM international workshop on Wireless sensor networks and applications. New York, NY, USA: ACM, 2002, pp. 88–97.

[3] A. Boukerche and A. Martirosyan, “An energy efficient and low latency multiple events’ propagation protocol for wireless sensor networks with multiple sinks,” in PE-WASUN ’07: Proceedings of the 4th ACM workshop on Performance evaluation of wireless ad hoc, sensor,and ubiquitous networks. New York, NY, USA: ACM, 2007, pp. 82–86.

[4] I. F. Akyildiz, T. Melodia, and K. R. Chowdhury, “A survey on wireless multimedia sensor networks,” Comput. Netw., vol. 51, no. 4, pp. 921– 960, 2007.

[5] P. Ciciriello, L. Mottola, and G. P. Picco, “Efficient routing from multiple sources to multiple sinks in wireless sensor networks,” in EWSN’07: Proceedings of the 4th European conference on Wireless sensor networks. Berlin, Heidelberg: Springer-Verlag, 2007, pp. 34–50.

[6] E. H. Mamdani, “Application of Fuzzy Algorithms for Control of Simple Dynamic Plant,” Proceedings of IEE Control and Sciences, vol. 121, no. 12, pp. 1585–1588, 1974.

[7] D. E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning. Addison-Wesley Longman Publishing Co., Inc. Boston, MA, USA, 1989.

[8] E. H. Mamdani, “Application of Fuzzy Logic to Approximate Reasoning Using Linguistic Synthesis,” IEEE Transactions on Computers, vol. 26, no. 12, pp. 1182–1191, 1977.

[9] Y. Shi, R. Eberhart, and Y. Chen, “Implementation of Evolutionary Fuzzy Systems,” IEEE Transactions on Fuzzy Systems, vol. 7, no. 2, pp. 109–119, 1999.

[10] R. L. Haupt and S. E. Haupt, Practical Genetic Algorithms. Wiley New York, 1998.

[11] F. Herrera, “Genetic Fuzzy Systems: Taxonomy, Current Research Trends and Prospects,” Evolutionary Intelligence, vol. 1.

Neural Fuzzy System for Improved Decision Making For the Selection of Coding Scheme for the On Chip Communication

Dr.M.Jasmin[1], Dr.D.Gokulakrishnan[2], Dr.M.Sriram[3]
{rifriz@gmail.com[1], gokulkrish1453@gmail.com[2], msr1sriram@gmail.com}

Associate Professor, ECE, Bharath Institute of Higher Education and Research, Chennai, India[1],
Associate Professor, ECE, Sri Sairam Institute of Technology, Chennai, India[2],
Associate Professor, CSE, Bharath Institute of Higher Education and Research, Chennai, India[3]

Abstract. Single coding scheme for the on chip communication in the SOC system may not be sufficient in the heterogeneous on chip communication .It is required to have multiple coding scheme and selection of optimal coding scheme is based on the communicating block .Selection of optimal coding scheme for the on chip communication is important to decide the overall performance. This paper proposes neural fuzzy system based optimal selection scheme to improve the performance .The fuzzy system will be able to provide optimal decision in presence of contradictory constraints and the neural network can able to provide a learning capability for the system .The results shows that the neural fuzzy system is able to provide superior performance comparing to the fuzzy alone system.

Keywords: Neural Fuzzy System, SOC system, Optimal Coding, Neural Network.

1 Introduction

Due to outstanding system modeling and control capability, neural fuzzy networks have been widely used in the literature. The structure of neural fuzzy networks possesses both the advantages of neural networks and of fuzzy systems. It brings the low-level learning and computational power of neural networks into fuzzy systems and provides the high-level human-like thinking and reasoning of fuzzy systems into neural networks.

Artificial neural fuzzy system is employed to pre distort the OFDM signal such that the output of power amplifier will be exactly the original signal without distortion [1].A neuro fuzzy agent is developed as a reconfigurable system on chip for ambient intelligent application [2]. The work reduced the computational complexity, gives scalability and modularity. Further to reduce the complexity, the dimensionality of the data is reduced by exploitation of redundancy in the data. A nuero fuzzy system that can reduces feature by identifying bad feature is proposed through a mechanism called membership modulator [3].Accurate prediction of wind speed is carried out by using a neural fuzzy system which is able to predict wind speed in hourly basis [4].An engine fault diagnosis is carried out using adaptive neuro-fuzzy inference system. From the training input and output data, a fuzzy inference system is developed by adjusting the membership function using a least squares method based on hybrid learning algorithm [5].

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A comparison analysis between support vector machine (SVM) and adaptive neuro-fuzzy inference system (ANFIS) is presented for the classification of electromyography (EMG) signals [6]. The EMG signals were acquired from seven hand common gestures. The ANFIS classification is able to achieve high accuracy than SVM around 91.43% with reduced feature set by applying principal component analysis (PCA). Brightness adjusting by adaptive neuro-fuzzy inference system is carried out for improve the object recognition process when improper intensity of light is presented [7].The adaptive neuro-fuzzy inference system is configured as control function to adjust the brightness.

An intelligent sensor for fault detection and compensation (FDC) is proposed for a hybrid grid with renewable energy (RE) sources [8]. The sensors in the control algorithm is crucial one if fault occurs in it which will result in system collapse. This issue is handled by a robust sensor fault control system using ANFIS. A recurrentmethod is provided for filtering the signal noise based on Lyaponov stability which can adaptively filter impulse noise filter. The recurrent method filtering input signal in order to construct ANFIS then that is used as updated-filter to filter the signal noise component [9].

An energy optimization of multi-carrier energy systems is given by combining an adaptive neuro-fuzzy inference system in order model and forecast the power demand of a plant, and a genetic algorithm to optimize the energy flow taking. The optimization algorithm is designed to satisfy the total power demand of the plant and minimizes optimization criteria such as energy usage, monetary cost and environmental cost [10].

The contribution of this work is summarized below:

1. There is no ANFIS system for selection of coding scheme for on chip communication of SOC .So this work will be unique.
2. The proposed ANFIS will be improving our previously developed fuzzy decisive coding scheme [11] by introducing learning capability.
3. The improvement of 10-50% is observed comparing our previous fuzzy alone system

2. System model

The system of neuro fuzzy for the optimal channel coding consists of neural network and fuzzy decisive system. Figure 1 shows the block diagram of cooperative neuro fuzzy system.The neural network is connected in the cooperative mode under the proposal. Under the cooperative mode the neural network operated only once to predict the parameters for the given environmental data .Then the predicted data is feed to the fuzzy unit to make the final decision for the selection of optimal coding scheme. The back propagation neural network architecture is used in this work.

Figure 1. Cooperative Neuro Fuzzy System for Coding Scheme Selection

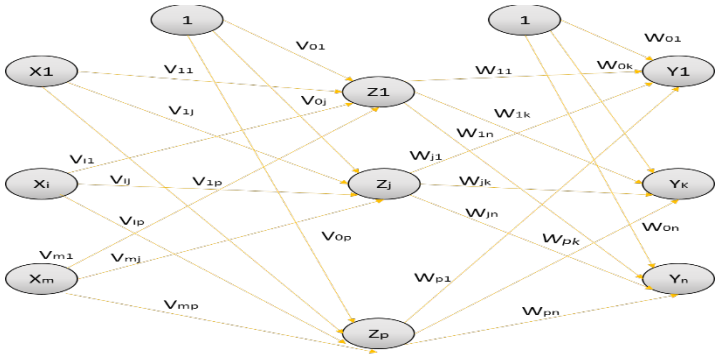

Figure 2. Back Propagation Neural Network Architecture

The architecture of the back propagation is given in figure 2. The architecture consist one input layer, one hidden layer and one output layer .The number of neuron in the input layer is 4 and the number of neuron in hidden layer is 55 and the neuron in output layer 4.

3. Result and Discussion

Random demand of QoS demanding input data's of sample of 1000 is generated which is applied to neural network to train and the trained neural network output is applied to fuzzy system which uses rule based reasoning to select the optimal coding scheme **.**In order to make different QoS different data types like chaotic random signal, audio signal, image and text are generated and applied to train the neural network and the output of trained neural network is used to adaptively change the parameters of fuzzy parameters and the membership function.

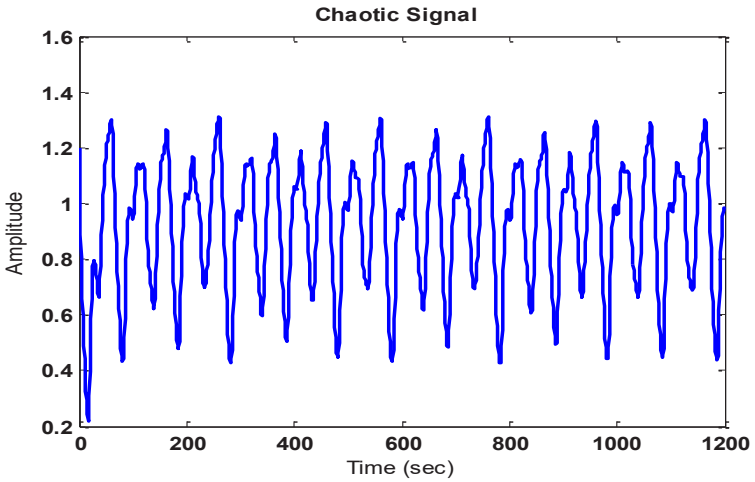

Figure 3.Sample Input Signal of Chaotic Signal

Figure 3 shows the sample input data of chaotic signal (random signal) fed to the neural network section. Using the above signal the neural network is trained which resulted in change of membership function of the fuzzy inference system. After training the reshaped

membership functions are plotted in figure .4.The reshaped membership function from the trained data ensure that the selection of error control code for the given input data type will be more accurate than that of fuzzy alone system.

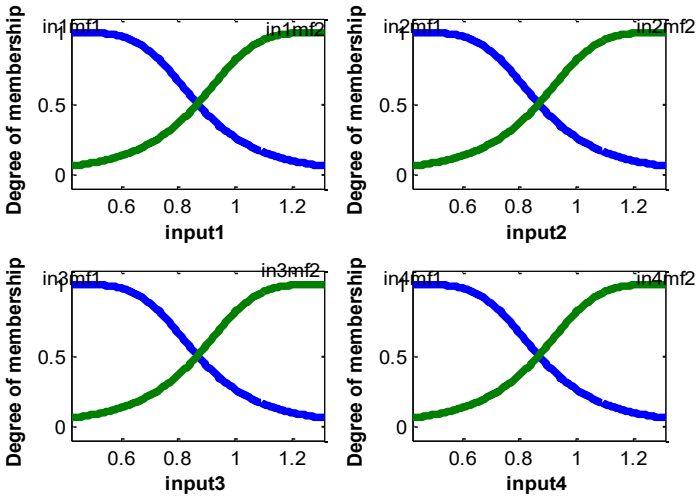

Figure 4.membership function after neural network training

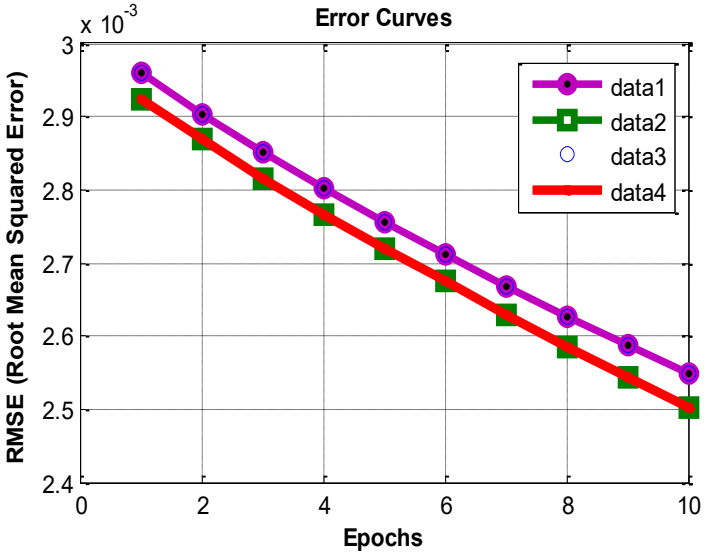

Figure 5.Error values on training and validation

Figure .5 gives the root means square error of the neural network learning process .It can be observed that with respect to increased training steps (Epochs) the root mean square error is getting reduced.It is also observed that for image and video data same error values are taken and for audio and text same error values are taken due to the previous training input.

In order to evaluate the impact of the introduced neural network on the fuzzy system, the error rate of the data transmission of the adaptive coding scheme for the various input data set is evaluated with neural network and without neural network by introducing noise signal into

the system .Table 1 gives the error rate analysis of the system for the signal to noise ratio on condition of 5dB.

Table 1.BER improvement of performance

Parameter	Before neural network	After neural network
audio	10^{-3}	$0.5x10^{-3}$
Image/video	10^{-4}	$0.6x10^{-4}$
Text	10^{-5}	$0.1x10^{-5}$
Average computational time by random type of data of size 10Mb	300ms	220ms

From the table 1 it can be observed that for audio data 50% improvement is achieved for the audio data, 40% improvement is achieved for image and video and 10% improvement is achieved for the text data type. The table also prove that the average computational time of the adaptive coding scheme is also improved for the random generation of input data type.80ms time is reduced because of selection of low complexity coding scheme on some input data type comparing to that of fuzzy alone system.

Table .2 resource occupancy of coding scheme

scheme	FPGA platform	Logic Slice LUT	Registers	Delay	Power consumption
ANTON, Constantin[12] Hamming code(15,5)	SPARTAN 3	46/ 3584	58/7168	5.778ns	Not reported
Jayan, Geethu[13]. Hamming code	SPARTAN 3	58409.4micro Metter	Not reported	6.7ns	20.5mW
Saleh, H.[14]Hamming Encoder Design Status with (64, 7) Code	SPARTAN 3	Encoder: Slice 28/1920 4input LUT 50/3840 Decoder:135/1920 4input LUT 245/3840	Not reported	Not reported	Not reported
Proposed Hamming code(15,5)	SPARTAN 3	44/ 3584	58/7168	5.12ns	19.5mW

Table 2 shows the comparison of resource occupancy of proposed scheme comparing with the literature .It is evident from the table that our proposed implementation of hamming code is less resource occupancy comparing literature methods.

Conclusion

Adaptive error control coding scheme is used in on chip communication in order to handle effectively error rate for different class of input data type like text, audio, video and image. The accuracy of selection decision is improved by means of fuzzy logic based decision system. The fuzzy system is improved by introducing neural network into the system to provide the learning capability which produced a system called Adaptive Neural Fuzzy Inference System (ANFIS).The result of error rate analysis proves that there is an improvement of 10%(for text data) to 50% improvement (for audio data) comparing the fuzzy alone system.80ms time saving in computation is achieved because of the introduced learning capability to the fuzzy system.

References

[1] Jiménez, Víctor P. Gil, et al. "High power amplifier pre-distorter based on neural-fuzzy systems for OFDM signals." IEEE Transactions on Broadcasting 57.1 (2011): 149-158.

[2] del Campo, Inés, et al. "A system-on-chip development of a neuro–fuzzy embedded agent for ambient-intelligence environments." IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics) 42.2 (2012): 501-512.

[3] Lin, Chin-Teng, et al. "An interval type-2 neural fuzzy system for online system identification and feature elimination." IEEE transactions on neural networks and learning systems 26.7 (2015): 1442-1455.

[4] Li, Chengdong, et al. "Functional-type single-input-rule-modules connected neural fuzzy system for wind speed prediction." IEEE/CAA Journal of AutomaticaSinica 4.4 (2017): 751-762.

[5] Chen Qing-Xie,Wu Chun-Fu,"Research on engine fault diagnosis technology based on ANFIS",Chinese Automation Congress (CAC), 2017: 278 – 281.

[6] Caesarendra, Wahyu, TegoehTjahjowidodo, and Daniel Pamungkas. "EMG based classification of hand gestures using PCA and ANFIS." Robotics, Biomimetics, and Intelligent Computational Systems (Robionetics), 2017 International Conference on. IEEE, 2017.

[7] Kim, EunKyeong, et al. "Image brightness adjustment system based on ANFIS by RGB and CIE L∗ a∗ b∗ ." Multisensor Fusion and Integration for Intelligent Systems (MFI), 2017 IEEE International Conference on. IEEE, 2017.

[8] Sowmmiya, Uthayakumar, and Govindarajan Uma. "ANFIS-based sensor fault-tolerant control for hybrid grid." IET Generation, Transmission & Distribution 12.1 (2017): 31-41.

[9] Nguyen, SyDzung, Seung-Bok Choi, and Tae-Il Seo. "Recurrent Mechanism and Impulse Noise Filter for Establishing ANFIS." IEEE Transactions on Fuzzy Systems (2017).

[10] Kampouropoulos, Konstantinos, et al. "Multiobjective optimization of multi-carrier energy system using a combination of ANFIS and genetic algorithms." IEEE Transactions on Smart Grid (2016).

[11] Anton, Constantin, et al. "Hardware Implementation Of A Single Bit Error Code Correction."UNIVERSITY OF PITESTI – ELECTRONICS AND COMPUTERS SCIENCE, SCIENTIFIC BULLETIN, No. 9, Vol.2, 2009

[12] Jayan, Geethu, and P. P. Pavitha. "FPGA implementation of an efficient router architecture based on DMC." Emerging Technological Trends (ICETT), International Conference on. IEEE, 2016.

[13] Saleh, H. "Design of Hamming Encoder and Decoder Circuits for (64, 7) Code and (128, 8) Code Using VHDL." Journal of Scientific and Engineering Research 2.1 (2015): 1-15.

[14] Kiran Kumar, T.V.U., Karthik, B., Improving network life time using static cluster routing for wireless sensor networks, Indian Journal of Science and Technology, 2013, 6(SUPPL5), pp. 4642–4647

[15] Thamarai, P., Karthik, B., Kumaran, E.B., Optimizing 2:1 MUX for low power design using adiabatic logic, Middle - East Journal of Scientific Research, 2014, 20(10), pp. 1322–1326

Stuttered Speech Recognition And Classification Using Enhanced Kamnan Filter And Neural Network

[1]B.Vaidianathan, [2]S.Arulselvi, [3]B.Karthik
{vaidia5000@gmail.com1, arulselvi2003@gmail.com2, karthikguru33@gmail.com3}

Research Scholar, Electronics and Communication Engineering, BIST, Bharath Institute of Higher Education and Research, Chennai, India.[1],
Associate Professor, Electronics and Communication Engineering, BIST, Bharath Institute of Higher Education and Research,Chennai,India.[2,3]

Abstract. Stuttering or stammering assessment is one of the vital factors in speech recognition algorithms. To reconstruct the stuttered speech into spontaneous speech it is necessary to detect and correct the features influencing the speech signal. In this paper the speech signal is processed based on the disturbances created by acoustic effects like pauses and noises made both externally and internally. To eliminate the effects of noise on speech signal an Enhanced Kalman Filter is introduced here and its performance along with various filters are studied and compared based on the parameters like Mean Square Error (MSE), Mean Absolute Error (MAE), SNR ratio, Peak Signal to Noise ratio and Cross correlation. Then based on the extracted features classification of the speech signal is carried out using Convolutional Neural Network (CNN) algorithm of Deep learning technique.

Keywords: Stuttering Enhanced Kalman Filter, Mean Square Error, Mean Absolute Error, Signal to Noise Ratio, Convolutional Neural Network.

1 Introduction

Speech is the most habitual way of communication for human beings. It is the physiological movement of air through vocal chords, tongue, jaw, teeth, lips, and palate to produce sound. When a person is unable to produce speech sounds fluently or perfectly which makes the listener helpless to recognize the words then it is termed as speech disorder. Almost seventy billion people undergo speech disorders like stuttering, mumbling, apraxia, cluttering, dysarthria, lisping, whispering etc., These disorders are due to damage to brain's motor nerves for speech, paralysis of speech muscles, Cleft Lip and Palate and some more.

Stuttering is a disorder found in speech pathology and commonly seen more in male compared to females. The normal flow of verbal communication is disturbed by occurrences of repetitions, long silences and prolongations of sounds. Interjections, revisions, incomplete phrases, repetition, Prolonged sounds, broken words are most prevalent stuttering types.

In recent years research for signal processing in acoustic science is popular as variety of application including medical application, robotics, home automation, defense, machine translation requires speech recognition. In speech recognition, digitizing of the signal is performed by separating from noise, detecting and comparing the phoneme to predict the word to determine the whole speech sequence.

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2 Literature Survey

Sakshi Gupta et al.,(2020) has structured an automatic speech disorder recognition method which is used to disclose the disorders like prolongation of a word and also repetition of a syllable, word or phrase from the speech given. Here the database for input speech signal was obtained from the archive of a university. These signals are pre-processed and segmented considering the above disorders. Then the extraction of both static and dynamic sound's features are done by using the WMFCC feature extraction algorithm. Next it is preceded with the classification of the signal by using the Bi-LSTM network of deep learning. Finally the proposed model is compared with the unidirectional LSTM model and the results portrays that the proposed method as highly accurate. [1]

The technology that is used to convert an audio speech into text information is called as Automatic Speech Recognition (ASR) system. But the dysfluencies like addition or elongation of words or syllables in the speech becomes a hurdle for the ASR system. For the proper function of this system two main operations namely classification and testing of the input have to be done. Here **Girirajan** et al., (2020) has proposed LSTM algorithm for the classification of the signal in MATLAB platform. The paper's main focus was to detect the mention abnormalities in the speech and classify them as normal and abnormal speech. This shows an slight hike in terms of efficiency when compared to other popular classification algorithms. [2]

Here **Mohammed Sidi Yakoub** et al.,(2020) formulated a novel approach for improving the detecting process of dysarthric speech. The EMDH technique is applied in the pre processing of the signal for determining and choosing the mode functions from the disturbed data to remodel the original signal. Then the features withdrawn are utilized for classification by merging the algorithms EMDH and CNN together. Compared to the standard system this new approach shows satisfactory results. [3]

Arjun et al., (2019), devised a method which is used to correct the stutters found in a speech signal. To avoid the recurrence of same word, the speech is sampled into individual words by using appropriate thresholding and speech energy techniques. For discarding the long pauses between the words, the speech signal is segmented into frames of 50ms windows. By using the LPC and MFCC methods every two subsequent frames are checked for feature extractions, here it is the similarity index. Based on correlation of these extracted details, normal pauses are retained and others are discarded to get speech signal in appropriate format. This type of speech signal processing method is regarded as simple and robust as it utilizes the thresholding and correlating concepts. [4]

Numerous speech enhancement algorithms have been designed to transform a corrupted speech signal into an intelligent form of signal. Mostly the corruption might have been caused by various types of noises. **Nasir Saleem** et al., (2019) have described about a study describing about the potentiality of various algorithms in enhancing the speech signal by removal of the distortions. Here the unsupervised type of SCS algorithms like WF, SigSub, MMSE, EMD etc.. are considered for surveying. This survey concludes that these algorithms potentiality is better in noise reduction to show the speech quality than in the speech intelligence. When the estimation of the speech is carried out too hard by these methods it may result in the content loss, so further research in this area is required. [5]

Selvaraj et al., (2019) suggested a method to enhance the speech signal which shows adverse effect by the non-stationary noises low SNR. Here the sliding window concept is combined with the EMDH algorithm to form the SWEMDH method, which is used to improve the speech enhancement process. The intrinsic mode function identified by the Hurst

exponent model is corrupted by the noises which results in the complexity of signal reconstruction. So the analysis of EMD is preceded by selecting the sliding window with respect to time frame. Here the sifting iteration's count is calculated by decomposing the consecutive windows and finding the mean sifting steps. Hence the time complexity is improved by the proposed system. [6]

3 Proposed System

The need of computer-aided speech recognition systems has led to the development of many algorithms using various methodologies. This paper focuses on improving the filtration of noise from the original speech signal by introducing an Enhanced Kalman filter and classifying the signal by employing CNN algorithm using Matlab. The process of assessing and classifying of the disfluency in speech signal is initialized by extracting the stuttered voice signal.

A.Preprocessing: The voice signal is always accompanied by noise which results in degradation of the signal. The factors that create interference may be due to disorders in organs, acoustic background, sensor positions, reverberation effect etc. Here various filters are surveyed along with the proposed Enhanced Kalman filter.

***EMD Filter*:** Empirical mode decomposition filter is a non – stationary and nonlinear adaptive method which does not require any basic function. The decomposition of the signals into Intrinsic Mode Functions (IMF) is obtained by detecting the local maxima and minima followed by its envelope value and then subtracting the mean of the envelope extremities from the input data. This is conducted until non IMF residual value is attained referred to as the sifting process. The EMD is expressed as total of IMF and residue.

$$r_n + \sum_{i=1}^{n} \mathrm{imf}_i(t) = x(t) \qquad \text{-----(1)}$$

where r – residue, i- index of mode. This is used to remove low noise frequencies.

DWT Decomposition filter: The discrete wavelet transformation is based on a series of filters. The signal 'x' is dilated by sub sampling and passed through low pass filter where it is convolved with the impulse response 'g' as follows

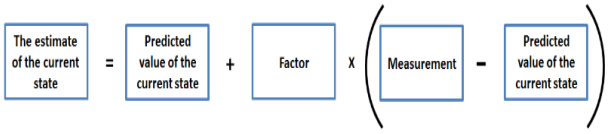
$$y[n] = x[n] * g[n] = \sum_{k=-\infty}^{\infty} x[k]g[n-k] \qquad \text{-----(2)}$$

Then it is decomposed by passing the high pass filter 'h'. The two filters are combined together to be called as quadrature mirror filter. Half the frequencies would have been filtered by now so by using Nyquist rule half of the samples can be removed. The filter output is sub sampled by two the process is repeated with new series of filters.

DWT Adaptive filters: The DWT shifts and dilates signals into a small number of coefficients of large magnitude. Dilations follow from the "discarding" features of wavelets, assures that the low-order polynomial signal's wavelet coefficients as zero. Practically, the signal will not be polynomial alone but, approximated by a polynomial function. So the DWT

is modified to adapt to match the signal. This adaptive DWT have the potential to improve the transforming process of denoising by providing higher efficiency and less computation.

Kalman filter: It is a recursive approach used to estimate hidden variable depending on the inaccurate measurements over time with statistical noise. It requires little computational power and has multiple applications which include navigation and control, time series analysis of signal processing. It works on two steps: Prediction – to provide estimate of current variables and Updation – of these values by weighted average of the outputs of next measurement. The equation for this updation state means as follow.



---(3)

Enhanced Kalman Filter: The proposed filter is the modified version of the KF. It is not confined to linearity but can work on nonlinear functions. It linearizes the signal for the current state estimate and use linear Kalman filter to predict the next estimate. The state transition and observation models are differentiable functions and can be expressed as,

$$\boldsymbol{x}_k = \boldsymbol{f}(\boldsymbol{x}_{k-1}, \boldsymbol{u}_k) + \boldsymbol{w}_k$$
$$\boldsymbol{z}_k = \boldsymbol{h}(\boldsymbol{x}_k) + \boldsymbol{v}_k \qquad \text{----------(4)}$$

where, w_k – process noise, v_k - observation noise, u_k – control vector

The prediction of state from the previous estimate is calculated by function 'f' and the calculation of predicted measurement is done with the help of function 'h'. As the application of these functions to the covariance is not possible the Jacobian of each step is analyzed with current predicted states.

B. Sampling: Sampling or segmenting is a process to divide a continuous speech into smaller units like words, syllable etc., The sampling of speech signal is based on the stuttering rate of various stuttering disorders. Prolongation (lengthy occurrence of a word), Repetition (repeating of syllable or word), Long pause (long silence between words) are the disorders considered in this process. The preprocessed signals are marked and segmented based on the disorder by adding, cancelling and dismissing some words. Automatic segmentations can be carried out by using any of the method like Fourier Transform, Short Term Energy, Minimum Phase Group Delay Method, Word Chopper, Wavelet Method and some more.

C. Feature Extraction: The objective is the conversion of acoustic signal into recognizable sequence of acoustic feature vectors. The segmented sample of the stuttered speech signal is arranged into differential sets for training, validation, and testing. The features are extracted based on the following parameters to calculate the efficiency of the algorithm:

Mean square Error: Error signal (e) is the difference between the input signal x(t) and the reconstructed signal. The sum of the squared average of the error signal is termed as MSE. It is expressed as

$$\text{MSE} = \frac{1}{l}\sum_{i=1}^{n} e_i^2, \quad \text{where} \quad e = \hat{x}(t) - x(t). \qquad \text{----(5)}$$

Mean Absolute Error: It is the amount of error between the input and reconstructed signal.

$$\mathrm{MAE} = \frac{1}{l}\sum_{i=1}^{n} e_i. \quad \text{--------(6)}$$

Signal to Noise Ratio: It is defined as the ratio of the speech signal to the noise present in the speech signal.

$$\mathrm{SNR\ [dB]} = 10\log_{10}\left(\frac{P_{\mathrm{signal}}}{P_{\mathrm{noise}}}\right) \quad \text{------(7)}$$

Peak Signal to Noise Ratio: It is the proportion of maximum attainable signal power to the distorting noise power and can be expressed in terms of MSE.

$$\mathrm{PSNR\ [dB]} = 10\log_{10}\frac{255^2}{\mathrm{MSE}}. \quad \text{-------(8)}$$

Cross correlation: It is used to determine the rate of relationship between two different entities f and g is given as

$$(f \star g)[n] \triangleq \sum_{m=0}^{N-1} \overline{f[m]}\, g[(m+n)_{\mathrm{mod}\ N}] \quad \text{------(9)}$$

D. Classification: The classification of the speech signal is performed by the widely popular Convolution Neural Network architecture. The application of CNN to acoustics modules enhance the performance of the process compared to various other classification algorithms. The CNN is a nonlinear function framed with several layers that includes convolutional, hidden and pooling. The features are extracted by the initial convolutional layers. From the featured information the pooling layer down sample the data by keeping important values and discards the insignificant values. Next the estimation of the class conditional probability is obtained by CNN, which is used to find the emission scaled-similarity to classify the data based on the value. The advantage of using CNN in speech recognition are based on the properties weight sharing, filtering and pooling which are used to enhance the overall performance of the system.

4 Results and Discussions

Now let us see the results that is been obtained from a stuttered speech. Here a stuttered speech is taken as input signal. Then the preprocessing stage takes place where the speech signal will be analyzed and the noise present in the signal has to be removed. Here our proposed Enhanced Kalman filter is used and the noise present in the signal is completely removed. Then according to the concept the pause, external parameters which affects the signal is found and eliminated. At last we will be using Convolution Neural Network where the signal will be classified and the stuttered word which is been pronounced by the particular person is analyzed and classified correctly.

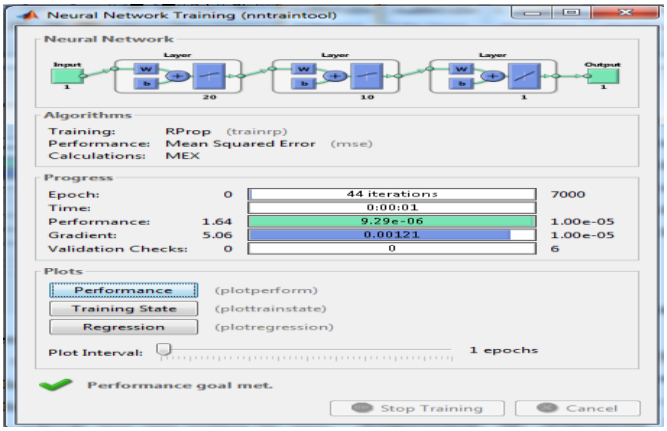


Figure 1: Neural Network Performance

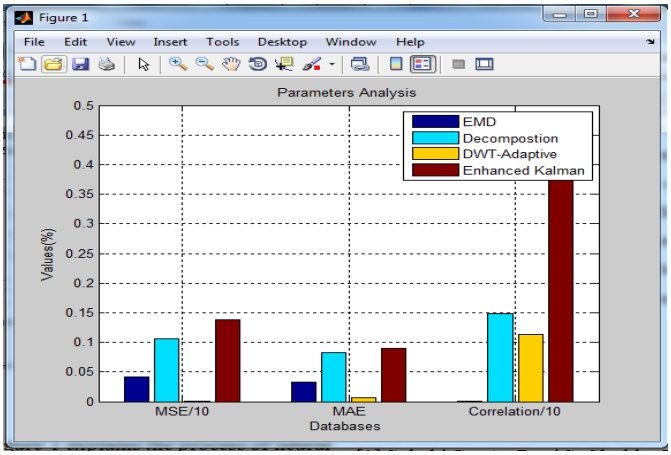


Figure 2: Parameter Analysis

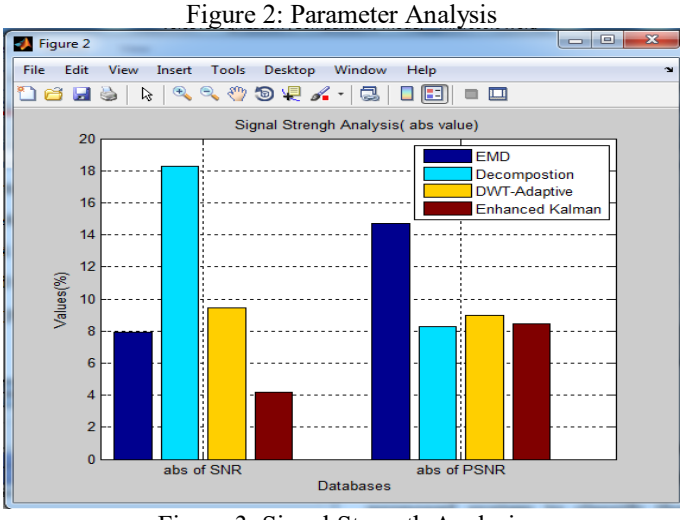


Figure 3: Signal Strength Analysis

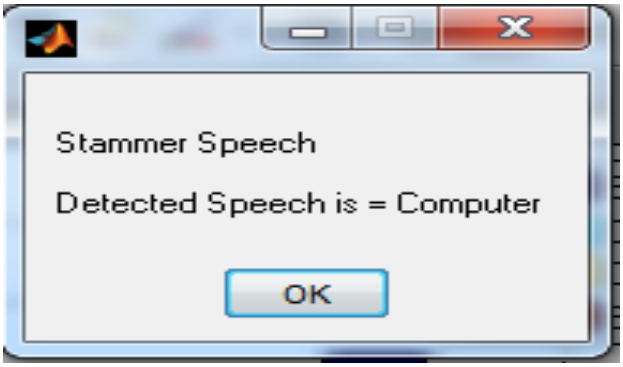


Figure 4: Classified Stuttered word

The above figure 1 explains the process of neural network performance that is been used in our proposed system to classify the stuttered words. Figure 2 represents the bar chart of parameter analysis of all 4 filters which we are using in our research. The parameters such as MSE, MAE and correlation have been measured and compared with existing filters. It states that the results obtained from Enhanced Kalman filter is good than other filters. Figure 3 represents the signal strength analysis where we will calculate the Absolute Value of SNR and PSNR. It is found that the absolute value obtained from Enhanced Kalman filter is better than other existing filters. The last Figure 4 represents the output of stuttered word that is been pronounced by the concern person.

Conclusion

In this paper an automated method to recognize and classify the stuttered speech signal is described based on Convolutional Neural Network by introducing an Enhanced version of Kalman filter (EKF) for nonlinear noise removal. The contamination of the stuttered speech signal by noise is filtered by using various types of filters and their performance are compared with the described EKF. From the obtained Matlab simulated results based on various parameters like MSE, PMSE, SNR, PSNR the proposed Enhanced KF executes satisfactory results.

References

[1] Sakshi Gupta, Ravi S. Shukla, Rajesh K. Shukla, Rajesh Verma, 2020, “Deep Learning Bidirectional LSTM based Detection of Prolongation and Repetition in Stuttered Speech using Weighted MFCC”, International Journal of Advanced Computer Science and Applications, Vol. 11, No. 9.

[2] S.Girirajan, R.Sangeetha, T.Preethi, A.Chinnappa, 2020, “Automatic Speech Recognition with Stuttering Speech Removal using Long Short-Term Memory (LSTM)”, International Journal of Recent Technology and Engineering, ISSN: 2277-3878, Volume-8 Issue-5

[3] Mohammed Sidi Yakoub, Sid-ahmed Selouani, Brahim-Fares Zaidi and Asma Bouchair, 2020, “Improving dysarthric speech recognition using empirical mode decomposition and convolutional neural network ”, EURASIP Journal on Audio, Speech, and Music Processing, https://doi.org/10.1186/s13636-019-0169-5

[4] Arjun K N, Karthik S, Kamalnath D, Pranavi Chanda, Shikha Tripathi, 2019, "Automatic Correction of Stutter in Disfluent Speech", Third International Conference on Computing and Network Communications, Procedia Computer Science, Vol. 171,pp. 1363–1370

[5] Karthik, B., Kumar, T.K., Dorairangaswamy, M.A., Logashanmugam, E., Removal of high density salt and pepper noise through modified cascaded filter, Middle - East Journal of Scientific Research, 2014, 20(10), pp. 1222–1228

[6] Nasir Saleem, Muhammad Irfan Khattak, Elena Verdú. 2019, "On Improvement of Speech Intelligibility and Quality: A Survey of Unsupervised Single Channel Speech Enhancement Algorithms", International Journal of Interactive Multimedia and Artificial Intelligence, (2019), http://dx.doi.org/10.9781/ijimai.2019.12.001

[7] Selvaraj Poovarasan‡, Eswaran Chandra 2019, "Speech Enhancement Using Sliding Window Empirical Mode Decomposition and Hurst-based Technique", Archives of Acoustics Vol. 44, No. 3, pp. 429–437, DOI: 10.24425/aoa.2019.129259

[8] Adappa S Angadi, Adokshaja Kulkarni, Ravi A Gadad, K. Sridhar 2020, "Survey on Efficient Signal Processing Techniques for Speech Enhancement", International Research Journal of Engineering and Technology, Vol. 7 Issue: 1, E-ISSN: 2395-0056

[9] Karthik, B., Krishna Kumar, T., Vijayaragavan, S.P., Sriram, M., Removal of high density salt and pepper noise in color image through modified cascaded filter, Journal of Ambient Intelligence and Humanized Computing, 2020

[10] Çakır, Emre, Parascandolo, Giambattista, Heittola, Toni, Huttunen, Heikki, Virtanen, Tuomas, 2017, "Convolutional Recurrent Neural Networks for Polyphonic Sound Event Detection", IEEE/ACM Transactions on Audio, Speech, and Language Processing, Vol. 25, doi - 10.1109/TASLP.2017.2690575

[11] G. Manjula, M. Shiva Kumar, 2016, "Overview of Analysis and Classification of Stuttered Speech", International Journal of Industrial Electronics and Electrical Engineering, ISSN: 2347-6982 Vol-4, Issue-7.

[12] Ossama Abdel-Hamid, Abdel-rahman Mohamed, Hui Jiang, Li Deng, Gerald Penn, and Dong Yu, 2014, "Convolutional Neural Networks for Speech Recognition", IEEE/ACM Transactions on Audio, Speech, and Language Processing, Vol.22, No. 10

[13] Karthik, B., Kiran Kumar, T.V.U., Noise removal using mixtures of projected gaussian scale mixtures, World Applied Sciences Journal, 2014, 29(8), pp. 1039–1045

Transmission Power Line Fault Detection using Convolutional Neural Networks

Kalanidhi K[1], Baskar D[2], Vinod Kumar D[3]

kalanidhik@gmail.com, basindia.kd@gmail.com, vino.kd@gmail.com

[1]Research Scholar - Electrical & Electronics Engineering, [3]Professor & Head - Biomedical Engineering,Vinayaka Mission's Kirupananda Variyar Engineering College, VinayakaMission'sResearch Foundation (Deemed to be University), Salem, Tamil Nadu, India.
[2]Assistant Professor - Electrical & Electronics Engineering, Annai Teresa College of Engineering, Viluppuram, Tamil Nadu, India.

Abstract: In an electrical power system, most of the faults occurs in overhead transmission lines because of most of the conductor exposure to the atmosphere. Therefore, Insulated Overhead Conductors (IOCs) are widely used. To overcome this, a robust real-time PD fault analysis system is required. To analyze and classify the raw voltage signal for detection of PD's in IOC's a Convolutional Neural Network (CNN) based fault classification algorithm is proposed in this paper. The CNN is implemented using popular pre-trained CNN architectures such as AlexNet, VGG16 & ResNet are applied to the voltage signals in the dataset. From the values of Precision, Recall & F1-Score it is observed that ResNet architecture provides the best prediction and classification results.

Keywords: Transmission Lines, Fault Analysis, CNN, AlexNet, VGG16, ResNet.

1 Introduction:

Partial discharge (PD) can occur in transmission lines. PD represents a breakdown between two conducting electrodes. If PD is not detected, the damage to the transmission line can be disastrous and cause serious safety events. Partial discharge can easily be detected by ultrasound and by a routine preventive maintenance inspection of transmission lines. Over the years, several algorithms have been expanded to automate the classification of Partial Discharge fault sources. There are models that include feature engineering into one framework. They can extract features and automatically create informative depictions of time series and these models are Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNN). CNN's based models for the classification of time series has numerous significant benefits over other methods.

2 VSB - ENET Dataset

The VSB ENET Centrein the Czech Republicmade several attempts over the past few years to obtain PD signals. They developed a measuring tool that can be placed on IOC's outer cover to measure PDs [1,2]. The configuration can be seen in Fig 1. A single layer coil is wrapped around the IOC to absorb the drift electric field voltage around the IOC, aiming to detect the hazardous PD actions. The voltage signal is further captured by using a capacitance-voltage divider whose output capacity is combined in parallel with the voltage output terminals and an inductor. VSB's approach is economicalthan another alternative solution that uses the Rogowski sensor [3,4,5] to calculate the current in the conductor explicitly.In 2018, VSB issued a dataset for this purpose, including a considerable number of waveform measurements acquired utilizing the system outlined above. The dataset was released by Kaggle[6,7].

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Fig. 1.VSBENET - PD Measuring Device.

The dataset contains 8,711 pre-labelled voltage signals consisting of 8186 Non-PD and 525 PD recorded from more than 20 real-time different locations[8]. Fig 2 presents the waveform of the PD and Non-PD signals. The Non-PD signal has a maximum value of 40 mV and a minimum value of 40 mV. The PD signal has a maximum of 60 mV and the minimum value is -80mV approximately the fluctuation of the signal rises significantly.

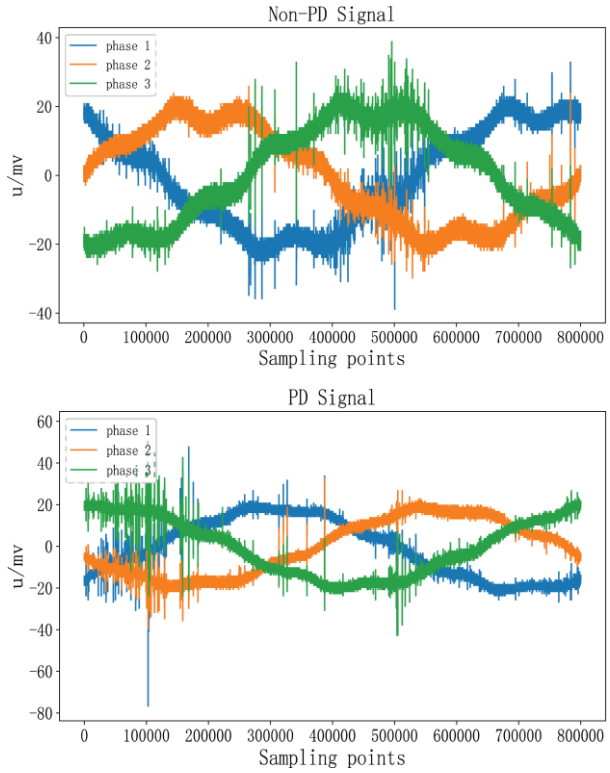

Fig. 2. Waveformof PD and Non-PD Signal records from ENET Dataset.

3 Performance Metrics

Standard classification evaluation tools such as Precision, Recall, F1-Score are used to evaluate the performance. True Positive (TP) is the cases in which we predicted YES. The actual output was also YES., False Positive (FP) are the cases in which we predicted YES and

the actual output was NO., True Negative (TN) is the cases in which we predicted NO. The actual output was NO., and False Negative (FN) is the cases in which we predicted NO. The actual output was YES.

Precision is the number of correct positive results divided by the number of positive results predicted by the classifier. Recall is the number of correct positive results divided by the number of all relevant samples (all samples that should have been identified as positive). F1 score is a measure of a test's accuracy and is defined as the weighted harmonic mean of precision and recall. The range for F1 Score is (0,1).

The precision and recall for PD signals are:

$$Precision = \frac{TP}{TP+FP} \qquad Recall = \frac{TP}{TP+FN} \tag{1}$$

The precision and recall for Non PD signals are:

$$Precision = \frac{TN}{TN+FN} \qquad Recall = \frac{TN}{TN+FP} \tag{2}$$

The F1-Score is the harmonic mean of Precision and Recall:

$$F1 = 2\frac{Presision \cdot Recall}{Presision+Recall} \tag{3}$$

4 Convolutional Neural Networks(CNNs)

Convolutional Neural Networks given in Fig 3. are also know as CNN or ConvNet which are complex feed-forward neural networks. Because of its high accuracy, CNN is used in various applications such as image recognition and classification. CNN architecture is different compared when compared with regular neural networks. A typical CNN has three layers namely such as convolution, pooling, and fully connected layers. The core building block is the convolution layer which transfers the network computation load. By applying a large number of kernels the input image is convoluted. By pooling the values in adjacent pixels each feature map is downsized to a smaller matrix. [12].

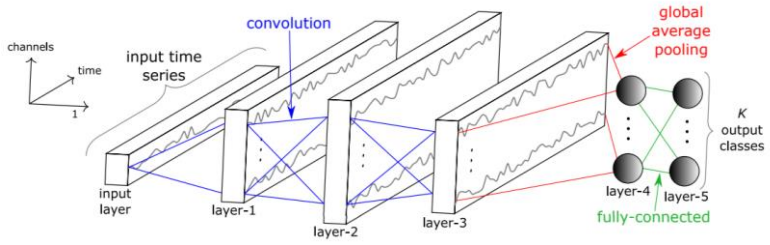

Fig.3. Fully Convolutional Neural Network Architecture

4.1 AlexNet

The AlexNet architecture [13,14,15] is shown in Fig 4. AlexNet is a convolutional neural network consist of eight layers. The initial five layers are convolutional and the rest three are fully connected layers. ReLU is cast-off after every convolutional and fully connected layer. To add non-linearity Rectified Linear Units is applied despite the Tanh function. The speed is increased by 6 times with the same accuracy. Dropout is equipped before the first two fully connected layers. To avoid overfitting dropout is equipped despite regularisation. Hence the dropout rate of 0.5 is doubled in training time. The network size is reduced by adding overlap pooling. AlexNet is used in various applications not limited to medical image processing, natural language processing and other image processing tasks.

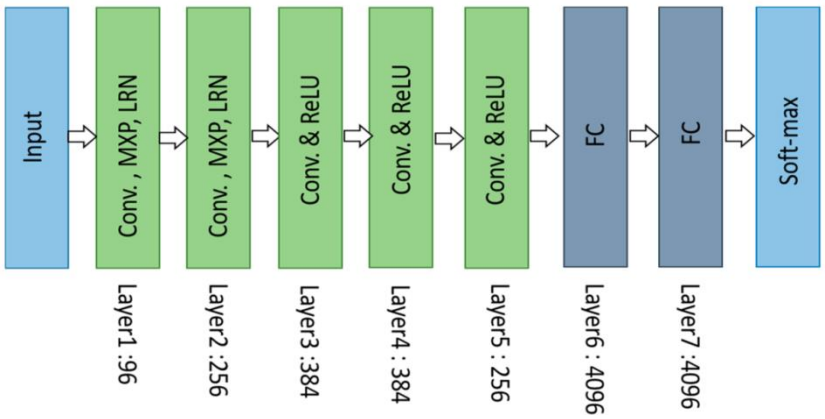

Fig. 4. Architecture of AlexNet. [14]

Table 1. Prediction Evaluation Metrics by AlexNet

Evaluation Category	Precision			Recall			F1-Score		
	Instance			Instance			Instance		
	5	10	15	5	10	15	5	10	15
PD Signals	0.68	0.70	0.72	0.72	0.73	0.74	0.70	0.72	0.73
Non-PD Signals	0.74	0.75	0.75	0.70	0.72	0.73	0.72	0.73	0.74

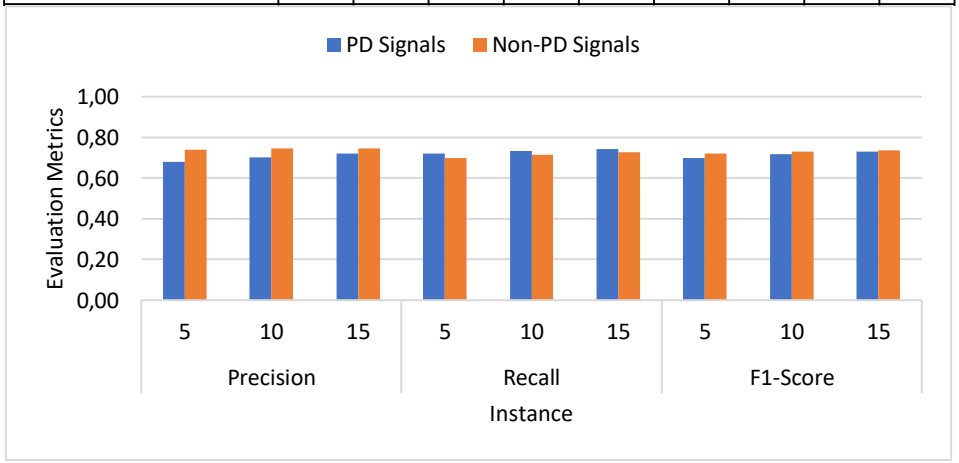

Fig.5. Prediction Evaluation Metrics Plot for AlexNet

Based on the performance evaluation metrics of AlexNet architecture is shown in Table 1 & Figure 5. At the various instances of 5, 10 & 15, it is observed that Precision & Recall values shows 68%, 70% & 72% of detected PD signals which are true PD signals out of 72%, 73% & 74% successfully detected PD signals the F1-Score at the various instances are 70%, 72% & 73% respectively.

4.2 VGG-16

The VGG-16 Network is shown in Fig 5. It consists of 16 layers with some weights. The input is an image with a dimension of 224 x 224 x 3. The initial 2 layers have 2 x Convolution & Max Polling layer with 64 channel feature map size of 244 x 224 x 64 and 112 x 112 x x 64 dimensions. The 3rd& 4th layers have 2 x Convolution & Max Polling layer with 128 channel feature map size of 112 x 112 x 128 and 56 x 56 x 128 dimensions. The 5th& 6th layers have 2 x Convolution & Max Polling layer with 256 channel feature map size of 56 x 56 x 256 and 28 x 28 x 256 dimensions. The 7th& 8th layers have 3 x Convolution & Max Polling layer with 512 channel feature map size of 28 x 28 x 512 and 14 x 14 x 512 dimensions. The last convolution layers have 3 x Convolution & Max Polling layer with 512 channel feature map size of 14 x 14 x 512 & 7 x 7 x 512 dimensions. All the layers have 3x3 Kernel size with a stride of (1,2) respectively. Followed by three Fully connected layers with a size of 25088, 4096 & 4096 are used. ReLU activation function is cast off in all hidden layers. The vanishing gradient problem is also decreased by using ReLU it also increases the learning time which leads to efficient computing. The output layer is also a fully connected layer with a size of 1000 and SoftMax as an activation function.

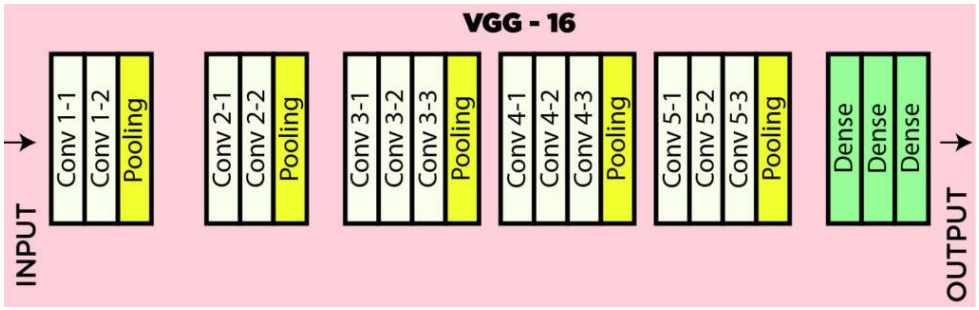

Fig.6.VGG-16 Network Architecture. [15,16]

Based on the performance evaluation metrics of VGG-16 architecture is shown in Table 2 & Figure 7. At the various instances of 5, 10 & 15, it is observed that Precision & Recall values shows 74%, 75% & 78% of detected PD signals which are true PD signals out of 76%, 78% & 79% successfully detected PD signals the F1-Score at the various instances are 75%, 76% & 78% respectively.

Table 2 Prediction Evaluation Metrics by VGG-16

Evaluation Category	Precision			Recall			F1-Score		
	Instance			Instance			Instance		
	5	10	15	5	10	15	5	10	15
PD Signals	0.74	0.75	0.78	0.76	0.78	0.79	0.75	0.76	0.78
Non-PD Signals	0.77	0.78	0.78	0.74	0.76	0.77	0.76	0.77	0.78

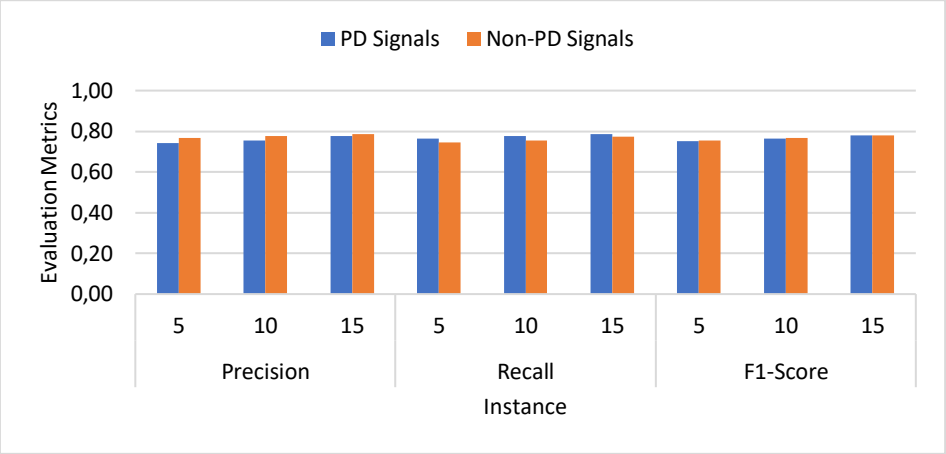

Fig. 7. Prediction Evaluation Metrics Plot for VGG-16

4.3 Residual Network (ResNet)

ResNet [17, 18, 19] shown in Fig 4. is a type of deep neural networks with 150+ layers. It is frequently used in many computer vision tasks. Before ResNet due to the problem of vanishing gradients training of deep neural network is problematic. To overcome the vanishing gradient problem, skip connection is used in ResNet. Layers such as 34, 50,101, 152, and even 1202 are used in ResNet. It consists of 49 convolution and 1 fully connected layer. ResNet is built with the total number of 25.5M weights & 3.9M Multiply and Accumulates (MACs).

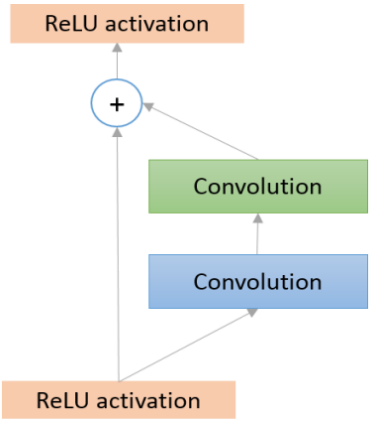

Fig. 8. Residual block. [19]

Based on the performance evaluation metrics of ResNet architecture is shown in Table 3 & Figure 9. At the various instances of 5, 10 & 15, it is observed that Precision & Recall values shows 79%, 80% & 80% of detected PD signals which are true PD signals out of 80%, 82% & 81% successfully detected PD signals the F1-Score at the various instances are 79%, 79% & 81% respectively.

Table 3 Prediction Evaluation Metrics by ResNet

Evaluation Category	Precision			Recall			F1-Score		
	Instance			Instance			Instance		
	5	10	15	5	10	15	5	10	15
PD Signals	0.79	0.80	0.80	0.80	0.82	0.81	0.79	0.79	0.81
Non-PD Signals	0.77	0.77	0.77	0.76	0.75	0.76	0.76	0.76	0.77

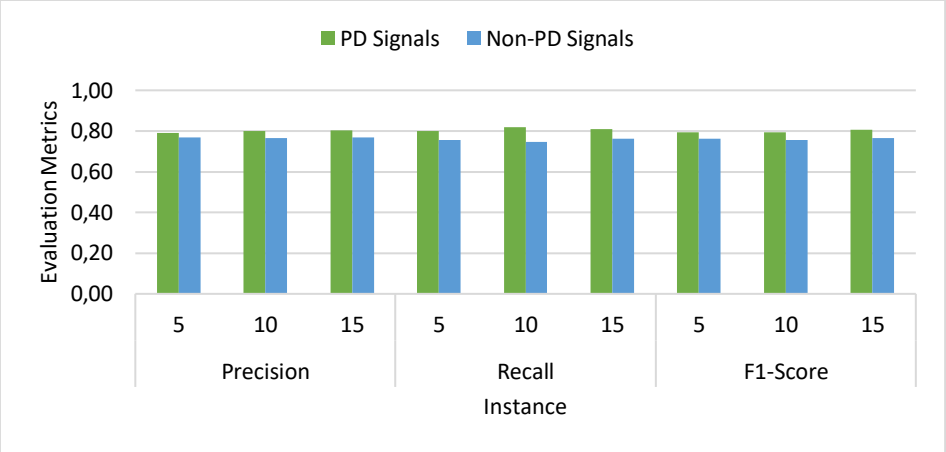

Fig.9. Prediction Evaluation Metrics Plot for ResNet

5 Result & Discussion:

At the various instance of 5, 10 & 15, it is observed that Precision & Recall values shows 70%, 72% & 73% of detected PD signals which are true PD signals out of 75%, 76% & 78% successfully detected PD signals the F1-Score at the various instances are 79%, 79% & 81% respectively. Based on the analysis of Prediction Evaluation Metrics shown in Table 4 & Figure 10 for different pre-trained CNN Architectures such as AlexNet, VGG-16 & ResNet, it is observed that ResNet architecture provides the best prediction and classification results.

Table 4 F1-Score of different pre-trained CNN Architectures

F1-Score	AlexNet			VGG-16			ResNet		
	Instance			Instance			Instance		
	5	10	15	5	10	15	5	10	15
PD Signals	0.70	0.72	0.73	0.75	0.76	0.78	0.79	0.79	0.81
Non-PD Signals	0.72	0.73	0.74	0.76	0.77	0.78	0.76	0.76	0.77

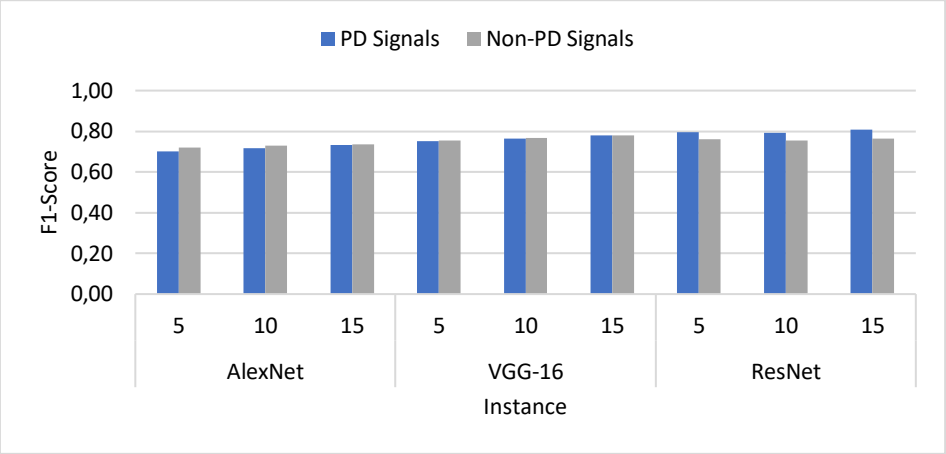

Fig.10.F1-Score Plot for different pre-trained CNN Architectures

6 Conclusion

In this paper, the contemporary development made on the application of CNN techniques for identifying PD sources are discussed. CNN based models for the classification of time series has numerous significant benefits over other methods. To analyze and classify the raw voltage signal for the detection of PD's in IOC's a CNN based fault classification algorithm is proposed. The CNN is implemented using popular pre-trained CNN architectures such as AlexNet, VGG16 & ResNet are applied to the voltage signals in the dataset. The trained classifier will be able to detect future PDs in IOC's. From the values of Precision, Recall & F1-Score it is observed that ResNet architecture provides the best prediction and classification results.

References:

1. W. ReklamníagenturaMARF, "ENET Centre - Introduction | ENET Centre | Centrum ENET", Cenet.vsb.cz, 2020. [Online]. Available: http://cenet.vsb.cz/en/informace/enet-centre/160/enet-centre-introduction.html. [Accessed: 21- Jun- 2020].
2. Baskar. D, Selvam. P, "Electrical Transmission Line Fault Detection and Classification using Convolution Neural Networks and Support Vector Machine," Test Engineering & Management, vol. 82, pp. 6803-6808, Jan./Feb. 2020.
3. N. Qu, Z. Li, J. Zuo and J. Chen, "Fault Detection on Insulated Overhead Conductors Based on DWT-LSTM and Partial Discharge," IEEE Access, vol. 8, pp. 87060-87070, 2020.
4. M. Dong and J. Sun, "Partial discharge detection on aerial covered conductors using time-series decomposition and long short-term memory network," Electric Power Systems Research, vol. 184, p. 106318, Mar. 2020.
5. Baskar, D. " Efficient sequential switching hybrid modulation techniques for cascaded multilevel inverters Middle - East Journal of Scientific Research, 2014, 20(12), pp. 2523–2528
6. "VSB Power Line Fault Detection | Kaggle", Kaggle.com, 2020. [Online]. Available: https://www.kaggle.com/c/vsb-power-line-fault-detection/data. [Accessed: 21- Jun- 2020].
7. Baskar. D, Selvam. P, "Machine Learning framework for Power System Fault Detection and Classification," International Journal of Scientific & Technology Research, vol. 9, no. 2, pp. 2002-2008, Feb. 2020.
8. "Apache Parquet", Parquet.apache.org, 2020. [Online]. Available: https://parquet.apache.org/documentation/latest/. [Accessed: 21- Jun- 2020].
9. Charles Rajesh Kumar, J., Vinod Kumar, D., Baskar, D., ...Jenova, R., Majid, M.A. "Offshore wind energy status, challenges, opportunities, environmental impacts, occupational health, and safety management in India" Energy and Environment, 2020
10. Baskar, D. " Current control of boost single phase PFC converters" Middle - East Journal of Scientific Research, 2014, 19(9), pp. 1250–1258.
11. R.S. Michalski, J.G. Carbonell, T.M. Mitchell, Machine Learning: An Artificial Intelligence Approach, Springer Science & Business Media, 2013.
12. B. Zhao, H. Lu, S. Chen, J. Liu and D. Wu, "Convolutional neural networks for time series classification," Journal of Systems Engineering and Electronics, vol. 28, no. 1, pp. 162-169, Feb. 2017.

13. Muthukrishnan, A.; Charles Rajesh Kumar, J.; Vinod Kumar, D.; Kanagaraj, M. Internet of image things-discrete wavelet transform and Gabor wavelet transform based image enhancement resolution technique for IoT satellite applications. Cogn. Syst. Res. 2019, 57, 46–53.
14. M. Z. Alom, T. M. Taha, C. Yakopcic, S. Westberg, P. Sidike, M. S. Nasrin, M. Hasan, B. C. Van Essen, A. A. S. Awwal, and V. K. Asari, "A State-of-the-Art Survey on Deep Learning Theory and Architectures," Electronics, vol. 8, no. 3, p. 292, Mar. 2019.
15. Charles Rajesh Kumar.J , Vinod Kumar.D, Baskar.D, Mary Arunsi.B, Jenova.R, ,M.A.Majid." VLSI design and implementation of High-performance Binary-weighted convolutional artificial neural networks for embedded vision based Internet of Things (IoT)".16th International Learning & Technology Conference (L&T), Procedia Computer science (Elsevier), Jeddah,2018.
16. K. Simonyan and A. Zisserman, "Very deep convolutional networks for large-scale image recognition," arXiv preprint arXiv:1409.1556, 2014.
17. Md ZahangirAlom , Tarek M. Taha , Chris Yakopcic , Stefan Westberg , PahedingSidike , MstShamima Nasrin , Brian C Van Essen , Abdul A S. Awwal , and Vijayan K. Asari, "The History Began from AlexNet: A Comprehensive Survey on Deep Learning Approach" arXiv:1803.01164, 2018.
18. Charles Rajesh Kumar, J., Vinod Kumar, D., Majid, M.A. "Wind energy programme in India: Emerging energy alternatives for sustainable growth" Energy and Environment, 2019, 30(7), pp. 1135–1189
19. K. He, X. Zhang, S. Ren, and J. Sun, "Deep Residual Learning for Image Recognition," 2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Las Vegas, NV, USA, June 2016; pp. 770–778.
20. T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.
21. D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9
22. Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.
23. Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020
24. C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2
25. Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.
26. Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

A Modern Approach For Analysis Of Manets For Dynamically Changing Network Topologies

S.Rajesh[1], Dr.M.Sangeetha[2]
{rajeshsports@gmail.com[1], sang_gok@yahoo.com [2]}

Research Scholar, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research Chennai, India[1],
Professor & Head, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, India[2]

Abstract. Versatility the board is a significant test in portable impromptu organizations (MANETs) due to a limited extent to the progressively changing organization geographies. For versatile sensor network that are conveyed for reconnaissance application, critical utilize portability the executives plot that can engage hubs to settle on better choices with respect to their positions to such an extent that essential assignments, for example, target following can profit by hub development. In this paper, we portray a disseminated portability the board conspire for versatile sensor organizations. The proposed conspire considers hub development choices as a component of a disseminated advancement issue which coordinates portability upgraded improvement in the nature of target following information with the related unfortunate results of expanded energy utilization because of movement, expected deficiency of organization network, defeat of detecting inclusion..

Keywords: Mobile Adhoc Networks, Target Tracking, Mobility Management.

1 Introduction

Portability the executives for quite some time been perceived significant test in versatile specially appointed organizations. Versatility the board is a significant test in portable impromptu organizations (MANETs) due partially to the progressively changing organization geographies.

Versatility the board in sensor networks is not quite the same as that in versatile specially appointed organizations on the grounds that the development of sensor hubs here isn't irregular; somewhat, development of sensors hubs is deliberate, e.g., effectively and improved trail interloper.

In such situations, imperative a proficient portability the executives plan to guarantee that sensor hub versatility isexploited in the most ideal manner, e.g., to recover the nature of board following. Simultaneously, the versatility board technique ought to stay away from wasteful use of scant assets, for example, energy and organization data transfer capacity.

Besides, the portability the executives plan ought to likewise consider the expected unfortunate results of hub development, e.g., injury of territory inclusion, loss of availability,

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and corruption of organization execution. Likewise, hub development additionally includes movement liveliness and directing upstairs, particularly the essential to restore courses.

2 Related Works

Late exploration endeavors on track following in remote sensor networks have zeroed in on communitarian detecting energy-effective directing and the executives and sensor hub sending. Cooperative detecting and sign handling give crude tactile information low-level detecting unit sensors node[7]. By and large, modest sensors, for example, omni directional acoustic sensor utilized meanwhile choices, for example, CCD camera for the most part necessitate extra assets for control, memory, data transmission and calculation.

We center around the versatility the board issue for portable sensor networks in this task. Versatility the executives in sensor networks is not quite the same as that in portable impromptu organizations in light of the fact that the development of sensor hubs here isn't irregular; slightly, the development of sensors hubs is deliberate, e.g., to effectively and improved trajectory an interloper. In such situations, it is imperative to have a proficient portability the executives plan to guarantee that sensor hub versatility is abused in the most ideal manner, e.g., to advance the nature of objective following. Simultaneously, the portability the executives methodology ought to keep away from wasteful use of scant assets, for example, energy and organization data transfer capacity.

Directing in impromptu sensor networks has gotten a ton consideration and is viewed as an extraordinary test for specially appointed sensor organizations. Numerous endeavors have been made to accomplish energy-productive directing in information conglomeration, particularly for target following applications. The LEACH convention shapes a grouped progressive system in sensor organizations, where the bunch bonce will be liable for sending sensors information group member[9].

A portability the board system that brings together following quality, detecting inclusion, network availability, and energy utilization is presented. At last, we present a dispersed calculation for executing the proposed versatility the executives plot.

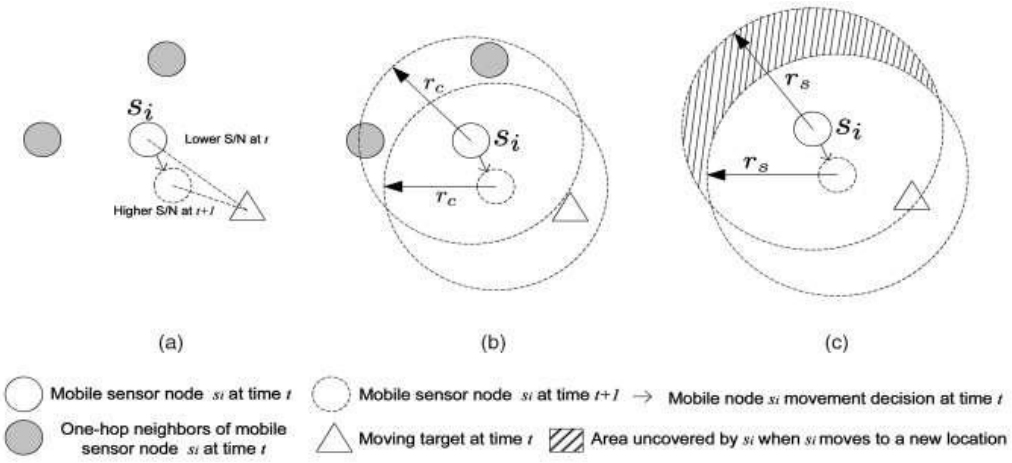

Fig: 1(a) To recover following quality, versatile hub Si decides to move to an area that is required to have a higher sign to-clamor proportion. Fig (b) Movement of Si may break the correspondence availability with its neighbor hubs. Fig (c) Movement of Si may make some territory under inclusion at t time to get revealed at t+1.

3 Assumptions

To rearrange the discussion [10], we variety the accompanying suppositions for the sensors organization:

1. In this articles, we accept that together sensor hubs and the objective are touching at consistent velocities.

2. We expect that the inspecting timespan sensor hubs is little enough with the end goal that there is no exceptional alteration in sensor estimations of the objective state.

3. All hubs have similar number of applicant areas where they can change.

4. A hub utilizes the earlier of its present area to foresee the sensors estimations at its up-and-comer areas.

5. A hub utilizes the current sensor estimations from its present one-bounce neighbor hubs.

Tracking

To improve the nature of target following, a hub can choose to move to one more area at the following time moment. These areas are alluded to as up-and-comer areas. At that point

define the issue of choosing the best up-and-comer area for a hub in a completely circulated way

5 Estimates of Negative Consequences

Evaluations of unfortunate results centers around the energy, network and inclusion issues. Hubs need to burn through extra effort for development. Despite the fact that sensor hubs on portable stages can convey more battery supplies guarantee that the accessible energy is appropriately used to best fill the need of reconnaissance assignments.

6 Decisions on Node Movement

Choices on hub development include the choice on hub development utilizing Cost assessment, choice on development and examination of time intricacy.

The choice standard dependent on the expense assessment that considers all adverse results because of move movement. Nodes can trade their normal absolute charge and conclude who would move. At the point when the complete expense is gotten for all applicant locations[11], the ideal choice of the up-and-comer area for hub can be acquired by thinking about together positive and unfortunate results.

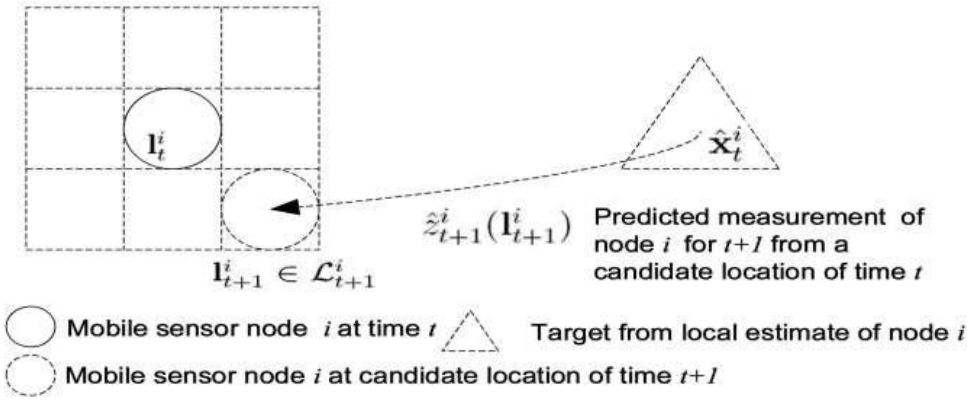

Fig: 2 Node Si predicts its measurement at a candidate location based on its current target estimate

7 Simulated Studies

7.1 Static Sensor Network versus Mobile Network with Mobility Management

The determination of the up-and-comer areas for target following information improvement depends on the hint of the mistake covariance grid. The blunder for a versatile

sensor network is not exactly that for the still organization. Another very much acknowledged measurement for assessing the following excellence is the standard of the location mistake. The standard of the location mistake for the versatile organization is generally 72.5 percent less throughout the time that board is traveling finished the sensors arena.

The normal worldwide inclusion is characterized as the amount of separate lattice focuses finished the complete amount of network focuses. The versatility the executives conspire improves the worldwide inclusion contrasted with the static organization. Each hub can settle on its development choice in an ideal way for dynamic objective following without long arrangement with neighbors for keeping up network and sensing coverage.

8 Results

Every hub chooses to move to arrive at their objective by assessing the results, for example, update check, bunching speed, between grouping distance, and correspondence cost.. In view of the grouping speed, between bunching distance, update check and correspondence cost hubs choose where to change.

The outcome shows the presentation of the future method circulated versatility method. Strategy 1 in the figure aftereffect of

animal power versatility show the outcome subsequent to smearing the savage power portability in the organization.

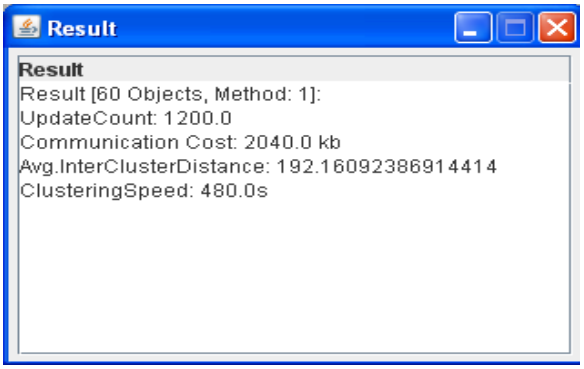

Fig:3 Result of Brute Force Mobility

Strategy 2 in the figure consequence of current appropriated portability method shows the aftereffect of current conveyed versatility method. The results show the distinction in the correspondence cost, apprise tally. Normal between grouping distance and bunching speed

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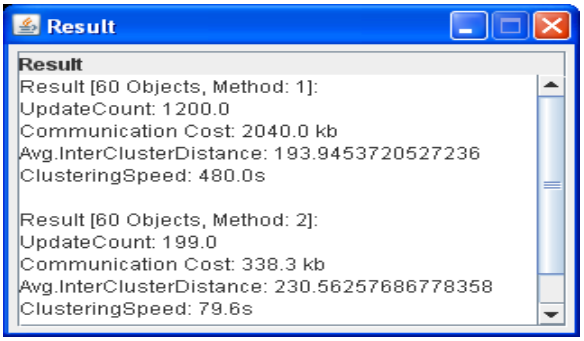

Fig:4 Result of Existing Distributed Mobility Approach

Technique 3 in the figure aftereffect of suggested disseminated versatility method shows the consequence of current appropriated portability method. The outcome show the distinction in the correspondence cost, update tally. Normal between grouping distance and bunching speed. Every one of the three outcomes demonstration that the future disseminated versatility method has more positive results.

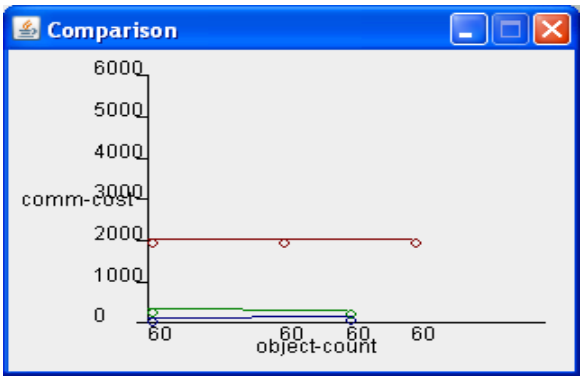

Fig:5 Comparison on Communication Cost

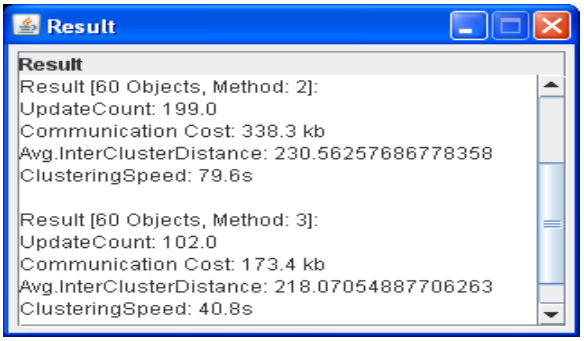

Fig: 6 Result of Proposed Distributed Mobility Approach

9 Comparisons

Correlations are done on the grouping speed, between bunching distance, update-check and correspondence cost. The examination on the outcomes, for example, update tally, bunching speed, between grouping distance and correspondence cost are appeared as a diagram. The examination assists with making an assessment of the exhibition of the hub development in existing framework and suggested framework just as it show how the still sensor network varies from versatile sensor organization. The outlines appeared beneath depict the adverse results between the current methodology and projected approach. It likewise depicts the improvement of the suggested approach.

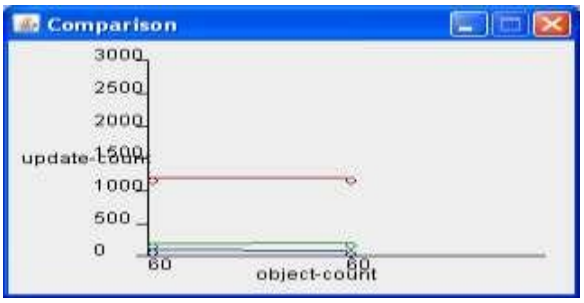

Fig:7 Comparison on Update-Count

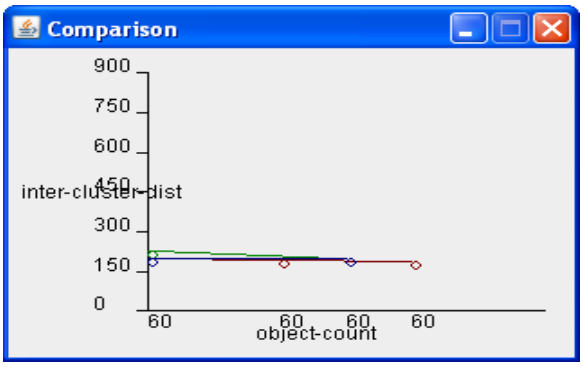

Fig:8 Comparison on Inter-Clustering Distance

Fig:9 Comparison on Cluster Speed

10 Conclusions

Portability the board conspire for versatile sensors network reflects target following quality, availability breakage, and loss of detecting inclusion and energy utilization because of hub development. The continually changing geography because of hub development makes versatility the board hard for portable sensor organizations. The expense assessment strategy permits us to compromise board following excellence development with the unfortunate results of energy utilization, damage of availability and inclusion.

References

[1] Zou and Chakrabary, "Distributed Mobility Management for Target Tracking in Mobile sensor Networks," IEEE Mobile Computing, pp 872 – 887, 2007.

[2] I.F. Akyildiz, W. Su, y. Sankarasubramaniam, and E. CAyirci, "A Survey on Sensor Networks," IEEE Comm. Magazine, pp. 102-114, Aug. 2002.

[3] F.Baker, "An Outsider's view of MANET,"IETF Internet draft, work in progress, June 2006.

[4] R.R.Brooks, C.Griffin, and D.Friedlander, "Distributed Target Classification and tracking in sensor networks," proc. IEEE, pp. 1163 -1171, 2003.

[5] T.Camp, J.Boleng, and V.Davies, "A Survey of Mobility Models for Ad Hoc Network Research," J.Wireless Comm. Mobile Computing, vol.2, pp.483-502, 2002.

[6] S.S. Iyengar and R.R. Brooks, Handbook on Distributed Sensor Networks. Chapman and Hall/CRC Press, July 2003.

[7] Dr. Kaliyamurthie K.P "An Application Of Non-Uniform Cellular Automata For Efficient Cryptography" , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4648-4652 May 2013.

[8] Dr. Kaliyamurthie K.P "K-Anonymity Based Privacy Preserving For Data Collection In Wireless Sensor Networks" , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4604-4614 May 2013.

[9] Dr. Kaliyamurthie K.P "Highly Secured Online Voting System Over Network" , Indian Journal of Science and Technology, Vol 6, Issue 6S page 4831-4836 May 2013.

[10] Dr. Kumaravel. A "Vehnode: Wireless Sensor Network Platform For Automobile Pollution Control" IEEE explore, Vol Page(s): 963 – 966, 2013.

[11] Dr. Kumaravel. A "Multi- Classification Approach For Detecting Network" IEEE explore, Page(s): 1114 –1117,April 2013.

[12] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.

[13] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9

[14] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.

[15] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020

[16] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2

[17] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.

[18] Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

Nationwide Corporate Multimedia Network Designfor IP Based Multimedia

A.StephenAntoJegan[1], Dr. K.P.Kaliyamurthie[2], Dr.M.Sriram[3]
{stephen_jegan@yahoo.co.in[1], kpkaliyamurthie@gmail.com[2], msr1sriram@gmail.com[3]}

Research Scholar, Department of CSE, Bharath Institute of Higher Education and Research, Chennai[1], Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai[2], Associate Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai[3]

Abstract. The Web Protocol (IP) Based Multimedia Network is the transmission of voice, video, information, video conferencing, web projecting and so on across IP Network. Plan of IP Based Multimedia Network is the finished manual for a triumph network plan technique. Assemble and plan a start to finish interactive media network with assistance of complete guide.This paper will cover all current key cycles, innovations and administrations and furthermore serves to

• Learn about current voice and information network foundations and transmission technologies.Understand innovation
• Requirements from both a client's and originator's viewpoint.
• Learn attempted and-tried plan tips for every innovation and service.Tune, get and distantly deal with your organization.
Contextual analysis of enormous complex corporate wide interactive media network is likewise portrayed.
• Understand fundamental and progressed convention layering ideas.
• Learn about fiber and copper link innovations. Gain a strong foundation on Multiplexing, exchanging and directing innovations and techniques. Find out about network data transfer capacity necessity and traffic designing..

Keywords: IP Network, Web Protocol, Multimedia Network , transmission of voice, video, information.

1 Introduction

In the professional workplace, data transfer capacity hungry and eager for processor customer worker applications have arrived at most corporate work areas. Undertaking asset arranging (ERP) apparatuses use to recover and profitability, voice-information video (interactive media) combination at the work area, expanded document sizes for data sets and clinical pictures records, colossal crosscountry and global record move and desktop video conferencing are only a couple business application heavy the requirement for additional data transfer capacity. In another time of appropriating registering, we consider that to be information move and capacity data transmission prerequisites for text, video, voice and imaging traffic increment dramatically, the organization conveyance necessities needed to move that traffic increment respectively, and no respectively[4].

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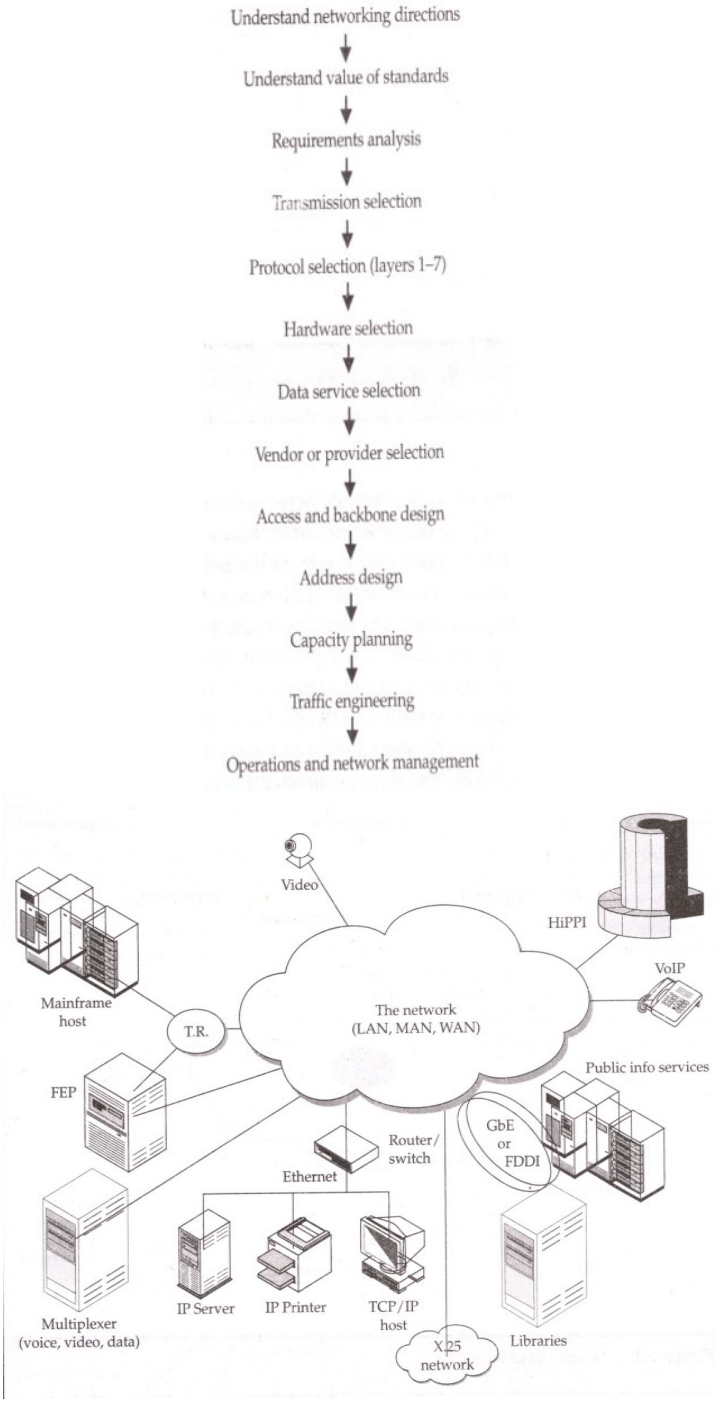

Fig. 1 : IP Based Multimedia Network with user-to-network interfaces

IP Based Multimedia Network with user-to-network interfaces is shown in figure 1 below.

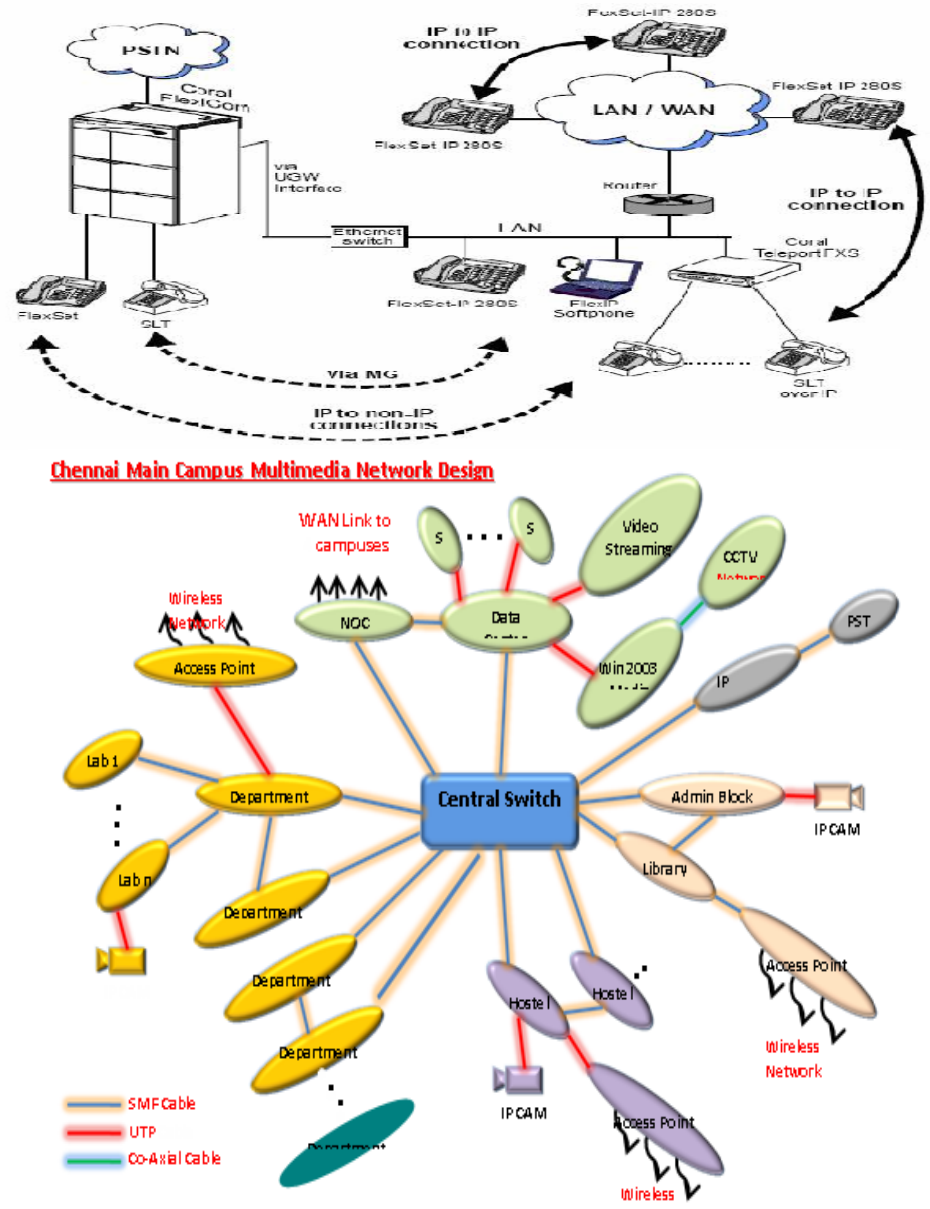

Fig. 2 : IP Based Multimedia Network design steps

The various steps of IP Based Multimedia Network design is shown in figure 2 above[5].

2. Problem definition:

Any commercial organization has least three organizations now-a-days.

- Telephone network for voice transmission.
- CCTV network for video transmission.

Information network for information transmission.

Each customer ought to have three gadgets for getting to voice, video and information. Phone for voice, TV for video and Computer for information.

A significant issue of Absence of Synchronization among the application manifests. It is additionally costly to keep up and oversee varied segments and organizations.

3. Solution:

Gadgets are accessible to change video and voice over to arrange. A camcorder yield can be changed over to Digital video and further to arrange parcels. Additionally gadgets, for example, IP telephones empower us to carry out Internet Telephony. In this way,

- Design of an appropriate organization engineering to incorporate the gadgets with the current IP organization would give ideal arrangement and compulsoryharmonization for the commercial application. would give the arrangement required.

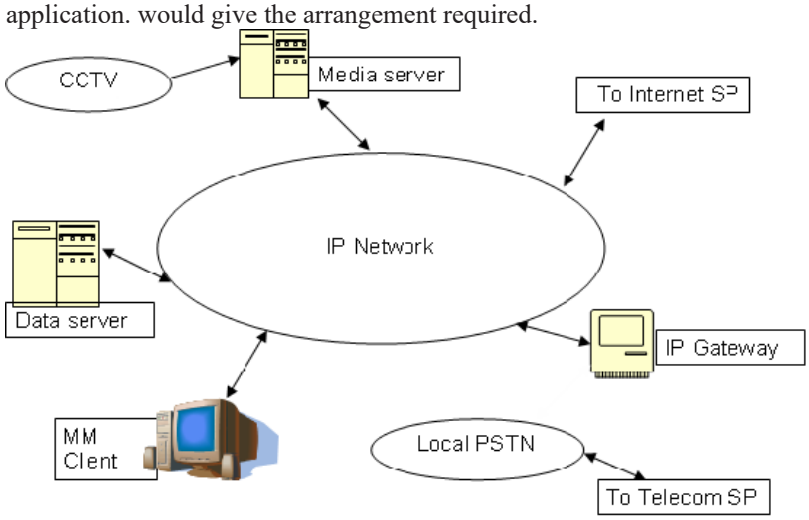

Fig. 3 Sample Multimedia network

5. Design considerations

There are bunches of difficulties for information proprietor to share their information on servers or cloud. There are various answers for take care of these issues. These strategies are particularly basic to deal with key shared by the information proprietor. This paper will acquaint the confided in power with verify client the individuals who have the entrance to the information on cloud. SHA calculation is utilized by the believed position to produce the key and that key will get offer to client just as the proprietor. The believed power module gets encoded record utilizing AES Algorithm from the information proprietor and processes hash esteem utilizing MD-5 calculation. It stores key in its database which will be utilized during the dynamic activities and to decide the conning party in the framework. Believed authority send document to CSP module to store on cloud. The subsequent key sets are appeared to have various alluring properties that guarantee the classification of correspondence meetings against conspiracy assaults by other system hubs.

6. Protocol selection:

One potential arrangement is to move character groupings to open distributed computing stages and to demand that Cloud Service Providers process succession correlations. At present, essential grouping examination calculations are conveyed as a widespread redistributing administration on open mists. And yet, its security and protection issues are progressively rising. The re-appropriated information put away as plaintext could without much of a stretch be presented to noxious outside interlopers and inner assailants in the CSP, and the individual private data conveyed by character arrangements (e.g., individual identification, financial exchange records, hereditary markers for certain maladies, data that is utilized to recognize paternity or maternity, and so forth.) could pretty much be unveiled or mishandled. Consequently, secure re-appropriating is intended to secure the protection of character successions, and to guarantee that the booked registering demands are regularly performed on the cloud servers.

8. Address design :

A salted hash calculation is improved to hash the character successions and the files of cost networks, in order to protect against measurable assaults. An added substance request protecting encryption calculation is intended to encode the components of cost frameworks. Additionally, this calculation can accomplish a lack of definition under added substance requested picked plaintext assault with straight time multifaceted nature. 3) A single cloud server works for the first time to provide a security safeguarding calculable redistributing administration to viably oppose plot assaults from the cloud. With pre-processing modules of padding, partition, and extension, there is no compelling reason to decode any redistributed information in the non-intuitive grouping correlation organize.

9. Network architecture :

With the quick improvement of distributed computing, the systems for safely re-appropriating restrictively costly calculations are getting across the board considerations in established researchers. In the re-appropriating calculation worldview, the customers with asset compelled capacities can redistribute the substantial calculation outstanding tasks at hand into the cloud server and appreciate boundless registering assets in a compensation for every utilization way. One of the most basic functionalities in re-appropriating calculation is the certainty of the outcome. That is, the customer ought to productively check the legitimacy of the outcome returned by the cloud servers. Right now, take care of the issue of undeniable re-appropriating calculation of succession examinations by coordinating the procedure of Yao's distorted circuit with homomorphic encryption. Contrasted and the current plans, our proposed arrangement empowers customers to effectively recognize the bad conduct of untrustworthy servers. Moreover, our development re-jumbles the circuit just for contorted reactions and consequently is exceptionally productive for genuine applications. Plus, we likewise present the conventional examination for our proposed development.

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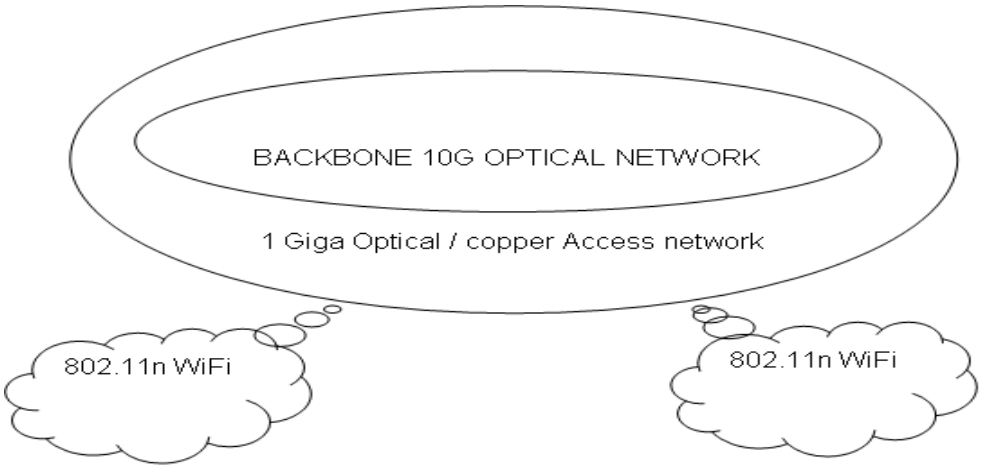

Fig. 4 Network Architecture

11. Summary

Through the above outline, because of the issues about the arrangement assaults that are across the board in the protected redistributing of grouping correlation calculations, this paper will acquaint the confided in power with validate client the individuals who have the entrance to the information on cloud. SHA calculation is utilized by the believed power to create the key and that key will get offer to client just as the proprietor. The believed position module gets scrambled record utilizing AES Algorithm from the information proprietor and figures hash esteem utilizing MD-5 calculation. It stores key in its database which will be utilized during the dynamic tasks and to decide the deceiving party in the framework. Believed authority send record to CSP module to store on cloud. The subsequent key sets are appeared

to have various alluring properties that guarantee the secrecy of correspondence meetings against arrangement assaults by other system hubs.

References

[1] Multimedia networking communication protocols- Thomas C.Schmidt, tschmidt@ieee.org
[2] Data network design Darren. L. Spohn, TMH publications
[3] Delivering Voice Over IP networks Daniel Minoli& Emma Minoli, Wiley Computer publishing.
[4] B. Balzer. Assuring the safety of opening email attachments.
[5] HouseCall. Free online virus scan. Online Publication,2002. http://housecall.antivirus.com.
[6] D. M. C. Jeffrey O. Kephart and S. R. White.Computers and epidemiology. IEEE Spectrum. http://www.research.ibm.com/antivirns/SciPapers/Kephar
[7] Dr. Kaliyamurthie K.P "An Application Of Non-Uniform Cellular Automata For Efficient Cryptography" ,Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4648-4652 May 2013.
[8] Dr. Kaliyamurthie K.P "K-Anonymity Based Privacy Preserving For Data Collection In Wireless Sensor Networks" , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4604-4614 May 2013.
[9] Dr. Kaliyamurthie K.P "Highly Secured Online Voting System Over Network" , Indian Journal of Science and Technology, Vol 6, Issue 6S page 4831-4836 May 2013.
[10] Dr. Kumaravel. A "vehnode: Wireless Sensor Network Platform For Automobile Pollution Control" IEEE explore, Vol Page(s): 963 – 966, 2013.
[11] Dr. Kumaravel. A "Multi- Classification Approach For Detecting Network" IEEE explore, Page(s): 1114 –1117,April 2013.
[12] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.
[13] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9
[14] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.
[15] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020
[16] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2
[17] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.
[18] Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

An adaptive approach for Human Emotions Recognition System for Neural Networks using Hidden Markov Model and Self Organizing Maps algorithms

K.M.Azaraffali[1], Dr.T.Krishnakumar[2], Dr.M.Sriram[3]
{azaraffali@gmail.com[1], drkk@bharathuniv.ac.in[2], msr1sriram@gmail.com[3]}

Research Scholar, CSE, Bharath Institute of Higher Education and Research, Chennai, India[1], Professor, CSE, Bharath Institute of Higher Education and Research, Chennai, India.[2], Assistant Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai[3]

Abstract. In machine learning, recognition of human emotions by a machine is an important research area. It is informal to reason of emotions as a luxury, approximately that is needless for basic intelligent operative, and something that is problematic to encode in a computer program. Then giving expressivecapabilities to machine has been a least priority up till now. But recent studies suggest that emotions play surprisingly dangerous role in balanced and brainybehavior. Too slightfeeling can damagebalancedthoughtful and behaviour. The main impartial of this paper is the identification of emotional states of human beings.Inthis researchthe algorithms to be used are Hidden Markov Model and Self Organizing Maps..

Keywords: Markov Model, Self Organizing Maps algorithms, Neural Networks, Human Emotions Recognition System.

1 Introduction

Evidently feeling connects with intuition in manners that are non clear however significant for astute working. Passionate insight comprises of the capacity to perceive, communicate and have feelings, combined with the capacity to manage these feelings. Machines may never require the entirety of the enthusiastic abilities that individuals need, anyway there is proof that machines will need probably a portion of these abilities to seem astute while interfacing with individuals.

2 Existing System

The existing system uses Ratio Template Algorithm. Only the three basic emotional states can be tracked with this. (happy, sad, angry). The use of back propagation and multilayer perceptrons delays the processing speed. Accuracy achieved is only 52%

Online review structures expect a critical activity in impacting purchasers' practices and dynamic, attracting various spammers to install fake studies to control study substance and assessments. To grow utility and improve customer experience, some online review structures

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license customers to shape social associations between each other and bolster their interchanges. At this moment, target giving a profitable and amazing system to recognize review spammers by combining social relations subject to two suppositions that people will undoubtedly consider overviews from those related with them as dependable, and review spammers are less disposed to keep up a tremendous relationship arrange with conventional customers. The duties of this paper are two-wrinkle: (1) We clarify how social associations can be combined into review rating desire and propose a trust-based rating conjecture model using closeness as trust weight, and (2) We structure a trust-careful area model reliant on rating vacillation which iteratively determines customer unequivocal all in all constancy scores as the pointer for spamicity. Tests on the dataset assembled from Yelp.com show that the proposed trust-based estimate achieves a higher exactness than standard CF procedure, and there exists a strong association between's social associations and the general constancy scores

In the existing system due to the use of the aforesaid algorithms[7], the processing speed is reduced. The accuracy achieved in this case is just 52%, which is way lower than the acceptable rate.

Another major drawback here is that, there could be only 3 emotional states identified, which are anger, happy, and sad. These are just the basic emotions, and affective communication cannot be achieved with the help of this.

3 Proposed System

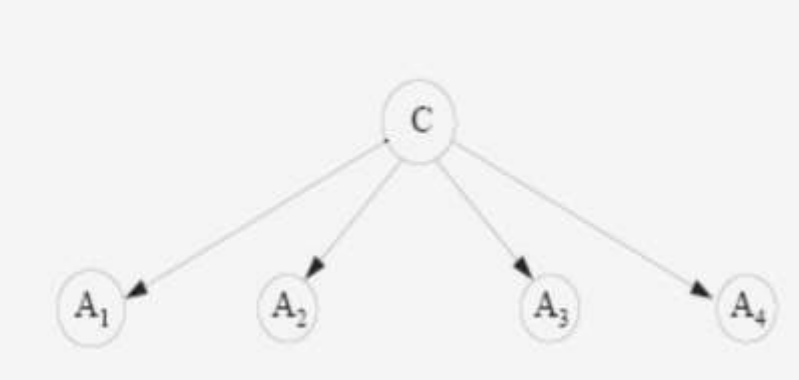
In the proposed system, we use Hidden Markov Model and self organizing maps. All emotional states are clearly identified. The use of TAN filters improves the accuracy. Accuracy can be achieved up to 86.3%. In the proposed system, TAN filters are used to identify the face region from the video input taken. The Tree-Augmented-Naive Bayes (TAN) classifier incorporates the dependencies between features, and a TAN structure is created, and the face is identified[9]. This proves to be more accurate way of face recognition from a video stream, or a sequence of input images. This improves the accuracy of the whole system.

In the proposed system, seven human emotional states are identified, which are anger, disgust, fear, happiness, sadness, surprise and neutral. This is a considerable improvement over the 3 emotional stages achieved in the proposed system. Due to all these factors, an accuracy of 86.3% is expected to achieve.

4 Self Organizing Maps

Oneself getting sorted out map (SOM) or Kohonen map is a subtype of fake neural organizations. It is ready utilizing lonepresuming out how to distribute low dimensional portrayal of the preparation tests while saving the topological possessions of the info interplanetary. This make SOM sensible for envisioning low-dimensional viewpoints on high-dimensional data[11], similar to multidimensional scaling. SOM were imagined by TeuvoKohonen, a teacher of the Academy of Finland, and they give a technique of addressing multidimensional evidence in much lower dimensional spaces - generally a couple of measurement.

5 Tree-Augmented-Naive Bayes (Tan)



An Example of naive BayesTree-Augmented-Naive Bayes

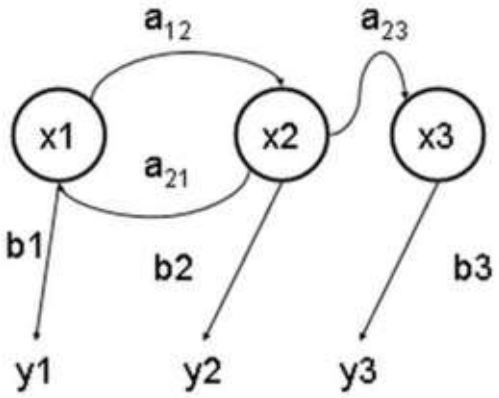
Gullible Bayes is a viable and proficient learning calculation in order. In numerous applications, in any case, a precise positioning of examples dependent on the class likelihood is more alluring. Tragically, credulous Bayes has been found to deliver helpless likelihood gauges. Various strategies have been proposed to broaden credulous Bayes for better arrangement precision, of which particular Bayesian classifiers (SBC), tree-expanded innocent Bayes (TAN), NBTree, helped gullible Bayes and AODE accomplish astounding improvement over guileless Bayes as far as order exactness.

One approach to mitigate the contingent freedom supposition that is to broaden the design of guileless Bayes to address expressly property conditions by adding curves between ascribes. Tree expanded innocent Bayes (TAN) is an all-encompassing tree-like credulous Bayes, in which the class hub straightforwardly focuses to all ascribe hubs and a characteristic hub can have just one parent from another property hub. TAN is a particular instance of general increased innocent Bayesian organizations, or essentially ANB, in which the class hub likewise straightforwardly focuses to all credit hubs, however there is no constraint on the connections among quality hubs. ANB can address discretionary trait conditions.

6 Hidden Markov Model

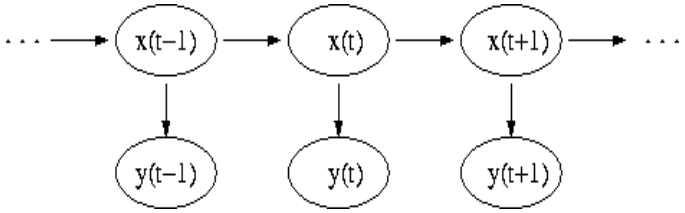
A secret Markov model (HMM) is a factual model Markov measure with obscure boundaries, and the test is to decide the concealed boundaries from the detectable boundaries. The separated model boundaries would then be able to be utilized to perform further analysis.A HMM can be measured as the least difficult unique Bayesian organization.

In a normal Markov model, the state is straightforwardly noticeable to the eyewitness, and consequently the state progress likelihoods are the solitary boundaries. In a secret Markov model, the state isn't straightforwardly noticeable, yet factors affected by the state are apparent. Each state has a likelihood dispersion over the imaginable yield token. In this way the sequence of token shaped by a HMM give some data about the group of conditions.



State transitions in a hidden Markov model (example)
x — hidden states
y — observable outputs
a — transition probabilities
b — output probabilities

7 Architecture of a Hidden Markov Model



General architecture of HMM.

Conclusion

The graph beneath shows the overall engineering of a HMM. Every oval shape addresses an arbitrary mutable that can embrace various qualities. The irregular variable x(t) is the worth of the secret variable at time t. The irregular variable y(t) is the worth of the noticed variable at time t. The bolts in the graph mean restrictive conditions.

From the outline, obviously the worth of the secret variable x(t) (at time t) just relies upon the worth of the secret variable x(t − 1) (at time t − 1). This is known as the Markov stuff. Essentially, the worth of the noticed variable y(t) just relies upon the worth of the secret variable x(t) (both at time t).

References

[1] Facial Expression Recognition with Local Binary patterns and Linear programming – X.Feng, M.Pietikäinen, A.Hadid.

[2] Toward Machine Emotional Intelligence - Rosalind W Picard, MIT Cambridge.

[3] Facial Expression Analysis - Ying-Li Tian, Takeo Kanade, and Jeffrey F. Cohn.

[4] Emotion Recognition from Facial Expressions using Multilevel HMM - Ira Cohen, AshutoshGarg, Thomas S. Huang

[5] Facial Expressions recognition from video sequences - Ira Cohen, NicuSebe, AshutoshGarg, Michael S. Lew, Thomas S. Huang. Web References.

[6] Dr. Kaliyamurthie K.P "An Application Of Non-Uniform Cellular Automata For Efficient Cryptography" ,Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4648-4652 May 2013.

[7] Dr. Kaliyamurthie K.P "K-Anonymity Based Privacy Preserving For Data Collection In Wireless Sensor Networks" , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4604-4614 May 2013.

[8] Dr. Kaliyamurthie K.P "Highly Secured Online Voting System Over Network" , Indian Journal of Science and Technology, Vol 6, Issue 6S page 4831-4836 May 2013.

[9] Dr. Kumaravel. A "vehnode: Wireless Sensor Network Platform For Automobile Pollution ControL" IEEE explore, Vol Page(s): 963 – 966, 2013.

[10] Dr. Kumaravel. A "Multi- Classification Approach For Detecting Network" IEEE explore, Page(s): 1114 –1117,April 2013.

[11] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.

[12] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9

[13] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.

[14] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020

[15] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2

[16] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.

[17] Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

Resource Constrained Scheduling using Behavioral Network Graph

Dr.M.Sangeetha[1*],Dr. R. Vani[2] and T. Vijayan[3]
{sang_gok@yahoo.com[1], rvani18@gmail.com[2], tvij16@gmail.com[3]}

Professor, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and research, Chennai, India[1]
Professor, Department of Electronics and Communication Engineering, SRM Institute of Science and Technology, Chennai[2]
Asst. Professor, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and research, Chennai[3]

Abstract. The behavioral modeling in HDL language is converted into Control Flow Graph (CFG). The resources in the HDL program is marked in the Control Flow Graph. Each node in the Control Flow Graph is replaced with state value node. Equivalent Behavioral Network Graph is generated for the Control Flow Graph. The unscheduled Behavioral Network Graph is scheduled according to the resources available. The scheduling is performed for any number of resources. Theoretically it is proved using Finite State Machine in this paper.

Keywords: Estimator, Behavioral network graph, Control Flow Graph, hardware estimation.

1 Introduction

The HDL program in functional level is simulated for functionality verification. The estimation is performed for the behavioral description. The estimation[1][2][3][4] will be accurate only if same intermediate format is used for High Level Synthesis and Logic Synthesis. The Behavioral Network Graph is used to represent the logic synthesis. The generated hardware is an optimized one. The state value node(STN) is used to represent each node. State cut variable SCi is associated with each state value node (STN). The algorithm is represented in [5][6]. The unscheduled control BNG is obtained. This unscheduled graph represents the worst case. It is scheduled according to the availability of resource. The behavioral description is transformed into Control Flow Graph(CFG). The nodes in the Control Flow Graph is replaced with state value node. The state value node consists of register, multiplexer and wire. The '1' in state cut variable is realized as register and '0' in state cut is replaced with wire. The number of register is estimated according to the state cut. If one adder is available, the state cut is placed every one adder.

The AND gate is estimated according to the fork nodes in the Control Flow Graph. OR gate is estimated according to the join nodes in the graph.

The designed estimator calculates register, AND gate and OR gate.

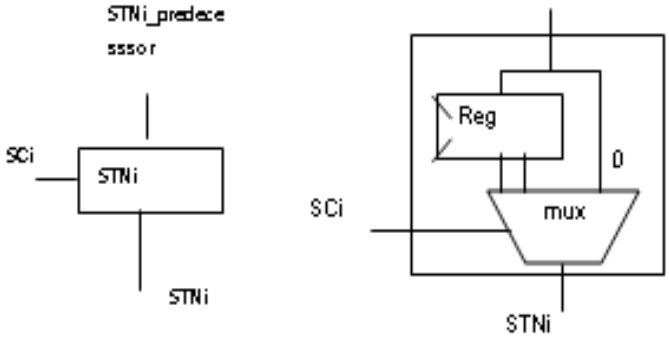


Figure 1 State Value Node

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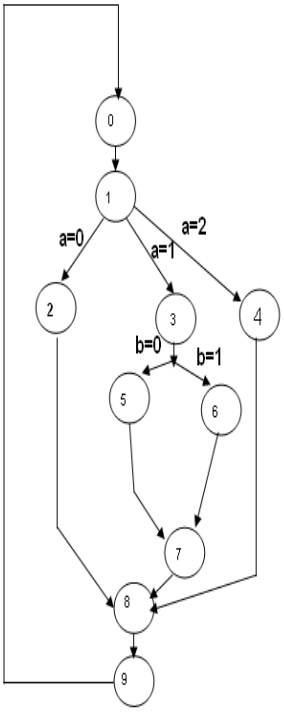
2 Previous Work

For Resource constrained scheduling and timing constrained scheduling Gang Wang et al used ant colony optimization techniques. The scheduling is done in behavioural description. The Data Flow Graph is used for each basic block. The scheduling performed is timing constrained scheduling(TCS) or resource constrained scheduling(RCS). With given deadline the number of resources is calculated. Presynthesis optimization is performed by Rafael Ruiz-Sautua et al does efficient High Level Synthesis of DFG by addition, multiplication and logic operation. Homogenous specification is used in HLS algorithm. Different type, width and format is used in every cycle. Bergamaschi used Behavioral Network Graph for High level Synthesis internal representation. Estimates the control construct from behavioral description. The obtained final behavioural network graph is the complete RTL design. Stitt and vahid has done traditional hardware/software partitioning. Control Flow analysis and data flow analysis is used for optimization. Functional partitioning is performed in hardware/software partitioning and hardware/hardware partitioning by Vahid. Multitasking overhead is obtained when software part is partitioned, heuristic algorithm is developed. Wonyong Sung et al presented optimization technique which reduces the code and data size, Optimization chances are increased, large grain is formed from fine grain cluster for nodes.

3. Cost Estimation

The Control Flow Graph is obtained from the behavioral description. The nodes which have resources are taken into consideration in CFG. Each node in Control Flow graph is represented with State Value Node (STN). The fork node is replaced with two inputs AND gate with a State Value Node and join nodes with OR gate and State Value Node. A simple nodes with IF within Case construct is shown in Figure 2. The number of nodes taken is 10. The node 1 represents the CASE statement, its successor are 2,3,4. Node 3 represents the IF statement and its successor are 5 and 6. Node 7 is end for the IF statement and node 8 is end of CASE statement. The condition for CASE statement is ‘a=0’, ‘a=1’ and ‘a=2’. The condition for IF statement is ‘b=0’ and ‘b=1’. The SCn represents the state cut variable. Each node has state cut variable. The state cut variable determines the realization of register or wire. If value in state cut variable is ‘0’ the state value node is realized as wire. If the value in state cut variable is ‘1’ the state value node is realized as register. The value of state cut variable depends on the number resources available. If resource available is one, state cut is placed after single resource.



IF within Case construct

node	successor
0	1
1	2,3,4
2	8
3	5,6
4	8
5	7
6	7
7	8
8	9
9	0

Figure 2 CFG for IF within Case Construct

Each node in Control Flow Graph in Figure 2 is replaced with State Value Node, the fork node and join node is placed in control BNG according to the algorithm discussed in [5][6].

4.Matrix representation of Control Flow Graph

The consecutive nodes are identified in two dimensional matrixes. The input to matrix is Control Flow Graph. The nodes are represented in rows of the matrix and successors with column of the matrix.

Table 1: Matrix representation of CFG

	0	1	2	3	4	5	6	7	8	9	10
0		1									
1			1	1	1						
2									1		
3						1	1				
4									1		
5								1			
6								1			
7									1		
8										1	
9											1
10	1										

Table 2: Expanded Matrix Representation for Estimation of Gates

	0	1	2	3	4	5	6	7a	7b	8a	8b	8c	9	10
0		1												
1			&	&	&									
2										1				
3						&	&							
4												1		
5								1						
6									1					
7											+			
8														
9a													+	+
9b														+
10	1													

The successor is checked if a node has successor it is represented in matrix as ‘1’ and remain columns will be blank.The matrix representation of CFG is shown as in Table 1 for the Figure 3. Figure 2 represents the node representation. The successors in node 1 is three ‘1’which is replaced with AND Gate. For node3 it has two successors which is replaced with AND Gate. The node which has more than two ‘1’s in the column, the columns are expanded according to the number of ‘1’s and replaced with ‘+’ which shows number of inputs to OR gate as shown in table 3.

The ‘&’ symbol is used to represent AND Gate and ‘+’ the number of inputs to OR gate. We can estimate the inputs to OR gate and also number of two input OR gate. Figure 3 represents the unscheduled BNG[5][6].

5 Algorithm for generation of Control BNG

Each node in the Control Flow graph is replaced with state value node. The AND gate is placed in fork nodes and OR gate is placed instead of join nodes. The Control BNG is generated using the following steps.

1. SCi variable is associatedwith each node
2. Nodes in CFG is traversed through entire graph. A node with single predecessor and single successor is replaced with state value node. State cut variable is associated with each state value node STNi.
3. STNij is formed from join nodes for each predecessor edge, all state value node STNij is connected to single OR gate. STNi is the output of OR gate.
4. Fork nodes(multiple successor edges), a state value node is created which is then connected to the AND gate. Two input AND gate is use. One input will be from fork node(STNi) and other input will be its corresponding successor edge. STNij is the output of each AND Gate.
5. State value node is connected as in Control Flow Graph. For join nodes extra state value node is created. State cuts are used in all state value node.

The generated Behavioral Network Graph represents all possible schedule. Since it has all possible schedule, the state cut can be placed at any position which is realized as register. Based on available hardware the state cut is placed.

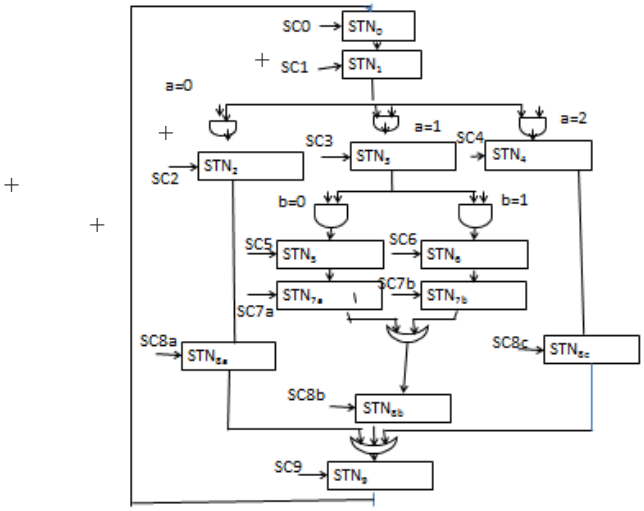


Figure 3 Unscheduled Controls BNG

The four adders are available in the Unscheduled BNG. So four state cut has to be placed. The theoretical representation for single adder is shown in the Figure 4.

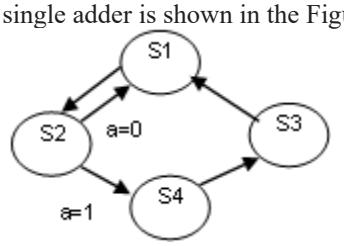


Figure 4 FSM for single adder/Subtractor

The estimator estimates four register, two '2' input AND gate and one '2' input OR gate as shown in Figure 5. The resources are shown as in unscheduled Control BNG as in Figure 3. The state cut is placed according to the hardware resources available. When state cut is placed it is realized as register else it is realized as wire. The final BNG is as shown in Figure 5.

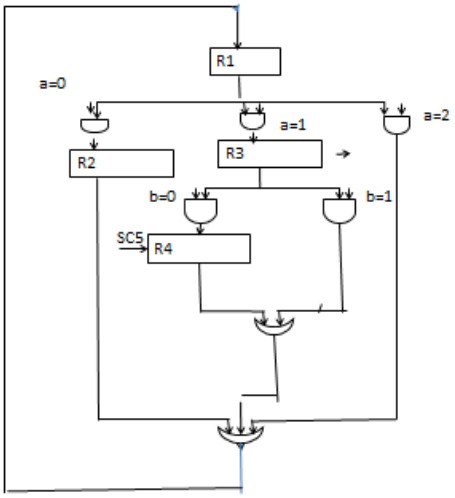


Figure 5 FSM implementation using BNG for single adder/Subtractor

The state cut is placed for every two adders. The FSM representation is shown in below Figure 6. The estimated registers are '3' and two '2' input AND gate and one '2' input OR gate.

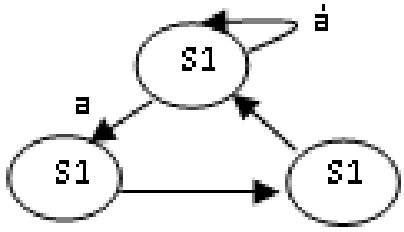


Figure 6 FSM for two adder/ Subtractors

6 Result and Discussion

The number of nodes is given as an input in the designed estimator. The successor for each node is given as an input as shown in Figure 7. Node 1represents the CASE statement and Node 3 represents the IF Construct. An example of IF within CASE statements is fed as an input as shown in Figure 2. The unscheduled Control Behavioral Network Graph is generated. The estimator needs the nodes with resources and requires number of resources available. The state cut is placed according to the number of resources available. Four state cut is placed which results in registers as shown in Figure 5. 5 two input AND gate, two input OR gate and three input OR gate is resulted. The final RTL is obtained as shown in Figure 5. The final Control BNG is obtained as shown in Figure 8.

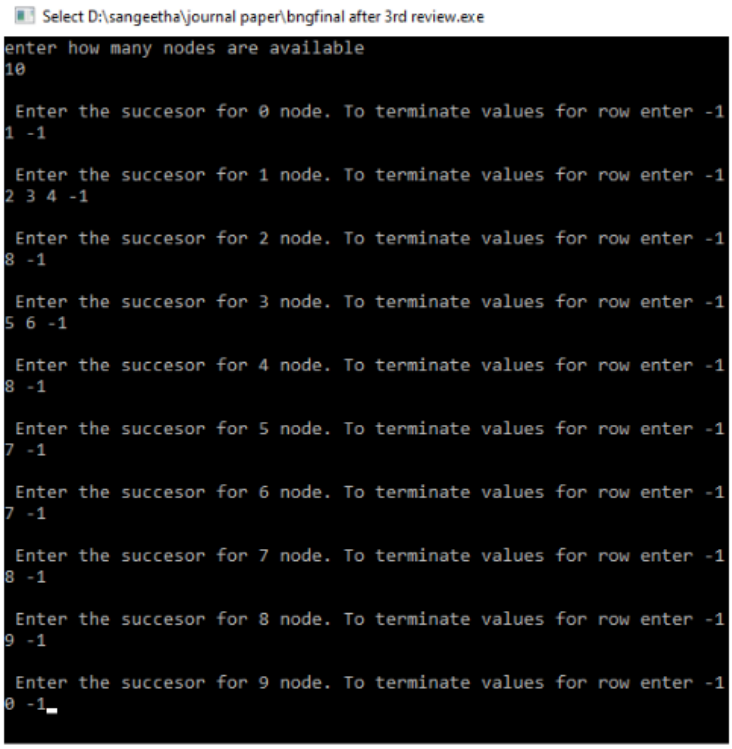


Figure 7 CFG for IF within Case Construct

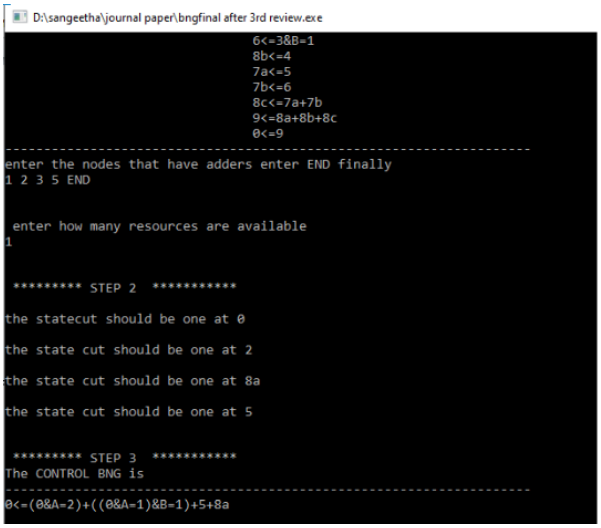


Figure 8 Control BNG

7 Conclusion

Hardware estimation is done using the Control Flow Graph. The concept state value node is used to obtain Unscheduled Behavioral Network Graph from Control Flow Graph which is given as an input in Figure 7. The Scheduling is performed in the unscheduled Behavioral Network Graph. The final gate level representation for the Control Flow Graph is obtained as in Figure 8. The scheduling is done for single resource availability. The estimator is verified theoretically using Finite State Machine. The number of two input AND gate, number of OR Gate. The designed estimator is verified using Finite state Machine.

Conflicts of interest

The authors should declare no conflicts of interest.

References

[1] R. A. Bergamaschi and S. Raje,Control flow versus data-flow-based scheduling: Combining both approaches in an adaptive scheduling system, IEEE Trans. Very Large Scale Integration Syst.,1997; 5(1):82-100.

[2] S. Davison, D. Landskov, B. Shriver, and P. Mallet, Some experiments in local microcode compaction for horizontal machines,IEEE Trans. Comput., 1981; C (30), pp. 460–477.

[3] A. C. Parker, J. T. Pizarro, and M. Mlinar, MAHA: A program for datapath synthesis, in Proc. 23rd ACM/IEEE Design Automat. Conf., June 1986, pp. 461–466.

[4] B. M. Pangrle and D. D. Gajski, State synthesis and connectivity binding for microarchitecture compilation, in Proc. IEEE Int. Conf. Computer-Aided Design, ACM/IEEE, Nov. 1986, pp. 210–213.

[5] P. G. Paulin and J. P. Knight,Force-directed scheduling for the behavioral synthesis of ASIC's,IEEE Trans. Computer-Aided Design, 1989; 8, pp. 661–679.

[6] M.Sangeetha, J.Raja Paul Perinbam :Estimation of control logic for binary synthesis, 2008 International Conference on Signal Processing, Communications and Networking,Chennai,India. DOI: 10.1109/ICSCN.2008.4447237.

[7] Sangeetha M., Tharini C., RajapaulPerinbam J: Equivalent Design Representation and Transformation for High Level Synthesis, online proceedings of 2nd IEEE RTAS Workshop on Model-Driven Embedded Systems (MoDES '04) conference conducted in Ontario, Toronto, Canada, May 2004.

[8] M. Xu, F. J. Kurdah: Area and Timing Estimation for Lookup Table Based FPGAs, European Design and Test Conference, 1996.

[9] J. Gerlach W. Rosenstiel: A Scalable Methodology for Cost Estimation in a Transformational HighLevel Design Space Exploration Environment. Design Automation and Test in Europe, Paris, February 1998.

[10] A. Srinivasan, G. D. Huber and D.P. LaPotin: Accurate Area and Delay Estimation from RTL Descriptioons, IEEE transactions on VLSI systems, 1998;6(1), pp. 168-172.

[11] F. Ferrandi, F. Fummi, E. Macii, M Poncino, D Sciuto, Power Estimation of Behavioural Descriptions Design Automation and Test in Europe, Paris, February 1998.

[12] R. A. Bergamaschi,Bridging the domains of high level and logic synthesis" in Proc. Trans. Computer-Aided Design, 2002;21, pp.582–596.

Sentiment Analysis Using Machine Learning Classifiers: Evaluation of Performance

R Vidhya[1], Pavithra Gopalakrishnan[2], Nanda Kishore Vallamkondu[3]
{vidhyar@srmist.edu.in[1], pavi.gk99@gmail.com[2], vallamnanda12@gmail.com[3]}

School of Computing, SRM Institute of Science and Technology, Kattankulathur, Chennai, 603203 Tamil Nadu, India.[1,2,3]

Abstract. Sentiment analysis is a process that is a very popular concept nowadays because of the high volume of reviews, micro blogs, comments etc., generated in different sites like e-commerce and social networking sites. The main problem in the current system is, for users to know the polarity result of bulk data, which is very tough because users need to study and understand each review in terms of the polarity. Users are expecting a onetime result of the polarity of bulk reviews, comments, micro blogs etc. In social networking sites, users post their status or opinions to share to the world. In this category, Twitter is the most popular one. In twitter, users post many micro blogs related to a topic or crisis etc, and the topic may be linked with a greater number of micro blogs based on the keywords or hash tags used. In twitter, we can search for any topic with keywords or hash tags, and we get a bulk of responses of the users world-wide. If we want to know the exact opinions of the users, we need to analyze the data with sentiment analysis. Sentiment analysis is a concept of defining a statement as positive, neutral, or negative by analyzing words of the statement. Many concepts have been proposed for this requirement, and many sentidatasets have been prepared for this requirement. But by taking the advantages of Machine Learning we are proposing a concept of sentiment analysis in twitter using ML techniques. In this we use multiple ML techniques such as Random Forest, Naïve Bayes and Support Vector Machine for evaluation and comparison of the results.

Keywords: SVM, NB, TF-IDF, Sentidatasets

1 Introduction

In the past decade, there has been no limit to the range of information that is being conveyed using tweets and text messages, which are often short messages used for sharing opinions called sentiments about things happening around them. The language used is mostly informal with creative spellings, new words, URLs, abbreviations, punctuations, and hashtags, which is a way of tagging. Similarly, it uses Pre-Processing, text analysis and computational linguistics for identifying and analyzing the raw data and predicting opinions. It is also referred as opinion mining. The internet has established a platform for people to express their views, emotions on products, people, and things around them. The objective of sentiment analysis is to extract important insights from large amounts of data by removing unnecessary data that would help organizations, better decision making and quality product consumption. In this paper, we look at an approach, where a model is built for classifying tweets, which are

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retrieved using consumer keys, access tokens from TwitterSearch API. This process is for calculating polarity.

2 Related Work

Social Media (SM) are online applications which enable sharing the moods, status, opinions of users to their virtual social circles for example twitter, Facebook, etc. [1], [2]. In machine learning there are few topics which are used to build the requirements of prediction, aggregation, and clustering etc. In different surveys many systems were proposed for sentiment analysis by using basic concepts of N-grams, string comparisons, clustering etc. Those only provide limited solutions of sentiment analysis. Mainly, sentiment analysis was used to produce important results like political analysis, rating prediction, product reviews monitoring etc. [3] [4]. Most surveys depend on a static sentiwordnet dataset to find the sentiment analysis. But we require finding a proper solution to find the polarity of the tweets.

2.1 Scope of the Work

The scope of work includes the following:

- The understanding of public opinions' importance in terms of a particular topic, and that opinion's collection from the internet using social networking sites.
- We can understand the importance of the Machine Learning classification algorithms and how it helps us in text classification.

Based on the training data of text labeled data, we will understand how classification algorithms can process using tokenizer concepts and classify the results.

3 Implementation

3.1 Architecture

In our system, sentiment analysis is based on machine learning algorithms applied to the tweets, and the architecture is developed in two modules. One is the Admin module, and the other one is a User module. In the following architecture diagram, we represent admin flow and user flow in two formats. Admin flow is represented in brown color and user flow is represented in blue color. In the admin module we are using three machine learning classifiers for training the data, and in the testing module we compare the algorithms with accuracy scores. We chose the best algorithm in terms of accuracy and deployed in the user module for performing the sentiment analysis of real time tweets. In this chapter we will discuss our main and sub modules in detail.

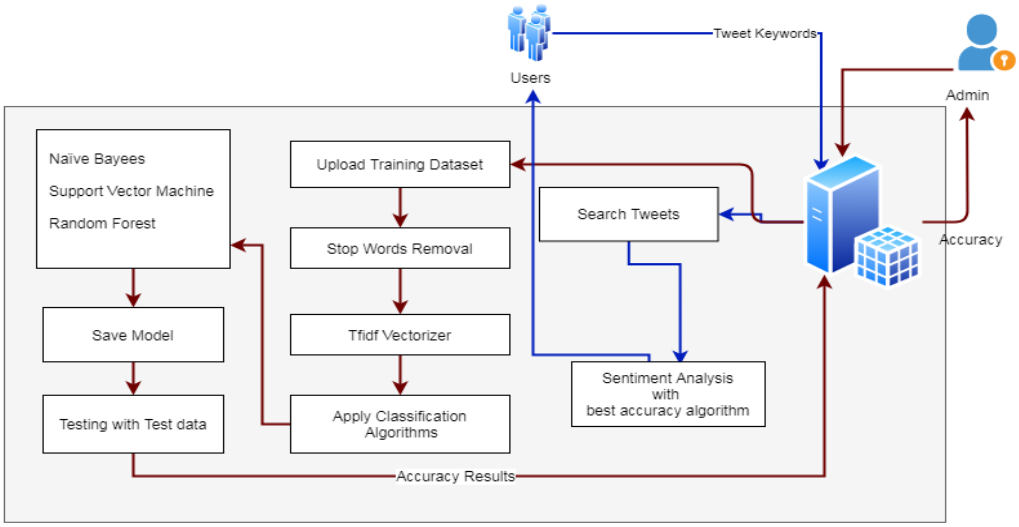

Fig. 1 System Architecture

3.2 Admin Module

In this admin module we train and test the dataset using three machine learning classifiers for accuracy calculation comparison.

3.3 Upload Dataset

For theSentiment analysis we have taken the dataset which consists of 156062 rows of labeled data. In this, we have words and statements in one column and in the other column we have label class of sentiment polarity, namely positive, negative and neutral. In the following table we can see the dataset description.

Table 1. Description of the dataset

String Data	Classes: negative, neutral and positive

	A	B
156035	is to substitute plot for personality .	negative
156036	is to substitute plot for personality	negative
156037	to substitute plot for personality	neutral
156038	substitute plot for personality	negative
156039	substitute plot	neutral
156040	for personality	neutral
156041	The film is darkly atmospheric , with Herrma	neutral
156042	is darkly atmospheric , with Herrmann quiet	neutral
156043	is darkly atmospheric , with Herrmann quiet	neutral
156044	is darkly atmospheric ,	neutral
156045	is darkly atmospheric	positive
156046	with Herrmann quietly suggesting the sadne	neutral
156047	Herrmann quietly suggesting the sadness ar	neutral
156048	Herrmann	neutral
156049	quietly suggesting the sadness and obsessic	negative
156050	suggesting the sadness and obsession bene	neutral
156051	suggesting the sadness and obsession	neutral
156052	the sadness and obsession	neutral
156053	sadness and obsession	negative
156054	sadness and	negative
156055	beneath Hearst 's forced avuncular chortles	neutral
156056	Hearst 's forced avuncular chortles	neutral
156057	Hearst 's	neutral
156058	forced avuncular chortles	negative
156059	avuncular chortles	positive
156060	avuncular	neutral
156061	chortles	neutral

Fig 2. Screenshot of the dataset

3.4 Stop words Removal

This step comes under the process of feature extraction. In every review statement of the training dataset, we identified the stop words and removed it. In the API which we are using we have a list which consists of list of English stop words like ‘a’, ‘about’, ‘according’, ‘across’ etc. We remove stop words because these words are useless for any judgment of text classification, and we can achieve better database space and computation cost.

3.5 TfidfVectorizer

Generally, Machine Learning algorithm only deals with numeric format data, hence in text classification we need to convert the data into numeric vector format. Generally, this process can be done in two ways, one is CountVectorizer and the other one is TfidfVectorizer. In CountVectorizer it will take the word count of the text, it is a very basic process. But in the TfidfVectorizer it will take the Tf*IDf score as its numerical data for the vector model.

For example,

dataset=*[‘problem of devil’, ‘devil queen’, ‘horizon problem’]*

Table 2. TfidfVectorizer Example

doc	*Devil*	*horizon*	*Of*	*problem*	*queen*
0	*0.517*	*0.000*	*0.680*	*0.517*	*0.000*
1	*0.605*	*0.000*	*0.000*	*0.000*	*0.795*
2	*0.000*	*0.795*	*0.000*	*0.605*	*0.000*

3.6 Apply Classification Algorithms

In this sub module after conversion of the dataset into the TfidfVectorizer, we apply the following classification algorithms:

- Naive Bayes
- Random Forest
- Support Vector Machine

Naive Bayes Algorithm

We upload the dataset (.csv file) by using the pandas API in python and we apply the TfidfVectorizer. After that we train the dataset and save the model file in the '.sav' file format. We store the fit model in .sav format for future testing purposes.

Naïve algorithm is an adoption format of the Bayes Formula. By using this we can calculate the probability of each class in terms of the attributes. We derive naïve bayes formula as the following:

$$p(c/d) = \frac{P\left(\frac{d}{c}\right)P(c)}{P(d)} \quad (1)$$

Where in:

'c' is a class,
'd' is a document,
'P(c)' is a class probability,

In the following figure, we can see the implementation code of training the dataset using Naive bayes algorithm.

```
def detecting(self,train_file):

    train_news = pd.read_csv(train_file)
    tfidf = TfidfVectorizer(stop_words='english',use_idf=True,smooth_idf=True) #TF-IDF
    print("Start Naive Bayes Classification")
    nb_pipeline = Pipeline([('lrgTF_IDF', tfidf), ('lrg_mn', BernoulliNB())])

    filename = 'nb_model.sav'
    pickle.dump(nb_pipeline.fit(train_news['review'], train_news['sentiment']),
    open(filename, 'wb'))

    print("Naive Bayes Model Successfully Trained")
```

Fig 3. Sample code of Naive Bayes

Random Forest Algorithm

We upload the dataset (.csv file) by using the pandas API in python and we apply the TfidfVectorizer. After that we train the dataset and save the model file in the '.sav' file format. We store the fit model in .sav format for future testing purposes.

Random Forest algorithm is a supervised algorithm for both classification and regression algorithm. It computes the decision based on the highest scores of multiple decision trees.

In the following figure, we can see the implementation code of the training the dataset using Random Forest algorithm.

```
def detecting(self,train_file):
    train_news = pd.read_csv(train_file)
    tfidf = TfidfVectorizer(stop_words='english',use_idf=True,smooth_idf=True) #TF-IDF
    print("Start RandomForest Classification")
    knn_pipeline = Pipeline([('lrgTF_IDF', tfidf), ('lrg_mn',
    RandomForestClassifier(n_estimators=100, max_depth=2))])
    filename = 'rf_model.sav'
    pickle.dump(knn_pipeline.fit(train_news['review'], train_news['sentiment']),
    open(filename, 'wb'))

    print("RandomForest Model Successfully Trained")
```

Fig 4. Sample code of Random Forest

Support Vector Machine

We upload the dataset (.csv file) by using the pandas API in python and we apply the TfidfVectorizer. After that we train the dataset and save the model file in the '.sav' file format. We store the fit model in .sav format for future testing purposes.

SVM algorithm is a supervised algorithm for both classification and regression algorithm. It calculate distance between the difference of the two classes by defining the closest points.

In the following figure, we can see the implementation code of the training the dataset using SVM algorithm.

```
def detecting(self,train_file):
    train_news = pd.read_csv(train_file)
    tfidf = TfidfVectorizer(stop_words='english',use_idf=True,smooth_idf=True) #TF-IDF
    print("Start SVM Classification")
    svm_pipeline = Pipeline([('lrgTF_IDF', tfidf), ('lrg_mn', svm.SVC(kernel='linear'))])

    filename = 'svm_model.sav'
    pickle.dump(svm_pipeline.fit(train_news['review'], train_news['sentiment']),
    open(filename, 'wb'))

    print("SVM Model Successfully Trained")
```

Fig 5. Sample code of SVM

3.7 Save Model

After executing our three classification algorithms, we can see the nb_model.sav, rf_model.sav and svm_model.sav files in the current folder. These files can be used for testing the data n number of times without training the dataset again. Simply, we store the fit model in to a file. And for the 156062 rows of the data, we convert it to .sav file with different sizes. For Naïve bayes algorithm, 2mb size of save file is created, for Random Forest 1mb size of save file is created and for SVM 57mb size of save file is created.

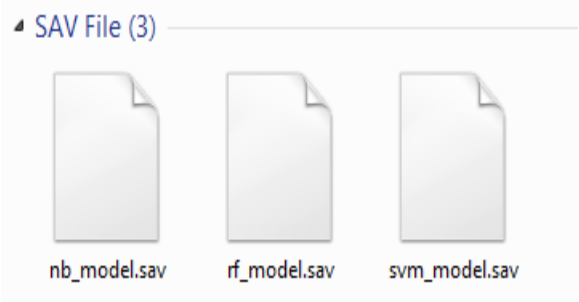

Fig 6. Screenshot of sav files

3.8 Testing with test data

After creation of the model files of three algorithms we take testing file (.csv) that consists of 1000 records. This data is already labeled data. After getting the results from the individual algorithms we compare with actual results. Then we can calculate the accuracy score by using the following formula:

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \quad (2)$$

where,

TP: True Positive
TN: True Negative
FP: False Positive
FN: False Negative

In this testing module we have Support Vector Machine algorithm with the best score in accuracy.

3.9 User Module

In this user module, user can provide keywords or hashtags of a topic, then user will get the real time tweets or re-tweets published in twitter which are identified by searching for the keyword in tweets and then display the evaluated polarity of the tweets as positive or negative or neutral.

3.10 Search Tweets

In this module, user searches for tweets using keywords or hash tags from the real time twitter database by using python API. In this module we will describe the process of getting the tweets from twitter using API's. We are developing our proposed system application by using Python coding language. So, we are using the python API called Tweepy for getting the tweets related to a topic.

3.11 Sentiment Analysis

In this module, we choose the best algorithm in terms of the accuracy and deploy it in the user module for performing sentiment analysis of the real time tweets. In this testing module,

Support Vector Machine algorithm shows best score in accuracy. So, our system will give the one-shot result of the polarity results of the tweets.

4 Experimental Results

4.1 Accuracy Score Graph

In the testing result page, we have a user interface to view the accuracy graph.

Table 3. Accuracy Results

Random Forest	Naïve Bayes	Support Vector Machine
0.67	0.731	0.783

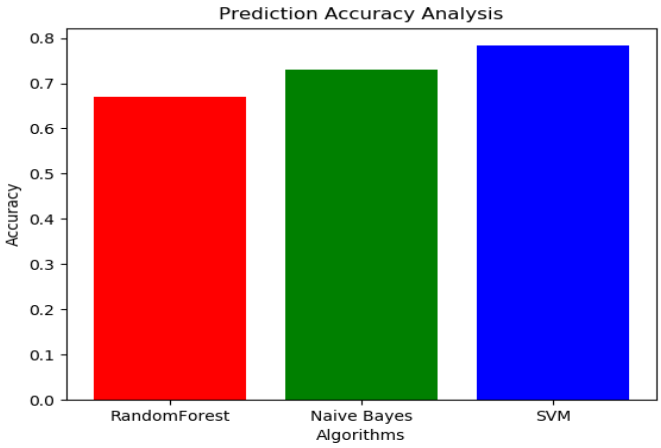

Fig 7. Accuracy Graph

4.2 F1Score Graph

In the testing result page, we have a user interface to view the F1socre graph.

Table 4. F1 Score Results

Random Forest	Naïve Bayes	Support Vector Machine
0.54	0.71	0.77

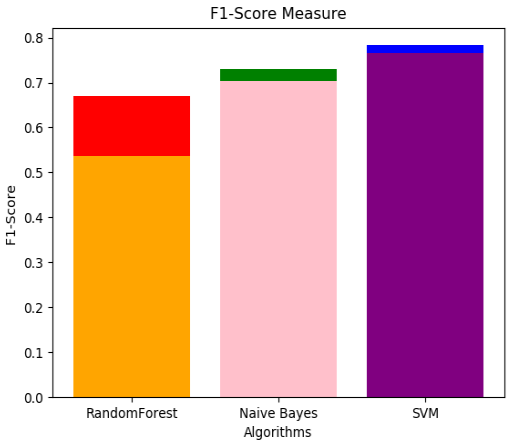

Fig 8.F1Score Graph

4.3 Search tweets in user home page

After successful login of the user, user can see 'get tweets option', user can enter the keywords and get the tweets. In the following example 'trump' has been inputted as keywords. We can see the tweets in right side.

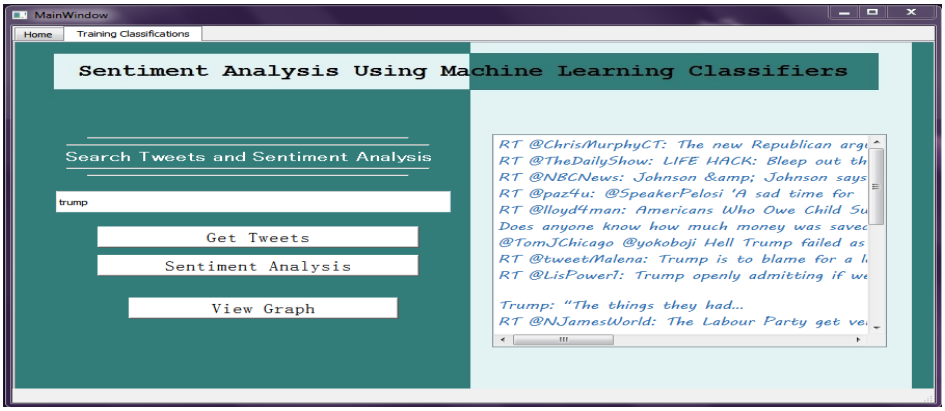

Fig 9. Search Tweets

4.4 Sentiment Analysis process

In the result page we have shown the process of the sentiment analysis. By clicking on the Sentiment Analysis button, SVM model will be implemented and all tweets will classified and labeled with sentiment classes like positive, negative, or neutral.

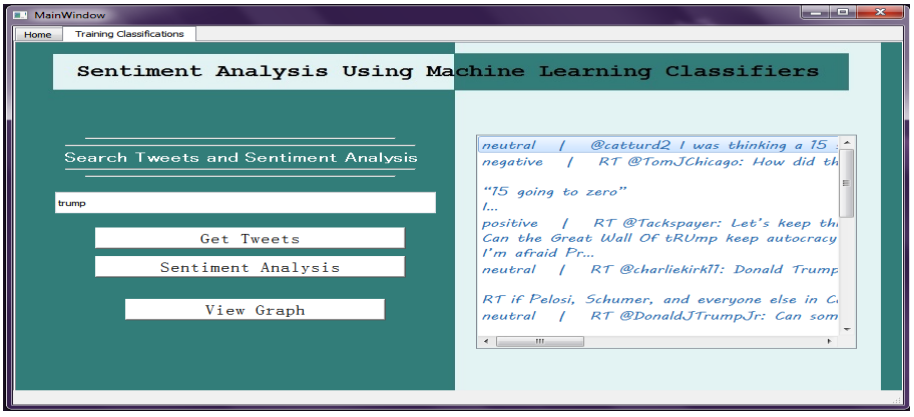

Fig 10. Sentiment Analysis Process

Sentiment Results graph

We can view the results graph by clicking on the 'View Graph' option. We can compare the sentiment score values of tweets as how many neutral, how many positive, and how many negative tweets are there, graphically.

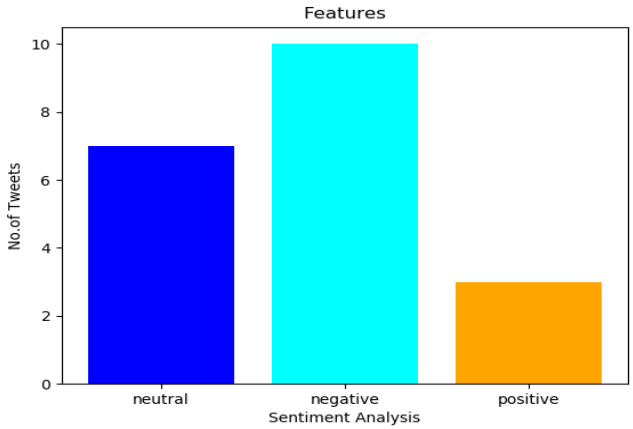

Fig 11. Sentiment results Graph

5 Conclusions

In our system we performed sentiment analysis by using machine learning algorithms on the tweets. Sentiment analysis is a process of calculating the polarity of the statement as to get the polarity namely positive, negative and neutral, of the posts, micro blogs, opinions or feedback which are published in social media sites or E-commerce sites. We developed the architecture in two modules. One is Admin module, and another one is User module. In admin module we are using three machine learning classifiers for training the data, in testing module we can compare the algorithms with accuracy scores. In our testing we see that Support

Vector Machine algorithm shows best accuracy when compared with Naive Bayes and Random Forest algorithms. We chose SVM algorithm based on the accuracy and deployed it in the user module for performing sentiment analysis of the real time tweets

References

[1] S. Rosenthal, P. Nakov, S. Kiritchenko, S. Mohammad, A. Ritter, and V. Stoyanov, "Semeval-2015 task 10: Sentiment analysis in twitter," in Proceedings of the 9th international workshop on semantic evaluation (SemEval 2015), pp. 451–463, 2015.

[2] Y. Wan and Q. Gao, "An ensemble sentiment classification system of twitter data for airline services analysis," in Data Mining Workshop (ICDMW), 2015 IEEE International Conferenceon, pp. 1318–1325, IEEE, 2015.

[3] Y. Wan and Q. Gao, "An ensemble sentiment classification system of twitter data for airline services analysis," in Data Mining Workshop (ICDMW), 2015 IEEE International Conferenceon, pp. 1318–1325, IEEE, 2015.

[4] Z. Jianqiang and G.Xiaolin, "Comparison research on text pre- processing methods on twitter sentiment analysis," IEEE Access, vol. 5, pp. 2870–2879, 2017.

A Hybrid Approach for Heart Disease Prediction

Kumaresan Angappan[1], N. Meenakshi[2], Joel Evans E[3], Harshitha Bharanika[4],Suganya Jothi[5]

{kummaresan@gmail.com[1], abu221985@gmail.com[2], itsjoeydale@gmail.com[3], harshithabaranka@gmail.com[4], suganya192002@gmail.com[5]}

Department of Information Technology, Hindustan Institute of Technology and Science, Chennai, India[1, 2, 3, 4]

Department of ECE, Mailam Engineering College, Mailam, India[5]

Abstract- An estimated count of 17900000people, i.e., 31% of deaths is related to cardiac diseases every year. This number is projected to rise to 22million by the end of this decade, making cardiac diseases among the most common global sources of death. The only effective method is ECG tests among various other limited methods for the detection of heart diseases. With regard to cardiac diseases, early diagnosis has the potential to produce better treatment outcomes. Hence, this paper discusses a Machine Learning methodology to detect heart diseases using the Data Set for Heart Disease by the repository of UCI Machine learning. This system is developed based on classification algorithms such as Support Vector Machines, K-Nearest Neighbour, Naïve Bayes, Decision Trees and Random forest classifiers. We define a hybrid stacking method and genetic algorithm which increases the accuracy achieved by the basic individual data mining techniques of classification.

Keywords— Data cleaning, Feature Scores, Machine Learning, Stacked Generalization, Genetic Algorithm

1 Introduction

Human hearts beat 1.5 lakh times each day, pumps around 2 thousand gallons of blood everyday and is the most vital organ of a human body. The heart's inability for supplying enough perfusion to target tissues and organs at physiological filling pressures to meet the metabolic demands and causes cardiac diseases which are chronic and a progressive condition. Despite the progress in treatment and medical industry, approximately 50% is the survival rate of the population affected with cardiac diseases for a period of 5 years.

In the typical case, most patients do not display symptoms and signs such as breathlessness, congestion etc., and are later admitted to receive intravenous medication treatments to help supply enough perfusion. 18.2 million adultsaround age 20 and older are detected with cardiac diseases and about 1 in every 4 deaths are related to cardiac diseases. According to the WHO, cardiac diseases account for 26% of the deaths in India and costs the economy a total of $2 trillion. Typically, two heart sounds are heard, S1 and S2 in healthy subjects. The closure of mitral and ventricular valve at the early systole is termed as S1; Theclosure of the aortic and pulmonary valves is S2 in the beginning of the diastole.

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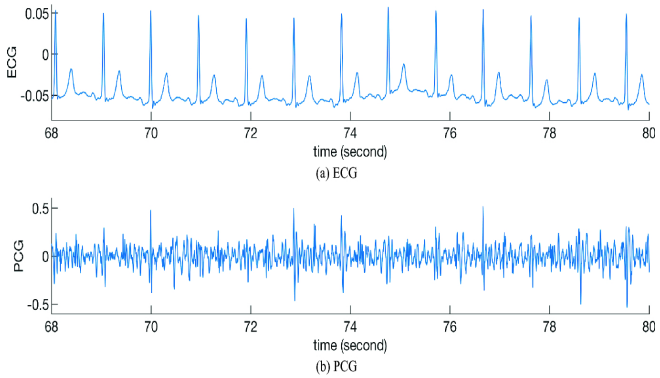

Fig. (1) ECG and PCG Recordings

In the phase of a cycle of a heart, the interval between S1 and S2 is systole, and diastole is interval between S2 and S1 also known as contraction phase. Fig. (1) shows the ECG and PCG recordings over time. ECG works with electrical activities of the heart and PCG is produced by the mechanical activities.In certain heart conditions that are never known to be normal, additional sounds S3 and S4 are heard. S3 appears to come 0.1-0.2 seconds after S2 as shown in Fig. (2).

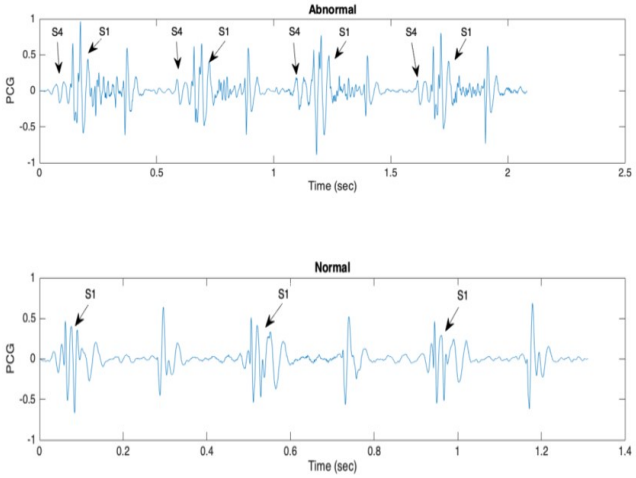

Fig. (2) Normal and abnormal sound waves of heart

The recordings of PCG that sound unhealthy to certain experts might sound healthy to others. Hence, only heart sounds cannot be used to diagnose and a holistic view of the patient that includes laboratory tests, medical history, blood pressure, age etc. is used.

Hand-in-hand,with the evolution of Machine Learning with digital era, an eruption of data from every single region of the world in all forms is brough together.

AI-ML learns to draw conclusions from data that is both unstructured and unlabelled. It has achieved breakthrough performance in image processing, speech and audio processing, pattern recognition, sensor data processing and natural language processing. While men as twice as likely to have heart diseases when compared to women, the risk persists equally with both genders. The signs of a women developing the risk of cardiac diseases or a heart attack are much less noticeable when compared to men and hence, early detectioncan help reduce the

number of hospitalizations that happen due to worsening of the condition and has the potential to decreasethe logistic and financial burden that's buried on the patient, hence improving the quality of life of patients. A successful approach of Machine Learning techniques such as stacking, boosting etc. with classification algorithm can surmount each single approach and can better help predict Cardiac Diseases.

2 Related Works

Cardiac diseases affect people in a way that can't be cured easily and hence diagnosing them at the right time is tough. K.G Dinesh et al. [1] worked on different techniques of machine learning for forecasting the uncertainty levels of cardiac diseases with the attributes from heart disease detection dataset by the UCI repository. Using the R environment, machine learning techniques such as Naive Bayes, Logistic Regression, SVM, Random Forest and Gradient boosting were used. An overall accuracy rate of 0.86 was given by the logistic regression model, however, ensemble techniques with more parameter settings can be used for better performance of these algorithms.

A hybrid method was given by H. A. Esfahani et al.[2], to outperform the results of individual machine learning methods. On the UCI dataset, pattern discovery algorithms like Neural Networks, Decision Trees, Support Vector machines, Rough set and Naive Bayes were applied and later, accuracy of their prediction was compared. F-measure is an important metric as it combines precision and sensitivity into a single value, hence among various measures, considering the F-measure metric, Rough set, Naive Bayes and Neural network achieved the highest performance. These classifiers were combined by the fusion strategy for better performance. The results later indicated that the fusion of outputs can improve the performance of the classifiers and hence, a trainable combining method such as a Bayesian combiner is unforeseen.

For solving both, constrained and unconstrained optimization problems to generate high quality solutions, Gino Sophia et al. [3] describes the approach of a proposed intelligent regressor system using Genetic operations and ANN. As Genetic algorithms look for optimal combination of solutions for brute force search problems, objective functions such as Crossover, Mutation, Fitness scaling, Selection and migration were used for increasing optimization performance of system developed and a Regression accuracy of about 98% was achieved by the model.

Cardiac diseases are critical health issues which occur with symptoms that are common such as shortness of breath, weakness of physical body and feet generally being swollen [4]. The need for efficient techniquesfor the detection of cardiac diseases has increased since existing diagnosis methods are not effective for early identification due to execution time and its accuracy. Hence, a system was developed based on classification algorithms such as KNN, Naive Bayes, Logistic Regression, Decision Trees and Artificial neural network [5]. A mutual information feature selection algorithm (FCMIM) was proposed. Hence, the results later showed the accuracy of SVM with FCMIM as 92.37%, which outperforms the other individual classifiers however, other feature selection algorithms with optimization methods can be used to further increase the performance of diagnosis.

A method combining classic Machine Learning and Deep Learning for detecting Chronic Heart Failure (CHF) from heart sounds was given byJ. P. Li et al. [6] which uses the recordings from six publicly available datasets of 947 subjects. The FCMIM feature selection

algorithm with mutual information and it was used for selection of features.Later, the model was trained by the Random Forest classifier. A Fully Connected Neural Network is used in the Deep Learning model, where the high-level abstractions from raw data are learnt by the FCNN model. While an accuracy of 93.2% was achieved, only 44 samples of 947 subjects were used for chronic heart failure detection, and hence the risk of overfitting in the final experiment exists making it a limitation for the approach. Hence, a solid base for further development is needed.

Zeinab Arabasadi et al. [7] proposed a system that increases performance of the neural network system by about 10% with the implementation of genetic algorithm and an accuracy of 92% was achieved on the Z-Alizadeh Sani dataset. While the system showed a great performance, other algorithms could have been tested and compared for the performance of the system with new dataset and its unique features.

3 The Method

The heart disease dataset from UCI Machine Learning repository consists of 4 databases that extract information from VA Long Beach, Hungary, Cleveland and Switzerland. It contains a total of 920 records with a total 76 attributes, but a subset of 14 attributes is used for experiments. These attributes are categorical, real and integer values.

The records classify into two columns i.e., training and testing dataset. The below table shows the list of 14 attributes that are significant for the experiment.

#	FEATURE	DESCRIPTION
1.		*age*Age (years)
2.		*sex*Gender [0: Female; 1: Male]
3.		*cp*Type of chest pain
	Value 1: Typical angina	
	Value 2: Atypical angina	
	Value 3: Non- anginal pain	
	Value 4: Asymptomatic	
4.		*trestbps*Resting BP (in mm Hg during admission at hospital)
5.		*chol*Serum cholesterol in mg/dl
6.		*fbs*Fasting blood sugar > 120mg/dl [0= False; 1= True]
7.		*restecg*Resting electrocardiographic results
	Value 0: Normal	
	Value 1: Having ST-T wave abnormality	
	Value 2: Showing definite or probable left ventricular hypertrophy	

8.	*thalach*Maximum heart rate achieved
9.	*exang*Exercise induced angina [0= False; 1= True]
10.	*oldpeak*ST Depression induced by exercise relative to rest
11.	*slope*The slope of the peak exercise ST segment
	Value 1: Upsloping
	Value 2: Flat
	Value 3: Downsloping
12.	*ca* Number of major vessels (0-3) colored by fluoroscopy
13.	*thal*[3: Normal; 6: Fixed defect; 7: Reversible defect]
14.	*num*Predicted attribute i.e., diagnosis of heart disease

Table. (1) List of attributes

The locations most often used to listen to the heart sounds, are named with respect to the positions where the valves are best heard:

1. Pulmonic area - along the left sternal border, the 2nd intercostal space.
2. Aortic area - centered at the second right intercostal space.
3. Mitral area - at cardiac ape.
4. Tricuspid area - along left sternal edge, the 4th intercoastal space.

*A. **Data analysis***

Data analysis performs major tasks such as data cleaning and integration, identification of missing values and removing the redundant data. Pandas recognizes all the features as numerical either as integers or floats. But some of the attributes are categorical in the dataset as their numbers represent mappings to a real-world phenomenon of the human heart. Hence, Exploratory Data analysis is performed where first, the list of all the features which are numerical is saved in a column in order to not mix in the analysis with categorical variables.Using Pandas Profiling, distribution of each variable is visualized and a detailed profile report is generated with inference type, quantile statistics, descriptive statistics etc. for exploratory data analysis.

The interactions between each variable is defined with their correlations for a measure of linear correlation between two variables using the Pearson's coefficient of correlation; Spearman'scoefficient for detecting the nonlinear monotonic correlations between the variables and Cramer's V coefficient for association measure of nominal random variables.

Statistical tests were used for picking the features that seem to contain best relationship with performance variable.. The SelectKBest class from the scikit-learn library is used to select features of different statistical tests. For non-negative features to select best features from the dataset, Chi-squared test has been used in the proposed methodology and then the ranks of features according to their importance is given, shown in Fig. (3).

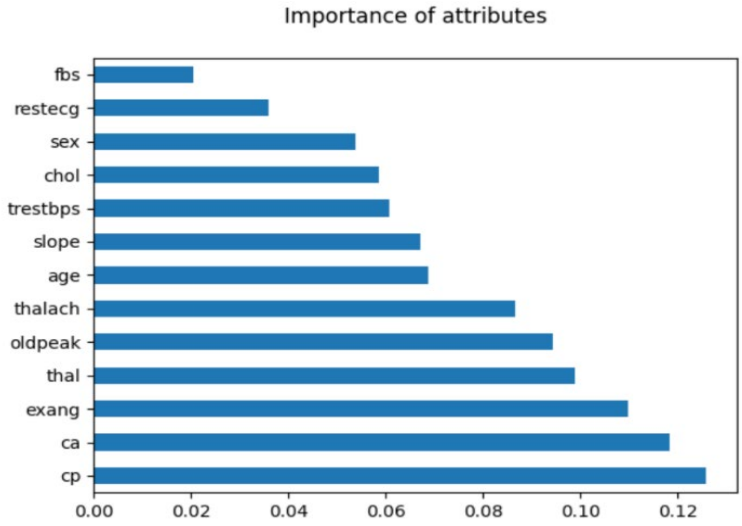

Fig. (3) Feature Importance

Using the Model Characteristics property, feature significance is gained. For extraction of the high scored features, the Extra Tree Classifier is used. It is a built-in class with Tree Based classifiers. A score for every function is given by the Feature value and it determines the significance of our performance variable.

With seaborn library, correlation matrix with Heatmap is generated for indicating the features and their relationwith one another and as well as to target variable. Fig. (4) shows the correlation values between the variables, which are positive or negative in nature. It has been noticed that the attribute highly related to target variable is ‘cp’ i.e., chest pain and hence contributes the most for prediction of cardiac diseases.

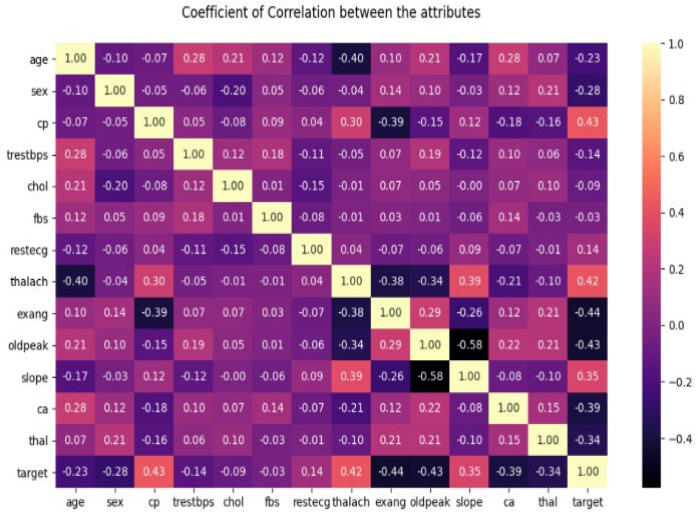

Fig. (4) Correlation Coefficient of attributes

In general, cardiac related diseases show symptoms such as pain in the center of the chest, sudden pressure discomfort or feeling of fullness in women and they're most likely less noticeable whereas in men, the typical symptoms such as chest pain, shortness of breath, sweating, discomfort, stress and other noticeable signs are seen. Hence, a detailed analysis was performed on this Heart Disease dataset and it shows that men are more susceptible to have a heart disease when compared to women. Fig. (5) shows the role played by Gender with respect to the Target variable where we can see that the ratio of men being affected by a heart disease when compared to women is 4:1.

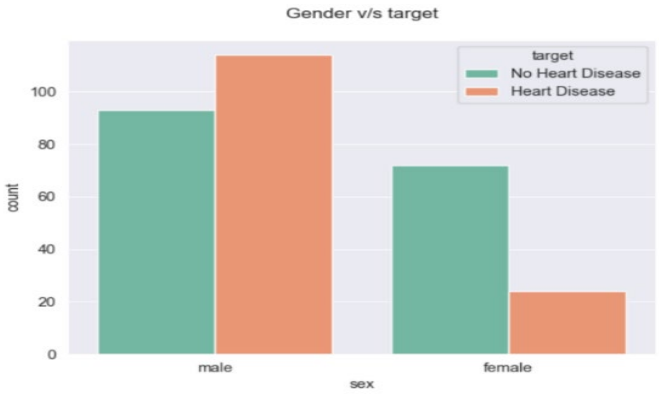

Fig. (5) Gender v/s Target

Fig. (6) Chest Pain Type v/s Target

Further, the dataset from the UCI Repository for cardiac diseases shows that 4 types of chest pain are generally produced- asymptomatic,atypical angina, non-angina and typical angina. Fig. (6) indicates the effect of these common chest pain types with respect to the target variable for both men and women. Most of the patients who are likely to have Cardiac

Diseasesseem to have an asymptomatic pain which involvesblood flow blockage to the heart, possibly damaging the heart muscle.

Age, high cholesterol, diabetes, high BP, obesity etc. are a variety of risk factors for asymptomatic pain. This puts a person at risk, as they have the possibility of developing a cardiac disease with serious complications. Other cardiac problems such as congestive heart failures, abnormal heart rhythms are associated with thalassemia- an inherited blood disorder which makes body have low levels of haemoglobin when compared to the normal count. Fig. (7) shows the comparison between the gender and thalassemia affected patients.

Male patients are more frequently affected than females, while it has little or less relationship with gender and mostly an inherited disease, it is most common in men.

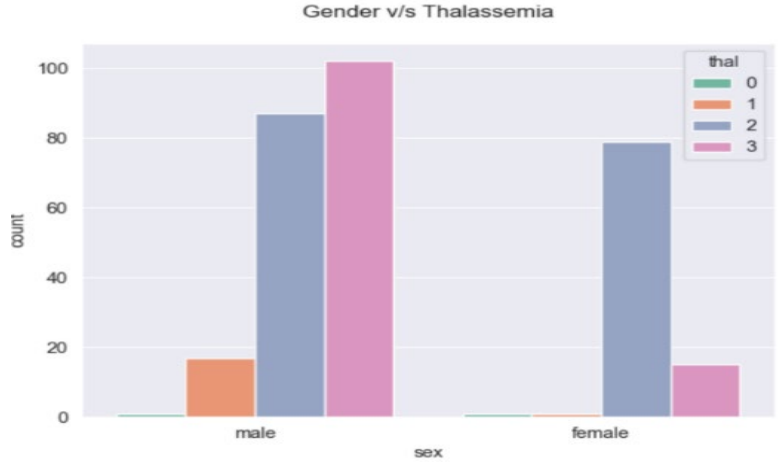

Fig. (7) Gender v/s Thalassemia

Heart Diseases affect both men and women irrespective of the age group but is very common in the age group above 60. For adults, total cholesterol levels are measured by milligram per deciliter (mg/dL). Cholesterol levels less than 200 (mg/dL) are desirable and considered. Borderline levels are considered around 200-239 (mg/dL) and high levels are considered to be above 240 (mg/dL). TheLDL (Low Density Lipoprotein) must contain less than 100 mg/dL of cholesterol. Fig. (8) and Fig. (9) show the age and cholesterol of patients with heart disease.

For healthy individuals 100 mg/dL are appropriate but are found to be relevant on individuals with cardiac problems and other heart diseases. The borderline moderate levels range around 130 and 159 mg/dL while moderate measures range around 160 and 189 mg/dL.Any reading above 190 mg/dL is considered high and risky. High density lipoprotein or HDL levels can only be measured with a maximum of 60mg/dL. Borderline levels to be maintained are near to 41mg/dL and 59mg/dL as the risk factor for cardiovascular diseases is a reading around 40mg/dL and less.

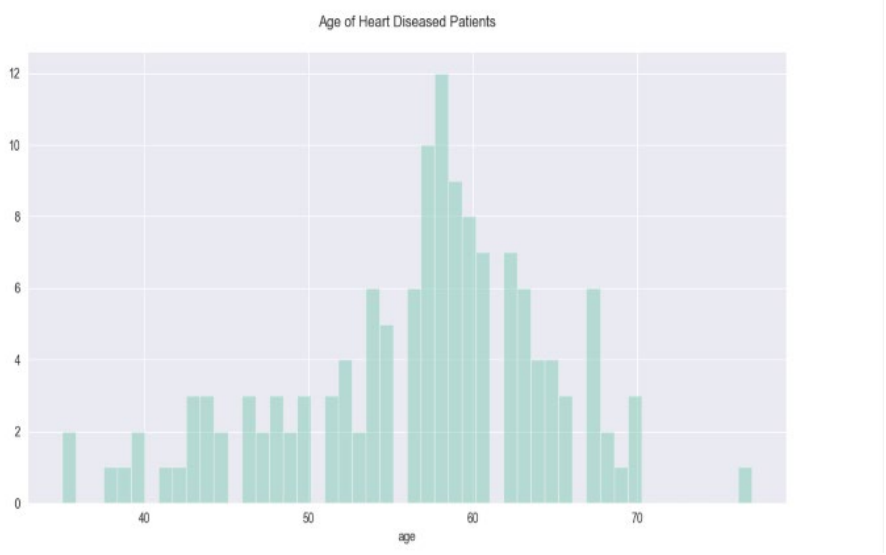

Fig. (8) Age of Patients who are affected with heart disease

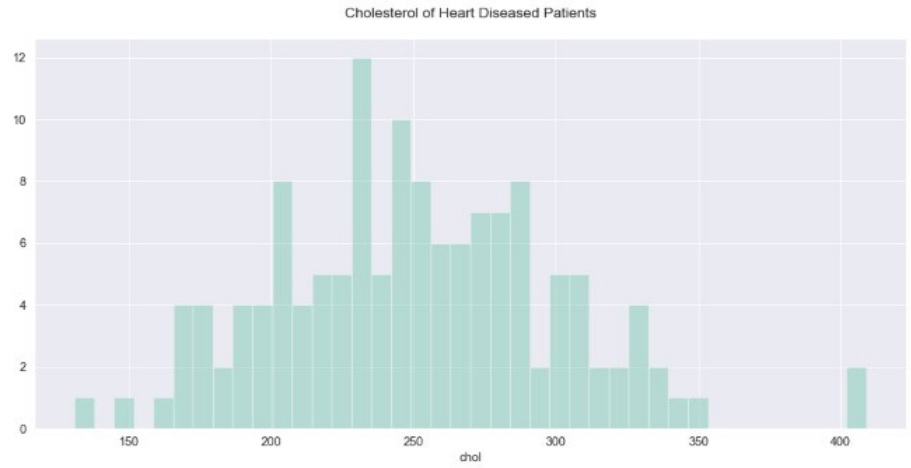

Fig. (9) Cholesterol in patients affected with heart disease

*B. **Experimental Analysis***

Genetic Algorithm With SVM

For both classification and regression tasks, A supervised algorithm known as Support Vector Machine can be used. It is most commonly used in classification problems. As a point in n-dimensional space, each data item is plotted (n is the number of features of the dataset after EDA). The value for the co-ordinate is given by the value of each feature and then

classification is performed by finding the hyperplane that differentiates the two train and test classes.

For n features in M dimensions, the equation for the hyperplane is given as...

$$\begin{aligned} y &= w_0 + w_1x_1 + w_2x_2 + w_3x_3 \ldots \\ &= w_0 + \sum_{i=1}^{m} w_i x_i \\ &= w_0 + w^T X \\ &= b + w^T X \end{aligned}$$

here,
Wi = input vectors (W0, W1, W2, W3……Wm)
b = biased component (W0)
X = variables.

Algorithm 1: Training an SVM

Input: X: The train set. δ: Threshold value

Output: $x_R : x_R \in x$ | x_R | <<< | x |.

Begin

Train one decision tree T;

$x_R \Leftarrow$ NULL

For each leaf L_i of T, follow

1. for each opposite class neighbour L_j do
2. if entropy of L_j is low then
3. Select closest examples.
4. Use L_i and L_j to build X+;
5. Compute
6. Add $x_i \in L_j$ to x_R
7. end for
8. else
9. Add all the elements in L_j to x_R
10. $x_R \Leftarrow x_R \cup L_j$;
11. end if: end for return x_R

End

After the columns are gathered and the data is split with test size 20% and train size 80%, it is fit into the SVM classifier by importing SVC i.e., Support Vector Classifier from sklearn library.

By relying on biological operators such as mutation, crossover and selection, to generate high quality solutions to optimization and search problems, Genetic algorithm has been used with SVM classifier.It is a search heuristic algorithm. The fittest individuals are selected and they are made to produce off springs which inherit the characteristics of parent individuals and are later, added to the next continuous generation. The same process iterates and at the end, fittest individuals of a generation are found.

Five phases are considered:

1. Initial Population: A given set of individuals form a population where each individual is distinguished by a set of parameters that are called genes.

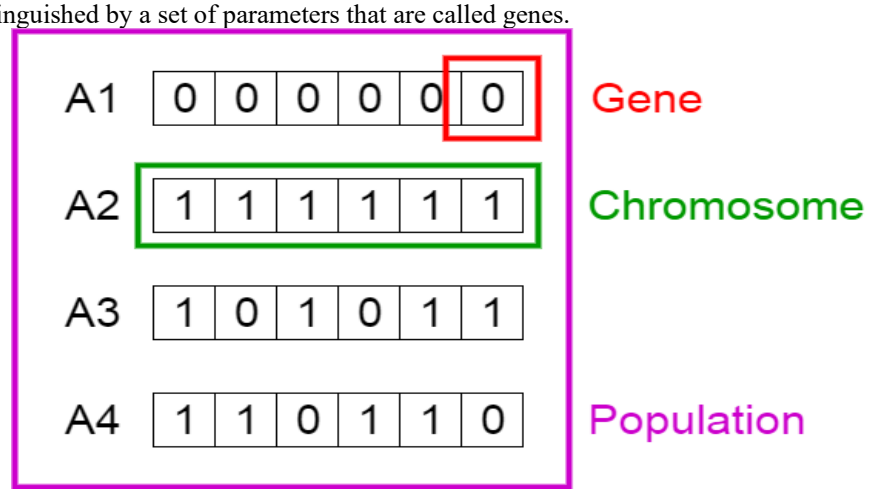

Fig. (10) Genetic Algorithm

To form a chromosome, these genes join as a string which are ideally solutions to each problem that needs to be solved. Genes usually are represented in terms of an alphabet by a string and it is said that genes of the population are encoded into chromosome.

2. Fitness Function: It determines the ability of an individual by evaluating and providing a fitness score for a particular individual who compete with other individuals and then get selected for reproduction based on their fitness scores.

3. Selection: Based on fitness scores of each individual, the selection phase takes place. Individuals with higher fitness scores have higher probability of getting selected for reproduction. This criterion helps the pair of individuals to pass on the genes for next generation.

4. Crossover: A Crossover is a stage used in generic algorithm during which a particular crossover point is picked at random fromthe genes of the parents. Then the genes are swapped among the parents until the reach of crossover point in order for the offspring to be produced.

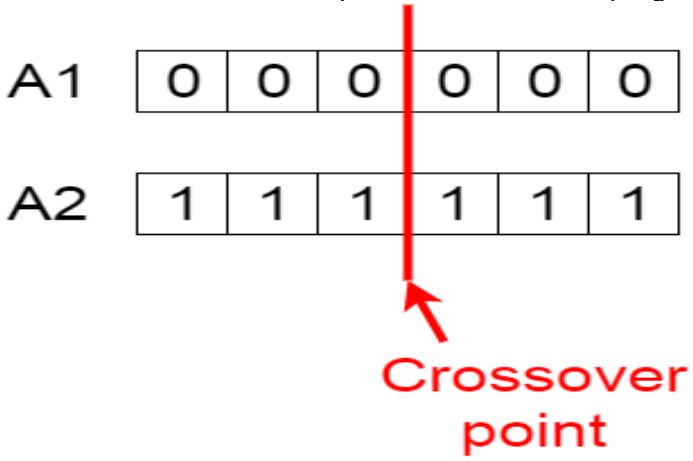

Fig. (11) Crossover phase

This is done in order for the offspring to consist of genes from both parents.

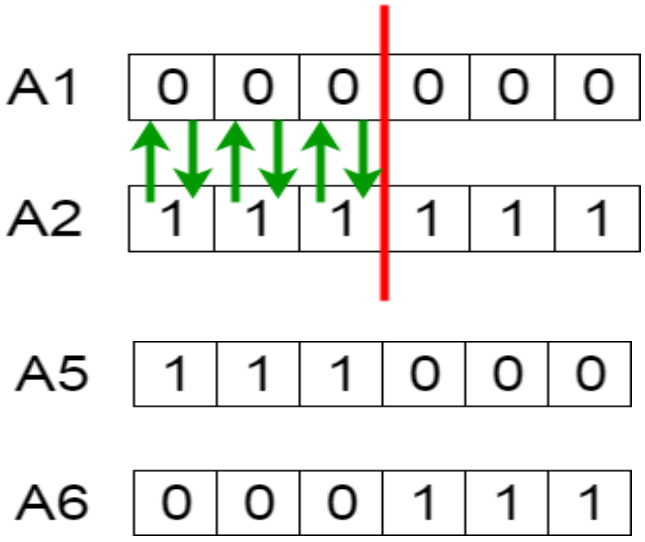

Fig. (12) Exchange of off springs for better performance results

5. Mutation: Sometimes for maintaining diversity within the population, a process known as mutation is performed by flipping a few of the bits in a bit string. Some of the genes in certain new offspring formed are subjected to mutation for a low discriminate probability.

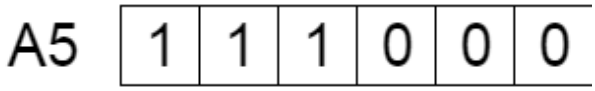

Fig. (13) Before Mutation

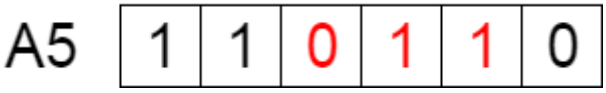

Fig. (14) After Mutation

This process also prevents premature convergence as well.

Algorithm 2: Genetic Algorithm

Start

1. Generating the initial population
2. Computing fitness

REPEAT

```
            3. Select
            4. Crossover
            5. Mutate
            6. Computation of Fitness
            UNTIL POPULATION INTERSECTS
End
```

A set of solution is provided after the population has converged. Individuals with minimal fitness die when additional individuals which are better than previous generations are formed.

Stacked Generalisation

Stacked Generalization considers heterogeneous weak learners using a meta-model to give predictions depending on multiple predictions given as outputs by the weak models.

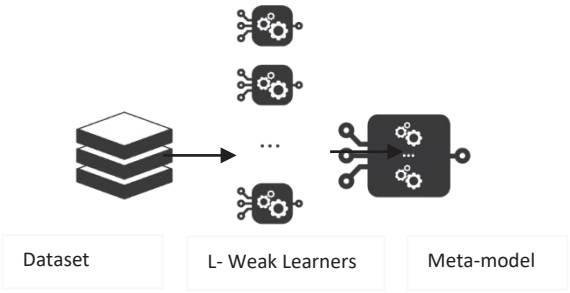

Fig. (15) Stacking concept

Multiple models are trained and combined to resolve a problem for better results. A paradigm of Machine learning, ensemble learning isworks on the main hypothesis which states that the weak models are combined to obtain more robust and accurate solutions and models.Depending on the volume of data, dimensionality of space,hypotheses distribution etc., the choice of model plays a major role in classification problems.

Base models or weak learners are models that don't perform so well as they have a high bias or too much variance to be robust. Hence, they can used as building blocks to combine and design complex models. These complex models are called strong models, which have less bias and variance and give better performance.The proposed stacking system works on the respective four classifiers:

1. K Neighbours classifier
2. Random Forest classifier
3. Gaussian NB
4. Decision Trees

Decision Trees acts as a meta model whereas the other classifiers act as the Base Learners.

Algorithm 3: Stacking

Input: Training Data D= $\{x_i y_i\}_{i=1}^{m}$ $(x_i \in R^n, y_i \in Y)$
Output: An ensemble learning classifier H
START
1. Learn classifiers of first level
2. for t =1 to T do
3. based on D, learn a base classifier h_i
End of for
4. Construct original data sets using D
5. For i=1 to m do
6. Construct new dataset that holds $\{x_i', y_i\}$, where $x_i'=\{h_1(x_i), h_2(x_i), \ldots\ldots, h_T(x_i)\}$
End of for
7. Learn second level of classifier
8. Based on the newly constructed data set,learn a new classifier h'
9. Return H(x)=h' $(h_1(x), h_2(x), \ldots\ldots, h_T(x))$
END

4 Results

For measuring the performance of the Classification model, ROC curve method was used. The true positive rate was plotted against the false positive rate, for the probabilities of predictions of classifiers.

SVM with Genetic Algorithm-After the columns are gathered and the data is split with test size 20% and train size 80%, it is fit into the SVM classifier by importing SVC i.e., Support Vector Classifier from sklearn library. Through evaluation, it is seen that the Support Vector Machine classifier on the heart disease predicts with accuracy 81.967%.

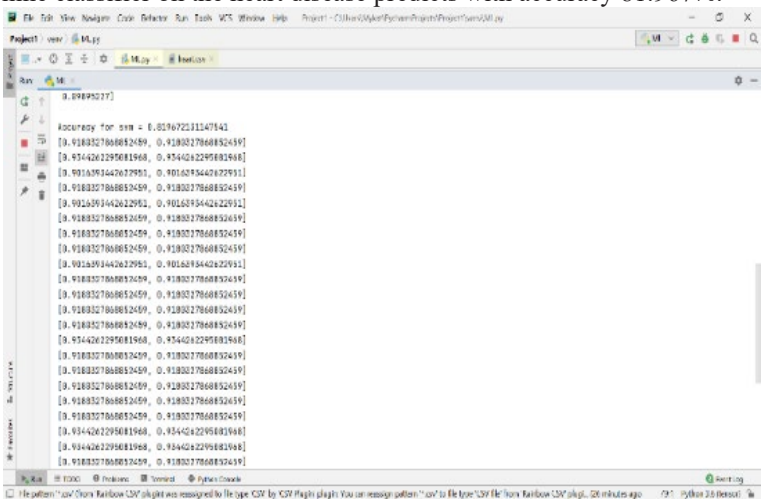

Fig. (16) Accuracy of SVM classifier

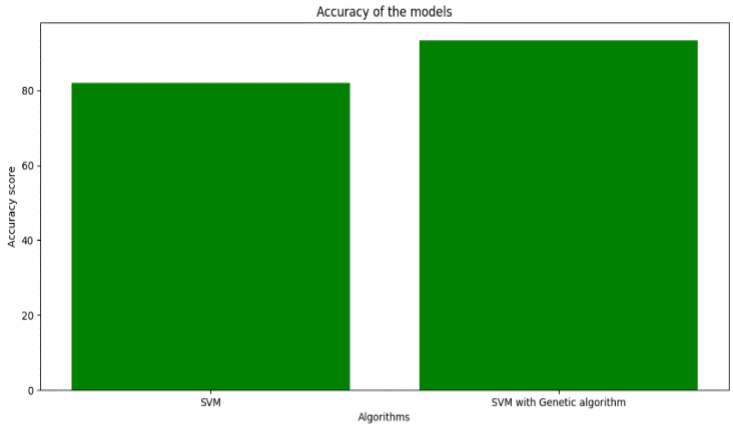

Fig. (17) Accuracy of SVM with Genetic algorithm

An accuracy of 93% has been achieved after implementing genetic algorithm on the heart disease dataset.

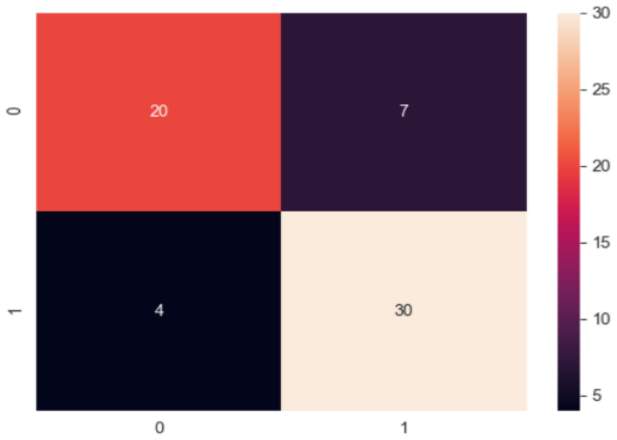

Fig. (18) Confusion Matrix for SVM with genetic algorithm

The Confusion Matrix shows True Positive rate to be 20 and True Negative as 30. The False Positive rateappeared to be 7 and False Negative with a total of 3.The ROC Curve with Genetic Algorithm for SVM is plotted and the Area under curve of the ROC is given to be 0.92 which says that the predictions are excellently made by the classifier.

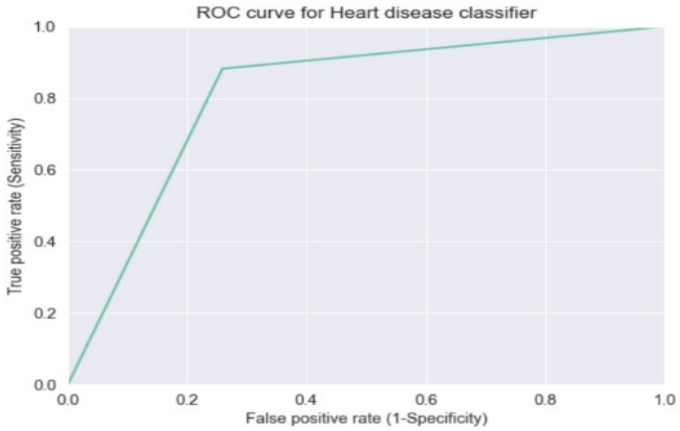

Fig. (19) ROC curve for SVM with genetic algorithm

Stacked Generalisation-After the base models were combined with a meta model as a learner, an accuracy of 86.88% was achieved. It surpasses the accuracy of each individual classifier.

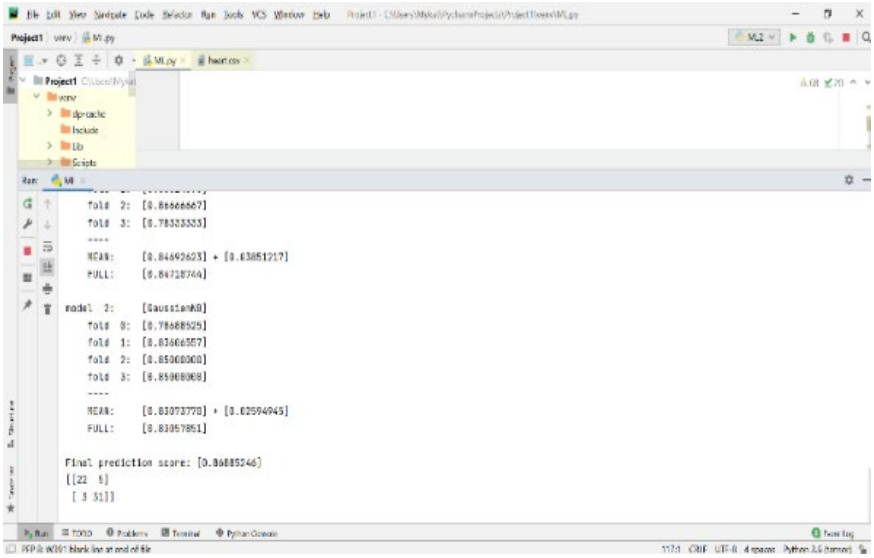

Fig. (20) Accuracy with stacked generalization

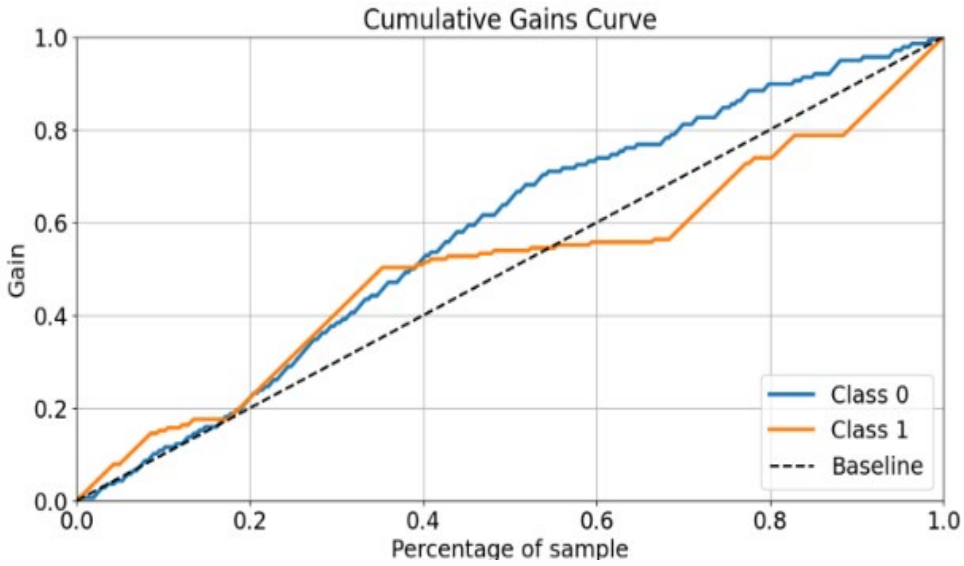

Fig. (21) Cumulative Gains Curve of the model

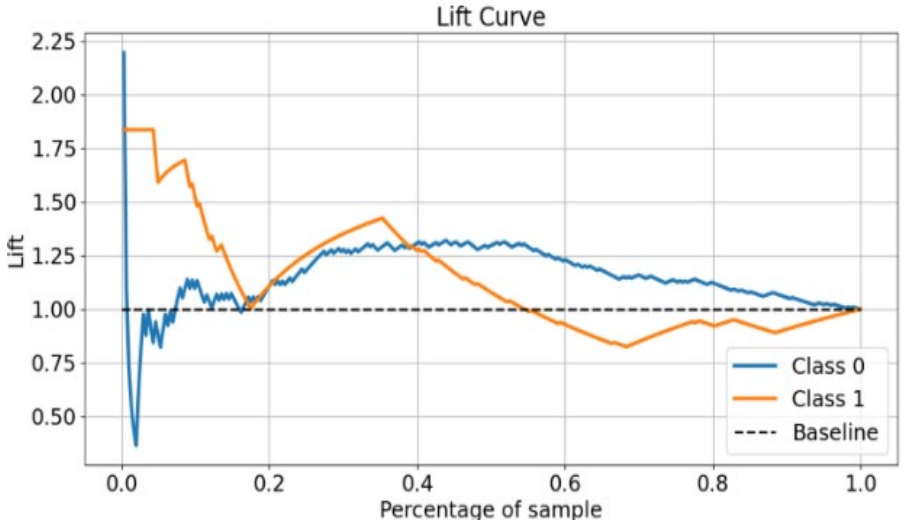

Fig. (22) Lift Curve for the model.

According to the UCI Heart Disease Dataset, 0 represents having affected by a heart disease and 1 represents not being affected by a heart disease. Hence, we can infer from Fig. (21) and Fig. (22) that the proposed system has gained a compelling accuracy in predicting the presence of heart disease.

With the generation of the classification report, it has been noticed that the precision rate for detecting presence of heart disease is 88.9% and for the absence of heart disease, it is

87.6%. Therefore, we can say that the stacking model performed well in predictions.The AOC under the ROC is calculated for stacked generalization method and a score of 0.86 is achieved which shows that the predictions are ranked with a good score.

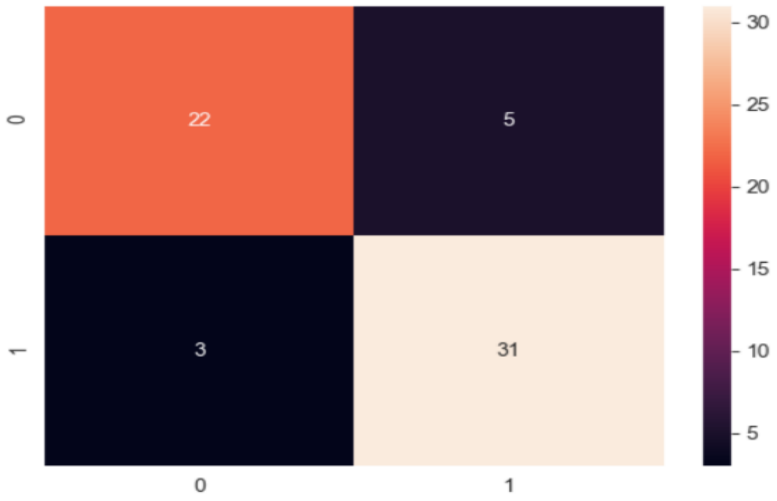

Fig. (23) Confusion Matrix for Stacking

Similarly, from Fig. (23) for the stacked method,Confusion Matrix displays True Positive rate to be 22 and true Negative with a rate of 31. The False Positive appeared to be 5 and False Negative as 3.The trade-off along the true positive rate and the false positive rate on the predictive model is summarized.

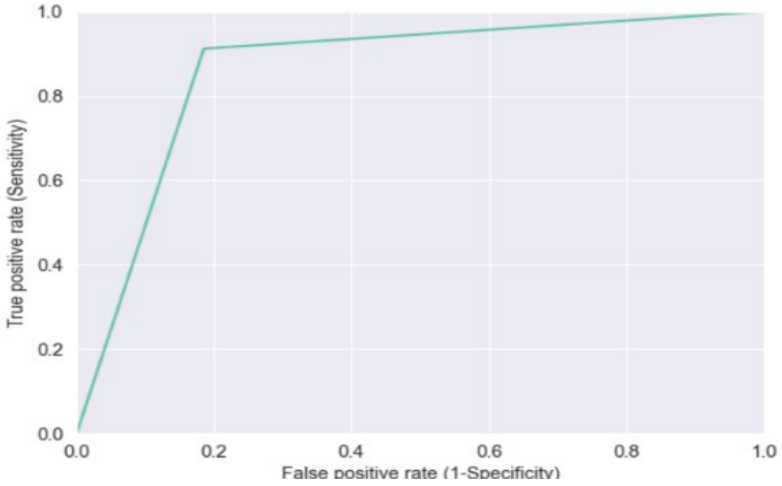

Fig. (24) ROC curve for Stacking

Fig. (25) AOC under ROC for stacked generalization

A web app has been deployed on the predictive model for the prognosis of heart disease.The web application takes the following features as input:Age, Gender, Chest pain type, Resting BP, Cholesterol etc. as they are considered to be the most important features in predicting the probability of developing a heart disease. After the input is gathered, the model runs and predicts the individual's risk of developing a heart disease in an effective manner.

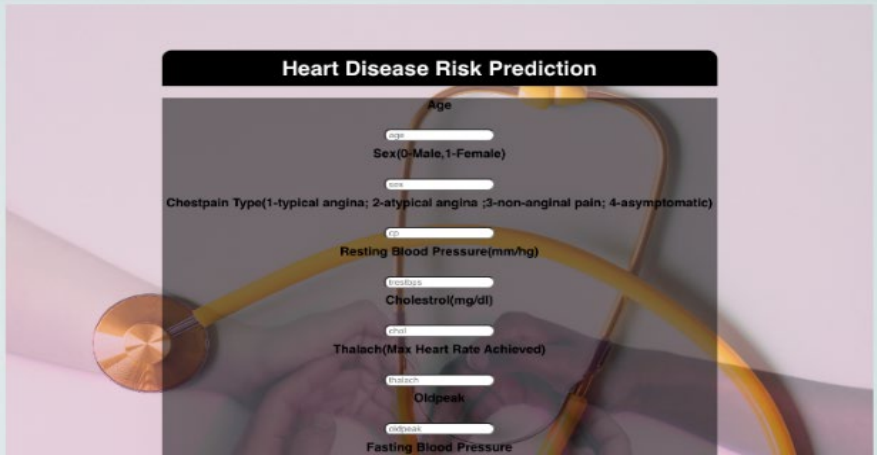

Fig. (26) Web Application

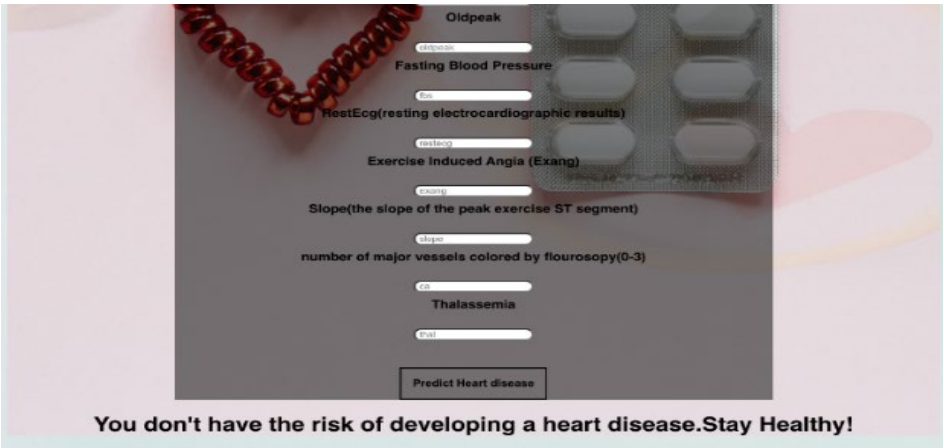

Fig. (27) Output from the web app

5 Conclusion And Future Work

With the aim to propose a hybrid method for prediction of cardiac diseases, the presented methodology achieved an accuracy of 86% with the concept of stacking and 93% accuracy for implementing the Genetic algorithm on the SVM classifier. This demonstrates the effectiveness of the proposed methodology for the identification of patients affected with heart disease or not. Although, there is a risk of overfitting since the dataset consists of 303 sample items, we trust that the results are encouraging and they represent a solid base for additional development of personalised models. Moreover, investigating other trainable combining methods is unforeseen.

Acknowledgements

The final outcome and success of this project required a lot of assistance andguidance and we are extremely privileged to have this along the completion of the project. All that we have done is only due to such assistance and supervision and we thank our guide Prof. Kumaresan Angappan for the support.

References

[1] K. G. Dinesh, K. Arumugaraj, K. D. Santhosh and V. Mareeswari, "Prediction of Cardiovascular Disease Using Machine Learning Algorithms," 2018 International Conference on Current Trends towards Converging Technologies (ICCTCT), Coimbatore, 2018, pp. 1-7.

[2] H. A. Esfahani and M. Ghazanfari, "Cardiovascular disease detection using a new ensemble classifier," 2017 IEEE 4th International Conference on Knowledge-Based Engineering and Innovation (KBEI), Tehran, 2017, pp. 1011-1014.

[3] Gino Sophia, Ceronmani Sharmila, “Water management using Genetic algorithm-based machine learning” Soft computing, Vol. No. 24, Issue No.22, ISSN:1432-7643, pp. 17153-17165

[4] Pavithra B., Rajalakshmi V. (2020) Heart Disease Detection Using Machine Learning Algorithms. In: Hemanth D., Kumar V., Malathi S., Castillo O., Patrut B. (eds) Emerging Trends in Computing and Expert Technology. COMET 2019. Lecture Notes on Data Engineering and Communications Technologies, vol 35. Springer

[5] Kumaresan, A, Mohankumar, N., Sureshanand, M. and Suganya, J. (2016) “An effective recognition of partial speech using non audible murmur (NAM) for speech impaired children”, International Journal of Control Theory and Applications, 9(28) 2016, pp. 165-174

[6] J. P. Li, A. U. Haq, S. U. Din, J. Khan, A. Khan and A. Saboor, "Heart Disease Identification Method Using Machine Learning Classification in E-Healthcare," in IEEE Access, vol. 8, pp. 107562-107582

[7] ZeinabArabasadi, RoohallahAlizadehsani, MohamadRoshanzamir, HosseinMoosaei, Ali AsgharYarifard, Computer aided decision making for heart disease detection using hybrid neural network-Genetic algorithm, Computer Methods and Programs in Biomedicine, Volume 141, 2017, Pages 19-26, ISSN 0169-2607

[8] Fatma Zahra Abdeldjouad, MenaouerBrahami, and Nada Matta, A hybrid approach for heart disease diagnosis and prediction using machine learning techniques, The Impact of Digital Technologies on Public Health in Developed and Developing Countries (Cham) (Mohamed Jmaiel, MounirMokhtari, BessamAbdulrazak, HamdiAloulou, and Slim Kallel, eds.), Springer International Publishing, 2020, pp. 299–306

[9] S. Babu et al., "Heart disease diagnosis using data mining technique," 2017 International conference of Electronics, Communication and Aerospace Technology (ICECA), Coimbatore, 2017, pp. 750-753

[10] A. Singh and R. Kumar, "Heart Disease Prediction Using Machine Learning Algorithms," 2020 International Conference on Electrical and Electronics Engineering (ICE3), Gorakhpur, India, 2020, pp. 452-457

[11] B. Gnaneswar and M. R. E. Jebarani, "A review on prediction and diagnosis of heart failure," 2017 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), Coimbatore, 2017, pp. 1-3

[12] Tougui, I., Jilbab, A. & El Mhamdi, J. Heart disease classification using data mining tools and machine learning techniques. Health Technol. 10, 1137–1144

[13] YashJayeshChauhan, "Cardiovascular Disease Prediction using Classification Algorithms of Machine Learning", International Journal of Science and Research (IJSR), https://www.ijsr.net/search_index_results_paperid.php?id=SR20501193934, Volume 9 Issue 5, May 2020, 194 - 200

[14] S. S. Yadav, S. M. Jadhav, S. Nagrale and N. Patil, "Application of Machine Learning for the Detection of Heart Disease," 2020 2nd International Conference on Innovative Mechanisms for Industry Applications (ICIMIA), Bangalore, India, 2020, pp. 165-172

[15] N. Louridi, M. Amar and B. E. Ouahidi, "Identification of Cardiovascular Diseases Using Machine Learning," 2019 7th Mediterranean Congress of Telecommunications (CMT), Fès, Morocco, 2019, pp. 1-6

[16] David H. Wolpert, Stacked Generalization, Neural Networks, Volume 5, Issue 2, 1992, Pages 241-259

An Efficient way of Predicting Covid-19 using Machine and Deep Learning Algorithms

Meenakshi N[1], Kumaresan Angappan[2],Sandhya A[3],NagaSusmitha V[4],Vaishnavi K[5]

{abu221985@gmail.com[1], kummaresan@gmail.com[2], chenchusandhya1999@gmail.com[3], susmithasubramanyam1234@gmail.com[4], vaishnavi12345@gmail.com[5]}

Department of Information Technology, Hindustan Institute of Technology and Science, Chennai, India[1,2,3,4]

Abstract- Recently the novel coronavirus disease pushed the world into the dramatic situation. The tough thing to deal with novel corona virus is the prediction. In the beginning RT PCR test is the golden standard test for the prediction of COVID, which takes more time, more licensed laboratories, trained personnel and prediction accuracy will be not fruitful. In our System, We used current technology for the prediction, which involves: An Efficient Random Forest, a machine learning classification model which predicts whether the person is Corona affected or not using routine blood reports and a deep learning model, Modified DenseNet121 which was pre-trained to predict theCovid using CT scan images. To analyze the machine learning model performance, 5744 blood report samples have been collected from Kagglerepository;similarly, 2482 CT scan samples have been collected from the Kaggle repository, for prediction using Random Forest and DenseNet121 model. The proposed model which is developed using machine and deep learning techniques can be deployed easily and can be used for rapid and accurate prediction of Covid19.

Keywords— COVID-19, clinical data analysis, Machine Learning, Deep Learning, Blood test, CT scan, Efficient Random Forest, Modified DenseNet121.

1 Introduction

COVID 19 [1][2] is an infection which occurs atrespiratory organs caused by SARS-CoV-2 virus. This novel coronavirusseverely affects the acute respiratory syndrome coronavirus 2 which is first appeared in Wuhan, China in December 2019.On 11th March,2020 WorldHealth Organization(WHO) announced upsurgeof Covid19 as pandemic in the global level. The growth of Coronavirus will be more when people come contact with other people directly. So, there it was mandatory to stop people travelling from one location to the other. And it is advised to wash the hands repeatedly for every 1 hour. This step may not prevent Corona however make us safe from being Corona affected. The general

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symptoms which was exhibited in many people are cough and fever and other symptoms may occur, including chest discomfort, sputum development.

The Coronavirus disease first started as an infection in throat along with any of the following symptoms : Cough, fever, body pains, headache, loss of smell and taste. It will easily spreads from one person to another person when they make direct contact with covid-19 infected patients. Jiang and his team [3] conducted a research and found 4.5 % as death rate with Covid19 infection across the world. Covid positive patients with age range of 70 to 79 years the death rate is 8.0%, and for patients above 80 years the death rate is 14.8%. It is also confirmed that the risk prediction of Corona Virus is at peek zone for the patients who are above the age of 50 years with chronic illnesses therefore they should take special precautions, care and attention. One of the pressing issue with Covid 19 is rapid spread of the disease that means if around 20 people are affected with COVID-19 positive, then they are more likely to infect 25–45 other people [4] within their community. Therefore, COVID 19 can be affected to large group of people with in less span of time until or unless some preventive measures are implemented.

At the beginning of the pandemic, RT-PCR [5], a gold standard test which is used to detect COVID-19 infection. Real-time Reverse Transcription Polymerase Chain Reaction (RT-PCR), generally this test analysis the De-oxyribo Nucleic Acids (DNA), however DNA is not collected directly, RNA is collected and then the collected RNA has to be converted to DNA because of this it is “Reverse Transcription”. In this test first swab test is performed to collect nasalsecrations and then the secrataions are analysed to find the Corona. But, lack of equipment and high standard Isolated laboratories for screening limited the fast and accurate testing. Later, the reverse transcription polymerase chain reaction (RT-PCR) [5] also giving false results.

In Wuhan China, clinical study with 1015 patients has shown that chest computed tomography(CT) analysis can achieve 0.97 of sensitivity, 0.68 of accuracy , 0.25 of specificity to detect COVID 19 disease, with RT-PCR [6]. Symptoms of coronavirus in lower parts of lungs gives more accuracy by using CT Scan[7][8][9] than using RT-PCR. To assist radiologists for the prediction of COVID 19 using CT Scan, we need to improve the system speed(prediction of COVID 19). This can be done by using Automatic diagnostic system, uses Machine Learning (changes in blood parameters of COVID-19 patients plays an important role in predicting coronavirus infection) and Deep Learning algorithms. Even for an experienced physicianit is difficult to extract all the necessary information from blood tests. Machine Learning algorithms can learn and distinguish various patterns from blood report analysis. Blood tests based ML System approach for Covid detection provides easy to use, a fast, accessible less expensive and more accessible less alternative to costly and time taking methods(like imaging based method and RT-PCR test. This approach is to decrease the mortality rate, the time , spread ratio and efforts by narrow down the testing time and produce fast and accurate results.

In our Model we are using :

- Machine Learning and Deep Learning algorithms[7] based diagnostic system used for early detection and fast assessment of risk detection in Coronavirus infection and it can be easily deployed.
- The ML Algorithms we are used : Random Forest[10], Decision Tree[11], Logistic Regression, Support Vector Machine[12] to detect negative/positive results of COVID-19 patients from blood reports and found Random Forest as best algorithm
- And DL Algorithm Modified DENSENET 121 is used for diagnosis of COVID-19 infection through CT Scan images.

- Integration of blood reports(laboratory/clinical blood reports) and radiological data (CT Scan) used to detect the Coronavirus presence.

In this Model, we concluded that Machine Learning and Deep Learning based classifier provides a diagnostic tool for prediction of COVID-19 using blood report samples,and CT Scan images.

2 RELATED WORKS

Beginning from the flare-up of the Covid numerous specialists are dealing with this, finding a wide range of ways for recognizing Coronavirus and just as for its cure. It is hard to distinguish uncovered people since they don't show infection indications right away. Along these lines, it is important to discover a strategy for assessing the quantity of conceivably contaminated people consistently to receive the suitable measures. Machine Learning and Deep Learning can be utilized to inspect an individual for Coronavirus as an option in contrast to customary techniques which are tedious and expensive. Although there are a few investigations on Coronavirus, this examination zeroed in on the utilization of ML in diagnosing patients for Coronavirus disease through Blood Reports, and CT Scan pictures.

Many researches have been done in this area(Machine Learning) and found the greatest advantage of Machine Learning, which can be trained with the existing data, further we can use that trained model for the prediction of the Covid 19. In our Model, Machine Learning was implemented by considering blood report samples to predict whether a patient is positive for COVID-19 and used Deep Learning based Densenet technique by using CT Scan pictures.

2.1COVID-19 DIAGNOSIS USING DEEP LEARNING MODEL :

It has been observed that the usage of Artificial Intelligence, Machine and Deep Learning has been increasing day by day in various field (example: medicine ,malware detection)[13],[14]. In 2012, deep learning a modern Machine learning system was introduced, which is based on Densely connected convolutional network a model of Deep Learning[20]. Deep learning consists of different techniques to deal with various problems, it comprises various layers for learning the data hidden in the images and from that learning it takes some decisions which we can use those decisions for the prediction. According to Le Cun and his team members[15], deep-learning techniques provides more accuracies and can speedup the output when compared with humans

2.1.1CT Scan Diagnosis Using Deep Learning Model :

Godfrey Hounsfield and Allan Cormack developed CT Scan 1972. The main advantage of CT scanning does not involve any pain, helps for precise prediction, consists of three-dimensional images [16 [17].

Jiang and his team[18] compared RT-PCR and CT Scans for 51 patients which comprises 29 men and 22 women with the history of travel to or residency in pandemic areas and founded that they are exhibiting the symptoms of fever and their CT Scan reports showed that they are having respiratory infection. They found sensitivity of the CT Scan reports as 98%, while the sensitivity of the golden standard RT-PCR found to be 71%.

Wang and his team [19] developed a deep-learning approach to extract the information(to understand the Covid19 features) from CT scans. Their study included a collection of 453 CT scans from 99 patients. They extracted 195 regions of interest (ROIs) of sizes ranging

from 395×223 to 636×533 pixels from the CT scans of 44 COVID-19-positive pneumonia patients and 258 ROIs from those of 50 COVID-19-negative patients. They have applied a modified network inception model and gained an accuracy of 82.9% for the internal validation with a specificity of around 80.5% and sensitivity of the model stand up at 84%. They tested the model with external dataset and that testing showed results as 73.1 % as total accuracy and specificity and sensitivity of the model is 67% and 74% respectively.

2.2COVID-19 INFECTION PREDICTION USING MACHINE LEARNINGTECHNIQUES:

Machine Learning is one of the largest technology in the Artificial Intelligence which comprises Deep Learning. It uses the concepts of mathematics like regression, probability etc to learn and analyze the interesting patterns from the data. Machine learning models are applied to a system and patterns are recongnised, the obtained validation data are then divided according to the patterns learned during the learning or training process. Hence machine learning can be used to predict the behavior from blood reports to decrease the spreading of virus in the early stages.

Wu along with his team members made the first study with the help of Random Forest Algorithm, a classification model of Machine Learning algorithm to detect covid 19 from samples of blood reports. They collected dataset which comprises of 253 blood report data of which 105 blood report data consists of COVID-19 cases, the data is collected from different hospitals in Lanzhou, China. From the sample blood report they identified 11 features as key features out of 49 features which they examined. Some of the key features are Leukocytes, Monocytes, Red Blood Cells etc.

Then the Random Forest model is built and then trained with 11 key features and resulted are noted. In results we can observe that model showed sensitivity of 95.12%, and specificity around 96.97% comprising the overall accuracy of the model as 96.95%.

However the performance of the model with the external data is not compromising, it was bit lower compared with trained result.

In addition to that the dataset is biased towards covid 19 positive data therefore the performance of the model will suffer for non Covid patient sample blood report s in the dataset.

3 An Efficient Random Forest Algorithm and Modified Densenet-121 Architecture

In our Model, we are using two algorithms. Machine Learning Algorithm(An Efficient Random Forest) was implemented by considering blood report samples and Deep Learning based Densenet technique implemented by using CT Scan picturesto predict whether a patient is positive for COVID-19 or not.

3.1Efficient Random Forest Algorithm:

Random Forest is one of the machine learning model which is used for classification. It is supervised learning model which means the model is trained with the training data and is tested with new sample of data (test data).

It is used for classification purpose and regression purpose and it is an ensemble learning model, it supports hyper parameter tuning all these together make the model more efficient.As the name suggests it considers multiple decision tree output to produce the final output, this is the advantage of the efficient Random Forest algorithm, it considers the output with majority votes by not depending on the single tree output. Thus increases the accuracy of the Random Forest Algorithm. The greater number of trees in theforest leads to higher accuracy and prevents the problem of overfitting byaveraging the result . One more advantage with Random Forest is, itsupports Hyper Parameter tuning whichagain increases thePrediction accuracy.

Efficient Random Forest Algorithm consists of two steps,

Creation of Random Forest

ii) Predicting from the created Random Forest

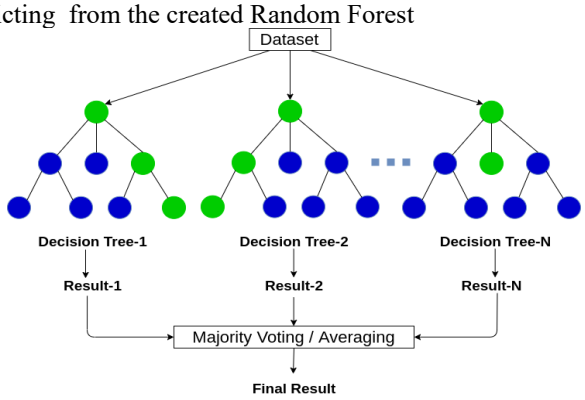


Fig. (1) Random Forest Model

The table shows the list of 21 attributes that are significant for the experiment.

#	Feature	Description
1.	age	Age in years
2.	Patient admitted to semi-intensive unit	[0= No/Not admitted; 1= Yes/admitted]
3.	Patient admitted to regular ward	[0= No/Not admitted; 1= Yes/admitted]
4.	Patient admitted to Intensive-care unit	[0= No/Not admitted; 1= Yes/admitted]
5.	Respiratory syncytial virus	detected/Not-detected
6.	Influenza A	detected/not-detected
7.	Influenza B	detected/not-detected

8.	Parainfluenza 1	detected/not-detected
9.	coronavirusNL63	detected/not-detected
10.	Rhinovirus/Enterovirus	detected/not-detected
11.	Coronavirus HKU1	detected/not-detected
12.	Parainfluenza 2	detected/not-detected
13.	Parainfluenza 3	detected/not-detected
14.	Adenovirus	detected/not-detected
15.	Parainfluenza 4	detected/not-detected
16.	Coronavirus 229E	detected/not-detected
17.	CoronavirusOC43	detected/not-detected
18.	Inf A H1N1 2009	detected/not-detected
19.	Metapneumovirus	detected/not-detected
20.	Bordetella pertussis	detected/not-detected
21.	Chlamydophila Pneumoniae	detected/not-detected

Table. (1) List of attributes

In the Hyper Parameter Tuning (used to inform the model how fastly it has to learn, it is like controlling the behavior of the model) we used number of estimators as “600” and criteria to be followed as “Gini Index”, minimum number of splits is 5, and minimum sample leaves is 1, and maximum features has to be learned is auto and random_state to be 1.

- We used dataset consisting of 5644 data
- We considered more number of attributes which enables the model to predict accuracy.

3.2MODIFIEDDENSE NET ARCHITECTURE (DENSENET 121):

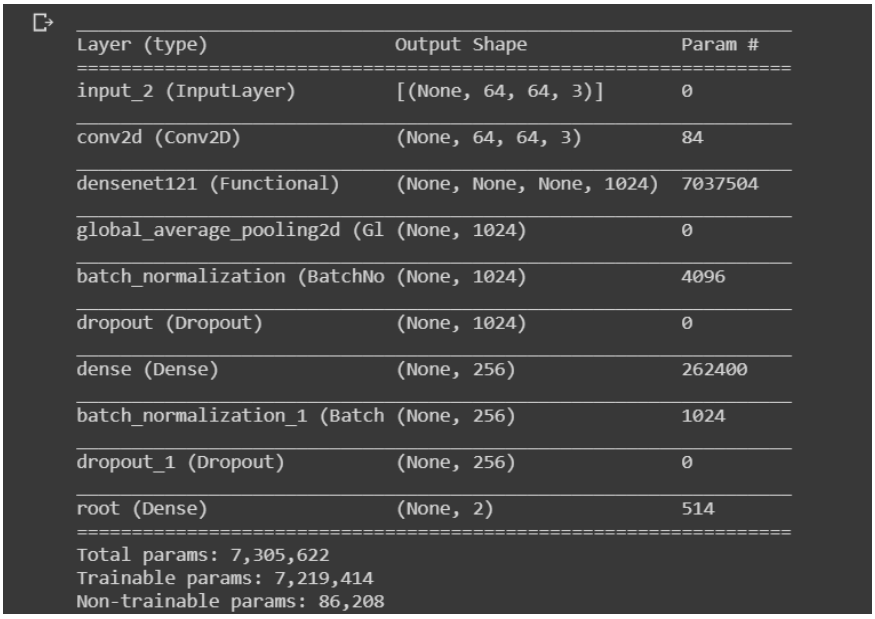
Densenet(121) is the Deep Learning Architecture (transfer model) which is pertained on huge Image dataset. It is especially designed for Image Classification and Prediction. Modified Denset 121 is a part of Convolutional Neural Network, in this DenseNet the layers are connected to each other through Dense Blocks. Each layer in the architecture produces the output in which this output is considered as input for the succeeding layers. Dense net consists of layers as a block (Dense Block), where layers are densely connected to each other, so this makes the algorithm to learn the features fastly and accurately.

The main components in theModified DenseNet architecture are:

1.Dense Blocks and 2.Transition Layers.

1. DenseBlock : It consists of multiple convolution blocks (layers) each one having the equal number of output channels, but, in the channel dimension we combines both input and output channels.

2. Transition Layers : If we increase the dense block then the number of channels will also be increasing which in turn makes the model complex. To reduce them we use Transition layers . So basically it is used to control the model complexity along with that it reduces the channel number. To achieve this ot uses the concept of 1*1 convolution layer.



Layer (type)	Output Shape	Param #
input_2 (InputLayer)	[(None, 64, 64, 3)]	0
conv2d (Conv2D)	(None, 64, 64, 3)	84
densenet121 (Functional)	(None, None, None, 1024)	7037504
global_average_pooling2d (Gl	(None, 1024)	0
batch_normalization (BatchNo	(None, 1024)	4096
dropout (Dropout)	(None, 1024)	0
dense (Dense)	(None, 256)	262400
batch_normalization_1 (Batch	(None, 256)	1024
dropout_1 (Dropout)	(None, 256)	0
root (Dense)	(None, 2)	514

Total params: 7,305,622
Trainable params: 7,219,414
Non-trainable params: 86,208

Fig. (2) Modified Densenet-121 Model

To predict Covid19 usingCTSCan our denset121 architecture consists of following layers:

Input Layer : Image height, image width and number of input channels (red, green ,blue are considered for our image which is 3).We used image size as 64*64.

ii. Conv 2d (convolutional 2D): We are using CT Scan because the effectiveness of prediction of Covid19 will be great and in general to predict presence of Covid19 using CT Scan requires doctors keen observation and sometimes doctors prediction might go wrong. Here the technology comes into picture.With the help of Deep Learning Convolution NeuralNetworks(DenseNet121) we can reduce the task for the doctor and prediction will be accurate as we are training more dataset and tested to guarantee the accuracy of the model.

iii.GlobalAverage_Pooling:In transition layers we are reducing number of channels to half of the excisting channels. Here, there are 1*1 conv layer and 2*2 average_pooling layer with stride of size 2.At last, we have globalAveragepooling, followed by final output layer.GlobalAveragePooling is applied on denseblock to make the connections.

4 METHODOLOGY :

4.1 . Dataset:

The dataset which was used to train the model is to predict COVID-19 and was gathered from Kagglerepository.It contains 5644 data about COVID-19 infected patients with 111 attributes, but all the the experiments refer to use a subset of 21 attributes. The attributes are

categorical, real and integer values. The dataset classify into two i.e., training and testing dataset.

And also we collected a datasets containingCT scan images to predict covid-19 from Kaggle Repository which contains 2 classes I.eCovid, Non-Covid.Because of limited availability of ct scan images we applied dataaugumentation.Data Augumentation methods are used commonly in Machine Learning to address class Imbalance problems,overfitting can be reduced in deep learning and improves convergence, which ultimately gives better results.

4.2 Data analysis

Data analysis performs major tasks such as data cleaning and integration, identification of missing values and removing the redundant data. Pandas recognizes all the features as numerical either as integers or floats. But some of the attributes are categorical in the dataset as their numbers represent mappings to a real-world phenomenon. Hence, Exploratory Data analysis is performed where first, the list of all the features which are numerical is saved in a column in order to not mix in the analysis with categorical variables. Using Pandas Profiling, distribution of each variable is visualized and a detailed profile report is generated with inference type, quantile statistics, descriptive statistics etc. for exploratory data analysis.

The interactions between each variable is defined with their correlations such as Pearson's correlation coefficient for the measure of linear correlation between two variables; Spearman's correlation coefficient for detecting the nonlinear monotonic correlations between the variables and Cramer's V coefficient for association measure of nominal random variables.

To pick the features that have best relationship with the performance variable, statistical tests are used. The SelectKBest class from the scikit-learn library is used to select features of different statistical tests. The proposed system uses the Chi-Squared test for non-negative features to select best features from the dataset and then ranks the features according to their importance as shown in Fig. (3).

	Specs	Score
0	Patient age quantile	116.870368
1	Patient addmited to regular ward (1=yes, 0=no)	101.944414
9	Rhinovirus/Enterovirus	8.724627
3	Patient addmited to intensive care unit (1=yes...	4.255048
2	Patient addmited to semi-intensive unit (1=yes...	4.168607
17	Inf A H1N1 2009	0.691753
4	Respiratory Syncytial Virus	0.187871
6	Influenza B	0.112047
10	Coronavirus HKU1	0.027124
14	Parainfluenza 4	0.024461

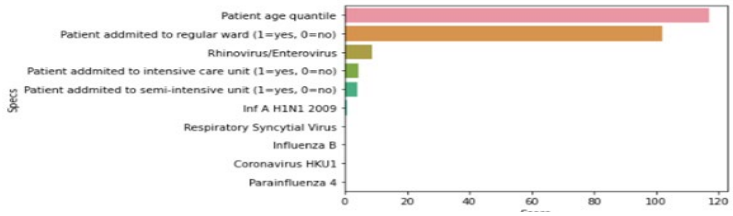


Fig. (3) Feature Importance - Efficient Random Forest Algorithm

Using the Model Characteristics property, the significance of each feature of theblood_reports Dataset is gained. To extract the top features from the dataset, the Extra Tree

Classifier is used where feature importance is a built-in class with Tree Based classifiers. A score for every function is given by the Feature value and it determines the significance of the performance variable.

With the seaborn library, the correlation matrix with Heatmap is generated to indicate how the features are related to each other as well as the target variable. Fig. (4) shows the correlation values between the variables, which are positive or negative in nature.

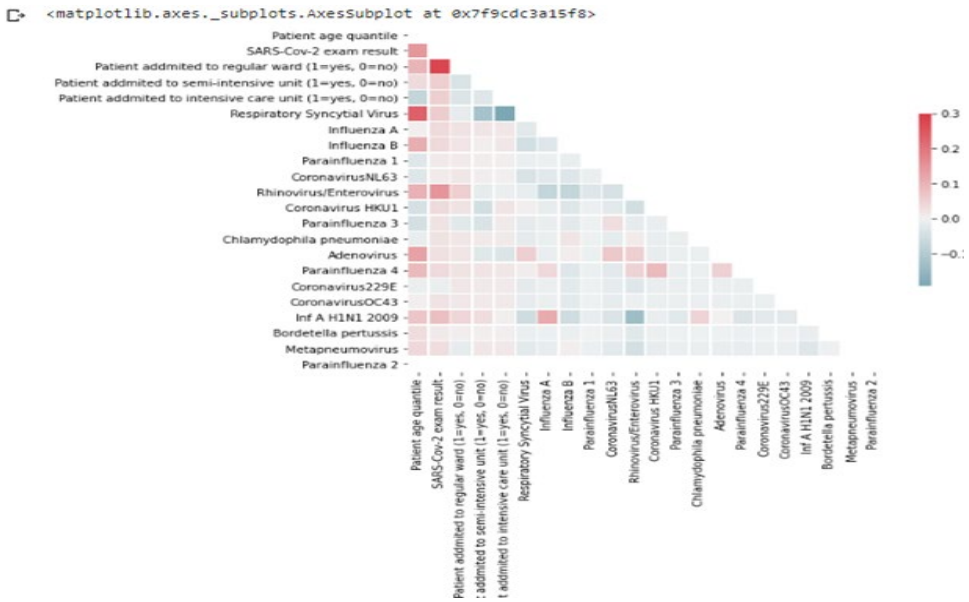


Fig. (4) Correlation Coefficient of attributes

4.3 Experimental Analysis

I. An Efficient Random Forest Algorithm:

Step- 1: Identified dataset from Kaggle.

Step- 2: Read the dataset using Pandas.

Import pandas as p

data = p.read_csv("dataset.csv")

Step 3: Findout the missing values using

data.isnull().sum()

Step- 3: Drop non required columns likes serial number etc using data.drop(columnname)

Step- 4: Drop the columns which are having missing rate(null values of the data) > 20% using

data.drop()

step- 5: Find the datatype of the attributes (We need to use integer for better prediction.)

dat = data.select_dtypes(['data type name']) to display all available attributes of that data type.

Step- 6: Convert them to Integer data type using Label Encoder.

le = preprocessing.LabelEncoder()
step- 7: Plot the heatmap to find the corelation between featureswith
cmap = sns.diverging_palette(220, 10, as_cmap=True)
sns.heatmap(corr, mask=mask, cmap=cmap, vmax=.3,
center=0,square=True, linewidths=.5, cbar_kws={"shrink": .5})
Step- 7: Find out the importance of from the available features Using SelectKBest.
X = data.loc[:, data.columns != 'SARS-Cov-2 exam result']
y = data['SARS-Cov-2 exam result']
betfea = SelectKBest(score_func=chi2, k=10)
Here we need to identify the predicting variable from our dataset and has to be stored in separate variable and then we need to perform the ChiSquareTest .
Plot a bar graph to understand the feature importance visually.
sns.barplot(x="Score", y="Specs", data=featurescore)
Step- 8: Find the ratio of values present in predicting variable, it should be almost same else the prediction of the model is going to be biased. To avoid those scenarios we need to perform:
Find the ratio values present in predicting variable
If the ratio is almost same then
Skip this step
Else then
Perform Sampling.
To our dataset we are using RandomSampler.
rus = RandomUnderSampler(random_state=42).
Step- 9: Split the datset into 2 parts among which one is used for training and other one will be used for testing.
X_train, X_test, y_train, y_test = train_test_split(X_re_s, y_re_s,
test_size=0.1, random_state=42)
We splitted the data in the ratio of 90:10 in which
90% iis used for training and 10% of data is usedfor testing.
Step- 10: Build and Train the model.
model_random= RandomForestClassifier(criterion="gini",n_est
imators=600,min_samples_split=5,min_samples_leaf=1,
max_features="auto",oob_score=True,random_state=1)
model_random.fit(X_train, y_train)
Step-11:Calculate and display the precision,recall and ROC:
Precision: scores.get('test_precision').mean())
Recall: scores.get('test_recall').mean())
ROC_ACU: scores.get('test_roc_auc').mean())

II. MODIFIEDDENSE NET ARCHITECTURE (DENSENET 121):

Step-1: First, we load the dataset then split it into covid and non covid (Using head and tail method)
Step-2: Then plot the count plot for finding the sampling.
Step-3: if(data is undersampled):
dodataagumentation process
else if (data is oversampled):
remove unnecessary data
else:

go to next step
Step-4: Resize the given images to standard pixels(i.e 64)
Step-5.Resize the images using resize().
Step-6.Split the dataset into train and test in the ratio of 80:20 using test_train_split()
Step-7. Now, set values:
BATCH_SIZE = 64
EPOCHS = 25
SIZE=64
N_chen =3
Step-8.Build the model() by using following inbuilt functions:
a. input()
b. convolution()
c. densnet()
d. GlobalAveragePooling2D()
e. BatchNormalization()
f. Dropout()
g. Dense()
h. BatchNormalization()
i. dropout()
Step-9.stores the model using model variable
Step-10.optimize the model using adam optimizer
Step-11.run the model to findout the accuracy
Step-12. Testing the model
a.fit the model with test data using test dataset
b.Store the results

```
[48]
Accuracy score (training): 0.821
Accuracy score (validation): 0.696
Accuracy score (training): 0.821
Accuracy score (validation): 0.696
Accuracy score (training): 0.821
Accuracy score (validation): 0.696
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Accuracy score (validation): 0.696
Accuracy score (training): 0.821
Accuracy score (validation): 0.696
Accuracy score (training): 0.821
Accuracy score (validation): 0.696
------------------------------
              precision    recall  f1-score   support

           0       0.89      0.57      0.70        14
           1       0.57      0.89      0.70         9

    accuracy                           0.70        23
   macro avg       0.73      0.73      0.70        23
weighted avg       0.76      0.70      0.70        23

/usr/local/lib/python3.6/dist-packages/sklearn/metrics/_classification.
  _warn_prf(average, modifier, msg_start, len(result))
------------------------------
Cross Validation Scores:
Precision:  0.7255555555555555
Recall:  0.8074074074074074
ROC_ACU:  0.7546296296296295
```
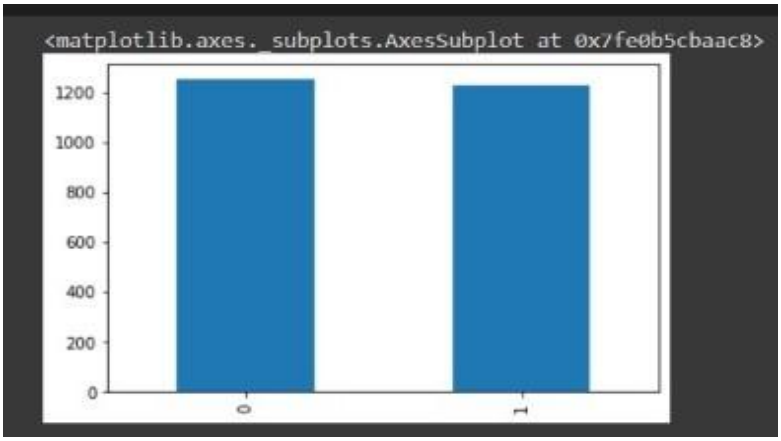

Fig. (5) Model Output



4.4
Simulation And Analysis:

Table 2.Comparison using P

Fig. (6) Samplified data

Algorithm	**Accuracy**
Gradient Boost Classification	**76.6%**
Logistic Regression	**65.22%**
Decision Tree Algorithm	**69.57%**
Support Vector Machine	**79.82%**
Random Forest Algorithm	**80%**
An Efficient Random Forest Algorithm	**82.1%**

From the above table.2 we concluded that Efficient Random Forest Algorithm is giving high accuracy than the other algorithms.An accuracy of 82.1% has been achieved after implementing Efficient Random Forest Algorithm on the blood_test_reports dataset.

```
------------------------------
              precision    recall  f1-score   support

           0       0.89      0.57      0.70        14
           1       0.57      0.89      0.70         9

    accuracy                           0.70        23
   macro avg       0.73      0.73      0.70        23
weighted avg       0.76      0.70      0.70        23

/usr/local/lib/python3.6/dist-packages/sklearn/metrics/_classifi
  _warn_prf(average, modifier, msg_start, len(result))
------------------------------
Cross Validation Scores:
Precision:  0.7255555555555555
Recall:  0.8074074074074074
ROC_ACU:  0.7546296296296295
```

Fig. (7)Efficient Random Forest Confusion Matrix

The Confusion Matrix shows the True Positive value and true Negative value.The ROC for Efficient Random Forest Algorithm is found and the Area under curve of the ROC is also found as best which says that the predictions are excellently made by the classifier.

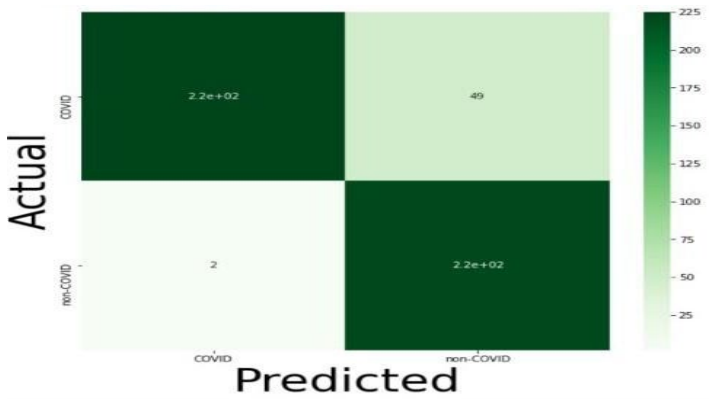


Fig. (8)Modified Densenet121 Confusion Matrix

The Confusion Matrix shows the True Positive value and true Negative values of the model.

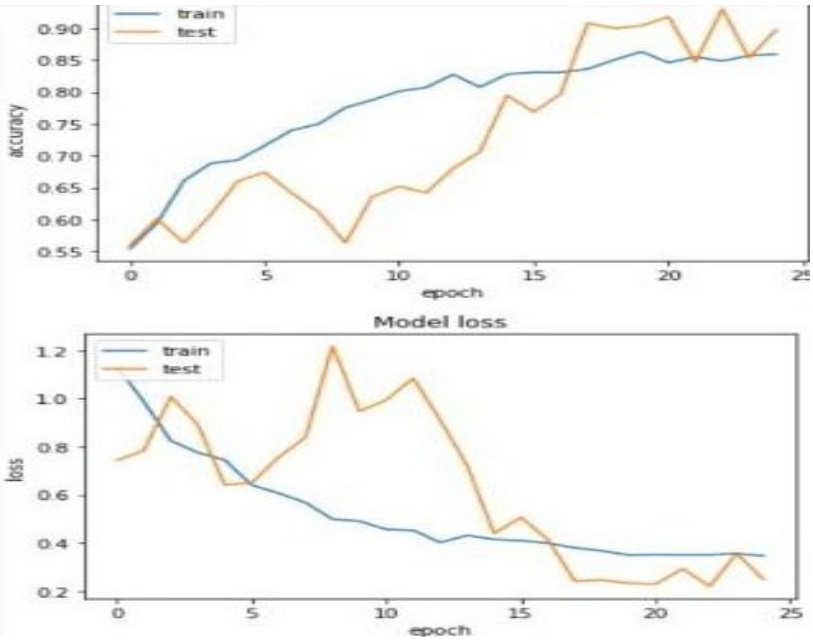


Fig. (9)ModifiedDensenet 121 Model Analysis

The ROC for Densenet-121 Architecture Modelfound and the Area under curve of the ROC is also found as best which says that the predictions are excellently made by the classifier.

A web app has been deployed on the predictive model for the diagnosis of Covid patients. The web application takes the following features as input: Age, influenza, ,Adenovirus, parainfluenza etc. These are the most important features in predicting the risk of Covid-19 infection. After the input is gathered, the model runs and predicts whether the person is covid affected or not in an effective manner.

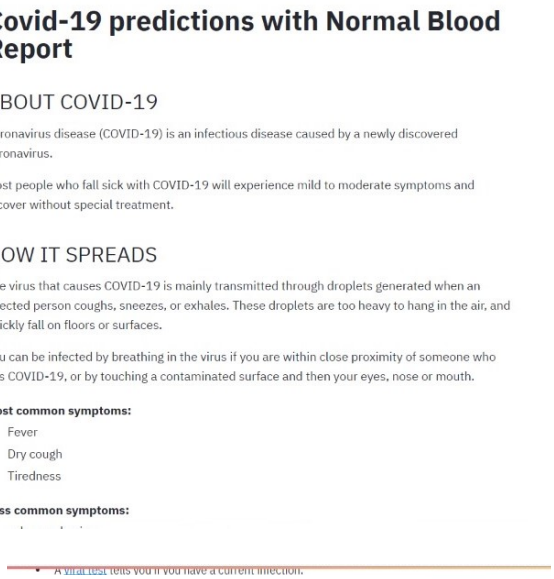


Fig. (10) Webapp Screenshot-1

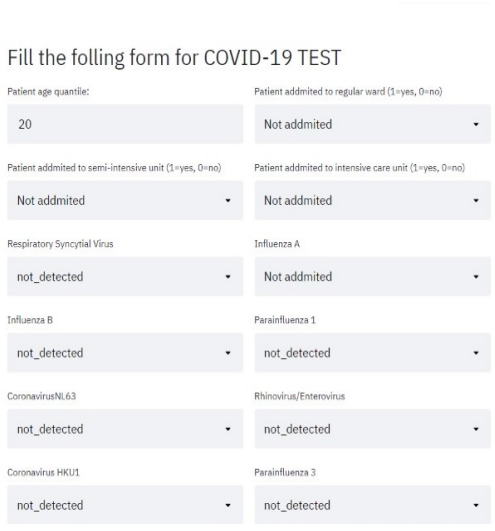


Fig. (11) Webapp screenshot-2

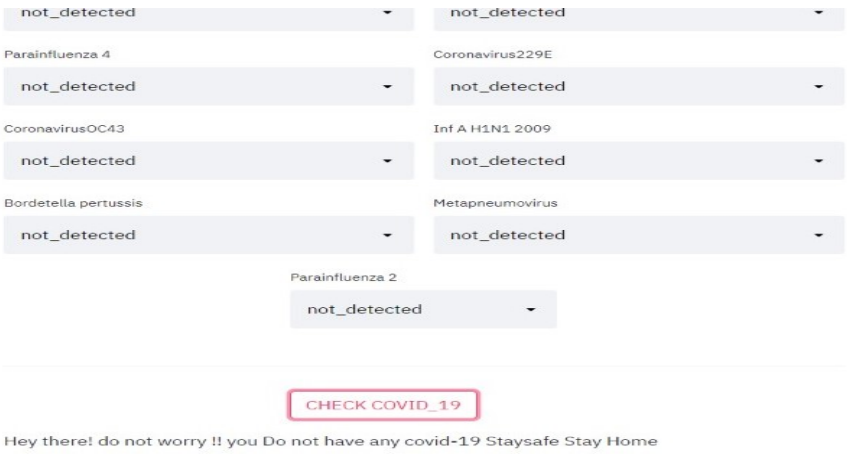


Fig. (12) Webapp screenshot-3

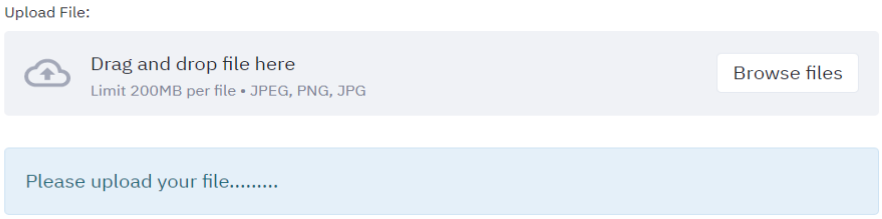


Fig. (13) Webapp CT-Scan Screenshot

Conclusion

In the rapidly spreading of global pandemic there is a need to improve current testing methods by implementing Machine Learning in the medical field. Which will give fast and accurate results in short period of time. And also helps in early prediction of the virus. Our experimental outputs showing that the proposed methods(machine learning algorithm I.e..EfficientRandom Forest and deep learning algorithm I.e..ModifiedDensenet-121)was trained properly with large dataset.In future work we want to implement same procedure to predict covid-19 using CT Scan images.

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References :

[1] C. Wang, P. W. Horby, F. G. Hayden, and G. F. Gao, “A novel coronavirus outbreak of global health concern,” Lancet, vol. 395, no. 10223, pp. 470–473, Feb. 2020.

[2] C. Huang et al., “Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China,” Lancet, vol. 395, no. 10223, pp. 497–506, Feb. 2020.

[3] F. Jiang, L. Deng, L. Zhang, Y. Cai, C. W. Cheung, and Z. Xia, "Review of the clinical characteristics of coronavirus disease 2019 (COVID-19)," Journal of General Internal Medicine, pp. 1-5, 2020.

[4] Z. Wu and J. M. McGoogan, "Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention," Jama, 2020.

[5] World Health Organization, "Laboratory testing for coronavirus disease 2019 (COVID-19) in suspected human cases: Interim guidance, 2 March 2020," World Health Organization, World Health Organization, 2020.

[6] T. Ai et al., “Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: A report of 1014 cases,” Radiology, vol. 2019, Feb. 2020, Art. no. 200642.

[7] L. Li, L. Qin, Z. Xu, Y. Yin, X. Wang, B. Kong, J. Bai, Y. Lu, Z. Fang, Q. Song, K. Cao, D. Liu, G. Wang, Q. Xu, X. Fang, S. Zhang, J. Xia, and J. Xia, ‘‘Artificial intelligence distinguishes COVID-19 from community acquired pneumonia on chest CT,’’ Radiology, vol. 296, Mar. 2020.

[8] S. Ahuja, B. Panigrahi, N. Dey, T. Gandhi, and V. Rajinikanth, ‘‘Deep transfer learning-based automated detection of COVID-19 from lung CT scan slices,’’ Techrxiv, 2020

[9] M. Anthimopoulos, S. Christodoulidis, L. Ebner, A. Christe, and S. Mougiakakou, ‘‘Lung pattern classification for interstitial lung diseases using a deep convolutional neural network,’’ IEEE Trans. Med. Imag., vol. 35, no. 5, pp. 1207–1216, May 2016.

[10] Safavian SR, Landgrebe D. A survey of decision tree classifier methodology.IEEE transactions on systems, man, and cybernetics. 1991;21(3):660–674. doi: 10.1109/21.97458.

[11] Kam H.T.: Random decision forest.. In: Proceedings of the 3rd International Conference on Document Analysis and Recognition, Montreal, Canada, August, vol 1416, p 278282, 1995

[12] Schölkopf B, Smola A.J., Bach F., et al., 2002 Learning with kernels: support vector machines, regularization, optimization, and beyond. MIT press

[13] A. A. Ogunleye and W. Qing-Guo, "XGBoost model for chronic kidney disease diagnosis," IEEE/ACM transactions on computational biology and bioinformatics, 2019.

[14] M. Kim, J. Yun, Y. Cho, K. Shin, R. Jang, H.-J. Bae, and N. Kim, ‘‘Deep learning in medical imaging,’’ Neurospine, vol. 16, no. 4, pp. 657–668, 2019

[15] Y. LeCun, Y. Bengio, and G. Hinton,"Deep learning," nature, vol. 521, pp. 436-444, 2015

[16] C. Feng, A. Elazab, P. Yang, T. Wang, F. Zhou, H. Hu, et al., "Deep Learning Framework for Alzheimer’s Disease Diagnosis via 3D-CNN and FSBi-LSTM," IEEE Access, vol. 7, pp. 63605-63618, 2019.

[17] C. Rachna. (2020, 15 April 2020). Difference betweenX-ray and CT Scan.

[18] F. Jiang, L. Deng, L. Zhang, Y. Cai, C. W. Cheung,and Z. Xia, "Review of the clinical characteristics of coronavirus disease 2019 (COVID-19)," Journal of General Internal Medicine, pp. 1-5, 2020.

[19] S. Wang, B. Kang, J. Ma, X. Zeng, M. Xiao, J. Guo, et al., "A deep learning algorithm using CT images to screen for Corona Virus Disease (COVID-19)," medRxiv, 2020.

[20] P. K. Sethy and S. K. Behera, "Detection of coronavirus Disease (COVID-19) based on Deep Features," 2020.

[21] Gino Sophia, Ceronmani Sharmila, "Recognition, Classification for Normal,Contact and Cosmetic Iris Images using Deep Learning", International Journal of Engineering and Advanced Technology, Vol. No. 8, Issue No. 3, ISSN : 2277-3878, pp. 4334-4340, September 2019.

Glaucoma and diabetic retinopathy diagnosis using image mining

B.V.Baiju[1], V.Ceronmani Sharmila[2],MuthurajB[3],Abdul Hasan M[4],Mahendar V[5]

(bvbaiju@hindustanuniv.ac.in[1], csharmila@hindustanuniv.ac.in[2],
muthuviz143@gmail.com[3], mohabdul20@gmail.com[4], mahendar0605@gmail.com[5])

Department of Information Technology, Hindustan Institute of Technology and Sciences, Chennai [1,2,3,4,5]

Abstract

Diabetes is an overall unavoidable sickness that can cause recognizable microvascular complexities like diabetic retinopathy and macular edema in the normal eye retina, the pictures of which are today used for manual disease screening and assurance. This work genuine task could inconceivably productive by customized acknowledgment using a Deep learning methodology. Here we present a profound learning structure that perceives referable diabetic retinopathy comparably or better than presented in the past investigations. The proposed strategy evades the need of sore division or applicant map age before the arrangement stage. Neighbourhood parallel examples and granulometric profiles are privately registered to extricate surface and morphological data from retinal images. Various blends of this data feed arrangement calculations to ideally separate brilliant and dark lesions from solid tissues. These outcomes propose, radial basis function in classification could build the expense viability of screening and finding, while at the same time accomplishing higher than suggested execution, and that the framework could be applied in clinical assessments requiring better reviewing.

Key words: Diabetic retinopathy, image processing, feature extraction, deep learning techniques.

1.INTRODUCTION

Diabetic retinopathy is the most notable microvascular intricacy in diabetes, for the screening of which retinal imaging is the most by and large used system in view of its high affectability in distinctive retinopathy. The evaluation of the earnestness and level of retinopathy identified with an individual having diabetes is correct currently performed by clinical experts subject to the fundus or retinal pictures of the patient's eyes. As the amount of patients with diabetes is rapidly growing, the quantity of retinal pictures made by the screening tasks will moreover fabricate, which along these lines presents a tremendous work heightened inconvenience on the clinical experts similarly as an expense to the clinical consideration organizations. This could be helped with a robotized structure either as help for clinical experts' work or as a full

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end instrument. There are two continuous assessments that have investigated the usage of significant learning structures in the automated acknowledgment of diabetic retinopathy. Both show that a robotized structure, considering the significant learning counterfeit neural association approach, can achieve high affectability with high unequivocally in distinguishing the referable diabetic retinopathy, described as moderate or more awful diabetic retinopathy. There are moreover other referable eye disarrays that have actually been investigated with this strategy, for instance, diabetic macular edema, and possible glaucoma, and age-related macular degeneration.

For a computerized system to be clinically sensible, it should have the alternative to portray retinal pictures subject to clinically used reality scales, for instance, the proposed worldwide clinical diabetic retinopathy and diabetic macular edema affliction scales, which are in like manner used in Finland. In the composition, one can find late examinations for the past case of diabetic retinopathy scale, yet there are no preliminaries yet to arrange macular changes with the last scale. Another liberal impediment to more broad and more suitable usage of significant learning structure is accepted to be the immense measure of explained pictures needed for the model to learn.

Also, we present what pre-processing and regularization steps to the pictures ought to be cultivated for the extraordinary handiness of the significant learning system and analyze deliberately how the size with much more unobtrusive number of pictures used in getting ready impacts its introduction.

2.LITERATURE SURVEY

Analysing the Obstruct outcome of the paper clears Diabetic retinopathy impacts on about one-fifth of the general population who is diagnosed with diabetes.. The paper [1] possess comparative analysis of different pre-processing technique to improve detecting diabetic retinopathy. Soft computing methodology [2] can handle both the experimental and computational data for simulation and modelling in the detection of diabetic retinopathy. The creation of a Novel Red Lesio System [3]isbased on super pixel segmentation and multi-feature classification. The proposed automated classification method [4] can be used to build specific computer-aided technology for fundus image ocular detection. The algorithm's robustness is the face of changes in its parameters has also been assessed.SVM method [7] is provided for diagnosing diabetic retinopathy based on different exudates and haemorrhage detection in the paper. The MLPNN classifier method [9] was proposed in the paper for detecting diabetic retinopathy in retinal photos. Features of retinal images include 64-point DCT and 09-point DCT. From retinal images, statistical parameters are derived.to be used as classifier inputs. The Hurst Exponent and Fractal Dimension [10] are used for diagnosing

diabetic retinopathy. A total of 100 photographs were gathered for review. The system explains [11] Localization of retinal structures (such as the optic disc, blood vessels, macula, and fovea), feature extraction, and classification using machine learning algorithms were proposed as part of a novel combination of fuzzy image pre-processing methods.The approach involved training an ANFIS neuro fuzzy model and then identifying dominant texture descriptors [14].A technique is used for obtaining functionality based on a variety of criteriamethods for extraction. The new techniques based on intelligent algorithms [17]proposed CNN model with deep learning techniques and also used a variety of our own hidden layers. CNN classification and transition learning [18] proposed a dynamic buffering algorithm that ensures an effective queue and power management scheme within the medical user's device in order to keep data in the queue for updating, prevent queue overflows, and minimise critical health data losses when involved entities are offline.Ceronmani Sharmila et al. [19] The aim of this paper is to implement a narrative approach for iris localization and solve the localization problem in an image using a dominant localization max–min algorithm that improves accuracy while reducing search time Ceronmani Sharmila et al.[20]The method we have approached non-invasive technique for detecting the sugar glucose level in the blood. For detecting the level of glucose and we have used many modules for the accuracy detectionA.Kumaresan et al.[5] The problem of diabetes prediction has been studied and analysed. Various methods on the prediction of disease has been studied. To improve the performance an Disease Influence Measure based algorithm is presented. The method estimates DIM measure for each test sample and performs diabetic prediction using the value of DIMBaiju B. V etal.

3. ProposedAlgorithm

This paper proposes a new method for recognising diabetic retinopathy illnesses (such as micro-aneurysms, retinal channels, and exudates) in retinal fundus images. Figure 1 depicts a schematic of the stream outline of our proposed method for recognising diabetic retinopathy disease configuration. The proposed strategy's organised usage times are discussed in this section.

Fig. 1. Diabetic Retinopathy infected retina

3.1 Pre-processing

Pre-processing is a chief cycle in a huge segment of the picture getting ready thoughts. In this stage, pre-planning involves three stages: HSI change and DE noising. [14]This paper provided a brief overview of the research work on detecting the world's second most common disorder, diabetic retinopathy, in human eyes, which could be identified using novel pre-processing and segmentation techniques.

HSI change

Ophthalmologists often include retinal fundus photographs for public informative indexes, and these photographs will appear in RGB (Red, Green, and Blue) format. It's possible to convert this RGB setup to HSI. Figure 2 illustrates this. To be understood, HIS reform is based on a number of comparable and radical developments that are not completely modernised.

Fig.2. Pre-processed image

DE noising

By and large, DE noising is the route toward wiping out clatter from the high-level picture, DE noising is indispensable before the picture taking care of stage since all pictures taken from the informational index contain upheavals during picture getting, coding, transmission, and planning steps. To dispose of upheavals we need to use the Non-Linear wiener channel of the fourth solicitation fragmentary auxiliary with quadtree decay.

3.2 Image Segmentation

Image segmentation is the fundamental cycle for image examination. A large number of the current methods for image acknowledgment rely profoundly upon the consequence of division. Division separates an image into districts that comprise the image. The division of images in 2D has numerous valuable applications in the clinical area: assessment of volume and perception of objects of interest, discovery of irregularities (like tumors), tissue measurement and arrangement, are among the few trivial. The objective of segmentation is to change the depiction of a picture into something more critical and less complex to analyze. Picture Segmentation is generally used to discover things and cutoff points in pictures. To be more definite, Image Segmentation is the path toward selecting a name to each pixel in a picture so much that the pixels with a comparative name share certain visual characteristics. The result of division is a lot of comparative portions that on the whole make up the whole image. All pixels in a given area are comparative concerning some trademark or computational property, like tone, force or surface. Contiguous areas incredibly vary regarding similar qualities. Segmentation calculations depend on one of two fundamental properties of power esteems: brokenness and likeness. Irregularity is to parcel the image based on unexpected changes in power, like edges in an image. Closeness depends on parcelling the image into areas that are comparable as per some predefined rule. Histogram thresholding approach falls under this classification. The automated image processing procedure [6] is used for NVD detection that includes vessel segmentation. The graphical user interface[11] uses a button framework to assist users in segmenting blood vessels in retinopathy images. This makes it simple for a non-technical consumer to see the results .The Figure 3. shows the segementaion image.

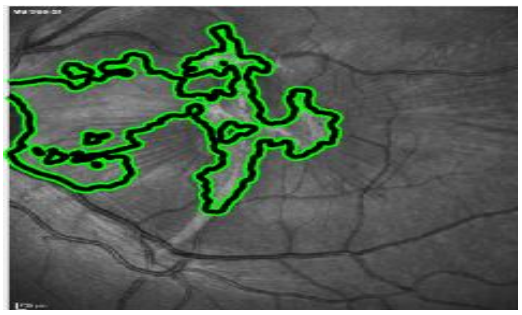

Fig.3. Segmentation image

Feature Extraction

Feature assumes a vital part nearby image preparing. Prior to getting highlights, different image pre-processing strategies like binarization, thresholding, normalization,masking approach and so forth are applied on the inspected image. From that point forward, feature

extraction methods are applied to get highlights that will be helpful in arranging and acknowledgment of images.

Binarization

Binarization approach relies upon the way that if the quantity of dark pixels in a computerized x-ray image is a lot more prominent than that of white pixels in a image so we reason that the x-ray report is ordinary eye image else it is unusual. Subsequently we began to include the dark pixels in a image for ordinary and strange images to get a normal that can be utilized later as an edge, if the quantity of the dark pixels of another image is more noteworthy that the edge which we have determined, at that point it demonstrates that the image is typical, something else, if the quantity of the dark pixels is more modest than the predetermined estimation of a threshold, it shows that the image is unusual.

Masking approach

Masking approach methodology relies upon the way that the majority are showed up as white associated zones inside ROI (eyes), as they increment the percent of malignancy presence increment. The presence of strong blue tone shows typical case while appearance of RGB masses demonstrates the presence of malignant growth; the TAR of this strategy is (89.7%) and FAR has (11.3%). On the off chance that we Combining Binarization and Masking together this will take a choice that whether the report is ordinary or unusual as per the referenced suppositions in the past two methodologies, we can say that the if the quantity of dark pixel is more prominent than the quantity of white pixel demonstrate that the report is typical in any case the report is strange.

3.3 Classification

SVM classifiers have shown stunning execution in an arrangement of model affirmation issues in which a high-dimensional component space is created from the data space..After that, the hyper planeis used to enhance the edge of parcel between classesthat is to be created. The centresmaintain vectors are those that are nearest to the chosen surface and directly influence its area. The ideal hyper plane is the one that limits the probability of request botch when the classes are non-distinct.The accuracy sensitivity and specificity of the output using SVM has high percentagewhich is mentioned in [8]. The RBF Kernel [13] is used to implement SVM. The SVM looks for an overall hyper plane to disengage all types of models in the planning set and prevent overfitting. In contrast to other AI procedures that rely on man-made intellectual prowess, SVM's miracle is favoured. The guided learning technique known as S is used to organise the data yield limits from a variety of named planning educational assortments.A hyper-straight segregating plane is used in Support Vector Machines to build the classifier. It's the perfect solution for problems that aren't easily isolated in the data space. The problem is solved by converting the main data space non-straightly into a high-dimensional component space, where an ideal secluding hyper plane is found. A maximal

edge classifier is a maximum edge classifier in terms of the rea. Due to their limited and limited responses across the entire range of real x-pivot, Radial Basis Function (RBF) is the most commonly used piece work for SVM. When compared to other bits, the RBF part had a high level of arrangement precision, as well as a low level of predisposition esteem and blunder rate. as the Figure 4 shows below.

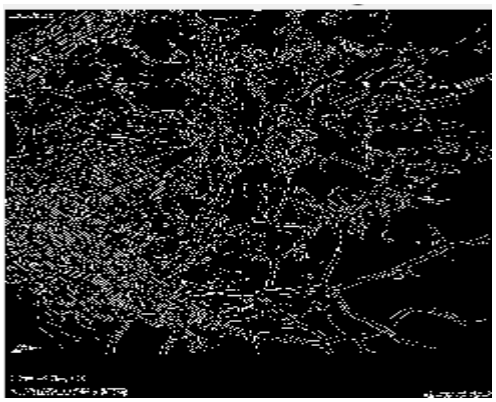

Fig.4. Classfication image

Pseudo code:

Data: Dataset with p* variables and binary outcome.

Output: Ranked list of variables according to their relevance.

Find the optimal values for the tuning parameters of the SVM model;

Train the SVM model;

```
p← p*;
while p≥ 2 do
SVMρ←SVM with the optimized tuning parameters for the p
variables and observations in Data;
ωρ←calculate weight vector of the SVMρ (ωρl.... ωρρ);
rank.criteria←(ω² ρl…….ω²ρρ);
min.rank.criteria ← variable with lowest value in rank.criteria
vector;
Remove min.rank criteria from Data;
RanK_ρ ← min.rank.criteria;
P←P-1;
end
RanK1←variable inData∉(RanK2,…..,RanK_ρ*);
return(RanK1... RanKρ*)
```

Radial Basis Function

In AI, the (Gaussian) extended reason work digit, or RBF portion, is a notable piece work used to help vector machine game plan. Figure 5 addresses a portrayal problem in which casting In a higher dimensional space, the RBF Network, which can be used to locate a fixed burden for a curve fitting problem, is more likely to be unique than in a low RBF Network. Heaps store special data in a higher-dimensional space, while special data is stored in a lower-dimensional space.Learning is indistinguishable from finding a surface in high-dimensional space that gives the best fit to planning data. When hidden layers are exposed to the covered space, they present a number of constraints that necessitate a confident purpose behind input plans. RBF refers to all thresholds.

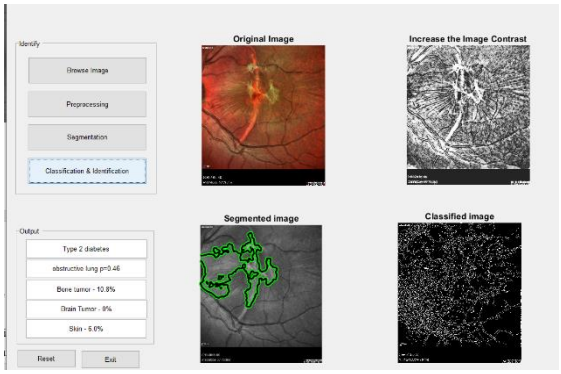

Fig.5. Output image

4.RESULT AND DISCUSSION

The E-OPHTHA dataset is a fundus image database designed specifically for diabetic retinopathy screening. Exudates and microaneurysms are two subsets of this public information base based on the sore sort.In this paper, We will use the exudates subset (E-OPHTHA EX), which is made up of 47 pathological images (Pathological EX) and 35 healthy images (Healthy EX). All of the retinal images were taken at the same field of view point of 400 and have different spatial goals: 13 images with 1440 960 pixels, 2 images with 1504 1000 pixels, 9 images with 2048 1360 pixels, and 23 images with the highest goal of 2544 1696 pixels.

The Training Accuracy metric measures the accuracy with which the preparation set was completed. This model achieves a Training Accuracy of 93.46 percent, implying that 22 out of 24 images were correctly classified, while two images were misclassified.The Validation Accuracy metric shows how precise the test set was. A Validation Accuracy of 100% is obtained from this model, implying that 6 out of 6 images were successfully orderedas shows in Figure 6 below.

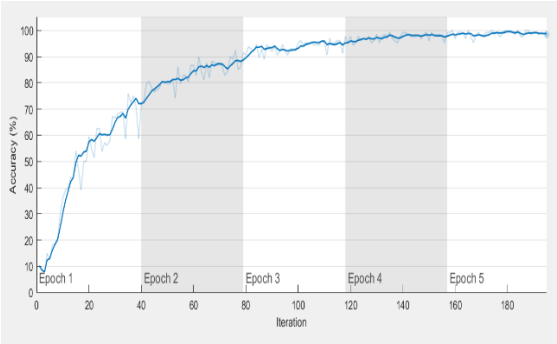

Fig.6. Prediction Accuracy

The Sensitivity or Recall is characterized as the extent of effectively distinguished positives. Subsequently, a Sensitivity of 98.2% has been accomplished from this model.

Precision is characterized as the proportion of accurately anticipated positive perceptions to all the anticipated positive perceptions. Subsequently, a Precision of 99% has been accomplished. F1-Score is characterized as the Harmonic Mean of Precision and Recall. From this model, F1-Score of 98.4% is accomplished.

This investigation hopes to propose a replacement appropriate and suitable picture getting ready systems to perceive retinal contamination like (i.e., diabetic retinopathy) images of the retinal fundus the show's estimations are evaluated in this section. to double-check the proposed procedure's presentation, a social affair of estimations appraisal and examination was performed. By and large, taking a gander at the presentation of various computations is a significant advance in numerous sorts of examination. Hence, we've assessed the proposed strategy by contrasting the got results and the cutting edge. the principal every now and again measurements are utilized like (i.e., affectability, explicitness, and precision). Execution measurements are perceived by the conditions:

Affectability = ((TP)/(TP + FN)) * 100%

Identity =((TN)/(TN + FP)) * 100%

Precision = ((TP) + (TN/FN)) * 100%

Where TP might be a True positive pixel, TN might be many True negative pixels, FN might be various False negative pixels, and FP might be various False positive pixels as shows in Figure 7 below.

Fig.7. Performance metrics

CONCLUSION

This paper proposed a Deep Learning way to deal with Diabetic Retinopathy through Deep Neural Network and planning a commonplace DNN Architecture using SVM. At last, an entire 100 % validation accuracy is gotten which is, by the most awesome aspect our insight has been the most noteworthy ever numeric precision came to by any Automated Diabetic Retinopathy Detection Model. The exploration done in this paper is planned to assist diabetic patients with staying careful about their ailment.It is obvious that the proposed system outperforms other well-known methodologies, and the split image obtained using the proposed approach is strikingly similar to that obtained using other well-known methodologies (affectability of about 98.2 percent). With PC-assisted assurance, the segmented vessel ID can be used in a clinical setting.At any rate, this work is used to identify the vein in diabetic retinopathy patients in the early stages. It's worth noting that the proposed method would not be able to replace specialists or ophthalmologists. The findings show that the system can assist ophthalmologists in detecting diabetes retinopathy in its early stages.

REFERENCES

[1]. Sharad Kumar Yadav, Shailesh Kumar, Basant Kumar, Rajiv Gupta.ComparativeAnalysis of Fundus Image Enhancement in Detection of Diabetic Retinopathy. 2015.

[2]. JyotiDnyaneshwarLabhade, L. K. Chouthmol, SurajDeshmukh. Diabetic Retinopathy Detection Using Soft Computing Techniques. 2015.

[3]. Wei Zhou, Chengdong Wu, Dali Chen, Zhenzhu Wang, Yugen Yi, Wenyou Du. A NovelApproach for Red Lesions Detection Using Superpixel Multi-Feature Classification inColor Fundus Images. 2017.

[4]. Ravitej Singh Rekhi, AshishIssac, Malay Kishore Dutta Carlos M. Travieso. Automatedclassification of exudates from digital fundus images. 2017.

[5]. Baiju, B. V. and Aravindhar, D. J.Disease Influence Measure Based Diabetic Predictionwith Medical Data Set Using Data Mining.2019; pp. 1-6.

[6]. Shuang Yu, Di Xiao and YogesanKanagasingam. Machine Learning Based AutomaticNeovascularization Detection on Optic Disc Region. 2017.

[7]. Enrique V. Carrera, Andr´esGonz´alez, Ricardo Carrera. Automated detection of diabetic retinopathy using SVM. 2017.

[8]. Harini R, Sheela N. Feature Extraction and Classification of Retinal Images forAutomated Detection of Diabetic Retinopathy. 2016.

[9]. Md. Jahiruzzaman, A. B. M. AowladHossain. Detection and Classification of DiabeticRetinopathy Using K- Means Clustering and Fuzzy Logic. 2015.

[10]. Amol Prataprao Bhatkar, Dr. G.U.Kharat. Detection of Diabetic Retinopathy in RetinalImages using MLP classifier. 2015.

[11]. DeepashreeDevaraj, Dr. Prasanna Kumar. Blood Vessels Segmentation with GUI inDigital Fundus Images for Automated detection of Diabetic Retinopathy.2015.

[12]. Akshatha Rao M., Rekha Bhandarkar, T. C. Manjunath. Automated Detection ofDiabeticRetinopathy through Image Feature Extraction. 2016

[13]. Muhammad Nadeem Ashraf a, ZulfiqarHabiba, Muhammad Hussainb. Texture Feature Analysis of Digital Fundus Images for Early Detection of Diabetic Retinopathy. 2016.

[14]. Yogesh Kumaran, Chandrashekar M. Patil. A Brief Review of the Detection of Diabetic Retinopathy in Human Eyes Using Pre-Processing & Segmentation Techniques2018.

[15]. S. S. Rahim, V. Palade, J. Shuttleworth, and C. Jayne. Automatic screening andclassification of diabetic retinopathy and maculopathy using fuzzy image processing2019.

[16]. Gino Sophia, Ceronmani Sharmila. Computer vision algorithms for dominant contactlens feature extraction using fuzzy-logic-based classifications. Soft Computing; March2020; Vol. No:24. Issue No:18. ISSN:1432-7643.pp. 14235-14249.

[17]. Gino Sophia, Ceronmani Sharmila. Recognition, Classification for Normal, Contact and Cosmetic Iris Images using Deep Learning", International Journal of Engineering and Advanced Technology. September 2019; Vol. No:8. Issue No:3. ISSN :2277-3878. pp. 4334-4340.

[18]. NagarjunaValeti, CeronmaniSharmila.V. Optimizing cloud health Care DataTransmissions using Fog. Journal ofPhysics. 2019; Vol. No. 1228, 1-9.

[19]. S.G.Gino Sophia, V.Ceronmani Sharmila. Zadeh max–min composition fuzzy rulefordominated pixel values in irislocalization. Soft Computing, SpringerJournal; November2018; Vol No:23. Issue No:6,ISSN:1432-7643, 1873-1889.

[20]. M. Suresh Anand, A.Kumaresan, R.Shubathra ,M.Ragavi, R.Bhagya Lakshmi Priya.Sugar Level Detection using Thermal Image of the Palm.International Journal ofEngineering and Advanced Technology. 2019; Vol No:9. Issue No:1. pp. 3695-3697.

[21]. Baiju, B. V. and Aravindhar, D. J.Multi attribute relational cluster modeling forbiomedical diabetic data with optimized influence measure based disease prediction.2019;pp.136-148.

Design of Intelligent Insect Monitoring System Using Deep Learning Techniques

V.Ceronmani Sharmila[1], Neeraj Chauhan[2], Rajdeep Kumar[3], Suraj Kumar Barwal[4]
{csharmila@hindustanuniv.ac.in[1] , neerajchauhan098009@gmail.com[2], rajdeepkumar1109199 9@gmail.com[3], barnwalsk14@gmail.com[4]}

[1-4]Hindustan Institute of Technology and Science, No.1, Rajiv Gandhi Salai, OMR, Chennai-603103

Abstract. The agriculture field is growing up its potential to better the demand of food and delivers healthy and nutritious foodstuff. This project presents an insect or pest detection and classification for the plant using machine learning. It's a challenging part for the farmers to the crops which are acquiring defective and the degree or grade of excellence is also getting reduced day by day due to various pest or insect attacks. Earlier insect identification has been a big issue due to not well-skilled taxonomists to name the insects based on surface structure construction features accurately. Here, the proposed system will be a research tool for the study of early insects on the plants and leaves which will classify it using CNN and K-Means Clustering algorithm in machine learning. The detection analysis of insects was executed with shorter computational point in time for wang dataset using insect image Median Filter. The final classification results of accuracy were utilized to identify the pest and insects in the earliest period and increased the period to grow the harvest fertility and crop degree of excellence in the field of agriculture.

Keywords: Insect or pest classification algorithm, Insect or pest detection algorithm, Machine Learning, CNN algorithm, K-Means Clustering algorithm.

1 Introduction

Agriculture plays a vital role in everybody's life, as it is measured as the foundation of any country's economically system and come up with the growth of economically system development and determines the living criterion. The field of agriculture and processing food manufacture is a major sector between any countries. Growth of expanding is an important character for the sell abroad of good quality food production and agriculture. In progressing countries, the growth of economic earnings mainly depends on market demands and export supply chain earnings.

Insect attack is one of the biggest issues in the agriculture field part that degrades the quality of crops. Pest, Germ, Insect and weeds created a heavy damage to the harvest and result has reduces the degree of excellence for the last part of products. It requires high care for the pest and insect attack on crops which make effects in the field of growth crops. The pest and insect is the main cause behind the crop quality downfall and reduces crop productivity. Therefore, the monitoring of crops and evaluating the loss from insects is essential for ensuring quality of crops and making safety in the area of agriculture [1]. The computer perception of the machine is used in monitoring of soil and crops, plant leaf disease detection, fruit scaling, pest and insect acknowledgment and detection. Nowadays, many

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improvement are processed in the agriculture field, to distribute and determine the pests in stored grains using machine learning. Various different learning features methods are developed for spontaneous classification of area harvest insects [2].The main reason for studying to distribute and determine the pest and insects in rice, wheat and tea etc. in various plants applying machine learning techniques for insect and pest identification algorithms in the initial period of growth of crops. The classification of insects on a survey using image based insect recognition. The shape extraction features are used for insect and pest classification by using CNN models [3]. The insect and pest detection algorithm is very easy and useful in running point in time for detection of insects and pests in the area of agriculture. Image processing technique applies to segments for the foreground structure of insects and positioning of insects in the image using edge detection with a bounding box [4].

2Related Works

The model is classification and detection of insects. Thenmozhi, et al. [5] designed a model as insect identification and detection in area harvest applying latest machine learning methodology. In this paper, we present the detection algorithm that consist of different dataset for insects such as Wang, Xie, Deng and IP102 for forefront extraction and outline identification to detect using highly complex background. The experiments have occurred for classification of 9 and 24 insect data of wang and xie dataset using structured characteristic using machine learning methodology such as KNN, SVM, ANN, NB and CNN model. The output of the CNN model proves that having greatest classification perfection is 91.5% and 90% for 9 and 24 data category of distinct insects or pest from different Wang and Xie dataset. The methods used for extracting the image as input insect dataset which will go under image pre-processing by applying filters with image augmentation technique for extracting the structured features of insects.

Chengjun et al. [6] designed a model for automatic identification of pests. In this paper, the classification methods perform on hand designed specifications such as HOG and SIFT in this work which gives the appearance of pest class in different poses. In this method, we are using unsupervised features learning methodology for unlabelled images for large amounts of image which transform the features of image obtained by low level features by alignment pooling (sparse coding). The experimental analysis on 40 insect species in the crop area that classify with multi-level learning specification which performs on the pest detection technique using the highest development methods in classification model. The representation of an image with multi-level learning specification consists of the feature encoding step which works with multi-level sampling step through unsupervised dictionary step.

Madhuri Devi et al. [7] designed a paper to Crop Insect Detection and Identification by K-Means. In this paper, the project scope is to classification and detection of the crop pest by providing the species type of pest and decreasing the use of fertilizer in the agriculture field. The images can be uploaded by farmer/user which is processed for extraction of image features. Colour images are based on image segmentation technique using the model as per Lab color space which will provide the k-means and EM clustering in fig 1. The region which is affected in the percentage form depends on various factors such as mean, entropy, RMS, energy, etc. are parameters which go under classification of the pest using the performance of multi SVM.

Yong He et al [8] created an application in insect administration: an actual time method for identification of insects. Here, we approach a method to determine the pest based upon machine learning, which increases the mean average precision (map) and output will be enhanced by 9.7% with the compare of original model. It is a mobile application platform to get benefits for every farmer in the program, which helps to degrade the pest in real time which suggests agriculture for pest controlling in the plants. The application platform has increased his environmental adjustability, reaction speed and contrast by accuracy with earlier works and benefit of lower budget and easy functioning which effectively improves the agriculture production efficiency. We generally focus on three major architectures sectors for detection of objects: R-FCN, Faster R-CNN, and SSD and use a method to avoid overfitting as dropout.

Hari Shankar et al [9] develop an App for detecting the insect, herbs and disease identification using open computer perception, which gives much attention to continuous agriculture which is an essential area for monitoring the crops growth for the most nutritious way of growth. We are proposing a system which will be easy to handle the various multiple tasks at a cheap cost. We utilizes a technology in deep learning and ANN algorithm for UAV that helps a region to specify which are impacted with chemicals in that proper field, with complete structure price effectiveness. Using a central operating system to visualise agriculture using OpenCV, and easiest user interface for observing purposes.

In [10], the author proposed this method, where he has used some kind of trapping method using sticky materials. Pest will be attracted towards these traps with the help of some smelly material. Here insects get glued, this is an exhausting way to reduce pests, this method is not applicable on those pests which cannot fly, or those insects which are at initial level. Among many techniques to detect pests or insects, the author chooses clustering. Clustering works by basically breaking the image on the basis of multiple factors, like area, height, entropy, colours, geometries, distances etc. In this proposed method for detecting the objects from an image, authors have transformed an RGB image to another colour space. Subsequently, applying K-Mean Clustering which will identify different objects/factors. This technique was made to detect the affected areas/parts in the human body even from different diseases.

3 Proposed System

In the previous work, many machine learning methodologies has been utilised for pest classification and detection such as Artificial Neural Network (ANN), Naïve Bayes (NB), k-nearest neighbors, Support vector machines (SVM) and convolutional neural network (CNN) model. The highest classification accuracy of 90% was achieved for Wang dataset using the CNN model [5]. Here, we have introduced two different classification algorithms random forest (RF) and logistic regression (LR) for comparing and analysing the best accuracy result. This study puts a step ahead of a far-reaching model that would expedite the detection and classification of the insect/pests by using CNN [11] and K-mean clustering methods. In this research paper, the image has been segmented from insect dataset by using updated K-Mean clustering segmentation technique and CNN algorithm which will identify and label the pests or any other object from the image. The feature extraction will be done using GLCM and classified using CNN to classify pests [12]. Using the multi-class insect/pest identification

using CNN architecture, High accuracy achieved which can be useful for identifying pests / insects in the agriculture field.

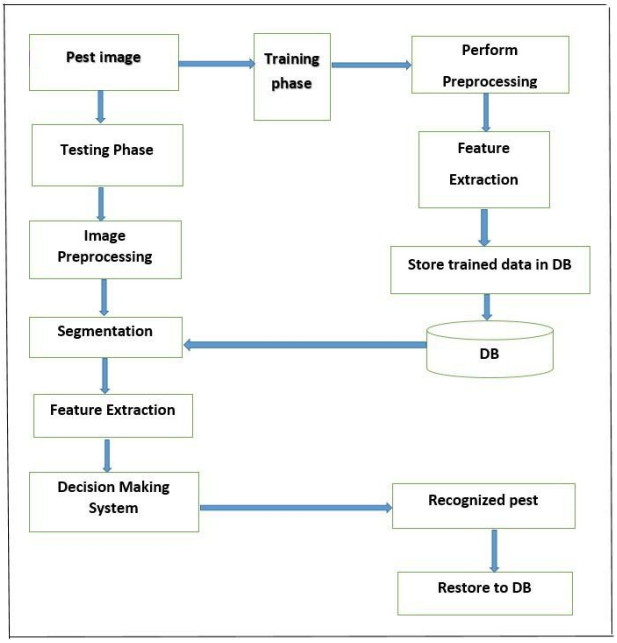

Fig.1. Functional Architecture

4 Methodology

4.1 Dataset

A. Wang Dataset

The insect and pest dataset repository consists of 9 classes and 282 total no of records of insect images attributes, but all the experiments refer to use a subset 2 or 3 attributes. The computational time for insect detection is less than (<5) five min [5].

The list of 9 classes that are significant for the experiment-

i) Locusta migratoria
ii) Parasa lepida
iii) Gypsy moth larva
iv) Empoasca flavescens
v) Spodoptera exigua
vi) Chrysochus chinensis
vii) Laspeyresia pomonella larva
viii) Atractomorpha sinensis
ix) Laspeyresia pomonella

4.2 Image Pre-Processing

Image pre-processing performs major tasks such as resized image, adding noise, filtering, HSV, Grey image, Binary image, complement image, edge detection segmentation, dilated image.

4.3 Shape Feature Extraction

In image processing, the feature extraction begins with a preliminary position of calculated values and construct into another values (features) considered to be communicative and non-significant, facilitating the consequent studying and normalization steps, and in few instance dominating to enhanced human interpretations [13]. Feature extraction is connected to proportional decrease.

4.4 Insect Classification

The pests are categorized within different classes applying the seven machine learning methods such as ANN, RANDOM FOREST , SVM, KNN, , LOGISTIC REGRESSION, NB and CNN classifier which are defined as follows[14].

1. ANN classifier -An easy neural network has an input, unseen, and output layer with linkage. At first, randomly weights are allocated. The last linkage weights were determined, and the activation rate of the output layer was measured. A feed-forward multi-layer artificial neural network is sketched to accordingly detect and divide mature-stage whiteflies and thrips in greenhouses [15]. The ability of the system of pest recognition system was developed by applying an ANN model to identify beet foreclosures (Spodoptera exigua) of different species of family in the fields.

2. SVM classifier –It is a supervised machine learning algorithm. Here, the measurement space build on the different types of characteristics that we are having. The values item is plotted as a point in a k -dimensional space, where we have 'k' attributes with the data of a specific coordinate, presenting the greater point. Pest classification is done by recognizing the hyper-plane, which separates the orbits into excellently. SVM [16] was applied completely to reduce the intersection error rate completely for the identification of mosquito and fruit flies [17].

3. KNN classifier –It is an idle learning algorithm that doesn't implement other specification. Here, weight is credited to the contribution of neighbors, like that adjacent neighbors always provide extra to the average than neighbors. In transforming identification difficulty with great amplitude and less samples, the KNN algorithm obtains an enhanced detection class for butterfly species [18].

4. Naive Bayes –It is formed on the probability of the Bayes theorem and take it an independence between every prophets. This classifier only observe the appropriation that the insect for a specific characteristics is not connected to the existence of over another attributes in the category. The Naive Bayesian classification was used to conclude a pests category probabilities that a given pair from a grain harvest pests dataset is a specific insect or pest category [19].

5. Random forest classifier-It is a classification algorithm that consists of multiple decision trees. It utilizes to captures and randomness of features when constructing every particular tree, trying to generate an unrelated forest area of trees whose prediction by the committee is increased accurate than that of particular specific tree. Random forest [20] constructs several decision trees and combines them all together to obtain a high accurate and secure prediction. Random forests have almost the similar hyper parameters as the decision tree or bagging classifier. Growing trees, random forest sum up additional unexpected to the system.

6. Logistic Regression-Logistic regression is firstly a supervised classification algorithm. In a classification complication, the goal variable (or yield), y, can take only distinct data for a prescribed feature (or input), x. Contrary to famous faith, logistic regression is a regression model. Regression is a classification algorithm used for observing discrete sets of category. Logistic regression converts its output applying the logistic sigmoid function to give back probability values.

7. CNN classifier-The term "conventional neural network" suggests that the network employs a mathematical operation called convolution. Sensory networks are a special class of neural networks used for the characterization of at least one of their layers in place of normal matrix multiplication [21].

The CNN layer is divided into further types of layers are mentioned as–

1. Input Layer: Input of an image with height, width and depth.
2. Convolution Layer: The output is produced using dot product between image patch and all filters.
3. Activation Function Layer: Convection layer containing the elevated activation function of the output. Ex- RELU
4. Pool Layer: Two types of Common pooling layers are average pooling and maximum pooling.
5. Fully Connected Layer: This step takes input from the earlier steps and generates a class score and output.

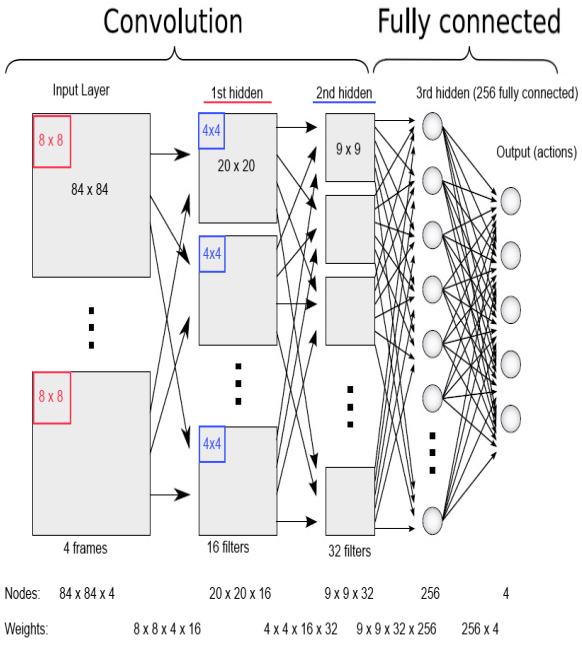

Fig.2. CNN Layered Architecture

4.5 Pest Classification Results

The classifier performance applying shape characteristics derived from image processing techniques with machine learning techniques which includes SVM, KNN, Nave Base, ANN, and CNN [22], for comparing the classification accuracy with every methodology of model in insect classification. Are also used. A nine folder cross checking was used to the Wang dataset

for 1359 insect and pest images. Comparing of the various methodology was performed just after the solution were composed in fig. 3 shows the results were achieved for insect and pest classification for Wang applying different machine learning algorithms techniques.

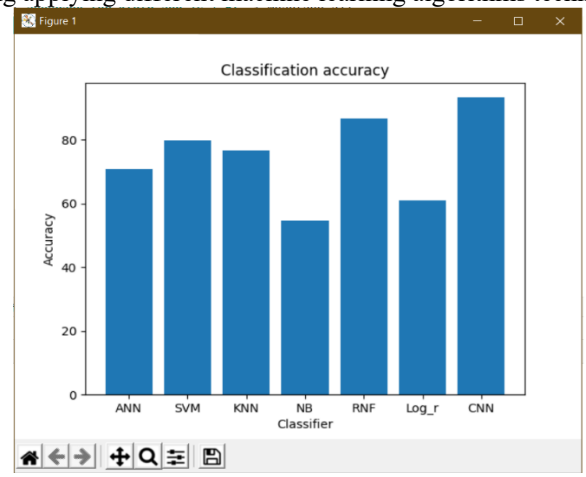

Fig.3. Accuracy Graph of different Classifiers

Different classifiers in size extracted from 9 insect classes of the WAND dataset have been applied. The classification accuracy is 86.9% and 70.8% for the 9 classes of pests obtained with nine size characteristics is predicted by Random Forest and ANN, respectively. The Gaussian naive Bayes classifier and logistic regression results resulted in lower accuracy of 54.54% and 60.92% due to the feature's dependence, and it weighs all features equally. As the writer applied moment-invariant characteristics with SVM classifiers and achieved an accuracy of 79.95% for 9 insect and pest classes. In KNN, 10 and the number of neighbors chosen as the Euclidean distance metric are used so it can give an accuracy of 76.43%. The CNN model has yielded 93.9% accuracy for 9 insect and pest classes as it relates to high discriminating characteristics in insect or pest images.

Time to process 9 class of insect datasets in different classifier system. The calculation time for different algorithm are ANN, SVM, KNN, Naive Bayes, Random Forest and logistic regression was shorter than the proposed CNN.

The order of time consumption is NB <KNN <SVM <RNF <LG <ANN <CNN.

5 Insect Pest Identification

5.1 Image Pre-Processing

Image pre-processing performs major tasks Such as resized image, adding noise, filtering, HSV, Grey image, Binary image, complement image, edge detection segmentation, dilated image [23].

The matlab is a software which recognises the original image of an insect and performs the various operations for pre-processing of an image. During pre-processing of an image it undergoes image resizing which resizes the original image with less resolution [24]. When the image is resized then noise is added to filter the image with high accuracy. After filtering it, HSV is applied and simultaneously converted into Gray image.

We applied binary conversion to convert the image into black and white and similarly we applied complement image to do vice versa of black and white image. Finally, the image undergoes an edge detection segmentation process for detecting the edge of the image of the insect.

In this methodology, we applied median filter to find the mse and psnr using noise added image [25].

Mean Square Error -

```
[row, col] = size(I);
mse = sum(sum((I(1,1) - K(1,1)).^2)) / (row * col);
```

Peak Signal to Noise Ratio –

```
psnr = 10 * log10(255 * 255 / mse);
```

Fig.4. Original Image

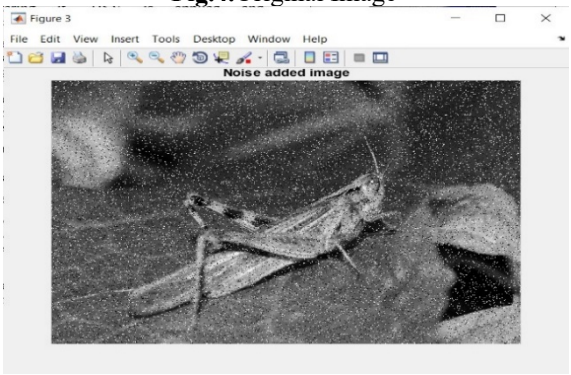

Fig.5. Noise Added Image

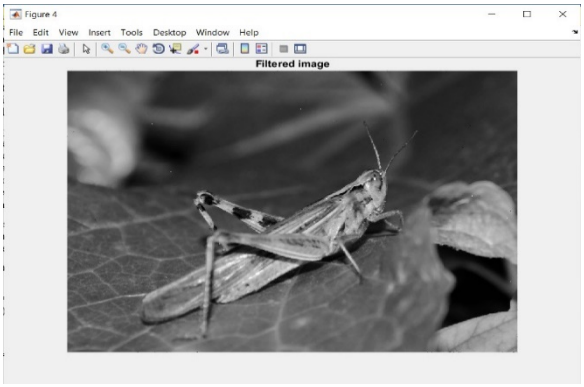

Fig.6. Filtered Image

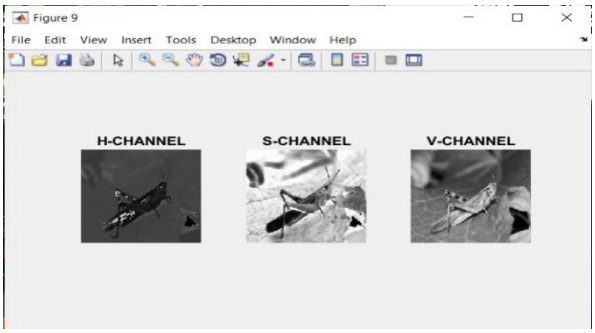

Fig.7. HSV Image

Fig.8. Adjusted Gray Image

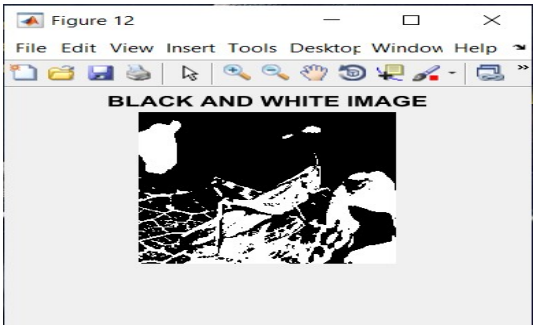

Fig.9. Binary Image

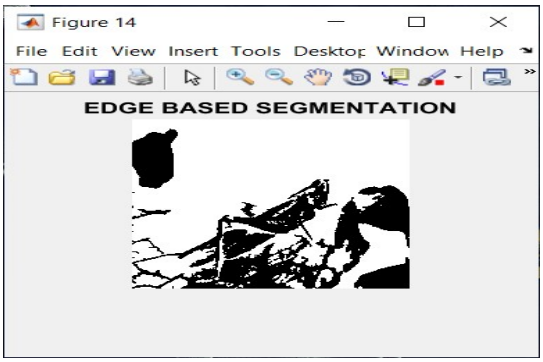

Fig.10. Edge Based Image

From this, we can pre-process the image using various operations on it for performing different tasks in the image. Hence we can find the mse and psnr from the above.

5.2 Segmentation

In computer perception, image segmentation is the procedure for splitting an image into multiple segments. The aim for segmenting an image is to replace the description of an image into different which is higher significant and simple to inspect. It is usually applied for identifying objects and generating boundaries.

In this the input image is segmented based on the color bands of the lab a*b*. The segmentation will be achieved by using the k-means clustering at t multiple level. The cluster is nothing but the group of the pixel belonging to the same color bands.

5.2.1 Clustering methods

The K-means algorithm is an iterative method that is applied for splitting an image into K clusters [26]. The basic algorithm is

- Select K cluster center, either randomly or based upon some heuristic technique, for example K-means++
- Provide every pixel in the image to the cluster that decreases the distance among the pixel and the cluster center.
- Compute the cluster centers by making average of the every pixels in the cluster.
- Repeat steps 2 and 3 until convergence is acquired (i.e. no pixels change clusters)

Enhanced Images are classified into three different phenomena to detect the best enhanced images from them to detect the best one from them.

Here, we made the enhanced images as enhanced1, enhanced2, enhanced3 which undergoes detection of images in segmentation process method [27].

Segmentation images first show the segmentation of the image from the enhanced image which turns into a completely segmented image which is the next peak level of segmentation.

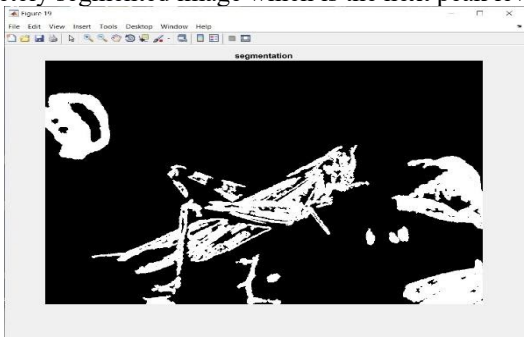

Fig.11. Pre Segmented Image

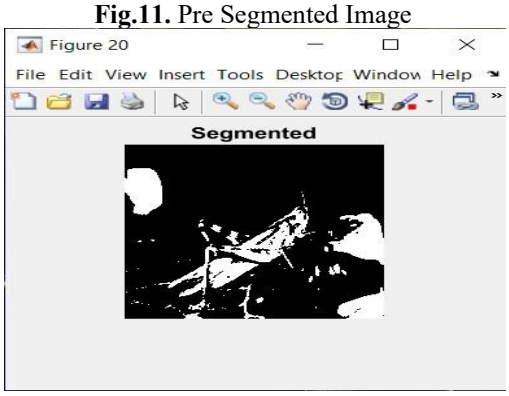

Fig.12. Segmented Image

5.3 Shape Feature Extraction

In image processing, feature extraction begins with a starting position of calculated values and construct into inherit values considered to be communicative and non-significant, facilitating the subsequent studying and normalization steps, and in few instance dominating for enhanced human clarification. Feature extraction is connected to proportional for decrease.

When the input of the values to an algorithm is too big to be procedure and it is doubtful to be extreme, then it can be transformed into a limited range of characteristics.

The picked characteristics are supposed to hold the particular information from the input values, so that the expected work can be transformed by applying this decrease presentation in place of the complete initial values [29].

Features are extracted using GLCM matrix such as:-

correlation, contrast, energy, entropy, inverse different moment, homogeneity, smoothness, mean, standard deviation, variance, skewness, RMS.

5.4 Classification and Labelling

CNN is a kind of deep, feed-forward artificial neural networks (where relations among nodes do not form a cycle) & utilize a difference of multilayer perceptron measured to require minimum pre-processing. These are motivated by animal visual cortex.

Training is determined using a "labelled" dataset of inputs in a wide group of representative input patterns that are attached with output response. Training uses general-purpose methodology to recursively determine the weights for middle and final feature neurons.

Again applying the standard neural network which would be equal to a CNN, because the unit of factors will be seriously greater, the training period will also be increment simultaneously. In a CNN, since the unit of factors is extremely decreasing, training period is simultaneously reducing [30]. Also, supposing excellent training, we can make a standard neural network whose characteristics will be similar to a CNN. But in experimental training, a standard neural network equally to CNN will have the higher characteristic, which would be conduct to noise addition during the training procedure. Hence, characteristics of a standard neural network equally to a CNN will all the time be lower [31].

Pseudo Code of the algorithm

- Precondition: train, validate_dir = train/validate('filepath', parameters)
- Define input shape, no.of classes & conv_size
- model = sequential model
- model.add(Conv2d(attributes…..) x 3)
- model.add(max pooling layer(attributes…...) x 3)
- model.add (flatten())
- model.add(dense(512 neurons with relu activation))
- add another dense layer but with softmax activation
- perform model.compile(loss, metrics and optimizer attributes)
- model.fit(specify train dataset, no.of epochs, steps per epoch, specify validation dataset).
- visualize accuracy and performance metrics as done previously

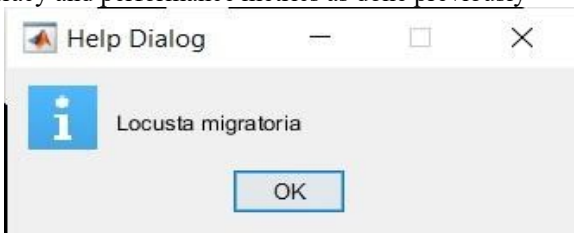

Fig.13. Labelled Image

6 Conclusion

In this research paper, we have compared the classification accuracy of CNN, ANN, SVM, KNN, Naïve Bayes, Random Forest and Logistic regression. In the proposed system, we proposed a pest detection by using a feature set which is executed on the dataset as a training, in which the characteristic values are generated and stored in the system database. User's input selected image is proceed to the system to extract input pest image characteristics. The image is then processed in multiple steps by using region-based segmentation of the images by applying the K-means clustering to generate the features of the dataset to give the final result by using the help of CNN to classify the pest and insect.

References

[1] Al-Hiary, H., S. Bani-Ahmad, M. Reyalat, M. Braik, and Z. AlRahamneh. (2011). “Fast and accurate detection and classification of plant diseases”. International Journal of Computer Applications, 17(1): 31-38. Doi:10.5120/2183-2754

[2] C. Xie, R. Wang, J. Zhang, P. Chen, W. Dong, R. Li, T. Chen, H. Chen (2018) “Multi-level learning features for automatic classification of field crop pests”, Computer Electron Agriculture, 152, pp. 233-241. Doi: 10.1016/j.compag.2018.07.014

[3] M. Martineau, D. Conte, R. Raveaux, I. Arnault, D. Munier, G. Venturini (2017). “A survey on image-based insect classification Pattern Recognition”, 65 pp. 273-284. Doi:/10.3390/insects11080458

[4] S.G.Gino Sophia, V. Ceronmani Sharmila, "Zadeh max–min composition fuzzy rule for dominated pixel values in iris localization", Soft Computing, Springer Journal, November 2018, Vol. 23, Issue-6, ISSN: 1432-7643, 1873-1889.

[5] K. Thenmohiz, U. Srinivasulu Reddy. (2017)” Image processing techniques for insect shape detection in field crops,” IEEE pp. 978-1-5386-4031-9. Doi: 10.1109/ICICI.2017.8365226

[6] Chengjun Xie, Rujing Wang, Jie Zhang, Peng Chen, Wei Dong, Rui Li, Tianjiao Chen, Hongbo Chen. (2018). “Multi-level learning features for automatic classification of field crop pests”, ScienceDirect, 152 pp.233-241. Doi: 10.1016/j.compag.2018.07.014

[7] Madhuri Devi Chobey, Humera Tamkeen (2019)."Crop Pest Detection and Classification by K-Means and EM Clustering”. International Research Journal of Engineering and Technology (IRJET) Volume: 06.

[8] Yong He, Hong Zeng, Yangyang Fan, Shuai Zheng Ji, Jianjian Wu. (2019). “Application of Deep Learning in Integrated Pest Management: A Real-Time System for Detection and Diagnosis of Oilseed Rape Pests”, Mobile Information Systems. Doi:10.1155/2019/4570808

[9] Hari Shankar RL, A. K. Veeraraghavan, Uvais, K. Sivaraman, S. Shreyas Ramachandran. (2018)."Application of UAV for pest, weeds and disease detection using open computer vision”, IEEE Xplore Part Number: CFP18P17-ART; Doi: 10.1109/ICSSIT.2018.8748404

[10] Sushma R Huddar, Swarna Gauri, (2018). “Novel algorithm for segmentation and automatic identification of pests on plants using image processing,” IEEE 2018.

[11] L.Q. Zhu, M.Y. Ma, Z. Zhang, P.Y. Zhang, W. Wu, D.D. Wang, et al. (2017). “Hybrid deep learning for automated lepidopteran insect image classification” Orient Insects, 51, pp. 79-91. Doi:10.1080/00305316.2016.1252805

[12] Argenti, F., L. Alparone, and G. Benelli. 1990. “Fast algorithms for texture analysis using co-occurrence matrices.” IEEE proceedings, 137, (6): 443-448 Doi: 10.1049/ip-f-2.1990.0064

[13] S.N. Yaakob, L. Jain, (2012). "An insect classification analysis based on shape features using quality threshold ARTMAP and moment invariant" Appl Intell, 37 (1) pp. 12-30. Doi:10.1007/s10489-011-0310-3

[14] Preetha Rajan, Radhakrishnan. B. (2016).” Detection and Classification of Pests from Crop Images Using Support Vector Machine”. ICETT, IEEE. Doi: 10.1109/ICETT.2016.7873750

[15] J. Wang, C. Lin, L. Ji, A. Liang “A new automatic identification system of insect images at the order level” (2012). Knowl-Based Syst, 33 (2012), pp. 102-110. Doi: 10.1016/j.knosys.2012.03.014

[16] Chih-Wei, H., and C. Lin. (2002).” A comparison of methods for multiclass support vector machines.” IEEE Transactions on Neural Networks, 13(2): 415-425. Doi: 10.1109/72.991427

[17] M. Fuchida, T. Pathmakumar, R.E. Mohan, N. Tan, A. Nakamura, (2017)"Vision-based perception and classification of mosquitoes using support vector machine" Appl Sci., 7 p. 51. Doi: 10.3390/app7010051

[18] Z. Iqbal et al.,” An automated detection and classification of citrus plant diseases using image processing techniques: A review,” (2018). Computers and Electronics in Agriculture 153 pp. 12–32. Doi: 10.1016/j.compag.2018.07.032.

[19] Sunil Joy Dommati, Ruchi Agrawal, Ram Mohana Reddy G, Sowmya Kamath S. (2012) "Bug Classification: Feature Extraction and Comparison of Event Model using Naive Bayes Approach." ICRTCIE (2012).

[20] Junfeng Gao, David Nuyttens, (2018) “Recognizing weeds in a maize crop using a randomforest machine-learning algorithm and near-infrared snapshot mosaic hyper spectral imagery,” IAgrE. Published by Elsevier Ltd.
[21] Gino Sophia, Ceronmani Sharmila, "Computer vision algorithms for dominant contact lens feature extraction using fuzzy-logic-based classifications", Soft Computing, Vol. No. 24, Issue No. 18, ISSN : 1432-7643, pp. 14235-14249, March 2020.
[22] Y. Shen, H. Zhou, J. Li, F. Jian, D.S. Jayas. (2018). “Detection of stored-grain insects using deep learning”, Computer Electron Agriculture, 145, pp. 319-325. doi:/10.1016/tii 2017.11.039
[23] C. Wen, D. Guyer ,(2012)."Image-based orchard insect automated identification and classification method" Comput Electron Agric, 89, pp. 110-115. Doi: 10.1016/j.compag.2012.08.008
[24] S. G. Gino Sophia, V. Ceronmani Sharmila. (2018) "Morphological-Based Localization of an Iris Image", Advances in Intelligent Systems and Computing, Springer,ISBN: 978-981-13-1579-4.
[25] A.M. Hambal, Z. Pei, F.L. Ishabailu (2017), "Image noise reduction and filtering techniques" Int J Sci Res, 6.pp. 2033-2038
[26] Yogesh Kumar, Ashwini Kumar Dubey, (2017)."Pest detection using adaptive thresholding,” IEEE. Doi: 10.1109/CCAA.2017.8229828
[27] M.C. Bakkay, S. Chambon, H.A. Rashwan, C. Lubat, S. Barsotti. (2017)."Automatic detection of individual and touching moths from trap images by combining contour-based and region-based segmentation". IET Comput Vis, 12, pp. 138-145. Doi: 10.3390/agriculture10050170
[28] Yu X, Zhuorui S, Seishi N. (2002). “Measuring geometrical features of insect specimens using image analysis.” In: Conference on Asian federation information in agriculture (AFITA).
[29] Nivetha. S, Ceronmani Sharmila. V. (2017). "Implementation of Connected Dominating Set in Social Networks using Mention Anomaly", Artificial Intelligence and Evolutionary Computations in Engineering Systems, Springer, pp. 777-790.
[30] Gino Sophia, Ceronmani Sharmila. (2020) "Water management using genetic algorithm-based machine learning", Soft Computing, Vol. No. 24, Issue No. 22, pp. 17153–17165.
[31] L. Deng, Z. Wang, C. Wang, Y. He, T. Huang, Y. Dong, et al. (2020), “Application of agricultural insect pest detection and control map based on image processing analysis” J Intell Fuzzy Syst, 38 pp. 379-389. Doi: 10.1016/j.inpa.2020.09.006

Early Strokes Detection of Patient and Health Monitoring System Based On Data Analytics Using K-Means Algorithm

Menaka. S[1], Bharathiraja. N[2], Badi Alekhya[3], Sasikumar. R[4]
{menakas311@gmail.com[1], rajamesoft@gmail.com[2], alekhyareddy1@gmail.com[3], rsn.cse@rmd.ac.in[4]}

[1]Assistant Professor, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Ramapuram Campus, Chennai, India., [2]Assistant Professor, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Ramapuram Campus, Chennai, India., [3]Research Scholar, Department of ICE, R.M.D Engineering College, Kavaraipettai, Chennai, India., [4]Professor, Department of Computer Science and Engineering, R.M.D Engineering College, Kavaraipettai, Chennai, India.

Abstract. The processing chain of scientific information in particular consists of information series, information storage, data sharing, and records evaluation. In the prevailing device, there is lots of improvisation wished for our health care device. The existing technique our affected person monitoring is a guide and time-consuming process. To conquer the task the proposed work proposed actual data series from sensors, IoT-primarily based totally sharing, and information analytics. This proposed device gives the gain for the respective medical doctor to display the affected person's health 24*7 regardless of geographical location. Example: The medical doctor can display the affected person's health even after the affected person receives discharged. This proposed work implies a health sensor named heartbeat sensor to display affected person fitness. The affected person information is monitoring through the sensorsand transmitted to the Arduino. The actual-time statistics from the COM port have acquired the usage of Net beans and stored in an SQL database. The actual-time information may be monitored with the aid of using each affected person and medical doctor. The real-time statistics are processed from Net beans as datasheet to R programming for statistical evaluation. For Clustering, we use the K-Means algorithm and for Classification, we use the Support Vector Machine. Also relying on the affected person's health situations emergency pills or injections are counseled routinely with the aid of using our device. Also, the affected person statistics have encrypted the usage of an ABE (Attribute-based Encryption) set of rules and saved in the public cloud particularly Dropbox. Thus invoking the statistics evaluation approach facilitates in identifying early stroke in the sufferers and offer medicinal diagnosis immediately.

Keywords: Heart-Beat Sensors, Attribute-Based, Encryption, K-Means, Support vector Machine.

1 Introduction

The creation of massive information in healthcare has paved the manner for brand spanking new possibilities in the remedy of sufferers, inclusive of precision medicine, drug development, and superior most cancers therapy. It additionally results in technological

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improvements throughout the quarter, inclusive of supplemented stronger health tracking, and the progressed renovation of electronic health records (EHRs). When imposing new analytical software programs and tools, workflow and standard-of-care also can be progressed. By contemplating workflow traits of the latest system as compared to the antique system, it permits facts to be collated to justify a return on investment. The analytical software program also can be used to reveal information and installation signals for different scientific processes inclusive of near radiation, the quantity of time affected person attending clinics, and additionally the procedural instances in labs. The world has visible a big inflow of robots and generation in the industry. However, they aren't taking on the healthcare quarter simply yet. Phrases inclusive of synthetic intelligence and gadget studying are starting to take maintain in the quarter, however, a human touch is nevertheless favored when it involves remedy. The emerging generation is converting the structure of healthcare support. But to make it useful human tracking is nevertheless a required factor, mainly concerning affected person interaction. When receiving a diagnosis, an affected person will, of course, locate it extra comforting to get hold of that facts from a human.. Technology is now making it easier for human beings to navigate existence and manipulate on their own. However, in healthcare, it is still in different from emotion, as one-to-one engagement is nevertheless the maximum green manner to treat sufferers.

The implementation of massive information increases the possibility for massive capacity advantages for healthcare. From use in normal obligations inclusive of information access to superior strategies like tracking sufferers, information is, in reality, shaping the manner of the way we stay and think. Big data has given health care a massive possibility to assess the excellent of remedy. By the use of best algorithms reviews may be created based on standards inclusive of health practitioner training, e-book history, modern institute, and affected person outcomes. It is likewise lifting the geographical barriers confronted via way of means of healthcare, permitting rural international locations to get hold of primary remedy and the get right of entry to a noticeably certified physician. However, ultimately, the goal is to offer the affected person's health information to make the most important choices concerning their remedy and care to make shipping loads extra efficient. Matching sufferers to the maximum experienced (and suitable) physicians for his or her unique wishes from the start.

2 Related Work

The current work focuses mostly on fine-grained privacy-preserving access and analysis of static medical text, which can hardly afford the rapid fluctuation of health conditions and analysis of medical images. No healthcare monitoring framework based on IOT was being introduced. Even with wearable devices, the patient is only able to access his health records. The current framework does not have a single architecture that gathers and analyses real-time patient health data using Big Data techniques. In the new method, only the patient will know after the stroke, i.e. only the patient will know that he/she is in the stroke by experiencing the outward symptoms. [3] Hybrid clustering technique is used in this existing work. Provide accurate results. Hybrid approach takes more execution time when compared to Remaining clustering techniques.[4] Google Trends, Data visualization, Correlation analysis, Dynamic regression approach. Forecasting patient volume of data in emergency. Need more man power

to maintain and privacy issues?[5] Integration tools and techniques. It provides different ideas to integrate data.

Especially, unstructured data by using big data tools and it needs experimental results to understand the effectiveness of Data integration tools.[6] The tool used in this paper helpful to classify ECG signals for early diagnosis Detection. ML-Libs and scale Language on Apache Spark. Limited to some classes of classification and datasets.[7] The technique used here explains multi class classification of heart beats from ECG signals.2D-Deep Convolution-al neural network, Short- Term Fourier Transform. The technique used single DB (MIT-BIH) not consider the experimental results of different DB's to compute Accuracy.[10] The techniques used here provide the signal quality importance in ECG signals under unsupervised diagnosis environments. Complete ensemble empirical mode decomposition (CEE MD) algorithm-peak Detection approach. It limits the experimental results to accept the noiseless signals and reject the noisy signals under unsupervised health monitoring. [11]It develops the precise learning algorithms that synthesize dynamic time deformation, C-means clump, and BP algorithmic program.

The 12-lead cardiogram (ECG) signals for cardiopathy identification were used for classification testing. The experimental results from 12-lead electrocardiogram signal across 10 forms of wellness classification verify the effectiveness of the model and therefore the projected algorithmic program. [12]Recently, good attention applications AR being fitted with wearable sensors, that AR principally accustomed monitor and strengthen the human action recognition (HAR) mistreatment supervised and unsupervised learning ways that fail to realize reduced computation time to on-nodule wearable sensors and through the process of knowledge within the network, it fails to cut back the reconstruction error rate with optimized accuracy throughout classification. [13] This instructed, associate degree innovative, unsupervised Deep learning motor-assisted reconstructed software engineer (UDR-RC) that optimize the info throughout pre-processing at on-nodule wearable sensors to induce reduced computation time.[14] Implementation of machine-learning-based patient processing is influenced by heterogeneous patient knowledge and inefficient in analysing feature-learning ways.[15]

This works transform such every which way ordered forward/backward firing sequence of transitions within the network into a set topological order of transition-firing in forward direction solely by exchange backward firing transitions into equivalent forward firing transitions. [16]Automatic detection and classification of noises will play an important role within the development of sturdy unattended graphical record (ECG) analysis systems. This paper proposes a unique unified framework for automatic detection, localization, and classification of single and combined electrocardiogram noises. ways .The projected framework consists of the changed ensemble empirical mode decomposition (CEEMD), the short-run temporal feature extraction, and also the decision-rule-based noise detection and classification.[17] Stroke was diagnosed by a specialist in a very hospital at or on top of the county level supported the self-reported history of stroke and so computed axial tomography or resonance imaging. Nonfatal cerebrovascular accident, cerebrovascular accident, and transient anaemia attack were all enclosed. The case history was outlined as a history of stroke in oldsters, grandparents, aunts or uncles, and 1st cousins. The smoking and uptake habits of those farmers are discovered.

3 Proposed Model for Patient and Health Monitoring System

In this proposed work, the proposed health sensor named heartbeat sensor to track the health of patients The real and complex patient data is transmitted to the system using the Ethernet cable, and the patient information is gathered on or after the sensors and transmitted to the Arduino. The real-time COM port statistics were acquired using the Arduino IDE and stored in the SQL database. Both the patient and the doctor will track the real-time data. This was achieved by exporting an excel file from the Arduino Software to the R programming studio for data analysis. We use the K-means algorithm for clustering and we use the Help Vector Machine algorithm for classification. Emergency medicines or injections are often proposed based on the patient's health conditions through our system automatically. The affected person, too, statistics have encrypted the usage of an Attribute-primarily based totally Encryption set of rules and saved in the public cloud namely Dropbox.

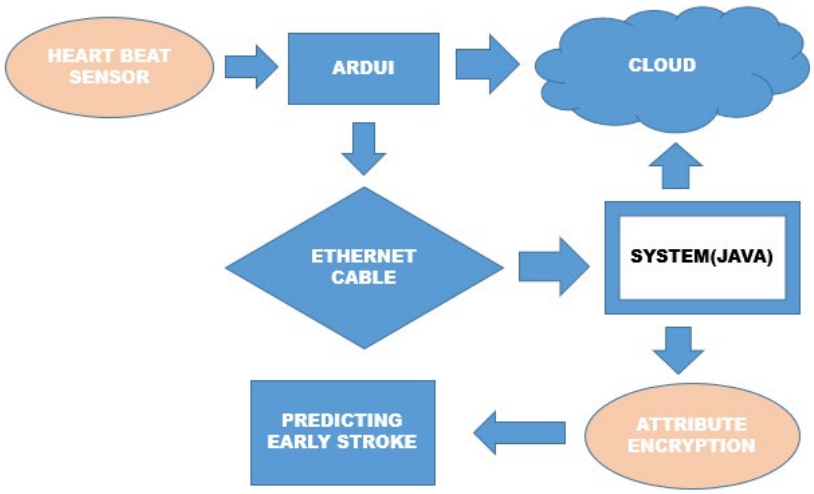

Fig 1: System Design for Patient and Health Monitoring System

3 Experimental Results

The Heart Rate sensor video display units the mild degree transmitted via the vascular tissue of the fingertip and the corresponding versions in mild. Intensities that arise as the blood extent extrudes in the tissue. The ease of use makes it feasible to degree everyone's coronary heart price, even in huge classes.

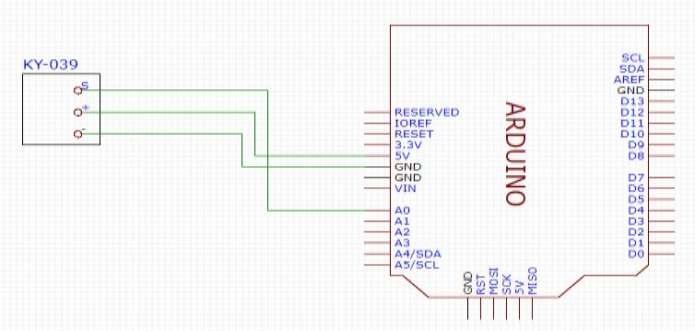

Fig.2 Arduino

Fig.3 ATmega328

The Heart Rate sensor measures a coronary heart rate between 0 and 200 bpm (beats per minute).The Arduino Uno is a microcontroller sensor module also on ATmega3288 (datasheet). It has 14 virtual I/O pins, including six PWM outputs, six analogue inputs, a 16 MHza USB connection, a power jack, a reset button, and an ICSP header. It must provide full assistance to the microcontroller. To get started, obviously attach to power with an AC-to-DC adapter or a computer with a USB cable. The FTDI USB-to-serial driving force chip is no longer used in the Uno, as it was in previous forums. Instead, the Atmega8U2 is set up to act as a USB-to-serial converter. The name "Uno" is a Italian word "uno," meanings "one." It is named after the upcoming Arduino 1.0.0 Version 1.0 of are the reference versions of Arduino that will be used in the future. The Uno is the most recent in a series of Arduino USB boards and the platform's reference model for a comparison of previous versions, see the Arduino board index.

API (Application Program Interface) by Java developers offers all functionality of serial communications. To render the API portable across platforms, it defines an abstract Serial Port class. This class is then converted into a child class's entity, which includes platform-specific functionality. This class then interacts with a Dynamic Connection Library (DCL) through the Java Native Interface (JNI). Once a Serial Port object has been developed, standard Input Stream and Output Stream objects perform communications through the physical port. Bytes, integers, and arrays of bytes are used to send and receive data in these streams.

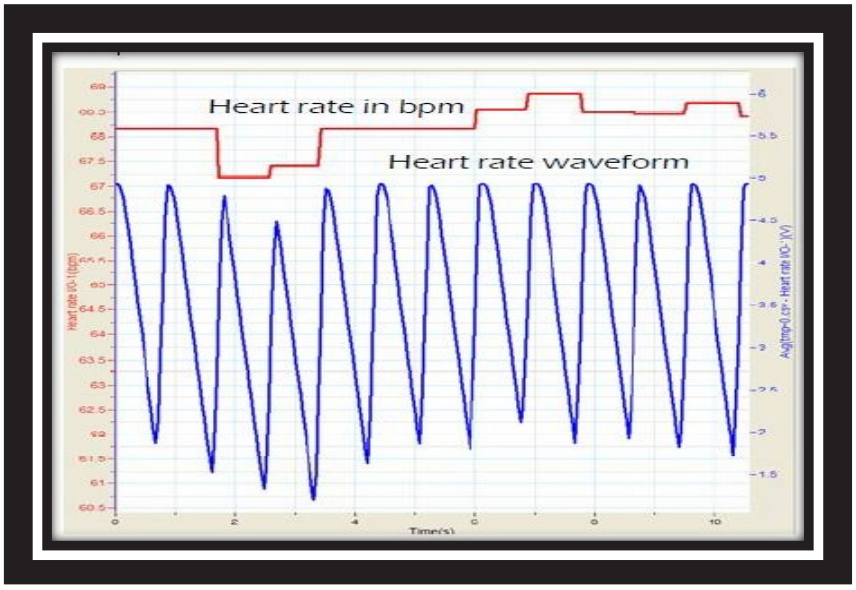

Fig 4: Monitoring both heart rate in bpm and waveform

ABE (attribute-based encryption) is a modern technique that rethinks the idea of public-key encryption. A message is encrypted using the receiver's public key for a specific receiver in traditional public key cryptography. Identity-based encryption and, particularly, identity-based encryption (IBE).The standard concept of public-key cryptography has modified by allowing the public-key to be any string, such as the recipient's email address. It is possible to encrypt roles and messages in relation to attribute subsets (key-policy ABE - KP-ABE) or policies which defines the identity as a set of attributes ABE rather than an atomic identity(cipher text- policy ABE - CP-ABE).The important challenge is that an user will only be able to retrieve a cipher text whether they have a key for "corresponding attributes" (see below), which is often provided by a trusted third party.

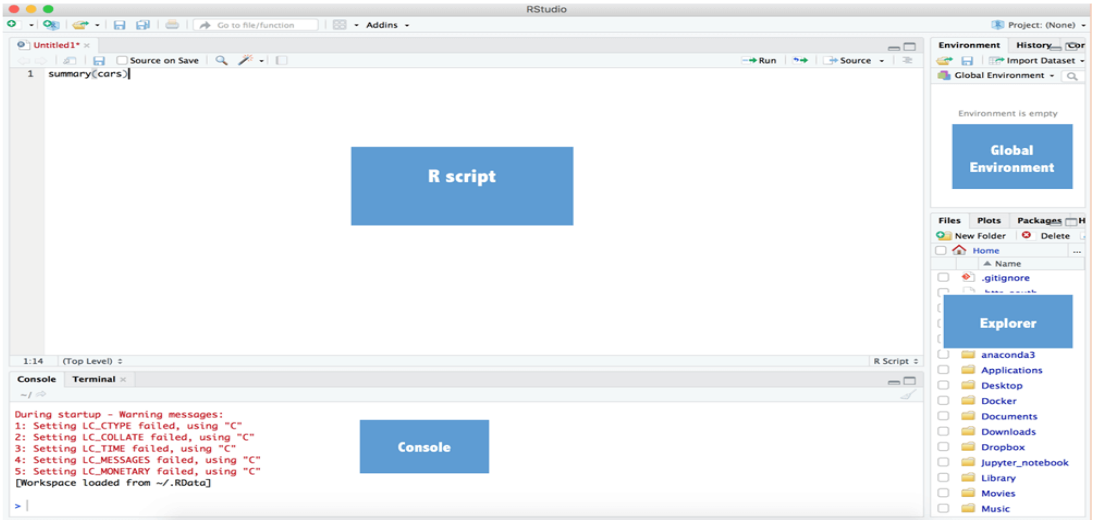

Fig 4: Perform Analytics

Cloud storage is a data processing model where virtual data are stored pools, where computing power covers multiple servers (and sometimes locations), and where a web host normally maintains and operates the physical environment. These cloud storage services are responsible for keeping the data available and accessible, and safeguarding and running the physical environment. Individuals and organizations purchase or lease computing space from vendors to store information from users, companies, or applications.

R is a scientific method, visualization representation and reporting programming language and software environment. In different areas, such as marketing, informatics and geo-spatial fields, a large amount of large databases has been obtained. Big data mining expertise is becoming a highly demanding field. It far surpassed the capacity of humans to analyse these enormous results, however. Unsupervised Machine Learning or Clustering is one of the most powerful data mining methods for discovering information in large datasets.

4 Conclusion

In this proposed work, the idea introduced real time data analytics using sensors and machine learning techniques to predict early stroke and save human lives. Here, he/she will be able to view the affected person listing with precedence device in step with their threat stage and he also can view the affected person's info and former analysis results. Besides, after clicking at the monitoring device button he/she will be able to visualize every affected person's health repute and real-time physiological information. In this work, Heart Rate Waveform also can be related to the Arduino in order to be able to transmitting real-time information to the server. The sensor isn't always introduced to the designed affected person tracking device because of the unavailability of a clinically diagnosed device at this moment. Though a version of the cloud-primarily based totally coronary heart sickness detection utility is represented here, the destiny works may be centered at the improvement of a committed server and database for this kind of affected person tracking utility. If the

proposed utility may be included and evolved successfully, it'll be to be had with inside the Android play save consequently. Thus, any affected person or medical doctor from any location of the globe may be able to putting in this utility and use this utility for coronary heart sickness prediction as reported .The experimental results provide promising results.

References

[1] In search of Medical Integrated solutions-A Comprehensive Survey, published by IEEE Access, 2019,vol 7,pg no91265-91290

[2] Big Data Features, Applications and Analytics in cardiology-A Systematic literature Review, published by IEEE Access, 2019,vol 7,pg no143742-143770

[3] Sunil Kumar ,Maninder Singh," A Novel Clustering technique for Efficient clustering for BigData in Hadoop Ecosystem", published by BigData Mining and Analytics ,2019,vol 2,pgno 240-247

[4] Andrew Fu Wah Ho, Bryan Zhan Yuan Se ,Jin Ming Koh,"Forecasting Hospital Emergency Department patient volume using Internet search data", published by IEEE Access 2019,vol 7,pgno 93387- 93395

[5] HousseinDhayne , Rafiqul Haque,rima Kilany1, And Yehia Taherin, "Search Of Medical Integrated Solutions-a Comprehensive Survey", published by IEEE Access 2019,vol 7,pgno91265-91290

[6] FajrIbrahemAlarsan, and Mamoon Younes, "Analysis and Classification of heart diseases using heart beat features and machine learning algorithms", published by Journal of Bigdata(Springer),2019,pgno1-15

[7] Jingshan Huang , Binqiang Chen , Bin Yao,AndWangpeng He, "ECGArrhythmia Classification Using STFT-Based Spectrogramand Convolutional Neural Network", published by IEEE Access 2019,vol7,pgno 92871-92880.

[8] Menaka. S, Rohini. S, "Secure the Data by using Image Compression in Multi-Cloud Storage," International Journal of Engineering and Advanced Technology (IJEAT), ISSN: 2249 – 8958, Volume-9, Issue-1S2, 2019.

[9] Menaka.S, Janarthanan, Karpagam,"PROVIDING INTEGRITY VERIFICATION FOR DATA DYNAMICS IN CLOUD," International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST), ISSN (Online): 2456-5717, Vol. 3, Special Issue 34, 2017.

[10] Udit Satija , Barathram Ramkumar, and M. Sabarimalai Manikandan , "A New Automated Signal Quality-Aware ECG Beat Classification Method for Unsupervised ECG Diagnosis Environments", published by IEEE Sensors Journal,2019,vol19,no1

[11] Naidan Feng, Shaohua Xu , Yongquan Liang, And Kun Liu A ,"Probabilistic Process Neural Network and Its Application in ECG Classification",published by IEEE access,2019,vol.7,pp.50432-50439

[12] R. Janarthanan, Doss, S. and S. Baskar. "Optimized unsupervised deep learning assisted reconstructed coder in the on-nodule wearable sensor for human activity recognition", Measurement, Vol. 164, https://doi.org/10.1016/j.measurement.2020.108050, 2020.

[13] Janarthanan, R., Balamurali, R., Annapoorani, A. and Vimala, V., Prediction of rainfall using fuzzy logic. Materials Today: Proceedings, Volume 37, Part 2, 2021, Pages 959-963, 2020.

[14] R Janarthanan, Pachaivannan Partheeban K Somasundaram, P Navin Elamparithi, "A Deep Learning Approach for Prediction of Air Quality Index in a Metropolitan City", Volume 67, 102720, April 2021.

[15] Janarthanan, R., Konar, A. and Chakraborty, A., " Propositional syntax and semantics induced knowledge re-structuring in a fuzzy logic network for ad hoc reasoning," International Journal of Approximate Reasoning, Vol. 82, pp.138-160, 2017.

[16] Udit Satija , Barathram Ramkumar, and M. Sabarimalai Manikandan “Automated ECG Noise Detection and Classification System for Unsupervised Healthcare Monitoring”, published by IEEE Journal Of Biomedical And Health Informatics,2018,vol 22,no3 S.
[17] Zhang, Z. Liu, Y. L. Liu, Y. L. Wang, and X. B. Cui, “Prevalence of stroke and associated risk factors among middle-aged and older farmers in western china. Environmental Health & Preventive Medicine”, 2017,vol. 22, no. 1, pp.6,
[18] I. M. B. Francischetti, A. Cajigas, M. Suhrland, J. M. Farinhas and S. Khader, Incidental primary mediastinal choriocarcinoma diagnosed by endobronchial ultrasound-guided fine needle aspiration in a patient presenting with transient ischemic attack and stroke. Diagnostic Cytopathology, vol. 45, no. 8, pp. 738-743,2017.
[19] M. Anand, N. Balaji, N. Bharathiraja, A. Antonidoss, A controlled framework for reliable multicast routing protocol in mobile ad hoc network, Materials Today: Proceedings,2021,ISSN 2214-7853,https://doi.org/10.1016/j.matpr.2020.10.902.
[20] Sasikumar, B., Naveenraju, D., Anand, K., Hariharan, S., Sudhakaran, P., & Bharathiraja, N. (2020). Diabetes Prediction Using Sensors By Analysing Skin Temperature. Journal of Engineering Science And Technology, 15(2), 1357-1370.

An analysis of Human Metabolic changes in Covid-19 pandemic scenario with the use of Bio-Informatics data for Thyroid disease using Machine Learning System

Katikireddy Srinivas[1], Dr K V D Kiran[2]
{srinivas.katikireddy@gmail.com[1], kiran_cse@kluniversity.in[2]}

Research Scholar, Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, AP, India[1], Professor, Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, AP, India [2]

Abstract. The Recent time the entire world had great experience of human mistakes with respect to environment safety and bio diversity leads to wonderful technological development along with danger symptoms of human life survival by increasing pollution levels to abnormal ranges.Covid-19 pandemic situation handling had shown the negative shade of technology development which ignores environment safety. At this pandemic Covid-19 Medical Emergency situation, Machine learning is inspired to develop an automated drug evaluation system for the patients suffering with routine illness conditions from the existing valid drug bank using a blend of clustering methods. The present pandemic disease covid-19 virus has explored the scope of Medical infrastructures to be improved world wide even in the 21st century. Tele medicine and digital health facilities to be incorporated using the Doctor, Patient, Network and relevant IT tools as the basic stakeholders to offer efficient, cost effective and better health facilities to common public. In this situation it is necessary to utilize software engineering information dependent on the physio synthetic properties and chemical hindrance properties of medication dataset given by standard medication bank storehouse derived from www.drugs.com, www.drugbank.ca and www.malacards.org. The existing grouping strategies are applied as a mix of k-implies, k-medoids, various leveled techniques and Fuzzy k-intends to decide a fitting arrangement of medications from the given drugbank for various disease states of thyroid patients. In this exploration work information groundwork for drug assessment is assuming a critical part, utilized Correspondence Analysis (CA) strategy to make our Cluster framework is productive and compelling. The outcome has shown the investigation as a mix of group techniques fruitful for this bunch framework utilizing graphical introduction and inferred best half and half bunch framework which creates proper medications set reasonable for different sorts of thyroid sicknesses. This machine learning system has shown better and appropriate drugs usage based on Physio Chemical Properties which effects human Metabolic changes in a controlled manner.

Keywords: Machine Learning, Medical Emergency, Covid-19, Telemedicine, Digital Health Clustering, Thyroid.

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1 Introduction

Clustering algorithms has been categorized as Exclusive, Overlapping, Hierarchical and Probabilistic Clustering. In exclusive method, data assembled in an elite manner, and if a datum has a place with a clear bunch then it couldn't be incorporated into another group[1]. The clustering by overlapping method utilizes fuzzy sets to group information, so each point may have a place with at least two groups with various degrees of participation. The most for the most part announced and regularly used isolating methods are k-implies, k-medoids, and different assortments.

For K-medoids, a medoid speaks to the most delegate purpose of a gathering of focuses. K-Means clustering [2] is also an iterative clustering procedure, but it predefines the number of clusters that will be in the dataset. PAM stands for “partition around medoids” [3]. The method intends to discover an arrangement of items called k-medoids that are halfway situated in groups. The objective of the algorithmic method is to reduce the object dissimilarities with respect to their nearby selected datum. The structure of k-medoids is nearly similar to that of k-means[4]. The cluster representative is the one data point which is located central in the cluster. Any two objects distance is calculated and the one having minimum dissimilarity when compared to all other objects is chosen as the center.PAM is susceptible but tough to noise as well as outliers than kmeans because k-medoids contemplates marginal distance which isolates it from alternate objects[5].

The observation being classified into groups necessitates few methods for measuring the distance between observations, which means no unsupervised machine learning algorithms can take place without some notion of distances. The selection of distance measure is crucial step in clustering [6]. It characterizes how the likeness of two components (x, y) is computed and it will impact the state of the groups. The most generally utilized and acknowledged technique is Euclidean separation measure. The estimation of separation measures is personally identified with the scale on which estimations are made. Therefore, factors are frequently scaled (i.e. standardized) before estimating the dissimilarities [7]. Generally variables are scaled to have standard deviation one and mean zero. The goal is to make the variables comparable and they will have equal importance in the clustering algorithm. This is especially prescribed when factors are estimated in various scales. The standardized data is a methodology broadly utilized with regards to gene examination before grouping [8].This work presents a hybridized program encompassing both k means and k-medoids algorithm to cluster a dataset of thyroid disease drugs and the program is run to generate data groups based on the algorithm, thereby refining the outcome based on fuzzy k-means.

2 Materials and Methods

2.1 Dataset: Nearly 189 drugs as dataset was utilized where they are reported as thyroid inhibitors, downloaded from Malady cards database [9].It was observed that few drugs come under other disease conditions; however, involved in the dataset because they are known to representation several other diseases including thyroid disease.

2.2 R: Result of information in science understood the criticalness of information mining in the structure of convolution of bio frameworks[11].R program is uninhibitedly accessible programming accessible in a domain utilizing object arranged programming for the most part focused for factual figuring just as designs.

2.3 Hybrid clustering

K-suggests pack technique is least requesting and the most exhaustively utilized parceling framework for segment a dataset into an arrangement of k groups. The system utilizes Euclidean separation evaluates between server farms to pick within and the between-bundle tantamount characteristics[12]. The PAM estimation depends upon the quest for k administrator objects or medoids among the perspective on the dataset. These acknowledgments should address the structure of the information. In the wake of finding a strategy of k medoids, k bundles are made by assigning every wisdom to the closest medoid.

3 Results and Discussion

3.1Cluster Validity: In this work, NbClust was engaged which was integrated with 30 validity indices to examine the numbers of groups in a given dataset. Therefore, from this analysis, the outcome signified that about 13 different index programs suggested three clusters as optimum whereas eleven index programs suggested two groups and 4 indices reported four clusters. As per the majority ruling method, the best output referred to three groups [8].

Hence, it can be established that the optimum numbers of clustering groups, k for the given dataset comprised of various drugs involved in thyroid disease was three cluster results. So, an initial k=3 value was utilized to achieve k-means, PAM as well as hybrid algorithm on the thyroid dataset [13].

3.2 k-means algorithm: The k-means approach is an apportioning issue, wherein the information isolated as gatherings with each redundancy of the calculation [10]. Since the assignments were begun aimlessly, n start = 25 is indicated, which implies that the program will endeavor 25 different arbitrary beginning stages and afterward picked the outcome with lowermost inside bunch disparity(Figure 1).A better group will bring about qualities with least withinss and greater betweenss which further depends on the whole of k groups chose initially. From this time forward, low withinss and high betweenss for k=3 was gotten.

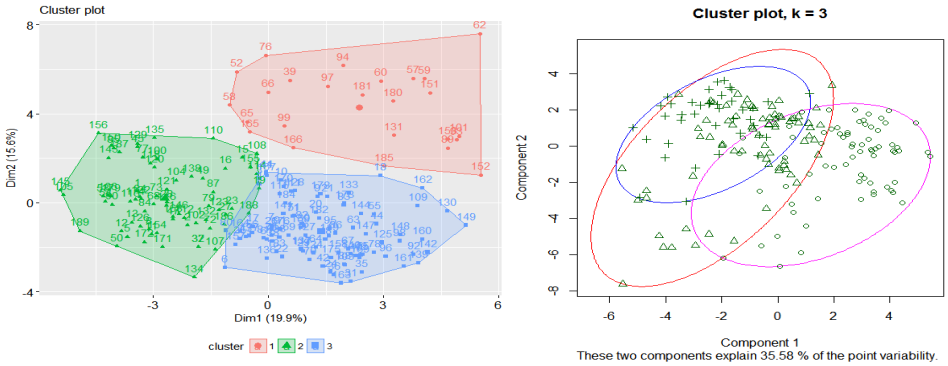

Figure. 1: Output of 3 clusters and cluster centers obtained from kmeans program and K-medoids.

3.3 Partitioning Around Medoids : It was reported that outliers influence the outcome of k-means cluster result which would otherwise influence the task of cluster annotations. Hence, a novel strong algorithm is presented by PAM algorithm, also referred as k-medoids [14].

From both methods, it was observed that some samples have a negative silhouette. This means that they are not in the right cluster. On contrast between k-means versus PAM, k-

means ensued silhouettes around 13 which are negative whereas PAM resulted in 27, respectively.

3.4 Hybrid k means-PAM Clustering Algorithm

Before long, these two standard gathering methods have their own one of a kind inclinations and imprisonments. In this manner, a novel hybrid methodology is executed to mix the best of k-means and PAM grouping. proceeds in three stages. First it figures k beginning medoids as k-bunches on the hidden dataset. By then the PAM bunch centers are determined trailed by handling k-implies by using group focuses as the underlying k [10].

The 3 grouping came about gatherings procured using k=cluster focuses, which are the three gatherings of PAM computation, achieved absolutely three different bundle sizes 77, 25 and 87 independently. Inquisitively, the negative blueprints got from blend system are 11 against 13 from k-suggests alone and 27 by PAM procedure, which prescribes the way that crossbreed method is valuable in expelling information from groups (Table 1).

Table 1: Three cluster groups appeared from kmeans and PAM methods.

	Group 1	Group2	Group3	Size of Hybrid cluster
Group1	59	18	0	**77**
Group2	9	14	2	**25**
Group3	4	44	39	**87**
Size of PAM cluster	**72**	**76**	**41**	

It is worth to take note of that the individual k-means calculation could group dataset as 25, 70 and 94 gatherings while the hybrid k-means_k-medoids brought about comparable cluster of size 25 and remaining being 87 and 77.

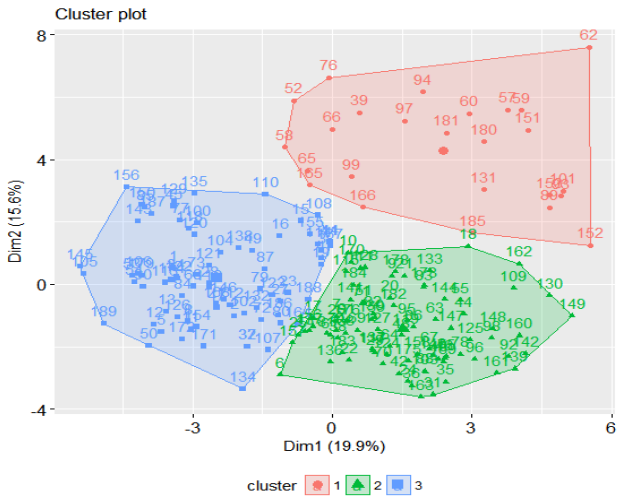

Figure 2: Visual representation of 3 clusters and centers resulted from hybrid k-means_k-medoids method.

It was observed from the plots of hybrid clustering algorithm that the data points at the edge of clusters 2 and 3 were found to be overlapped and efficient clustering was not possible when plots are visualized. Hence, work was initiated to introduce k-means procedure coupled

with fuzzy algorithm [8]. Fuzzy being soft clustering procedure mixed with hard clustering k-means, reported as fuzzy k-means (FKM) algorithm in order to produce meaningful clusters.

3.5 Fuzzy k-means algorithm: A subset including 25 information focuses from the 189 thyroid medication parameter dataset was exposed to fkm calculation and the yield chart is accounted for in Figure 3. It is confirm that the program can bunch 3 sets with clear division.

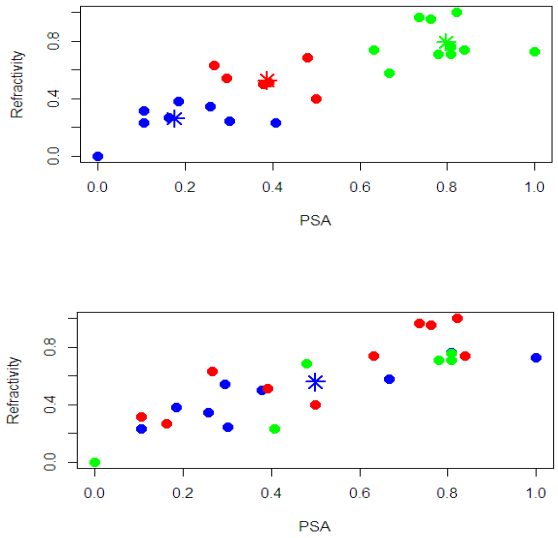

Figure 3: Dataset clusters via FKM algorithm with Entropy regularization.

3.6 Fuzzy k-means via entropy regularization

An energizing stuff in regards to the fluffy k-implies by means of entropy regularization is that the models are gotten as weighted methods with loads proportionate to the enlistment degrees (rather than to the cooperation degrees at the force of m as is for the fluffy k-implies). It is seen from Figure 5 that couple of articles from one bunch showed up in other bunch gatherings.

3.7 Fuzzy k-means via entropy regularization plus noise cluster: The entropy regularization abstained from utilizing the fake fluffiness parameter m. The clamor group is an extra bunch (concerning the k standard groups) to such an extent that items perceived to be anomalies are allotted to it with high enrollment degrees [8].

3.8 Gustafson and Kessel-like fuzzy k-means: The program plays out the Gustafson and Kessel-like soft k-suggests packing computation and is worthwhile to choose gatherings.

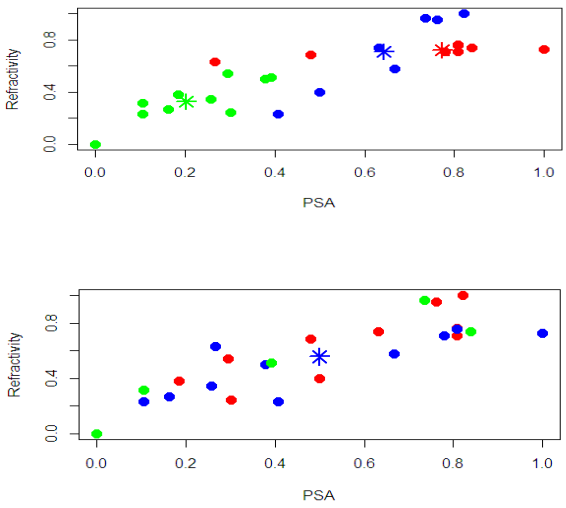

Figure 4: Gustafson and Kessel - like fuzzy k-means clustering algorithm with Entropy Regularization

3.9 Gustafson and Kessel-like fuzzy k-means via entropy regularization: The program performs the Gustafson and Kessel - like fuzzy k-means clustering algorithm with entropy regularization [21]. The method permits to evade utilizing the artificial fuzziness parameter m. If standardization is set to stand=1, the algorithm runs based on standard data. Figure 5 suggested that the data was discrete and the program unable to identify and cluster better possibilities.

3.10 Gustafson and Kessel-like fuzzy k-means using entropy regularization plus noise cluster: The program runs the Gustafson and Kessel-like fuzzy k-means clusters using entropy regularization and noise cluster which is different from fuzzy k-means, and the method identifies non-spherical clusters.

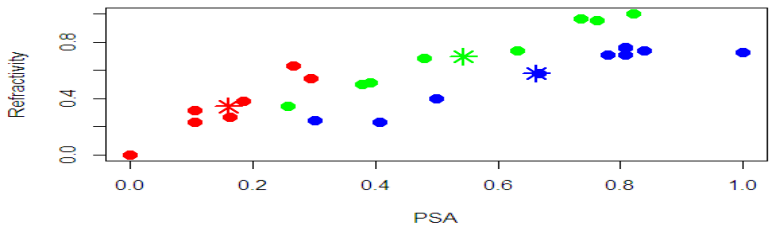

Fig. 5: Gustafson and Kessel - like fuzzy k-means clustering algorithm with entropy regularization and noise cluster resulted in better clusters.

Of all variations in FKM algorithms presented here, only natural FKM algorithm is able to produce estimated three better cluster solutions. Hence, it should be noted that testing all possibilities should be made before proceeding with allied variations of algorithms.

4 Conclusion

From both individual k-means and k-medoids strategies, it was seen that a few examples announced negative outlines. On correlation between k-means and PAM, the previous brought about 13 negative outlines though PAM technique brought about 27 negative outlines and comparable is the perception with bunch size. In addition, covering of bunches was seen for each situation just as in half breed strategy. Consequently, a lot of six fluffy calculation variations concentrated on a subset of thyroid dataset brought about 3 unmistakable groups by fluffy k-implies followed by Gustafson and Kessel - like fluffy k-implies with entropy regularization and commotion bunch calculation[8]. Table 2 shows the drugs suitable for Hyper Thyroid and Hypo Thyroid patients derived from the mappings of this novel cluster system [10].

Table 2: Cluster System Output – Drugs data set divided into 3 Cluster groups as shown below (Hybrid K-Means K-Medoids Algorithm)

S. No	Drug_ID	Cluster 1 DRUGS	S. No	Drug_ID	Cluster 2 Drugs	S. No	Drug_ID	Cluster 3 Drugs
1	1	**Nitroprusside**	**1**	39	**Methotrexate**	**1**	6	**Sevoflurane**
2	2	**Propylthiouracil**	**2**	52	**Folic Acid**	**2**	7	**Etoricoxib**
3	3	**Hydrocortisone**	**3**	57	**Paclitaxel**	**3**	9	**Remifentanil**
4	4	**Prednisone**	**4**	58	**Pemetrexed**	**4**	10	**Methylprednisolone**
5	5	**Nitric Oxide**	**5**	59	**Everolimus**	**5**	17	**Diclofenac**
6	8	**Propofol**	**6**	60	**Sirolimus**	**6**	18	**Travoprost**
7	11	**Menthol**	**7**	62	**Octreotide**	**7**	20	**Bimatoprost**
8	12	**Acetylcholine**	**8**	65	**Doxycycline**	**8**	21	**Latanoprost**
9	13	**Benzocaine**	**9**	66	**Oxytetracycline**	**9**	22	**Dexmedetomidine**
10	14	**Dexamethasone**	**10**	76	**Leucovorin**	**10**	24	**Tizanidine**
11	15	**Triamcinolone**	**11**	89	**Indinavir**	**11**	25	**Clonidine**
12	16	**Dinoprost Tromethamine**	**12**	93	**Ritonavir**	**12**	26	**Methyltestosterone**
13	19	**Timolol**	**13**	94	**Azithromycin**	**13**	29	**Bupivacaine**
14	23	**Metoprolol**	**14**	97	**Doxorubicin**	**14**	30	**Celecoxib**
15	27	**Estradiol**	**15**	99	**Minocycline**	**15**	31	**Sertraline**
16	28	**Guaifenesin**	**16**	101	**Vincristine**	**16**	33	**Morphine**
17	32	**Pseudoephedrine**	**17**	131	**Etoposide**	**17**	35	**Fentanyl**

18	34	**Metformin**	**18**	151	**Docetaxel**	**18**	36	**Diazepam**
19	37	**Ephedrine**	**19**	152	**Vinorelbine**	**19**	38	**Xylometazoline**
20	41	**Betamethasone**	**20**	165	**Cefazolin**	**20**	40	**Donepezil**
21	45	**Ribavirin**	**21**	166	**Piperacillin**	**21**	42	**Citalopram**
22	47	**Dopamine**	**22**	180	**Pimecrolimus**	**22**	43	**Exemestane**
23	49	**Entecavir**	**23**	181	**Tacrolimus**	**23**	44	**Amiodarone**
24	50	**Cysteamine**	**24**	185	**Bromocriptine**	**24**	46	**Olanzapine**
25	53	**Niacin**	**25**	153	**Vinblastine**	**25**	48	**Risperidone**
26	54	**Nicotinamide**				**26**	51	**Droperidol**
27	68	**Carboplatin**				**27**	55	**Imatinib Mesylate**
28	72	**Carbimazole**				**28**	56	**Chlorpheniramine**
29	73	**Epinephrine**				**29**	61	**Miconazole**
30	77	**Alendronate**				**30**	63	**Sorafenib**
31	79	**Lacosamide**				**31**	64	**Bexarotene**
32	80	**Carbamazepine**				**32**	67	**Vildagliptin**
33	84	**Caffeine**				**33**	69	**Levonorgestrel**
34	85	**Vitamin C**				**34**	70	**Ropivacaine**
35	87	**Genistein**				**35**	71	**Topiramate**
36	90	**Acetaminophen**				**36**	74	**Esomeprazole**
37	100	**Carbidopa**				**37**	75	**Norgestimate**
38	102	**Cyclophosphamide**				**38**	78	**Ezogabine**
39	104	**Vorinostat**				**39**	81	**Melatonin**
40	105	**Hydroxyurea**				**40**	82	**Ergocalciferol**
41	106	**Fluorouracil**				**41**	83	**Vitamin E**
42	107	**Histamine**				**42**	86	**Cholecalciferol**
43	108	**Bortezomib**				**43**	88	**Midazolam**
44	110	**Fludarabine**				**44**	91	**Lansoprazole**
45	112	**Chlorpropamide**				**45**	92	**Sunitinib**
46	113	**Salicylic acid**				**46**	95	**Loperamide**
47	114	**Glipizide**				**47**	96	**Rosiglitazone**
48	116	**Tolbutamide**				**48**	98	**Ezetimibe**

49	118	**Zoledronic acid**				**49**	103	**Nitisinone**
50	120	**Decitabine**				**50**	109	**Dabrafenib**
51	121	**Dacarbazine**				**51**	111	**Glimepiride**
52	122	**Temozolomide**				**52**	115	**Glyburide**
53	123	**Melphalan**				**53**	117	**Desogestrel**
54	126	**Valproic Acid**				**54**	119	**Pioglitazone**
55	129	**Azacitidine**				**55**	124	**Tamoxifen**
56	132	**Ifosfamide**				**56**	125	**Gefitinib**
57	134	**Mechlorethamine**				**57**	127	**Drospirenone**
58	135	**Vidarabine**				**58**	128	**Capecitabine**
59	138	**Gemcitabine**				**59**	130	**Irinotecan**
60	143	**Levodopa**				**60**	133	**Trametinib**
61	145	**Glycine**				**61**	136	**Diphenhydramine**
62	146	**Tretinoin**				**62**	137	**Promethazine**
63	150	**Tagatose**				**63**	139	**Crizotinib**
64	154	**Metronidazole**				**64**	140	**Rabeprazole**
65	155	**Famotidine**				**65**	141	**Lenalidomide**
66	156	**Mannitol**				**66**	142	**Ponatinib**
67	164	**Cocaine**				**67**	144	**Calcitriol**
68	167	**Ursodeoxycholic acid**				**68**	147	**Alfacalcidol**
69	168	**Ketorolac**				**69**	148	**Tipifarnib**
70	171	**Isoflurane**				**70**	149	**Lapatinib**
71	172	**Desflurane**				**71**	157	**Vitamin A**
72	174	**Aspirin**				**72**	158	**Vatalanib**
73	179	**Vigabatrin**				**73**	159	**Veliparib**
74	186	**Pentoxifylline**				**74**	160	**Erlotinib**
75	187	**Glucosamine**				**75**	161	**Hydroxychloroquine**
76	188	**Thiamine**				**76**	162	**Bosentan**
77	189	**Choline**				**77**	163	**Ketamine**
						78	169	**Reboxetine**
						79	170	**Cortisone acetate**
						80	173	**Rocuronium**
						81	175	**Anastrozole**
						82	176	**Letrozole**

					83	177	**Tropicamide**
					84	178	**Tauroursodeoxycholic acid**
					85	182	**Cyproterone Acetate**
					86	183	**Doxepin**
					87	184	**Lovastatin**

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References

[1] Hastie T, Tibshirani R, Friedman J. Unsupervised learning. In The elements of statistical learning 2009 (pp. 485-585).Springer New York

[2] www.drugbank.ca

[3] Halkidi M, Batistakis Y, Vazirgiannis M. On clustering validation techniques.Journal of intelligent information systems. 2001 Dec 1;17(2):107-45

[4] http://www.malacards.org/

[5] Banerjee, A. (2004). "Validating clusters using the Hopkins statistic". IEEE International Conference on Fuzzy Systems: 149–153

[6] Ferraro M.B., Giordani P., 2013. A new fuzzy clustering algorithm with entropy regularization. Proceedings of the meeting on Classification and Data Analysis (CLADAG)

[7] Chris Fraley, A. E. Raftery, T. B. Murphy and L. Scrucca (2012).” mclust Version 4 for R: Normal Mixture Modeling for Model-Based Clustering, Classification, and Density Estimation”,Technical Report No. 597, Department of Statistics, University of Washington.

[8] Chris Fraley and A. E. Raftery (2002). “Model-based clustering, discriminant analysis, and density estimation”, Journal of the American Statistical Association 97:611:631.

[9] http://www.sthda.com/english/wiki/factoextra-r-package-quick-multivariate-data-analysis-pca-ca-mca-and-visualization-r-software-and-data-mining

[10] Gustafson E.E., Kessel W.C., 1978,”Fuzzy clustering with a fuzzy covariance matrix”, Proceedings of the IEEE Conference on Decision and Control, pp. 761-766

[11] www.drugs.com

[12] “The art of R Programming”, Norman Matloff, William Pollack, 2013,I edition .

[13] Data mining Concepts and Techniques, Han & Kamber, Morgan Kaufmann(Elsevier)

[14] www.sthda.com

[15] www.datanovia.com

Identification of Deception Detection on Social Media (Twitter) Data Sets using Naive Base Classification and RVNN Model

N.Kanagavalli[1], S.BaghavathiPriya[2] and 3S.Ilavarasan[3]
{kvalli.818@gmail.com[1], baghavathipriya.s@rajalakshmi.edu.in[2], ilavarasan.sargunan@gmail.com[3]}

Assistant Professor, Department of CSE, Rajalakshmi Institute of Technology, Chennai[1],
Professor, Department of CSE, Rajalakshmi Engineering College, Chennai[2],
Assistant Professor (SG), Department of IT, Saveetha Engineering College, Chennai[3]

Abstract. Twitter being a famous social media site not only helps people to share their thoughts in microblogs but also plays a pivotal role in situations of emergency for communication, announcement and so on. However, it results in anaversive effect when inappropriate tweet is reposted or shared to people thereby spreading rumors. This work describesthe methodologies in identifying the rumors using specific attributes like precision, fi-score, recall and support thereby solving the ranging rumor issues across the social media platform. A system detects candidate's rumor from twitter and then evaluates it applicably. The result of experiment shows the proposed algorithm in order to detect the rumors with acceptable accuracy.

Keywords: Rumor, Social media, CNN model, RvNN model,Twitter data set.

1 Introduction

This

The perils of rumor have an adverse consequence and it shall not be corroborated with any substantiation to prove its authenticity. Tweet means interact with massages to other users. Twitter having two users one is registered Users and another one is Unregisters Users. Registered users have all the rights like posts, tweet and retweet etc. Unregistered users have only read rights. The types of Misinformation are false news, reviews, listings, and more.Social psychology states that a rumor is allegedly claimed news without proper evidence thereby creating a chaos in the calm functioning world. As a matter of fact, it is hardly possible to envisage the trust worthiness of information circulated in social media. Demystifying the counterfeit information at the initial stage certainly paves way to limit the detrimental repercussions.The amalgamation of distrust information and deception developers' eventually impinges the regular flow of activities in the world of social media. The Existing websites which exclusively focuses rumor reporting in the social mediaare snopes.com and factcheck.org making effective strategies to detect the falseness of the information through manual verification process but fails to process the procedure with the aid of a proper coding system. The work attempts to bridge the gap between the conventional ideologies and to conceive a proper channel for better detection of the false information in the social media platform.

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2. LITERATURE SURVEY

This section embraces a review of the literature on various existing rumors detection on social media. These research papers are taken and reviewed according to the recent published years based on the rumors identification in social media.

Authors	**Methods**	**Advantages**	**Disadvantages**
Jadhav S S and Thepade S D [9]	Deep Structured Semantic Model, Recurrent Neural Networks	Detection accuracy is high.	Failed to integrate other social media systems to extend this method.
Kaliyar R K *et al.* [2]	A deep convolutional neural network.	Cross-entropy rate is less in this method.	User profile-based features were not included for better prediction of news articles.
Vishwakarma D K *et al.* [3]	Fake detection based on maximally stable extremal regions detector.	Better detection accuracy was obtained.	Not included splicing localization algorithms for image tampering.
de Oliveira N R *et al.* [4]	A computational stylistic approach.	Minimum overhead was obtained in this method.	Computation time was high.
Shu K *et al.* [5]	A principled method.	Auxiliary information was included to improve the fake news detection.	Failed to identify user profiles for enhanced feature extraction.
Shu K *et al.* [6]	A Data Mining method.	Better classification accuracy was achieved.	Failed to include effective visual features, such as traditional local and global features.
Han Y *et al.* [7]	Graph Neural Networks with Continual Learning Method.	Computational time was very fast.	The developed classifier is not performed well on other environments, like Gossip Cop.
Zhang J *et al.* [8]	Deep Diffusive Network Model.	Detection accuracy was high in this method.	Computation time will be extended in other heterogeneous network

3. HARDWARE & SOFTWARE REQUIREMENTS:

- This project is executed with the help of Deep Learning Python libraries. Anaconda Navigator, Pythonlibraries(Tensorflow, Keras)

4.MODULE EXPLANATION:

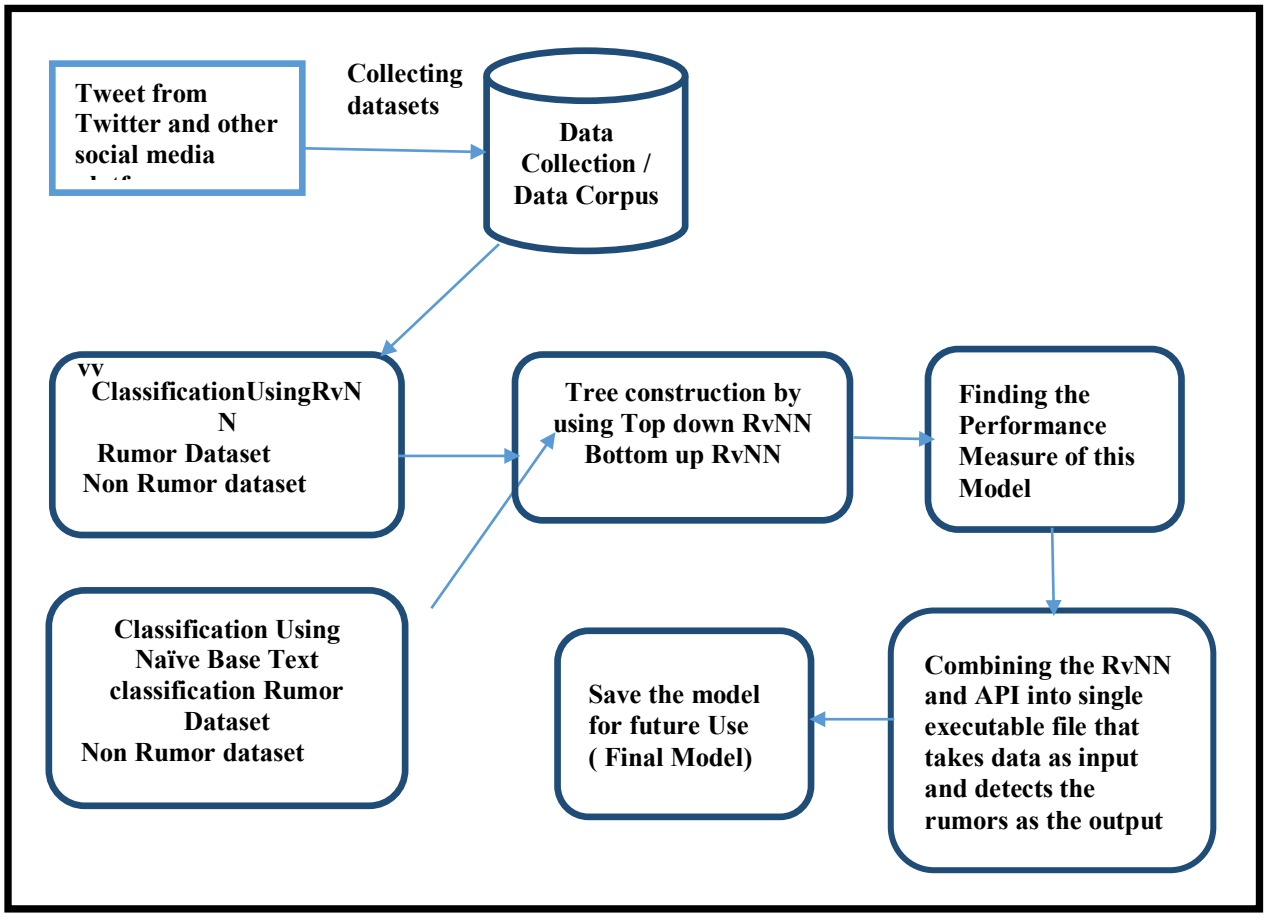
MODULE 1 - (PRE-PROCESSING MODULE)

Extracting the relevant fields from the dataset is the preprocessing step. The relevant fields include tweet ID, tweet reply status ID, tweet text, screen name. In which screen name is of little importance and the other three are used for further purposes. After extracting these fields from json, write them to csv files for the rest of the work.

MODULE 2 (POLARITY IDENTIFICATION MODULE)

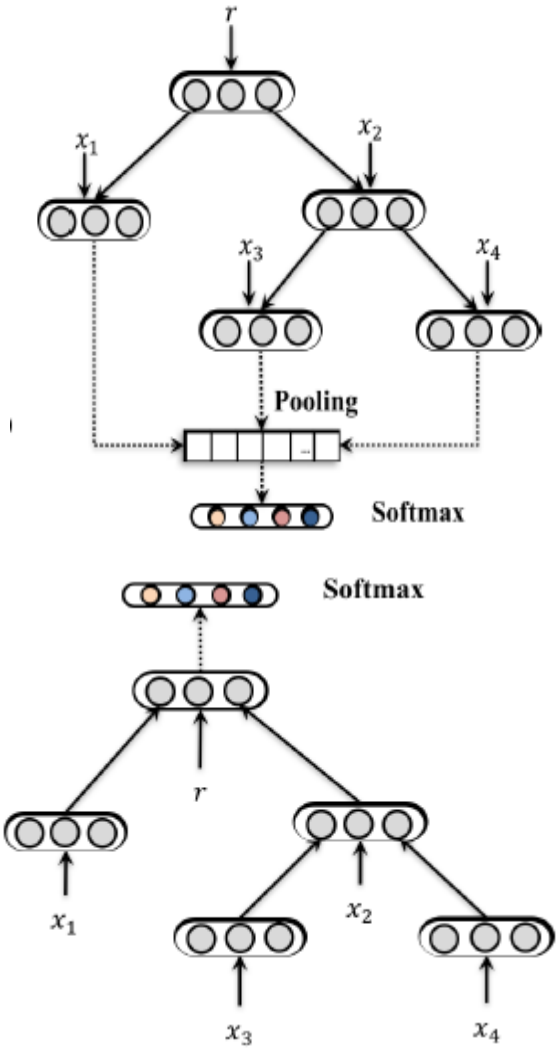
In this module, each tweet's sentiment polarity will be analyzed. This polarity is also considered as one feature for CNN and RNN. Tweets were extracted from the tweets column from the csv file and the polarity is calculated using Sentiment Intensity Analyzer from the nltk sentiment vader. Each tweet is given as an input to the polarity score calculator and returns a dictionary with 4 values, negativity, positivity, neutral and compound.

Fig 1: DATAFLOW FOR RUMOUR DETECTION



MODULE 3 (TREE STRUCTURING MODULE)

This module is one of the main tasks in the proposed model and this part provides structure for each csv file input. It is implemented by parsing through each file and identifying the parent node and child nodes based on ID and response tweet ID.The first figure is Top down RvNN Model, and the second figure is Bottom up RvNN Model.



MODULE 4 (NEURAL NETWORK MODEL CREATION)

- In this module, 4types of neural network model is building using CNN, RNN, CNN +RNN and RvNN. First three models is based only on text and RvNN model is based on structure as well as content based.

5. METHODOLOGIES

1. NB Classification

Naive base classification is the preeminent method for text classification. This is based on baye's theorem concept oriented model. It originates the probability of the given Item's vector are assigned with a specific label. Generally Naive Bayes is known asdirect and quick classification algorithm, which is appropriate for a hugeportion of data.There are totally 3 types of NB classifier. 1. Gaussian Naive Bayes classifier: Especially used for when items are in continuous. 2. Multinomial Naive Bayes Classifier: It is used when items follow a multinomial distribution. 3 Bernoulli Naive Bayes classifier: It is mainly used when items are in the type of Boolean.

For example the datasets are collected and completed as on 30/03/2021. The four datasets as an example data for this work.

The election was over on 1ST April 2021 -**False**
Tamilnadu Election date is April 6th 2021 - **True**
Tamilnadu people waiting eagerly for the election - **True**
It was a close election – **False**

Find the statement "Tamilnadu election over on April 6th 2021" is True or false

STEPS INVOLVED IN NB CLASSIFICATION

Step1: Take the probability value for each and every item in the given statement then multiply and get the results.

Step2: P(Tamilnadu)*P(election)* P(over)* P(on)* P(April)*A(6th)*P(2021)

Step3: Need to identify the two attributes such as True and false.

Step4: Total words in True list =14

Step5: Total words in False list =13

Step6: Total Unique words in list =19

Step 7:

Find 1. P(Tamilnadu election over on April 6th 2021/True)

P(Tamilnadu/True) = 2/14
P(election/True)=2/14
P(Over/True)=0/14
P(On/True)=0/14
P(April/True)=1/14
P(6th/True)=1/14
P(2021/true)=1/14

P(Tamilnadu/True)*P(election/True)* P(over/True)* P(on/True)* P(April/True)*A(6th/True)*P(2021/True)

Answer = 0

To rectify the above results using Laplace smoothing formula, that is as follows

$$P(\text{Choosen Word}) = \frac{(\text{Choosen count} + 1)}{(\text{total number of word} + \text{Number of unique words})}$$

P(Tamilnadu/True) = 3/33
P(election/True)=3/33
P(Over/True)=1/33
P(On/True)=1/33
P(April/True)=2/33
P(6^{th}/True)=2/33
P(2021/true)=2/33

P(Tamilnadu/True)*P(election/True)* P(over/True)* P(on/True)* P(April/True)*A(6th/True)*P(2021/True)

Answer = 1.68940944 e^{-9}

Find 2. P(Tamilnadu election over on April 6th 2021/False)

P(Tamilnadu/False) = 0/13
P(election/False) 2/13
P(Over/False) 1/13
P(On/False) 1/13
P(April/False)=1/13
P(6^{th}/False) 0/13
P(2021/False) 1/13

P(Tamilnadu/False) P(election/False) *P(over/False) * P(on/False)* P(April/False)*A(6th/False) *P(2021/False)
Answer = 0

To rectify the above results using the same above formula,

P(Tamilnadu/False) = 1/32
P(election/False) = 3/32
P(Over/False) = 2/32
P(On/False) = 2/32
P(April/False) =2/32
P(6^{th}/False) = 1/32
P(2021/False) 2/32

P(Tamilnadu/False) P(election/False) *P(over/False) * P(on/False)* P(April/False)*A(6th/False) *P(2021/False)

Answer = 1.39698386ee-9

Step 8: compare these 2 results. The first one is higher value compared to another one.

Step 9: Higher value is depend on the True attributes

Step 10: The given statement “Tamilnadu election over on April 6th 2021” is comes under **‘True”**

2. STEPS INVOLVED IN RVNN MODEL

1. Install anaconda
2. Import python libraries

importnumpy as np
import pandas as pd
importmatplotlib.pyplot as plt

3. Read two files one is original Information and another one is rumor information
4. Set label value as true = 0 and false =1
5. Convert all the text files into numerical values
6. Combine both information into a single file using pandas function pd.concat ([dataset1,dataset2])
7. Check balanced or unbalanced dataset
8. Shuffle or Resample by using code

dataset = dataset.sample(frac = 1) dataset.head(20)

9. Import Natural Language Tool Kit packages(nltk)
10. from the nltk.corpus import stopwords
11. from the nltk.stem import WordNetLemmatizer
12. Data cleaning by using the function defcleaning_data(row):
13. This function returns the cleaned information
14. Then perform feature extraction by importing tfidVectorizer
15. Model selection by using this code

fromsklearn.model_selection import train_test_split

train_data ,test_data , train_label , test_label = train_test_split(x, y , test_size = 0.2 ,random_state = 0)

16. Perform vectorization for train data and test data

vec_train_data = vectorizer.fit_transform(train_data)

17. Check the balanced partition using this line of code

train_label.value_counts()
test_label.value_counts()

18. Develop model by using Naïve Base

fromsklearn.naive_bayes import MultinomialNB
fromsklearn.metrics import accuracy_score,classification_report

19. Accuracy and precision and recall are calculated by using the formula. The result is as follows

```
print(classification_report(test_label , y_pred))
```

```
              precision    recall  f1-score   support

           0       0.96      0.94      0.95      3326
           1       0.95      0.96      0.96      3674

    accuracy                           0.95      7000
   macro avg       0.95      0.95      0.95      7000
weighted avg       0.95      0.95      0.95      7000
```

Now predict on both train set

```
y_pred_train = clf.predict(training_data)
print(classification_report(train_label , y_pred_train))
```

```
              precision    recall  f1-score   support

           0       0.96      0.95      0.96     13385
           1       0.96      0.96      0.96     14615

    accuracy                           0.96     28000
   macro avg       0.96      0.96      0.96     28000
weighted avg       0.96      0.96      0.96     28000
```

```
accuracy_score(train_label , y_pred_train)
```

```
0.9584642857142858
```

```
accuracy_score(test_label , y_pred)
```

```
0.9531428571428572
```

20. Finally save this model using joblib library file.

RESULTS

Calculate the given information is original or rumor from the trained data model. If the output of the array shows the numerical value 1 then the information is rumor. Or else the output of the array shows the numerical value 0 then the information is Original information.

Output

info= cleaning_data(str(" Tamilnadu Election will get over by April 1 2021."))
single_prediction = clf.predict(vectorizer.transform([info]).toarray())
single_prediction

Output
array([1])

This result shows that the given information is Rumor.

info= cleaning_data(str(" Tamilnadu Election will get over by April 6 2021."))
single_prediction = clf.predict(vectorizer.transform([info]).toarray())
single_prediction

Output array([0])This result shows that the given information is Original Information

Conclusion

Most people are gathering news online today. Everyone is free to get and share information on social networks anywhere at any time. So, in social media, breaking news spread very quickly. Sometimes rumors spread rapidly in social media with breaking news, which can also harm society and government.In that need to take some steps to prevent this rumor from spreading. There are different rumour detection techniques that use machine learning, deep neural network, etc. This work focuses primarily on a comparative study of different neural networks for social media rumour detection. Lots of work is done in the detection of rumors using neural networks that make use of CNN and RvNN.

References

[1] Ozbay F A and Alatas B, "Fake news detection within online social media using supervised artificial intelligence algorithms", Physica A: Statistical Mechanics and its Applications, vol.540, pp.123174, February 2020.

[2] Kaliyar R K, Goswami A, Narang P, Sinha S, "FNDNet–A deep convolutional neural network for fake news detection", Cognitive Systems Research, vol.61, pp.32-44, January 2020.

[3] Vishwakarma D K, Varshney D, Yadav A, "Detection and veracity analysis of fake news via scrapping and authenticating the web search", Cognitive Systems Research, vol.58, pp.217-29, December 2019.

[4] de Oliveira N R, de Medeiros D S, Mattos D M, "A Sensitive Stylistic Approach to Identify Fake News on Social Networking", IEEE Signal Processing Letters, July 2020.

[5] Shu K, Wang S, Liu H, "Understanding user profiles on social media for fake news detection", Multimedia Information Processing and Retrieval (MIPR) IEEE, pp.430-435, April 2018.

[6] Shu K, Sliva A, Wang S, Tang J, Liu H, "Fake news detection on social media: A data mining perspective", ACM SIGKDD explorations newsletter, vol.19, no.1, pp.22-36, September 2017.

[7] Han Y, Karunasekera S, Leckie C, "Graph Neural Networks with Continual Learning for Fake News Detection from Social Media", arXiv preprint, pp.2007.03316, July 2020.

[8] Zhang J, Cui L, Fu Y, Gouza F B, "Fake news detection with deep diffusive network model", arXiv preprint, pp.1805.08751. 2018.

[9] Jadhav S S and Thepade S D, "Fake news identification and classification using DSSM and improved recurrent neural network classifier", Applied Artificial Intelligence, vol.33, no.12, pp.1058-68, October 2019.

[10] Afroz S, Brennan M, Greenstadt R, "Detecting hoaxes, frauds, and deception in writing style online", In proceedings of IEEE Symposium on Security and Privacy, pp.461-475, May 2012.

[11] Hardalov M, Koychev I, Nakov P, "In search of credible news", In proceedings of International Conference on Artificial Intelligence: Methodology, Systems, and Applications, pp.172-180, September 2016.

[12] Shu K, Wang S, Liu H, "Beyond news contents: The role of social context for fake news detection", In Proceedings of the Twelfth ACM International Conference on Web Search and Data Mining, pp.312-320, January 2019.

[13] Zhou X and Zafarani R, "Network-based fake news detection: A pattern-driven approach", ACM SIGKDD Explorations Newsletter, vol.21, no.2, pp.48-60, November 2019.

Surveillance Camera Based Fall Detection System Using Long Short Term Memoryfor Elderly People

G.Anitha[1], S.BaghavathiPriya [2]
{anitha.g@rajalakshmi.edu.in[1], baghavathipriya.s@rajalakshmi.edu.in[2]}

Department of IT, Rajalakshmi Engineering College, Chennai[1], Department of CSE, Rajalakshmi Engineering College, Chennai[2]

Abstract. Event detection in videos is becoming an emerging area of research now a day. Monitoring of people activities using a surveillance camera is an essential one in a recent lifestyle for safety and security. The surveillance cameras are used in a wide variety of places such as in public places, Hospitals, Schools, and Homes for the beneficiaries of common people, patients, children and the elderly. In case of any emergency or abnormal events, immediate notification should be given to the respective people. The abnormal events are recognized from the videos using deep architectures. The goal of event detection in videos is to detect simple and complex actions in real-time data. This has a lot of attention in real-time ambient assisted living environments especially for elder people who live alone in the home. In this paper, a deep architecture of long short term memory recurrent network is proposed to detect fall actions in video inputs..

Keywords: RNN, LSTM, CNN, Action Recognition and Fall.

1 Introduction

Fall detection has become the most interesting research area due to the most attractive and efficient features of the deep learning algorithms in computer vision domain. In the last few decades more number of research works is evolved in the field of Ambient Assisted Living (AAL) for elderly people. AAL and smart home automation is achieved with various kinds of sensors and monitoring devices to enhance the life style of the elderly people. In recent decades,the life time of people is increasing drastically due to the recent advancements and growth of technology in medicine field. This leads to the population growth in old age people.

The number of people and proportions of older persons are increasing day by day all over the world. By 2050, one in six people in the world will be over age 65 stated by world population prospects: The 2019 revision [1]. The old age people wish to live independently and peacefully in their last days in home. Due to aging they may experience health issues like sight problems, unbalancing while walking, dementia etc. It is mandatory to have health care assistant and being monitored around 24 hours and it is possible only when they are in the clinical environment. But the older persons are willing to have ageing at home. They hesitate to be in the hospital like environment.

In this research work a novel deep learning algorithm is proposed to detect human fall in indoor environment automatically using computer vision techniques. The paper is further organized into related work, methodology, results and discussion and conclusion.

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2 Related work

`To overcome this issue researchers have developed many monitoring devices to support aging at home. The monitoring devices are further classified into three broad categories acoustic and ambient sensors based method, wearable sensors based method, computer vision based method [2].In acoustic ambient method the sounds of the surrounding and frequencies are recorded to detect the fall. In this method various sensors like floor vibration sensor, location sensor, RFID, temperature sensor and infrared sensors are embedded in to the environment to detect the actions and context of the elderly [3]. In wearable sensors based method various kinds of sensors like accelerometers [2-table] and gyroscopes are used to detect the fall event. In computer vision based methods surveillance cameras are used to monitor the people daily activities and if any fall events occur that can be detected based on their postures or from other parameters using well defined algorithms and alarm is sent to caretakers immediately.

Among the all fall detection methods computer vision based methods are giving better accuracy compared to other traditional methods. They produced less false alarm rate and the results can be further improved by the efficient deep learning algorithms. Deep learning supports real time applications and large volume of data and gives better accuracy than other machine learning algorithms. ArifMahamood et.al extracted spatio temporal features from images and classified using ada boost algorithm to detect fall [4]. Manuel Martinez proposed a bed aligned map method to recognize human activities in bed [5]. Many researches have proposed many feature extraction and classifiers to detect human fall automatically like HOG[8], fuzzy rules[9], SVM[7], GMM [6], DAG [10].

In [11] Guo-Jun Qi extracted position, angle, offset, velocity, pairwise joint distances of the persons from image and proposed differential recurrent neural network deep algorithm to find the change of information between successive frames for the classification. MirtoMusci[12] detected fall using wearable devices and artificial intelligence techniques.Ruizaho et al. combines RNN with CNN and finally used SVM classifier to classify the classes. Ahmed Naitaicha compared CNN, LSTM and ConvLASTM on wearable devices data for detection [13].Adrian Nunez Macros implemented CNN on publically available fall detection datasets URFD, Multicam, FDD and achieved 94% results[14].Deepika Sign et al classified fall events on sensor data using LSTM and RNN deep learning algorithms and it outperforms traditional algorithms NB, HMM and CRF[15]. Chi Chuntian proposed a novel method that extracts channel state information from WiFi signals and trained with RNN model. Then it is improved with RSR-RNN model[16]. `

3 Methodology

The automatic fall detection system captures input frames from the video surveillance camera and extracts the important features. Then it converts the data to CSV file format to train the RNN model with the pre-processed data in the training phase. In testing phase a new input data is processed by the trained model and the events are classified accordingly. Fig.1 shows the basic model of the automatic fall detection system using the deep learning algorithm RNN.

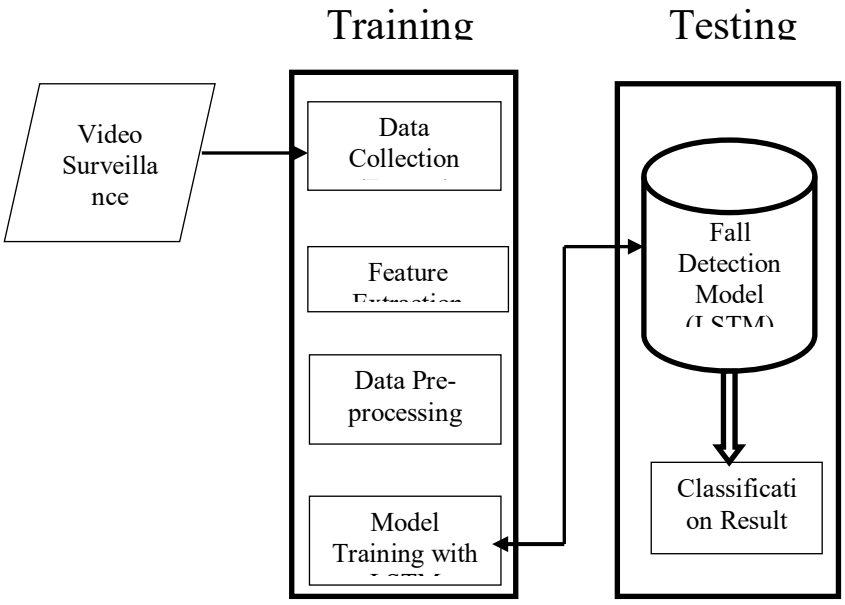

Fig.1 Automatic Fall Detection System

RNN

Recurrent Neural Network is a well defined deep network for time series data. RNN structure includes an input layer multiple hidden layers and an output layer. This forwards input x to a internal hidden layer h at time step t. The deep network passes the hidden state $h_t$along with the next input x_{t+1} to the neuron at every time step. The number of hidden layers is determined by trial and error methods in training phase. Each hidden layer is having its own weights and biases. RNN provides same weights and biases to all the layers to reduce the complexity so that all the hidden layers have same weights and biases in a single recurrent layer. Fig.2 shows a simple RNN structure.

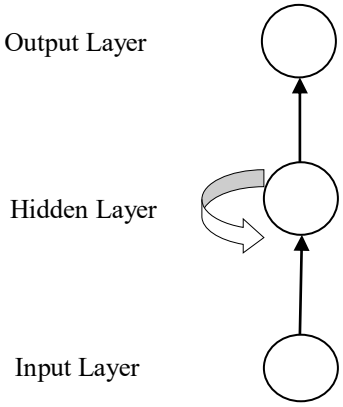

Fig.2 A simple RNN structure

Formula (1) shows the calculation of the current state where $h_t$and h_{t-1} are the current and previous states and $X_t$is the input state. Formula (2) depicts activation function f() where

W_{hh} is weight at recurrent neuron and $W_{xh}$is weight at input neuron. Formula (3) states the calculation of output Y_t where w_{hy} is weight at output layer.

$$h_t = f(h_{t-1}, X_t) \quad (1)$$

$$h_t = \tanh(W_{hh}h_{t-1} + W_{xh}X_t \quad (2)$$

$$Y_t = W_{hy}h_t (3)$$

LSTM

RecurrentNeural Network algorithm is the best choice to analyze sequential input data. Video inputs have information in many frames. All of them need to be analyzed to understand the context of the event. Longer sequences cannot be handled in RNN as it forgets previous input sequence. To diminish this gradient descent problem, Long Short Term Memory has been designed to analyze the longer sequences and preserve contextual information of input sequence. Back propagation technique can be used to overcome the problem of vanish. Its architecture with input output and forget gates help to identify long term patterns in sequential input.In LSTM the input output and control gates are represented as x_t, c_t, $o_t$with hidden state h_t at time t. At each time step the LSTM neuron depends on the values of input gate, cell state and hidden states to produce output. Each LSTM unit's functionality is depicted in equations (3)-(8). Using this values LSTM unit memorize long term input sequence.

$$i_t = \sigma_g(W_{xi}x_t + W_{hi}h_{t-1} + b_i) \quad (3)$$

$$f_t = \sigma_g(W_{xf}x_t + W_{hf}h_{t-1} + b_f) \quad (4)$$

$$o_t = \sigma_g(W_{xo}x_t + W_{ho}h_{t-1} + b_o) \quad (5)$$

$$g_t = tanh(W_{xg}x_t + W_{hg}h_{t-1} + b_g) \quad (6)$$

$$c_t = f_t \odot c_{t-1} + i_t \odot g_t \quad (7)$$

$$h_t = o_t \odot \sigma_h(c_t) \quad (8)$$

The human actions are recognized and classified using this LSTM model and achieved better accuracy.

4 Results and Discussions

The proposed model is evaluated with Gaussian Naïve Bayes classifier and proposed method. Table 1 shows the performance of our model with different number hidden layers. Figure 2 shows the live capture of fall event. Table 2 and 3 shows the precision, recall, f1 score and support values of Gaussian and LSTM methods. The three class labels are fall, non fall and about to fall. Table 4 shows the accuracy values of both the algorithms and LSTM achieved 85.79% .

a b

Figure 2. Fall Event Detection a. Non-Fall (Person Detection) b. Fall

Table 2: Gaussian Naïve Bayes

Class	Precision	Recall	F1-Score	Support
0	0.42	0.65	0.51	438
1	0.89	0.87	0.88	587
2	0.95	0.83	0.88	1861

Table 3: LSTM

Class	Precision	Recall	F1-Score	Support
0	0.45	0.38	0.41	405
1	0.82	0.95	0.88	591
2	0.93	0.91	0.92	1890

Table 4: Accuracy

Method	Accuracy
Gaussian Naïve Base	82%
LSTM	**85.79%**

Conclusion

A deep architecture of long short term memory recurrent network is proposed to detect fall actions in video inputs. The method achieved good results than machine learning algorithms. The results can be improved with more number of input video samples. In future work, Attention based models can be used to improve the model performance.

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References

[1] https://www.un.org/en/sections/issues-depth/ageing/

[2] SreeMadhubala J, Umamakeshwari A, JenitaAmali Rani B, "A Survey on technical approaches in fall detection", National Journal of Physiology, Pharmacy and Pharmocology, 2015

[3] SreeMadhubala J, Umamakeshwari A, JenitaAmali Rani B, "A Survey on technical approaches in fall detection", National Journal of Physiology, Pharmacy and Pharmocology, 2015

[4] Syed Farooq Ali, Reamsha Khan, Arif Mahmood, Malik Tahir Hassan and Moongu Jeon, "Using Temporal Covarience of Motion and Geometric Features via Boosting for Human Fall Detection", sensors,2018,doi:10.3390/s18061918.

[5] Manuel Martinez, Lukas Rybok and Rainer Stiefelhagen, "Action Recognition in Bed using BAMs for assisted living and elderly care", 14th IAPR International Conference on Machine Vision Applications (MVA), May 18-22, 2015, Miraikan, Tokyo, Japan.

[6] Hamid Rajabi, ManoochehrNahvi, "An Intelligent Video Surveillance System for Fall and Anesthesia Detection for Elderly and Patients", 2nd International Conference on Pattern Recognition and Image Analysis (IPRIA 2015) March 11-12, 2015.

[7] Omar Aziz, JochenKlenk, Lars Schwickert, Lorenzo Chiari, Clemens Becker, Edward J.Park, Greg Mori and Stephen N.Robinovitch, "Validation of accuracy of SVM-based fall detection system using real-world fall and non-fall datasets", https://doi.org/10.1371/journal.pone.0180318.

[8] Mai Nadi, Nashwa EI-Bendary, Hamdi Mahmoud and Aboul Ella Hassanien, "Fall Detection System of elderly people based on integral image and histogram of oriented gradient feature", International Conference on Hybrid Intelligence Systems(HIS), IEEE,2014.

[9] KhosroRezaee, JavadHaddadnia, Ahmad Delbari, "Intelligent Detection of the Falls in the Elderly using Fuzzy Inference System and Video based Motion Estimated Method", 8th Iranian Conference on Machine Vision and Image Processing (MVIP), IEEE, 2018.

[10] Miao Yu, Adel Rhuma, Syed Mohsen Naqvi, "A posture Recognition Based Fall Detection System for Monitoring an Elderly Person in a Smart Home Environment", IEEE Transactions on Information Technology in Bio Medicine, Vol.16, No.6, November 2012.

[11] VivekVeeriah, Naifan Zhuang, Guo-Jun Qi, "Differential Recurrent Neural Networks for Action Recognition", IEEE Explore, ICCV.

[12] MirtoMusci, Daniele De Martini, Nicola Blago, TullioFacchinetti and Macro Piastra, "Online Fall Detection using Recurrent Neural Network", arXiv:1804.0497 [cs.CY] 13 Apr 2018.

[13] Ahmed NaitAicha, Gwenn Englebienne, Kimberley S. van Schooten, MirjamPijnapples and Ben Krose, "Deep Learning to Predict Falls in older Adults Based on Daily –Life Trunk Accelerometry", Sensors, 2018, 18, 1654, doi:10.3390/s18051654.

[14] Adrian Nunez-Macros, GorkaAzkune, and Ignacio Arganda-Carrearas, " Vision – Based Fall Detection with Convolutional Neural Networks", Hindawi, Wireless Communications and Mobile Computing, Vol.2017, Article ID 9474806.

[15] Deepika Singh, ErincMerdivan, IsminiPsychoula, Johannes Kropf, StenHanke, Matthiedu Geist and Andreas Holzinger, "Human Activity Recognition Using Recurrent Neural Network", IFIP International Federation for Information Processing, Springer, 2017, Doi: 10.1007/978-3-319-66808-6_18.

[16] Chi Chuntian, "Fall Detection for Elders in Indoor Environment using WiFi Signals", Thesis, Camford Royal School, Beijing, China, September 2017.

IoT based Smart Technology for Post-Harvest Handling in Agro Industry

Jaichandran R[1], R. Prabha[2], Karunakaran A[3], S. Hemavathi[4], A.Anushya[5]
{rjaichandran@gmail.com[1], r.praba05@gmail.com[2], karunakaran.a@ritchennai.edu.in[3], hemavathi.cse@sairam.edu.in[4], anushya.alpho@gmail.com[5]}

[1]Professor, Department of Computer Science and Engineering, Aarupadai Veedu Institute of Technology, Vinayaka Missions Research Foundation (Deemed to be University), Chengalpattu, India
[2]Associate Professor, Department of Electronics and Communication Engineering, Sri Sairam Institute of Technology, Chennai, India
[3]Assistant Professor, Department of Electronics and Communication Engineering, Rajalakshmi Institute of Technology, Chennai, India
[4]Assistant Professor, Department of Computer Science and Engineering, Sri Sairam Engineering College, Chennai, India
[5]Assistant Professor, Department of Computer Science, St. Jerome's College, Nagercoil, India

Abstract. The Smart innovation application is growing quickly in the agro-modern areas. The goal of this exploration was to plan and build up an ideal and versatile framework for post-reap taking care of tomatoes agro-industry. In this analysis, the Internet of Things (IoT) was added, in particular the distant detecting to anticipate the reap sum and creation limit. Prior to carrying out IoT, the viewpoint was dissected utilizing geo-handling strategy. Analysis tests utilized an arbitrary network dependent on Tamilnadu. In this exploration, temperature and stickiness, and precipitation were analysis at 5 focuses. These sensors have given information routinely each day to 30 days. The outcomes showed that for 24 example points of the size of 2.5 m x 2.5 m, the normal gather was 8.62 kg/m2 and the anticipated efficiency was 13.79 ton/ha. The framework could foresee precisely the collect sum and creation limit with respect to an exactness pace of 89.35%. This strategy can be utilized and addresses agribusiness through advanced development utilizing shrewd agro-mechanical innovation. For future exploration, this strategy can be proceeded for post-collect taking care of utilizing Android Operating Systems..

Keywords: Smart technology, IoT, Sensors, spatial analysis, Post-harvesting, prediction.

1 Introduction

Right now, agrarian cropland can be chosen dependent on its territory appropriateness utilizing exactness farming (Seminar, 2016). A portion of the advances that have been created are distant detecting and Geographic Information Systems (GIS) (1). Both of these innovations give arrangements and comfort in persistent investigation with a generally wide inclusion region (2). The elaboration between far off detecting and GIS by considering a viewpoint is relied upon to introduce keen horticulture through computerized advancement.

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The all out collect expectation of agro-mechanical wares is required in arranging, dynamic, and vital arrangement for food security (3). One of wares that needs extraordinary consideration system is tomatoes (Solanum tuberosum L). It is an item that has the potential and possibilities to help enhancement for accomplishing economical food security (4). Tomatoes is the fourth biggest food agro-modern ware in Tamilnadu with is filling great in the natural temperature of 15.6 – 18.30C, dampness of 80-90% and precipitation of 300 mm/month (5-9). In view of information from the Tamilnadun Central Statistics Bureau in 2019, the 5 areas with the most tomato creation are appeared in Table 1.

2 Related Study

The Internet of Things (IoT) stage can enhance the activity of accuracy farming (6-9). IoT can be utilized to oversee creation, and streamline crop nature of agro modern items (10,11). The information is recovered by distant detecting at that point went into an AI calculation. Nonetheless, it didn't talk about the sort of sensor utilized. Data expressed that exactness horticulture upholds with IoT and food security endeavors can possibly prompt autonomous farming. Nonetheless, the investigation didn't clarify the IoT execution.

Execution assessment and use of dynamic to increase agro-modern production requires a Decision Support System (DSS) (12-16). An IoT-based DSS has been created. In their exploration, temperature, and environment information were gathered utilizing the IoT. They utilized the IoT Node MCU stage, the DHT11 mugginess sensor, and a temperature sensor. Other exploration identified with shrewd farming has been led by Kiani and Seyyedabbasi (2018). The primary target of their exploration was to decrease water consumption while expanding rural profitability. In any case, this investigation didn't talk about analysis in the agro-business.

3 Research Methods

In this analysis, a computerized guide of the area organizes (X, Y) is handled. The layer stacking result and mathematical pictures decide cropland appropriateness. The spans utilized were 5 classes

Boundary for research study
Temperature, Mositure, and Rainfall

Research analysis Framework
Information assortment utilizing SHT15 temperature and moistness sensor with a solitary chip of an adjusted advanced yield (exactness ± 0,4 @ 5–40° C) with a 2.5 V force supply. The sensor will send information in *.dat expansion structure each 60 minutes. The information was handled from the sensor into a temperature, stickiness, and precipitation map. Subsequent to deciding the most appropriate arrange area, at that point the aggregate reap forecast is prepared. This cycle requires information on the current absolute reap from each facilitate focuses, drone readiness, picture handling, and picture procurement. The forecast results were at that point contrasted and the current yields.

The structural framework was planned into 2 primary exercises, specifically cropland appropriateness, and aggregate gather expectation. The structural framework in
anticipating absolute reap with IoT.

4 Information Collection and Analysis

Information were gathered from 5 areas in Dharmapuri, Salem, Krishnagiri, Dindigul, and Coimbatore (Tamilnadu) to decide a fitting exploration test. This analysis chose dependent on the biggest number of creations. The point of view was dissected utilizing analysis.

Examination variable

The effect of environmental change on cropland reasonableness is vital to economical agribusiness (Worqlul et al. 2019). In view of their examination, Peter and Messina (2020) proposed the variables that influence cropland appropriateness are temperature and precipitation. In expansion, Tesfay et al. (2017) found the slant profile, soil type, and dampness are additionally significant factor of cropland appropriateness.

5 Results And Discussion

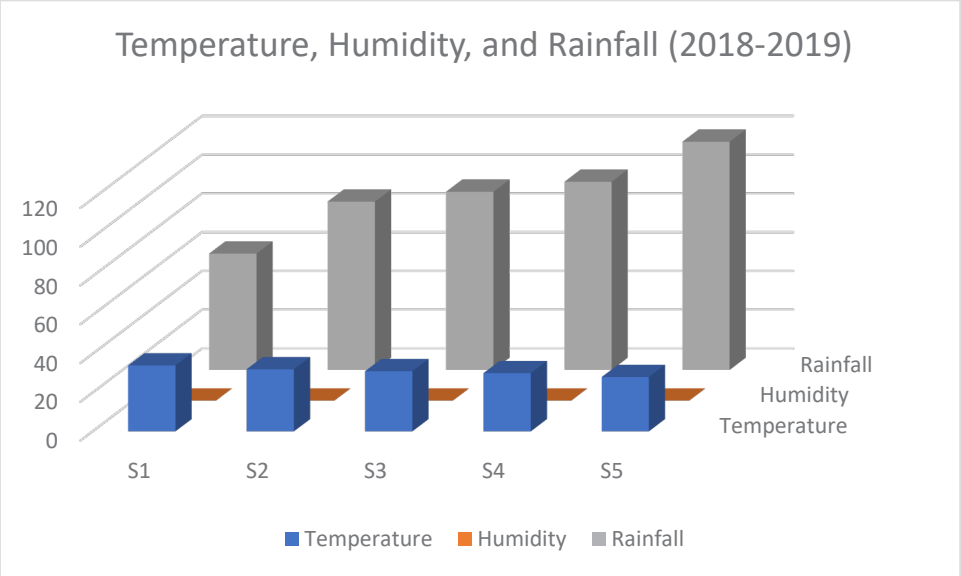
Spatial analysis of data reveal the exact prediction of product production from 5 districts in Dharmapuri, Salem, Krishnagiri, Dindigul, and Coimbatore (Tamilnadu). This study selected based on the largest number of tomato product productions.

Parameters like temperature, humidity, and rainfall are varies with district along with their yield. The higher temperature causes loss in production where lower temperature cause minimal yield during production. Optial temperature were noted with higher yield throught year. Similarly humidity and rainfaill also plays significant roles in production (Table 1 and Figure 1)

Table 1. Value of temperature, humidity, and rainfall (2018-2019)

Sample code	**Temperature**		**Humidity**		**Rainfall**	
	0C	**Value**	**Percentage**	**Value**	**mm/ Yearly**	**Value**
S1	34	4	65 – 70	4	60.00	5
S2	32	3	70 – 75	4	86.83	5
S3	31	3	75 – 80	3	91.92	4
S4	30	2	70 – 80	3	97.08	4
S5	28	2	85 – 90	2	117.75	2

Figure 1. Temperature, Humidity and Rainfall (2019-2020)

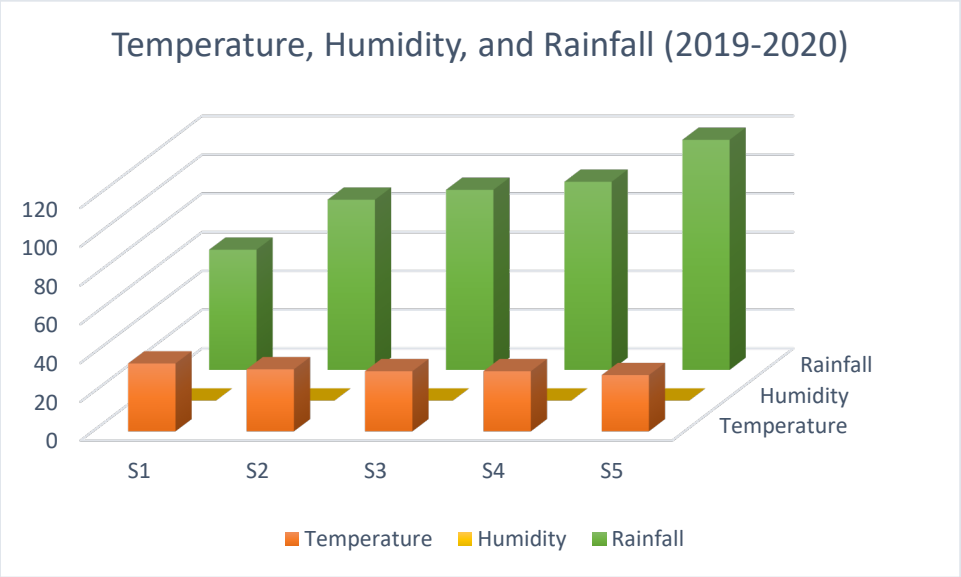


Parameters like temperature, humidity, and rainfall are varies with district along with their yield. The higher temperature causes loss in production where lower temperature cause minimal yield during production. Optial temperature were noted with higher yield throught year. Similarly humidity and rainfaill also plays significant roles in production (Table 2 and Figure 2)

Table 2. Value of temperature, humidity, and rainfall (2019-2020)

Sample code	**Temperature**		**Humidity**		**Rainfall**	
	0C	**Value**	**Percentage**	**Value**	**mm/ Yearly**	**Value**
S1	35	4	65 – 70	4	62.00	5
S2	32	3	75 – 75	4	87.83	5
S3	31	3	70 - 80	3	92.92	4
S4	31	2	75 - 80	3	97.08	4
S5	29	2	85 - 90	2	118.75	2

Figure 2. Temperature, Humidity and Rainfall (2019-2020)



Predicton of yield in various district using IoT based sensor and grid helps farmer do farming according with different plant varieties. Here comparison made between 2018- 2019 and 2019-2020 which reveals the productivity prediction with harvest area and also total productions.

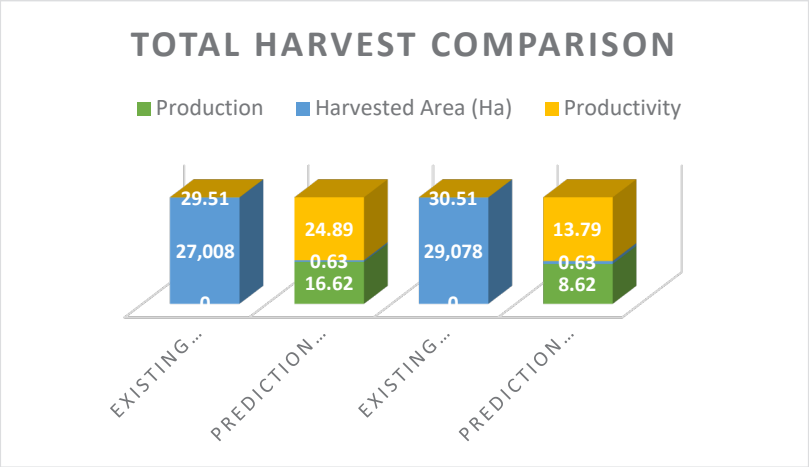
Table 3. The total harvest comparison (2018-2019)

Comparison	**Existing condition**	**Prediction of the total harvest**
Production (tons)	7,87,180	16.62
Harvested Area (Ha)	27,008	0.63
Productivity (m.tons/Ha)	29.51	24.89

Table 4. The total harvest comparison (2019-2020)

Comparison	**Existing condition**	**Prediction of the total harvest**
Production (tons)	8,87,080	8.62
Harvested Area (Ha)	29,078	0.63
Productivity (m.tons/Ha)	30.51	13.79

Figure 3. Total Harvet Comparison



The partition of locales utilizing multi-thresholding was then shown in the division results. Where district 1 is the foundation picture, and locale 2 was the potato leaf picture. In the wake of handling the pixel rate information for every district, the collect examples were gauged. The normal example weight was 8.62 kg or has profitability of 1.38 kg/m2 (13.79 tons/ha)

Conclusion

In view of 5 example focuses with a normal zone of 2.5m x 2.5m, the normal all out gather was 8.62 kg per m2. A correlation of existing conditions with expectations utilizing IoT and examination can be found in Table 3 and 4.

The Web Ontology Language (WOL) design in the semantic web utilizing - transient factors, just as introduction and collection strategies on measurements, can additionally improve the exactness of forecasts (13-17). Keen System joined with DSS can foresee all the more precisely collect time, holding up time, and ideal course assurance in the agro-modern area (6-9). The exactness got in this examination, as indicated by Dewi and Muslikh (2013), is acceptable since it was higher than 80%. This exploration has affirmed that an IoT based keen agro-mechanical innovation and examination can anticipate collect volume and efficiency with a superior exactness rate (17-22).

References

[1] Antony AP, Leith K, Jolley C, Lu J, Sweeney DJ. 2020. A review of practice andimplementation of the internet of things (IoT) for smallholder agriculture. *Sustainability.* 12(9):1-19.

[2] Araby AA, AbdElhameedMM, Magdy NM, Said LA, Abdelaal N, Abd Allah YT, DarweeshMS, Fahim MA, MostafaH. 2019. Smart IoT Monitoring System for Agriculture with Predictive Analysis. *Proceedings of 8th International Conference on Modern Circuits and Systems Technologies,* Thessaloniki, Greece. 13-15 May 2019.

[3] Backhausen JE, Klein M, Klocke M, Jung S, ScheibeR. 2005. Salt tolerance of potato (SolanumtuberosumL .var . Desire) plants depends on light intensity and air humidity. *Plant Science.* 169(1): 229-237.

[4] Dewi C and MuslikhM. 2013.PerbandinganAkurasiBackpropagation Neural NetworkdanANFIS Untuk Memprediksi Cuaca. *Journal of Scientific Modeling& Computation.*1(1):7-13. FoughaliK, Fathallah K, and Frihida A.2019.A Cloud-iot based decision supportsystemfor potato. *Procedia Computer Science.*160(1):616-623.

[5] Foughali K, Fathallah K, and Frihida A. 2018. Using Cloud IOT for disease prevention in precision agriculture. *Procedia Computer Science.* 130(1): 575-582.

[6] HouX, Li R, He W, Ma K. 2020. Effects of planting density on potato growth, yield, and water use efficiency during years with variablerainfall on the Loess Plateau, China. *Agricultural Water Management.* 230(11): 1-9.

[7] Kardiyono, Marimin, Indastri NS, Yuliasih I, Pramuhadi G. 2018. Strategipeningkatanproduktivitasdankualitaskedelailokaldenganpendekatanproduktivitashijau. *JurnalTeknologiIndustriPertanian.* 28(3): 342-353.

[8] Kiani F and Seyyedabbasi A. 2018. Wireless sensor network and Internet of Things in precision agriculture. *International Journal of Advanced Computer Science and Applications.* 9(6): 99-103.

[9] Kuyu CG, Tola YB, and Abdi GG. 2019. Study on post-harvest quantitative and qualitative losses of potato tubers from two different road access districts of Jimma zone , South West Ethiopia. *Heliyon.* 5(7): 1-7.

[10] Liu W, Huang Y, Ye Z, Cai W, Yang S, Cheng X. 2020. Renyi's Entropy Based Multilevel Thresholding Using a Novel Meta-Heuristics Algorithm. *Applied Sciences.* 10(1): 1-18.

[11] MarcuI,VoicuC,DragulinescuAMC,FratuO,Suciu G, Balaceanu C, Andronache MM. 2019. Overview of IoT basic platforms for precision agriculture. *Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering.* 283(3):124- 137.

[12] NellisMD,PriceKP,andRundquistD.2008.Remote Sensing of Cropland Agriculture. In *The SAGE Handbook of Remote Sensing*. University of Nebraska - Lincoln. pp.368–383.

[13] Peter BG and Messina JP. 2020. Crop climate suitability mapping on the cloud : a geovisualization application for sustainable agriculture. *Scientific Reports*:1-17.

[14] Rad C-R, Hancu O, Takacs I-A, Olteanu G. 2015. Smart Monitoring of Potato Crop: A Cyber-Physical System Architecture Model in the Field of Precision Agriculture. *Agriculture and Agricultural Science Procedia.* 6(1): 73-79.

[15] Raja S, Govindakrishnan P, and Chakrabarti S. 2020. A Review: A Framework for Yield Improvement in Kharif/Rainy Season Potato in the Low Land Tropics. *Acta Horticulturae et Regiotecturae.* 23(1): 44-55.

[16] Rykaczewska K. 2017. Impact of heat and drought stresses on size and quality of the potato yield. *Plant Soil Environment.* 63(1): 40-46.

[17] Sugiharyanto S. 2017. Prospek Pengembangan Budidaya Tanaman Kentang di Indonesia. *Geomedia: Majalah Ilmiah dan Informasi Kegeografian.* 6(2): 43-52.

[18] Tervonen J. 2018. Experiment of the quality control of vegetable storage based on the Internet-of-Things. *Procedia Computer Science.* 130: 440-447.

[19] Tesfay T, Biedemariam M, Hagazi M, Hailu TG. 2017. Land Capability and Suitability Evaluation for Rain-fed Crops in Semi-arid Lowland Area of North. *An International Journal of Plant Research.* 30(3): 1-5.

[20] Voss RE, Baghott KG, and Timm H. 2004. Proper Environment for Potato Storage. *Vegetable Research and Information Center.* 3(1): 1-3.

[21] Wang Y, Naber MR, and Crosby TW. 2020. Effects of wound-healing management on potato post-harvest storability. *Agronomy.* 10(4): 1-17.

Comparative Studies on Indian Population using Data Mining Tools

A.Saravanan[1], Gurpreet Singh[2], Su. Suganthi[3], P. Perumal[4], Amanpreet Kaur[5]
{saran200579@gmail.com[1], myselfgurpreet@gmail.com[2], suganthi.ece@sairamit.edu.in[3], perumalsrec@gmail.com[4], aman_preet_k@yahoo.co.in[5]}
[1]Principal & Professor, SMK Fomra Institute of Technology, Chennai, India
[2]Associate Professor, Department of Computer Science and Engineering, Punjab Institute of Technology (A Constituent College of MRSPTU), Rajpura, Punjab, India
[3]Associate Professor, Department of Electronics and Communication Engineering, Sri Sairam Institute of Technology, Chennai, India
[4]Professor, Department of Computer Science and Engineering, Sri Ramakrishna Engineering College, Coimbatore, India
[5]Associate Professor, University Institute of Engineering, Chandigarh University, Gharaun, District Mohali, Punjab, India

Abstract. In the following ten years India will beat China as the most crowded country on the planet because of its high preparation and energetic individuals. Constantly 2025 every nation will have an expected 1.5 billion individuals. India contrasts regarding everybody of the ignorant conventional individuals with a wide assortment of youngsters as a rule and instructed metropolitan ladies with under 1.5 kids and the extraordinary variety between nations. We show that overall population insights are generally reliant on how these distinctions are consolidated into the disparities in the human hypothesis model utilized. The customary model of hypothesis, which just thinks about the age and sexual direction of society in general, benefits broadened individuals not exactly the equivalent standard utilized at the global level accepts that in time the high extent adds more weight, accordingly utilizing higher qualities for more individuals. Conflicting outcomes rise out of the speculations guessed to get ready for the distinction as far as the manner by which over the long haul the degree of ladies who are additionally empowered by low-level develops, subsequently advancing lower-than-anticipated turn of events. To take care of this issue totally, we built up a five-dimensional model of the Indian populace overall by country, country/metropolitan territory, age, sex, and level of control and showed the impacts of different degrees of grouping. Moreover we offer HR conditions to all Indian contacts proposing that India will before long gain the absolute most created nations in Asia if another speed of groundwork for extension is kept up.

Keywords: Population, instruction, rate of birth, relocation rate, yearly change.

1 Introduction

India is a low-lying mainland that incorporates an assorted populace of individuals whose pockets change by language, character, religion and stance (1-5). While some portion of this variety is topographically communicated and can be accomplished by separating among districts and metropolitan regions just as broad provinces, various classes (like standing) exist in pretty much every locale. As authentic data will be accessible for true focuses, the nearest qualification can be gotten all the more adequately from genuine and unlimited sources. A part

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of the different wellsprings of heterogeneity can be acquired solely from explicit level information or a more offbeat division of enrollment information. As recently battled (6-9) and truth be told by Lutz and KC (10), the achievement pace of lighting and metropolitan/country region are the two most basic estimations of various age gatherings and sex that shroud social orders appropriate for isolation and ought to be utilized during reviews and presentations. Following this methodology, this examination utilizes segment information for every one of the 35 territories of India dependent upon the situation (age, sex, level of control, and city/neighborhood common habitat) (11-14).

The information utilized in this investigation comes from a progression of focuses from India's latest measurable focuses associations directed in 2001 and 2011. This particular definition has been created corresponding to crisis rates by associations from the Sample Registration Survey (SRS) with yearly information for the years 1999–2013 (15-16). This allows us to think about troublesome data, yet additionally to isolate models later in the year 1999.

2 Research Methodology

Indian population studied before 2020 and after 2020. List of year's used for study listed below (Table 1)

Table 1. List of year for study analysis

S.No	Before 2020	After 2020
1	2020	2020
2	2015	2025
3	2010	2030
4	2005	2035
5	2000	2040
6	1995	2045
7	1990	2050

Data source

Population information has been taken from public website for analysis. Dataset was obtained from the Worldometer website.

The Weka 3.8.9 has implemented to get the optimal solution of the above dataset. The below approaches have implemented and got optimal solution.

3 Results and Discussion

Dataset were obtained from worldometer website and analysed in different parameter. Results are predicted in yearly change, median age, fertility rate, urban population, Country's Share of World Pop (Table 1 -3 and Figure 1-2).

Table 2. India population before 2020 data

Year	Population	Yearly Change	Density (P/Km²)	Urban Population	World Population
2020	**1,380,004,385**	13,586,631	464	483,098,640	7,794,798,739
2015	**1,310,152,403**	15,174,247	441	429,069,459	7,379,797,139
2010	**1,234,281,170**	17,334,249	415	380,744,554	6,956,823,603
2005	**1,147,609,927**	18,206,876	386	334,479,406	6,541,907,027
2000	**1,056,575,549**	18,530,592	355	291,350,282	6,143,493,823
1995	**963,922,588**	18,128,958	324	255,558,824	5,744,212,979
1990	**873,277,798**	17,783,558	294	222,296,728	5,327,231,061

Table 3. India population Before 2020 with other variables

Year	Yearly % Change	Median Age	Fertility Rate	Urban Pop %	Country's Share of World Pop
1990	2.17%	21.1	4.27	25.50%	16.39%
1995	1.99%	21.8	3.83	26.50%	16.78%
2000	1.85%	22.7	3.48	27.60%	17.20%
2005	1.67%	23.8	3.14	29.10%	17.54%
2010	1.47%	25.1	2.8	30.80%	17.74%
2015	1.20%	26.8	2.4	32.70%	17.75%
2020	0.99%	28.4	2.24	35.00%	17.70%

Figure 1. India population before 2020 data

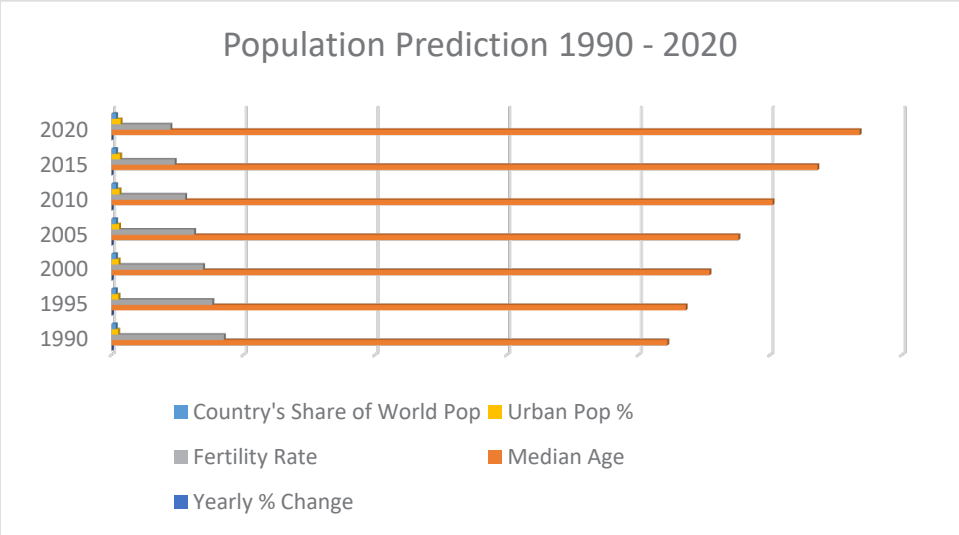


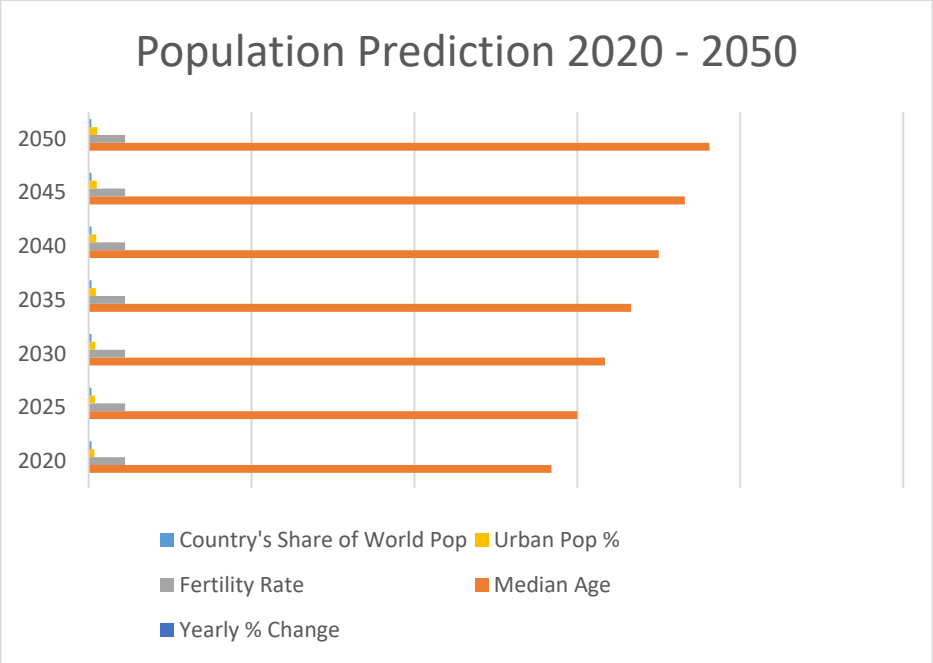
Table 4. India population after 2020 data

Year	Population	Yearly Change	Density (P/Km²)	Urban Population	World Population
2020	**1,380,004,385**	13,970,396	464	483,098,640	7,794,798,739
2025	**1,445,011,620**	13,001,447	486	542,742,539	8,184,437,460
2030	**1,503,642,322**	11,726,140	506	607,341,981	8,548,487,400
2035	**1,553,723,810**	10,016,298	523	675,456,367	8,887,524,213
2040	**1,592,691,513**	7,793,541	536	744,380,367	9,198,847,240
2045	**1,620,619,200**	5,585,537	545	811,749,463	9,481,803,274
2050	**1,639,176,033**	3,711,367	551	876,613,025	9,735,033,990

Table 5. India population after 2020 with other variables

Year	Yearly % Change	Median Age	Fertility Rate	Urban Pop %	Country's Share of World Pop
2020	1.04%	28.4	2.24	35.00%	17.70%
2025	0.92%	30	2.24	37.60%	17.66%
2030	0.80%	31.7	2.24	40.40%	17.59%
2035	0.66%	33.3	2.24	43.50%	17.48%
2040	0.50%	35	2.24	46.70%	17.31%
2045	0.35%	36.6	2.24	50.10%	17.09%
2050	0.23%	38.1	2.24	53.50%	16.84%

Figure 2. India population after 2020 with other variables



Output gave fragmentary speculations on India's destiny corresponding to the destiny of communicating estimations across the planet. We have shown that various degrees of adapting to unrivaled actual work change the manner in which we see the future (Tables 2 and 4). There is no open interior and outer recommendation that can be settled, and we propose following Long's dynamic (8) plan to join those guidelines that illuminate clients and that there is motivation to look. While age and sexual orientation are obviously included by numerous segment makers, we accept that arrangement ought to be also recalled considering its introduction of preparation for death (10, 16), all methodologies and subtleties are opened promptly, and future schooling courses are led at a tremendous premium through their endeavors as a public HR image. future and improvement abilities (17, 18).

Since freedom, India has seen an emotional expansion in the size of its populace as a rule, an increment of 3.6 percent to date. All things considered, it was being told by the first class, most individuals and the ladies were evidently unconcerned with the preparation. All things considered, by 1990, 70% of more established ladies had never been to any school, which is the place where the requirement for administrations dropped to 46% today. Similarly, the rate for more seasoned ladies with an advanced education has expanded from 3 to 7%. In this way, the creating years have seen quick improvement in bearing, and the presence of solid accomplices demonstrates that India is set for additional development. Among created ladies matured 15-19 today, just 14% don't have formal preparing, and as of now 65% have finished next to zero progressed preparing. Given the normal affirmation of a more extensive meaning of administration, the advantages from monetary destitution and monetary improvement to flourishing and success in a hierarchical setting and an enormous piece of government administration (18-22) propose conceivable future renewal of new human turn of events. Notwithstanding, our examination additionally shows that, if the augmentation of the organization could be deferred soon, some portion of the potential advantage would be lost (23).

Conclusion

Where does this leave us as for association of the world's two billion or more people groups? Since India has fundamentally positioned resources into broad direction since the 1950s, it is around three to forty years before India to the degree HR. In reality, the mentoring pyramid of India today emits an impression of looking like that of China around 1980. Moreover, the one projection given here for India in 2050 appears, apparently, to take after that of India today. While social and institutional elements may separate between the two nations, and there can be no ideal relationship, this evaluation makes it look likely that India will encounter correspondingly smart HR driven progress as India has all through the last three to forty years. this assessment makes it look likely that India will experience correspondingly snappy HR driven headway as India has throughout the last three to forty years.

References

[1] National Informatics Centre. (2007) Economic Survey 2006-2007: 9.4 State-wise literacy rates (1951-2001) (National Informatics Centre, Ministry of Finance, New Delhi). Available at https://www.indiabudget.gov.in/es2006-07/chapt2007/tab94.pdf. Accessed December 7, 2017.
[2] Cassen R. (1995) Review of the "Second India" revisited: Population, poverty, and environmental stress over two decades. PopulDev Rev 21:163–170.
[3] James KS. (2011) India's demographic change: Opportunities and challenges. Science 333:576–580.
[4] Haub C, Sharma OP. (2006) India's Population Reality: Reconciling Change and Tradition (Population Reference Bureau, Washington, DC).
[5] Lutz W, Scherbov S. (2004) Probabilistic population projections for India with explicit consideration of the education-fertility link. Int Stat Rev 72:81–92.
[6] Vaupel JW, Yashin AI. (1985) Heterogeneity's ruses: Some surprising effects of selection on population dynamics. Am Stat 39:176–185.
[7] Rogers A. (1995) Population forecasting: Do simple models outperform complex models? Math Popul Stud 5:187–202, 291.
[8] Long JF. (1995) Complexity, accuracy, and utility of official population projections. Math Popul Stud 5:203–216.
[9] Lutz W, Goujon A, Doblhammer-Reiter G. (1998) Demographic dimensions in forecasting: Adding education to age and sex. PopulDev Rev 24:42–58.
[10] Lutz W, KC S. (2010) Dimensions of global population projections: What do we know about future population trends and structures? Philos Trans R SocLond B BiolSci 365:2779–2791.
[11] Bhat PM. (2002) Returning a favor: Reciprocity between female education and fertility in India. World Dev 30:1791–1803.
[12] KC S, Speringer M, Wurzer M. (2017) Population projection by age, sex, and educational attainment in rural and urban regions of 35 provinces of India, 2011-2101: Technical report on projecting the regionally explicit socioeconomic heterogeneity in India (International Institute for Applied Systems Analysis, Laxenburg, Austria).
[13] Sobotka T, Lutz W (2011) Misleading policy messages derived from the period TFR: Should we stop using it? Comp Popul Stud-Z FürBevölkerungswissenschaft 35:637–664.
[14] ORGI. (2014) Sample registration system statistical report 2013 (Office of Registrar General of India, New Delhi).
[15] USAID (2006) Demographic and health survey India 2005/2006 (ICF International, Rockville, MD). Available at www.dhsprogram.com/Data/. Accessed June 4, 2016.
[16] Lutz W, Butz WP, KC S (2014) World Population and Human Capital in the Twenty-First Century (Oxford Univ Press, Oxford).
[17] Lutz W (2017) Global sustainable development priorities 500 y after Luther: Sola scholaetsanitate. ProcNatlAcadSci USA 114:6904–6913.
[18] Lutz W, Cuaresma JC, Sanderson W (2008) Economics. The demography of educational attainment and economic growth. Science 319:1047–1048.
[19] Lutz W, Cuaresma JC, Abbasi-Shavazi MJ (2010) Demography, education, and democracy: Global trends and the case of Iran. PopulDev Rev 36:253–281.
[20] Lutz W, Muttarak R
[21] (2017) Forecasting societies' adaptive capacities through a demographic metabolism model. Nat Clim Chang 7:177–184.
[22] Pamuk ER, Fuchs R, Lutz W (2011) Comparing relative effects of education and economic resources on infant mortality in developing countries. PopulDev Rev 37:637–664.
[23] Cutler DM, Lleras-Muney A (2010) Understanding differences in health behaviors by education. J Health Econ 29:1–28.
[24] Wittgenstein Centre for Demography and Global Human Capital (2015) Wittgenstein Centre Data Explorer. Version 1.2. Available at www.wittgensteincentre.org/dataexplorer/. Accessed September 26, 2017.

A Novel Computational Rough Set Based Feature Extraction For Heart Disease Analysis

Dr.R.Prabha[1], G.A.Senthil[2], Dr.A.Lazha[3], Dr.D.VijendraBabu[4], ,Ms.D.Roopa[5]
{r.praba05@gmail.com[1],, senthilga@mail.com[2], lazhadinesh@gmail.com[3],
drdvijendrababu@gmail.com[4], roopa.cse@sairamit.edu.in[5]}

Associate Professor,,SriSairam Institute of Technology, Tambaram, Chennai[1], Research Scholar, Vels Institute of Science, Technology & Advanced Studies, Chennai[2], MD(S) Reader, Dept of UdalThathuvam, Sri Sairam Siddha Medical College & Research Centre, Chennai[1]., Professor & Vice Principal, Aarupadai Veedu Institute of Technology, Vinayaka Mission's Research Foundation[4], Assistant Professor, Sri Sai Ram Institute of Technology, Tambaram, Chennai[5]

Abstract. Cardiovascular disease is the most difficult disease to diagnose in the medical field. The diagnosis is often contingent on a judgment based on the grouping of vast amounts of clinical and pathological data. As a result of this complication, a number of researchers have based their efforts on determining the most cost-effective and accurate way to predict heart disease.In the case of heart disease, an accurate diagnosis at an early stage is critical, since time is of the essence when heart disease is detected at an inopportune time. Machine learning has evolved in recent years with a plethora of accurate and supporting resources in the medical domain, and it has offered the best support for predicting disease with proper training and research. The main goal of this study is to use a rough computational intelligence approach to find specific heart disease features among a large number of features. The output of the proposed feature selection method outperforms that of conventional feature selection approaches. The rough computation approach's output is evaluated using various heart disease data sets and checked using real-time data sets.

Keywords: Please list your keywords in this section.

1 Introduction

Based on clinical evidence generated by patients, a heart disease prediction system will assist medical professionals in predicting the condition of the heart. When it comes to diagnosing a patient's heart disease, doctors may still make mistakes [1][14]. As a consequence, in order to obtain reliable outcomes, heart disease prediction systems employ machine learning algorithms. The use of adequate therapy and medications is needed for early detection and proper diagnosis of heart disease. Machine learning techniques have the ability to greatly assist in medical diagnosis[2]. For heart disease prediction, various supervised machine learning methods such as decision trees, support vector machines, naive bayes, random forests, and neural networks can be used, and all must be evaluated in terms of output[3][13].

Diabetes, a family history of heart disease, smoking, obesity, high cholesterol, and low cholesterol are all major risk factors for heart disease. The biggest challenge in the health

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domain is to identify the key features that cause heart disease. The aim of this study is to define the key characteristics that are used to diagnose heart disease in order to solve the heart attack problem in a safe society [4]. In the healthcare industry, effective and reliable automated heart disease prediction systems can be useful for heart disease prediction. The number of tests a patient must take will be reduced as a result of this automation. As a result, it would save not only money but also time for both doctors and patients [5][6].

The best feature selection approach for finding the main features that cause heart disease is often critical for good heart disease prediction models. Principal component analysis, wavelet transformation, single value decomposition process, linear discriminant analysis, and minimum noise ratio methods have all been used to select key features from large dimensional textile data in previous studies[7][12][15]. To address the shortcomings of current approaches, a rough computational intelligence-based attribute selection algorithm is proposed to identify the key attributes that play a role in predicting heart disease. The rough set soft computing approach is used to determine the value of the attributes. With this detailed introduction Section 2 describes the design and procedure for proposed feature selection approach, Section 3 depicts the comparison results followed by conclusion in Section 4.

2 DESIGN AND IMPLEMENTATION

The theory, design, implementation, and creation of biologically and linguistically motivated computational paradigms is known as computational intelligence (CI). Rough Set, Neural Networks, Fuzzy Systems, and Evolutionary Computation have traditionally been the three four pillars of CI. Successful intelligent systems, such as medical and cognitive developmental systems, rely heavily on CI. The aim of this study is to use a rough set approach to create a good feature selection model.

2.1 Rough set attribute dependency

Rough set theory is a valuable data mining method. The definition of a simple rough collection has been expanded in several different ways in recent years. Rough set theory can be generalised in three ways: set-theoretic structure with non-equivalence binary relations; granule-based description with coverings; and subsystem-based definition with other subsystems[8]. The definition of rough set theory is depicted in Figure 1.

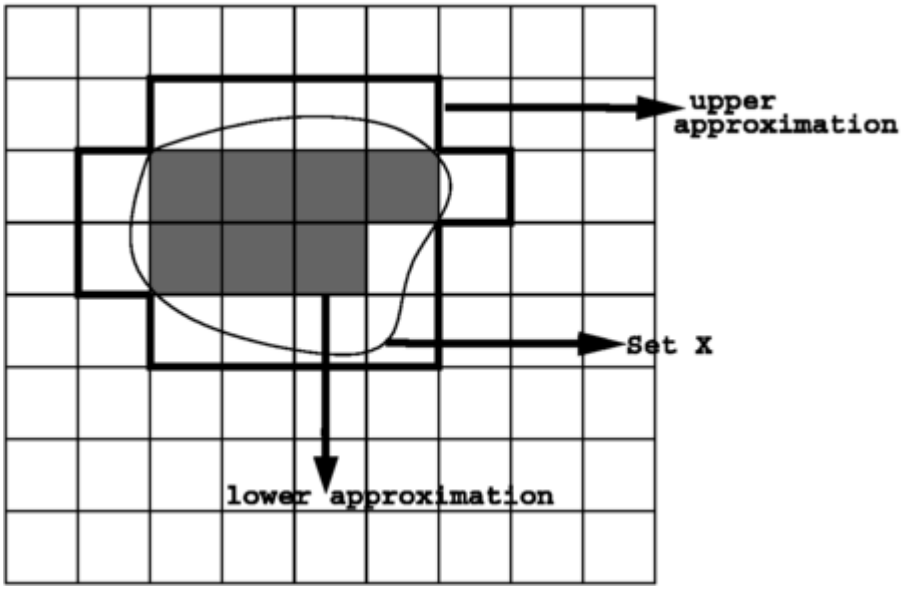

Figure 1. Rule generation using rough set

In a rough collection, attribute dependency can be described as the use of a combination of objects to determine the values of attributes. This determines how dependent the two attributes are on each other. Any attribute causes indistinguishability between the two rough sets. In rough sets, the principle of indiscernibility relation describes the relationship between a set of attributes[9]. The same indistinguishable artefacts may be described multiple times. The following is a list of attributes A that are dependent on attributes B:

$A \Rightarrow B$

Where the values of A's attributes are independently determined by the values of B's attributes. If there is a functional dependency relationship between them, A is entirely dependent on the values of B. Both A and B are subsets of each other, as seen by the functional dependence. If B is absolutely dependent on C, then with a degree of k, it can be written as $k(0 <= k <= 1)$ denoted by the positive region,

$A \Rightarrow_k B$

The degree to which x is dependent on A is determined by the value of k. If k=1, we can say that B is fully dependent on A, and if k<1, we can say that B is partially dependent on A. The degree of dependence is expressed by the k, which expresses the blocks of I/B with respect to A[10][11].

2.2 Rough set based feature selection procedure

Rough set theory's definition of reducts and core is used to evaluate the significant attributes. Finding redundant values or redundant attributes of a set becomes easier thanks to this indiscernibility relationship. Reductions are the various set approximation subsets of attributes that occur in minimal. A core is defined as the intersection of all the reductions to a set or a system considered, and it is the set of all the conditional attributes of set approximations that exist as a set. For instance, if A is a set of attributes, and r is a subset of$e$, then the diagram looks like this:

$A = (U, r, d)$ &$P_R(d) = P_C(d)$

where, core (e) defines all the conditional attributes, and $r(e)$ defines all the set of reducts of attribute e .One method for calculating these reducts or conditional attributes is to use

decision tables, which are dynamically generated. The attributes are listed in two ways in these decision tables: important and frequently. When attributes are replicated often, they are given the status of majority or significant, and the collection of attributes that tend to be common to the original sets in decision tables is given priority. The rough computational intelligence based attribute selection algorithm is proposed based on the rough set theory principles core and reduce.

Significant attributes can be described as the removal of unnecessary data from a decision table or information table without affecting other data in the table. As a result, the value of attributes is used to generalise the reduction of redundant attributes. Prior to determining the value of attributes, they must first be assessed. As a result, dispensability and indispensability are included in this assessment. A very similar interval [0,1] can also be used to achieve this.

By removing attributes from the attribute collection, the process of acquiring significant attributes in a decision table can be completed.For a set considered as $\beta(r, e)$ let the attribute be in a set. And when the attribute a is removed from the set $\beta(r, e)$ then it can be given as,

$\beta((r \Leftrightarrow a, e))$

Then by the above conditions and processes the significance of attributes can be given as by normalizing the basic difference in between the coefficient and the set obtained after removing the attribute i.e.$\beta(r, e)$ and $\beta((r \Leftrightarrow a, e))$ is given as below:

$\alpha(r,e)(a) = (\beta(r <=> a, e))/(\beta(r, e))$

Thus here, The coefficient $\alpha(a)$ is termed as error of classification. This error of classification in general occurs when the attribute is removed from the set considered. And so the significance of the attributes can be protracted by the other remaining attributes of a set and can be given as,

$\alpha(r,e)(x)=(\beta(r, e))<=> (\beta(r<=>x,e))/(\beta(r, e))$

Here, $\alpha(x)$ is given as the coefficient obtained from the extension of an attribute significance. Also x is considered as subset of r i.e. x is a reduct of the set of attributes in r. The attribute of any subsets x and r is deliberated as the reduct of r and so after removing the attribute this can be given as,

$\alpha(r,e)(x) = (\beta(r, e)) <=> \beta(x, e)/(\beta(r, e))$

Thus, $\alpha(r, e)$ is defined as the reduct approximation or error of reduct approximation which depicts the significance of attributes of x relatively in the set r. Via a classification method, the minimum error of approximation leads to an improvement in accuracy in a series. On heart disease data sets, the proposed Rough Computational Intelligence based Attribute Selection method is used to find the most important features that cause heart diseases in the health domain.

3 EVALUATION RESULTS

Using rough set techniques, a rough computational intelligence-based attribute selection algorithm is built in Matlab to find the significant attributes among the various conditional attributes. The attributes will be listed using the attribute significant value derived from the computational programme. The significance value of the Hungarian data set is shown in Table 1.

Table 1. Significance Value of Hungarian Data Set

Feature	**Value**
Age	0.6673
Sex	0.6216
Cp	0.6537
trestbps	0.6690
chol	0.6554
fbs	0.7795
restecg	0.6775
thalach	0.6486
Exang	0.9887
Oldpeak	0.6690
Slope	0.6673
Ca	0.6809
Thal	0.6758

The graphical representation of each heart disease feature's significance value with respect to Hungarian data sets is shown in Figure 2. The graph depicts the importance of each trait in the diagnosis of heart disease. Exang (exercise-induced angina) and fbs (fasting blood sugar) contribute significantly more than other factors. The attribute significant values of the Cleveland data set are shown in Table 2.

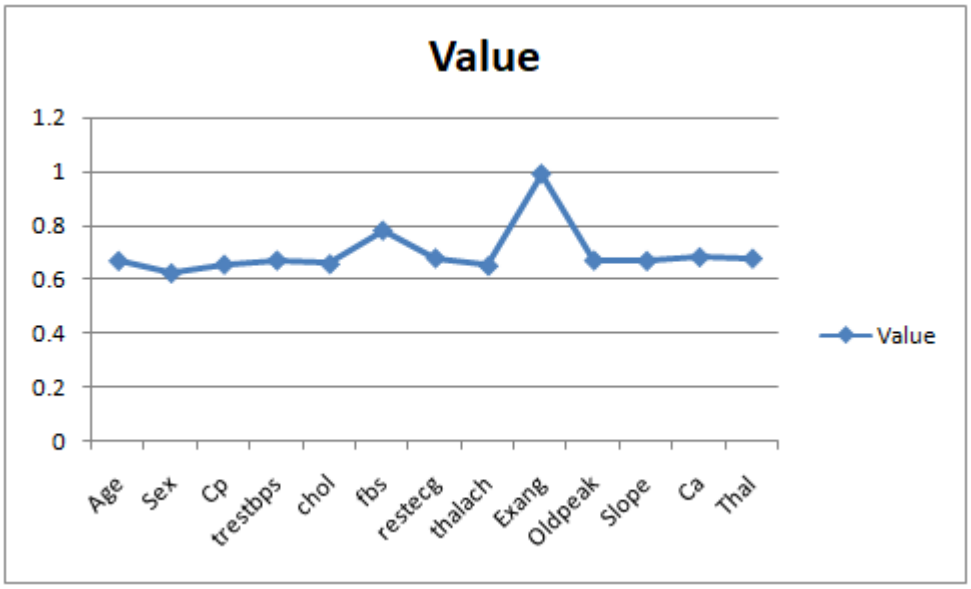

Figure 2. Hungarian Heart disease data set features with significance value.

The graphical representation of each heart disease feature's importance value in relation to Cleveland data sets is shown in Figure 3. The graph depicts the importance of each trait in the diagnosis of heart disease. Fasting blood sugar, exercise-induced angina, ca (number of main vessels), and resteog (resting electrocardiographic results) all play a bigger role in heart disease prediction than other factors.Based on the proposed procedure result analysis on Hungarian and Cleveland data set, Figure 4 shows that, the important attributes, are exang(exercise induced angina) ,fbs(fasting blood sugar),ca (number of major vessels),restecg (resting electrocardiographic results),thal,slope (the slope of the peak exercise ST segment),oldpeak (ST depression induced by exercise relative to rest) and trestbps (resting blood pressure).

Table 2. The attribute significant values of Cleveland data set.

Feature	**Value**
Age	0.5036
Sex	0.4856
Cp	0.4986
trestbps	0.5069
chol	0.4953
fbs	0.5564
restecg	0.5267

thalach	0.5069
Exang	0.5300
Oldpeak	0.5217
Slope	0.5267
Ca	0.5316
Thal	0.5250

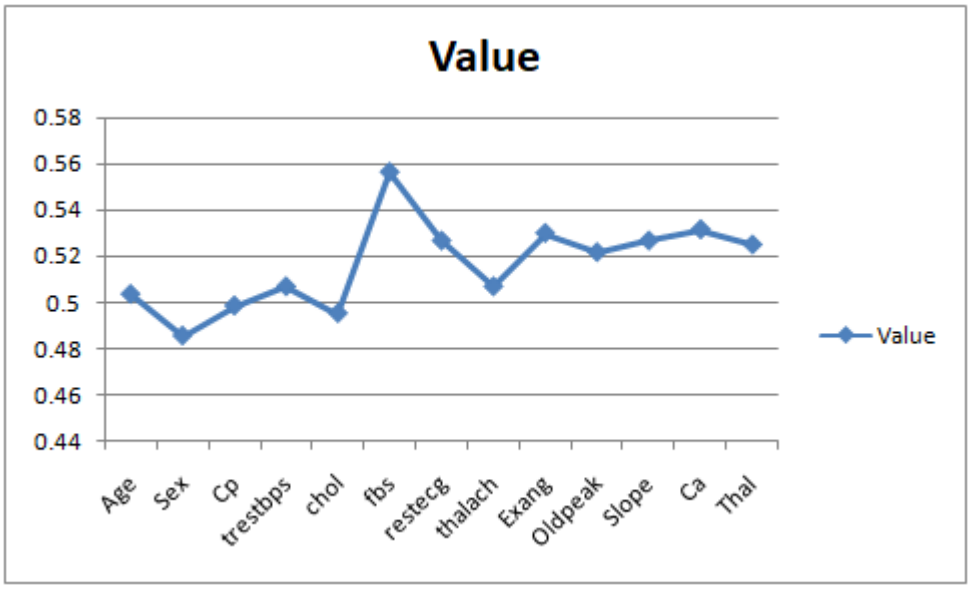

Figure 3. Cleveland Heart disease data set features with significance value

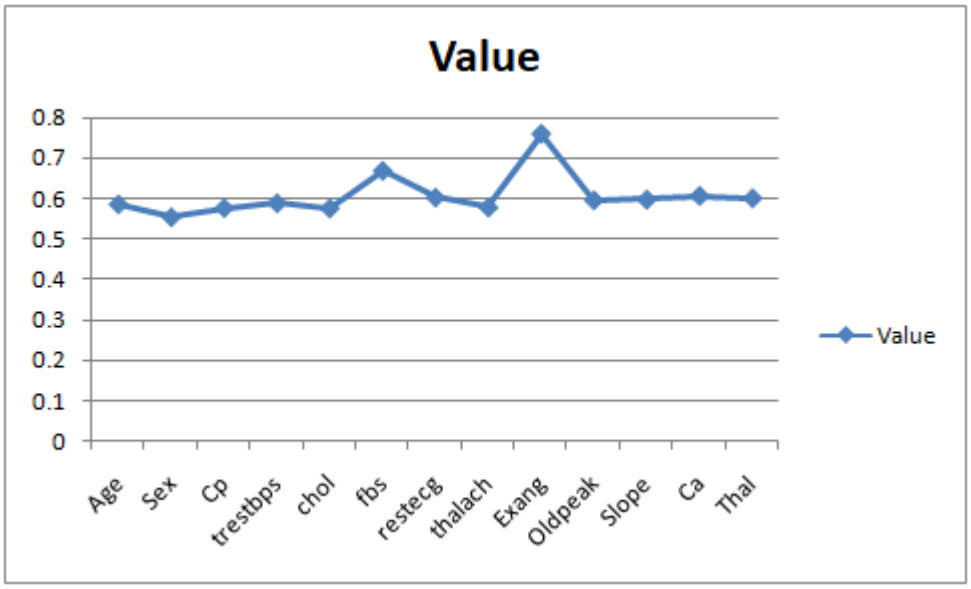

Figure 4. Significance of Features based on both the data sets

Based on the proposed algorithm result analysis on Hungarian and Cleveland data set, Figure 4. shows that, the significant attributes, are exang(exercise induced angina) ,fbs(fasting blood sugar),ca (number of major vessels),restecg (resting electrocardiographic results),thal,slope (the slope of the peak exercise ST segment),oldpeak (ST depression induced by exercise relative to rest) and trestbps (resting blood pressure).To predict heart disease, the significant attribute will be given to the data mining prediction algorithm. The main goal of this project is to solve the problem of dealing with high-dimensional data. In the health domain, the proposed algorithm is used to solve this problem.

4. CONCLUSION

Heart disease diagnosis is complex because it relies on the grouping of vast amounts of clinical and pathological data. A rough computational intelligence-based attribute selection algorithm is proposed to find significant heart disease features among the large number of features, and the algorithm's output is checked with important heart disease data sets Cleaveland and Hungarian. The proposed algorithm was also compared to a variety of feature selection methods used in the prediction of heart disease. Observation reveals that the proposed algorithm outperforms other feature selection approaches in the vast majority of cases. The proposed feature selection technique suggests that exang, fbs, ca, restecg, thal, slope, oldpeak, and trestbps are the most significant features for heart diseases. For the creation of novel heart disease prediction models, a good feature selection algorithm would be more useful.

References

[1] Bashir, Saba & Khan, Zain & Khan, Farhan&Anjum, Aitzaz& Bashir, Khurram. (2019). Improving Heart Disease Prediction Using Feature Selection Approaches. 619-623. 10.1109/IBCAST.2019.8667106.

[2] El-Bialy, Randa& A. Salama, Mostafa&Karam, Omar &Khalifa, M.. (2015). Feature Analysis of Coronary Artery Heart Disease Data Sets. Procedia Computer Science. 65. 459-468. 10.1016/j.procs.2015.09.132.

[3] Gárate Escamilla, Anna &Hajjam, Amir &Andrès, Emmanuel. (2020). Classification models for heart disease prediction using feature selection and PCA. Informatics in Medicine Unlocked. 19. 100330. 10.1016/j.imu.2020.100330.

[4] Güzel Aydın, Seda& Kaya, Turgay&Guler, Hasan. (2016). Heart Rate Variability (HRV) Based Feature Extraction for Congestive Heart Failure. International Journal of Computer and Electrical Engineering. 8. 272-279. 10.17706/IJCEE.2016.8.4.272-279.

[5] LE, HUNG & TRAN, TOAN & Tran, Lang. (2018). AUTOMATIC HEART DISEASE PREDICTION USING FEATURE SELECTION AND DATA MINING TECHNIQUE. Journal of Computer Science and Cybernetics. 34. 33-48. 10.15625/1813-9663/34/1/12665.

[6] Martiana, Entin&Barakbah, Ali &Hermawan, Aditya. (2018). Feature Extraction For Application of Heart Abnormalities Detection Through Iris Based on Mobile Devices. EMITTER International Journal of Engineering Technology. 5. 312. 10.24003/emitter.v5i2.202.

[7] Methaila, Aditya &Kansal, Prince & Arya, Himanshu. (2014). Early Heart Disease Prediction Using Data Mining Techniques. Computer Science & Information Technology. 4. 53-59. 10.5121/csit.2014.4807.

[8] Muthuvel, Marimuthu&Abinaya, M &Hariesh, K &Madhankumar, K &Pavithra, V. (2018). A Review on Heart Disease Prediction using Machine Learning and Data Analytics Approach. International Journal of Computer Applications. 181. 975-8887. 10.5120/ijca2018917863.

[9] Raju, V & Devi, G &Sampath, A &Achanta, Sampath&Saikumar, K &Jagan, B.Omkar. (2020). HEART DISEASES CLASSIFICATION AND FEATURE EXTRACTION BY SEGMENTATION AND MACHINE LEARNING MODEL. 24. 8992-9001.

[10] Ramalingam, V V&Dandapath, Ayantan& Raja, M. (2018). Heart disease prediction using machine learning techniques: A survey. International Journal of Engineering & Technology. 7. 684. 10.14419/ijet.v7i2.8.10557.

[11] Ravindran, Kavitha&Kannan, E.. (2016). An efficient framework for heart disease classification using feature extraction and feature selection technique in data mining. 1-5. 10.1109/ICETETS.2016.7603000.

[12] Sun, Shuping. (2015). An innovative intelligent system based on automatic diagnostic feature extraction for diagnosing heart diseases. Knowledge-Based Systems. 75. 224-238. 10.1016/j.knosys.2014.12.001.

[13] Yadav, Dhyan& Pal, Saurabh. (2020). Prediction of Heart Disease Using Feature Selection and Random Forest Ensemble Method. International Journal for Pharmaceutical Research Scholars. 12. 56-66. 10.31838/ijpr/2020.12.04.013.

Estimation of the ambit of breast cancer with a modified ResNet analysis using machine learning approach

Narayanappa C K[1], Poornima G R[2], Basavaraj V Hiremath[3]
{[1]c_k_narayanappa@msrit.edu,[2]poornima_g_r@yahoo.com, [3]bvhiremath@msrit.edu}

[1,3] Department of Medical Electronics & Engineering, Ramaiah Institute of Technology, Bengaluru
[2]Department of Electronics & Communication Engineering, Sri Venkateshwara College of Engineering, Bengaluru

Abstract. Breast Cancer has been one of the most common reasons for mortality and morbidity among the females around the world especially in developing countries. In this regard, Mammography is a popular screening technique for breast cancer diagnosis so as to label the existence of cancerous cells. The present work encompasses the design and development of a M-ResNet (Modified ResNet) approach so as to classify the breast cancer into benign and malignant conditions with the inclusions for supervised classification models with the training of both upper as well as the lower layers of the designed networks. The efficacy of the developed approach was evaluated using various performance evaluators such as those of sensitivity, specificity, accuracy and F1-Score. Bi-Rads score was used as a basis for the classification process wherein a score of 0-3 correlated to benign and it is non-cancerous nature of tissues whereas malignancy was denoted by a score of 4 and above. InBreast dataset, a publicly available online dataset with 112 breast images were used for the evaluation of the developed paradigm. The present paradigm portrayed an accuracy of 96.43% with Area Under the Curve (AUC) of 95.63%.

Keywords: Breast Cancer, classification, benign, Malignant Bi-rads, M-ResNet.

1 Introduction

Breast cancer is one of the most common pathology seen in females, with the statistics suggesting this to be the leading cause of death in the recent times [1]. Although these exist numerous ways to approach this issue, early detection and diagnosis has been the key in every therapeutic approach pertaining to breast cancer, the most common tool being that of mammography [2].However, mammography does not contribute towards early detection, as the normal as well as abnormal tissues seem similar in the initial phases. Early diagnosis of cancer aids in a better treatment plan. Radiological imaging finds its use in cancer diagnosis with mammography being a cost-effective approach [3].Full Field Digital Mammography (FFDM) provides images of good quality with higher contrast resolutions which are extremely helpful in the diagnosis of cancer in subjects with denser breasts, as seen in women of younger age. Cancerous cells are imaged as masses with a diameter of 5-30nm. At times, non-palpable masses of above 20 nm diameter are not elicited as cancerous cells in mammography. Cranial-caudal (CC) and Medio Lateral Oblique (MLO) are the two most common views used to

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predict the anatomical structure of the breasts in mammography [4]. Both these views can identify the cancer if the lesions are visible. MLO is commonly used to define the morphological descriptors such as those of architectural distortion, bilateral asymmetry, micro-calcifications and abnormal lesions, based on which further clinical decisions are made. Manual interpretation of mammograms poses numerous challenges due to which CAD based approaches are incorporated with the advent of technology in FFDM based diagnosis. However, CAD based approaches seem to have a higher False Negative (FN) and False Positive (FP) rates due to image based limitations. Overlapping and surrounding approaches with regard to dense parenchymal tissues have resulted in an accuracy of close to 80% in certain case studies. Non-Palpable lesions are identified with histopathological approaches with biopsy. Accurate assessment of lesions can aid in better diagnosis and help the subjects as well. There have been numerous attempts to improve the accuracy of the detection of lesions in case of breast cancers with non-invasive and technology-oriented approaches, trying to avoid invasive aspects such as those of biopsy with machine learning models. Many statistical approaches with 1st and 2nd order statistics have been helpful in the assessment of various disorders such as those of occupational disorders including those relevant to psychoacoustics as well as visual psychophysics [5].These approaches have largely been subjective and the cancer-based assessment approaches require objective assessment with statistical aspects wherein machine learning models find their applications with a higher accuracy in the predictive results pertaining to breast cancer.

2 Background

Several researchers have been focusing in the diagnosis as well as the assessment of breast cancer. In this regard, X Sun considered the image pixels to be an important feature with region growing approach so as to segment the tumor in the mammogram [6]. N Saidin employed Water shed algorithm to obtain a coarser segmentation of the breast tumor with the assessment of the edge of the image based on the integration of the regions with similar gray scale value [7]. M H Yap proposed a novel approach so as to assess the suspicious masses in mammogram images with local thresholding and adaptive global segmentation [8]. M H Yap incorporated various deep learning models such as those of transfer learning method, Patch-based Le-Net, a U-Net with the pre-trained FCN-Alex.Net for the assessment of lesions in breast ultrasound images [9]. M Roberts differentiated malignant and benign tissues in breast images using Bayesian network with CAD approach [10]. Z wang used Extreme Learning Machine (ELM) based approach to categorize the breast tumors and compared the same with the Support Vector Machine (SVM) classifiers [11]. Y Qui used Convolution Neural Networks (CNN) to predict the risks of breast cancer [12]. W Sun introduced Deep Neural Network (DNN) approach to estimate the breast cancers at a 420-time series [13]. Z Jiao incorporated a deep feature-based framework for the assessment of mass of the breast with the CNN and decision-making approaches [14]. J Arevalo used CNN to abstract the breast tumor and then, categorize the same into malignant and benign, with the aid of an automated mammogram analysis using deep learning for the risk evaluations [15]. G Carneiro introduced a novel image retrieval approach with Zernike Moments (ZMs) so as to extract the features affecting the efficiency of CAD based breast cancer recognition [16]. Y Kumar developed the CAD based breast cancer assessment approach incorporating the extraction of significant features and then, to conclude about the nature of the image [17]. Costa, Moura and Kim have

introduced several CAD system-oriented textures-based features so as to ascertain the tumor, to detect the Region of Interest (ROI) and to extract the lesions in breast images. The aspects such as those of Gabor wavelets, Singular Value Decomposition (SVD), Gray-level-co-occurrence matrices (GLCM), Local-binary-pattern-histogram (LBPH), Gray-level-run-length matrices (GLRLM), Gaussian derivatives and discrete wavelets were incorporated in their approaches [18-20]. Zhang, Wei and Vadivel have demonstrated the use of CADx systems based on the shape-oriented features [21-23]. Homer and Sickles used the shape-based features to extract the ROIs and then the coordinates of the same were used as markers. The mathematical descriptors were used to categorize the areas as malignant or benign. The likelihood of malignancy was correlated to the shape of the mass under consideration. While malignant masses were found to be speculated, well-circumscribed, ill-circumscribed, round, micro lobulated and oval, the benign portions were homogenous with well-defined boundaries [24,25]

With the afore mentioned literature, available with regard to the assessment of breast cancers, the present work incorporated a novel approach based on modified ResNet (M-ResNet) algorithm due to the fact that this is based on Bi-Rads score. Deep learning models have been incorporated as well. The standard dataset available online (Source: InBreast dataset) was used to test the developed approach for sensitivity, specificity and accuracy. Details of the algorithm developed as well as the results obtained have been provided in the succeeding sections

3 Materials & methodology

This section provides a complete overview of the novel approaches incorporated in the present work, with the development of M-ResNet model using a dell inspiron laptop with 1 TB HDD, 16 GB RAM and 2GB Nvidia graphics cord.

Basis

Consider two domains (source domain and the destination domain). Equation 1 indicates the source domain and equation 2 indicates the destination domain.

$$\mathbb{E}_t = \left\{\left(\mathbb{Z}_j^T, \mathbb{Y}_j^T\right)\right\}_i^{o_t} \tag{1}$$

$$\mathbb{E}_u = \{\mathbb{Y}_k^u\}_{k=1}^{\mathbb{O}_u} \tag{2}$$

Moreover Equation 1 and equation 2 are characterized through the probability distribution which can be denoted as $\mathbb{Q}$ and $\mathbb{R}$ respectively.Here a neural network can be constructed so as to be used for the cross-domain as well as for the design of a classifier.

$$\mathbb{V} = \omega(\mathbb{Y}) \tag{3}$$

The equation 3 denotes the classifier that can further reduce the risk, similarly the equation 4 is for risk

$$\mathrm{A}_v(\omega) = Pr_{(\mathbb{Y},\mathbb{Z})\sim r}[\theta(\mathbb{Y}) \neq \mathbb{Z}] \tag{4}$$

Hence,

$$\mathbb{E}_a = \left\{\left(\mathbb{Z}_j^b, \mathbb{Y}_j^b\right)\right\} \tag{5}$$

Hence, the modified ResNet can be developed for feature assessment and learning.

Model

Consider a CNN architecture, which has the five layers of convolution and three layers of FC (Fully Connected). Here each layer of FC, learns the non-linear mapping. Further learning is given through the equation 6.

$$\mathbb{I}_j^m = fun^m\left(\mathbb{C}^{\mathrm{m}} + \mathbb{X}^m \mathbb{I}_j^{m-1}\right) \tag{6}$$

In equation 6,h^ℓ is the l[th] hidden layer of given point x. b^ℓ and W^ℓ are bias and weight of the given layer, f^ℓ indicates the activation layer. Further, the Rectifier units given in equation 2 are considered in case of hidden layer and in case of output layer. The softmax equation is given in equation 8

$$func^m(\mathbb{Y}) = max(0, \mathbb{Y}) \tag{7}$$

$$fun^m(\mathbb{Y}) = e^{\mathbb{Y}}\left(\sum_{k=1}^{|\mathbb{Y}|} e^{\mathbb{Y}} k\right)^{-1} \tag{8}$$

Furthermore, set of parameters used in the architecture is considered and equation 9 presents the same.

$$\Theta = \{\mathbb{c}^{\mathrm{m}}, \mathbb{X}^\ell\}_{m=1}^m \tag{9}$$

Moreover, the learning of the architecture can be represented through the equation 10.

$$\min_{\Theta} \frac{1}{o_b} \sum_{i=1}^{o_b} k\left(\mathbb{Z}_j^b, \theta\left(\mathbb{Y}_j^b\right)\right) \tag{10}$$

In equation 10, k presents the loss function, $\theta\left(\mathbb{Y}_j^b\right)$ presents the probability of assigning of architecture from $\left(\mathbb{Y}_j^b\right)$ to label$\mathbb{Z}_j^b$.

In any standard architecture of convolution neural network,the deep features transits from general to the particular through the least existed layer of network. Later the architecture is fine-tuned by adding the regularized parameter. Hence, equation 6 of learning feature is added with regularization parameter and depicted in the equation 11.

$$\min_{\Theta}(o_b)^{-1} \sum_{j=1}^{o_b} \mathbb{Z}_j^b + \lambda \sum_{m=m_1}^{m_2} e_l^2(\mathbb{E}_u^m, \mathbb{E}_t^m,) \tag{11}$$

λ is penalty function, m_1 and m_2 are the layer index and these layers are selected based on the size of dataset and number of fine tune parameter, $e_l^2(\mathbb{E}_u^m, \mathbb{E}_t^m,)$is the learning feature between the domain on the given layer.

Selection of the optimal kernel

With the available information being limited, selection of an optimal kernel becomes quintessential for learning. Let $\mathbb{I}_l$ be the reproduced kernel with the Kernel$\mathbb{I}$, further mean embedding is calculated through $\mathbb{Q}$ in $\mathbb{I}_l$ such that it should satisfy the particular equation given below.

$$\mathbb{F}_{\mathbb{Y}\sim\mathbb{Q}} func(\mathbb{Y}\ ) = \left(\vartheta_l(\mathbb{Q}), func(\mathbb{Y}\ )\right)_{\mathbb{I}_l} \quad \forall func \in \mathbb{I}_l \tag{12}$$

$E_l^2(\mathbb{Q},\mathbb{R})$ Is learning model and Distribution between $\mathbb{Q}\ and\ \mathbb{R}$ is defined as the reproduced kernel space distance between the Mean Embedding.

$$E_l^2(\mathbb{Q},\mathbb{R}) \triangleq \left\|\mathbb{F}_{\mathbb{Q}}[\sigma(\mathbb{Y}^T)] - \mathbb{F}_{\mathbb{Q}}[\sigma(\mathbb{Y}^T)]\right\|_{\mathbb{I}_l}^2 \quad (13)$$

Later $\mathbb{Q} = \mathbb{R}$, if and If and only if and only if $E_l^2(\mathbb{Q},\mathbb{R})$ is equal to zero, hence activation map associated with characteristic kernel is presented in the below equation.

$$\sigma, l(\mathbb{Y}^3, \mathbb{Y}^u) = \langle \sigma\big(\ \sigma(\mathbb{Y}^u, \mathbb{Y}^t)\big)\rangle \quad (14)$$

Moreover, the characteristics kernel associated with the activation map is depicted through below equation

$$l \triangleq \left\{ l = \sum_{v=1}^{n} \varepsilon_v l_v : \sum_{n=1}^{n} \varepsilon_v = 1, \right\} \quad (15)$$

$$\varepsilon_v \geq 0, \forall v$$

ε_v Is the COC (Constraints on Coefficient), In order to guarantee the characteristics kernel β_u is imposed so that the multi- kernel l is derived. Furthermore, it is observed that mean map of $\mathbb{Q}$ and $\mathbb{R}$ fails to provide the least test error; hence, multi-kernel is used for the ideal kernel selection

Learning feature algorithm

In this section,a two-step mechanism is developed to learn the origin feature, the first being the parameter learning of the architecture followed by the kernel parameter learning. In order to train the parameter, the kernel trick is used (i.e. from equation 1) and the computed kernel function depicted in equation 16.

$$E_l^2(\mathbb{Q},\mathbb{R}) = \mathbb{F}_{\mathbb{y}^s\mathbb{y}'^s} l(\mathbb{Y}^t, \mathbb{Y}'^t) + \mathbb{F}_{\mathbb{y}^s\mathbb{y}'^s} l(\mathbb{Y}^u, \mathbb{Y}'^u) - 2\mathbb{F}_{\mathbb{y}^s\mathbb{y}'^s} l(\mathbb{Y}^t, \mathbb{Y}'^t) \quad (16)$$

In the above equations, $\mathbb{Y}^t$and $\mathbb{Y}'^t$is approximately equal to$\mathbb{Q}$, similarly $\mathbb{Y}^u$and $\mathbb{Y}'^u$ is approximately equal to q and l belongs to $\mathbb{L}$, however further computation takes long time and causes the obstacle thus to avoid the we use the bias function estimatorthat formulatesthe linear complexity.

$$E_l^2(\mathbb{Q},\mathbb{R}) = 2(o_t)^{-1} \sum_{j=1}^{o_t/2} \mathbb{h}l\left(\mathbb{A}_j\right) \quad (17)$$

In the above equation quad tuple is used denoted by $\mathbb{A}_j$ and it is given in below equation.

$$\mathbb{A}_j \triangleq \left(\mathbb{Y}_{2j=1}^u, \mathbb{Y}_{2j}^u, \mathbb{Y}_{2j=1}^t, \mathbb{Y}_{2j}^t\right) \quad (18)$$

Further multiple kernel function $k$is evaluated onthe given tuple $\mathbf{z}_i$ using the below equations.

$$\mathbb{h}l\left(\mathbb{A}_j\right) \triangleq l\left(\mathbb{Y}_{2j=1}^t, \mathbb{Y}_{2j}^t\right) + l\left(\mathbb{Y}_{2j=1}^u\, \mathbb{Y}_{2j}^u\right) - l\left(\mathbb{Y}_{2j=1}^u\, \mathbb{Y}_{2j}^u\right) - l\left(\mathbb{Y}_{2j}^t, \mathbb{Y}_{2j=1}^u\right) \quad (19)$$

The above scenario computes the expected independent variable given in equation 16. Further while trainingthe gradient of the objective is considered with respect to the data points x_i , and the gradient of neural network learning$\frac{\partial k(\mathbb{A}_j)}{\partial \theta^m}$ is computed as in equation 20.

$$\mathbb{A}_j^m = \left(\mathfrak{I}_{2j-1}^{um}, \mathfrak{I}_{2j}^{um}, \mathfrak{I}_{2j-1}^{tm}, \mathfrak{I}_{2j}^{tm}\right) \quad (20)$$

$k\left(\mathbb{A}_j\right)$ is the labeled example for the quad tuple

$$k(\mathbb{A}_j) = \sum_{j'} \left\{\mathbb{Y}_{j'}^b, \mathbb{Z}_{j'}^b\right\}, k\left(\theta\left(\mathbb{Y}_{j'}^b\right), \mathbb{Z}_{j'}^b\right) \quad (21)$$

Further we compute the gradient of the objective function w.r.t the given lth layer parameter Θ^m.

$$\nabla_{\Theta^m} = \lambda \frac{\partial_{\mathbb{h}l}\left(\mathbb{A}_j^m\right)}{\partial \Theta^m} + \frac{\partial J(\mathbb{A}_j)}{\partial \Theta^\ell} \quad (22)$$

Now, consider the kernel k as the linear combination of given Gaussian kernels m is given in the below equation.

$$\left\{l_v(\mathbb{Y}_j, \mathbb{Y}_k) = e^{-\|\mathbb{Y}_j - \mathbb{Y}_k\|^2/\gamma_v}\right\} \quad (23)$$

In the above equation chain rule is employed to obtain the gradient $\frac{\partial_{\mathbb{h}l}\left(\mathbb{A}_j^m\right)}{\partial \Theta^m}$

$$\frac{\partial k\left(\mathfrak{F}_{2j-1}^{tm}, , \mathfrak{F}_{2j}^{tm}\right)}{\partial \mathbb{X}^{\mathrm{m}}} = -\sum_{v=1}^{n}\left(\mathbb{I}\left[, \mathfrak{F}_{2j}^{um\,t(m-1)}{}_{2j-1}\right] - \mathbb{I}\left[\mathfrak{F}_{2j}^{um\,u(m-1)}{}_{2j}\right]\right)^{\mathrm{U}} X \frac{2\beta_v}{\gamma_v} l_v\left(\mathfrak{F}_{2j-1}^{tm}, , \mathfrak{F}_{2j}^{um}\right) \times \left(\mathfrak{F}_{2j-1}^{tm} - \mathfrak{F}_{2j}^{um}\right) \quad (24)$$

The above equation computes the gradient of the layer , here $\mathbb{I}$ is indicator.

Learning optimal kernel parameter

In this sub-section a model is developed to learn the kernel parameter in efficient way, further this is carried by reducing the type 2 error and reducing the test power, later these two are integrated to observe the desired result and this optimization is given in the below equation.

$$\max_{l \in \mathbb{L}} E_l^2(\mathbb{Q}, \mathbb{R})\,(\mathbb{E}_t^m, \mathbb{E}_u^m)\sigma_l^{-2} \quad (25)$$

In the above equation, σ indicates the estimated variance and it is computed through the equation 18, where E=(E_1, E_2, ….., E_n)^U, further the estimated variance is computed through the below equation.

$$\sigma_l^2 = \mathbb{F}_A h_l^2(\mathbb{A}) - [\mathbb{F}_A h^2(\mathbb{A})]^2 \quad (26)$$

Further, the covariance is computed using the equation 28, whereas equation 27 presents the covariance

$$\mathbb{R} = \mathrm{cov}(h_l) \in \mathbb{S}^{n \times n} \quad (27)$$

$$\mathbb{R}_{vv'} = 4\,(o_t)^{-1} \sum_{k=1}^{o_t/4} h_{l_v}^{\Delta}\left(\bar{\mathbb{A}}_j\right) h_{l_{v'}}^{\Delta}\left(\bar{\mathbb{A}}_j\right) \quad (28)$$

$$\bar{\mathbb{A}}_j \triangleq \left(\mathbb{A}_{2j-1}, \mathbb{A}_{2j}\right) and h_{l_{v'}}^{\Delta}\left(\bar{\mathbb{A}}_j\right) \triangleq h_{l_{v'}}\left(\mathbb{A}_{2j-1}\right) h_{l_{v'}}(\mathbb{A}_{2j}) \quad (29)$$

Once the covariance is formulatedequation28 is reduced to equation 30 for the optimization problem

$$\min_{\mathrm{E}^{\mathrm{U}}\beta = 1, \beta \geq 0} \beta^{\mathrm{U}}\,(\mathbb{R} + \varepsilon \mathbf{J})\beta \quad (30)$$

Initially, the regularizer ofε=$10^{-3}$is set for ideal problem formulation, later by minimizing the false negative an intermediate optimization is adopted that can update both.

Residual Block Formulation

The ResNet possesses the lower convergence if overfitting is avoided and residual connection helps in accelerating the deep layer convergence. Moreover, huge number of layers are added to maximize the performance and avoid the overfitting. Hence,the residual block is formed which is given in the below equation. Here $\mathbb{I}_m$ is input block and $\mathbb{I}_{m+1}$ is the output block, w_l is parameter, $f(.)$ indicates mapping function

$$\mathbb{I}_{m+1} = \mathbb{V}(func(\mathbb{I}_m, \mathbb{X}_m) + \mathbb{I}_m) \quad (31)$$

Moreover if $func(\mathbb{I}_m, \mathbb{X}_m)and\mathbb{I}_m$ are not it then $\mathbb{B}_m$ is used for dimension matching and the above equation are written as:

$$\mathbb{I}_{m+1} = Relu(func(\mathbb{I}_m, \mathbb{X}_m) + \mathbb{B}_m\mathbb{I}_m) \quad (32)$$

These blocks have the convolution layer and contains the neurons with bias and learnable weights. The weights update while training

$$\mathcal{Z}_k^j = \tau\left(\sum_{n=1}^{N} \mathbb{C}_k^j + \mathbb{X}_{kn}^j * \mathcal{Z}_n^{j-1}\right) \quad (33)$$

$\mathbb{X}_{kn}^j$ is feature map weight in the given layer, $\mathbb{C}_k^j$ is jth bias in the i-th layer, further$\tau(.)$ is non-linear activation function of convolution layer. $\tau(\mathbb{Y}) = \max(\mathbb{Y}, 0)$ is the activation function.Further the residual block is optimized to reduce the cost along with its dimensions and it is presented in the below equation.

$$\mathbb{I}_m = \sum_{i=1}^{M-1} func\left(\mathbb{I}_j, \mathbb{X}_m\right) + \mathbb{I}_m \quad (34)$$

L Indicates the RU (Residual unit) and computed as the sum of the mapping and unit. Further we derive the back-propagation from the above equation and depicted in the below equation. Since the optimization in ResNet mainly depends on the back-propagation algorithm.

$$\frac{\partial\theta}{\partial\mathbb{I}_j} = \frac{\partial\mathbb{I}_j}{\partial\mathbb{I}_j}(1 + \frac{\partial}{\partial\mathbb{I}_j}\sum_{i-1}^{L-1} func(h_i, w_i)) \quad (35)$$

Hidden layerupdation (Iterative manner)

The above model possesses the unstable gradients, hence to avoid that we train the hidden layer discriminatively, further this is achieved through feature feedback in the given hidden layer, the weight is updated.

$$\varphi(\mathbb{Y}; \mathbb{Z}) = \sum_{\mathbb{z}_j \in \mathbb{Y}} -logp\left(\mathbb{U}_j \middle| \mathbb{y}_j; \mathbb{X}\right) \quad 36$$

In the above equation, training dataset is indicated by X, T_i indicates the target label of input image $\mathbb{y}_j$. Furthermore, to train the data we use $\mathbb{X}_e$ from $\mathbb{X}_e = (\mathbb{x}_1, \mathbb{x}_2, \mathbb{x}_3, \mathbb{x}_4 \ldots\ldots\ldots \mathbb{x}_e)$ which represents the weight for the dth layer feature. Further we compute the auxiliary loss through the below equation.

$$\varphi_e(\mathbb{Y}; \mathbb{X}_e; \widetilde{\mathbb{x}_e}) = \sum_{x_i \in X} -log\mathbb{Q}\left(\mathbb{U}_j \middle| x_i; \mathbb{X}_e; \widetilde{\mathbb{x}_e}\right) \quad 37$$

Further, the algorithm is reduced as follows, through the backpropagation.

$$\varphi = \varphi(\mathbb{Y};\mathbb{X}\ ) + \sum_{E\in\mathbb{E}} \eta_E \varphi_E\ (\mathbb{Y};\mathbb{X}_e;\widetilde{\mathbb{X}_e}) + \lambda\left(\sum_{E\in\mathbb{E}} \|\widetilde{\mathbb{X}_e}\|^2 + \|\mathbb{X}\|^2\right) \quad (38)$$

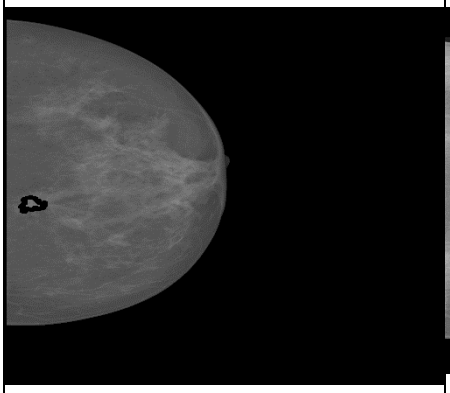
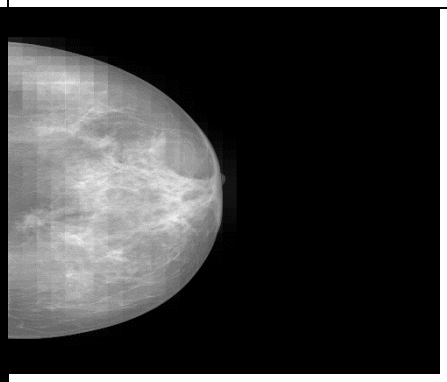
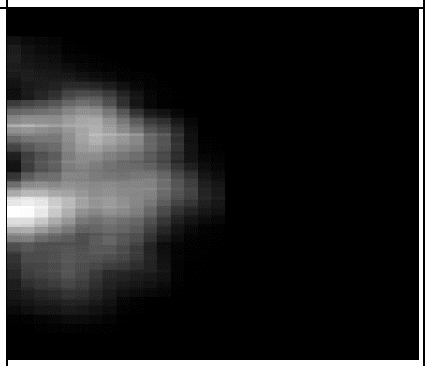
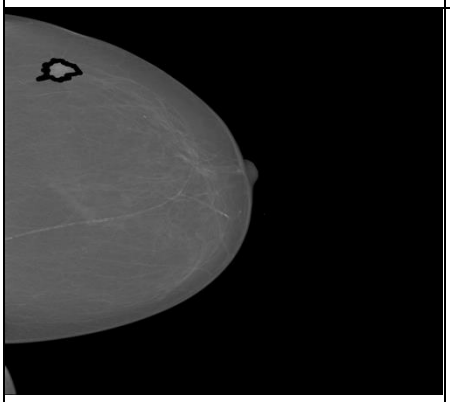
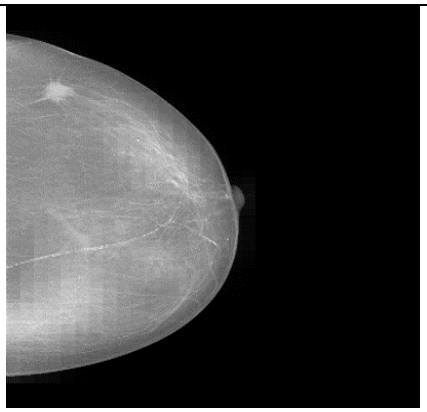
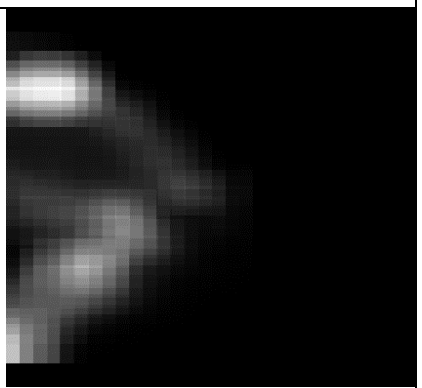
In the above equation η_e acts as the balancing weight for φ_e since the weight might decay while training, set of hidden layers are denoted by $\mathbb{E}$. Meanwhile the above equation has three consecutive part, first part comprises the output result, second part is for the intermediate hidden layer result. λ indicates the trade-off parameter.

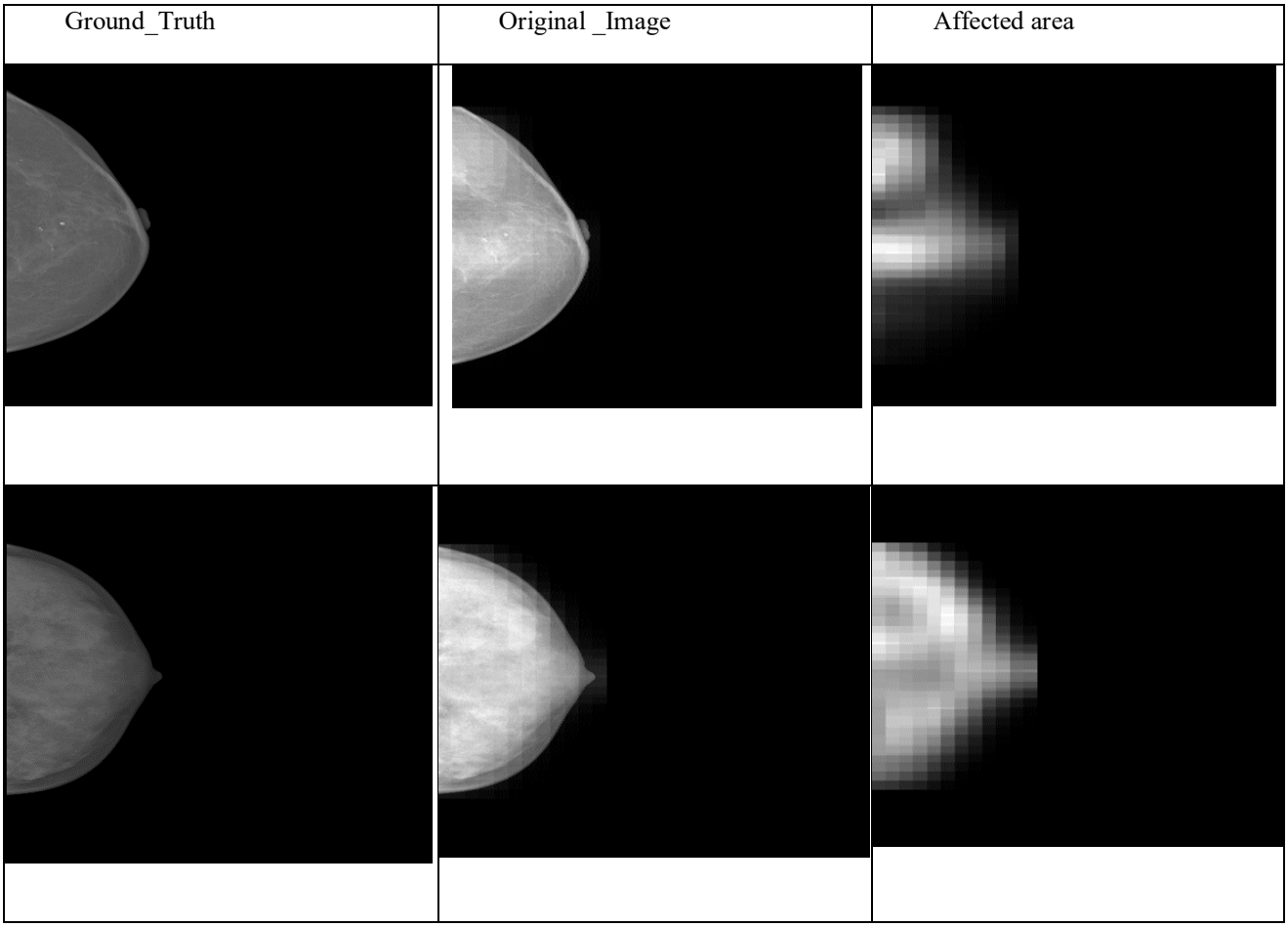
Datasets

In order to evaluate the M-ResNet, the InBreast dataset, (publicly available) is used. This online dataset has 112 breast images. These images are cropped into the pixels size of 256X256, and contains the ROI (Region of Interest). Moreover, according to the BI-RADS(Breast Imaging Reporting and Data system), there are 75 mass with the BI-RADs, the value of 4,5 and 6 which indicate that it is malignant whereas 37 masses are value of 2 and 3 which are classified as benign. Further, there are two different view namely CC and MLO.

Image Classification

Benign

Ground_Truth	Original _Image	Affected area
		
		



Comparative Analysis

The classification performance of proposed M-ResNet is evaluated by considering the five important measuring metrics namely Accuracy, Sensitivity and specificity and all three metrics are compared with various existing technique and it is depicted in table 1.

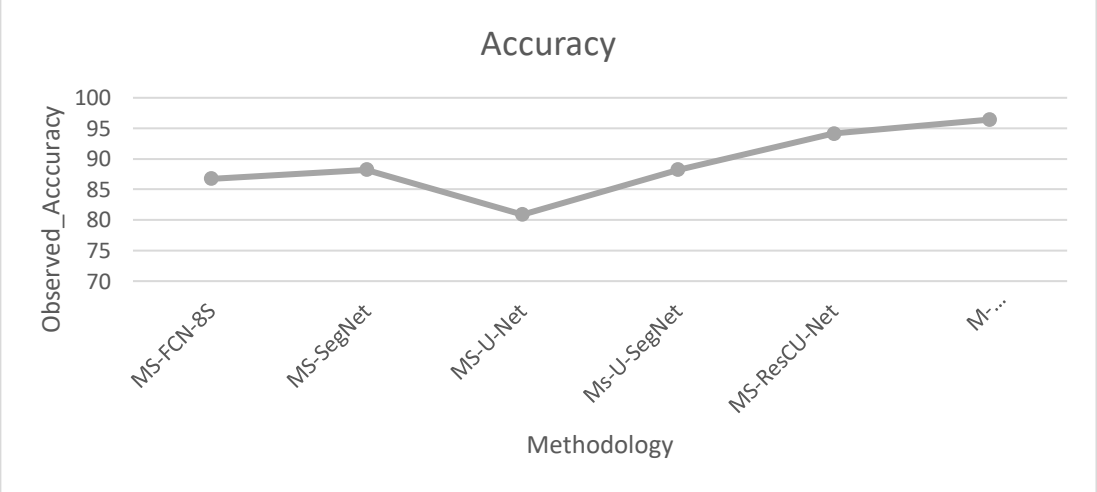
Table 1: Performance of classifiers

Methodology	Accuracy	Precision	Specificity	Recall(Sensitivity)	F1-SCore
MS-U-Net[26]	80.88	88.89	85.19	78.05	83.12
MS-FCN-8s[27]	86.76	90.00	85.19	87.80	88.89

MS-U-SegNet[28]	88.24	86.67	77.78	95.12	90.70
MS-SegNet[29]	88.24	94.59	92.59	85.37	89.74
MS-ResCU-Net[30]	94.12	93.02	88.89	97.56	95.24
M-ResNet(proposed)	96.43	95.24	87.50	98.99	97.56

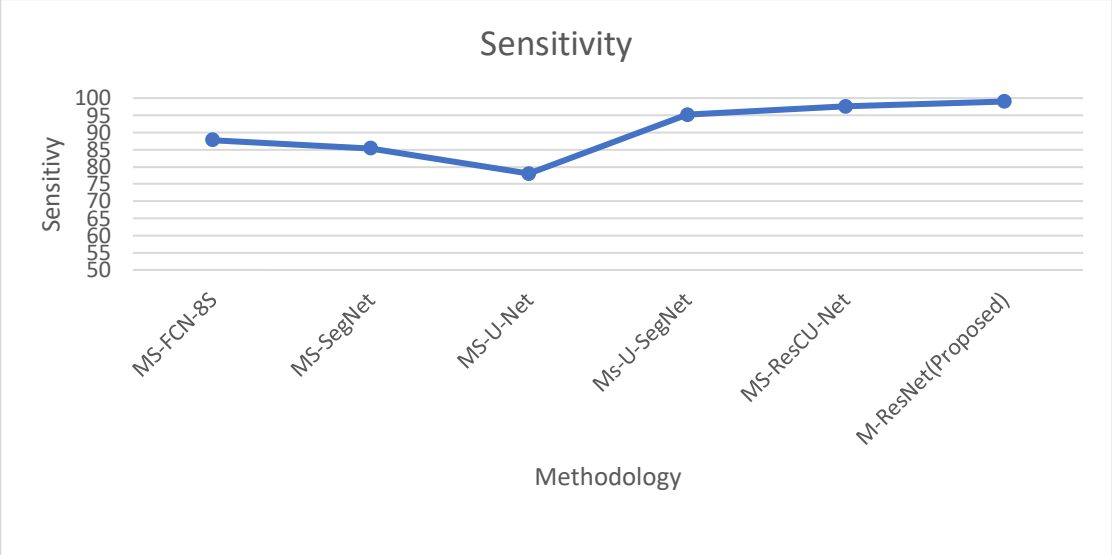
Accuracy

In general, accuracy is referred as the measured value to the standard value. In table 1, the first column shows the different methodologies, second column presents the accuracy. Higher value of the model suggest that the model has been a better classifier. Here it is observed that MS-FCN-8S, MS-SegNet, MS-U-Net, MS-U-segNet achieved the accuracy of 86.76, 88.24, 80.88, 88.24, 80.88, 88.24 and 94.12 respectively whereas in comparison to the same, the proposed model i.e. M-ResNet achievedan accuracy of 96.43 (all these values are observed in percentage).



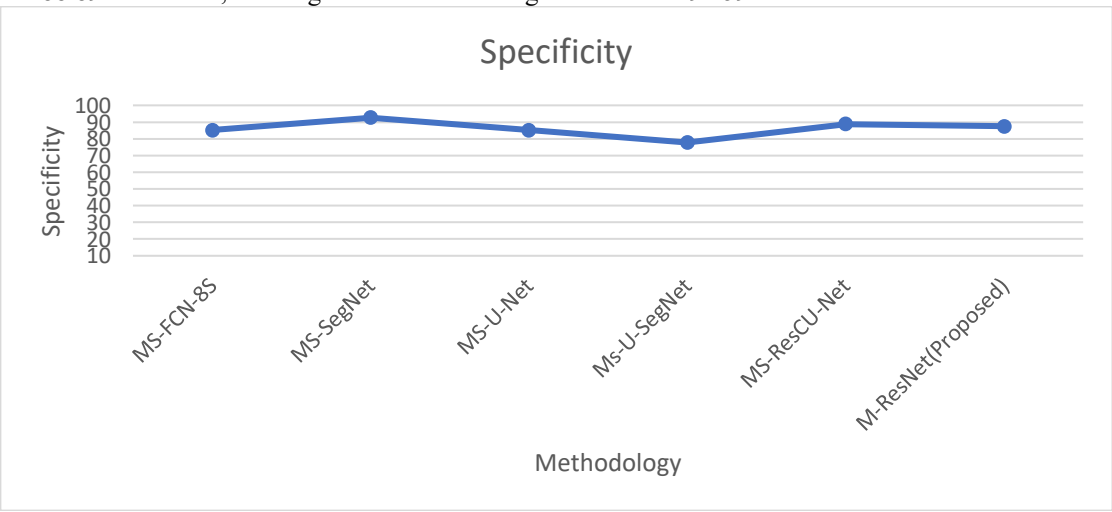
Sensitivity

Sensitivity is the statistical measure of binary classification test performance, it measures the actual proportion identified correctly, and the value should be higher. The third column of table 1 shows the sensitivity of different methodology, in here MS-FCN-8S, MS-SegNet, MS-U-Net,MS-U-segNet achieves the value of 87.80, 85.37, 78.05, and 95.12 respectively whereas proposed model M-ResNet achieves the value of 98.79.



Specificity

Specificity is the measure of actual negative, which is identified correctly, in here MS-FCN-8S; MS-U-Net, MS-U-segNet achieves the value of 85.19, 85.19 and 77.78 respectively. Proposed model achieves the 87.50; here it is observed that existing model achieves the higher value of 88.89. Moreover, MS-SegNet achieves the highest of all i.e. 92.59.



Precision

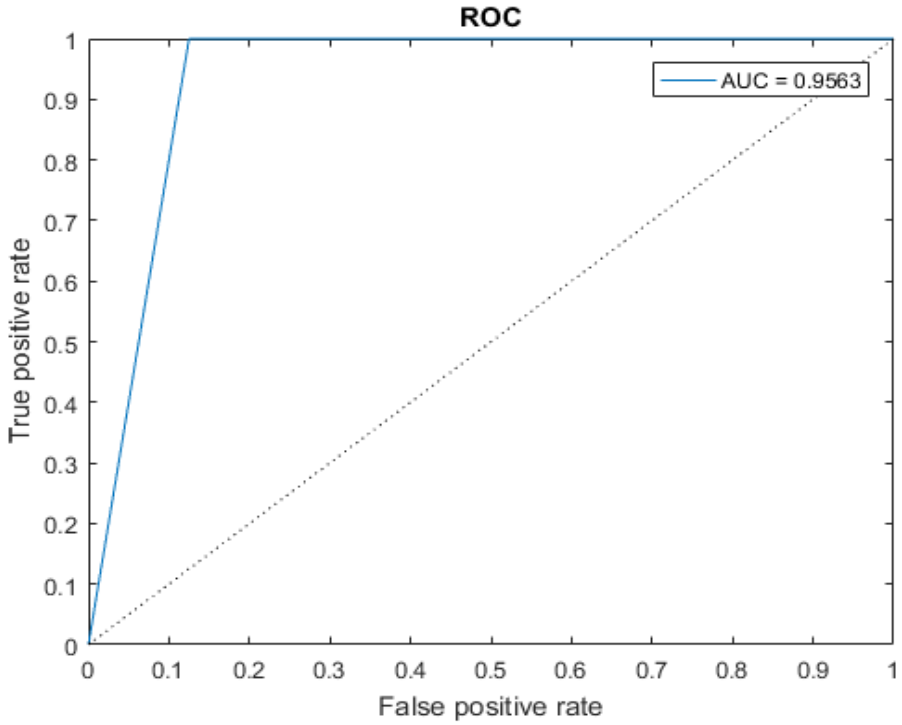
Precision isconsidered one of the measurement metrics, whichmeasures the closeness to each other, higher precision indicates the better model. In table 1 we observe that MS-U-Net, MS-FCN-8s, MS-U-SegNet, MS-U-SegNet and MS-ResCU-Net achieves the precision value of 88.89, 90.00, 86.67, 94.59 and 93.02 respectively whereas our model i.e. M-ResNet achieves higher than all of 95.24.

F1-Score

F1-score also known as F-measure or F-score is the measure of test's accuracy; it conveys the balance between recall and precision. It is considered to be one of the important metrics, higher indicates. In table 1, MS-U-Net, MS-FCN-8s, MS-U-SegNet, MS-U-SegNet and MS-ResCU-Net achieves the precision value of 83.12, 88.89, 90.70, 89.74 and 95.24 respectively whereas our model i.e. M-ResNet achieves higher than all of 97.56.

AUC-ROC curve

AUC-ROC curve is one of the performance measurement metrics for the classification problem and plotted at the different threshold; ROC is the probability curve whereas AUC presents degree of separabilityFurthermore,it indicates the how much capable model is to distinguish between the class. Higher AUCindicates better model prediction, in our case higher AUC indicates that our model is better in distinguishing between benign and malignant i.e. non-cancerous and cancerous.



Conclusion

This research presents the novel M-ResNet for mammography-based cancer diagnosis with novel classification approach based on the Bi-Rads score. From the datasets available, five important measuring metrics namely Accuracy, precision, specificity, Recall and F1-score

have been used to quantify the present approach. The results depicted that the novel proposed method outperforms the existing methodology by achieving an accuracy of 96.43, 95.24, 87.50, 98.99 and 97.56. Classification technique plays an essential part in cancer detection as based on the bi-Rads score it decides whether patient is suffering from cancer or not. Hence to adopt in real time environment it has to be designed very carefully by considering several circumstances. The present work portrays a higher accuracy and the model perform on lower side in terms of specificity and hence, further optimization can be carried out with several constraints with regard to the performance of the model.

References

[1] R. L. Siegel, K. D. Miller, S. A. Fedewa, D. J. Ahnen, R. G. S. Meester, A. B. M. PhD, and A. J. D. PhD, "Colorectal cancer statistics, 2017," Ca A Cancer Journal for Clinicians, vol. 67, no. 3, pp. 177–193, 2017.

[2] J. B. Harford, "Breast-cancer early detection in low-income and middle-income countries: do what you can versus one size fits all," Lancet Oncology, vol. 12, no. 3, pp. 306–312, 2011.

[3] Xuejun Sun, Wei Qian, Dansheng Song and A. C. Robert, "Ipsilateral multi-view CAD system for mass detection in digital mammography," Proceedings IEEE Workshop on Mathematical Methods in Biomedical Image Analysis (MMBIA 2001), Kauai, HI, USA, 2001, pp. 19-26.

[4] Sanjay H S, Prithvi B S, Nikhil M N, "Auditory Temporal Resolution based Psychophysical Evaluation of Healthy Individuals Exposed to Occupational Noise and Solvents", WSEAS Transactions on Acoustic & Music, Vol 5(1), 20-30, (2018)

[5] G. Carneiro, J. Nascimento and A. P. Bradley, "Automated Analysis of Unregistered Multi-View Mammograms With Deep Learning," in IEEE Transactions on Medical Imaging, vol. 36, no. 11, pp. 2355-2365, Nov. 2017.

[6] X. Sun, W. Qian, and D. Song, "Ipsilateral-mammogram computer-aided detection of breast cancer," Computerized Medical Imaging and Graphics the Official Journal of the Computerized Medical Imaging Society, vol. 28, no. 3, pp. 151–158, 2004.

[7] N. Saidin, U. K. Ngah, H. Sakim, and N. S. Ding, Density based breast segmentation for mammograms using graph cut and seed based region-growing techniques. IEEE Computer Society, 2010.

[8] S. Xu, H. Liu, and E. Song, "Marker-controlled watershed for lesion segmentation in mammograms," Journal of Digital Imaging, vol. 24, no. 5, pp. 754–763, 2011.

[9] K. Hu, X. Gao, and F. Li, "Detection of suspicious lesions by adaptive thresholding based on multiresolution analysis in mammograms," IEEE Transactions on Instrumentation and Measurement, vol. 60, no. 2, pp. 462– 472, 2011.

[10] M. H. Yap, G. Pons, J. Marti, S. Ganau, M. Sentis, R. Zwiggelaar, A. K. Davison, and R. Marti, "Automated breast ultrasound lesions detection using convolutional neural networks," IEEE J Biomed Health Inform, vol. 22, no. 4, pp. 1218–1226, 2017.

[11] K. C. Jr, L. M. Roberts, K. A. Shaffer, and P. Haddawy, "Construction of a bayesian network for mammographic diagnosis of breast cancer," Computers in Biology and Medicine, vol. 27, no. 1, pp. 19–29, 1997.

[12] Z. Wang, G. Yu, Y. Kang, Y. Zhao, and Q. Qu, "Breast tumor detection in digital mammography based on extreme learning machine," Neurocomputing, vol. 128, no. 5, pp. 175–184, 2014.

[13] Y. Qiu, Y. Wang, S. Yan, M. Tan, S. Cheng, H. Liu, and B. Zheng, "An initial investigation on developing a new method to predict short-term breast cancer risk based on deep learning technology," in Medical Imaging 2016: Computer-Aided Diagnosis. International Society for Optics and Photonics, 2016.

[14] W. Sun, T. L. Tseng, B. Zheng, and W. Qian, A Preliminary Study on Breast Cancer Risk Analysis Using Deep Neural Network. Springer International Publishing, 2016.

[15] Z. Jiao, X. Gao, Y. Wang, and J. Li, "A deep feature based framework for breast masses classification," Neurocomputing, vol. 197, pp. 221–231, 2016.
[16] J. Arevalo, M. A. G. Lopez, and M. A. G. Lopez, "Representation learning for mammography mass lesion classification with convolutional neural networks," Computer Methods and Programs in Biomedicine, vol. 127, pp. 248–257, 2016.
[17] G. Carneiro, J. Nascimento, and A. P. Bradley, "Automated analysis of unregistered multi-view mammograms with deep learning," IEEE Transactions on Medical Imaging, vol. 36, no. 11, pp. 2355–2365, 2017.
[18] Y. Kumar, A. Aggarwal, S. Tiwari, and K. Singh, "An efficient and robust approach for biomedical image retrieval using zernike moments," Biomedical Signal Processing and Control, vol. 39, pp. 459–473, 2018.
[19] Costa, D.D., Campos, L.F., Barros, A.K.: 'Classification of breast tissue in mammograms using efficient coding', Biomed. Eng. Online, 2011, 10, (1), p. 55
[20] Moura, D.C., Guevara Lopez, M.A.: 'An evaluation of image descriptors combined with clinical data for breast cancer diagnosis', Int. J. Comput. Assist. Radiol. Surg., 2013, 8, (4), pp. 561–574
[21] Kim, D.H., Lee, S.H., Ro, Y.M.: 'Mass type-specific sparse representation for mass classification in computer-aided detection on mammograms', BioMed. Eng. Online, 2013, 12, (Suppl 1), p. S3, http://www.biomedical-engineeringonline.com/content/12/S1/S3.
[22] Zhang, Y., Tomuro, N., Furst, J., et al.: 'Building an ensemble system for diagnosing masses in mammograms', Int. J. Comput. Assist. Radiol. Surg., 2012, 7, (2), pp. 323–329.
[23] Wei, C.-H., Chen, S.Y., Liu, X.: 'Mammogram retrieval on similar mass lesions', Comput. Methods Programs Biomed., 2012, 106, (3), pp. 234–248.
[24] Vadivel, A., Surendiran, B.: 'A fuzzy rule-based approach for characterization of mammogram masses into BI-RADS shape categories', Comput. Biol. Med., 2013, 43, (4), pp. 259–267.
[25] Homer, M.J.: 'Mammographic interpretation: a practical approach' (McGraw-Hill, Boston, MA, 1997, 2nd edn.), pp. 1–6.
[26] D'Orsi, C.J., Sickles, E.A., Mendelson, E.B., et al.: 'ACR BI-RADS atlas, breast imaging reporting and data system' (American College of Radiology, Reston, VA, 2013 edn.)
[27] J. Long, E. Shelhamer, and T. Darrell, "Fully convolutional networks for semantic segmentation," in CVPR, 2015, pp. 3431–3440.
[28] V. Badrinarayanan, A. Kendall, and R. Cipolla, "Segnet: A deep convolutional encoder-decoder architecture for image segmentation," IEEE transactions on pattern analysis and machine intelligence, vol.39, no. 12, pp. 2481–2495, 2017.
[29] O. Ronneberger, P. Fischer, and T. Brox, "U-net: Convolutional networks for biomedical image segmentation," in MICCAI, 2015, vol. 9351 of LNCS, pp. 234–241.
[30] P. Kumar, P. Nagar, C. Arora, and A. Gupta, "U-segnet: Fully convolutional neural network issue segmentation tool,"inICIP. IEEE, 2018.
[31] SanaUllah Khan, Naveed Islam, Zahoor Jan, IkramUd Din, Joel J. P. C Rodrigues, A novel deep learning based framework for the detection and classification of breast cancer using transfer learning, Pattern Recognition Letters, Volume 125, 2019, Pages 1-6.

A Systematic Approach For Data Cleansing Process of Geospatial Data to Perform Application Specific Data Analytics

M S Satyanarayana[1], Dr. Nageswara Guptha M[2], Dr. Vasanthi Kumari P[3]
{satya.satya2011@gmail.com[1], mnguptha@yahoo.com[2], vasanthipvk@gmail.com[3]}

Research Scholar, SVCE, Bengaluru[1], Associate Professor Senior Grade 2, VIT Bhopal University[2],Sehore, Associate Professor, Dayanand Sagar University, Bengaluru[3]

Abstract. Data Analytics is the key word of today's era. Huge data is getting generated day by day from various resources starting from social networking sites to sensors then machines. How this can be handled in effective manner to get some value out of it, this is the biggest question in front of all engineers today. Geo Spatial Data, this data is another type of data which is getting produced because of the objects on the surface either they are static or dynamic. As per the statistics every year there is a 20% increase in Geospatial data production. And this Geospatial Data can be used for multiple purposes in various applications like autonomous vehicles, location based services, identifying the object in surface etc..., but the biggest challenge faced here is how this data can be analyzed and stored for future purpose. This data may be live data or stored data, it might be structured, un-structured or quasi structured data, it might be with duplicates or without duplicates and with null values or without null values. The challenge here is how this data can be used to perform data analytics and produce the results which can be used for future use. In the proposed research the main concentration is on how Geospatial data can be cleaned and made ready to use for data analytics for future use in applications like driverless vehicles, Location Based Services etc.., the first step in performing data analytics is collecting the Geospatial data then cleaning the same for further use. Once it is cleaned and ready to use the data analytics will be performed for further decision making.

Keywords: Data Analytics, Geospatial Data, Structured, Quasi Structured, Un-Structured.

1 Introduction

Geospatial data is getting accumulated in different forms each and every day. As geospatial data is going to be the next generation data which would be used in marketing, sales, identifying the people of same mindset etc.., the geospatial data will play vital role in the next generation business. The geospatial data is going to be the heart of decision making in next generation business either IT or Non IT Industries. Most of the companies are working on processing this geospatial data either for their own purpose or for the customers. Every year the size of the geospatial data is getting increased on an average of 20%. The biggest challenge here is how this data can be handled further for the performing analytics and to take final decisions.[15]

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The geospatial data is entirely different from normal data which is getting accumulated every day. The normal data might consist of text, images or videos which can be easily analyzed for further data processing. Coming to geospatial data the biggest challenge is storing the longitude and latitude of an object. Once the data of the object stored it can be further used. But here the biggest challenge is if the object is dynamic, continuously the location information has to be stored. Sometimes more than the exact information, nearby equal information has to be recorded to get the required output of the application. The geospatial data has to be processed effectively in order to get the final results. [14]

Here in the proposed research the main concentration is on developing a frame work in order to process geospatial data analytics with the operations like Geospatial data gathering, Analyzing, Cleaning, Enriching and Storing the data for further use. The first step in analyzing the geospatial data is to remove the spaces and null values. And also avoid the duplicate data.

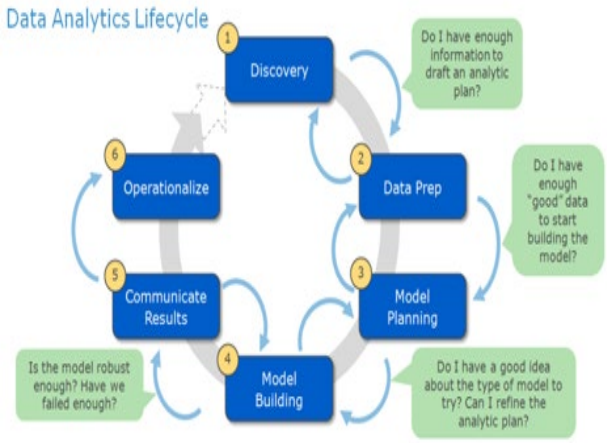

Fig.1. Data Analytics Lifecycle

By referring the default data science life cycle (Referred from Google) Fig.1. it is clearly evident that to build any model for data analytics firstly the data has to be analyzed and pre processed. Once the data is ready as per the requirement the model can be built effectively. [13]

In the same way geospatial data analytics also has the process to be followed while processing the data to build a model. By understanding, the Fig.1. As reference the model for Geo Spatial Data Analytics will be build effectively with accurate results.

2 Literature Survey

In this paper the main takeover from this paper is how spatial data will be analysed and visualized with respect to cloud. Terrafly Cloud a wlak through has been done to understand how the data will be processed for further use. [19]

This paper has given insight into how data can be utilized to intercommunicate amongst the vehicles for smooth and intelligent transportation. The data processing techniques has been understood to process the collected data while taking the decision. [20]

This paper gave a deep insight into how Location Based Services using GMAPS can be used for identifying the near by vehicles. And how algorithms like KNN can be used to preprocess and take decision on the LBS. [7]

This paper gave insight of how to identify the Natural Disaster based on the previous data and also which can be used to process and predict current scenario. [8]

This paper gave insight of how to build a framework for moving objects like Vehicles using service oriented architecture. And how to use cloud based intelligent system to build the advanced automation system for autonomous vehicles. [9]

The main takeover of this paper is to understand how geospatial data can be combined with big data for further processing. How machine learning or AI can be combined with geospatial data for further processing. [18]

The main insight in this paper is how big data can be combined with geospatial data for further processing to perform analytics. [17]

3 Proposed Method:

After extensive research on the existing methodologies, frameworks, algorithms etc…, used for data analytics either on the normal data or Geospatial Data the proposed frame work will be developed in order to perform data analytics on the geospatial data. Performing this analytics on geospatial will surely help the industries in the growth of their organization, to do next level marketing, identify the potential customers and identify the potential market, trace the customers when they move around etc…,[5]

The proposed method consists of step by step process as shown below before performing the analytics. The geospatial data has to be cleaned by following step by step process manually i.e. line by line but the problem here is time consuming. So there are tools which will be used for further processing like tableau, MS-Power BI for further processing in the form of heat maps. But the major problem here is it can only process the data which is already structured. [4]

The biggest challenge here is how to analyze and make structured data out of the initially gathered geospatial data which might be having duplicates, null values, redundant values etc.., most of the times the data collected will be Un-structured or Quasi Structured Data. [6]

The proposed research mainly concentrates on the data cleaning and enriching activities of geospatial for further use. [3]

The following are the steps followed in doing the process.

- Problem definition
- Requirement gathering
- Data acquisition
- Data Fusion, Filtering and pre-processing[3]
- Data Extract & Store
- Data Cleansing& Quality Assurance
- Data Partitioning
- Spatial Data Analytics

The above steps are considered while developing the proposed frame work for geospatial data. All these steps has to be performed every time to make sure that the quality and structures data is getting generated which is further used for the data analytics as well as to build the model.[12]

Common Issues faced in the existing system are:

Huge geospatial data is getting generated – The problem here is

- The entire data is treated as a one data set. Then the comparison and segregation will take huge time.
- Geospatial data clusters are not created based on the problem definitions.[10]
- The data is still at macro level not processed at micro level.
- Searching the required geospatial data in the entire data sets is very difficult.
- Normal data will be stored in the form of rows and columns which can be easily tracable, but same method with respect to geospatial data wont workout as it is not going to have fixed data and it is application specific.[2]

After the continuous research on the existing methodologies the key observations made are.

- There are so many tools available to perform the data analytics and provide the results.
- The main issue is the available tools are not application specific they are very generic in nature.[2]
- Segregation of geospatial data as per the need of the customer is very much essential.

On top of the above key observation the biggest challenge is providing the proper input geospatial data to the tools. That means there is a need for system or application which can easily segregate the data and make the geospatial data as structured data before giving it as input to the tools for analytics. [1]

4 Proposed Methodology:

In the proposed method the main concentration is given on creating platform to segregate data based on following steps as shown in Fig.2.

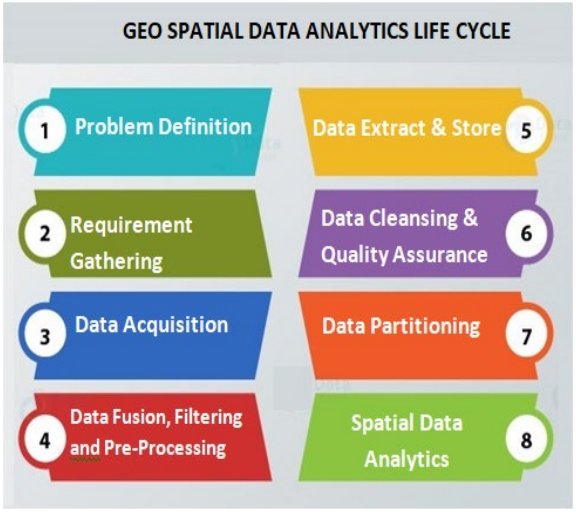

Fig.2. Geospatial Data Analytics Life Cycle

5 Problem Definition

Before simply processing the data, the first step is need to analyze what kind of application this data will be used and check whether it required entire data or only portion of the data.

This is the initial phase but crucial phase to define the problem so that the delay in further process will be reduced. [4]

Requirement gathering

Once the problem is defined, the next step is to gather the requirements as per the problem statement. What are the required main parameters and supporting parameters based on that the data will be gathered either live data or stored data. [2]

Data Acquisition

Collecting the data of the objects based on the movement on the surface and converting them into required format either in the form of tables, paragraphs etc.., and [1]

Data Fusion, Filtering and pre-processing

In this step data fusion will be done by collecting data from multiple sources and integrating the required data as per the nee of the application. [3]

Once Data Fusion is done, the filtering operation is carried out where the data collected in fusion will be considered in the form of sub sets as a portion of data and segregated data based on the requirement.

As a last step the data pre processing is carried out to make the geospatial data into understandable format for further processing. And data will be stored in the tables or data base. [4]

Data Extract & Store

Once the data preprocessing activity is performed, only meaningful data will be available for further use. Based on the requirement the data extraction process is carried out and stored into temporary tables for performing analytics to make decisions. [4]

Data Cleansing& Quality Assurance

In this step in order to make sure that there is no inconsistent data, the data will be verified for incomplete data, inconsistent data, null values, duplications etc.., to make sure that the data is qualitied for further processing. [2]

Data Partitioning

In the above step the entire data is processed made readily available for further processing, in this step the data will be partitioned further based on the macro level need to serve their micro solutions. Means based on the need it will be partitioned and stored, based on the requirement to gather data it will be directly searched in that portion in order to save the time and get the accurate data for further processing**.** [3]

Spatial Data Analytics

This is the next step after entire input spatial data is ready as per the problem definition. This spatial data can be further used for the analytics to solve real time problems. [11]

Algorithm - Selection & Clustering:

1. Start
2. Select the Problem Statement/Application
3. Collect the required information based on Step 2
4. Analyse the required data after collecting information
5. Apply the process of Data Cleansing and Fusion
6. After step 5 cluster the data based on the need.
7. Apply the Analytics and store the result data for further use
8. Repeat Step 4 to 7 until the final results are obtained
9. Consider the final output as input to the final deciaion making.
10. Stop

The above algorithm will give an exclusive procedure to be gollowed while performing spatial data analytics.

6 Conclusion:

After extensive survey and research on geospatial data it is concluded that there should be a systematic procedure based on platform to analyse the geospatial data in very effective manner for further decision making at high level in an organization. This geospatial data can be used for various applications like sentimental analysis, autonomous vehicles, business intelligence etc..,

Future Enhancement:

In future the same system can be enhanced with efficient and optimized way to identify the natural disasters. It helps especially in the field of autonomous vehicles to move further one step. And also sentiment analysis for the machines can be implemented to test the efficiency and accuracy of the system.

References

[1] Hema M.S., Maheshprabhu R., Nageswara Guptha M. (2018) Data Access in Heterogeneous Data Sources Using Object Relational Database. In: Venkataramani G., Sankaranarayanan K., Mukherjee S., Arputharaj K., Sankara Narayanan S. (eds) Smart Secure Systems – IoT and Analytics Perspective. ICIIT 2017. Communications in Computer and Information Science, vol 808. Springer, Singapore. https://doi.org/10.1007/978-981-10-7635-0_3

[2] Hema M S and Dr. Nageswara Guptha M, "Service Oriented Quality Driven Ontology Based Data Federation with User Feedback", Proceeding IEEE Second International Conference Convergence in Technology, 2017. (IEEE explorer)

[3] Hema M S and Nageswara Guptha M, "Data fusion in data federation using modified discriminative Markov logic networks" International Journal of Advanced and Applied Sciences, 2016, Vol. 3, No. 8 pp. 78-84. DOI: 10.21833/ijaas.2016.08.013

[4] M. Nageswara Guptha, P. T. Rajan, A. Chitra, "Data Sourcing using Federated Database System in Service Oriented Architecture", CSI Communications, April – 2009, Vol 33, 1, 12-18

[5] T. Ortner, J. Sorger, H. Steinlechner, G. Hesina, H. Piringer and E. Gröller, "Vis-A-Ware: Integrating Spatial and Non-Spatial Visualization for Visibility-Aware Urban Planning," in IEEE Transactions on Visualization and Computer Graphics, vol. 23, no. 2, pp. 1139-1151, 1 Feb. 2017

[6] A. Elliethy and G. Sharma, "A joint approach to vector road map registration and vehicle tracking for wide area motion imagery," 2016 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Shanghai, China, 2016, pp. 1100-1104

[7] M. F. Rahman, S. Bin Suhaim, W. Liu, S. Thirumuruganathan, N. Zhang and G. Das, "ANALOC: Efficient analytics over Location Based Services," 2016 IEEE 32nd International Conference on Data Engineering (ICDE), Helsinki, Finland, 2016, pp. 1366-1369, doi: 10.1109/ICDE.2016.7498346.

[8] J. Wang, Y. Wu, N. Yen, S. Guo and Z. Cheng, "Big Data Analytics for Emergency Communication Networks: A Survey," in IEEE Communications Surveys & Tutorials, vol. 18, no. 3, pp. 1758-1778, thirdquarter 2016,

[9] Z. Yang et al., "Web service-based SMAP soil moisture data visualization, dissemination and analytics based on vegscape framwork," 2016 IEEE International Geoscience and Remote Sensing Symposium (IGARSS), Beijing, China, 2016, pp. 3624-3627, doi: 10.1109/IGARSS.2016.7729939.

[10] Amir Gandomi, Murtaza Haider, Beyond the hype: Big data concepts, methods, and analytics, International Journal of Information Management Volume 35, Issue 2,2015, Pages 137-144,

[11] Mengfan Tang, P. Agrawal, S. Pongpaichet and R. Jain, "Geospatial interpolation analytics for data streams in eventshop," 2015 IEEE International Conference on Multimedia and Expo (ICME), Turin, Italy, 2015, pp. 1-6, doi: 10.1109/ICME.2015.7177513.

[12] D. Guo and Yi Du, "A visualization platform for spatio-temporal data: A data intensive computation framework," 2015 23rd International Conference on Geoinformatics, Wuhan, China, 2015, pp. 1-6,

[13] L. J. Klein et al., "PAIRS: A scalable geo-spatial data analytics platform," 2015 IEEE International Conference on Big Data (Big Data), Santa Clara, CA, USA, 2015, pp. 1290-1298, doi: 10.1109/BigData.2015.7363884
[14] A. Andrejev, D. Misev, P. Baumann and T. Risch, "Spatio-Temporal Gridded Data Processing on the Semantic Web," 2015 IEEE International Conference on Data Science and Data Intensive Systems, Sydney, NSW, Australia, 2015, pp. 38-45,
[15] C. Zhou, P. Meysman, B. Cule, K. Laukens, and B. Goethals, “Discovery of spatially cohesive item sets in three-dimensional protein structures,” IEEE/ACM Transactions on Computational Biology and Bioinformatics, vol. 11, no. 5, pp. 814–825, 2014.
[16] X. Wu, X. Zhu, G.-Q. Wu, and W. Ding, “Data mining with big data,” IEEE Trans. Knowl. Data Eng., vol. 26, no. 1, pp. 97–107, Jan. 2014.
[17] X. Chen and X. Lin, “Big data deep learning: Challenges and perspectives,” IEEE Access, vol. 2, pp. 514–525, May 2014.
[18] A. Katal, M. Wazid, and R. Goudar, “Big data: Issues, challenges, tools and good practices,” in Proc. 6th Int. Conf. Contemp. Comput. (IC3), Aug. 2013, pp. 404–409.
[19] Yun Lu, Mingjin Zhang, Tao Li, Yudong Guang, and Naphtali Rishe. 2013. Online spatial data analysis and visualization system. In Proceedings of the ACM SIGKDD Workshop on Interactive Data Exploration and Analytics (IDEA '13). Association for Computing Machinery, New York, NY, USA, 71–78.
[20] W. Chen, F. Guo and F. Wang, "A Survey of Traffic Data Visualization," in IEEE Transactions on Intelligent Transportation Systems, vol. 16, no. 6, pp. 2970-2984,

Implementation of dual-band Planar Inverted F-Antenna (PIFA) using machine learning (ML) for 5G mobile applications

[1]T. Padmapriya, [2]S.V.Manikanthan
{[1]padmapriyaa85@pec.edu, [2]manikanthan.s.v@gmail.com}

Managing Director, Melange Academic Research Associates, Puducherry[1], Director, Melange Academic Research Associates, Puducherry[2]

Abstract. This paper proposed a new hybrid model for feeding printed PIFA antennas with the dual frequency ranges of 29GHz and 32GHz, which are optimal for 5G mobile communications. A two-element rectangular PIFA with an inset feed for the 29GHz and 32GHz bands is the first prototype in this initiative.To create The second program involves PIFA inset-fed lines and is symmetric dual-band two-element slotted rectangular patches. Inverted I-shaped slots in primary patches could be used to gain dual-band response. For 5G portable apps, hybrid algorithms are used.Bayesian convolution and the genetic algorithm are the two algorithms. These two algorithms are useful for wireless 5G applications. The third prototype is an asymmetric PIFA antenna with inverted I-shaped slotted perpendicular patches in dual service. The partial rectangular ground plane is inserted with the slot-formed DGS. The substrate has a width of 52074mm2, and the integrated antennas have very limited planar configurations occupy hardly any room, making them easier to fit into handset devices for the upcoming 5G mobile communications. Return demand drops, and bandwidths are diminished.Without any supplementary constructions, PIFA has a small mutual coupling. By using these two algorithms the antenna systems have directivity, gain, and providing effective values that are perfect for 5G mobile applications, as well as expected reflections and interactive application characteristics.

Keywords: planar inverted F- array(PIFA), Bayesian regularization, genetic algorithm.

1 Introduction

Varied wireless and mobile networks, namely 3G (UMTS, CDMA2000), LTE (Long Term Evolution), Wi-Fi (IEEE 802.11 wireless networks), Wi-MAX (IEEE 802.16 wireless and mobile networks), and additional networks, such as sensor networks and personal area networks, are also generally used (e.g., Bluetooth, ZigBee). Mobile terminals have a vast array GSM, for starters, is centered on old-fashioned circuit switching, a technique that is approaching the end of its useful life. At the network layer, all wireless and mobile networks are heading toward an all-IP model, in which all data and activation is transported over IP (Internet Protocol) [1].So, although,IP, which is a unifying technology, is the common "thing" for all of them. There can different Radio Access Technologies (RATs) can be used today, and new RATs will also be established in the future (e.g., LTE-Advanced), however IP, which is a unifying technology, is the common "thing" for all of them. The term 4Centered" to the

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accessible the ITU have set a minimum specification for a technology to be labeled as 4G: bit rates in the access channel of more than 1 Gbps. All-IP, on the other hands, is a 4G functionality in the access and core network modules; there would have been no circuit-switching, as in 3G systems like UMTS. In the concepts of next-generation networks (NGN), however, numerous attempts to differentiate the transport and network strata (NGN) have been made[2,3]. The next generation of mobile and wireless networks would inevitably need to fit into the NGN because it incorporates wireless and wired advanced functions and includes most resources. However, the core idea of NGN is the parallel separation of the understanding in access and from core systems are developed from the service stratum, i.e. service provisioning. The next generation of mobile and wireless networks is due to come in the next few months already at the "front door" of the worldwide web, will be founded on 4G, if follow the same model as a previous couple of decades, will be labeled 5G. Conclude that the 5G policy would be concentrated on the consumer.Since in the coming years, there will be enough computational power for control information, as mobile terminals get more computationally machines with even more advanced systems for doing calculations, as well as more storage space and battery life Then, in the IP world, the main premise from the start was to keep network nodes basic, spite of the availability of smart end devices (and this was a very completely different thing than that of the Public Old Telephone Systems) (POTS).Smart devices are described on the network side in the all-IP concept, which should be used to interface with user equipment premises (mobile terminals in the case of mobile networks) in order to provide sufficient quality of service, as well as authentication, authorization, accounting, and monitoring safety functionality. Figure 1. shows the applications of the 5G network.

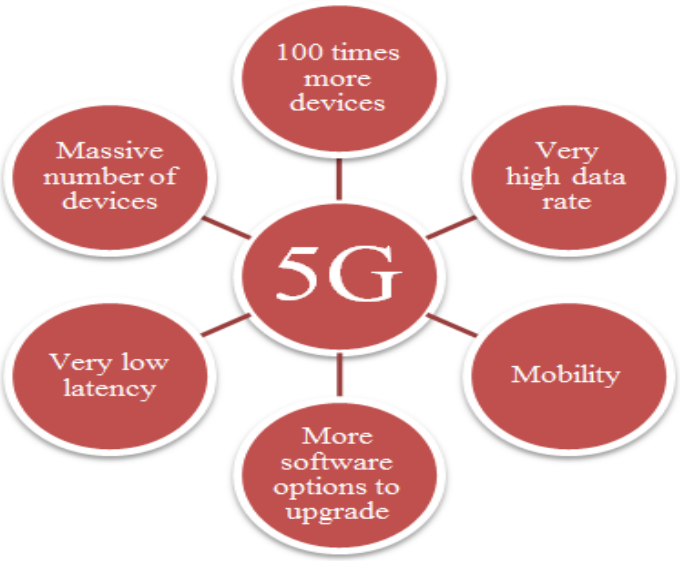

Figure 1. Applications of 5G

There are many obstacles to address to meet the goals of the 5G networks. For example, strength, some of the obstacles that will be met entail data rate, E2E latency, critical transformation communication, and QoE issuesexplored, as well as some potential

alternatives.Mobile networks would need to accommodate more data traffic than they do now, as well as higher data speeds, in the future. To achieve this, more actions are needed all other system components, such as the backbone, backhaul, and front haul, were included in RAN. It's important to know everything to attain higher data rates and capacity more bandwidth, quality, and network residential creation are awaited in the RAN. In time for 5G networks to enable chopping real-time applications, latency and reliability are important factors. Personalized healthcare systems, industrial applications, cloud for example, devices, smart grids, and potential high communication infrastructure should all operate properly and safely. Furthermore, latency is a big issue for applications based on transportation networks to operate in future networks, since vehicles, especially high-speed trains, can pass at gusts of up to 500 km/h, possibly requiring a rapid response to queries with high reliability and availability.As a practice, in decided to conduct out these and future applications, 5G networks must accept 1 ms E2E latency. The latency concern, which is dependent on various factors, is a difficult problem to solve because that can be accomplished by writing a single parameter or procedure[4].

Progress in the progress wireless phones, higher data rate demands, and higher system reliability demands all concern cellular network generations. There has also been a considerable rise in cellular networking seen in recent years, owing to a spike in the volume of smartphone users and effects of change on the market such as smartphones, tablets, and e-book readers.These new devices' collective property allows them to support applications and services that need a lot of data. By the end of 2020, it is estimated it next-more than 50 billion connected devices will be supported before next networks. This rise in the proportion of object parts to a network, based on known networks, would result in massive data usage. Political approaches, though, are difficult to sustain the aforementioned challenges. As a result, the aim of improving products is to improve the efficiency of 5G networks by successfully using all resources.

in the last fifteen years, mobile and wireless networks have grown dramatically. A WLAN adapter is now available in about all smart phones. Many mobile phones, in response to their 3G, 2G, WLAN, Bluetooth, and other functionality, would likely have a Wi-MAX adapter in the immediate future.The use on the one extreme, IP is being used by both 2.5G and 3G public land mobile networks (PLMN), and WLAN has figured prominently in their convergence, which has now been split into two subgroups: loose and strong coupling.The focus of 4G is on seamless implementation of cellular networks like GSM and 3G, WLAN, and Bluetooth. Multimode user terminals are known as a must-have for 4G, but different security measures and QoS support in smart devices and sensors remain a challenge.On 5G terminals, software-defined radios, modulation structures, and revolutionary error-control systems are all on the roadmap, will be available online. Generally exhibit, which will be the focus of 5G mobile networks, are the aim of the growth. The terminals would have had coordinated links to various wireless technologies but should have been able to integrate possible development from different applications Vertical handovers should be avoided at all costs easiness of installation. After all, there are plenty technologies, operators, and service providers to choose between. Each network in 5G now have user mobility, while the terminal does not choose between various wireless/mobile access network providers for a given service. Such a recommendation would have been centered on the smartphone's open intelligent middleware.

Machine learning is the by converting data from raw data (ML), artificial intelligence (AI) systems can learn to develop expertise. This technology, which is centered on linear algebra and probability theory [6], has shown to work for a multitude of activities, namely image recognition and natural language processing.When coping with large volumes of data, also regarded as "big data," machine learning is pretty helpful. Larger datasets allow very these datasets have become too massive for the human eye to absorb, but they can be scanned by computers that use data mining algorithms, making for accurate learning during ML training. It is obvious that data science systems can be used to enhance communication networks equivalently priced.In most circumstances, optical networks are defined by a large number of network hardware (NEs). This figure is even greater for networks that use channels, IP, devices, or the "Internet of Things" These lines contain a vast quantity of observations that could be used by machine learning. Thirdly, multi-layer, multi-vendor telecommunications networks becomes difficult to manage very rapidly. This is where deep learning applications come in useful.At the time, the use of computer vision in communication networks still in its initial phases. This may be due to the fact that machine learning techniques need a significant infrastructure before they can accurately reach network data. Furthermore, the advancement of machine learning infrastructure and applications generally requires a nice collection of multidisciplinary skills not historically available on the market. N, as well as others), network equipment vendors (Ciena, Cisco) and private phone companies (Google, Facebook, and others), as well as others) are all beginning to invest in machine learning aimed at communication networks. Diagram 2. shows the flow diagram of machine learning.

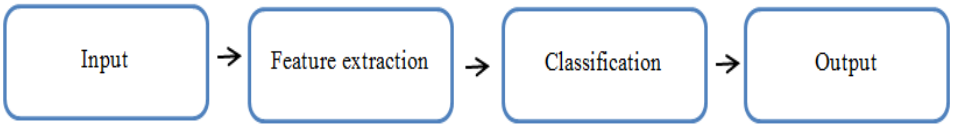

Figure 2. Machine learning - Architecture

This section examines the different conceptual scenarios, threats, and the 5G vision and standards, as well as primary 5G interoperability technologies. To create the 5G concept, the relevant aspects and core technologies are extracted. The smart 2020 and beyond communications will be dominated by the internet of things (IoT) and mobile internet. 5G will have to deal with a variety of Knowles in the future, namely work, leisure, and transportation. S-UHD videos, augmented reality, virtual reality, cloud desktop, edge cloud computing, and online gaming too are manifestations of cutting-edge technology are all manifestations of cutting tools are all manifestations of ultimate service experiences.Moreover, 5G will infiltrate the digital revolution (IoT) and construct the internet of anything (IoE) in order to accommodate the diverse client needs of transportation, manufacturing, medicine, and other vertical industries. In a multitude of settings, where main three metrics (KPIs) such as user-experienced performance are used, 5G may address the concerns raised by wildly differing quality standards, signalized it will be difficult to achieve intersection density, latency, power generation, and power density. Mobile internet and IoT reform possibilities, innovation process, and major issues have resulted in four traditional operational scenarios for 5G: a scenario with a high-capacity hotspot, a scenario with frictional pressure drop connections, a scenario with a circumstance with low latency and high reliability, and even a seamless wide-area coverage are all considerations. There will definitely be progressive web cases that are

not currently expected. Future 5G might need flexibility to respond to change integration services with a wide range of standards.Analysis forums and other government agencies who want to contribute to 5G's industrial prosperity can pay attention to the following criteria crucial sectors [5].

- Spectrum related issues
- Traffic characteristics
- Radio interface(s) and their interoperability
- Access network related issues

2 Literature Survey:

Zikria, Y. B, et al..,[5] proposed that the fifth-generation (5G) network is trusted to complete vast datasets volume and wireless connections. Different types of data traffic need variants with support (QoS). The 5G mobile network aims to examine the shortcomings of previous cellular (e.g., 2G/3G/4G) networks and will be a critical enabler for IoT-based applications (IoT). Smart houses, mentor automobiles, drone operations, health and mission-critical services, device IoT, and entertainment and multimedia are only a few descriptions of what the Artificial intelligence can doare all indicators of 5G networks support all IoT applications. Multiple 5G sectors are classified into integrated 5G services, analytical 5G services, omnipresent 5G services, autonomous 5G services, and public 5G services centered on end users' experiences. In this report, they present a brief description of 5G plausible situations. Then we'll go through all the reports that have been posted for our special issue on 5G phone carriers and situations right away. Finally, they should tie up this story.

Burden, F, et al..,[6] described that thestandard back-propagation nets are less robust than bayesian approved artificial neural networks (BRANNs), which can minimize or reduce the need for longer - distance. Bayesian convolution, unlike ridge regression, is a mathematical method for translating a nonlinear regression into a statistical problem that's also "well-posed" The models are durable, and the validation process, which takes some time, is also one of the strengths of BRANNsin standard regression methods like backpropagation scales as O(N2), is no longer necessary. These networks tackle a variety of issues in QSAR design, namely model evaluation, robustness, validation set availability, validation effort volume, and existing network optimization.Evidence procedures will have an objective Bayesian norm for determining when to avoid learning, allowing overuse injuries impossible. Since the BRANN picks and trains on a set of essential network weights or parameters, they're often tough to overfit, literally shutting off those that aren't necessary.The number of weights in a fully interconnected genetic algorithm including back-propagation is typically much smaller than this effective number. BRANNs may use automatic importance determination (ARD) of input variables, which helps to “estimate” the value of each input, and using a network. The ARD procedure means that no irrelevant or directly relate indices are used in models and reveals which variables are most appropriate for simulating activity data.

Kabalci, Y[7] explained that every decade sees great progress in wireless and mobile communication technology. These changes are precipitated by changing consumer demands and the advances presented by emerging technologies. The current state of this paper

examines mobile communications services of the fifth generation (5G). And drilling down into the complexities of 5G networks, it's critical to understand where mobile communication technologies developed from the first to the 4th century.Each generation's upsides and downsides are associated. Later, the innovative industry advances in mobile devices and 5G communication systems were analyzed by comparing 5G communication systems emerging interfaces like 4K video streaming, tactile internet, and virtual reality. This project's expected objectives are used in application areas fifth introduction begins are described after the strategic components and standards of 5G networks are defined.Also, specific ITU-2020 usage scenarios and minimum criteria are determined. On the other hand, there are many barriers to tackle for the 5G corporate structure to achieve its intended objective. These issues, as well as probable remedies, are discussed in the following parts the conclusion of the chapter. As they've been classified as important core technologies for 5G networks, powerful multiple-input multiple-output (MIMO), millimeter-wave (mm-wave), mm-wave massive MIMO, and beamforming techniques are being covered extensively. Prospective usage at the end of this chapter, there are also some areas and software examples for 5G communication systems.

Janevski, T[8] described that today's 3G phone carriers have IP communication in both services that are there are two main forms of time: real-time and non-real-time. On the other hand, a multitude of communications and multimedia are being considered important, namely 802.11 wireless local area networks (WLAN), wireless metropolitan area networks (WMAN), and 802.16 wireless personal area networks (WPAN), as well as ad-hoc wireless personal area networks (WPAN) and wireless networks for digital radio and television transmission.Then there are the 4G concepts, which were hotly argued, and it may well be that, like 3G, 4G may include a slew of standards, with IEEE 802.xx wireless mobile networks included from the end.This paper's key contribution is the interpretation of the 5G (Fifth Generation) mobile network is known as a user-centric concept, as contrasted to an operator-centric concept, as in 3G, or a service-centric concept, just like 4G.The mobile client is highlighted in the concept. On there would be 5G terminals, software-defined radios and modulation systems, and the most up-to-date error-control schemes. Professionals are expected to get better flight, which is a top priority for 5G mobile networks. The terminals would have access to a wide variety of wireless technologies at the same moment and should be likely to digest various flows from emerging systems.Each network will have user mobility, and also the terminal will choose amongst several providers of wireless connections for a particular service. The findings also showed an intelligent internet phone concept, in which the phone identifies connections program is a collection of predefined conditions and performs significant change during a single end-to-end communication. This paper proposes a radical change in mobile networking strategy in comparison to current 3G and eventually, this description of 4G mobile technology is related to as 5G here.

Tudzarov, A., & Janevski, T[9] described that they introduce a different network architecture design solution for 5G cellular networks and in future The proposed design is based on the customer digital world that contains a range of wireless and mobile technologies.Because it is impossible to reverse all wireless technologies in a heterogeneous wireless setting, each solution for although in a next-generation network, radio access appropriate clustering to the transport stratum, just next mobile and wireless networks should be included in service stratum. The user terminal in the proposed design has the opportunity to alter the radio access technology - RAT depending on the specific requirements. As a node in the core network, we activate the so-called policy-router, which develops IP tunnels to the

mobile terminal leveraging different alternative RATs, helping the mobile terminal to blatantly alter RATs By implementing the prescribed from the mobile terminal's numerous contributions to an established, the mobile terminal prefers the RAT as a user agent for multi-criteria decision-making. For the purpose of accessing control information between the mobile terminal and the policy router, should use QoSPRO procedurein the performance measurement method.

Ameerudden, M. R., & Rughooputh, H. C[10]explained that the accelerated advancement leading to the nanotechnology of radio frequency transceivers and the growth of mobile communications, small and low-profile antennas functioning at mobile frequencies are now becoming highly essential are experiencing exponential growth.As a response, new antennas with higher range and reduced dimensions should be developed.This article describes transgenic to construct genetic algorithms (GA), an intelligent optimization technique, were paired with the intelligence of the binary string fitness characterization (BSFC) technique.The aim of this project is to design and enhance a planar inverted-F antenna's bandwidth (PIFA) in the 2 GHz band. The methods of binary-coded GA (BCGA) and real-coded GA were preferred (RCGA). The optimization strategy was introduced using just a clustering algorithm to minimize the appropriate price.During the optimization process, the different PIFA models are evaluated using the finite-difference time-domain (FDTD) method.

El Misilmani, H. M, et al..,[11] explained that the change in the size and variety of data available, as well as machine learning is attracting much attention in terms of securing the correct strategy in a number of fields, thanks to sophisticated computing and effective data storage. Algorithms are a huge part of the ongoing studies, and they're predicted to play an important role in current technology.The applications of machine learning in antenna creation are introduced and investigated in this paper. It dives deep into the concepts of machine learning, as well as how it encompasses computational science and deep learning, learning algorithms, and its possible application in a number of fields, with a special focus on antenna design. The research focuses on the implementation of using machine learning in antenna array previous techniques.

3 Proposed System:

When constructing PIFA antennas, segmentation techniques must be taken into account for a simple design. That include radiating plate's width (W), length (L), and height (H), and the width of the radiating plate form short circuit plate (Wc).The PIFA is based on a plated short circuit applied to an inverted L antenna (ILA). The used substrate is FR-4, but it must includes the required performance requirements: tangential loss tan =0.02, thickness T = 1.6 mm, relative permittivity r=4.4, relative permeability r=1, and relative permittivity r=1. (fit) (fit (const. fit).In particular, as compared to other designs, the PIFA slit structure was chosen since it releases the smallest number of driven at the second resonance frequency, radiation is focused towards the individual.Equation(1), which is connected to the electrical dimensions, is used to evaluate the resonance frequencies. r indicates the substrate's relative permeability.

$$Fr1 = K / (S_p + Z_p + H + A) * \sqrt{\epsilon r} \quad (1)$$

$$Fr2 = K/ 4* (S_p + Z_p)* \sqrt{\epsilon r} \quad (2)$$

Where r denotes the substrate's permeability and K denotes the in free space, a speed of light. Several equations and methods have been developed to learn more about efficient classification. Indeed, using the partnerships S+H = 4fr/c and S+Z+H-Ws = 2fr/c, the F1 and F2 are the two frequencies that have already been calculated. The gauss-newton method has been used to enhance least-squares data in a non-linear methodis also necessary yields a product that is best for modeling PIFA antennas.

System Design:

The platform is arranged in three steps, continuing with 2 distinct antenna designs and culminating with a symmetric two-element PIFA antenna. designs to four-element PIFA antenna designs. Each antenna is a planar arrangement that can be a fine time to get a multi-resonance effect. For 5G mobile communications, low-cost, closer printed slotted antennas are now being builtare some of the three device designs. In all 3 types, the machine circuit board is nominated to be 50mm x 112mm, this is appropriate for 5G smartphones. The adapters are developed with a method for copies the mask on a silicon slab using photoresist layers that uses electronics and radiation, yet was estimated using a vector network analyzer ZVA 67 (measures up to 67GHz frequency) and a port impedance of 50.The antenna was created with the purpose of offering broadband wireless technology. The legal frequencies for 5G mobile applications are 29GHz and 32GHz. The required antenna's geometry is demonstrated. It's built on a rogers RT5880 substrate with parameters of W L = 55110mm^2 with a thickness of 0.532mm, a loss tangent tan =0.0012 and a dielectric constant of 2.5 The ground plane, and the two radiating places, are printed on the substrate and are crafted of copper material.Figure 3. shows the design of an antenna

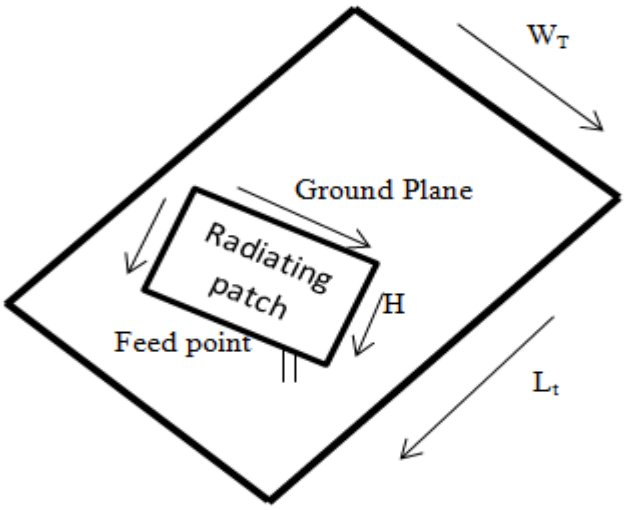

Figure 3. Antenna design

The dimensions of necessary radiating patches are first measured using the defined resonant frequency. For dual-band activity, there are 2 different operating frequencies.The

28GHz antenna has a patch size of W_{20}* L_{20} =3.452.362mm^2 with an inset feed ofg* d1 =0.3*1.5mm^3. The 32GHz antenna with a patch size of W_{28}*L_{28}= 3.9*2.2mm^2 and then g *d2 = 0.1*3.2mm^2 insert feed. To stimulate the correct set of data, the a microstrip transmission line eats the patches. Have used W40*L40 = 1.52*2.36mm2 to achieve 55 input impedance matching. 75 quarter wavelength transformers in an array of configurations are also used to feed the process of W_{10}* L_{10}28 =0.75(32.96)mm^2 and W_T*L_T38 =0.84(21.88)mm^2 and W_T*L_T25 =0.75(25.34)mm^{2}and W_T* L_T18 =0.70(35.42)mm2 and W_5* L_5 =0.62(37.50)mm^2 and W_T*L_T28 =0.4(1.17*22.45)mm^{2}that is perhaps the ground plane (Lg = 5325mm2) or the slot dimension (WS* LS =122.05mm2). Between the two antennas, the ground plane moulds an extended rectangular strip even further decrease mutual coupling and raise impedance bandwidth.Mutual coupling is the core idea of multi-port engineering, and it feels more confident although the distance between the two antennas is lesser mutual coupling is increased by optimizing the distance between the two energy sourcescan be minimized.D = 11.16mm is the distance between any two ends of the patch antennas, which is only large enough to resist grating lobes. Even then, since the width and distance of the inset feed have a significant effect on resonant frequencies and return loss levels,optimization and a range of parametric cases can be used to achieve and selecting the right potential scenarios. The ground has both a slot designed into the backside of the substrate to boost impedance matching and isolation. Table 1.shows the value of the parameter.

Parameter	Values(mm)
W20	25
L20	40
W28	18
L28	33
W40	28
L40	50
W10	98
L10	30
WT	63
LT	47
W5	58
L5	39
WS	57
LS	66

Table 1. Antenna dimensions

Regularized Bayesian Neural Networks:

By introducing Bayes' theorem into the batch normalization scheme, bayesian standardized machine learning (BRANNs) help to address these things.

$$B(\alpha) = \beta\sum_{i=0,1,2}^{Nd} zi\text{-}\,[f(x)]^2 + \sigma\sum_{k=0,1,2.}^{N\,d} wj^2 \qquad (3)$$

N_d is the maximum number of weights. The cost function, B (α), is reduced concerning the weights w despite the hyper parameters' initial values.By multiplying the data, arean estimate of and is made.Assuming Gaussian probability distributions both for the weight and information, it is accurate that now the prior possibility over the weights, w, can be written as

$$P (Z(\alpha,M) = 1/B_s(\lambda) \exp(- \mu E_w) \quad (4)$$

With..,

$E_w = \sum_{i=0,1,2}^{Nd} \omega j2$ being the weight of the error

Similarly, the frequency of errors could be written as

$$P(|K ,h,\alpha) = 1/z_0(\beta) \exp(-\beta E_0) \quad (5)$$

With..,

$$E_d = \sum_{j=0,1,2}^{Nd} [Z]i - f(x)]^4 \text{being the error of the data} \quad (6)$$

$$P(\omega|B|, \lambda,\mu, K) = P(D)|W, \beta, H), P(D),W,\alpha,H) / P(D|\beta, \alpha, \mu, H) = 1/z_k \exp [-S(w)] \quad (7)$$

B (α) can be written as a Taylor expansion of the weights' most probable (MP) value, w MP.

$$B (\alpha) = B(\alpha_{kl}) = +1/4(\alpha- \alpha_{kl})^t H(\alpha- \alpha_{kl}) \quad (8)$$

If G is the maximum error function's Hessian matrix,

$$G= \beta B(\alpha_{kl}) = \mu(1.15287)k^i(\alpha- \alpha_{kl}) = \beta d^{-1} \quad (9)$$

$$P(\alpha,H |D|, \beta) = 1 / Z^*_{(B)} \exp – [- B(\alpha_{kl})]- ¼(\Delta W^t K \Delta W) \quad (10)$$

The term means the number of parameters for the model. Minimization has been the most time-consuming step. This cannot be performed by using backpropagation as in a simple ANN; however, that is enough to use a method like with the conjugate-gradient process, and even the output and the inversion of G. The inverse of the data Hessian, D, which has already been evaluated in the intelligence optimization loop, can also be used to add error bars to predictions made from BRANN models.After connecting w to each weight in the network, the derivative (g) is computed and use a finite difference method that measures the network predictions (y) concerning the weights.

4 Genetic algorithm:

Genetic algorithms are a method of machine learning that deals with capability challenges and how to solve them. A GA interprets data, helping it to reject bad approaches to create nicer designs. GA is a healthy heuristic approach to solving search and optimization problems. It refers to a family of algorithms known as evolutionary algorithms.At GAs, we're working to refine a population of candidate solutions to find the best one. The model learns by developing exponentially valuable offspring, as determined by a fitness function, which is a measure of the desired result (maximum or minimum). To arrive at an optimal solution, GA simulates normal techniques like crossover, mutation, selection, and inheritance.The proposed method determines the initial population at random, and ordinary nodes and cluster heads (CHs) are dispersed so widely that they cover the entire network.

Pseudo Code for Genetic Algorithm:

t = 0;
initialize(P(t= 0));
evaluate(P(t = 0));
while *is Not Terminated()* **do**
  P_P (t) = P(t). select Parents();
  P_c(t) = reproduction(P_p);
  Mutate(P_c(t));
  Evaluate(P_c(t));
  P(t+1) = build Next Generation From (P_c(t), p(t));
  t = t + 1;
end

As a rule, 1) the average distance of each node, with lower CH, to send the message to the base station; and 2) the average distance of each node, with lower CH, to send the message to the base station (BS) reduced energy consumption and, as a factor, expanded node scalability.At first, each fitness parameter is assigned an arbitrary weight; however, the most comfortable chromosome is measured after each generation, and the weights for each fitness parameter are adjusted. The GA effect determines acceptable network clusters.The sensor nodes realize the largest network data from the BS. The planning process for the demand, the number of CHs, the stakeholders associated with-CH, and the number of transmissions for this structure are indicators of such communicating messages.The cluster fabrication process has been completed when all of the sensor nodes receive packets from BS and form people into groups based from them. The data transfer process then proceeds.

5 Result:

With a port impedance of 50, the antenna distance is produced that used a ZVA 67 vector network analyzer (measures speeds up to 67GHz). The 29GHz and 32GHz ranges are being used in the comprehensive integrated systems**.**For the 29GHz and 32GHz, mm-wave band frequencies can perceive |S11| and |S22| 10dB. As a result, both antennas achieve the necessary return loss standards. The simulation generates frequencies of 27.946GHz and 37.83GHz, although the calculated two-element design yields frequencies of 28.3GHz and

38.9GHz. In 5G wireless connectivity, each of these bands can be used. The two-port antenna system's transmission coefficients. mm-wave frequencies may perceive S21 and S12 at 29dB for 29GHz and 32GHz, so the two antennas are similar to each other and. The two antennas are equally linked. The performance of simulation and measurement are incredibly well correlated.Moreover, there are no appear different isolation mechanisms, resulting in excellent isolation. The discrepancy between simulation and measurement refractive index parameters may be attributed to fabrication safety margins, defect SMA connector damage, improper soldering of the SMA connector, tangent of the rogers substrate, or mismatching between the connector and the sensor antenna feeder, and ecological consequences. Diagram 4. shows the results of the proposed system using bayesian regularization.

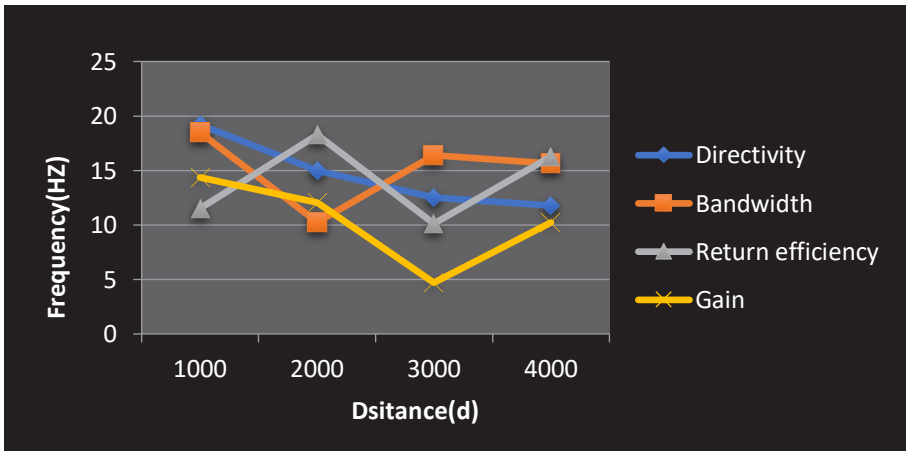

Figure 4. The directivity, bandwidth, return efficiency and gain using bayesian regularization algorithm

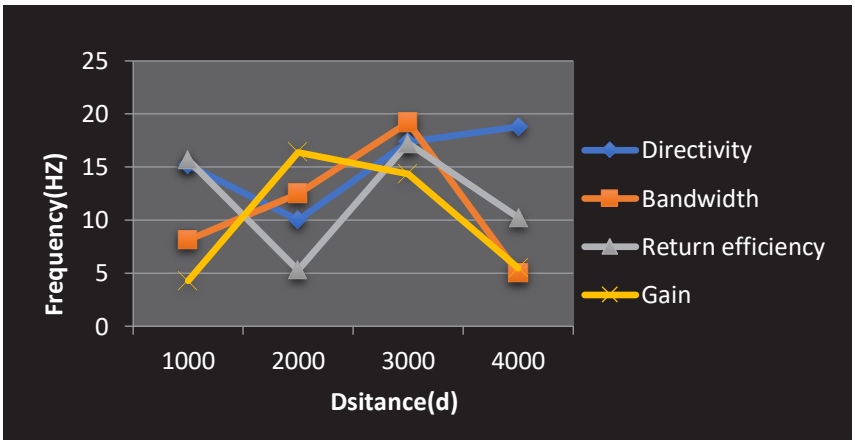

Figure 5. The directivity, bandwidth, return efficiency, and gain using genetic algorithm

A for mobile communication applications, a a design of a two-element dual-band slotted microstrip PIFA antenna. Cutting inverted I-shaped slots into the upper sides of two rectangular microstrip patch more of the PIFA antenna. This antenna is positioned on a Rogers

5880 substrate that is lossy and satisfies the following structure: h = 0.508mm, r = 2.2, and loss tangent tan = 0.0009, and a width of wL = 55110mm^2. With different blade lengths, the slots imprinted in the rectangular patches change. This difference results in the superior match at the preferred.With an inset feed of gi =0.21.2mm2, the WPLP =4.592.82mm2 seems to be the patch size generated by a single antenna. To discourage mutual coupling and grating lobes, the two patch edges are separated by a length of D =9.41mm (about 0.87mm).As a rule, the introduced PIFA system's two separate antennas are adequate when opposed to other systems. The parameters were finally adjusted.The wavelength distributions of surface waves at 29 and 32GHz. The central the surface currents are centered on a patch with a resonant frequency of 29GHz in the "far to the I-slots' deepest field." The current paths develop to a resonant frequency as the evolutions through the slots of 32GHz.Diagram 5. shows the results of the proposed system using a genetic algorithm.

Conclusion

Artificial intelligence is at its height. It seems to be well known that ML is not only theoretically safe but also strategically beneficial.The present state of artificial intelligence in communication networks is just scratching the surface, but there is no denying that this technology will be made effective in the future. From a theoretical standpoint, we have reviewed how the major ML principles apply to networking applications in this paper.Besides, illustrated an actual deep learning program that is presently being used in manufacturing. We expect a slew of impactful neural network models to develop later I'll be in the networking community. Only "read-only" network data connection is needed for descriptive and predictive applications.As a response, even at this experimental stage, they are safe and relatively easy to configure. Nevertheless, they have the potential to fix a wide range of problems using arbitrarily sophisticated data mining algorithms.The as the infrastructures for computer vision, big data, and ip based networking (SDN) evolve, the telecommunications and networking industry is ready to use them considering the problems imposed by ML applications. This will pave the way for "adaptive networks," that would change today's static network into a dynamic, programmable environment driven by analytics and intelligence.

References

[1] T. Janevski, “Traffic Analysis and Design of Wireless IP Networks”, Artech House Inc., Boston, USA, 2003.
[2] ITU-T, Y.2001, “General overview of NGN”, December 2004.
[3] ITU-T, Y-2002, "Overview of ubiquitous networking and its support in NGN", October 2009
[4] T. Mitchell, Machine Learning, McGraw Hill, 1997.
[5] Zikria, Y. B., Kim, S. W., Afzal, M. K., Wang, H., & Rehmani, M. H. (2018). 5G Mobile services and scenarios: Challenges and solutions.
[6] Burden, F., & Winkler, D. (2008). Bayesian regularization of neural networks. Artificial neural networks, 23-42.
[7] Kabalci, Y. (2019). 5G mobile communication systems: Fundamentals, challenges, and key technologies. In Smart Grids and Their Communication Systems (pp. 329-359). Springer, Singapore.
[8] Janevski, T. (2009, January). 5G mobile phone concept. In 2009 6th IEEE consumer communications and networking conference (pp. 1-2). IEEE.

[9] Tudzarov, A., & Janevski, T. (2011). Design for 5G mobile network architecture. International Journal of Communication Networks and Information Security, 3(2), 112-123.
[10] Ameerudden, M. R., & Rughooputh, H. C. (2012). Hybrid BSCF Genetic Algorithms in the Optimization of a PIFA Antenna. International Journal of Machine Learning and Computing, 2(6), 746.
[11] El Misilmani, H. M., & Naous, T. (2019, July). Machine learning in antenna design: An overview on machine learning concept and algorithms. In 2019 International Conference on High-Performance Computing & Simulation (HPCS) (pp. 600-607). IEEE.

Student Career Prediction Using Decision Tree and Random Forest Machine Learning Classifiers

N. VidyaShreeram[1], Dr. A. Muthukumaravel[2]
{vidushreeram123@gmail.com[1], dean.arts@bharathuniv.ac.in[2]}

Research Scholar, Department of Computer Applications, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India.[1],
Dean, Faculty of Arts and Science, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India.[2]

Abstract. Education is so important for the youngsters; some of them don't have the interest towards schoolings, so they drop their study after certain time. As in this fastest world student are going through their academics and with their interested courses. So this is an important in the entire student to choose his future career. Machine learning approaches are applied in various domains. This proposed work deals with the career predication of the students as weather they will be going for their next level of higher education from their present graduation level using machine learning concepts like DT (Decision Tree) and RF (Random Forest). Applying the concept of DT it yields a result of about 91% of accuracy and applying RF it gives 93% of accuracy level. The result of the proposed system helps the recruiters to select the only needed and proper candidates.

Keywords: Random Forest, Machine Learning, Decision Tree, Classifier, Accuracy, Career Prediction

1 Introduction

The literacy in the world is the key for the social economic progress, as per the calculation the India has 81.1% of education people. The topmost country in the education is Kerala. The percent of the educated one includes from both the rural and urban areas. But the rest of the 18.9 percent of illiterates is noticeable. The reason for illiteracy in India is many and more. The most common reason for the illiteracy is the poverty condition of the family, inadequate of school and also because of the inadequate number of properly trained educators. There is more number of children in street or orphans who don't even get a chance for education. In this society competition is multiplying day by day. Mainly it is a very tremendous to beat the competition in this difficult world. Though it is a tough one student should compete it and reach the goal. So there is a need to evaluate the student with their performance in a constant manner and the interest towards their goal should be evaluated. And it is very important that they are directed towards a right path. There are various types of sectors for the candidates to choose their right path.

Machine learning is an application which makes the system to learn and improve from the experience without being explicitly programmed. It is a process of data analysis which automates analytical model building; machine learning is one of the branches of the AI (Artificial Intelligence). The systems that were built on the machine learning algorithms have

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the ability to learn something from the past data. Machine learning is basically of three types they are supervised learning, unsupervised learning and reinforcement learning. Here in this proposed system machine learning concepts are applied to detect weather the particular candidate will be preceding his higher level education. Machine learning has many concepts and branches. Such as decision tree, naviebayes, random forest etc. By applying the concept of RF and DT on the student dataset and accuracy level of RF is better comparing with DT.

The section II conveys different reviews of the authors at machine learning concepts. Section three elaborates the concept in this proposed system. Section four is about the result and discussion of the proposed method. Finally in the last section concludes the result of the proposed system.

II LITEERATURE REVIEW

Students doing their favorite stream and doing their academic activities based on their own decision. Evaluate students capability is very important to find their career path. This evaluation is helpful to the students to increase the performance level and encourage their interested area. The job providing companies are also evaluating the students in various aspects. Career prediction systems are used to decide the suitable role of the students or they are interested to their higher studies. K. Sripath Roy et al., provides more importance of computer field student's career prediction with the help of three machine learning concepts. Here the data can be trained by using various three machine learning algorithms like SVM, XGBOOST and decision tree. From the above mentioned algorithms SVM produces better result in term of accuracy level [1].

Taking decision about their career in people life is very difficult. Normally the student's career is predicted by using questionnaires method. But in this method does not reflect the state of the students. Min Nie, et al., proposed a new model based on students behaviors in college campus. Student's behaviors also used to predict their career [3].

Due to the advancement of computing concepts deep learning approaches has considered for various domains. It is used in the education domain also. Bendangnuksung et al., proposes a new model called DNN (Deep Neural Network) to find the category of the students. This model is used to provide the solution for failed people. The same data set can be applied on existing machine learning concepts. But this proposed model produces 84.3% of accuracy and performed well compared with existing machine learning approaches [4].

Companies spent lot of time to appoint the students from various educational institutions. The educational intuitions also not able to provide 100% job facility within the qualified students. Students from the various intuitions are also unable to get proper training from their educational institutions. They are not providing the proper training based on organization requirements. The recruiting organizations also have no knowledge about the students. To solve the above problem KachiAnvesh et al., developed a new tool. It will be executed automatically. The main task of this tool is to find the student's eligibility based upon various qualifications such as CGPA, extra courses completed, projects completed, internship etc. The main goals of this project are 1.to make the decision to go the students to the interview or refuse them. 2. Educational institution provides training to students those who are refused by small reasons like programming skill, communication skill etc. This task is executed based on minimum eligibility and preferred eligibility. These two types of eligibilities are important for job providing companies [5].

Success is one of the important factor is everyone life. The public needs to be doing well should provide concentration to their younger people, because the youngest peoples are the future of the country. In this research article Vahide Nida Uzel et al., studied about the performance of various level students to be measure with the help of various classifiers like MLP (Multilayer Perceptron), RF (Random Forest) ,NBC(Naïve Bayes Classifier), DT (Decision Tree) and classifier based on voting. This study also used to find the academic related characteristics of the students. Various features affect the achievement of the people. The important features are student absent, satisfaction of parents about school, activity on the class and the responsibility of the parents. Here Apriori concept is used to identify the association between the various features. According this research classifier based on voting concept provides better result than existing ANN(Artificial Neural Networks) technique. ANN and classifier based on voting method is also use the same dataset [6].

Vladimir L. Uskov et al., presented the output of their research project. The aim of their research work is to evaluate eight types of machine learning approaches. This research work mainly focuses on student's performance in academic. The authors also conducted a survey on computer science graduates to identify their attitude about using of machine learning based analysis in education field and the student's responses also added in the research paper [7].

III PROPOSED SYSTEM

In earlier days student's career is forecasted by using questionnaire method. But it is a time consuming process and it is very difficult to find the status of student's opinions. Various computing techniques are used to predict the career of the student's. In this research work DT and RF machine learning concepts are used to forecast the student's career. Compare to existing traditional methods new computing concepts like machine learning approaches produces better result. The following Fig 1 shows the flow diagram of proposed system.

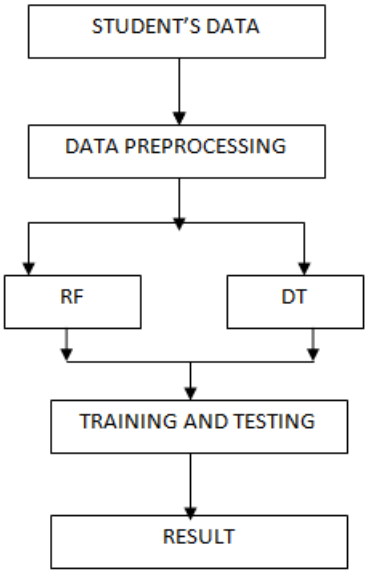

Fig1 Proposed System Flow Diagram

Student's data is given to the input of the proposed system. Data collected from colleges and do the preprocessing task. Preprocessing task is important for data analysis task because in this process remove the unwanted data from the original data and fill the mission values. DT and DT algorithms are applied on the preprocessed data. In the next level train and test the data. This research work uses 16 various attributes like age, father and mother education status, health condition, family economy level etc. are used to predict their career. The following correlation heat map fig 2 shows the various attributed in this research.

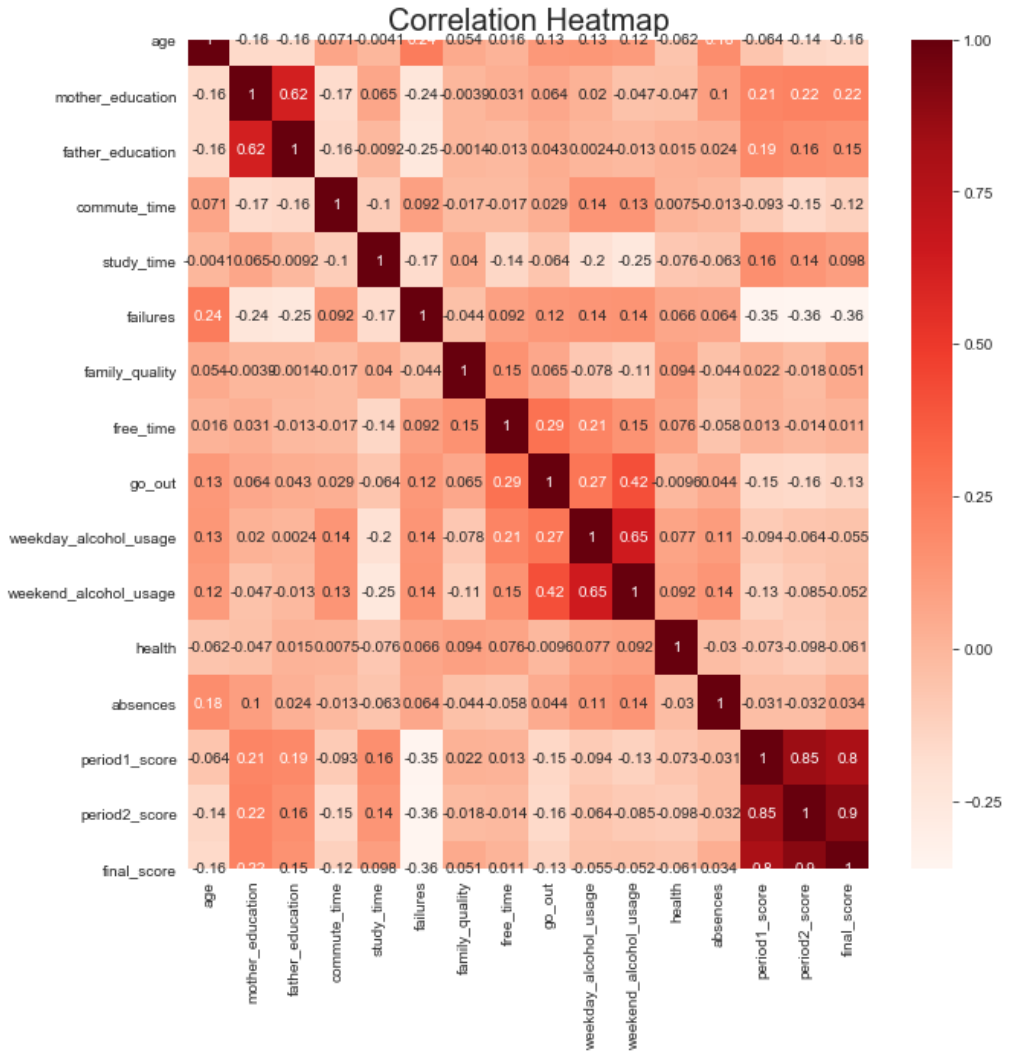

Fig 2 Correlation Heat map

Decision Tree (DT)

Decision tree are most common in research operation, particularly in decision analysis to identify a strategy which is most likely to reach a goal and it tree and turns out that it has influenced a wide area of machine learning, covering both classification and regression. Using the basic concepts of decision tree various advance concepts also implemented like RF,

bagging and gradient boosting. XG Boost technique is also one of the advance concepts of DT. Normally CART, C5, ID3 and C4.5 type of decision trees are used to classify the data. in DT node represented as the input identifier(X) and divide the variable, assumption of identifier is numerical value. The leaf of the decision tree is called as terminal node and represented by using the identifier(Y) which is important for forecasting. The intital step of the DT is selecting the root value. In the next stage compute the IG (Information Gain) and Entropy of every node before division. Then choose the nodes which contain more IG or low entropy value. Again divide the node and repeat the same process until no option to divide or the value of entropy is low. Entropy is one of the important metric to assess the chance of information. IG is used to evaluate how much the entropy value is decreased prior to past division.

Construct DT, to compute two kinds of entropies with the help of frequency data table. Entropy value is calculated by using only one attribute in frequency table is as the following equation.

$$E(S) = \sum_{i=1}^{c} - p_i \log_2 p_i \qquad \text{--------(1)}$$

Calculate the Entropy value of frequency table by using two attributes as the following equation.

$$E(T, X) = \sum_{c \in X} P(c) E(c) \qquad \text{-------(2)}$$

The IG value can be calculated by using the following equation.

$$Gain(T, X) = Entropy(T) - Entropy(T, X) \qquad \text{------(3)}$$

RANDOM FOREST (RF)

RF is on the best prediction instrument in the field of education. It yields better prediction result in terms of accuracy compared with other machine learning concepts and it is working like as bagging and boosting techniques. RF approach creates many decision trees by using sample predictor identifiers. It makes the assumptions of nominal type of identifiers (regressions) and continuous identifiers (classifications). Mean value of every tree are used in regression type of problems and weighted value of decision trees are used for classification type of problems. Aggregate values of all decision trees produce the better prediction result. RF concept is unique for handling large amount of data and it is easy to handle missing data. The RF approach can be explained as the following steps.

Acquire K samples information data from the training information

For every sample construct RF tree

*choose m_{try} identifier

*choose the best identifier / division point with in m_{try} identifier

*divide the node into 2 sub nodes

c) Do again the step b until n_{min} value reached

d) Forecast the new information from model tree

Here K number of trees can be described as follows:

$\{T_k\}_1^K$

The point x , predicted can be developed as follows:

$$Regression : \hat{f}_{rf}^{K}(x) = \frac{1}{K}\sum_{k=1}^{K} T_k(x)$$

$$Classification : \text{Given that } \hat{C}_k(x) \text{is the class prediction of the } k^{th} \text{ tree}, \hat{C}_{rf}^{K}(x) \text{ is the majority vote of the random forest trees}(\{\hat{C}_k(x)\}_1^K)$$

In this research work RF and DT concepts are used to predict the student's career. This concept can be implemented with the help of python programming.

IV RESULT AND DISCUSSION

Machine learning approaches are used in various fields. In education domain also machine learning concepts are used. This research mainly focuses on student's career forecasting. Student's historical data can be used as the input of this work. From the entire data the various features are extracted by using feature extraction methods. The prediction accuracy value changed depends on the number of features extracted from the original data. The following figure 3 shows the relation between the number of features and the prediction accuracy level.

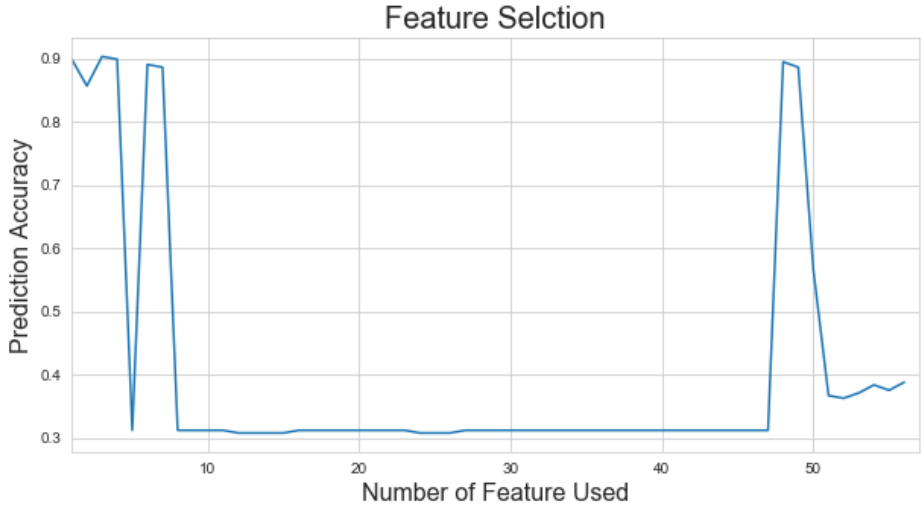

Figure 3 Relation between number of features and Accuracy level

Initially, preprocessed data can be classified by using decision tree and the next level DF classifier also applied on the preprocessed data. The following figure 4 a) and b) shows the accuracy level of Decision tree and random forest classifier.

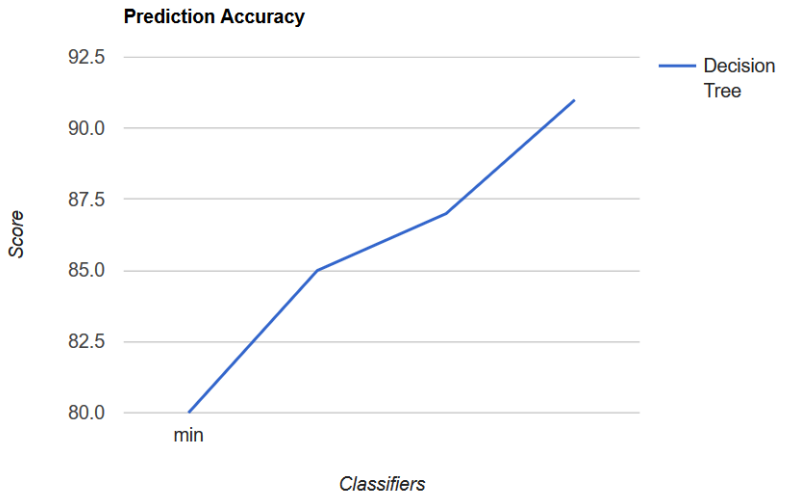

Figure 4 a) Accuracy Level of Decision Tree

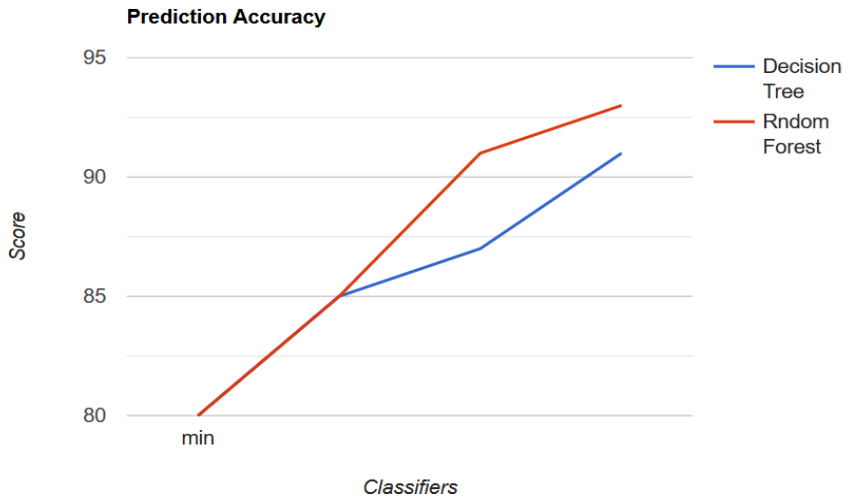

Figure 4 b) Accuracy Level of Decision Tree and Random Forest

Based upon the output of our proposed system accuracy level of Random Forest is better than Decision Tree.

V CONCLUSION

The thing that is very important for the student who chooses their higher level education is that they should know their capability and select their courses with their interest towards the particular course. The output of the career prediction is also mainly used by the recruiters, because the job providing organizations spent large amount of money for selecting the suitable candidates. This research work forecast the undergraduate students' career by using RF and DT machine learning classifier. The classifiers are implemented by using Python programming languages. Compared with other programming language it is easy to implement real world problems. Final output shows that Random Forest classifier produces better result than the Decision Tree classifier.

References

[1] K. SripathRoy ,K.Roopkanth , V.UdayTeja , V.Bhavana and J.Priyanka (2018), "Student Career Prediction Using Advanced Machine Learning Techniques", International Journal of Engineering & Technology, Vol. 7, pp. 26-29.

[2] Min Nie , ZhaohuiXiong , RuiyangZhong , Wei Deng and Guowu Yang (2020), " Career Choice Prediction Based on Campus Big Data—Mining the Potential Behavior of College Students" , Journal of Appl. Sci. pp. 1-14.

[3] Min Nie, Lei Yang, Jun Sun, Han Su, Hu Xia, DefuLian& Kai Yan (2018), "Advanced forecasting of career choices for college students based on campus big data, Springer Frontiers of Computer Science , Vol. 12, pp. 494–503.

[4] Bendangnuksung andPrabu P (2018)," Students' Performance Prediction Using Deep Neural Network", International Journal of Applied Engineering Research ISSN 0973-4562, Vol. 13, No. 2, pp. 1171-1176.

[5] KachiAnvesh, B. Satya Prasad, V. Venkata Sai Rama Laxman, B. Satya Narayana (2019), Automatic Student Analysis and Placement Prediction using Advanced Machine Learning Algorithms", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Vol. 8, No, 12, pp. 4178-4183.

[6] Vahide Nida Uzel, Sultan SevgiTurgut and Selma Ayşe Özel (2018), "Prediction of Students' Academic Success Using Data Mining Methods", IEEE 2018 Innovations in Intelligent Systems and Applications Conference (ASYU).

[7] Vladimir L. Uskov , Jeffrey P. Bakken , Adam Byerly and Ashok Shah (2019), "Machine Learning-based Predictive Analytics of Student Academic Performance in STEM Education", 2019 IEEE Global Engineering Education Conference (EDUCON).

[8] S.Umadevi, S. Nirmala SugirthaRajini, A. Punitha and Viji Vinod (2020)," Performance Evaluation of Machine Learning Algorithms In Dimensionality Reduction", International Journal of Advanced Science and Technology, Vol. 29, No. 9s, (2020), pp. 3845-3853.

Traffic Prediction System Using Machine Learning Algorithms

Nazirkar Reshma Ramchandra [1], Dr. C. Rajabhushanam [2]
{reshma174@gmail.com[1], rajabhushanamc.cse@bharathuniv.ac.in[2]}

Research Scholar, Department of Computer Science and Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India.[1],
Professor, Department of Computer Science and Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India.[2]

Abstract. Traffic congestion is defined as the state on transport which is characterized by slower speeds of vehicles this is also because of the bad condition of the roads, weather, concern zone, temperature, etc. This traffic flow prediction is mainly based on the real-time dataset which is collected with the help of various cameras and sensors. In recent day the deep learning concepts has dragged the attention for the detection of traffic flow predictions. In this paper, some of the common and familiar machine learning concepts like Deep Autoencoder (DAN), Deep Belief Network (DBN), and Random Forest (RF) are applied on the online dataset for the traffic flow predictions. The important attributes of weather, temperature, zone name, and day are used to predict the traffic flow of the particular zone. The performance of the proposed system can be evaluated by using accuracy, precision, and RMSE, and MSE value. Among the three methods, the DT technique produces a better result.

Keywords: Traffic Flow, Machine Learning, Prediction, Accuracy, Recall, Performance.

1 Introduction

This world is very busy today. Each and everyone in this world has something to do always. This leads to many difficulties in society. One of the main problems is traffic congestion. This is due to overpopulation. Because of traffic congestion, there are many economic problems over society, health problems, and a heavier impact on the environment. So this condition should be changed. Decreasing the level of traffic congestion is an important research area. Proper traffic prediction is one of the challenging tasks because the traffic data is dynamically and complex. The traffic of the zone depends on the capacity of the road, type of road users, time, weather, events, and traffic policies, time of the day, etc. This research work uses machine learning concepts to predict traffic flow.

Section two elaborates on the view of various authors regarding machine learning concepts used to predict the traffic flow. Section three explains the methods used in this prediction system. Section four deals with the experiment result. Finally, section five concludes with the proposed system.

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2 Literature Review

The main aim of the Smart transport system is to distribute new services to various modes of transportation and managing traffic. The flow of traffic forecasting is the key attribute used to managing traffic. Due to the growth of modern technology in real-time, various new techniques and types of equipment are used in the traffic prediction system. From the various new techniques, deep learning is one of the important concepts used to retrieve important characteristics effectively from the amount of raw data with the help of unseen layers. Traffic data with nonlinear features is one of the important reasons for producing less accuracy result in traffic prediction. Shiju George et al., 2020 proposes a new bioinspired technique with a fuzzy concept. Technological indicators issue the flow characteristics of an input. Unseen layers of the Deep learning framework continuously learn the characteristics and transmit to the next level layer. Membership degree is measured with the help of membership methods. Finding optimized weight value with the help of the Dolphin Echolocation concept to set the model for data with nonlinear features. Experiments were conducted on two various datasets and display the output for the new proposed deep learning-based framework. Produced results show that the key significance of the traffic jam prediction [5].

Vehicle identification is an important technique in the transport system. By identifying the vehicle, the number of automobiles is known and the presences of the vehicles on the path are important factors. High dimensional data can be used to denote the automobiles. Feature retrieval and classifying features are the important processes used to identify the automobiles. High dimension data takes more computation time during the feature extraction process. D. M. S. Arsa et al., 2017, proposes the DBN (Deep Belief Network) technique for reducing the dimension of the data to detect the vehicles. In this research, the authors try to identify motorbikes and cars. Here DBN technique is used to reduce the dimension of the data and the SVM concept is used to classify the data. The proposed method applied to the UIUC dataset and the outcome of the current technique is compared with the PCA method. The experiment outcomes show that DBN concept provides a better result than traditional PCA method in the identification of automobiles [6]

In the transport system traffic flow forecasting is a major issue. Various existing techniques produce unsuccessful output due to various reasons like thin framework, engineering manually, and learning separately. W. Huang et al., 2014 proposes a new deep framework that contains two basic parts. At the base part contains DBN and the top portion contains the regression layer. DBN technique is applied for the purposed of unsupervised learning and it learns efficient attributes for traffic forecasting an unsupervised manner. It produces a better result for many places like audio and image classification. The regression layer is used for supervised forecasting. The experiment outcomes describe that the proposed method increases the performance of existing systems. The positive outcomes say that multitask regression and deep learning are important technologies in the transport system research [7].

Sheik Mohammed Ali et al., 2012 presented the best algorithm to categorize automobiles recognized using many inductive systems. RF (Random Forest) algorithm can be used for classification purposes. This proposed system is used to categorize the vehicles and count them based on the traffic situation. The output of the proposed method compared with other techniques depends on signature and threshold data. The outcome from the proposed system shows improved accuracy compared to signature and threshold-based techniques [8].

According to Zhenbo Lu et al., 2019 recognizing and identifying the mode of travel and passenger travel pattern are the major issues in the transportation system. MSD (Mobile-

phone Signaling Data) technique have various merits like wide area coverage and less acquisition amount, reliability and stability of data, and better performance in real-time. Here the authors develop a travel mode identification system using MSD integrated with travel data. GIS data and navigation type data. The proposed system applied to the Kunshan data set in China and the model produces better accuracy 90%. This accuracy level is suitable for all kinds of transport modes except for buses [9].

3 Proposed Methodology

Traffic is one of the major issues in an urban area. Due to the unemployment in the village, the people move to urban areas. The population rate is increased day by day in cities. Various techniques are followed to control the traffic flow in major areas. Machine learning concepts are playing a major role in all domains. Traffic flow is also predicted with the help of machine learning techniques. This research work uses three kinds of machine learning approaches like DAN, DBN, and RF.

DAN

DAN is one of the neural network technique using feed-forward concepts. It accepts a value x and converted to an unseen symbol or space (h). Autoencoders reduce the input into a low dimension and produce the output data from the given input representation. It contains three important elements. They are encoder, code, and decoder. The encoder process is represented by using the following equation (1).

$$h = \sigma(wX + b) - - - - - - - - - - - - - - - - - - (1)$$

From the above equation, W represents the unseen weight value and b represents the components and σ stands for the sigmoid method. The decoder element changes the resulting unseen representation into feature space y with the help of the following equation (2).

$$y = \sigma(W'\, h + \, b') - (2)$$

Here W represents weight and b states the weight value. The succeeding layer is an unseen layer of the preceding one. Each layer is trained with the help of the gradient descent method with an optimization technique, which is J (reconstruction error) of every layer. This concept is represented by using the equation (3).

$$argmin_{\ w1\ \ b1w2b2\ \ } [j] = argmin_{\ w1\ \ b1w2b2\ \ } \left[\frac{\sum_{i=1}^{m}\|x_i - x_i'\| + J_{wd} + J_{sp}}{2}\right] - - - - - (3)$$

From equation (3) J denotes the squared reconstruction error of the autoencoder layer $x_i \ and \ x_i'$ denotes the ith data of input.

DBN (Deep Belief Network)

DBN is one of the most familiar and efficient techniques among the entire deep learning techniques. It is used to identify, group, and produce pictures, video streams, and motion data. DBN is a mixture of RBMs (Restricted Boltzmann Machines). RBM contains a two-level layer graphical system that can be made up of two layers are hidden and visible layers represented by the following figure 1.

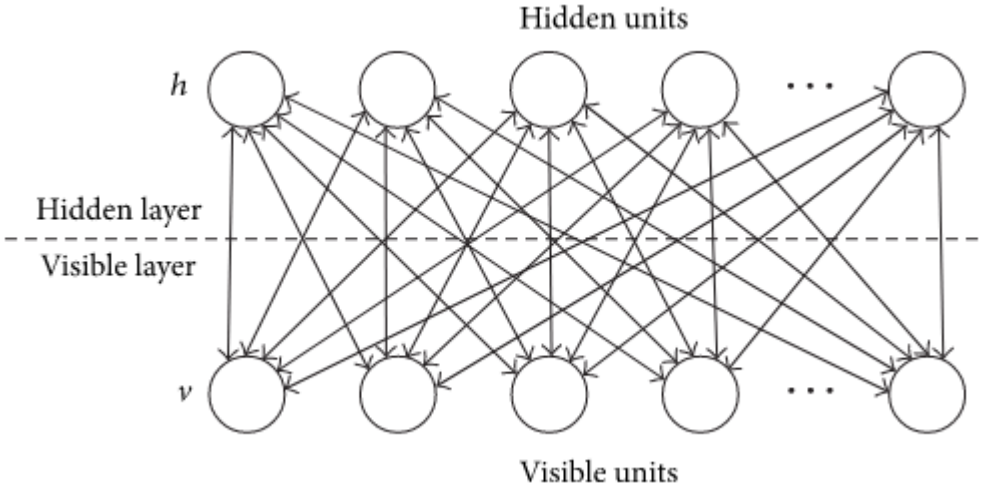


Figure 1 Restricted Boltzmann Machine [11]

Every element of the layer is linked with all other elements by using edge values. The elements available in a similar layer are disjoined with other elements. DBN approach is like a stack of different RBMs. All units' values are random identifiers. Noticeable and unseen elements are obeyed Gaussian and Bernoulli distribution. It is described as follows:

$$P(v_i|h) = N\left(b_i + \sum_{j=1}^{j} w_{i,j}\, h_j, 1\right), P\left(h_j = 1\middle|v\right) = \text{sigm}\left(a_j + \sum_{i=1}^{I} w_{i,j}\, v_i\right) - - - -(4)$$

From the equation (4) $N\left(b_i + \sum_{j=1}^{j} w_{i,j}\, h_j, 1\right)$ represents Gaussian distribution, mean value is $b_i + \sum_{j=1}^{j} w_{i,j}\, h_j$ and variance value is 1. The equation $\text{sigm}(z) = \exp(z)/(1 + \exp(z))$ is used to describes the sigmoid method. The identifiers I and J used to denote noticeable and unseen units. The values of b_i and a_j represent the bias value of the noticeable and unseen elements. The value of $w_{i,j}$ denotes the association between noticeable element v_j and unseen element h_j. Probability distribution method over noticeable and unseen elements can be represented by

$$p(v,h) = \frac{\exp\left(-E(v,h)\right)}{\sum_{v,h} \exp\left(-E(v,h)\right)} - - - - - \quad (5)$$

From the above equation $E(v,h)$ known as energy method described as

$$E(v,h) = -\frac{1}{2}\sum_{i=1}^{I}(b_i - v_i)^{\ 2} - \sum_{j=1}^{J} a_j h_j - \sum_{i=1}^{I}\sum_{j=1}^{J} w_{i,j}\, v_i h_j - - - - - (6)$$

A greedy method is used to train DBN.

RF (RANDOM FOREST)

According to Juan Cheng et al., 2019, RF is a combined learning technique based on DT. It is a high precision technique in machine learning it avoids the issues of single forecasting or classification system. RF is an ensemble technique that is used to manage continuous reaction and label values. The main benefit of the RF method is it does not affect the issue like

overfitting. Here the value of the error rate is less when more CARTs are further added with the existing one. The major idea used to create RF is to develop a major collection of weak models, which will generate the final powerful model. RF is the huge collection of un-pruned DTs (Decision Tree) with predictors. Un- pruned DTs are trained with the help of a bootstrap model from the given dataset. CART is a machine learning approach used to create RF. CART follows the greedy technique partition of the data recursively by using a top-down partitioning approach that segregates the attribute into a group of disjoint sections. RF consists of many DTs. The following equation (7) denotes the meaning of RF.

$$\{h(x, \theta_t), t = 1,2 \ldots . T\} - - - - - - - - - - - - (7)$$

Here $h(x, \theta_t)$ is represented tree classifier and $\{\theta_t\}$ denotes random vectors, x is known as an independent identifier, θ_t denotes random identifier, T indicates the number of DTs.

The average value of every DT as a prediction output, represented in equation (8)

$$\bar{h} = \frac{1}{T}\sum_{i=1}^{T}\{h(x, \theta_t)\} - - - - - - - - - - - - (8)$$

From equation (8) $h(x, \theta_t)$ is the result based on the values xand θ.

Bagging and subspace are introduced to increase the accuracy value and to avoid the overfitting in DT.

Performance Evaluation

The performance of the proposed system is evaluated for the various metrics like accuracy, precision, root mean squared error (RMSE), and MSE.

The metric RMSE is measured by using the following equation (9).

$$\text{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y_i})^2} \text{ ---------- (9)}$$

From the above equation, y_i is the real value collected during the time of travel, $\bar{y_i}$ denotes the predicted time when the traveling, and n indicates the total number of observations.

The MSE (Mean Square error) can be computed by using the equation(10)

$$\boldsymbol{MSE = \frac{1}{N}\sum(Y - \hat{Y})^2 - - - - - - - - (10)}$$

From the equation $(Y - \hat{Y})^2$ represents the square difference between normal value and forecasted value.

The accuracy value of the proposed system calculated by using the formula (11)

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN} - - - - - - - - (11)$$

The recall metrics can be measured by using the equation (12)

$$Recall = \frac{TP}{TP + FN} - - - - - - - - - - - - (12)$$

TP denotes True Positive value. It means the observation value is positive and the predicted value also positive. FN indicates False Negative. FN represents the observation data is a positive value and the predicted value is negative. TN means True Negative. It means the observed value is negative and the predicted value also negative. FP denotes False Positive. It represents the observed data is a negative value but the predicted value is positive.

4 Result And Discussion

Traffic congestion is considered as one of the most important issues faced in urban areas. Due to the growth of the computing technologies various advanced concepts are used to predict the traffic congestion and traffic flow. This research uses three machine learning concepts such as DAN, DBN, and RF are used to predict the traffic flow. The traffic data set was collected from the online and initial done the preprocessing steps. After preprocessing apply machine learning concepts to predict the traffic flow. The performance of the proposed system is evaluated by using the metrics accuracy, precision, RMSE, and MSE.

Table 1 demonstrates the value of accuracy, precision, RMSE, and MSE.

Metrics/Method	ADN	DBN	RF
Accuracy	88.6%	90.43	92.6
MSE	3340.25	1709.71	346.35
RMSE	57.794895968	41.3486396	18.6104809

Figure 2 shows the performance comparison of various metrics like accuracy, recall, RMSE and MSE.

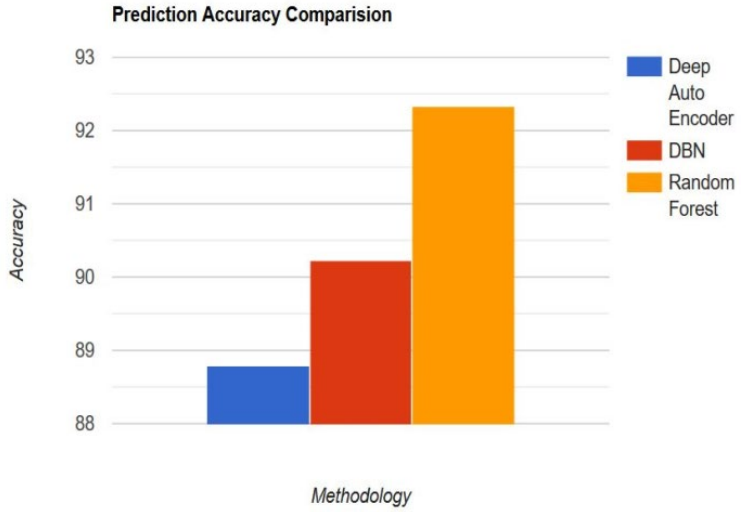
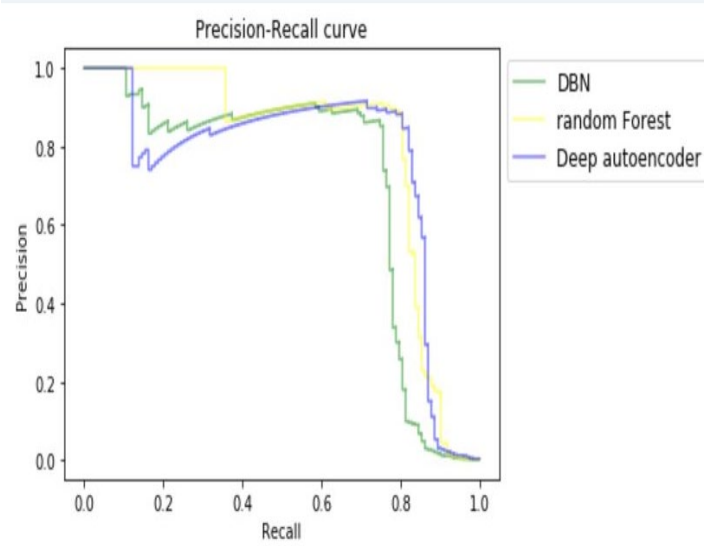
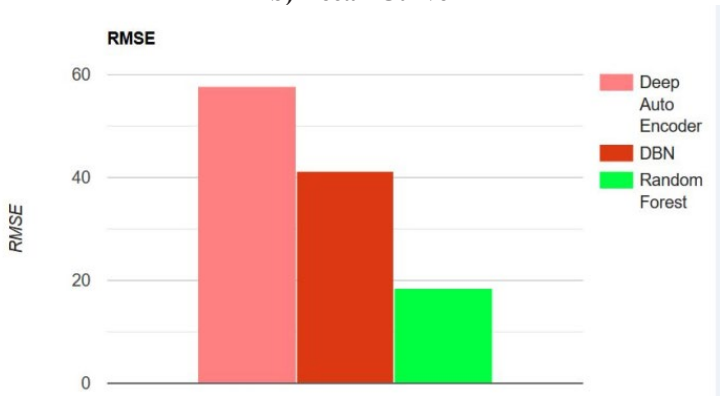


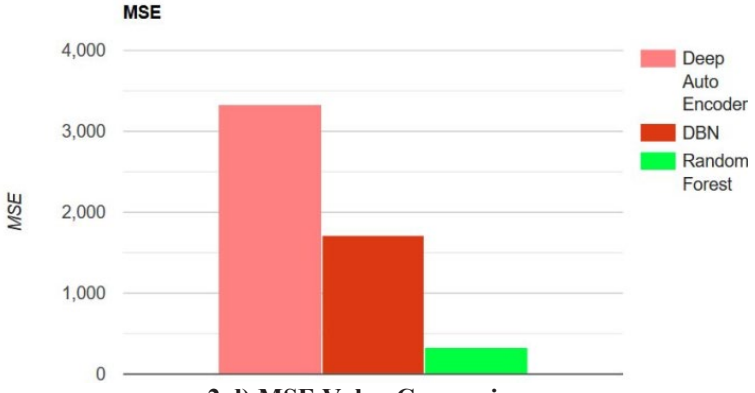
Figure 2 a) Accuracy Comparison



2b) Recall Curve



2c) RMSE value Comparison



2 d) MSE Value Comparison

Conclusion

Due to the huge population traffic is one of the important problems in most of cities. Computing techniques are used to predict the output based on given data in various domains. In smart transport system also uses machine learning concepts to predict the traffic flow. In this research work DAN, DBN, and RF approaches are used to measure the traffic flow. Here the data collected from an online website and are initially preprocessed. During this process, the unwanted and noisy data are removed from the original data. Then machine learning concepts are applied to the preprocessed data to predict the flow. The experimental results show that the DF approach produces a better result than the other two methods. This proposed work is implemented using Python programming

References

[1] Sen Zhang, Yong Yao , Jie Hu , Yong Zhao , Shaobo Li &Jianjun Hu (2019), "Deep Autoencoder Neural Networks for Short-Term Traffic Congestion Prediction of Transportation Networks" , Sensors, Vol. 19, 2229, pp. 1-19.

[2] A. Dairi, F. Harrou, Y. Sun & M. Senouci (2018), "Obstacle Detection for Intelligent Transportation Systems Using Deep Stacked Autoencoder and k -Nearest Neighbor Scheme," IEEE Sensors Journal, vol. 18, no. 12, pp. 5122-5132.

[3] S. Uma Devi & S. Nirmala SugirthaRajini (2019), " Detection of Traffic Violation Crime Using Data Mining Algorithms", Jour of Adv Research in Dynamical & Control Systems, Vol. 11, No.9, pp. 982-987

[4] Arya KetabchiHaghighat, VarshaRavichandra-Mouli, Pranamesh Chakraborty, YasamanEsfandiari, Saeed Arabi& Anuj Sharma (2020), Applications of Deep Learning in Intelligent Transportation Systems, Journal of Big Data Analytics in Transportation.

[5] Shiju George &Ajit Kumar Santra (2020), "Fuzzy Inspired Deep Belief Network for the Traffic Flow Prediction in Intelligent Transportation System Using Flow Strength Indicators", Big Data, Vol. No. 4.

[6] D. M. S. Arsa, G. Jati, M. Soleh& W. Jatmiko(2017), "Vehicle Detection using Dimensionality Reduction based on Deep Belief Network for Intelligent Transportation System," 6th IEEE International Conference on Advanced Logistics and Transport (ICALT), pp. 199-204.

[7] W. Huang, G. Song, H. Hong & K. Xie (2014), "Deep Architecture for Traffic Flow Prediction: Deep Belief Networks With Multitask Learning," IEEE Transactions on Intelligent Transportation Systems, vol. 15, no. 5, pp. 2191-2201.

[8] Sheik Mohammed Ali, Niranjan Joshi, Boby George & L. Vanajakshi (2012), "Application of random forest algorithm to classify vehicles detected by a multiple inductive loop system", 15th International IEEE Conference on Intelligent Transportation Systems

[9] Zhenbo Lu , Zhen Long, Jingxin Xia &Chengchuan An (2019), A Random Forest Model for Travel Mode Identification Based on Mobile Phone Signaling Data, Sustainability, 11, 5950, pp. 1-21.

[10] Juan Cheng , Gen Li &Xianhua Chen (2019), "Developing a Travel Time Estimation Method of Freeway Based on Floating Car Using Random Forests", Hindawi Journal of Advanced Transportation, pp. 1-13.

[11] LaisenNie,XiaojieWang,Liangtian Wan, Shui Yu, Houbing Song and Dingde Jiang(2018), "Network Traffic Prediction Based on Deep Belief Network and Spatiotemporal Compressive Sensing in Wireless Mesh Backbone Networks", Crowdsourcing for Mobile Networks and IoT.

Product Sentiment Analysis Using Particle Swarm Optimization Based Feature Selection in a Large-Scale Cloud

P.Vasudevan[1*] and K.P.Kaliyamurthie[2]
{vasudevan62@gmail.com[1*], kpkaliyamurthie@gmail.com[2]}

Research Scholar, CSE, Bharath Institute of Higher Education and Research, Chennai, India.[1],
Professor/CSE, Bharath Institute of Higher Education and Research, Chennai, India[2]

Abstract. Cloud computing is evolving by shifting its services out of the applications of the firewall, storage, services, and applications that are accessible on the web. After this, the services will be used with the help of the Internet and paid according to the user's/customer's needs. Big data can be efficiently and economically analysed using Cloud computing. Sentiment Analysis deals with study of opinions, and is based on the emotions, attitudes, and opinions of this entity. The objective of the proposed work sentiment analysis using Particle Swarm Optimization (PSO) algorithm based on new Feature Selection (FS) method. FS method is quite complex and a demanding task in terms of computation more so for a high dimension dataset. Swarm Intelligence (SI) is techniques capable of solving computational problems that are NP-hard (Non-Deterministic Polynomial time). It is gaining plenty of popularity to solve the problems of optimization and FS. Particle Swarm Optimization (PSO) is used widely for solving problems of optimization and also the problems of FS. The Support Vector Machine (SVM) analyses data and further identify patterns utilized for classification purposes. In this work, a PSO-based FS is proposed for product sentiment analysis. The classification accuracy achieved by PSO based FS is higher by 5.93% and by 6.91% for 20% training when compared to IG and GA based FS, respectively. Similarly, classification accuracy achieved by PSO based FS is higher by 3.65% and by 0.89% for 80% training when compared to IG and GA based FS, respectively.

Keywords: Sentiment Analysis, Feature Selection (FS), Swarm Intelligence (SI), NP-hard, Particle Swarm Optimization (PSO).

1 Introduction

Today, corporations are getting more information produced frequently and incessantly online, which needs to be analysed for various measures for the Expansion of their business. Big Data can be defined as the process used to record and further analyse huge datasets that were structured, semi-structured, or unstructured. Distribution of information on various systems can be a challenge that is important while processing large amounts of data within a reasonable time frame. Aside from this, deployment, accessibility, security, and privacy were the other issues the decision-makers had to take into consideration before there were major benefits among Big Data for gaining a competitive advantage [1].

Another primary challenge faced by the researchers that work with Big Data will be its high dimensionality occurring when the dataset has a very high number of attributes. For

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reducing the number of attributes (or features) a process for identifying and removing features that were irrelevant (which cannot be used to classify data) is applied. The selection of feature subsets relevant to a class attribute was an important step in creating a usable and meaningful model [2].

Today, social media has a major effect in the digital media and communications. It was evident from the increase in the number of consumer opinions, as well as reviews, regarding the products of smartphones writing on different types of social media. It can be identified that different sentiments of the product can be positive or negative and sometimes neutral. Sentiment analysis can be identified as a study of computation on the opinion study, emotion, and behaviour of people, topics, or events. These topics will normally be reviews of various datasets, among which one is a product review. A smartphone product review is re-examined as a product review. A re-examination of smartphone product review is made means of a classification of either positive or negative classes which can be a way in which the response of consumers can be found out properly and quickly.

The meta-heuristic algorithms will follow procedures of the search for solving problems of optimization. The common algorithms include the Particle Swarm Optimization (PSO) and the Genetic Algorithm (GA). The PSO is employed widely for solving problems of optimization and also for solving problems of FS. For the PSO, every solution has been viewed as a particle, and an algorithm will also search for ideal solutions by taking into consideration the experience of the particles [3].

The Support Vector Machine (SVMs) is an effective technique applied for the problem of binary classification [3]. They are able to achieve optimal classifications for the cases that are linear and separable. The power of generalization is very remarkable, and the main advantages are it not having a local minimum, solution's sparseness, and their capability of optimizing the margin. The SVM can identify and separate hyperplane to maximize the actual margin between two of the classes.

In order to overcome this drawback, a method of PSO-based FS used for text mining Sentiment Analysis has been proposed. The rest of the paper contains related work available in the literature in Section 2. The techniques used in the investigation are explained in Section 3. Simulation results were explained in Section 4, and the Section 5 concludes the paper.

2 Literature Survey

Developing IOT technologies were massively admired and also accepted as applications and tools of social media. Applying Opinion mining with Sentiment Analysis (OMSA) in Big Data is employed in such a way in which the opinion is categorized into various sentiments and evaluation of the public mood. Furthermore, there are various OMSA techniques that were developed in different periods that were applied to the experimental settings. Shayaa et al. [4] had proposed a review of literature that was systematic and comprehensive. This aims to discuss the OMSA, its types and techniques, and the non-technical aspect as discussed using areas of application. The manuscript also highlights the technical characteristics of the OMSA as challenges in developing the techniques and the non-technical issues based on application.

Meera and Jeetha [2] focused on the different research methods to find methods of effective selection of features to produce optimal feature subset. The earlier approaches were presented along with their advantages, as well as disadvantages, and there were some additional areas of research to focus. All simulations were carried out on MATLAB

simulation, which was differentiated for identifying the ideal methodologies under various measures of performance.

As comprehensive surveys made in this field were minimal, the main objective was to fill the existing gap in covering the SI algorithms for the FS. Brezočnik et al. [6] had made a review of the literature of the SI algorithms to provide an overview of about 64 SI algorithms used for the FS grouped into various approaches that were explained along with their settings and used for a variety of aspects of the FS. Several datasets were frequently used for evaluating the SI algorithms used in the FS that were presented along with the common areas of application. There were guidelines on ways in which the SI approaches used for the FS were developed and were also provided for research support to analysts for tasks of data mining and for endeavours in which open questions and issues were discussed. This way, with the proposed framework and given explanations, it is possible to design the SI approach for a particular problem of the FS.

Big Data consists of challenges that stem from communities of academic research, and IT deployment made commercially that are the root sources in Big Data found on the curse of dimensionality and data streams. This is called data that is sourced from the streams of data that collect continuously, thus the traditional algorithms of batch-based model induction that may not be feasible for real-time data mining. According to Joshi et al. [7], this concept of FS permits data choice by using its features to filter data based on features. Where there is a large dataset coming, FS may get complicated. And for cases of a high dimension of data, filters will also be increased accordingly.

An SVM can identify a separated hyperplane to maximize the margin of two different datasets belonging to other classes. But the SVM lacks suitable features or parameters, and election features along with setting parameters at the SVM can affect the features and their classification accuracy. Thus, in this type of research, the method of merger for the election of features such as the PSO is employed to effectively increase the classification accuracy of the SVM. Wahyudi and Kristiyanti [8] had produced the text of classifications that were either positive or negative for the reviews of smartphone. The evaluation was made using a 10-Fold Cross-Validation. Accuracy evaluation was made using the ROC curve and the Confusion Matrix[9]. Results proved that there was an increase in the accuracy of the SVM from 82.00% to 94.50%.

3 Methodology

In this section, a review of the dataset of Amazon products used for evaluation is presented. The proposed FS based on the PSO, and the SVM employed is detailed.

Dataset

Amazon is a large site of E-Commerce, with numerous reviews seen online. The Amazon product dataset is created by the researchers, which is employed for investigations **[9].** This was an unlabelled dataset to be used as a model of supervised learning for labelling of data. The website proves to be a forum that has assorted opinions. The websites that are similar to amazon.com will promote the users to write a review. Such reviews may be grouped into three categories: either positive or negative and sometimes neutral. For all the chosen categories, three among them are the reviews of Electronics products, accessories, and Cell phones that constitute about 48500 product reviews. Among them, 21600 reviews are for mobiles, 24352 for electronics, and 2548 for musical instruments.

Feature Extraction Using Term Frequency-Inverse Document Frequency (TF-IDF)

TF-IDF can be termed as a numerical statistic to mirror the rank of a word to a document in a collection. The method is utilized in the form of a weighting factor in text mining. The TF-IDF is chiefly used for stopping the filtering of words in the summarization of text and application categorization. Conventionally, the value of the TF-IDF will increase in proportion as the frequency of word occurring in one document and is further offset by the frequency of the same word found in the collection. This assist in controlling the statistic that certain words tend to be more common than that of the others. A frequency term denotes the actual raw frequency of a term found in a document. Furthermore, the word with regards to the frequency of an inverse document will be a degree of whether this word is rare or common among the reviews got by dividing the total reviews by the number of words [10].

TF-IDF denotes the numeric measure applied to score the word and its significance in the document based on its frequency. The intuition here was that the word will need an additional high score. If the word continues to appear in several documents that are not unique as an intender, it will be given a score that is lower. The TF-IDF is formulated as below (1):

$$TFIDF(t,d,D) = TF(t,d) \times IDF(t,D) \quad (1)$$

Here, t signifies all terms; d is the document; D is its document collection.

Proposed Particle Swarm Optimization (PSO) based Feature Selection (FS)

PSO [11, 12] is a technique of metaheuristics which simulate the bird and its movements for finding food. Every particle within the swarm will represent a new candidate solution that flies through a search space that is multi-dimensional. The particle will make use of the best position which is explored and the neighbours will shift nearer to their optimum solution. The particle and its fitness (the actual goodness) of the particle to its global minimum will be computed in accordance with the fitness function that is pre-defined. If the search space is found to be D-dimensional with m particles in the swarm, every particle will be placed in the position which is $X_i = [x_{i1},\ x_{i2},\ \ldots,\ x_{iD}]$ that has a velocity $V_i = [v_{i1},\ v_{i2},\ \ldots,\ v_{iD}]$, wherein i=1, 2, …, m. In the case of a PSO algorithm, every particle will move closer to its best position (pbest) represented as $P_{best_i} = [p_{best_{i1}},\ p_{best_{i2}},\ldots,\ p_{best_{iD}}]$ with the best position for the entire swarm (the gbest) shown as $G_{best} = [g_{best_1},\ g_{best_2},\ldots,\ g_{best_D}]$. Now every particle will change its actual position in accordance with the velocity and this is generated randomly to the pbest as well as the gbest positions. For every particle, i and its dimension s, there is a new velocity which is vis and a position xis that is computed as per equation (2):

$$v_{is}^{t} = wv_{i}^{t-1} + c_1 b_1 (pbest_{is}^{t-1} - x_{is}^{t-1}) + c_2 b_1 (gbest_{s}^{t-1} - x_{is}^{t-1})$$
$$x_{is}^{t} = x_{is}^{t-1} + v_{is}^{t} \quad (2)$$

Wherein t denotes the iteration number. Inertial weight w will be utilized for controlling velocity and the balance of both exploration, as well as exploitation of the algorithm. A larger value of that of w will keep the particles within a high velocity thus preventing them from getting caught inside the local optima. There may be a smaller value of w that sustains the particles at a low velocity and further boosts them to exploit the search area. Constants c1 and c2 will denote the coefficients of acceleration to regulate if the particles will want to shift nearer to their pbest or their gbest positions. Both b1 and b2 will denote independent random numbers that are distributed uniformly between 0 and 1. The termination criterion for the PSO[11] will include the actual maximum number of generations and the designated value for

pbest, without enhancement in pbest. PSO can be implemented with a few parameters escaping from local minima [12]. In this work, maximum number of iteration is taken as the termination criterion [13].

Normally, in the case of a continuous PSO being applied to difficulties of FS, the search space, and its dimensionality will be n and this represents the total features available within the dataset. Every particle found in the swarm will be encoded by making use of a vector of the n real numbers. The actual position of a particle i which is in the dth dimension, the xid will be in the interval [0, 1]. For the purpose of determining if the feature is chosen on not, threshold $0 < \theta < 1$ will be required for relating with real numbers found in the position vector. In case xid> θ, the consistent feature d is chosen.

The goal of a FS was to increase the accuracy of classification in a dataset. Thus, while making an evaluation of the particle and its fitness value, a training set is divided equally into 10 folds the actual fitness value of the particle, also cross-validation is run on a training set that has a supervised scheme of machine learning with the feature subset represented by the particle. The fitness value of this particle denotes the actual average accuracy of the 10 runs.

Support Vector Machine (SVM) Classifier

A technique of classification that is powerful and is also a sample of supervised learning working on the principle of the lowest structural risk is the SVM. At the time of training, the algorithm will create a new hyperplane to separate the samples into positive or negative. After this, the new samples are classified by means of specifying the point on the hyperplane in which every sample has to be placed. The SVM is a method of supervised learning which can analyse data and further identify the patterns employed in classification. The SVM[14] also has the major benefit of identifying separate hyperplanes to maximize the margin existing between two different classes [15].

The SVM was based on the theory of statistical learning to increase the property of generalization. It uses training instances to predict newer instances using two class labels −1 and 1. In figure 1, a hyperplane is $w^T x + b = 0$, wherein $w \in R^n$ denotes an orthogonal to a hyperplane and $b \in R^n$ the constant as in equation (3):

$$D = \left\{ (\vec{x}_i, \vec{y}_i) \mid \vec{x}_i \in R^m, \vec{y}_i \in \{-1, +1\} \right\}_{i=1}^{n} \quad (3)$$

Wherein, x_i denotes a m-dimensional real vector, y_i the class of an input vector x_i either −1 or +1. It aims at searching a hyperplane to maximize the margin between two sample classes D with minimal empirical risk [15].

$$y_i(\vec{w}^T \vec{x} + b) \geq 1 \quad (4)$$

The SVM also attempts to increase the distance between two hyperplanes. One computes the distance between them using $\frac{1}{\| \vec{w} \|}$. SVM training for a case that is non-separable is solved with a quadratic optimization as per equation (5):

$$\begin{aligned} &\min imize: \ \mathrm{P}(\vec{\mathrm{w}},\mathrm{b},\xi) = \frac{1}{2} \| \vec{w} \| + C \sum_{i=1}^{n} \xi_i \\ &subjectto: \ \mathrm{y}(\vec{\mathrm{w}}.\phi(\vec{\mathrm{x}}) + \mathrm{b}) \geq 1 - \xi_i \quad , \xi_i \geq 0 \end{aligned} \quad (5)$$

3 Results And Discussion

The proposed PSO based FS methods are evaluated and compared with IG and GA FS for varying training percentage. The performance metrics used are classification accuracy, recall, precision and average f-measure. As shown in tables 1 to 4 values obtained figures 1 to 4 respectively.

Table 1 Classification Accuracy for PSO- FS

Training Percentage	IG based FS	GA based FS	PSO based FS
20%	63.33	62.71	67.2
40%	67.92	68.79	69.42
60%	78.33	75.46	79.94
80%	81.25	79.04	81.98

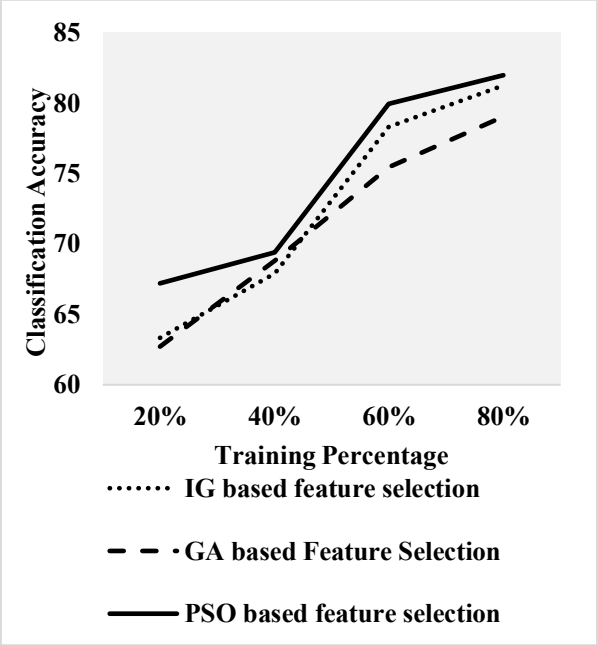

Fig 1 Classification Accuracy for PSO – FS

From figure 1 and Table 1, it can be observed that the classification accuracy achieved by PSO based FS is higher by 5.93% and by 6.91% for 20% training when compared to IG and GA based FS, respectively. Similarly, classification accuracy achieved by PSO based FS is higher by 3.65% and by 0.89% for 80% training when compared to IG and GA based FS, respectively.

Table 2 Recall for PSO - FS

Training Percentage	Positive	Negative	Neutral
IG based FS			
20%	0.6	0.675	0.6286
40%	0.6222	0.7	0.7286
60%	0.7444	0.8	0.8143
80%	0.7991	0.817	0.8152
GA based FS			
20%	0.6522	0.6163	0.6071
40%	0.7067	0.6825	0.67
60%	0.8	0.745	0.7071
80%	0.8667	0.745	0.7443
PSO based FS			
20%	0.6861	0.6589	0.6688
40%	0.7053	0.6797	0.6966
60%	0.7917	0.805	0.8029
80%	0.7778	0.825	0.8429

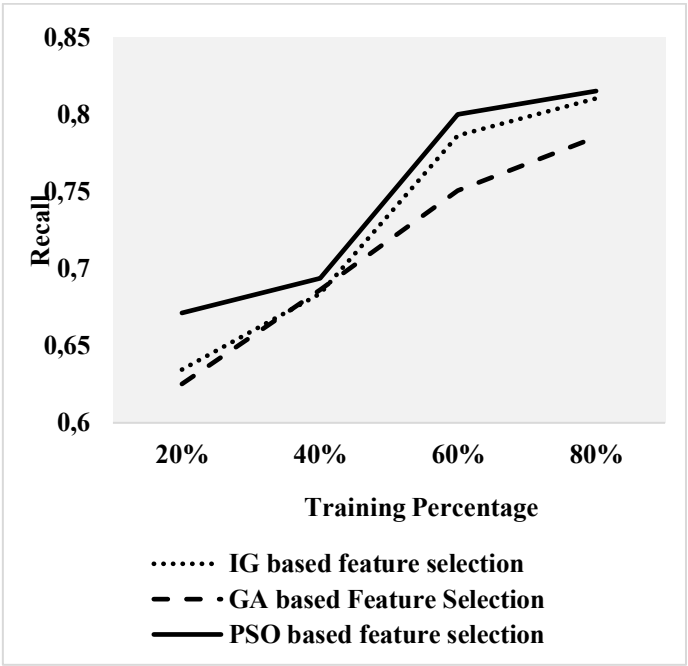

Fig 2 Average Recall for PSO - FS

From figure 2 and Table 2, it is seen that recall achieved by PSO based fs is higher by 5.62% and by 7.11% for 20% training when compared to IG and GA based fs, respectively. Similarly, recall achieved by PSO based fs is higher by 1.72% and by 6.34% for 60% training when compared to IG and GA based fs, respectively.

Table 3 Precision for PSO - FS

Training Percentage	Positive	Negative	Neutral
IG based FS			
20%	0.6879	0.6353	0.5752
40%	0.732	0.6829	0.6258
60%	0.8121	0.7805	0.755
80%	0.8652	0.7868	0.7732
GA based FS			
20%	0.6732	0.6178	0.5822
40%	0.7106	0.6877	0.6596
60%	0.7843	0.7385	0.7333
80%	0.7975	0.8043	0.7651
PSO based FS			
20%	0.7102	0.706	0.5972
40%	0.7346	0.7343	0.6131
60%	0.849	0.7781	0.7667
80%	0.8434	0.8049	0.7867

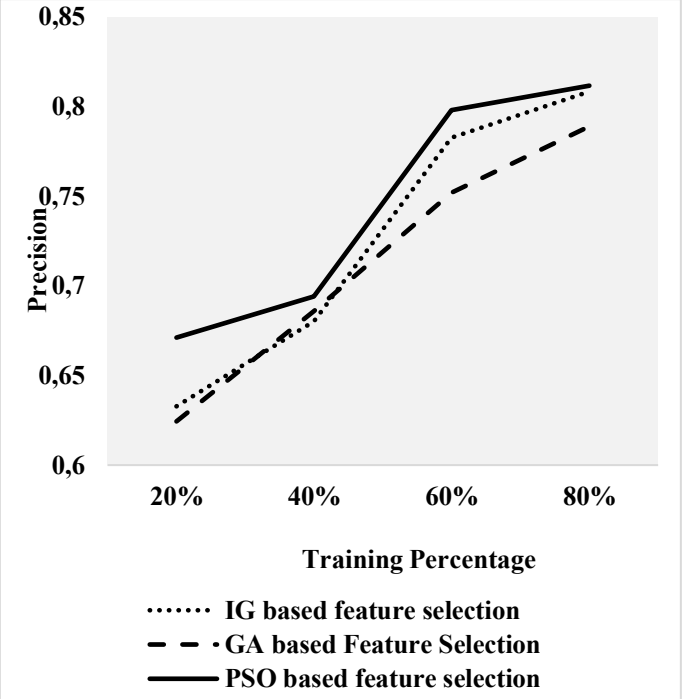

Fig 3Average Precision for PSO - FS

From figure 3 and Table 3, it seen that the precision achieved by PSO based fs is higher by 5.9% and by 7.21% for 20% training when compared to IG and GA based FS, respectively. Similarly, the precision achieved by PSO based fs is higher0.4% and by 2.43% for 80% training when compared to IG and GA based FS, respectively.

Table 4 F Measure for PSO - FS

Training Percentage	Positive	Negative	Neutral
IG based FS			
20%	0.641	0.6545	0.6007
40%	0.6726	0.6913	0.6733
60%	0.7768	0.7901	0.7835
80%	0.8308	0.8016	0.7936
GA based FS			
20%	0.6625	0.617	0.5944
40%	0.7086	0.6851	0.6648
60%	0.7921	0.7417	0.72
80%	0.8307	0.7735	0.7546
PSO based FS			
20%	0.6979	0.6816	0.631
40%	0.7197	0.7059	0.6522

60%	0.8193	0.7913	0.7844
80%	0.8093	0.8148	0.8138

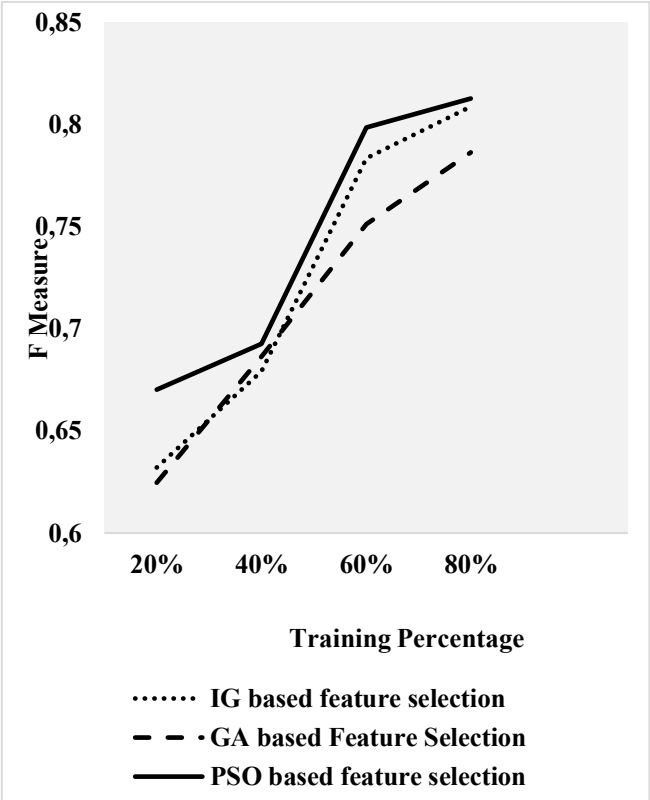

Figure 4 Average F Measure for PSO - FS

From Figure 4 and Table 4, it seen that the f-measure achieved by PSO based FS is higher by 5.85% and by 7.03% for 20% training when compared to IG and GA based FS, respectively. Similarly, the f-measure achieved by PSO based FS is higher by 0.49% and by 2.81% for 80% training when compared to IG and GA based FS, respectively.

4 Conclusion and future work

Sentiment Analysis will be performed for checking the positive, negative or neutral opinions of users. There are several issues connected to the classification of the sentence that is solved using machine learning. The PSO is employed for optimal parameters in the region of prediction and can also be employed for overcoming the local optimum problem. Results have proved that the classification accuracy achieved by PSO based FS is higher by 5.93% and by 6.91% for 20% training when compared to IG and GA based FS, respectively. Similarly, classification accuracy achieved by PSO based FS is higher by 3.65% and by 0.89% for 80% training when compared to IG and GA based FS, respectively.

Conflicts of interest

The authors should declare any conflicts of interest exist. If no conflict exists, the authors should state: the authors have no conflicts of interest to declare.

References

[1] A. Misra, A. Sharma, P. Gulia, and A. Bana. Big data: Challenges and opportunities. Int. J. Innov. Technol. Exploring Eng. 2014; 4(2): 41–42.

[2] Meera, S., &Jeetha, B. R. Survey on Swarm Search Feature Selection for Big Data Stream Mining. International Journal of Computer Applications. 2017; 158(1).

[3] Madhusudhanan, B., Sumathi, P., Karpagam, N. S., Mahesh, A., &Suhi, P. A. P.. An hybrid metaheuristic approach for efficient feature selection. Cluster Computing. 2019; 22(6). 14541-14549.

[4] R. Batuwita and V. Palade. Class Imbalance Learning Methods for Support Vector Machines. In Imbalanced Learning: Foundations. Algorithms and Applications. Haibo He and Yunqian Ma Ma (Eds.). Wiley. 2013.

[5] Shayaa, S., Jaafar, N. I., Bahri, S., Sulaiman, A., Wai, P. S., Chung, Y. W., ... & Al-Garadi, M. A. Sentiment analysis of big data: Methods, applications, and open challenges. IEEE Access. 2018; 6. 37807-37827.

[6] Brezočnik, L., Fister, I., &Podgorelec, V. (2018). Swarm intelligence algorithms for feature selection: a review. Applied Sciences. 8(9). 1521.

[7] Joshi., R, B and Rode., S, V. "Particle Swarm Optimization Feature Selection for Data Stream Mining". International Journal of Innovative Research in Computer and Communication Engineering. 2016; 4(11).

[8] Wahyudi, M., &Kristiyanti, D. A. Sentiment Analysis Of Smartphone Product Review Using Support Vector Machine Algorithm-Based Particle Swarm Optimization. Journal of Theoretical & Applied Information Technology. 2016; 91(1).

[9] He, Ruining, and Julian McAuley. "Ups and downs: Modeling the visual evolution of fashion trends with oneclass collaborative filtering." Proceedings of the 25th International Conference on World Wide Web. International World Wide Web Conferences Steering Committee. 2016.

[10] Munot, N., &Govilkar, S. S. Comparative study of text summarization methods. International Journal of Computer Applications. 2014;102(12). 33-37.

[11] Amoozegar, M., &Minaei-Bidgoli, B. Optimizing multi-objective PSO based feature selection method using a feature elitism mechanism. Expert Systems with Applications. 2018;113. 499-514.

[12] Marinakis, Y., Marinaki, M., & Dounias, G. A hybrid particle swarm optimization algorithm for the vehicle routing problem. Engineering Applications of Artificial Intelligence. 2010; 23(4). 463-472.

[13] Xue, B., Zhang, M., & Browne, W. N. Particle swarm optimisation for feature selection in classification: Novel initialisation and updating mechanisms. Applied soft computing. 2014; 18. 261-276.

[14] Kiran Kumar, T.V.U., Karthik, B., Improving network life time using static cluster routing for wireless sensor networks, Indian Journal of Science and Technology, 2013, 6(SUPPL5), pp. 4642–4647

[15] Thamarai, P., Karthik, B., Kumaran, E.B., Optimizing 2:1 MUX for low power design using adiabatic logic, Middle - East Journal of Scientific Research, 2014, 20(10), pp. 1322–1326

[16] Istia, S. S., &Purnomo, H. D. Sentiment Analysis of Law Enforcement Performance Using Support Vector Machine and K-Nearest Neighbor. In 2018 3rd International Conference on Information Technology. Information System and Electrical Engineering (ICITISEE) IEEE 2018; 84-89.

[17] Aruna, S. K., Sindhanaiselvan, K., &Madhusudhanan, B. Computerized grading of brain tumors supplemented by artificial intelligence. Soft Computing. 2019;1-7.

Author Bibliography

Prof. P. Vasudevan received his Master of Computer Science Engineering degree from Sathiyabama Institute of Science and Technology, Chennai. Currently, he is working as Associate Professor in Department of CSE, Mookambigai College of Engineering since 2006 and doing research in the field of Data Mining in Bharath University. His area of interests includes Data Mining and Warehousing, Cloud Computing and Artificial Intelligence. His e-mail address is vasudevan62@gmail.com

Dr.K.P.Kaliyamurthie is self- directed, enthusiastic educator with a commitment on student development. He is with Bharath University, Chennai, Tamil Nadu, India as Professor and Dean of Computer Science and Engineering. He has over 29 years of rich experience in teaching along with student administration. He has guided more than 300 UG, PG projects and organized various national level conferences. He served as Senior Chair, Technical advisor in various national level conferences and Technical Committee member in International Conferences. He is an active member in CSI, IEEE, ISTE, ACM etc., His area of interests includes Computer Networks, Cloud Computing, Networks and Software Engineering. He can be contacted through Email:kpkaliyamurthie@gmail.com

Student Career Prediction Using Machine Learning Approaches

N. VidyaShreeram[1], Dr. A. Muthukumaravel[2]
{vidushreeram123@gmail.com[1], dean.arts@bharathuniv.ac.in[2]}

Research Scholar, Department of Computer Applications, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India.[1],
Dean, Faculty of Arts and Science, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India.[2]

Abstract. India is blessed with the number of good schools and colleges. But most of the students are dropping their next level of education because of various reasons. The reason is many and more, some of the students have some economic problem with their family, some of the students don't have interest towards their next level of education, some matters about the gender and some rural areas don't have good schools and educators. So this proposed method deals weather the students will be going to the next level of higher education. This can be evaluated with the concepts of machine learning which the subset of artificial intelligence. Machine learning is made up with the Mathematics and Science concepts. This paper deals with the students' career prediction by using various machine learning concepts like Decision Tree (DT), Random Forest (RF), Support Vector Machine (SVM) and Adaboost. RF classifier yields better accuracy of 93% compared with other machine learning classifier. Machine learning classifiers are implemented by using Python programming language.

Keywords: Machine Learning Classifier, Support Vector Machine, Random Forest, Decision Tree, Adaboost

1 Introduction

Traditionally student's career can be predicted by using questionnaire. But this method takes lot of time. Now, computing technologies play a vital role in various fields. Machine learning is one of latest computing technique. In this digital world Machine learning is used in various fields and industries such as clinical analysis, image processing, classification, regression then more and more. It has the capability to develop and study automation without being explicitly. Machine learning is of three types supervised machine learning, unsupervised machine learning and reinforcement machine learning algorithms. Machine learning in simple words it is the science of obtaining to learned and behave like humans. It is so important to analyze the ability of the students and they should be directed in the right path way.

In this research work the concepts of machine learning are applied to detect the next level of education of the particular candidate. This prediction is important for all type of educational institutions and recruiters. Based upon the result of this prediction accuracy the educational institutions find the low level people and provide the proper training to them to improve their performance. Job providing companies also spent lot of amount of selecting a proper candidate. The output of the prediction model is also used to find the status of the students, if

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they are interested to go to the job or they interested to do their higher studies. This research work mainly focus on the career prediction of undergraduate level students. Machine learning algorithms such as DT, RF, SVM and Adaboost classifiers are used to construct the model. From the above classifiers RF produces better result. These classifiers are implemented with the help of python programming, because most of the real time problems are easily implemented by this language.

Section two deals with the views and approaches are used by various authors in career prediction research domain. Section three explains the proposed system with appropriate algorithms. In section four elaborates the proposed system result part. Finally section five concludes the proposed work.

2Literature Review

Career selection is playing a major role in the life student's life. Traditionally specialized profession people using questionnaires to identify the important factors affecting career paths. But it is very difficult to predict the career path because of complication of every student aim and dreams. A recent fact provides the suggestion using student's data based on their behavioral aspects to forecast the career path. Min Nie et al., proposed a novel model known as ACCBOX (Approach Cluster Centers Based On XGBOOST) to forecast student's choices in their career. The final result clearly states that the current method is better than other predicting methods. In this model uses 13 behavioral data collected from 4000 students [1].

Mining education data is also one of the important tasks in education field. In the beginning days data mining methods are used in education field by using less number of arguments, because low record maintenance in concern institutions. Recently the large volume of data can be stored on student. In India 0.3 % people only move from their PG level to research level. This prediction task concentrates performance of the student's by using various arguments and the students are classified as low, high and medium type. To execute the above process the authors K. B. Eashwar et al., combines SVM and K-means method. A SVM concept is used for classification purpose and K-mean technique is mainly used for cluster the student's data [2].

In education domain predicting the student performance level is one of the important tasks. Data mining concepts are used to predict the student's performance by using various types of tests. AnkitaKadambande et al., uses semantic rules and SVM concepts to do predictions. Semantic rules are used to improves the educational content quality and convey education action to every student. Here the authors helps the students by providing better suggestion and issues recommendations for improving student's performance level in forthcoming exams. This system will provide the helps to low level and high level students and also to increase the student's interest about their education. The main purpose of this research work is to increase the quality of learning measures and support the students by forecasting their academic level and help the students [3].

The authors S.A. Oloruntoba et al., identifies the association among initial academic profile level and the last academic profile level. For this research work Federal Polytechnic student database can be used. The initial academic profile is represented as O level. The performance of the students in academic is defined by using GPA (Grade Point Average). Current research work mainly focused on develops a new model for predicting performance of the student with the help of data mining approaches. Preprocessing task is used to delete the

unwanted data. Here student's performance can be predicted by using SVM concept. The result of this classifier is compared with other machine learning concepts like linear regression, KNN and decision tree. The accuracy level of SVM is better than other machine learning concepts [4].

Student's performance prediction is important in higher educational institutions. The prediction result is used to spot and increase the performance level of the students. Various factors are influenced to improve the performance level. AhmedSharafElDen et al., uses classification concept to increase the quality of advanced learning system. Here the authors uses Adaboost technique with genetic technique is known as Ada-GA to increase the performance of the classifiers. Ada-Ga technique is useful to identify the student's risk level in earlier manner with large amount of data. This output is used by the tutor to issue the proper advice to the concern students [5].

Student's data are increased day by day. Among the various prediction methods machine learning concept is one of the outstanding model. Meimei Han et al., proposed a Adaboost model to predict the students level. The result of the Adaboost classifier is compared with other machine learning concepts like neural network, decision tree, SVM and random forest. Initially association policy and correlation study are used to find the characteristics of the model. In next level various prediction models are used to predict the data. Finally compare the accuracy level of the prediction models. In term of accuracy level AdaBoost is higher but the time and cost is high compared with other models. Association rule mining is used to assist the students locate their issues from the origin of the issue to assist them to resolve the issues [6].

Level of student's performance is one of the major significant values of the all type of educational organizations. To improve the value of the institutions, need to forecast the performance of the student's. Special type of treatment is needed for low level performer. FaridJauhari, et al., proposes three various boosting approaches to construct the classifier for forecasting the level of student's. In this research 1UCI dataset is used for developing model [8].

3Proposed System

In this proposed work the four concepts of machine learning are applied that are decision tree, random forest SVM and Adaboost.

DT is one of the predictive modeling methods that are helpful in the statistics data mining and machine learning. It is very popular and easiest concept to develop a model for real time issues. Decision tree is of two types they are categorical variable decision tree and continuous variable decision tree. DT is basically a graph which is the branching method that is used to explain all the possible results of the decision. Decision tree can be drawn or created by graphics program or with some specific programs the various outcomes from the drawn tree that can be used as a decision making tool for research analysis or for planning strategy. RT is also called as random decision forest is an ensemble learning process for the classification, regression and some other tasks. This concept of machine learning gives a good accuracy level for the result.

RF classifies will handle the missing values and maintain the accuracy for a large proportion of data. RF is a branch of machine learning techniques. The main advantage of RF classifier is it performs classification task and regression task. RF classifier having the

capability of managing large amount of dataset and it avoids the issue like overfitting. The steps are shows the working procedure of the RF classifier.

1. Choose "K" number of features from the total "m" number of features.
2. From K features, compute the value d by using split point
3. Divide the nodes into sub nodes using the data best split
4. Repeat the steps 1-3 until "l" nodes reached
5. Construct the forest by repeat the 1-4 steps for n times to construct number of trees 'n'

SVM is also a branch of machine learning SVM is also called as support vector machine or support techniques that is associated with the learning algorithms which analyze the dataset used for classification and regression analysis. It is one of the suitable methods of linear and nonlinear data type. Each student has various identifiers, and each of them is represented as a multidimensional items. Hyperplane separates the data from one class to another class. SVM find the hyperplane and using vectors and edges. Many data analysts says that SVM takes more time for training; but the accuracy level is high compared with other techniques. SVM approach is best method when the training samples are classified by using large amount of arguments. Using nonlinear approach compare selected argument of one student with others to forecast the performance of the students. The sample data falls on HP(hyperplane) are called as support vectors. Normally HP value is closer to MMH (maximum marginal hyperplane). SVM approach is best suitable for fewer amounts of data with less than training set 2000. MMH has been defining by using Lagrangian formulation is represented as follows.

$$d(X^T) = \sum_{i=1}^{l} y_i \alpha_i X_i X^T + b_0 \qquad \text{----------(1)}$$

Here $y_i$isrepresented as label of call vector X_i .

X^T represented as a test record

α_i and b_0 are used to represent the numeric arguments that are find in automatic manner by SVM classifier.

l identifier represented a s the total number of support vectors.

ADABOOST:

Adaboost is a machine learning mean concept algorithms. This Adaboost works with the principle to generate different weak learners and combine their prediction to forms one strong rule. Boosting is use to create a group of predicators. The following steps are used to understand the concept of Adaboost classifier.

1. From the top training data set create the weaker classifier
2. Construct the decision stump of every identifiers
3. Assign high weight value to wrongly classified samples
4. Repeat the process from step 2 until all data points properly classified.

4Result And Discussion

The main concept of this proposed system is to find whether a student is interested towards the next level of higher education. This proposed works mainly is based on the career aspect prediction with the help of ML concepts. Here machine learning concepts are applied

by using Python programming language. Compare with other programming languages Python programming mainly used for implement real time problems. For this research work the data collected from various educational institutions. Preprocessing concepts are applied on the collected data. During the preprocessing task the missing values are filled on the collected student's data. The unwanted data also removed from the original data during preprocessing process. Then the important features are extracted by using feature extraction techniques. In this research work 16 features are used to develop the prediction model. The important features are age, health condition, parent's status, study time etc. The following Correlation Heatmap figure 1 shows that what are the features are used to construct a prediction model.

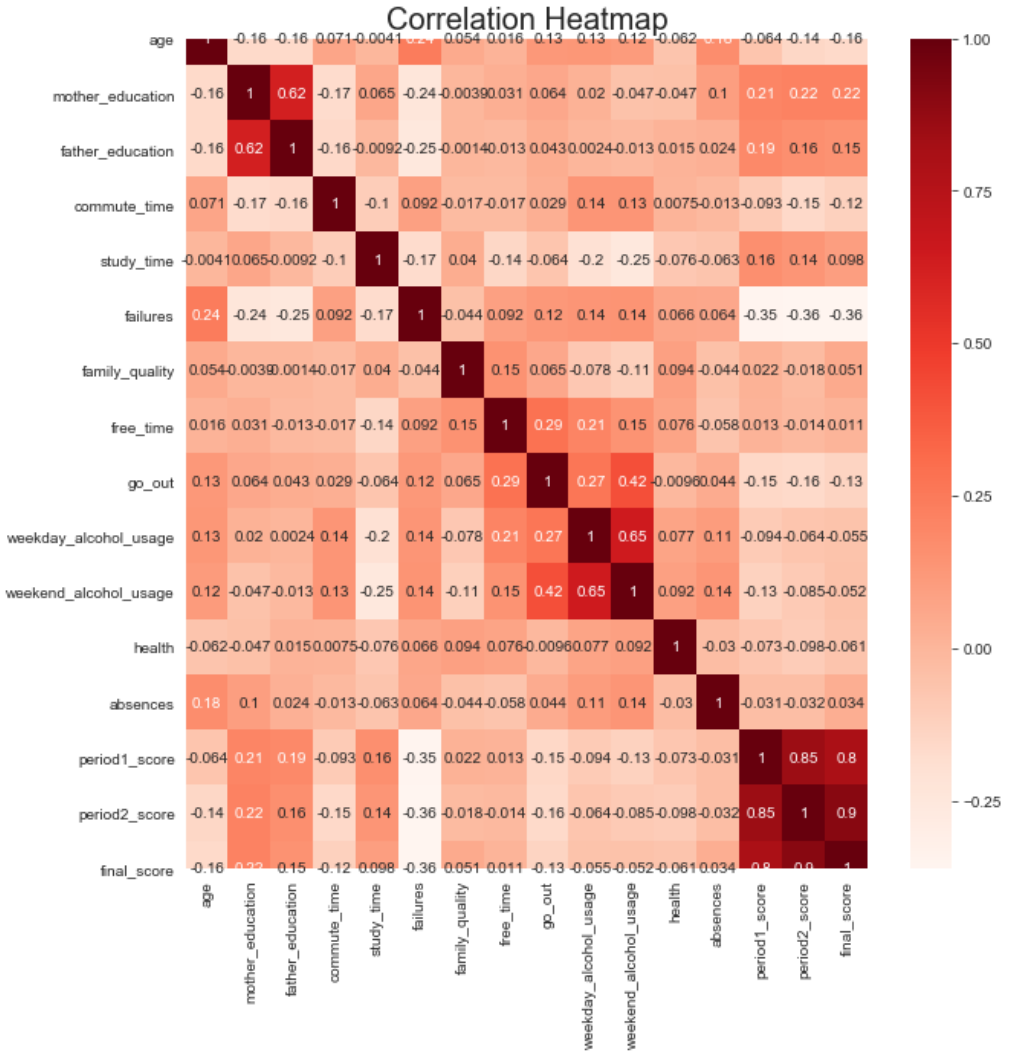

Fig 1: Correlation Heatmap

The prediction accuracy value changed depends upon the number of features. The following figure 2 shows the association between number of features and accuracy value.

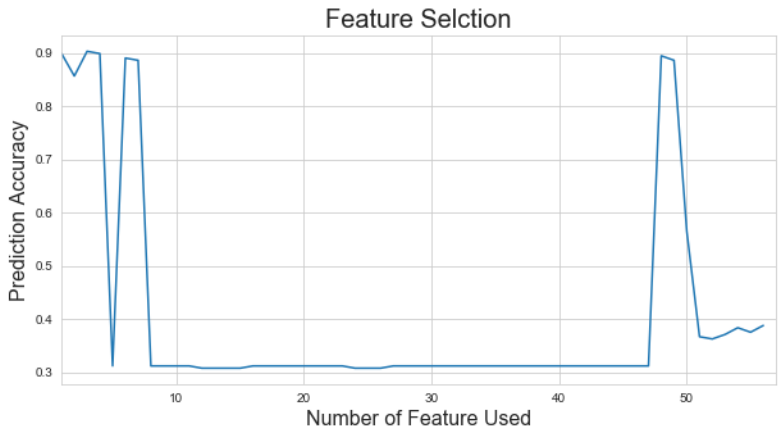

Figure 2 Relation between number of features and prediction accuracy

In this research work the authors predict the student's career by using four machine level classifiers. The following table 1 shows the accuracy level of the four different classifiers.

Table 1 Classifier name with Accuracy Value

Sl. No	Classifier Name	Accuracy Value
1.	Adaboost	87.00%
2.	SVM	88.50%
3	Decision Tree	91.00%
4.	Random Forest	93.00%

The following figure 3 a) and 3 b) demonstrates the different classifier accuracy value using line and bar chart.

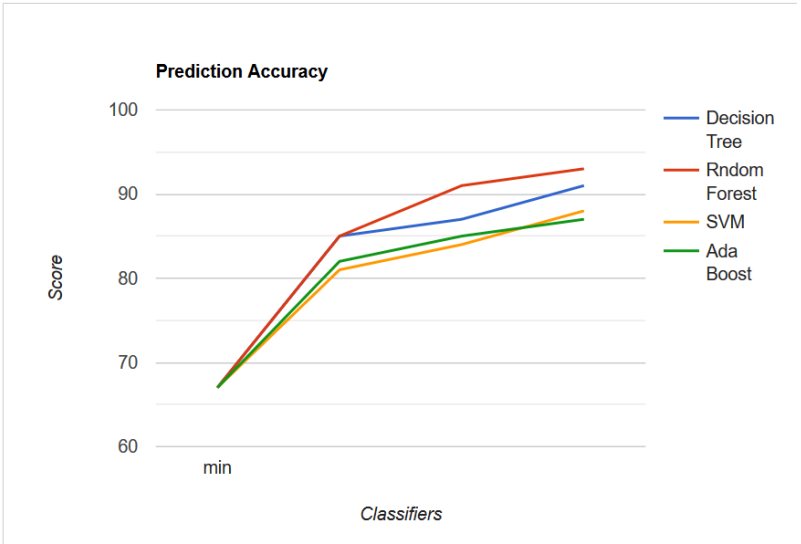

Figure 3 a) Line graph for comparing accuracy level of 4 classifiers

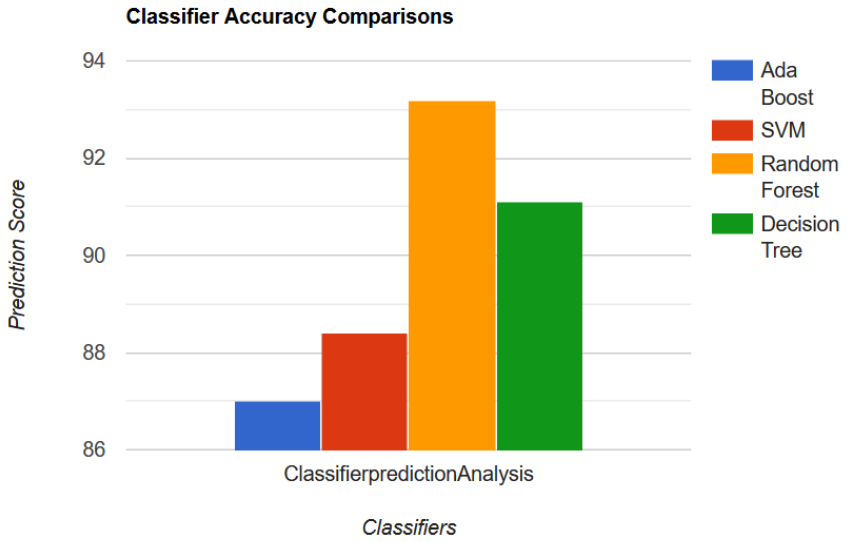

Figure 3 b) Bar graph for comparing accuracy level of 4 classifiers

Conclusion

Student's career prediction is one of the important research areas in this current digital world. Traditionally various survey methods are used to predict the student's career. But those methods take large amount of time to predict the result. This current digital world various computing techniques are used to predict the result in various domain. Student's career data also predicted by using computing concepts like machine learning. Compared with traditional methods it takes less amount of time and it yields better result. In this research paper to predict the student's career by using Adaboost, SVM, RF and DT approach. From the above mentioned concepts RF produces better result in term of accuracy value. The machine learning concepts are implemented by using the programming language Python. Using the output of this research work educational institutions take more care about the low level students and the recruiters select the suitable candidates for their companies.

References

[1] Min Nie , ZhaohuiXiong , RuiyangZhong , Wei Deng and Guowu Yang (2020), " Career Choice Prediction Based on Campus Big Data—Mining the Potential Behavior of College Students" , Journal of Appl. Sci. pp. 1-14.

[2] K. B. Eashwar, R. Venkatesan and D. Ganesh (2017), "Student Performance Prediction Using SVM", International Journal of Mechanical Engineering and Technology (IJMET) Vol. 8, No. 11, pp. 649–662.

[3] AnkitaKadambande, Snehal Thakur, AkshataMoholand A.M.Ingole (2017), "Predict Student Performance by Utilizing Data Mining Technique and Support Vector Machine", International Research Journal of Engineering and Technology (IRJET), Vol. 04, No. 05, pp 2818-2821.

[4] S.A. Oloruntoba1 and J.L.Akinode (2017), “Student Academic Performance Prediction Using Support Vector Machine”, International Journal Of Engineering Sciences & Research Technology, pp. 588-598.

[5] AhmedSharafElDen ,Malaka A. Moustafa, Hany M. Harb and AbdelH.Emara (2013), “Adaboost Ensemble With Simple Genetic Algorithm For Student Prediction Model”, International Journal of Computer Science & Information Technology (IJCSIT) , Vol. 5, No 2, pp 73-85.

[6] MeimeiHan ,Mingwen Tong , Mengyuan Chen , Jiamin Liu and Chunmiao Liu (2017), “Application of Ensemble Algorithm in Students' Performance Prediction“, IEEE 6th IIAI International Congress on Advanced Applied Informatics (IIAI-AAI).

[7] V. Prasannakumari B. Bavani, S. Nirmala SugirthaRajini, M.S. Josephine (2019), “Heart Disease Prediction System based on Decision Tree Classifier”, Jour of Adv Research in Dynamical & Control Systems, Vol. 11, 10-Special Issue, 2019, Volume 11, Issue 10.

[8] FaridJauhari and Ahmad AfifSupianto (2019), “Building student’s performance decision tree classifier using boosting algorithm”, Indonesian Journal of Electrical Engineering and Computer Science Vol. 14, No. 3, June 2019, pp. 1298 - 1304.

Performance Evaluation Of Machine Learning Algorithms In Traffic Flow Prediction

Nazirkar Reshma Ramchandra [1], Dr. C. Rajabhushanam [2]
{reshma174@gmail.com[1], rajabhushanamc.cse@bharathuniv.ac.in[2]}

Research Scholar, Department of Computer Science and Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India.[1],
Professor, Department of Computer Science and Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India.[2]

Abstract. The main and foremost reason for traffic congestion is overpopulation and the poor condition of the roads. This mostly happens in the urban cities where all the people in the urban areas go for some work or certain purposes. Due to the current growth of the communication technology various computing techniques are used to predict the outcome based on a given dataset. This research work uses four kinds of machine learning techniques line Deep AutoEncoder (DAN), Deep Belief Network (DBN), Random Forest (RF), and Long Short Term Memory (LSTM) to predict the traffic flow. This proposed system is implemented using Python programming. Lastly, the outcome describes that the proposed model using the LSTM technique produces 94.3% accuracy and less error value.

Keywords: Traffic Flow, Machine Learning, Prediction, Accuracy, Recall, Performance.

1 Introduction

Traffic congestion on the road is caused because of many and more reasons. The traffic congestion is defined by the overload of vehicles in the road, the insufficient way to move the vehicles further in the road. In road the rate of traffic increases. Some of the most important effects of traffic congestion are because of environment, mechanical and human. The environment affects traffic because some of the bad weather conditions may cause traffic, mainly sometimes due to heavy rain. The mechanical means the vehicle is sometimes defected by mechanical issues the next is mainly by humans. The main cause of traffic because of drunk and drive, humans drive their vehicle after consuming alcohol the vehicle gets out of their control. In this proposed work these machine learning techniques are used to learn generic traffic flow prediction.

The second part of this research article elaborates on the overview of existing techniques used in the application traffic prediction. The third part describes the proposed methods are used in this research work. The fourth section deals with the result part of the current system. Finally, the fifth section concludes the proposed work.

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2 Literature Review

Traffic prediction is a very critical task in current traffic handling systems. Forecasting accuracy value in traffic system is decreased when uncovered events like accidents, weather changes, and condition of roads. Mining the data from social media like twitter increased the traffic flow prediction because traffic-related data also posted on social media regularly. AniekanEssien et al., 2020 propose a new traffic forecasting system using the concept of deep learning that incorporates traffic data retrieved from twitter and climate data. This model uses LSTM and stacked autoencoder framework for predict traffic flow using tweet data, climate datasets, and traffic. The proposed model has been with the UK city road network. The result of the system describes that it increases the forecasting accuracy level than other classical and machine learning approaches. this improved result direct decreases the irritation of the people, cost benefits for companies, and low impairment to the surroundings[1].

The prediction of traffic flow is a very critical task. Traffic prediction is used to increase the effectiveness of the transport system. Compare to the prediction of traffic flow, traffic jam forecasting researches are very less due to the lack of the best quality data set and recent techniques. Sen Zhang et al., 2019 proposes a common workflow to collect traffic jam data and generate traffic jam datasets depends on the analysis of images. The authors make a new traffic dataset by using traffic jam images from concern state transportation. They also propose a new model DCPN using a deep autoencoder with the concept of decoder and encoder to find about the relation of network transport and forecast traffic jam. The outcome of the proposed model describes the association of congestion intensity for traffic jam forecasting. This proposed work performed better than existing methods in terms of forecasting and computation effectiveness. This research work mainly focuses on forecasting of traffic jam levels with the help of images from the data set [2].

Object identification is one of the important parts of the growth of smart transport for a decreasing number of accidents. A. Dairi et al.., 2015 developed a new technique for recognizing objects in surroundings. This new model is integrated into the greedy method with a reduction of data dimension capability and KNN concept to reliable and accurate identification of the objects. The model was tested by using three data sets available publically. The outcome of the proposed model is compared with the deep belief network technique with the clustering technique. The result represents the proposed model is best to examine urban spots [3].

In recent days smart transport is one of the fast developmental areas by using deep learning methods. Due to the advancement of technology security and safety is increased and maintenance cost is decreased. In this research paper Arya KetabchiHaghighat et al., 2020 provides an outline and broad advantages of deep learning techniques on smart transport and presented the growth of smart transport. Initially, the authors discussed the various concepts of deep learning methods and the importance of the techniques. Lastly elaborates various systems using deep learning techniques are look over and the merits and demerits [4].

The number of vehicles is increased day by day. Due to the number of vehicles traffic flow is also increased in urban areas. Y. Liu et al., 2017 developed a prediction model by using random forest technique. The important features of the RF are more robustness, more performance and it is suitable to implement real-time problems. Climate type, time, type of road, quality of the road, and days are the important identifiers used to predict the traffic flow. At last, the outcome of the proposed model with the RF technique produces 87.5% accuracy and less error value. The computation process RF approach is simple and it is implemented

easily than other techniques. Due to that reason in data mining, RF is an efficient and fast technique [6].

L. Nie et al., 2017, proposes a new model for traffic forecasting using the DBN concept. This model initially takes on wavelet transform to retrieve the low pass element of traffic. A prediction system is developed by using DBN from the retrieved elements. High pass elements that represent an unequal variation of traffic network, a Gaussian system is used to simulate it. The authors measure the arguments of the Gaussian model with the help of the highest likelihood technique. From the output of the proposed model, the authors say that the newly proposed technique is outperformed than other techniques [7].

3 Proposed Methodology

Current computing techniques are playing an important role in real-time applications. Recent techniques are also used to predict the flow of traffic in the real world. This research article mainly concentrates on various machine learning concepts like DAN, DBN, RF, and LSTM. Here the data collected from the online website.

DAN

Deep autoencoders are the deep neural networks that are helpful to reproduce the input dataset at the output layers which is the number of neurons in the input layer. These algorithms consist which are encoder, code, and decoder. This is the type of artificial neural network that is used to analyze the data coding in an unsupervised manner. It has two internal layers that described a code that is used to represents the input and it is engaged with two main concepts that are the encoding which map the input into the code and a decoder that maps the code for the rebuilt of the original input dataset. Commonly autoencoder contains an unseen layer h that represents the code to indicates input data. It consists of two major elements: encoder method $h - f(x)$ and decode function$-g(h)$. The framework is represented in figure 1.

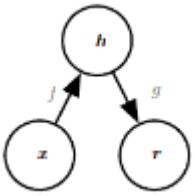


Figure 1 General framework of an autoencoder

The x(input data) mapped to r (output) using the ode value h. It has two elements: encoder f(mapping x to h) and decoder g (mapping h to r)New autoencoders have an idea of encoder and decoder beyond ahead of a deterministic method to stochastic associations $p_{encoder}(h|x)$ and $p_{decoder}(x|h)$. In the olden days, autoencoders are used to reduce the dimension of the data and learning features. Currently, associations between autoencoders and latent identifiers systems are used to construct generative systems. The one drawback that is found in the autoencoder is that when the size that that of the input layer, this concept can potentially learn the function identity. The next algorithm that has been applied to the real-time dataset is DBN, which s commonly called Deep belief Network.

DBN

DBN is a generative model based on the probabilistic system. It is constructed by using several layers of RBMs (Restricted Boltzmann Machines), each layer contains an unseen part

and visible part. DBN in the machine learning concepts DBN is considered as the generative graphical model or otherwise a deep neural network that is filled with different layers of latent variables. This algorithm aims to help the classification of the system in various types. It is trained to retrieve the input value with the help of the greedy method. After a trained RBM layer, the preceding unseen layer input is given to the next unseen layer. The pictorial representation of DBN is described in Figure 2[11].

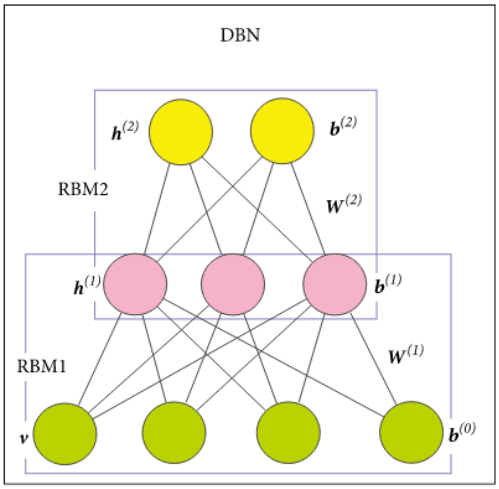


Figure 2 DBN[11]

Figure 2 indicates the two-layer DBN loaded by 2 RBMs. It consists of visible parts and 2 layers of unseen parts. From the figure 2 $h^{(1)}$ and $h^{(2)}$ denotes state vectors of unseen layers v denotees the state vector of the visible part, $W^{(1)}$ and $W^{(2)}$ are symmetrical weights matrices, bias vectors of unseen layers are $b^{(1)}$ and $b^{(2)}$, and bias vector of the noticeable layer is $b^{(0)}$.

RF

RF approach is one of the ensemble approaches of DTs constructed on an arbitrarily divide dataset. The set of DT classifiers are called as forest. Every DT can be constructed using the identifiers like gain ratio value, Gini Index value, and information gain of every identifier. In classification, every DTs are voted and a famous class only was chosen for final output and regression all trees outputs average values are considered for final output. RF is one of the familiar and powerful classification concepts than other classification techniques. The working procedure of the RF technique is described below.

- From the concern dataset choose the samples randomly
- Make a DT or every sample and find the perdition output from every DT
- Do the vote for predicted output
- Choose the predicted output with the majority votes as the final output of the prediction

When creating RF depends on classification information Gini Index value is used.

$\text{Gini} = 1 - \sum_{i=1}^{C}(p_i)^2$ ---------- (1)

This function uses probability and class value to find the Gini of every node. From equation (1) $p_i$indicates the comparative frequency value of class in the given dataset and c denotes the total amount of classes. The entropy value can decide how data nodes in every branch in DT.

$\text{Entropy} = \sum_{i=1}^{C} -p_i * \log_2(p_i)$ --------- (2)

LSTM

The researcher from German introduces LSTM in 1997. It is the kind of RNN, able to learn long term associations. Multiple numbers of gate parts learn to close and open to the regular error value low. O(1) is the computational complexity value of the LSTM technique. The following diagram represents the LSTM model with a single memory part [1].

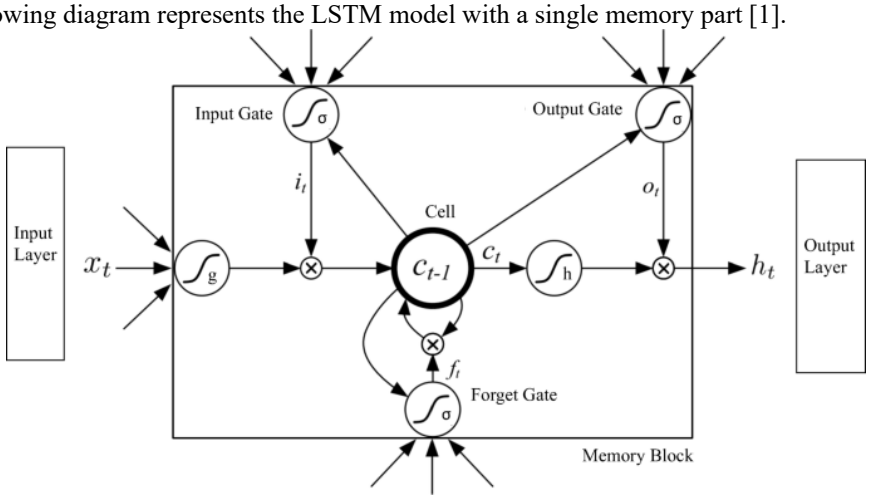


Figure 2 LSTM model with a single memory block [1]

The important parts of the LSTM are:

Forget gate - it deletes data not essential for the end of the task. This part is important to increase the performance of the entire network.

Input gate - this part is accountable for insert data into cells.

Output gate - this part is used to choose the results essential information.

In the model of LSTM, the input series is denoted as $x = x_1 + x_2 + x_3 \ldots . x_t$ and the output series $y = y_1 + y_2 + y_3 \ldots . y_t$ is calculated with the help of historical data. This is attained by using the following equations.

$i_t = \sigma(W_{xi}x_t + W_{hi}h_{t-1} + W_{ci}c_{t-1} + b_i$ ---------- (3)

$f_t = \sigma(W_{xf}x_t + W_{hf}h_{t-1} + W_{cf}c_{t-1} + b_f$ ---------- (4)

$c_t = f_t c_{t-1} + i_t g(W_{xc}x_t + W_{hc}h_{t-1} + b_c$ ---------- (5)

$o_t = \sigma(W_{xo}x_t + W_{ho}h_{t-1} + W_{co}c_t + b_o)$----------(6)

$h_t = o_t h(c_t)$----------(7)

From the above equations, W indicates the weight matrixes; the bias vector indicates as b and $\sigma(.)$ represent a sigmoid method. The Sigmoid method is described as follows.

$\sigma(x) = \frac{1}{1+e^{-x}}$ ---------- (8)

$g(x) = \frac{4}{1+e^{-x}} - 2$---------(9)

$h(x) = \frac{2}{1+e^{-x}} - 1$----------(10)

From the above equation $g(.)$ and h (.) denotes the sigmoid methods. The identifiers i is used to indicating the input gate, f denotes the forget fate, o denotes the output gate value, and indicates cell activation vector value. LSTM model can be widely used to predict traffic flow and speed prediction.

Performance Evaluation

The main intention of the current research work is to predict the traffic flow by using a given data set using machine learning techniques. The performance of the given techniques can be evaluated by using various parameters like accuracy, precision, MSE, and RMSE.

Accuracy means the exact prediction percentage value for the given test data. The following equation (11) is used to compute the accuracy value.

$$\text{accuracy} = \frac{\text{correct predictions}}{\text{all predictions}} \text{ ------- (11)}$$

The precision metric can be evaluated by using the following equation (12)

$$\text{precision} = \frac{\text{true positives}}{\text{true positives+false positives}} \text{ ------- (12)}$$

The recall value is calculated by using the equation (13)

$$recall = \frac{true\ positives}{true\ positives + false\ negatives} \text{ ---------- (14)}$$

Mean squared error (MSE) is measured by using the following equation.

$$MSE(y_{true}, y_{pred}) = \frac{1}{n_{samples}} \sum (y_{true} - y_{pred})^2 \text{ ---------- (15)}$$

Equation (16) is used to calculate Root Mean Square (RMSE) value.

$$\text{RMSE} = \sqrt{\frac{1}{n} \sum_{i=1}^{n} |e_i^2|} \text{ ---------- (16)}$$

Here $e_i, i = 1,2, \ldots . . n$ indicates n number of sample modal error values, x_i denotes the input value and y_i represents the output value.

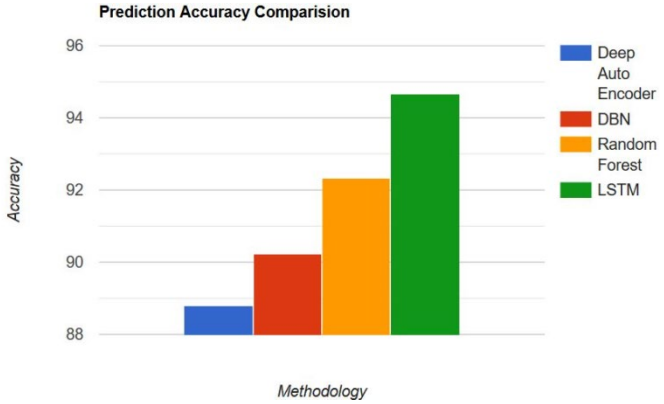
4 Result And Discussion

The performances of machine learning concepts are analyzed by using various metrics. Here the concepts are applied to the online traffic dataset. This proposed system is implemented by using python programming languages. The performance of the given system is evaluated with the help of accuracy, precision, recall, MSE, and RMSE metrics. The attributes like day, weather condition, events are mainly used to predict the traffic flow on a particular place. The following table shows the values of the metrics.

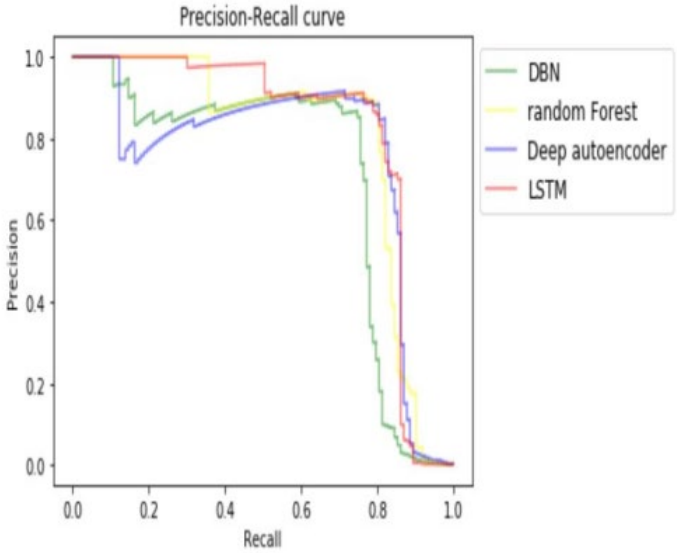
Table 1 Values of Metrics

Metrics/Method	ADN	DBN	RF	LSTM
Accuracy	88.6%	90.43	92.6	94.3
MSE	3340.25	1709.71	346.35	250.93
RMSE	57.794895968	41.3486396	18.6104809	15.84077

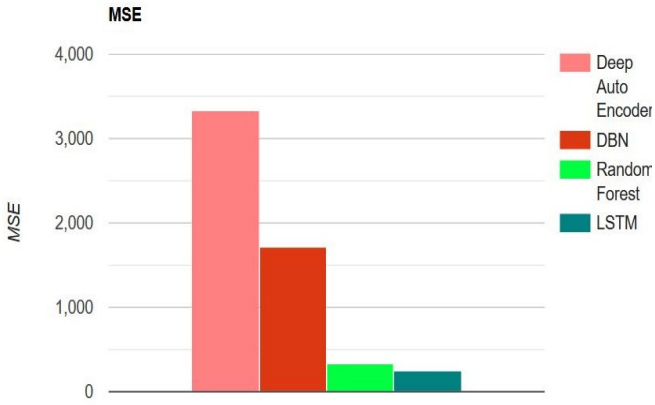
Figure 3 demonstrates the performance comparison of various metrics like accuracy, recall, RMSE, and MSE.



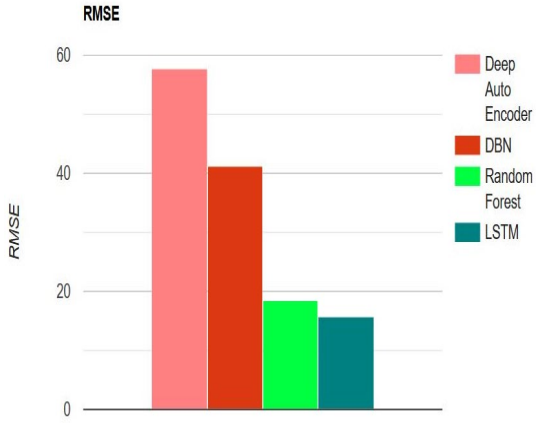
2 a) Accuracy Comparison



2 b) Precision-Recall Curve



2 c) MSE Metric Comparison



2 d) RSME metric Comparison

Conclusion

Proper traffic prediction is one of the challenging areas in the current situation. Due to the overpopulation number of vehicles is also increased in urban places. Advanced techniques like machine learning techniques are used to predict the traffic flow properly. Weather condition, vehicle speed, day, events, the green and red cycle time of the signals are the important parameters that are used to predict the traffic flow. The data collected from online websites and implemented by using python programming. In this research work uses four types of machine learning algorithms to predict the traffic flow. From the outcome of the four techniques, LSTM produces better accuracy of 94.3%.

References

[1] AniekanEssien&IliasPetrounia& Pedro Sampaio1 & Sandra Sampaio, "A deep-learning model for urban traffic flow prediction with traffic events mined from twitter", Springer World Wide Web.

[2] Sen Zhang, Yong Yao , Jie Hu , Yong Zhao , Shaobo Li &Jianjun Hu (2019), "Deep Autoencoder Neural Networks for Short-Term Traffic Congestion Prediction of Transportation Networks" , Sensors, Vol. 19, 2229, pp. 1-19.

[3] A. Dairi, F. Harrou, Y. Sun & M. Senouci (2018), "Obstacle Detection for Intelligent Transportation Systems Using Deep Stacked Autoencoder and k -Nearest Neighbor Scheme," IEEE Sensors Journal, vol. 18, no. 12, pp. 5122-5132.

[4] Arya KetabchiHaghighat, VarshaRavichandra-Mouli, Pranamesh Chakraborty, YasamanEsfandiari, Saeed Arabi& Anuj Sharma (2020), Applications of Deep Learning in Intelligent Transportation Systems, Journal of Big Data Analytics in Transportation.

[5] S. Uma Devi & S. Nirmala SugirthaRajini (2019), " Detection of Traffic Violation Crime Using Data Mining Algorithms", Jour of Adv Research in Dynamical & Control Systems, Vol. 11, No.9, pp. 982-987

[6] Y. Liu & H. Wu (2017), "Prediction of Road Traffic Congestion Based on Random Forest," 10th International Symposium on Computational Intelligence and Design (ISCID), Hangzhou, pp. 361-364.

[7] L. Nie, D. Jiang, S. Yu & H. Song(2017), "Network Traffic Prediction Based on Deep Belief Network in Wireless Mesh Backbone Networks," IEEE Wireless Communications and Networking Conference (WCNC), pp. 1-5.

[8] L. Han & and Y. Huang, "Short-term traffic flow prediction of road network based on deep learning," in IET Intelligent Transport Systems, vol. 14, no. 6, pp. 495-503.

[9] L. Nie, D. Jiang, L. Guo, S. Yu & H. Song(2016), "Traffic Matrix Prediction and Estimation Based on Deep Learning for Data Center Networks," IEEE Globecom Workshops (GC Wkshps), pp. 1-6.

[10] YuhanJia, Jianping Wu &Yiman Du(2016), "Traffic speed prediction using deep learning method," IEEE 19th International Conference on Intelligent Transportation Systems (ITSC), pp. 1217-1222.

[11] Jiangeng Li, Xingyang Shao &Rihui Sun(2019), “A DBN-Based Deep Neural Network Model with Multitask Learning for Online Air Quality Prediction”, “,Hindawi Journal of Control Science and Engineering, , pp.1-9.

An Analysis of blood donors and Hepatitis C patients by using big data techniques

M. Sivachandran [1], Dr.T.Krishnakumar [2]
{sivachandranm08@gmail.com[1], drkk@bharathuniv.ac.in[2]}

Research Scholar, Department of CSE, Bharath Institute of Higher Education and Research, Chennai, India.[1],
Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai, India.[2]

Abstract. The system focuses and produces the optimal solution. Such as the SGD Text approach gives the highest and optimal result such as 88.38% compare with other models. and Simple Linear Regression approach gives very lowest result compare with other models. SGD Text approach produces highest precision value level which is 82.61% compare with other models, The lowest precision value is 60.02% which is produced by Simple Linear Regression approach, the highest precision value is 81.19% which is SGD Text approach. The Simple Linear Regression, SMOreg and SMO and have respectively 0.21,0.23 and 0.25 seconds to build the model. Fast and exact clinical screening is essential for the fruitful treatment of infections. Utilizing AI calculations and dependent on research center blood test results. This information extends the model's utility for use by broad professionals and demonstrates that blood test results contain more data than doctors for the most part perceive.

Keywords: SGDText, SimpleLinearRegression, SimpleLogistic, SMO, SMOreg and VotedPerceptron.

1 Introduction

Evaluation of this danger requires ideal, precise and dynamic blend of the enormous measure of clinical data in the preoperative period. [1-4]Current preoperative danger definition is restricted to a doctor's emotional danger evaluation or danger scores that frequently require expound information extraction [5-10]. While most of existing preoperative AKI hazard scores are restricted to heart medical procedure and have humble precision [11-13], instruments for preoperative danger delineation for extreme sepsis are missing.[14]

Multivariate relapse models are customarily utilized for hazard forecast in clinical exploration because of their simplicity of result understanding and investigation however AI classifiers have picked up energy in biomedical examination during the previous few years with the accessibility of electronic wellbeing records and more perplexing clinical data.[15] Even however the decision of danger expectation model assumes a part in creating vigorous and exact danger prediction,[16] information cleaning and preprocessing are similarly significant for model execution [17].

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2 Material And Methods

The dataset collected from UCI repository. The study data set comprise of laboratory diagnosis values of blood donors for the patients and subjects of Hepatitis C patients and more details in demographic values. The below information have given about the list of the attributes.

S.No	Attribute
1	X (Patient ID/No.)
2	Category (0=Blood Donor, 0s=suspect Blood Donor, 1=Hepatitis, 2=Fibrosis, 3=Cirrhosis)
3	Age
4	Sex (female,male)
5	ALB
6	ALP
7	ALT
8	AST
9	BIL
10	CHE
11	CHOL
12	CREA
13	GGT
14	PROT

The Weka 3.8.9 has implemented to get the optimal solution of the above dataset. The below approaches have implemented and got optimal solution.

- SGDText,
- SimpleLinearRegression,
- SimpleLogistic,
- SMO,
- SMOreg and VotedPerceptron

3 Results And Discussions

In this section discuss about the results and discussions of this research work. The below table clearly demonstrates that the Accuracy levels of all approaches namely SGDText, SimpleLinearRegression, SimpleLogistic, SMO, SMOreg and VotedPerceptron All of these algorithms belong to Function Category.

Table 1: Various Approaches Vs Accuracy

S.No	Algorithm	Accuracy
1	SGDText	88.38%
2	SimpleLinearRegression	60.02%
3	SimpleLogistic	60.93%
4	SMO	69.23%
5	SMOreg	80.14%
6	VotedPerceptron	77.57%

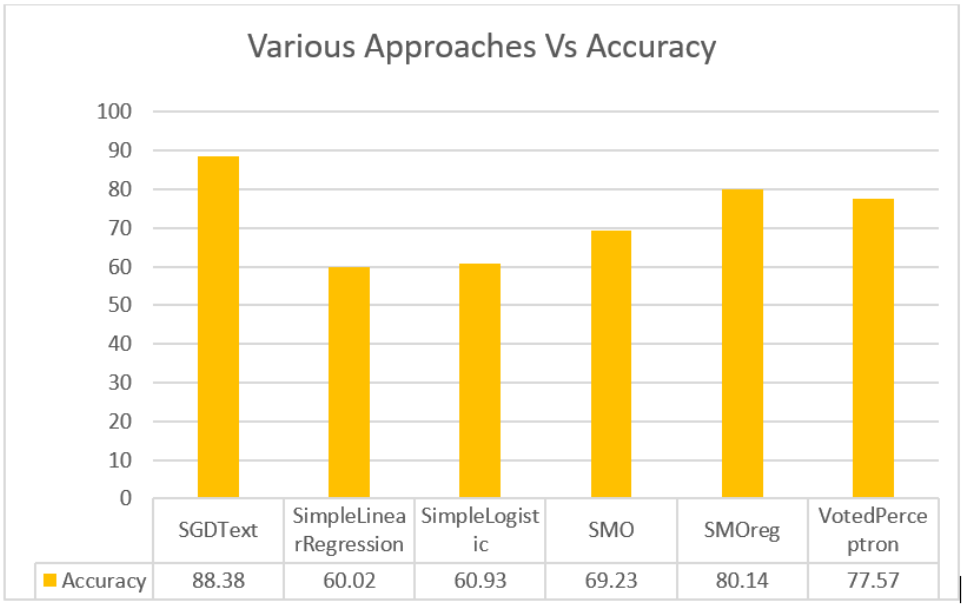

Figure 1: Various Approaches Vs Accuracy

This above diagram clearly represents that the SGDText approach produces 83.38 % of accuracy level , SimpleLinearRegression approach holds 60.02% of accuracy level, SimpleLogistic approach is holding 60.93% of accuracy level, SMO gives the accuracy level is 69.23% of accuracy level, SMOreg approach gives that 80.14% of accuracy level and VotedPerceptron approach has 77.57% of accuracy level.

The SGDText approach and SMOreg approach have above 80% accuracy level, VotedPerceptron has 77.57% and rest of the SimpleLinearRegression approach, SimpleLogistic approach, and SMO approach have the range between 60% to 70% .

The SGDText approach gives the highest and optimal result such as 88.38% compare with other models. and SimpleLinearRegression approach gives very lowest result compare with other models.

Table 2: Various Approaches Vs Precision Values

S.No	Algorithm	Precision
1	SGDText	82.61%
2	SimpleLinearRegression	66.8%
3	SimpleLogistic	67.57%
4	SMO	62.7%
5	SMOreg	81%
6	VotedPerceptron	70.68%

The above table clearly demonstrates that the Precision levels of all approaches namely SGDText, SimpleLinearRegression, SimpleLogistic, SMO, SMOreg and VotedPerceptron All of these algorithms belong to Function Category.

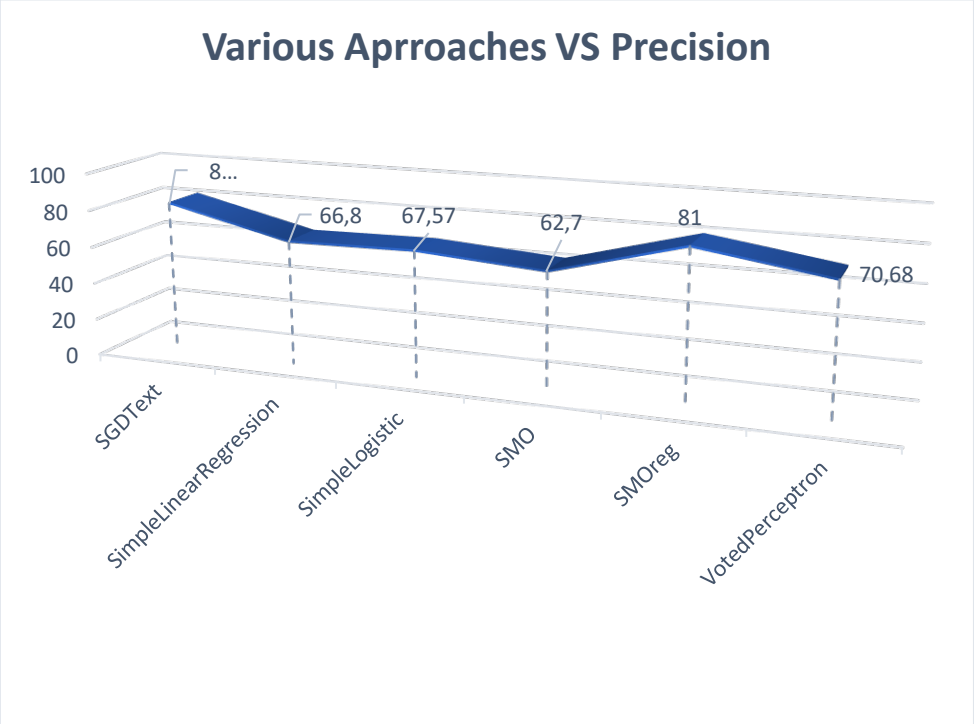

Figure 2: Various Approaches Vs Precision

The above diagram represents that the SGDText approach produces 82.61% of precision value, SimpleLinearRegression approach holds 66.8% precision value, SimpleLogistic approach is holding 67.57% precision value, SMO gives the precision value approach is 62.7% , SMOreg approach gives that 81% precision value and VotedPerceptron approach has 70.68% of precision value.

SGDText approach produces highest precision value level which is 82.61% compare with other models, Next highest precision value is produced by the SMOreg approach which is

81%. The next highest priority is VetedPerception approach which is 70.68% of precision value, the rest of the SimpleLinearRegression, SimpleLogistic and SMO have the range between is 60% to 67%.

Table 3: Various Approaches Vs Recall Values

S.No	Algorithm	Recall
1	SGDText	81.19%
2	SimpleLinearRegression	60.02%
3	SimpleLogistic	60.68%
4	SMO	62.49%
5	SMOreg	80.14%
6	VotedPerceptron	71%

The above table clearly demonstrates that the recall values of all approaches namely SGDText, SimpleLinearRegression, SimpleLogistic, SMO, SMOreg and VotedPerceptron All of these algorithms belong to Function Category.

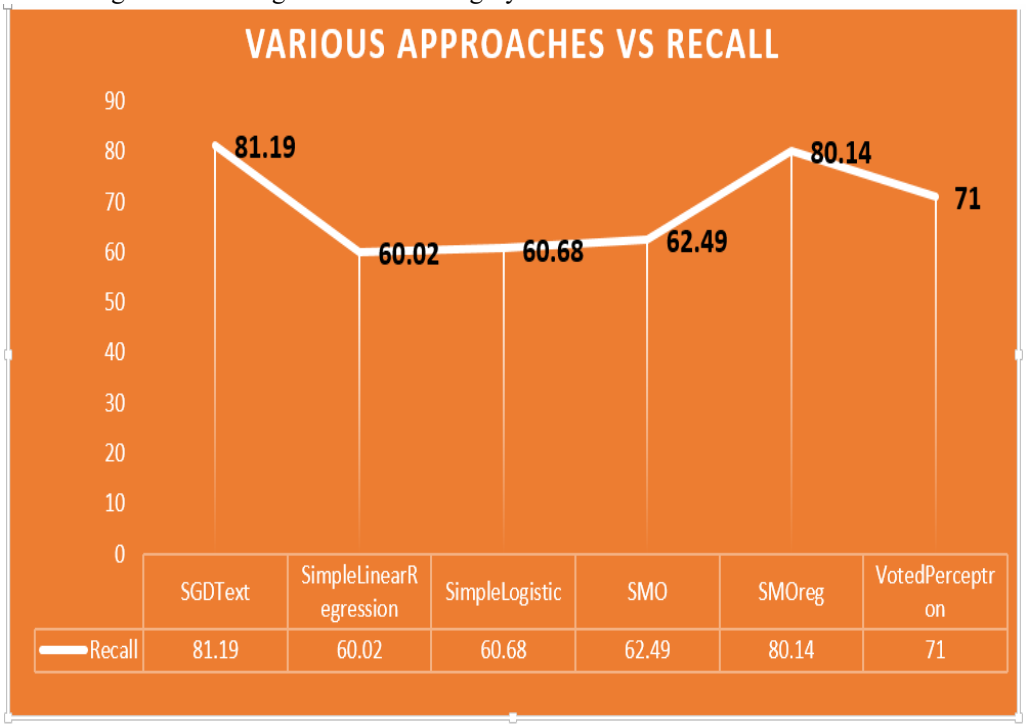

Figure 3: Various Approaches Vs Recall Values

The above diagram represents that recall values have been produced by using various algorithm the SGDText approach produces 81.19% of Recall value, SimpleLinearRegression approach holds 60.02%% of recall value, SimpleLogistic approach is holding 60.68% of recall value, SMO approach gives the recall value is 62.49% , SMOreg approach gives that 80.14% recall value and VotedPerceptron approach has 71% of recall value.

The lowest precision value is 60.02% which is produced by SimpleLinearRegression approach, the highest precision value is 81.19% which is SGDText approach. The SMOreg approach is 80.14% which is the next highest precision level. The SimpleLinearRegression, SimpleLogistic, and SMO have the range between 60% to 63%.

Table 4: Various Approaches Vs Time Taken to build the model

S.No	Algorithm	Time taken to build model(In Seconds)
1	SGDText	0.19
2	SimpleLinearRegression	0.21
3	SimpleLogistic	0.49
4	SMO	0.25
5	SMOreg	0.23
6	VotedPerceptron	0.91

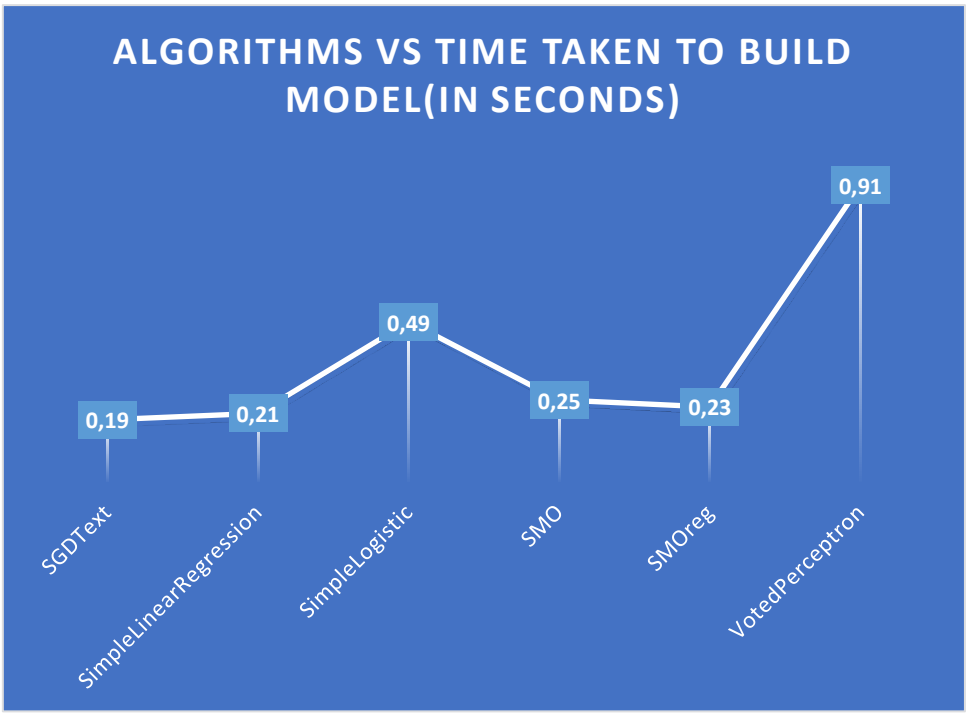

Figure 4: Various Approaches Vs Time Taken to build the models(In Seconds)

The above table clearly demonstrates that the time consumptions of various approaches namely SGDText, SimpleLinearRegression, SimpleLogistic, SMO, SMOreg and VotedPerceptron. All of these algorithms belong to Function Category.

The above diagram represents that all approaches have taken the time to build the model like SGDText approach takes the time to build the model around 0.19 seconds, SimpleLinearRegression approach takes 0.21 seconds to build the model, SimpleLogistic approach takes the time to build the model around 0.49 seconds, SMO approach takes 0.25 seconds to build the model, SMOreg approach takes 0.23 seconds to build the model and VotedPerceptron approach takes 0.91 seconds to build the model.

The SGDText is taking low time consumption to build the model. It takes only 0.19 seconds. It is very low time consumption compare with other approaches for building the models.

The SimpleLinearRegression, SMOreg and SMO and have respectively 0.21,0.23 and 0.25 seconds to build the model. The SimpleLogistic approach has 0.49 seconds to build the model. The highest time has taken VotedPerceptron approach which is 0.91 seconds to build the model.

4 Conclusion

This system concludes that the SGDText approach gives the highest and optimal result such as 88.38% compare with other models. and SimpleLinearRegression approach gives very lowest result compare with other models. SGDText approach produces highest precision value level which is 82.61% compare with other models, The lowest precision value is 60.02% which is produced by SimpleLinearRegression approach, the highest precision value is 81.19% which is SGDText approach. The SimpleLinearRegression, SMOreg and SMO and have respectively 0.21,0.23 and 0.25 seconds to build the model.

References

[1] Khan NA, Quan H, Bugar JM, Lemaire JB, Brant R, Ghali WA. Association of postoperative complications with hospital costs and length of stay in a tertiary care center. J Gen Intern Med. 2006;21(2):177–80. Epub 2006/04/12. JGI319 [pii] pmid:16606377

[2] Hobson C, Ozrazgat-Baslanti T, Kuxhausen A, Thottakkara P, Efron PA, Moore FA, et al. Cost and Mortality Associated With Postoperative Acute Kidney Injury. Ann Surg. 2014. Epub 2014/06/03.

[3] Korenkevych D, Ozrazgat-Baslanti T, Thottakkara P, Hobson CE, Pardalos P, Momcilovic P, et al. The Pattern of Longitudinal Change in Serum Creatinine and 90-Day Mortality After Major Surgery. Ann Surg. 2015.

[4] Bihorac A, Brennan M, Ozrazgat-Baslanti T, Bozorgmehri S, Efron PA, Moore FA, et al. National surgical quality improvement program underestimates the risk associated with mild and moderate postoperative acute kidney injury. Crit Care Med. 2013;41(11):2570–83. pmid:23928835

[5] Bihorac A, Yavas S, Subbiah S, Hobson CE, Schold JD, Gabrielli A, et al. Long-term risk of mortality and acute kidney injury during hospitalization after major surgery. Ann Surg. 2009;249(5):851–8. pmid:19387314

[6] Huber M, Ozrazgat-Baslanti T, Thottakkara P, Efron PA, Feezor R, Hobson C, et al. Mortality and Cost of Acute and Chronic Kidney Disease after Vascular Surgery. Annals of vascular surgery. 2015.

[7] Ozrazgat-Baslanti T, Thottakkara P, Huber M, Berg K, Gravenstein N, Tighe P, et al. Acute and chronic kidney disease and cardiovascular morltaity after major surgeyr Annals of Surgery. 2015.

[8] Zarjou A, Agarwal A. Sepsis and acute kidney injury. J Am Soc Nephrol. 2011;22(6):999–1006. Epub 2011/05/14. ASN.2010050484 [pii]. pmid:21566052

[9] Copeland GP, Jones D, Walters M. POSSUM: a scoring system for surgical audit. Br J Surg. 1991;78(3):355–60. Epub 1991/03/01. pmid:2021856

[10] Lake AP, Williams EG. ASA classification and perioperative variables: graded anaesthesia score? Br J Anaesth. 1997;78(2):228–9. Epub 1997/02/01.

[11] Hobson CE, Singhania G, Bihorac A. Acute kidney injury in the surgical patient. Crit Care Clin. 2015.

[12] Huen SC, Parikh CR. Predicting acute kidney injury after cardiac surgery: a systematic review. Ann Thorac Surg. 2012;93(1):337–47. S0003-4975(11)02155-2 [pii] pmid:22186469
[13] Miyagawa T, Nishida N, Ohashi J, Kimura R, Fujimoto A, Kawashima M, et al. Appropriate data cleaning methods for genome-wide association study. J Hum Genet. 2008;53(10):886–93. Epub 2008/08/13. pmid:18695938
[14] Osborne JW. Is data cleaning and the testing of assumptions relevant in the 21st century? Front Psychol. 2013;4:370. Epub 2013/06/28. pmid:23805118
[15] Van den Broeck J, Cunningham SA, Eeckels R, Herbst K. Data cleaning: detecting, diagnosing, and editing data abnormalities. PLoS Med. 2005;2(10):e267. Epub 2005/09/06. 04-PLME-PF-0256 [pii] pmid:16138788
[16] Paul Thottakkara, Tezcan Ozrazgat-Baslanti, Bradley B. Hupf, Parisa Rashidi, Panos Pardalos, Petar Momcilovic, Azra Bihorac, Application of Machine Learning Techniques to High-Dimensional Clinical Data to Forecast Postoperative Complications, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0155705
[17] https://pubmed.ncbi.nlm.nih.gov/29323142/

Prediction and Validation of Biometric Authentication Security System Using Various Algorithm Tools

G.B.Veeresh[1], Dr.B. Satyanarayana[2]
{veereshksrm@gmail.com[1], bachalasatya@yahoo.com[2]}

Asst.Professor, CSE. Dept ,KSRM College of Engg , Kadapa, AndhraPradesh, India. 516003.[1],
Professor ,CST Dept, SK university, Anantapur, Andhra Pradesh State , India, 515003 [2]

Abstract. Ensuring touchy data is vital in this computerized world because of the simple accessibility of vindictive clients. These days, advanced wholesale fraud is on the ascent in the computerized local area. What's more, recognizing and alleviating this sort of work is a test. Biometric verification qualifications assume a significant part in securing most of online business. Confirmation of conventional strategies, for example, IDs and passwords isn't adequate to battle wholesale fraud or security sharing. The responsibility for introductions of the understanding might be effortlessly neglected, speculated, lost, shared or taken. To defeat security penetrates, we should guarantee free exchanges that give security and ease of use in any electronic business. In this paper, a legitimate biometrics ID is introduced. This incorporates highlights, for example, palm printing, finger impression and iris to give a more exact distinguishing proof of the individual. The proposed framework is most appropriate for individual distinguishing proof and requires high security during internet shopping, banking network and so on Each biometric component is tried and the equivalent is under 80%, the client will confirm each secret key in turn. Something else, exchanges can be dropped consequently and security infringement will be diverted to the worker. The proposed biometric framework is exceptionally dependable and secure with the goal that unapproved client access is confined. Particulars map is presented for finger extraction, iris and palm print and different encryption calculation. The framework is executed and tried with various boundaries like precision, productivity, protection, security, unwavering quality and gives the most encouraging outcomes in experiments.

Keywords: Biometric, Accuracy, Performance, Usability, Algorithm.

1 Introduction

Information security is worried about the confirmation of privacy, respectability and admittance to data definitely. There are numerous apparatuses and techniques that can uphold data security the executives. In any case, the biometric-based framework has developed to help different parts of data security. Biometric validation upholds the part of ID, verification and credibility in data security. Biometric approval has filled in notoriety as an approach to give human ID. Individual distinguishing proof is vital in numerous applications and the expansion in Visa extortion and information burglary as of late shows that this involves extraordinary worry to the more extensive local area. Singular passwords, pin ID or token settings all have deficiencies that upset their activity in a more extensive organization [1-5]. Biometric is utilized to distinguish the personality of an information test when contrasted with

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a format, which is utilized in cases to recognize explicit people by explicit attributes. Proprietor based: utilizing a solitary "token, for example, a security tag or card and data support: utilization of a code or secret phrase. Traditional confirmation frameworks frequently utilize various example contributions for adequate approval, for example, explicit example highlights. This expects to fortify security as various examples are required, for example, wellbeing labels and codes and test sizes. Thusly, the benefit tried to demonstrate biometric validness is that they can build up a consistent coordinated association between an individual and a piece of information [14 - 16].

2 Related work

The E-installment framework is a mechanized interaction of trading monetary incentive for business bunches in deals and broadens this level past ICT (Information Communication Technology) networks [7]. Power installments are coordinated into four stages. They are Electronic Check, Online Electronic Cash, Smart Card installment and Online Card Payment [13]. Suitable power installments are utilized for a particular gathering of power exchanges. A dependable e-installment framework can give respectability, guarantee security, effectiveness, consistence, versatility, convenience, acknowledgment and negligible monetary danger. These are viewed as components of a biometric framework [8]. The Biometric framework is safer in check and ID and is a significant worry for wellbeing improvements in our current circumstance [5]. The Biometrics framework is protected and dependable and utilizes fingerprints, iris and palm print for the actual varieties of human existence. The social attributes of the monster, the voice are additionally affirmed [11]. In 2009, Stanley depicted biometrics as the least difficult and most secure verification instrument. It won't be fake, taken, fake or acquired. The element number in the biometric goes about as a dependable check instrument. These incorporate variety, general acknowledgment, acknowledgment, consistence, shirking and execution. Verification is fundamental to secure the whole framework. Incorporates confirming framework client ID. Validation can be confirmed in three different ways utilizing a pin and secret key, one client has a shrewd card and security token or another client has social or actual highlights like the iris, palm and finger [12 - 14]. In [14], a safe biometric framework was presented. The biometric application has two unmistakable classes [9]. Confirmation and enlistment. In the enrollment area the client ID subtleties are gone into the program data set. In the confirmation segment the biometric client data is contrasted and the records of the data set.

3 Research Methodology

Biometric framework gives a superior method of client confirmation. Biometric confirmation is a programmed strategy wherein the character of an individual is checked by various conduct or actual elements. Parameters considered for study are Accuracy Efficiency Privacy Security Reliability

i)Accuracy (1) *False Acceptance Rate. (2) False Rejection Rate (3) Equal Error Rate (4) Authentication Accuracy*

ii)Efficiency

iii)Privacy

iv)Security
v)Reliability

Potential Risks in Biometric Authentication

Fake sensor
Resubmitting biometric signal
Common network signal

Algorithm used

SVM Algorithm
Minutiae Algorithm
DWT Algorithm
RC4 Algorithm

The Weka 3.8.9 has implemented to get the optimal solution of the above dataset. The below approaches have implemented and got optimal solution

4 Results And Discussion

Study conducted in Mat Lab tool along with weka software tool. Various algorithmshows its significance in security authentication. RC4 algorithm based tools shows improved performance for all criteria. The values showed herewith table no 1 &2 and also in figure 1 and 2.

Table 1.Evaluation of Total score of criteria level for different algorithm

Criteria	SVM Algorithm	Minutiae Algorithm	DWT Algorithm	RC4 Algorithm
Accuracy	85	67	70	86
Efficiency	80	70	77	85
Usability	87	80	65	87
Privacy	90	85	70	91
Security	92	80	79	90
Reliability	78	70	80	85

Figure 1.Total score of criteria level for different algorithm

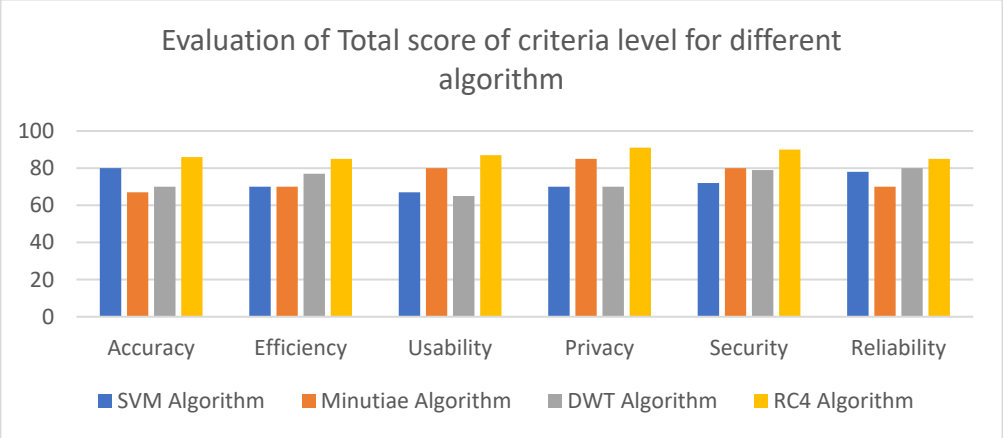
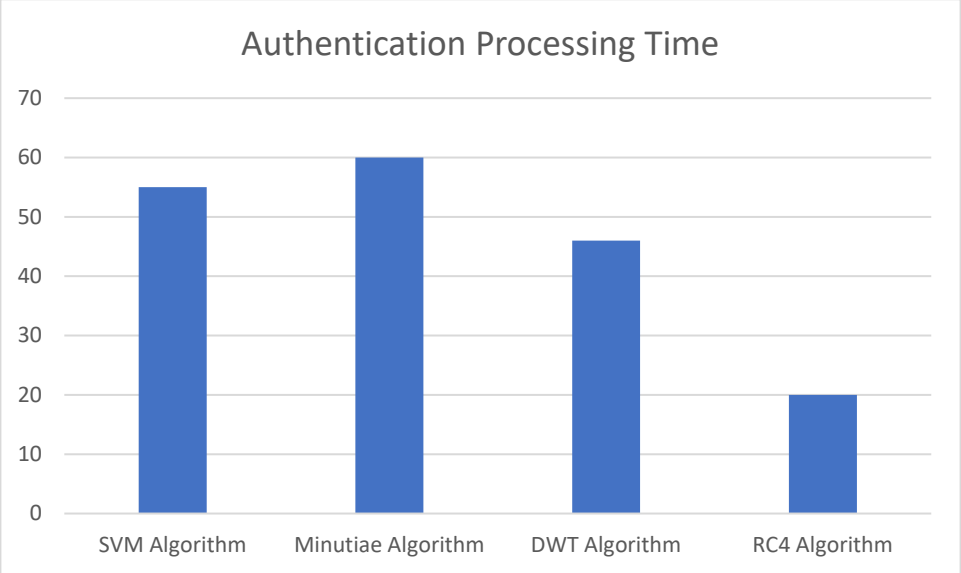


Table 2. Authentication processing time

S.No	Algorithm	Time (ms)
1	SVM Algorithm	55
2	Minutiae Algorithm	60
3	DWT Algorithm	46
4	RC4 Algorithm	20

Figure 2. Authentication processing time



Advances in the field of Information Technology additionally make Information Security an indistinguishable piece of it. To manage security, Authentication assumes a significant part. This paper presents a survey on the biometric confirmation methods and some future prospects in this field [10-13]. In biometrics, a person should be distinguished dependent on some trademark physiological boundaries. A wide assortment of frameworks require solid individual acknowledgment plans to either affirm or decide the character of an individual mentioning their administrations. The motivation behind such plans is to guarantee that the delivered administrations are gotten to simply by a real client, and not any other individual. By utilizing biometrics it is feasible to affirm or build up a person's character [6-9].

Conclusion

Late advances in the field of biometric confirmation. We brought up possible assaults and security hazards in biometric validation and further proposed a progression of assessment

models for assessing the presentation of existing works. We gave a relative assessment on the new writing by partitioning existing biometric verification frameworks into two classifications by utilizing either static biometric highlights or dynamic ones. We tracked down that the greater part of the current frameworks experience the ill effects of safety and protection issues, albeit the confirmation precision of certain frameworks dependent on unique biometric highlights ought to be additionally improved. In light of our overview, we tracked down a few open issues and conjecture future examination headings. We accept that improving the security and protection of biometric confirmation ought to be accentuated in future exploration

References

[1] R. Spolaor, Q. Li, M. Monaro, M. Conti, L. Gamberini, and G. Sartori, "Biometric authentication methods on smartphones: A survey," PsychNology Journal, vol. 14, no. 2-3, pp. 87–98, 2016.

[2] A. K. Jain, L. Hong, S. Pankanti, and R. Bolle, "An identity-authentication system using fingerprints," Proceedings of the IEEE, vol. 85, no. 9, pp. 1365–1388, 1997.

[3] V. M. Patel, N. K. Ratha, and R. Chellappa, "Cancelable biometrics: A review," IEEE Signal Processing Magazine, vol. 32, no. 5, pp. 54–65, 2015.

[4] N. K. Ratha, S. Chikkerur, J. H. Connell, and R. M. Bolle, "Generating cancelable fingerprint templates," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 29, no. 4, pp. 561–572, 2007.

[5] W. Yang, J. Hu, S. Wang, and J. Yang, "Cancelable Fingerprint Templates with Delaunay Triangle-Based Local Structures," in Cyberspace Safety and Security, vol. 8300 of Lecture Notes in Computer Science, pp. 81–91, Springer International Publishing, Cham, 2013.

[6] D. Ahn, S. G. Kong, Y. Chung, and K. Y. Moon, "Matching with Secure Fingerprint Templates Using Non-invertible Transform," in Proceedings of the 2008 Congress on Image and Signal Processing, pp. 29–33, Sanya, China, May 2008.

[7] Ayo C.K and. Ukpere, W. I. (2010), "Design of a secure unified e-payment system in Nigeria: A Case Study". African Journal of Business Management,Available online at http://www.academicjournals.org/AJBM, 4(9), pp. 1753-1760

[8] Biometrika, (2011), "Introduction to Biometric Systems", s.l.: Biometrika (Italy) Available at:http://www.biometrika.it/ eng/wp_biointro.html.

[9] Deravi, F. (1999) "Audio-Visual Person Recognition for Security and Access Control" Joint Information Systems Committee, University of Kent at Canterbury.

[10] Drygajio, A, (2011), "Information and Communication Security", LIDIAP Speech processing and Biometrics Group, Institute of Electrical Engineering, EcolePolytechniqueFederalede Lausanne (EPFL).http//scgwww.epfl.ch/courses.

[11] French, T, (2012), "CIS050-6 Week 6: Biometrics". , Luton Campus, UK: University of Bedfordshire. Available at: http://breo.beds.ac.uk.

[12] Kay,R.(2005),"Biometric authentication", s.l.: Computerworld, Available at:http://www. computerworld.com/s/article/100772/Biometric_Authentication.

[13] Mukherjee, A. &Nath P, (2003), "A model of trust in online relationship banking". International Journal of Bank Marketing, 21(1), pp. 5-15.

[14] Ratha, N. K., Connell, J.H, and Bolle, R.M, (2010), "Enhancing Security and Privacy in Biometric Based Authentication System". IBM Systems Journal, 40(3), pp. 615-634.

[15] Stanley, P., Jeberson, W., and Klinsega V.V., (2009), "Biometric Authentication: A Trustworthy Technology for Improved Authentication", International Conference on Future Networks, , pp. 171-175.

[16] Ronald G. Wolak, (1998),"Network Security: Biometrics –The Password Alternative," School of Computer and Information Sciences.

[17] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.

[18] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9

[19] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.

[20] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020

[21] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2

[22] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.

[23] Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

An Efficient Design of Blood Vessel Image Extraction Using LBP Technique

G. Somasekhar [1], Dr. O.Obulesu[2], Dr. P. Appala naidu[3], Dr.Rokesh Kumar Yarava[4]

{giddalurisomasekhar@gmail.com[1], obulesh194@gnits.ac.in[2], appalanaidu.p@raghuenggcollege.in[3], rokeshy1@gmail.com[4]}

Associate Professor, Department of Computer Science and Engineering, CMR Technical Campus, Hyderabad, Telangana-501401[1], Associate Professor, Department of IT, G.Narayanamma Institute of Technology & Science (Autonomous), Hyderabad, Telangana-500104[2], Associate Professor of CSE, Raghu Engineering College, Dakamarri (V), Bheemunipatnam (M), Visakhapatnam (Dt), A.P.-531162.[3] Yarava, Associate Professor, Department of CSE, Chalapathi Institute of Engineering and Technology(A), Guntur,A.P.-522006.[4]

Abstract. An efficient architecture of blood vessel image extraction is implemented. This system provides both physiological and behavioral characteristics which give the overview of retina, iris recognition, and face detection. The main intent of this project is to detect and measure the blood vessels present in the retina. This is done by using the classifier technique. By using classifier technique, the accuracy of the system will be increased. Image segmentation is applied to divide the number of cells available in the retina. The LBP technique will extract the features of input retinal images. Image feature extraction using LBP will extract the images which are featured. Imaging Library provides the interpreter with image editing capabilities. Hence this blood vessel image extractiongives effective results and this can be observed from simulation results.

Keywords: Blood Vessel Image Extraction. Classifier Technique, Image Segmentations, Histogram Equalization, Local Binary Pattern (LBP)..

1 Introduction

Eyes are the most significant organs in our body, called as organs of vision. Vein extraction is significant and the same number of eye sicknesses is perceived by assessing the vein. These veins convey crisp oxygenated blood from heart to sustain sustenances to tissues and cells present in retina and afterward convey the deoxygenated blood from eye to heart. There are for the most, two sorts of veins supply routes.

i) The veins that convey new blood.

ii) The veins that convey oxygenated blood

Photoreceptors move light into neural sign that are passed to the cerebrum through the optic nerves. A fundus camera system is normally utilized for capturing retinal images to save the retina condition. Retinal image contains important diagnostic data which helps to identify whether the retina is diseased or non-diseased. Blood vessels appear as networks of mesh-like structure or tree-like structure of either dark red or orange-red fibers that start inside the optic disc and dynamically which reduces the width. The morphological characteristics of the retina

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such as length, width, and branching is essential for diagnosis, screening, early detection and treatment of various diseases such as stroke, vein occlusions, glaucoma, hypertension, diabetes and arteriosclerosis which aid a appropriate detection and treatment in an early stage.

In addition, the investigation of retinal blood vessels can support in the assessment of retinal image segmentation in terms of the relationship between vessel and hypertensive retinopathy, retinopathy of prematurity, reflectivity, arteriolar narrowing, mosaic synthesis, biometric identification, foveola vascular region detection and computer-assisted laser surgery.

While cardiovascular and ophthalmologic diseases have a severe impact on human's life, so retinal blood vessels analysis is more significant. The patients might not notice a vision loss until it turned out to be serious; consequently, early diagnosis and appropriate treatment are necessary to prevent visual hinder and blindness. It has great significance in clinical applications to expose important information about retina for treatment. So it is mandatory to develop an efficient technique for segmentation of retinal vessel for diagnosis.

The process of dividing image into various regions is called as image segmentation, every region have different properties such as texture or colour. The pixels are arranged as background or foreground by using segmentation in the experiment of microarray. For every spotted DNA sequence, the fluorescence intensities can be determined.

Spot mask is produced by segmentation method, it contains foreground pixels set. In the foreground spots fluorescence signals mean intensity determination is known as spot intensity extraction [1]. Mean intensities are extracted which are matched to gene expression levels then transferred into biological conclusions by using data mining techniques. The problems of segmentation of microarray image are discussed in segmentation of microarray image.

The goal of segmentation is division of microarray image pixels into various groups or regions. Set of foreground pixels are in one group and background pixels are in another group. Here different types of pixels are existing like noisy pixels; these are contaminated pixels which are generated during microarray production and scanning. In the process of segmentation these pixels are removed from foreground region or background region [2].

Based on methods for classification of pixels, another type of pixels contains foreground region surrounded by edge pixels. Due to these pixels intensities presents in between background and foreground, adding or removing those causes SNRs are present. Usually two clusters are assumed that they are for the foreground pixels and $co_2$for the background pixels. In this d-dimensional feature vector real values are used to show the features that are extracted from pixel p.

The problem of segmentation contains assigning of every pixel of I, G or R to predefined classes. In segmentation method the output will be binary image B or white or black. In the image each pixel assigned by label, by using various statistical measures intensities of background and foreground can be manipulated. To find the process of typical objects from background which is called image segmentation. In vision systems first step is the image segmentation, for additional processing like recognition or description it is the basic step. From the images, important features are extracted by the segmentation.

The image segmentation can also be stated that each pixel assigned to compositions of image. There are five types of image segmentation methods; they are hybrid methods, boundary detection methods, shape-based methods, threshold based or clustering methods and region growing methods. To get good results some application domains uses the different image segmentation methods such as motion image segmentation, color image segmentation, real time image segmentation and 3-D image segmentation. Most basic image segmentation method is the threshold or clustering technique. In these techniques,pixels are classified into different regions by getting the information about pixels and its neighbors [3].

Contour detection is focused by edge-based methods or Boundary detection. The segmentation of image depends on linking and edge finding or spatial discontinuity. Edge detection operators are Laplacian, Prewitt and Sobel operators. The image segmentation performed by method of region growing and depends on pixels spatial similarity [4].

Same intensity levels of neighboring pixels are grouped and by using this images are divided into connected regions. After that, merge the adjacent regions which contain sharpness or homogeneity of region boundaries. The shape of object which has to be segmented is used by shape based methods such as template matching and mathematical morphology. For image segmentation, there are different methods present. For analysis, microarray image special techniques are implemented. In microarray image, the characteristics are considered by these techniques [5].

2. Related Work

Fig. 1:STRUCTURE OF RETINA VESSEL

Segmentation can improve screening for retinopathy by decreasing the quantity of falsepositive results from the patient which is taken under various circumstances by depicting the optic disc region and fovea. In any case, manual detection of blood vessels is complicated since the blood vessels in a retinal image are obscure and low contrast. In modern healthcare community, medical imaging has turned into the most vital tool due to visual documentation

and to record the patient's information for diagnosing. By employing computational approaches, for this reason would help in the efficient retinal analysis.

Image processing techniques are widely used in medical diagnosis for efficient segmentation. Pre-processing, feature extraction, segmentation, and classification are the common image processing techniques used for segmentation of retinal blood vessel. Automatic segmentation of retinal blood vessels is a prevailing tool for medical diagnostics and enhances the diagnostic performance of less specialized physicians. For this reason, the segmentation method is utilized because of accurate and reliable. The important process of segmentation is to distinguish features and the background from a given image. The basic strategies for retinal blood segmentation are supervised methods and unsupervised methods.

Supervised methods acquire segmentation results with labeled images whereas unsupervised methods do not need a labeled image. Automatic blood vessel segmentation in the images can help speed diagnosis and improve the diagnostic performance of less specialized physicians. A crucial step in feature extraction is the segmentation of the original image. This work focuses on developing a new approach for retinal blood vessel segmentation, to overcome the flaws of existing algorithms by comparing their performances to achieve the efficient performance. In this blood vessel image extraction, unsupervised method for segmentation of retinal blood vessel from color fundus retina image for classifying the image as disease affected blood vessel or non disease affected blood vessel. This proposed method is based on generating a feature vector for every image pixel by utilizing training samples (known classes) to design a classifier to classify these training samples into their subsequent classes and to classify the disease as diabetic retinopathy.

Here it is used to implement the structure. The main uses of the retina blood image extraction in image processing are given below:

1. It is used to read an image and save it in another image file format
2. It is used to read an color image and convert into gray scale image.
3. It is used to increase the contrast of image.
4. It is used to increase the brightness of image.
5. It is used to display the image name of images stored in directory.

3. Proposed Method

The below figure (2) shows the architecture of retina blood image extraction vessel using LBP. Here first an RGB image is taken. After that pre processing method is applied to that input image. By using histogram equalization method, the contrast of the obtained image is improved. Here classifier technique is implemented which uses both KNN (K-Nearest Neighbor) and RF (Random Forest) classifiers. Now after applying the classification technique image is segmented into number of pixels. After segmentation the features are extracted from that image. Hence from this one can observe the output image.

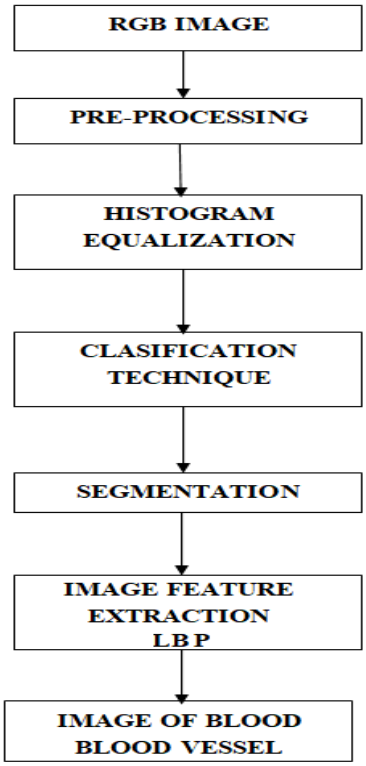

Fig. 2: RETINA BLOOD IMAGE EXTRACTION VESSEL

Pre processing step is improved to distinguish the suspicious district by the utilizing of the Pre-handling methods. The initial step of pre-handling is following the highlights which includes those exercises that are typically vital preceding real data audit and detail extraction, and are every now and again gathered as radiometric or geometric enhancements. For instance, film antiques or names, age and characteristics of the patient. Through the following calculation, film curios are dispensed. Now, the power estimation of the pixels are beginning from the essential line and the underlying segment is examined and the limit estimation of the film ancient rarities is found. The edge worth ought to be noted to surpass the edge esteems expelling from Blood Vessel Imagewipe out of the film ancient rarities high power esteem. Sooner or later in taking out film ancient rarities, the picture incorporates salt and pepper clamor.

Visual review of a great deal of pictures uncovers that the objects of interests have a dim worth that is not quite the same as the foundation. In these cases, the histogram will frequently demonstrate a bimodal dissemination. Thresholding is the least complex strategy for picture division. From a grayscale picture, thresholding can be utilized to make parallel pictures.

Morphological picture preparing is a gathering of non-straight tasks identified with the shape or morphology of highlights in a picture, for example, limits, skeletons, and so forth. In some random system, testing a picture with a little shape or format is called as an organizing component, which characterizes the district of intrigue or neighborhood around a pixel. Morphological administrators enlarge, disintegrate, open, and close can be connected through

picture sifting to develop or psychologist picture areas, just as to expel or fill-in picture locale limit pixels. As zones of closer view pixels develop in size, gaps inside those locales become littler.

The yields for proposed technique comprises of different sorts of exactnesses, those are resemble RBF precision, Linear precision, Polygonal precision and Quadratic precision. A Radial Basis Function is a genuine esteemed capacity whose worth depends just on the good ways from the beginning, then again on the good ways from some other point, called as inside, so that, the RBF execution is prepared enough to have the RBF abused in various designing applications.

Precision and repeatability are two significant determinations of a direct movement stage. In spite of the fact that they are connected, precision and repeatability in straight movement frameworks are not something very similar. The engine, drive and actuator itself all impact these details. Now and then, repeatability could really compare to generally exactness. The overall significance of the two relies with an intensive comprehension of your application.

Pre-preparing procedures is utilized to improve the identification of the suspicious district from blood vessel image. The pre-handling and upgrade techniques comprises of two stages; first the evacuation of film antiquities, for example, names and X-beam imprints are expelled from the Blood Vessel Image utilizing following calculation. Second, the evacuation of high recurrence parts utilized Ant Colony Optimization (ACO) system.

4. Results

The below figure (3) shows the input fundus image.

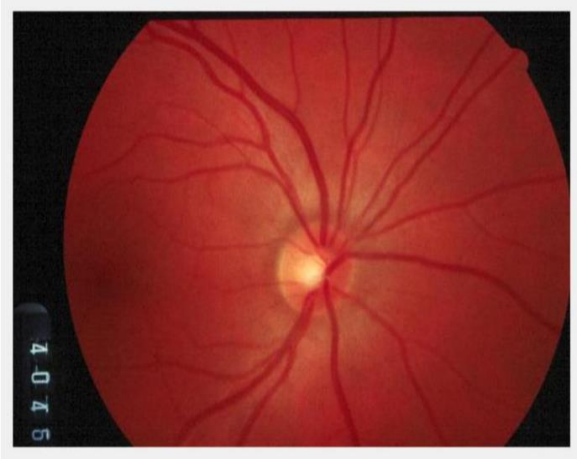

Fig. 3: INPUT FUNDUS IMAGE

The below figure (4) shows the gray scale image. The input image is converted into gray scale image.

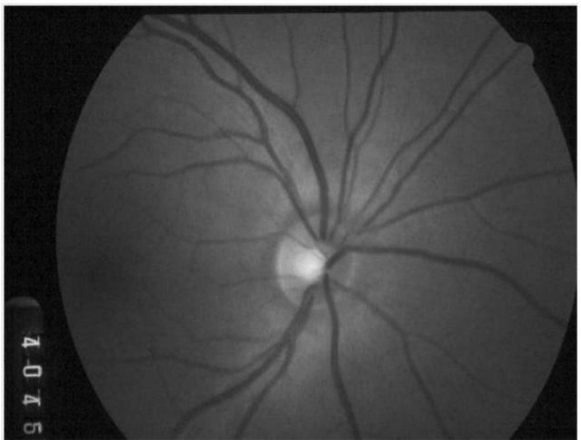

Fig. 4: GRAY SCALE IMAGE

The below figure (5) shows the pre processing image. The converted image is pre processed.

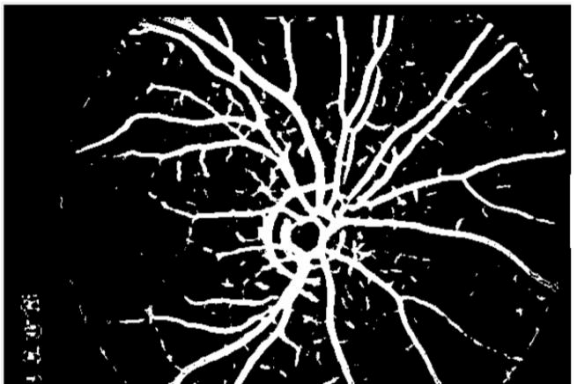

Fig. 5: PRE-PROCESSED IMAGE

The below figure (6) shows the output KNN classifier image. The processed image is classified using KNN.

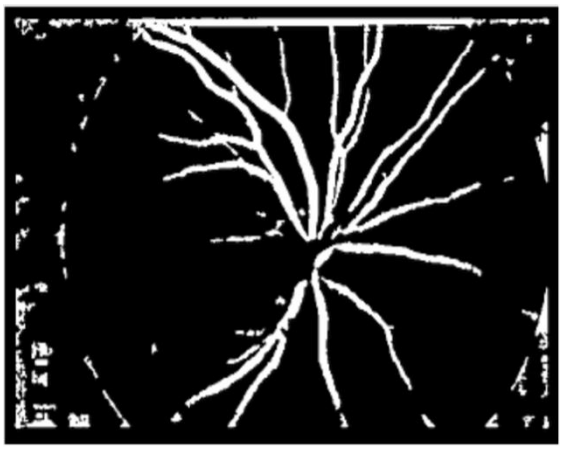

Fig. 6: OUTPUT OF KNN CLASSIFIER

The below figure (7) shows the extracted blood vessel image.

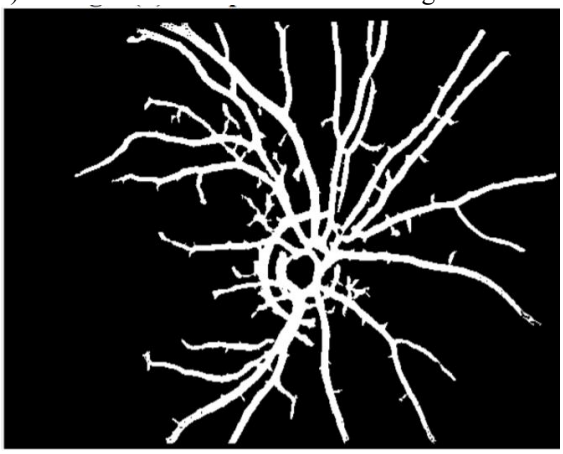

Fig. 7: EXTRACTED BLOOD VESSEL

Table. 1: ANALYSIS OF PROPOSED AND EXISTING SYSTEM

S.No	Name of the parameter	Blood Vessel Image Extraction	Blood Vessel Image Extraction using LBP technique
1	Accuracy	31%	95%
2	Number of Hidden Nodes	52	6
3	Learning Rate	0.08	0.05
4	Number of Maximum Iterations	500	1000

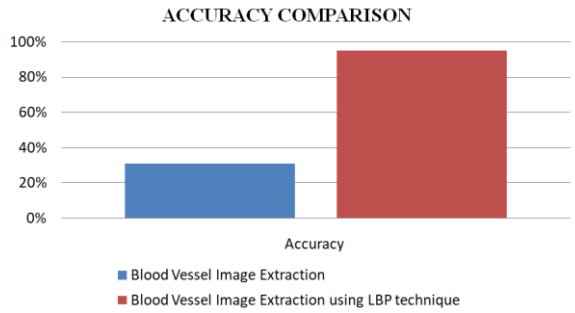

Fig. 8: ACCURACY COMPARISON

The above figure (8) shows the accuracy comparison of existing and proposed system. Compared to existing , proposed system increases the efficiency.

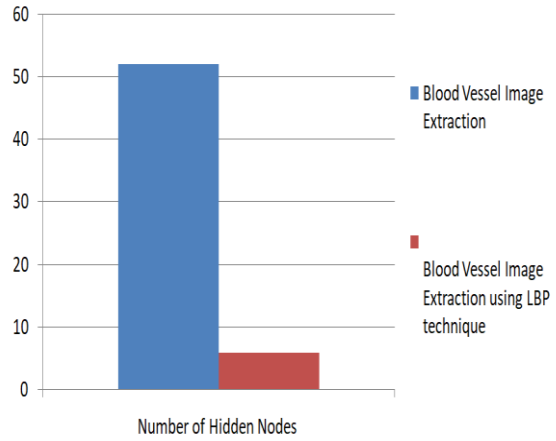

Fig. 9: COMPARISON OF NUMBER OF HIDDEN NODES

The above figure (8) shows the comparison of number of hidden nodes in existing and proposed system.

5. Conclusion

Hence the blood vessel image in the retina is extracted by using LBP in effective way. Basically, this system supports very powerful tools when comes to image processing. By using classifier technique the image improves the accuracy level. This is mainly used in the applications of high security. This is a unique system which improves the accuracy in effective way.

References

[1] M Anna Latha , N Christy Evangeline , S. Sankara Narayanan, 2018 Fourth International Conference on Biosignals, Images and Instrumentation (ICBSII), 2018 Conference Paper, Published on IEEE.

[2] P. T. Karule , Shilpa Joshi , 2017 International Conference on Intelligent Computing and Control (I2C2), 2017 Conference Paper, Published on IEEE.

[3] Siva Teja Kakileti, Krithika Venkataramani, 2016 IEEE International Conference on Image Processing (ICIP), 2016Conference Paper, Published on IEEE.

[4] VeronikaKurilová , JarmilaPavlovičová , Miloš Oravec , Radoslav Rakár , Igor Marček, 2015 International Conference on Systems, Signals and Image Processing (IWSSIP), 2015 Conference Paper, Published on IEEE.

[5] Sohini Roychowdhury , Dara D. Koozekanani , Keshab K. ParhiIEEE Journal of Biomedical and Health Informatics, 2015 Journal Article, Published on IEEE.

[6] Wan Azani B Wan Mustafa , Haniza Yazid , Sazali Bin Yaacob , Shafriza Nisha Bin Basah, 2014 IEEE REGION 10 SYMPOSIUM, 2014 Conference Paper, Published on IEEE.

[7] Murat Ceylan, Hüseyin Yaçar, 36th International Conference on Telecommunications and Signal Processing (TSP), 2013Conference Paper, Published on IEEE.

[8] Chien-Cheng Lee , Shih-Che Ku, 2012 International Conference on Information Security and Intelligent Control, 2012 Conference Paper, Published on IEEE.
[9] Erhan Bas , Nastaran Ghadarghadar , Deniz Erdogmus, 2011 IEEE International Symposium on Biomedical Imaging: From Nano to Macro, 2011 Conference Paper, Published on IEEE.
[10] D. Wu, Ming Zhang, Jyh-Charn Liu, W. BaumanIEEE Transactions on Biomedical Engineering2006, Journal Article, Published on IEEE.

Classification of Leaf Diseases in Paddy Plant Based on Combined Approach of Texture and Colour Feature Extraction and Optimized Feature Selection

Nithiya S[1], AnnapuraniK[2]
{ nithiyas@srmist.edu.in[1], annapook@srmist.edu.in[2]}

Research Scholar, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Kattankulathur[1], Associate Professor, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Kattankulathur[2]

Abstract. This paper proposes a methodology for the classification of leaf diseases by using the different characterization of shape, and colour properties. Paddy plant diseases are discussed in this research work. Bacterial light, Brown Spot, Leaf smut diseases is identified in paddy crops. A plant leaf is pre-processed at first utilizing the improved BAHE (brightness adapted histogram equalization). Leaf image is segmented using K mean clustering algorithm. The feature extraction is improved by combination of texture feature and colour features. The extracted feature is given as an input for feature selection using optimized firefly algorithm's after that it is used for the classification of diseases in paddy plant. The optimization result is compared with PSO and Genetic algorithm..

Keywords: BAHE, K mean clustering, PSO, Firefly algorithms, GA.

1 Introduction

The main goal of exploration in farming is to expand the profitability of food and improved in nature of products. The creation of agribusiness and its quality relies upon soil, seed, and agro synthetics. The farming items (vegetables and organic products) are the fundamental for the endurance of individuals. The horticultural efficiency diminishes when the harvests are influenced by different infections. The illnesses of plants are only debilitations that changes the typical plants in their crucial capacities viz., photosynthesis, fertilization, preparation and germination. Because of the impact of antagonistic ecological conditions, infections in plants are brought about by different parasites, microbes and infections. In the event that the infection isn't distinguished at beginning phase, at that point yield diminishes. In this paper, distinguishing proof of leaf infection utilizing numerous descriptors is introduced. At first the pictures are caught utilizing actual gadgets and information base is made containing solid and unfortunate leaf

This research work is used for effective feature extraction and feature selection technique. For this research work 300 leaf image is collected from Villupuram district at krishnapuram village. The collected leaf was undergone for classification process. The direct classification of image may get the chances of misclassification due to the noise and morphological changes in the image quality and capturing device. Appropriate brightness and contrast in the captured image quality is improved at the pre-processing stage.

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2.Related Work

Texture analysis is used for determine the homogeneity characteristics of an image which act as the centra unit. texture appear on the leaf disease generally located on specific routine, way and scale. Surface examination dependent on the neighbourhood spatial variety of force or shading brilliance serves a significant part in numerous uses of distant detecting pictures [1,2]. Surface investigation is broadly utilized in picture division, order, what's more, design acknowledgment. Also, surface component extraction is a significant substance of surface investigation, which is a compelling strategy for taking care of the issues of unearthly variance and spatial scatter in a similar classification [3]. Essential to quantify the surface sensibly and viably, on the grounds that the removed surface highlights straightforwardly influence the nature of resulting handling. As of now, the strategies for surface data extraction are as per the following: measurable strategy, wavelet change, fractal technique, Markov arbitrary field (MRF, etc. Measurable technique is basic, simple to execute, and has solid versatility and power. Among measurable techniques, the Dark level Co-event Lattice (DLCL) is widely applied in surface portrayal [4], and the outcomes from the co-event technique are in a way that is more suitable than the surface segregation techniques [5]. The high computational intricacy and absence of worldwide data need for effective segmentation,and also understanding of the relationship between neighbour pixel is very hardwhen we focus on surface measurement.While dealt with surface data of distant detecting pictures dependent on multi-scale Wavelet change and fractal strategy are recently created. The wavelet changes are used for detecting the appropriate information. and has a decent impact on the order of surface pictures with routineness and solid directionality. Notwithstanding, for the complex characteristic pictures, it is regularly inadequate because of commotion impedance. Fractal strategy measures naturally different scale property and scale invariants that can be skilled for harshness highlights in the textural portrayal of a surface picture. Utilizing the MRF model to portray the surface highlights of distant detecting pictures can consider the nearby haphazardness and the general routineness, and notes the multi-goal of the surface, which mirrors the law of topography by and large. Nonetheless, it is fundamentally through model coefficients to distinguish the surface highlights; in this way addressing the model coefficients is troublesome, and the model boundary change isn't advantageous. The GLCM is an exemplary strategy for surface component extraction, which is successful in picture acknowledgment [7], picture division [8], picture recovery [9], picture arrangement [10], and surface investigation techniques [11,12]. The use of GLCM to extricate the surface component happens by means of the joint condition likelihood dispersion of the picture dark level to speak to surface and figures the nearby connection of pixels to acquire the surface element esteem. The GLCM is broadly utilized in numerous fields and has been consistently improved [13]. By ascertaining various bearings and window sizes of the GLCM, Pacific et al. [14] removed multi-scale surface highlights from exceptionally high-goal panchromatic symbolism. Mukherjee et al. [15] pre-processed and consolidated the surface highlights by extricating from the GLCM and utilized a BP-MLP (backpropagation-multilayer perceptron's) neural organization to order two sorts of therapeutic plants. Li et al. [16] played out a foremost segment examination of the picture and utilized the GLCM to extricate surface highlights from the initial two head segments. The surface highlights as another band joined with the first picture band all together to shape another picture, which was utilized for managed characterization. Utilizing the surface highlights separated from the GLCM, Huang et al. [17] proposed the dynamic windows calculation to group far off detecting symbolism as per the blend of dark scale and surface highlights. Rao et al. [18] extricated two-request factual

boundaries from the GLCM of the fluid precious stone surface, including contrast, energy, consistency and relationship, and recognized the stage change temperature of the gem. Teng et al. [19] chose five run of the mill surface class tests from Quick Bird information and utilized GLCM to quantitatively ascertain six factual surface highlights that were gotten by figuring the normal values in four ways and one pixel of pair-wise distance. The paper talked about which boundaries were reasonable for the particular surface arrangement. The above examination applies GLCM to all angles, furthermore, the surface highlights of pictures are separated for ensuing preparing, however less exploration takes into account the spatial directionality of surface appropriation. Periodicity, directionality and haphazardness are the three most significant factors in describing surfaces [20]

3 Architecture Diagram Of Proposed Leaf Disease Identification In Paddy Crop System

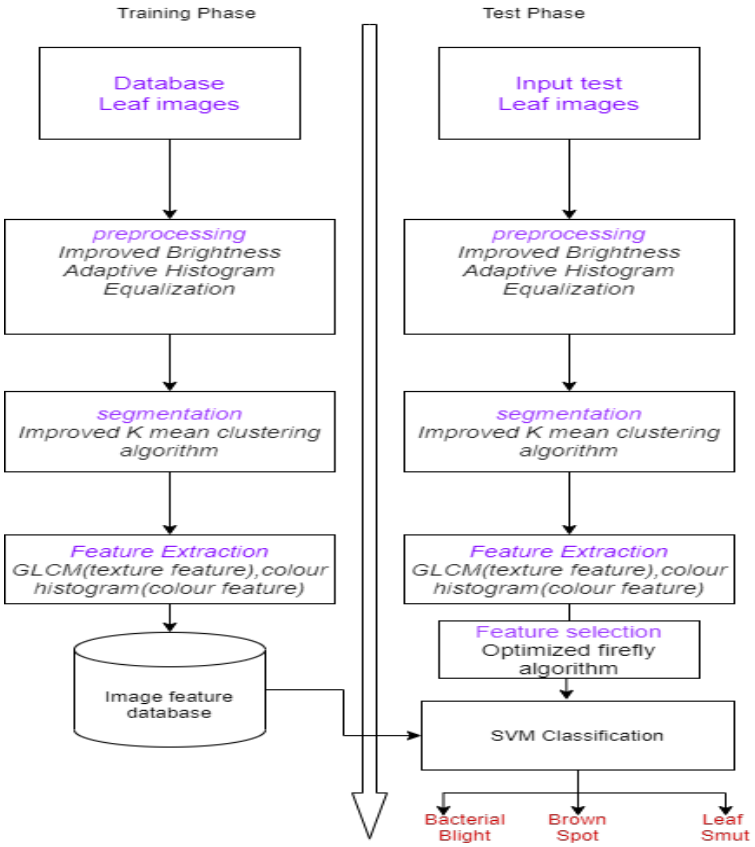

Fig. 1. Proposed Architecture Diagram

Image was collected from Villupuram district at krishnapuram village totally 300 leaf images are collected. paddy leaf image is collected from the real time environment. Diseases image is given to the input for pre-processing step. Image quality is the important factor for leaf disease classification. In this stage image quality is improved through ImprovedBAHE

algorithm which is used for increase the proper brightness in the images. In next stage K mean clustering algorithm is used for leaf diseases segmentation. Segmented diseased leaf image is given for colour and texture feature extraction Technique. Extracted feature is Optimized using firefly feature selection algorithm. Leaf diseases are classified using Binary SVM.

3.1 PLANT DISEASES

Most plant illnesses – around 85 percent – are brought about by parasitic or contagious like creatures. Notwithstanding, other genuine illnesses of food and feed crops are brought about by viral and bacterial life forms. Certain nematodes likewise cause plant infection. Some plant sicknesses are delegated "abiotic," or illnesses that are non-irresistible and incorporate harm from air contamination, dietary insufficiencies or poison levels, and develop under not exactly ideal conditions. For the present, we'll see infections brought about by the three fundamental pathogenic microorganisms: parasite, microscopic organisms and infection. On the off chance that plant illness is suspected, cautious consideration regarding plant appearance can provide a decent insight with respect to the kind of microorganism included.

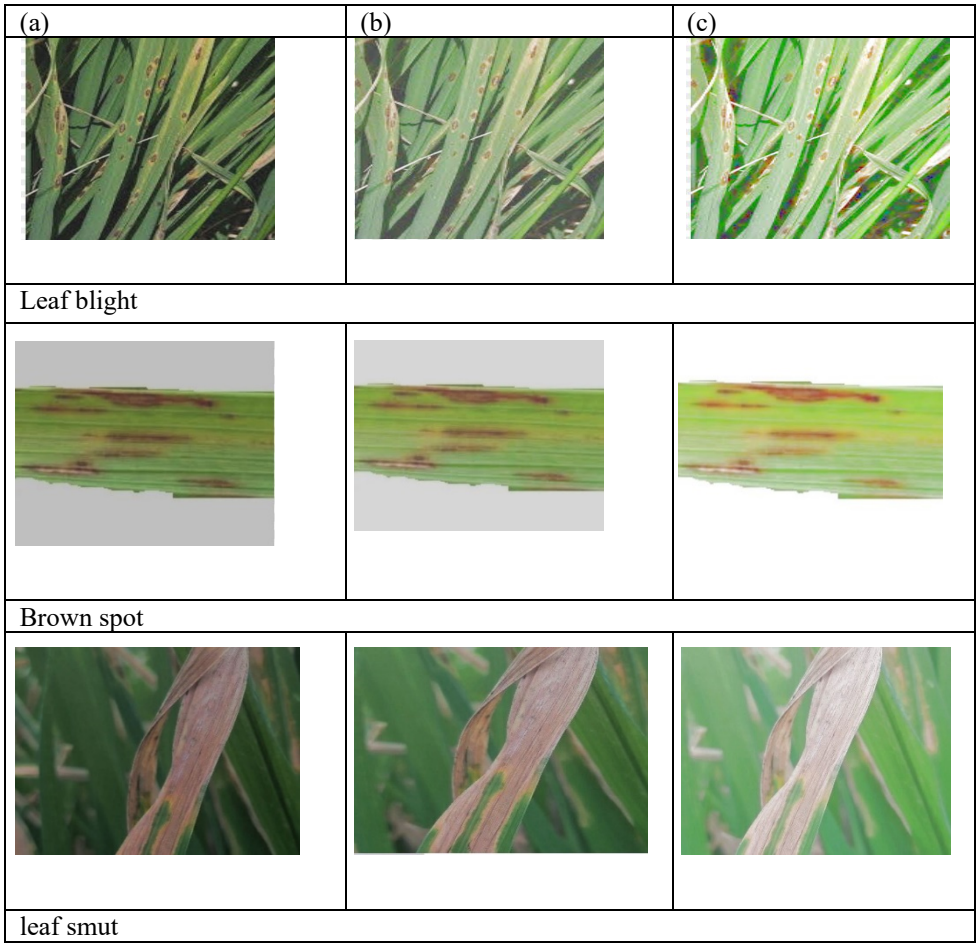

Fig. 2. Results for BAHE (a) Original image (b) HE (c) BAHE

In figure 2 shows the output of IBAHE algorithm. This algorithm was compared with an existing algorithm of HE (histogram equalization).in this figure 2(a) shows the health image figure 2(b) shows the output of Histogram Equalization Algorithm and figure 2(c) show the improved output of BAHE. Image quality get increased in BAHE algorithm when Compare with the real image and HE image.

3.2 Improved Brightness Adaptive Histogram Equalization Algorithm[Bahe]

This algorithm is used for preserve the brightness in the image. Using the equation 1 histogram of an image is calculated and it is constructed as the two-sub part by using median value of a histogram.

$X_{=}k$ where $_Z(k) \geq \frac{N}{2}$ (1)

Median based partition having various level of intensity values known by low range to mid-range, mid-range to high ranges in equation 2

$\text{partition}^1: \omega_0 = \sum_{L=0}^{Xmd-1} \text{pdf}(L)$, (2)

$\text{partition}^2: \omega_1 = \sum_{L=Xmd}^{L_{max}} \text{pdf}(L)$.

Normalization of histogram is the final step. Highest intensity value in each partition is applied for histogram normalization the histogram is applied to partitioned part using equation 3

$T(L) = L - l\text{mi}\ L\text{mx} - L\text{mi}\ (L\text{up} - L\text{lw}) + L\text{lw}$, (3)

3.3 Improved K Mean Clustering Algorithm

One of the major disadvantages in k mean clustering is centre initialization. this was improved using proposed k mean clustering algorithm this consist of three parts (1) Image background removal (2) Introductory to cluster centre

3.3.1 Image Background Removal

Image is captured in Realtime environment it consists of background potion also. one of the ways to speed up the k mean clustering algorithm is background removal process. The background of white and black colour is removed using equation 4.

Diff1=Ired-Igreen; (4)

Diff2=Ired-Iblue

Centre of the cluster is calculated by below equation

$$d: = \sum_{\forall sj \in c}^{n} \left(\bigcup_{y_i}^{m} \frac{R_n G_n B_n}{m} \right) \in \omega'$$

(5)

3.3.2 Introductory to Clustering Center

The choice of starting cluster habitats is significant for precise division of infection pictures. On the off chance that a fixed grouping community is utilized, versatility of the calculation will be an issue. For arbitrarily chose beginning cluster communities, Kmeans doesn't ensure novel grouping. Subsequently, we proposed a self-learning strategy for starting cluster places in light of a division crop infection picture. The means of oneself learning strategy for beginning cluster focuses are as per the following:

1. Input: Color image
2. Output: Optimal segmented color image CIsegment
3. Initialize the image (x)
4. Remove the white and back background
5. Diff1=Ired-Igreen;
6. Diff2=Ired-Iblue;
7. Identify the peaks in the RGB histogram

8. Maximum Peak in green pixel= health part
9. Other peaks are treated as lesion
10. for i = 1 : l (pks and pts) j = 1:d(pks and pts)
11. Apply the threshold for obtain the maximum green peak region for healthy part cluster
12. Calculate the centroid for healthy part of the cluster using RGB pair equation (10)
13. Apply the threshold for obtain the less green part region for lesion part
14. Calculate the centroid for lesion part of the cluster using RGB pair equation (10)
15. Calculate the equlitian distance between centroid and cluster points
16. Mean value=(total measure / length of clustering positions)//
17. Choose the new centroid point
18. Again, calculate the distance between the centroid and RGB pairs
19. Until the centroid position does not change

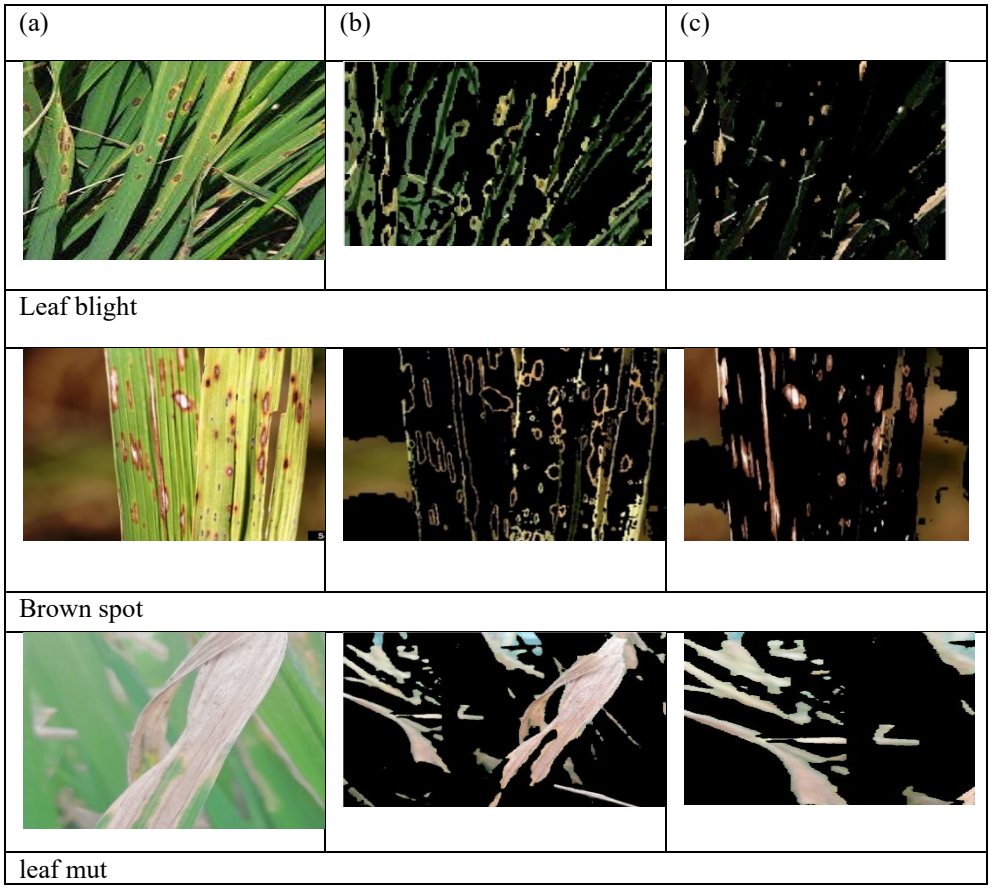

Fig 3: Results for K mean clustering (a) Original image (b) cluster1 (b) cluster 2

In figure 3 shows the output of K mean clustering algorithm. In this figure 3(a) shows the unhealth image figure after the enhancement of BAHE algorithm 3(b) shows the output for

cluster 1 and 3(c) show the output of cluster 2 . Various clustered output is taken into the iput for the svm

3.4 Feature Extraction Method

Combined features are extracted in this work. Colour and texture features are extracted. 10 texture feature and 27 colour features are extracted in this work. Texture features is extracted from GLCM and colour features is extracted from various colour channel mean and std deviation information.

3.4.1 Grey Level Co-Occurrence Matrix

GLCM is used for the texture feature extraction. Texture features denotes the characteristics of an area information. GLCM is used to perceive the information of various probability of intensity occurrences. GLCM is based on the second order statistic. In table1 show the feature extracted information through the GLCM matrix. Totally 10 features are extracted using the formula mentioned in table1

Table 1: GLCM features

Entropy	$\text{Entropy } = \sum_{i,j=0}^{n-1} P(i,j)\log\left(p(i,j)\right)$
Correlation	$\text{Correlation } = \sum_{i,j=0}^{N-1} \frac{(1-\mu_i)\left(j-\mu_j\right)P_{i,j}}{\sigma_i\sigma_j}$
Mean	$\mu_i = \sum_{i,j=0}^{n-1} iP(i,j)$ $\mu_j = \sum_{i,j=0}^{n-1} jP(i,j)$
Variance (Sums of Squares)	$\sigma_i = \sum_{i,j=0}^{n-1} (i-\mu_i)^2 P(i,j)$ $\sigma_j = \sum_{i,j=0}^{n-1} (j-\mu_i)^2 P(i,j)$
Sum Average	$AVER = \sum_{i,j=0}^{2n-2} iP_{x+y}(i)$
Sum Entropy	$SENT = -\sum_{i,j=0}^{2n-2} P_{x+y}(i)\log\left(P_{x+y}(i)\right)$
Sum of Variance	$SVAR = -\sum_{i,j=0}^{2n-2} (i-SENT)^2 P_{x+y}(i)\log\left(P_{x+y}(i)\right)$
Difference Entropy	$SVAR = -\sum_{i,j=0}^{2n-2} (i-SENT)^2 P_{x+y}(i)\log\left(P_{x+y}(i)\right)$
Information Measure of Correlation 1	$IMC1 = \frac{\text{Entropy-HXY1}}{max\{HX,HY\}}$
Information Measure of Correlation 2	$IMC2 = \sqrt{1-\exp\left[-2.0(HXY2-HXY)\right]}$

3.4.2 Colour Descriptors

For this colour feature extraction various format of image is consider like HSV,LAB,RGB From each colour channel so totally 27 features are extracted.

Moment 1:mean value is calculated using the equation (6).MN is used to represent the total number of pixels

$$\mu = \frac{1}{MN}\sum_{i=1}^{M}\ \sum_{j=1}^{N}\ P_{i,j} \quad (6)$$

Moment 2: Standard Deviation of each colour channel is calculated using equation 7. It is used to represent the root difference of a distribution

$$\sigma = \sqrt{\left[\frac{1}{MN}\sum_{i=1}^{M}\ \sum_{j=1}^{N}\ \left(P_{ij}-\mu\right)^{2}\right]} \quad (7)$$

Moment 3 : Skewness and kurtosis is measured by equation (8)(9).This equations are used to calculate the Asymmetric and peakedness

$$\theta = \sqrt[3]{\left[\frac{1}{MN}\sum_{i=1}^{M}\ \sum_{j=1}^{N}\ \left(P_{ij}-\mu\right)^{3}\right]} \quad (8)$$

$$\gamma = \sqrt[4]{\left[\frac{1}{MN}\sum_{i=1}^{M}\ \sum_{j=1}^{N}\ \left(P_{ij}-\mu\right)^{4}\right]} \quad (9)$$

3.5 Optimized Feature Selection Using Firefly Algorithm

Firefly algorithm is based on the attraction's properties of each firefly. Lesser bright firefly will be attracted by highest brightness firefly. If the distance between 2 fireflies increases then the attractiveness also reduced.

1. Objective function f(x), x = (x1, ..., xd)
2. Generate initial population of fireflies xi (i = 1, 2, ..., n)
3. Initialize iteration (max Generation)
4. Initialize the dimension(D)
5. Randomly initialize the position of the fireflies
6. For i=1:n all n fireflies
7. For j=1 to I all n fireflies
8. while (t <max Generation),
9. Calculate the fitness function
10. If(j>i) move the fireflies i towards j
11. Evaluate the new solution and update the light intensity
12. End for i
13. End for j
14. Rank the fireflies and find the optimal selection

optimized feature was compared with other features selection algorithm like PSO and GA. The performance of firefly algorithm is high than the others

Table2: Comparison table of feature selection algorithm

Algorithm	Iteration	Selected features
PSO	1000	27
GA	1500	25
Firefly algorithm	500	10

Table 2 shows the feature selection comparison between various algorithm. Firefly algorithm obtained the better result than the others which choose the optimal features.

3.6 SVMClassification

SVM is used as the classification algorithm for plant disease identification. Optimally selected feature is given for the classification process.In this research work denotes the binary SVM it is used to map the datapoint in two classes.

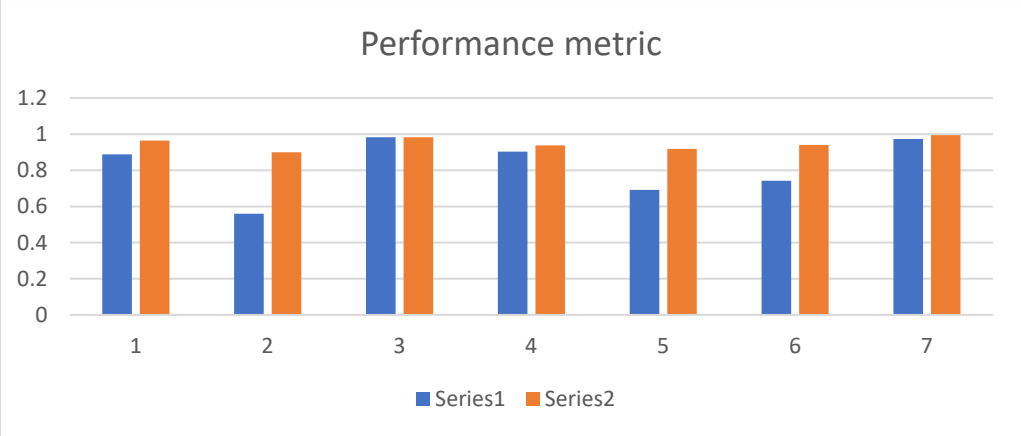

Fig.4. SVM performance

Given input features is separated by hyperplane's which is compared with KNN andSVM.Theperformance of an SVM is better than KNN by analysing various performance metrics which is shown in table 3

Table 3. SVM performance metrics

Sensitivity	$SN = \frac{TP}{TP + FN}$	KNN	SVM
Specificity	$SP = \frac{TN}{TN + FP}$	0.8879	0.9641
Accuracy	$Acc=\frac{\sum TP+\sum TN}{\sum TOTALELEMENT}$	0.5600	0.9000
Precision	$Precision=\frac{TP}{TP+FP}$	0.9827	0.9827
F_measure	$Acc=\frac{2(percision*sensitivity)}{(percision+sensitivity)}$	0.9032	0.9375
Goodness mean	$GM=\sqrt{\frac{TPR}{TNR}}$	0.6914	0.9184
Area under curve	$AUC=\int f(a)da$	0.7418	0.9404
		0.9729	0.9946

CONCLUSION

This research work is successfully executed by MATLAB 2020R version. In this research work conclude the many advancement technique for plant diseases identification and classification purpose. Initially at pre-processed stage improvement in histogram equalization algorithm is adopted and it is compared with existing algorithm and K mean clustering algorithm used to segmentation purpose. Many Mathematical derivation is used for texture and feature extraction. by combining the texture and colour feature 37 features are extracted. These 37 features are given to the input for PSO, GA and firefly for feature selection process. Thefirefly performance is high when compare with GA and PSO

References

[1] Kitada, K.; Fukuyama, K. Land-use and land-cover mapping using a gradable classification method. Remote Sens. 2012, 4, 1544–1558.

[2] Racoviteanu, A.; Williams, M.W. Decision tree and texture analysis for mapping debris-covered glaciers in the Kangchenjunga area, Eastern Himalaya. Remote Sens. 2012, 4, 3078–3109.

[3] Myint, S.W.; Lam, N.S.N.; Tyler, J.M. Wavelets for urban spatial feature discrimination: Comparisons with fractal, spatial autocorrelation, and spatial co-occurrence approaches. Photogramm. Eng. Remote Sens. 20014, 70, 803–812.

[4] Haralick, R.M.; Shanmugam, K.; Dinstein, I. Textural Features for Image Classification. IEEE Trans. Syst. Man Cybern. 2015, SCM-3, 610–621.

[5] Davis, L.S. A survey of edge detection techniques. Comput. Graph. Image Process. 2014 , 4, 248–270.

[6] Huang, D.S.; Wunsch, D.C.; Levine, D.S.; Jo, K.H. Advanced Intelligent Computing Theories and Applications. With Aspects of Theoretical and Methodological Issues (ICIC). In Proceedings of the Fourth International Conference on Intelligent Computing, Shanghai, China, 15–18 September 2018.

[7] Zhang, Y. Optimisation of building detection in satellite images by combining multispectral classification and texture filtering. ISPRS J. Photograms. Remote Sens., 54, 50–60.

[8] Sahoo, M. Biomedical Image Fusion and Segmentation using GLCM. In Proceedings of the 2nd National Conference-Computing, Communication and Sensor Network (CCSN), Orissa, India, 29–30 October; pp. 34–39.

[9] Kekre, H.; Thepade, S.D.; Sarode, T.K.; Suryawanshi, V. Image retrieval using texture features extracted from GLCM, LBG and KPE. Int. J. Comput. Theory Eng. 2010, 2, 695–700.

[10] De Almeida, C.W.D.; De Souza, R.M.C.R.; Candeias, A.L.B. Texture Classification Based on Co-Occurrence Matrix and Self-Organizing Map. In Proceedings of the IEEE International Conference on Systems, Man and Cybernetics, Istanbul, Turkey, 10–13 October 2010; pp. 2487–2491.

[11] Srinivasan, G.N.; Shobha, G. Segmentation Techniques for ATDR. NAUN Int. J. Comput. 2008, 2, 165–171. Sensors 2017, 17, 1474 15 of 15

[12] Tuceryan, M. Moment-based texture segmentation. Pattern Recognit. Lett. 1994, 15, 659–668.

[13] Liu, J.; Cheng, Y.; Sun, J. Modified FCM SAR image segmentation method based on GMCL feature. Comput. Eng. Des. 2012, 33, 3502–3506.

[14] Pacifici, F.; Chini, M.; Emery, W.J. A neural network approach using multi-scale textural metrics from very high-resolution panchromatic imagery for urban land-use classification. Remote Sens. Environ. 2009, 113, 1276–1292.

[15] Mukherjee, G.; Chatterjee, A.; Tudu, B. Study on the Potential of Combined GLCM Features towards Medicinal Plant Classification. In Proceedings of the 2nd International Conference on

Control, Instrumentation, Energy & Communication (CIEC), Kolkata, India, 28–30 January 2016; pp. 98–102.
[16] Li, Z.; Zhu, G.; Dong, T. Application of GLCM—Based texture features to remote sensing image classification. Geol. Explor. 2011, 47, 456–461.
[17] Huang, X.; Yang, W. Classification of remotely sensed imagery according to the combination of gray scale and texture features based on the dynamic windows. J. Geomat. Sci. Technol. 2015, 32, 277–281.
[18] Rao, C.N.; Sastry, S.S.; Mallika, K.; Tiong, H.S.; Mahalakshmi, K. Co-occurrence matrix and its statistical features as an approach for identification of phase transitions of mesogens. Int. J. Innov. Res. Sci. Eng. Technol. 2013, 2, 4531–4538.
[19] Teng, X.; Song, S.; Zhan, Y. Statistical Class Feature in Texture Analysis of Remote Sensing Imagery. Adv. Environ. Sci. Eng. 2012, 518–523, 5749–5753.
[20] Liu, F.; Picard, R.W. Periodicity, directionality and randomness: Wold features for image modeling and retrieval. IEEE Trans. Pattern Anal. Mach. Intell. 1996, 18, 722–733.
[21] Chen, B.; Zhang, Y.; Chen, L. RS Image classification based on SVM method with texture. Eng. Surv. Mapp. 2007, 16, 23–27.
[22] Zhao, L.; He, H.; Yin, Z. Texture direction adaptive image interpolation based on Curvelet transform. J. Optoelectron. Laser 2012, 23, 799–804.
[23] Puissant, A.; Hirsch, J.; Weber, C. The utility of texture analysis to improve per-pixel classification for high to very high spatial resolution imagery. Int. J. Remote Sens. 2005, 26, 733–745.
[24] Zheng, S.; Zheng, J.; Shi, M.; Guo, B.; Sen, B.; Sun, Z.; Jia, X.; Li, X. Classification of cultivated Chinese medicinal plants based on fractal theory and gray level co-occurrence matrix textures. J. Remote Sens. 2014, 18, 868–886.

A Study of Mammographic Image Segmentation with its Morphological Operation

G Balanagireddy[1], J K Periasamy[2], G Saritha[3], M Sujatha[4], G Nirmalapriya[5]
{nagireddy.nano@gmail.com[1], jkperiasamy.cse@sairam.edu.in[2], saritha.ganesan@gmail.com3, sujakarthik77@kluniversity.in[4], nirmalapriya.g@ritchennai.edu.in[5]}

[1]Assistant Professor, Department of Electronics and Communication Engineering, PACE Institute of Technology and Sciences, Ongole, Andhra Pradesh, India., [2]Associate Professor, Department of Computer Science and Engineering, Sri Sairam Engineering College, Chennai, Tamil Nadu, India. [3]Assistant Professor, Department of Electronics and Communication Engineering, Sri Sairam Institute of Technology, Chennai, Tamil Nadu, India, [4]Professor, Department of Electronics and Communication Engineering, Koneru Lakshmaiah Education Foundation, Vijayawada, Andhra Pradesh, India, [5]Professor, Department of Electronics and Communication Engineering, Rajalakshmi Institute of Technology, Chennai, Tamil Nadu, India.

Abstract. The Malign cell extraction and segmentation differentiation from normal cells is widely researched topic. The process of segmentation with single strategy might miss the features leading to increased mortality rate. This work characterizes the different segmentation methods and two simulation tools for mammogram images. The non-feature pixel values are represented by the nearest feature pixel in distance by watershed segmentation. Simulations are performed with ImageJ using Morphological library where binary mammogram images are analysed with connected components and distance based watershed transform. Finally the mammogram image in DICOM format is analysed for segmenting spanning lower and upper threshold with clustering..

Keywords: Breast cancer, Image segmentation and Morphological operations.

1 Introduction

The process variations in malignant cells spanning across varying size is observed in medical images to provide appropriate diagnosis. Digital mammogram has been the widely imaging modality uses fifty two percentages whereas the other modules occupy the remaining forty eight percentages [6]. The step by step process from imaging module with early detection to subsequent segmentation, classification is vital to reduce call back and mortality rates. ImageJ tool is used with morphological library work [11] with electronic samples of the binary image. Segmentation of non significant minima of tumour areas is clearly segmented.

Semiautomatic segmentation has been used where there is a failure in accuracy of fully automated segmentation using ITK SNAP [12]. In this work malign images with annotation has been used thus threshold and clustering of images is performed with ITK SNAP using Segment 3D. The paper is organised as follows. The section 2 reviews the limitations of mammogram images with discussion on machine learning, segmentation and describes the associated problems. Section 3 deals with "ImageJ" and ITK SNAP procedure for the underlying segmentation works. Section 4 provides results and discussion using ImageJ. Section 5 concludes the overall work and future direction.

2. Literature review

The machine learning algorithms predominantly use training followed by testing from the same feature space of cohort of images. The mammogram approach which underlies machine learning fails when the distribution of feature space varies across the newly procured images. Transfer learning approaches are suggested superior performance in [1] across several mammogram databases improves classification accuracy and reducing the computation time in processing new models.

2.1 Image segmentation

The contrast of mammogram images using "linearly quantile separation and histogram equalization" prior to segmentation improves the accuracy and reduces the false alarm rate. The simulation has been carried out using "LQSHE-GRA" which is suitable for MIAS database and unsupervised segmentation is difficult [2]. Selecting a best segmentation process by comparing it to a best atlas image has been discussed. The process incurs demon registration where in a static image and a moving image has been used for interpreting the nature

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of deformation [3]. Multilevel segmentation along with "Harris Hawk optimization" has been incorporated in digital mammograms. The superiorly performance of image segmentation is achieved using multi-level segmentation. This is accomplished via a fitness function using "Minimum cost entropy Thresholding" [4]. In-homogenous region across the tumor area has been worked with active contour methods considering the local and global regions. Energy function along with Laplace function eliminates the false contour [5]. Generative Adversarial Network (GAN) has been discussed in [7] wherein the binary mask is generated and compared with ground truth. Further the losses are combined and feedback to generator network to minimize the losses. The shape classification along with molecular subtypes is also studied in GAN.

The outlier detection in noisy mammogram images for maintaining consistency has been done using "Intuitionistic Possibilitic Fuzzy C-mean Clustering" (IPFCM). The superior result of classification has been achieved even in the case of increasing noise in IPFCM [8].However, assigning member ship functions for Intuitionistic may fail to work for all images in minimal execution time.

3. Proposed work

The ImageJ procedure has been given for connected components with distance based watershed is shown from step 1 to step 5.

Step1. The given image from a DDSM database is taken.
Step2. The malign images with landmarks are considered for processing.
Step3. Image is being converted into a binary format.
Step4. From the morphological library connected components has been used to calculate the distance map in binary image. The value of 4 has been used for analysis with 16 bits.
Step5. Then distance transform watershed segmentation has been done using "Borgefors transform" [10].

The ITK SNAP procedure has been given for Manual Thresholding and clustering is shown from step 1 to step 3.

Step1. The given image is converted into DICOM format.
Step2. Perform manual Thresholding of the given image to segment the tumour area using segment 3D option.
Step3. Perform clustering with appropriate cluster size and foreground cluster.

4. Results and discussion

The images has been obtained from DDSM [9] where in malignant samples are alone being analysed through ImageJ software. The first patient meta-details consist of age 72 with density 2 and malignancy is found in left breast shown in figure 2. The right breast does not contain any malignancy.

4.1 Results with Image J

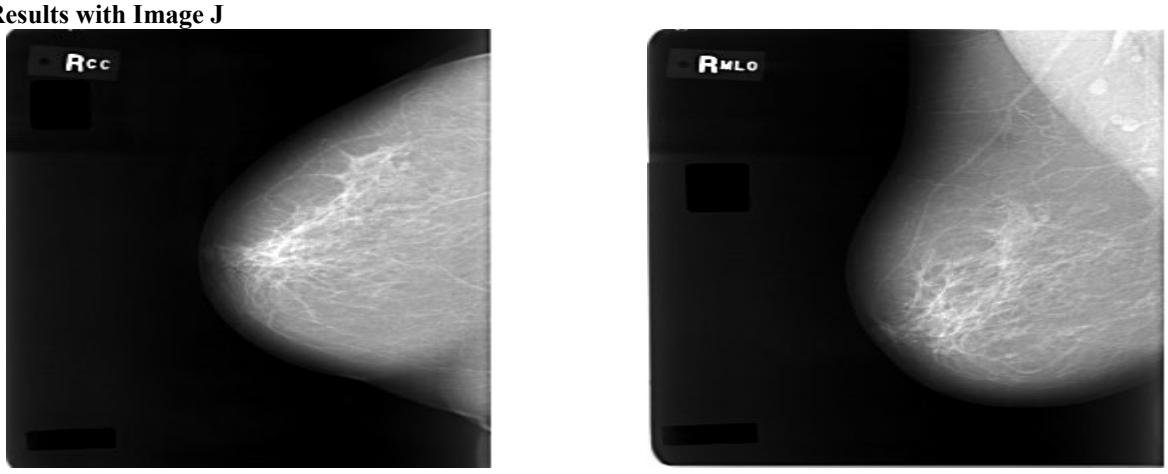
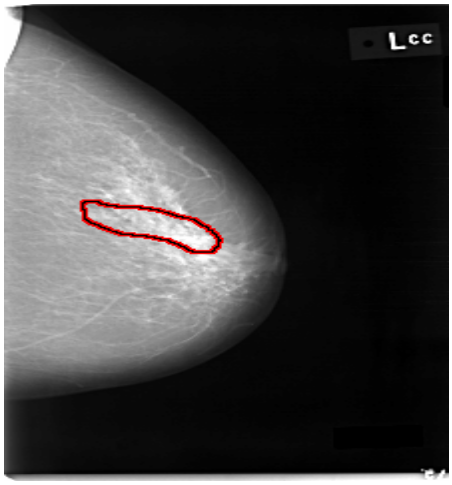


Figure 1(a) Shows the right CC view and 1(b) the right MLO view with no malign cells as landmarks.



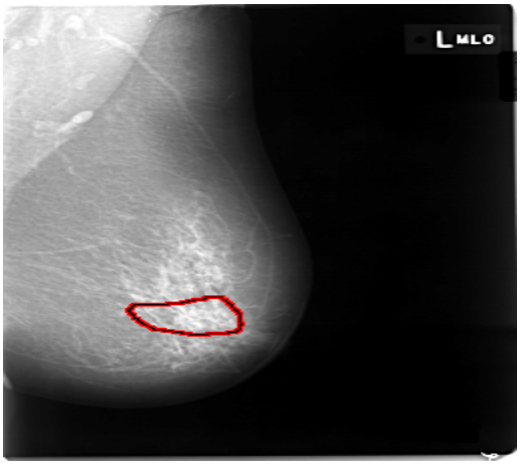


Figure 2 (a) Shows the left CC view and 2 (b) the left MLO view with malign cells as landmarks shown in red colour.

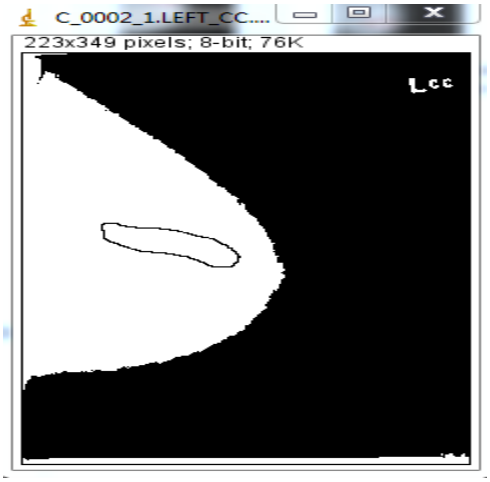


Figure 3(a) Shows the binary image in Left CC view. Figure 4 (b) Shows the binary image in connected component view.

Figure 3(c) Distance transform watershed segmentation of Left CC view.

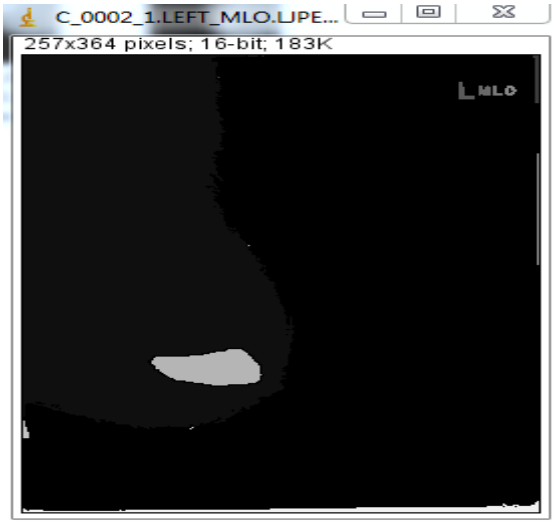


Figure 4(a) Shows the binary image in Left MLO view. Figure 4 (b) Shows the binary image in connected component view.

Figure 4(c) Distance transform watershed segmentation of Left MLO view.

4.2 Results with ITK SNAP

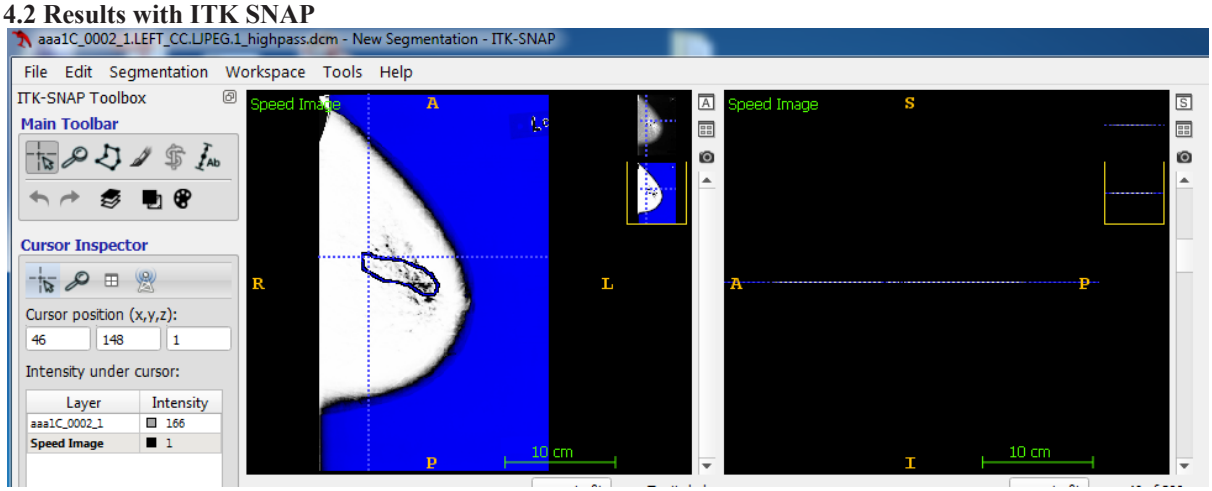
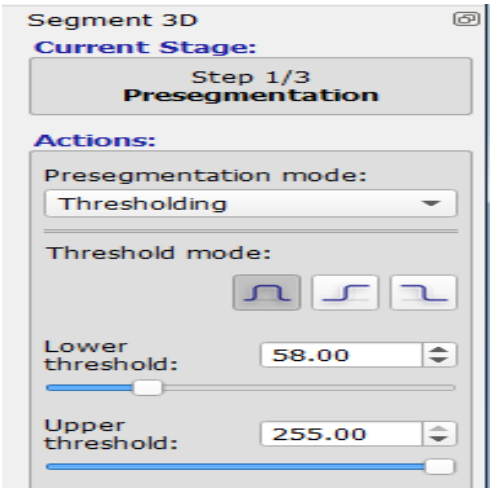
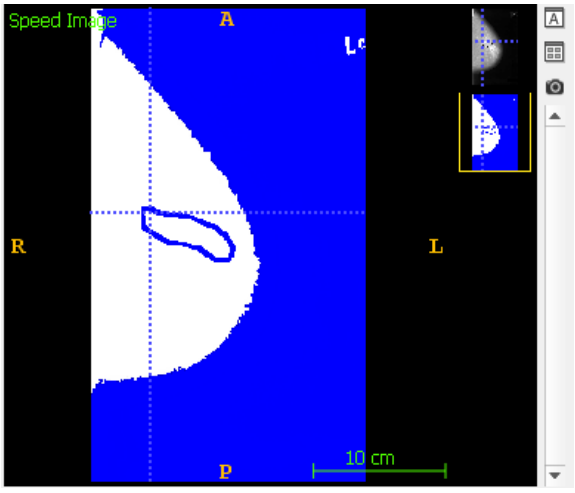


Figure 5a Thresholding image with Left CC view using ITK snap tool.





5b 5c

Figure 5b Corresponding values of lower threshold and upper threshold used for interpreting 5a.
Figure 5c The final clustering image is shown.

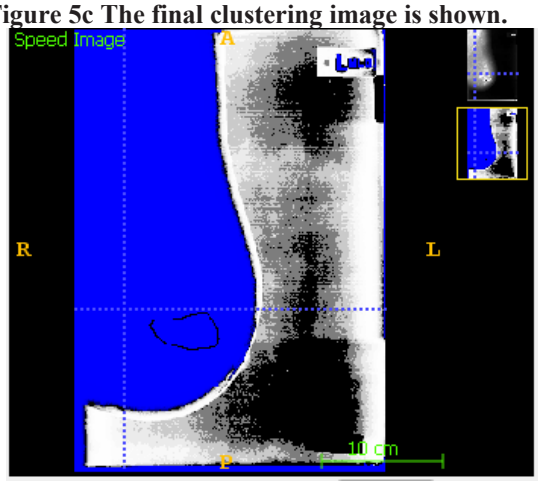
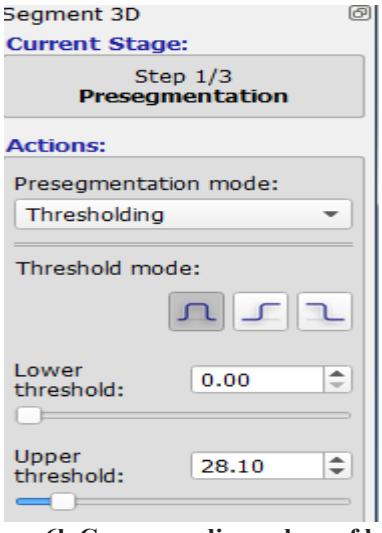


Figure 6a Thresholding image with Left MLO view using ITK snap tool.



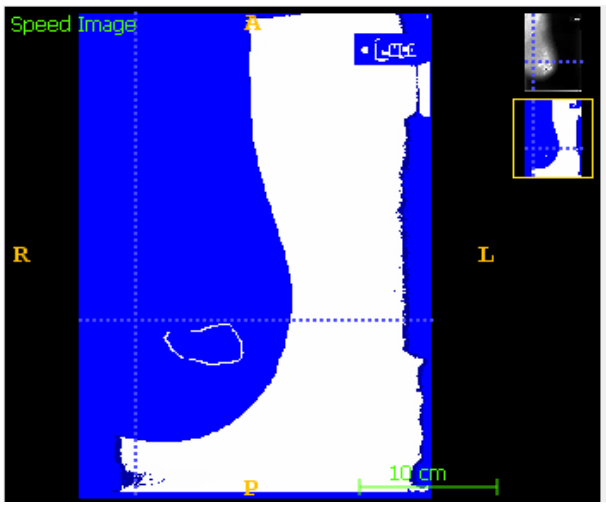


Figure 6b Corresponding values of lower threshold and upper threshold used for interpreting 6a.
Figure 6 c The final clustering image is shown.

5. Conclusion

Two corresponding views of mammogram images with annotated landmarks have been taken for segmentation. The process is initially being analysed with connected pixels and distance based watershed transform using ImageJ with plug-in for performing morphological operation. The second half works with DICOM format in manual threshold and clustering to illustrate the spread of malign cells across the image with its corresponding orientation. Thus an elusive work customised to different segmentation has been done. Future work will deal with multimodal techniques with image fusion such as thermography and mammogram in identifying cancerous cells with its corresponding morphology.

References

[1] Kumar, D., Kumar, C., & Shao, M. (2017, December). Cross-database mammographic image analysis through unsupervised domain adaptation. In 2017 IEEE International Conference on Big Data (Big Data) (pp. 4035-4042). IEEE.

[2] Gupta, B., Tiwari, M., & Lamba, S. S. (2019). Visibility improvement and mass segmentation of mammogram images using quantile separated histogram equalisation with local contrast enhancement. CAAI Transactions on Intelligence Technology, 4(2), 73-79.

[3] Sharma, M. K., Jas, M., Karale, V., Sadhu, A., & Mukhopadhyay, S. (2019). Mammogram segmentation using multi-atlas deformable registration. Computers in biology and medicine, 110, 244-253.

[4] Rodríguez-Esparza, Erick, Laura A. Zanella-Calzada, Diego Oliva, Ali Asghar Heidari, Daniel Zaldivar, Marco Pérez-Cisneros, and Loke Kok Foong. "An Efficient Harris Hawks-inspired Image Segmentation Method." Expert Systems with Applications (2020): 113428.

[5] Niaz, A., Memon, A. A., Rana, K., Joshi, A., Soomro, S., Kang, J. S., & Choi, K. N. (2020). Inhomogeneous Image Segmentation Using Hybrid Active Contours Model With Application to Breast Tumor Detection. IEEE Access, 8, 186851-186861.

[6] Mahmood, T., Li, J., Pei, Y., Akhtar, F., Imran, A., & Rehman, K. U. (2020). A Brief Survey on Breast Cancer Diagnostic With Deep Learning Schemes Using Multi-Image Modalities. IEEE Access, 8, 165779-165809.

[7] Singh, V. K., Rashwan, H. A., Romani, S., Akram, F., Pandey, N., Sarker, M. M. K., & Torrents-Barrena, J. (2020). Breast tumor segmentation and shape classification in mammograms using generative adversarial and convolutional neural network. Expert Systems with Applications, 139, 112855.

[8] Chowdhary, C. L., Mittal, M., Pattanaik, P. A., & Marszalek, Z. (2020). An efficient segmentation and classification system in medical images using intuitionist possibilistic fuzzy C-mean clustering and fuzzy SVM algorithm. Sensors, 20(14), 3903.

[9] http://www.eng.usf.edu/cvprg/Mammography/DDSM/thumbnails/cancers/cancer_01/case0002/C-0002-1.html.

[10] Borgefors, G. (1986). Distance transformations in digital images. Computer vision, graphics, and image processing, 34(3), 344-371.

[11] Legland, D., Arganda-Carreras, I., & Andrey, P. (2016). MorphoLibJ: integrated library and plugins for mathematical morphology with ImageJ. Bioinformatics, 32(22), 3532-3534.

[12] Yushkevich, P. A., Gao, Y., & Gerig, G. (2016, August). ITK-SNAP: An interactive tool for semi-automatic segmentation of multi-modality biomedical images. In 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) (pp. 3342-3345). IEEE.

Enhanced LBP Method to Detect Change in Brightness of Copy Pasted Region in an Image

Venu K N[1], Dr. B K Sujatha[2]
{[1]venu1.kn@msrit.edu, [2]bksujatha@msrit.edu}

[1]Research Scholar, VTU Belagavi., Assistant Professor, Department of Electronics and Telecommunication Engineering, RIT, Bangalore, India, [2]Professsor, Department of Electronics and Telecommunication Engineering, RIT, Bangalore, India,

Abstract. Anyone with average knowledge about image editing software can modify an image and make people believe it is the real image. One type of image modification is to copy a portion of an image, change its brightness, and paste it onto another location. In this paper, we are intending a method to perceive the brightness changes in the copy-pasted region of a colour image by applying LBP (Local Binary Pattern) on all three channels R(red), G(green), and B(blue) of an image. After the application of the LBP, the image is separated into overlapping blocks, and those blocks with equal LBP values in each channel indicate brightness or contrast modified pasted regions. Each of the channels detected regions are combined to identify brightness change in the duplicated region of the image.

Keywords: LBP, Overlapping Blocks, Brightness, Contrast.

1 Introduction

In copy paste image modification a part of the image's brightness or contrast is modified before pasting onto the destination. When such images are shared on social media it changes the perception of the people and, hence there is a need to develop techniques for the detection of tampered images. When the brightness of the colour image is changed and pasted on to the same image by the use of adobe photoshop the pixel values in the red, green, and blue channels are not changed by equal values, hence the detection of a pasted region using Block-based technique [1] is not possible.

Y. Wang, L. Tian and C. Li [2] used LBP- SVD method to detect the pasted region's brightness change, which is computationally intensive. A. A. Alahmadi, M. Hussain, H. Aboalsamh, G. Muhammad and G. Bebis [3] used complex method of detecting forgery region by using chromatic channel information with LBP and DCT operation. S. Kumar, J. Desai and S. Mukherjee [4] used DCT method to compute tampered regions but the method fails to detect the brightness changed regions. Z. Moghaddasi, H. A. Jalab and R. M. Noor [5], Zhao J, Guo JC [6] used DCT and SVD to identify tampered regions but again fails to identify brightness changed regions. X. Kang and S. Wei [8] used SVD method to detect tampered regions but it also fails to identify brightness changed regions. There exists numerous approaches with regard to the assessment of such aspects which are of prime importance in applications pertaining to psychophysics as well as perceptive learning often used in case of different psychophysical tests [9][10]

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1.1 Proposed Method

In the proposed method, we apply LBP on R, G, B channels of a colour image of size $(M \times N \times 3)$. The image in each channel is divided into overlapping blocks of size $(b \times b)$. The number of overlapping blocks created in Red, Green, and the Blue channel is respectively $(M-b+1)(N-b+1)$. Blocks with equal LBP values indicate brightness or contrast change in the pasted region. We then combine such detected regions from all channels to obtain the final brightness or contrast change in the pasted region of an image. The flow chart of the implementation is shown below in figure 1.

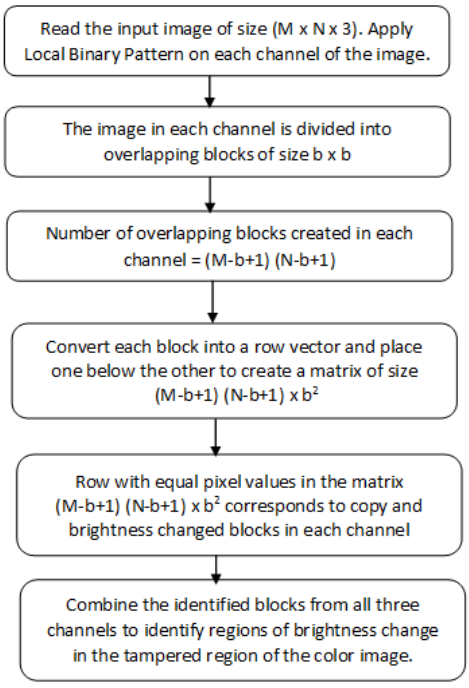


Figure 1: Implementation of detection duplicated brightness modified region using LBP

2. Steps Involved In The Implementtion

2.1 Calculation of LBP on each Channel

LBP is a texture-based descriptor [7], it is used for the classification of objects, scene, and face, LBP computes the local representation of the texture [11]. LBP is computed by comparing the neighbourhood pixel value with the central pixel, depending on the outcome of comparison a binary result is assigned. LBP is computed by using the following algorithm

a) Red, green, and blue channel images of the color image are used as input.

b) For each pixel c in an image find the p neighbourhood pixels that surround it. LBP works in a block size of 3×3.

c) Compare the surrounding pixel intensity with respect to the central pixel, assign a binary 1 if it is more than the central pixel else assign a binary 0.

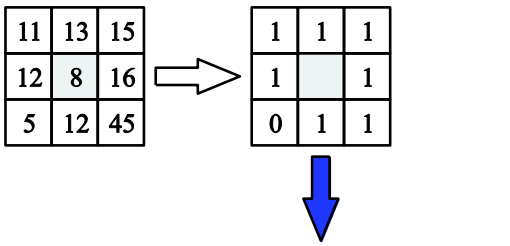
LBP value of a central pixel is calculated using the formula

$$LBP = \sum_{i=0}^{p-1} g(n_i - c) \times 2^i.$$

$$g(x) = \begin{cases} 1 & if \ x > 0 \\ 0, & otherwise \end{cases}$$

where c is the central pixel and n_i is the i^{th} neighbouring pixel.

LBP computation operation is shown in the below figure 2



$$1\times2^7 + 1\times2^6 + 1\times2^5 + 1\times2^4 + 1\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0 = 253$$

Figure 2: LBP computation

d) Repeat the process for the entire image.

e) Repeat the process for all the channels of color image

2.2 Generation of Overlapping Blocks

LBP computed image from previous Step is divide into overlapping blocks of size $b \times b$. The total number of blocks created will be equal to $(M-b+1)(N-b+1)$.

2.3 Extract Pixels from the Blocks, from a Row Vector, and place one below the other to form a Matrix of Size (M – b + 1) (N – b + 1) x b^2

From each of the overlapping blocks extract pixels and form a row vector and place those row vectors one under the other to make a matrix of size (M-b+1) x (N-b+1) x b^2. The process is shown in figure 3.

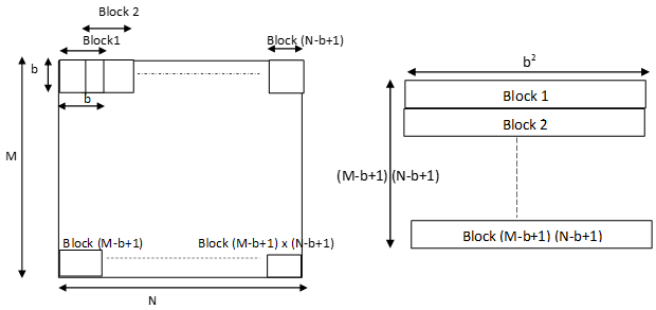


Figure 3: Representing the progression of converting the input image of size $M \times N$ in to $(M-b+1)(N-b+1)\times b^2$ matrix

2.4 Row with Equal Pixel Value represents Brightness Changed Pasted Regions

Rows with equal pixel values in the pixel in the matrix $(M-b+1)(N-b+1)\times b^2$ represents brightness or contrast modified pasted blocks. Highlight these blocks by filling pixel value equal to 255 in this area.

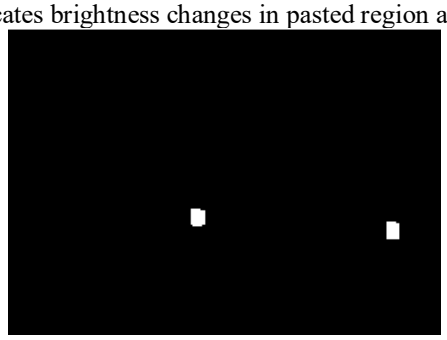
2.5 Combine the Identified Pasted Brightness or Contrast Blocks to find the Total Region

The process of detecting brightness or contrast change in the pasted region is carried out for all three channels and all detected blocks are combined to identify the final brightness of the modified region in the image.

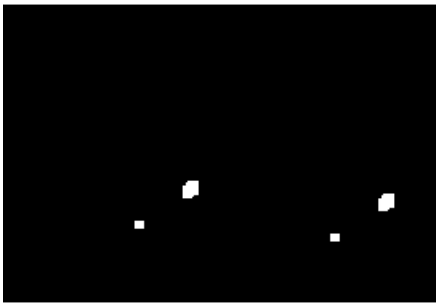
3. Results

The proposed algorithm is run on an image and the brightness or contrast modified region is detected. The results of brightness and contrast change detection are shown in Figures 4,5,6 and 7 respectively.

Figure 4: Indicates brightness changes in pasted region and its detection



Red Channel



Green Channel

Blue Channel

Figure 5: Indicates brightness change detected region in Red, Green and Blue channels

Figure 6: Indicates contrast change in pasted region and its detection

Red Channel

Green Channel

Blue Channel

Figure 7: Indicates contrast change detected in Red, Green and Blue channels

5. CONCLUSION

In the previous methods, if the colour image is converted into greyscale and LBP is applied, it is not possible to detect the brightness modified blocks because the Adobe photoshop tool will not uniformly change pixels in the red, green and blue channels. The proposed technique is an improvement in the detection of the tampered region compared to the previous techniques because it overcomes this drawback.

The proposed method has been applied to more than 100 images that are downloaded from the internet and whose brightness or contrast is modified by using the Adobe Photoshop tool. The proposed algorithm is implemented in MATLAB and the brightness or contrast changes are detected.

References

[1] J. Fridrich, D. Soukal, J. Lukas, Detection of copy–move forgery in digital images, in: Proceedings of Digital Forensic Research Workshop, IEEE Computer Society, Cleveland, OH, USA, August 2003, pp. 55–61.

[2] Y. Wang, L. Tian and C. Li, "LBP-SVD Based Copy Move Forgery Detection Algorithm," 2017 IEEE International Symposium on Multimedia (ISM), Taichung, 2017, pp. 553-556

[3] A. A. Alahmadi, M. Hussain, H. Aboalsamh, G. Muhammad and G. Bebis, "Splicing image forgery detection based on DCT and Local Binary Pattern," 2013 IEEE Global Conference on Signal and Information Processing, Austin, TX, 2013, pp. 253-256

[4] S. Kumar, J. Desai and S. Mukherjee, "A fast DCT based method for copy move forgery detection," 2013 IEEE Second International Conference on Image Information Processing (ICIIP-2013), Shimla, 2013, pp. 649-654

[5] Z. Moghaddasi, H. A. Jalab and R. M. Noor, "SVD-based image splicing detection," Proceedings of the 6th International Conference on Information Technology and Multimedia, Putrajaya, 2014, pp. 27-30

[6] Zhao J, Guo JC. Passive forensics for copy-move image forgery using a method based on DCT and SVD. Forensic Science International. 2013. December; 233(1):158–166

[7] T. Ojala, M. Pietikainen and T. Maenpaa, "Multiresolution gray-scale and rotation invariant texture classification with local binary patterns," in IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 24, no. 7, pp. 971-987, July 2002

[8] X. Kang and S. Wei, "Identifying Tampered Regions Using Singular Value Decomposition in Digital Image Forensics," 2008 International Conference on Computer Science and Software Engineering, Hubei, 2008, pp. 926-930

[9] Sanjay H S, Bhargavi S, Dinesh P A, "Auditory Temporal Resolution Based Psychophysical Evaluation of Healthy Individuals Exposed to Desired and Undesired Conditioning", Biomedical & Pharmacology Journal, Vol 10, no 3, pp 1449-1461, Sep 2017.

[10] Kumar, Y. B. Ravi; Narayanappa, C. K.; Dayananda, P., "Weighted full binary tree-sliced binary pattern: An RGB-D image descriptor", Science direct, Heliyon 6 , e03751,pp 1-18, April 2020.

[11] B.P.Pradeep kumar et.al published paper entitled "Performance Analysis of KNN, SVM and ANN Techniques for Gesture Recognition System" Indian Journal of Science and Technology, Vol 9(S1), DOI: 10.17485/ijst/v9/iS1/111145 December 2016.

An Novel Hand Gesture System for ASL using Kinet Sensor based Images

[1]Manoj H. M., , [2]Pradeep Kumar B.P., [3]Anil Kumar.C.[4] Rohith.S
, 2nd author's name and surname[2], etc
{manojhm@bmsit.in[1], pradi14cta@gmail.com[2], canilkumarc22@gmail.com[3],
rohithvjp2006@gmail.com[4]}

[1] Assistant Professor, Dept of CSE, BMSIT&M, Bangalore-64., [2] Associate Professor, Dept of ECE, HKBKCE,Bangalore-45, [3] Associate Professor & HoD, Dept of ECE., RLJIT, Doddaballapur, [4]Associate Professor, Dept of ECE.NCET, Bangalore

Abstract. The prime goal of this study is to perform resolution enhancement using experimental analysis. The framework presents hand image resolution enhancement techniques based on multi scale decomposition and edge preservation smoothing. The proposed technique Dual Tree complex wavelet transform (DT-CWT) and edge preservation smoothing (EPS) algorithm images are decomposed into different sub bands and interpolated, after which sub bands are reconstructed to achieve the enhanced image. The study outcome of this phase is studied with respect to PSNR and RMSE for all the letters of ASL.

Keywords: American Sign Language, Camera, Gesture, Wavelet transform, kinet sensor.

1 Introduction

Gestures used for communicating between person and machines also between persons using sign language [5][6]. Gestures can be static (posture / certain pose) or dynamic (series of postures). The static-gestures require less computational complexity whereas dynamic-gestures are more complex. Various techniques have been developed for acquiring necessary information for gestures recognition system [4][6]. Some methods are utilized for external hardware-devices such as data-glove devices and colour-markers which can easily extract the comprehensive-description of Gesture-features. Other methods are based on the appearance of hand which segments the hand and extracts the essential features, these methods are considered as natural, easy and less cost effective than other [7][8].

For most hard of hearing people in the United States, American Sign Language (ASL) is the preferred dialect. For everyday terms, ASL employs approximately 6,000 gestures, with finger spelling for conveying dark words or structured objects, locations, or items. In ASL, communication is often based on available shapes placed in or transferred crosswise over various areas of the endorser's body, despite changes in the head and arm, as well as physical appearance [12]. In any case, proper names and words without a unified sign are spelled in English letter by letter, and ASL understudies often begin their studies by learning the 26 hand shapes that make up the manual letter range [12, 13].

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1.1 Hand Gesture Recognition System

The vision is one of the physical senses which computer is instantiated perceptibly during the communication with humans. Thus, the vision based mechanisms are considered more in HGR. The HGR system based on computer vision consists of three different steps and is shown in Figure.1. The typical process includes a) image enhancement to remove noises as a pre-processing step, b) segmenting the palm portion from the captured image of either human body or hand ,c) feature extraction and finally d) classification [14, 15].

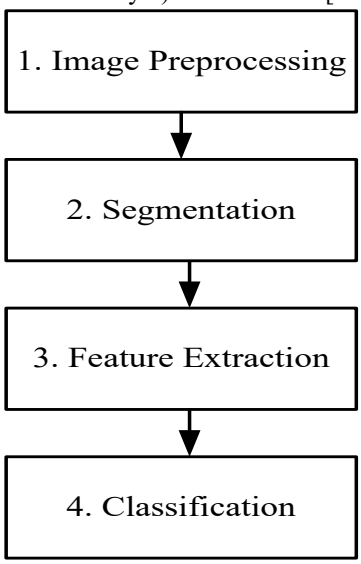


Figure.1. Main Steps of HGR System based on computer vision

1.2. Modeling Hand Gesture

The 2D modelling of hand can be mentioned with motion, shape and deformable templates. The shape based hand modelling can be classified as non-geographic and geographic models [2][3]. The non-geographic models consider the shape based features to model the hand like edges, contour, Eigen vectors etc, which are used for feature extraction and perform analysis too. The flexible/deformable models give an object shape changing flexibility level to pass the little variation of hand shape.

The 3D model of the hand can be represents and classified into skeletal, geometrical and volumetric models. The geometric models can be utilized in the real-time applications and hand animation. The skeletal models needs less parameters to structure the hand shape. The volumetric models are very complex and needs more parameters to shape the hand [14]. The geometric surfaces significantly performs the simulation of the visual hand image but it needs more parameters and is more time consuming process. The visual shapes like cylinders and ellipsoids are the alternative mechanism of geometric shape [15]. The Figure.2, describes the hand modelling mechanisms

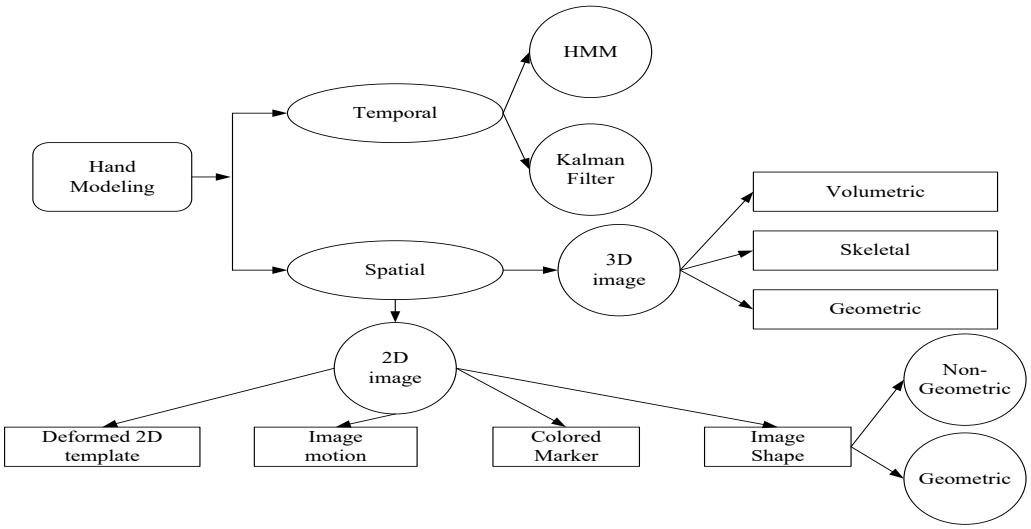


Figure.2. Hand Modelling

1.3 Research Aim And Objectives

A novel system for contact-less Hand gesture recognition using Microsoft Kinect for Xbox is described, and a real-time Hand gesture recognition arrangement is modelled and simulated into numerical computing platform (Matlab). The arrangement permits the user's to choose a situation, and it is clever to notice hand motions prepared by users. To recognize fingers, and to identify the meanings of gestures, and to show the meanings and pictures on screen. The prime aim of the proposed research work is to design a simple framework that can offer enhanced performance of hand gesture recognition system in effective manner considering ASL. In order to accomplish this research goal, following objectives were set:

- ***Preprocessing:*** To design a model that can offer enhanced resolution for input images
- ***Feature Extraction:*** To develop a simple modeling for hand gesture recognition emphasizing on an efficient feature extraction.
- ***Classification:*** To develop a hybridized scheme of hand gesture recognition for increasing recognition performance.
- ***Optimization***: To apply optimization for enhanced performance of hand gesture recognition system in cost effective manner.

2 Resolution Enhancement Of Hand Gesture Images

The hand gesture recognition (HGR) system which mainly emphasizes on the limitations of traditional hand gesture recognition techniques. This section mainly argues two-level architecture for the real-time hand gesture recognition scheme using only one camera as the input device. second describes the resolution enhancement problem and technique for hand gesture images using four different algorithms namely 1) The Nearest Value Algorithm, 2)

The Bilinear Algorithm , 3)The Bi-cubical Algorithm , 4) Dual Tree Complex Wavelet Transformation (DTCWT), further Bilateral Filter is used in order to obtain enhanced performance.

2.1 Skeleton Identification Of Kinect Camera

In this proposed system, "Kinect camera" plays the major role to gather the depth information from the skeleton. The new version of Kinect with its SDK (Software Development Kit) containing the skeleton tracking tool. This unique tool provides the system to collect the 20 joint information of the human body. For each frame, the positions of 20 points are estimated and collected. The 20 joints which is taken as an reference points is as shown in Fig 3

The kinect device provides the both RGB and D-image. This camera utilizes a structured light method to generate the real time depth information which consists of discrete measurements of physical scene. In this study, first creating the depth images of human in different sizes, and shapes, and generate the big dataset. The RGB and D-image are the input images of the system for the recognition of different ASL alphabetic symbols. This skeletal tracker device able to track the skeleton image of one or more persons moving within the kinect area view for gesture driven applications i.e. this tool able to collect 20 joint information about the skeleton. From the skeleton tracked by the Kinect first it extracts the feature of joint positions. Since, each joint has 3 values and also 3 coordinates and the detected skeleton has of 20 joints. So, the feature vector has 60 dimensions. The position of 20 points identified by kinect afterwards it will segment the right hand posture to recognize and stored in the database. From this sets can select the wanted joints of images for representing the postures.

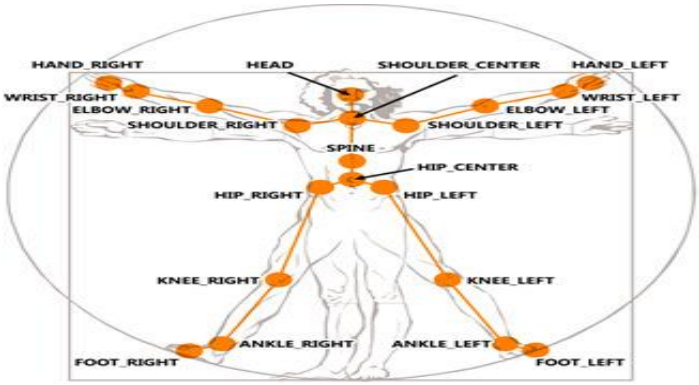


Figure. 3 Human skeleton joints as reference points

2.2 Algorithm: Skeleton identification from Kinect-Sensor.

Input: one or more people image, Output: 20 joint images

a. start
b. capture the image from kinect camera
c. segment the image from skeleton viewer
d. for reference points in body portion finds the depth-information
e. segmented moving body portion is mapped to the skeletal co-ordinates
f. if more than one moving body portion presents
g. calculate skeleton connection map for x,y coordinate
h. display the multiple skeleton moving body
i. end of predefined frames
j. stop.

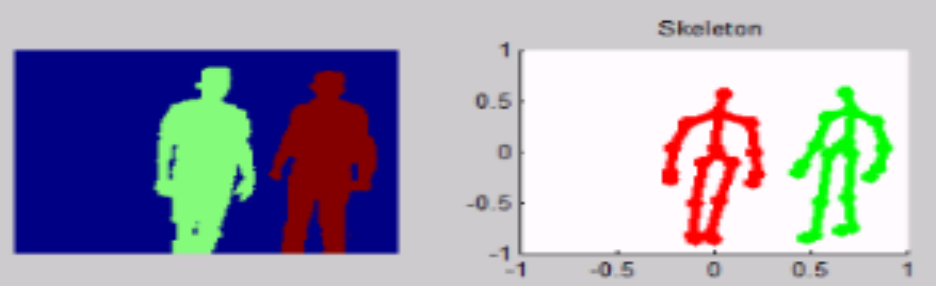


Figure.4. Skeleton-image identification from kinect sensor

Figure 4 shows the outcomes of identifying multiple skeletal signs under different distance using kinet-sensor device which represents the colour and depth image. Figure 5 shows in multiple user environments also our proposed system is identifying the user hand with respect to the distance from camera and extract the hand sign clearly for storing in to database.

Figure. 5. Multiple skeletal sign recognized under different distance

2.3. Multiple Depth Recognition:

(i) To calculate centroid: Here system is considering the three co-ordinates X, Y and Z. Calculating the centroid for each axis independently the mathematical interpretation for centroid is given by

X= sum (x) / length(x)..... .....… 1

Y= sum (y) / length (y)…….....2

Z= sum (z) / length (z)…….....3

(ii) **To calculate mean:** The system will calculate the mean for the entire segmented region calculated by the centroid of the body part by pixel basis. The mathematical interpretation for mean for pixels is given by:

$\bar{x}=\frac{1}{K}\sum_{i=0}^{K} x(i)$ and $\bar{y}=\frac{1}{K}\sum_{i=0}^{K} y(i)$……..4

The flow graph in figure 6 shows for the multiple depth recognition using Kinect sensor is as follows

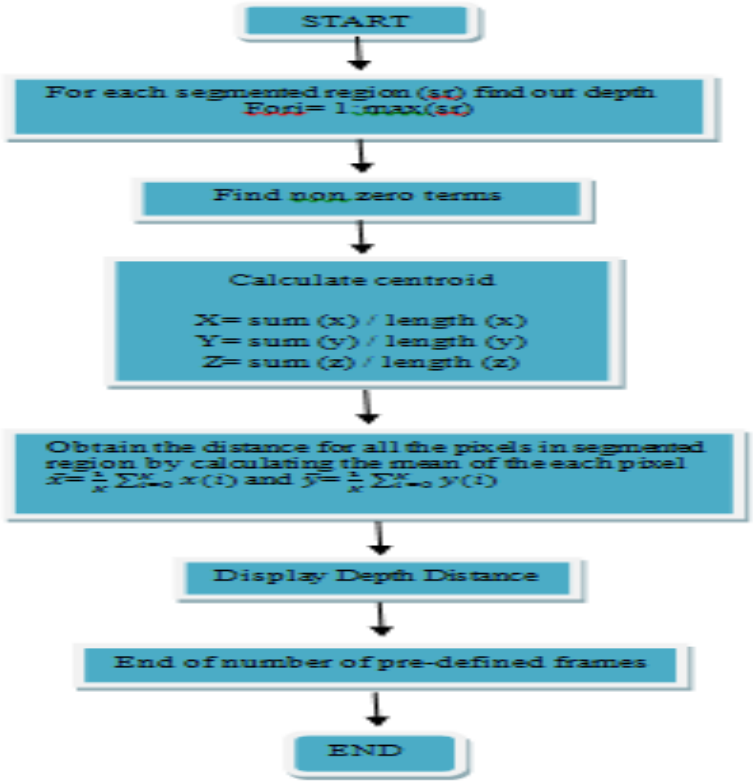


Figure. 6 The flow graph for the multiple depth recognition

2.4. Data Acquisition and Pre-Processing

The raw information acquired from the Kinect sensor via the Natural User Interface (NUI) contained 512×424 depth data, 1920×1080 RGB data, and 26-joint body skeleton data. The hand region in the depth image was illustrated using spatial thresholds in X-axis direction [Tx_min, $Tx_$], Y-axis direction [Ty_min, Ty_max] and Z (depth)-axis direction [$TDepth_min$, $TDepth_max$]. As demonstrated in Figure 6, the Kinect depth sensor placed at position $\boldsymbol{S}$ has angles of view α (horizontal) and β (vertical). The declaration of the depth image is $RxbyRy$ pixels. The position of the "hand" joint (x, y, D) in the depth image can be attained from the Kinect skeleton data (Figure 8a). Thus, the spatial thresholds are illustrated as:

$$[T_{x_min}, T_{x_max}] = [x - \frac{d_x}{2}\frac{\frac{R_x}{2}}{Dtan\frac{\alpha}{2}}, x + \frac{d_x}{2}\frac{R_x/2}{Dtan\frac{\alpha}{2}}] \quad \text{.....5}$$

$$[T_{y_min}, T_{y_max}] = [y - \frac{d_y}{2}\frac{R_y/2}{Dtan\frac{\beta}{2}}, y + \frac{d_y}{2}\frac{R_y/2}{Dtan\frac{\beta}{2}}] \quad \text{.....6}$$

$$[T_{Depth_min}, T_{Depth_max}] = [D - \frac{d_z}{2}, D + \frac{d_z}{2}] \quad \text{.....7}$$

where dx , dy and dz are stable dimensions (in millimetres) of the hand's region. The hand's region in the depth image is revealed in Figure 7. The hand's region in the color image can also be gained by mapping the hand's region on top of the color image (Figure 8 a).

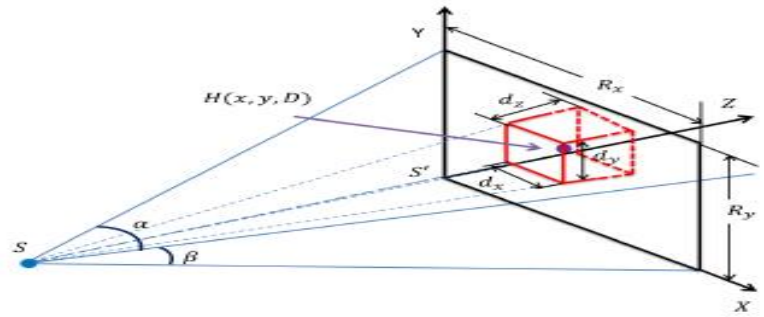


Figure. 7.. Illustration of the hand region segmentation: the$dx \times dy \times dz$hand region at
(x, y, D) was segmented from the$Rx \times Ry$depth image obtained using a depth sensor located at the position S.

(a) (b)

Figure. 8. Illustration of data obtained using Kinect.
(a) RGB Color image of the hand region. (b) Depth image of the hand region.

The following table illustrates the result analysis of proposed system can measure the recognition accuracy in different distance ranges. As sample we are experimenting skeletal signs as 10 times with different distance like 850mm to 1000mm …3000mm to 3500 mm and evaluating the recognition accuracy with time. The recognition accuracy is calculated in terms of percentage like for first experiment we are considering the (skeletal and camera) distance as 850mm to 1000mm and getting the 70% of recognition accuracy. Like this from the experiment analysis results, we can get the following results, which is shown is following table 1.

Table. 1 analysis results for recognition accuracy calculation

Distances from Kinect In mm	Number of times checked	Number of times recognised	Recognition Accuracy in %
850-1000	10	7	70 %
1000-1500	10	10	100 %
1500-2000	10	10	100 %
2000-2500	10	10	100 %
2500-3000	10	10	100 %
3000-3500	10	8	80 %

3. Framework For Resolution Enhancement

In this research methodology using experiential analysis image enhancement is executed as shown in fig 9. The techniques used here are Edge preservation smoothing and multi-scale decomposition. To obtain the enhanced image, the method of DT-CWT and EPS algorithm images are decomposed to a different sub band. At a regular interval of 5 minutes, samples of sign language are recorded from Kinect camera at a distance of 1500-2000mm. Values of PSNR, RMSE, are used to further proceed with quantitative analysis. The output of this phase is an enlarged image.

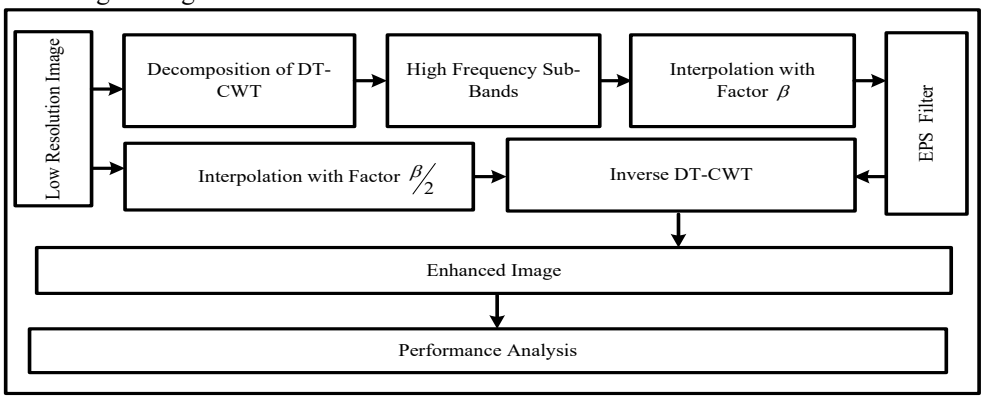


Figure.9. Block diagram representing framework for resolution enhancement

3.1. The Nearest Value Algorithm

Nearest Neighbour interpolation or proximal interpolation is way by which multiple dimensions can be interpolated. For a random point in space surrounding the nearest point (Neighbouring) would have its value approximated leading to the interpolation problem. Hence, the algorithm of the nearest neighbour selects the nearest point and neglects the value of points around it.

The above mentioned is the nearest neighbour algorithm which selects the nearest point eliminating the value associated to the random points around it. The original disk on file (I) is initialized and the size of the resized image is computed (I_{new}).Now, the size of the original file on disk is calculated. Further to check a condition that size of I and I_{new} match or not the number of rows and columns are compared respectively. If the resized image has higher number of rows then its new value will be ranging from 1-to-rows of original image considering first row and first column. If the original image has higher number of rows then its new value will be ranging from 1-to-rows of resized image considering first row and first column. Same procedure is applied to check the condition for the columns. The value of PSNR is calculated to be 23.3591, RMSE is 17.3214 for the input image as shown in fig 10.

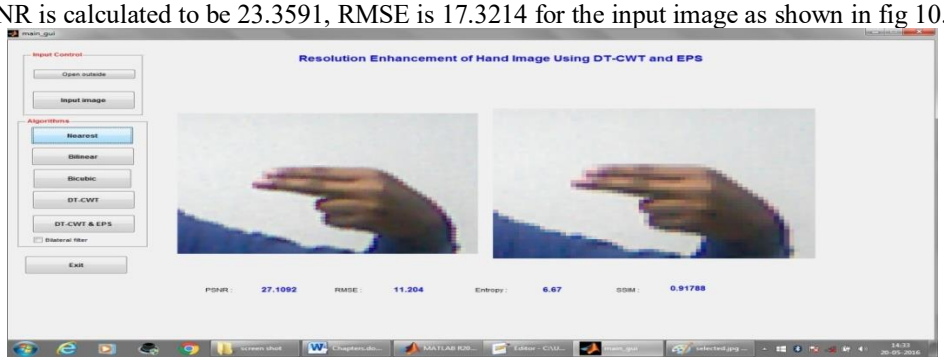


Figure.10. Application of Nearest Neighbor Transformation Function

3.2. Bilinear Interpolation

An image transformation process used in cases where pixel matching is impossible is called as bilinear interpolation. When compared to other methods of transformation bilinear interpolation considers closet 2x2 neighbourhood of known pixel values surrounding the unknown pixel's computed location.

Computation of PSNR $(\beta) = 10\log_{10}\left(\frac{255}{\alpha}\right)$; Computation of RMSE $(\gamma) = \sqrt{MSE}$

The above mentioned is the bilinear interpolation method which considers 2x2 neighboring pixels. The original disk on file (I) is initialized and the size of the resized image is computed (I_{new}).Now, the size of the original file on disk is calculated. Further to check a condition that size of I and I_{new}match or not the number of rows and columns are compared respectively. If the resized image has higher number of rows then its new value will be ranging from 1-to-rows of original image considering first row and first column. If the original image has higher number of rows then its new value will be ranging from 1-to-rows of resized image considering first row and first column. Same procedure is applied to check the condition for the columns. The value of PSNR is calculated to be 23.591, RMSE is 17.3214 for the input image as shown in fig 11.

Figure. 11. Application of bilinear Transformation Function

3.3. Bicubic Interpolation.

This technique is implemented using Lagrange polynomials cubic splines or cubic convolution algorithm. Bicubic interpolation can be chosen over other methods if speed is not a constraint. Smoother images are obtained as output with lesser interpolation artifacts. The above mentioned is the bicubic interpolation method which is based on cubic convolution algorithm, Lagrange polynomials. The original disk on file (I) is initialized and the size of the resized image is computed (I_{new}).Now, the size of the original file on disk is calculated. Further to check a condition that size of I and I_{new}match or not the number of rows and columns are compared respectively. If the resized image has higher number of rows then its new value will be ranging from 1-to-rows of original image considering first row and first column.If the original image has higher number of rows then its new value will be ranging from 1-to-rows of resized image considering first row and first column. Same procedure is applied to check the condition for the columns. The value of PSNR is calculated to be 24.953, RMSE is 17.3214 for the input image as shown in fig 12.

Figure.12. Application of bicubic Transformation Function

3.4. Bilateral Filtering Process

Bilateral filter is a noise reducing filter for images with the property of non-linearity and preserving the edge. Each pixel has an intensity value a picture restored by weighted average from nearby pixels. Weight can be based on Gaussian distribution and the sample output is shown in fig 13.

The bilateral filter is defined as:

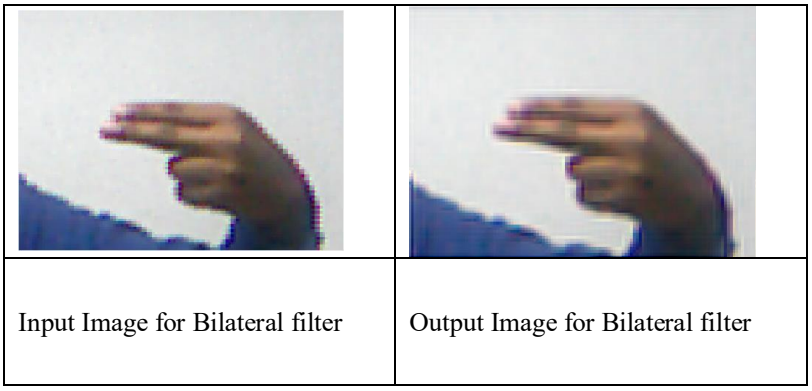
$$I^{filtered}(x) = \frac{1}{W_p} \sum_{xi \in \Omega} I(x_i)\, fr(\| I(x_i) - I(x) \|) g_s(\|x_i - x\|) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 8$$

Where the normalization term;

$$W_{p=} \sum_{xi \in \Omega} fr(\| I(xi) - I(x) \|) gs (\| xi - x \|) \quad \text{.....9.}$$

Ensures that the filter preserves image energy and

- $I^{filtered}$ is the image after filtration: Iis the original input image
- xare the directs of the current pixel to be filtered: Ω is the window centered in x
- f_r is the range kernel for smoothing differences in intensities. This utility can be a Gaussian function
- $g_s$is the spatial kernel for smoothing differences in coordinates. This function can be a Gaussian function.



Input Image for Bilateral filter	Output Image for Bilateral filter

Figure 13.Application of bilateral filtering process

3.5. Dual Tree Complex Wavelet Decomposition Transformation (DTCWT)

Using the dual tree complex wavelet transformation method the image is decomposed. This happens with respect to Discrete Continuous Wavelet Transformation (DWT) and Continuous Wavelet Transformation (CWT) .In DWT the basis function used is symlet mother wavelet. Image will be decomposed into two parts, the approximation coefficients and detailed coefficients. Only approximation coefficients are considered and similar mechanism is implemented for CWT. The algorithm of DTCWT is being performed above for the resolution enhancement for a hand gesture by splitting the image mainly into real and imaginary parts. To evaluate the analysis and synthesis parameter taken into consideration, the dual filter function is worked on. The dual cell structure is determined via cplx dual 2D function. Frequency values are divided into lower and higher components. The higher frequency components are normalized to nullify the effect of frequencies lying outside the desired range of detection. The lower frequencies have their highest value used in the algorithm among all of them. Further lower frequency image is converted into original image with the inclusion of the new dual tree cell structure. for the input image as shown in fig 14.

Figure.14. Application of DTCWT and EPS algorithm

Table.2. Comparison of algorithms for sign H

Algorithms	PSNR	RMSE
Nearest	26.24	12.37
Bilinear	28.08	10.01
Bicubic	28.11	10.11
DT-CWT	28.50	13.8
DT-CWT & EPS	29.07	10.006

Table 3 showing the detailed tabulated parametric values for all the signs using DT-CWT conditions respectively considering performance parameters of PSNR, RMSE

Table.3 Numerical Outcome of Performance parameters of DT-CWT

ALPHABET	A	B	C	D	E	F	G	H	I
PSNR	28.5	29.61	30.35	28.96	29.02	29.14	28.84	26.24	30.77
RMSE	13.8	8.66	8.63	10.49	10.9	10	12.38	12.37	8.44

ALPHABET	J	K	L	M	N	O	P	Q	R
PSNR	28.82	29.45	28.45	28.33	29.43	29.77	30.12	29.25	29.43
RMSE	12.15	12.15	11.15	9.6	11.56	10.32	7.85	11.9	8.43

ALPHABET	S	T	U	V	W	X	Y	Z
PSNR	29.59	29.89	30.45	27.78	27.32	27.55	28.56	26.72
RMSE	8.8	8.99	9.2	12.73	9.34	13.92	12.44	14.6

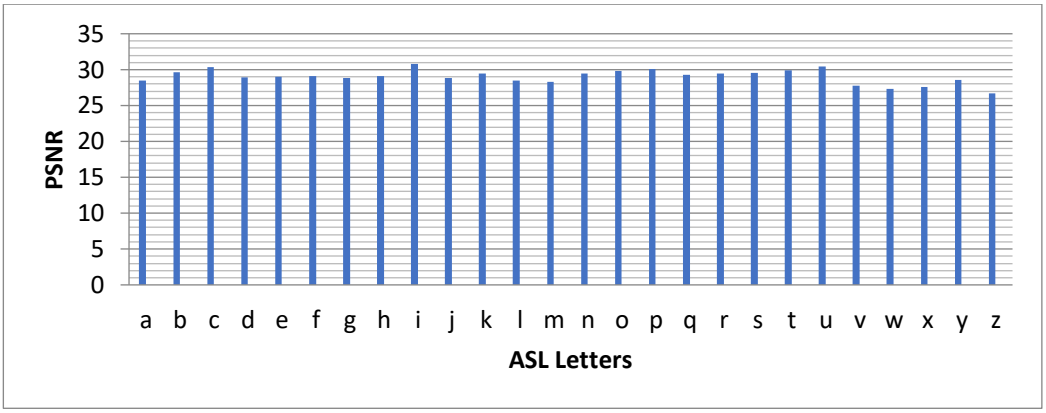


Figure.15. Illustration of PSNR values for the algorithm DT-CWT and EPS.

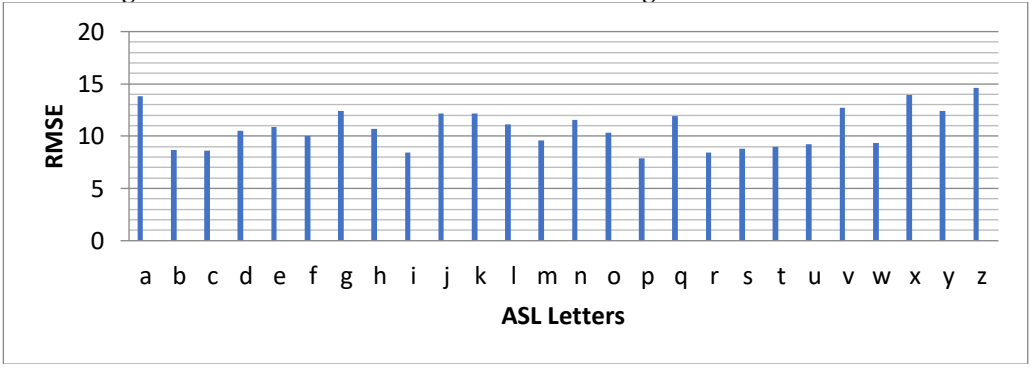


Figure.16. Illustration of RMSE, values for the algorithm DT-CWT and EPS.

4. Conclusion.

Thus, this study quickly abridges about every thing of the calculations being executed for the upgrade of a hand signal acknowledgment framework alongside the examination procedures required behind it. A novel picture determination improvement procedure in view of DT-CWT and EPS channel. The method breaks down the LR input picture utilizing DT-CWT. EPS (Bilateral) sifting is utilized to safeguard the edges and de-noising the picture and to additionally improve the execution of the proposed method as far as RMSE, PSNR

References

[1] A.R. Sarkar, G. Sanyal, and S. Majumder, "Hand gesture recognition systems: a survey", International Journal of Computer Applications, 71.15, 2013

[2] N. Neverova, Natalia, "A multi-scale approach to gesture detection and recognition", Proceedings of the IEEE International Conference on Computer Vision Workshops, 2013

[3] S. Yang, P. Premaratne, and P. Vial, "Hand gesture recognition: An overview", Broadband Network & Multimedia Technology (IC-BNMT), 5th IEEE International Conference, 2013

[4] T. Osunkoya and J-C. Chern, "Gesture-based human-computer-interaction using Kinect for Windows mouse control and Powerpoint presentation", Department of Mathematics and Computer Science, Chicago State University, Chicago, IL 60628, 2013

[5] J. Katkar, Jayshree, "Hand Gesture Recognition and Device Control", Hand, 2017
[6] J.G. Kyle and B. Woll,“Sign language: The study of deaf people and their language”, Cambridge University Press, 1988
[7] M.C. Thomas and A. P. M. S. Pradeepa,“A comprehensive review on vision based hand gesture recognition technology”, International Journal 2.1, 2014
[8] H. Zhouand H. Hu,“A survey-human movement tracking and stroke rehabilitation”, University of Essex, Colchester United Kingdom, 2004
[9] M. Turkand M.Kölsch,“Perceptual user interfaces”, Emerging Topics in Computer Vision, Prentice Hall, 2004
[10] K.K. Vyas, A. Pareek, and S. Tiwari, "Gesture Recognition and Control", International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169, Retrieved on 16th August, 2017
[11] D.H. Stefanov, Z. Bien, and W-C. Bang,“The smart house for older persons and persons with physical disabilities: structure, technology arrangements, and perspectives”, IEEE transactions on neural systems and rehabilitation engineering, vol.12.2, pp.228-250, 2004
[12] D.C. L-Martin, “Universal grammar and American sign language”, Universal Grammar and American Sign Language, pp.1-48, 1991
[13] M.L. McIntire, “The acquisition of American Sign Language hand configurations”, Sign Language Studies, 16.1, pp.247-266, 1977
[14] M. Alsheakhali, “Hand gesture recognition system”, Computer Engineering Department, The Islamic University of Gaza, Gaza Strip, Palestine, 2011
[15] S.D. Badgujar, “Hand Gesture Recognition System”, International Journal of Scientific and Research Publications, 4.2, 2014

Classifying shoulder implants in X-ray images using Big data techniques

M. Sivachandran[1], Dr.T.Krishnakumar[2]
{sivachandranm08@gmail.com[1], drkk@bharathuniv.ac.in[2]}

Research Scholar, Department of CSE, Bharath Institute of Higher Education and Research, Chennai, India.[1],
Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai, India.[2]

Abstract. This research work focuses on optimal solution for the image detection and segmentation. The prosthesis may – a few or numerous years after it was embedded – come needing fix or substitution. In a portion of these cases, the maker and the model of the prosthesis might be obscure to the patients and their essential consideration specialists, for instance when the medical procedure was led in another nation where the patient has presently no admittance to the records. The highest accuracy value is 81.68% which is while applying the=7k=6 and the lowest accuracy value is 65.6% when apply the k=7. The highest precision value is 81.68% while applying the k=1 and very lowest precision value is 73.69% lies on k=2 and k=9.The highest recall value is 83.69% which is produced by while applying the parameter k=6, the lowest recall value is 65.76% while applying the parameter k=9. The K=10 model takes more time to build the model is while applying the k=10 and very low time consumption model is k=8. Another conceivable instance of not knowing the specific producer and model could be expected uncertainty in clinical records or clinical images.

Keywords: KNN, Instance based classifier, Lazy classifier, TSA,UW.

1 Introduction

Total Shoulder Arthroplasty (TSA) is a typical intrusive system for treating harmed shoulder joints, where the shoulder ball is supplanted with a prosthesis.[1] The method is gone before and followed by a progression of X-beam pictures to evaluate arrangement and fit.[2] Common explanations behind going through TSA medical procedure are basic shoulder wounds or serious arthritis.[3,17] The technique mitigates torment and reestablishes movement to the patients shoulder.[4,16] There are a few distinct makers delivering prostheses, and every one of them offers a few unique models to all the more likely fit any sort of circumstance and patient.[5,15]The prosthesis may – a few or numerous years after it was embedded – come needing fix or replacement.[6,14] In a portion of these cases, the producer and the model of the prosthesis might be obscure to the patients and their essential consideration specialists, for instance when the medical procedure was directed in another nation where the patient has right now no admittance to the records.[7,13] Another conceivable instance of not knowing the specific maker and model could be expected uncertainty in clinical records or clinical images.[8,12] right now, the errand of recognizing a prosthesis model in such cases is based on thorough assessments and visual correlations of X-

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beam pictures taken from the embed by clinical experts.[9,10,11] This can be a dreary assignment and requires time and exertion for each new patient.

In this paper presents in section 2 presents the materials and methods adopted and section 3 presents the details of the experiments and discussions. Finally section 4 concludes the paper by sharing our inferences and future plans.

2 Materials And Methods

The dataset gathered from UCI vault. Pictures were gathered by Maya Stark at BIDAL Lab at SFSU for her MS postulation project. They are from The UW Shoulder Site ([Web Link]), producer sites, and Feeley Lab at UCSF. The first assortment included 605 X-beam pictures. Eight pictures that seemed to have been taken from similar patients were eliminated, bringing about the last 597 pictures. The last set contains pictures from the accompanying makers: 83 from Cofield, 294 from Depuy, 71 from Tornier, and 149 from Zimmer, bringing about a 4-class arrangement issue. Class marks are given as the maker name in document names. Pictures are with 8-bit grayscale and different measurements in jpeg design. Weka 3.9.8.tool has implemented for the analysis and the below methods have implemented in this research work.

- Instance based classifier(KNN)

3 Results And Discussions

In this section focuses on the results and discussions of the instance based classifier implemented in this dataset.

Table 1: Instance based classifier Vs Accuracy

S.No	**K**	**Accuracy**
1	1	79.49
2	2	79.44
3	3	74.81
4	4	77.43
5	5	73.69
6	6	81.68
7	7	65.6
8	8	76.19
9	9	77.43
10	10	73.69

The above table clearly shows that the instance based classifier is producing the accuracy levels are different while doing the parameter tuning like K parameter. In this dataset we implemented the lazy classifier while K=1 then the system gets an accuracy value is 79.49%, while K=2 then the system gets an accuracy value is 79.44%, while K=3 then the system gets

an accuracy value is 74.81%, while K=4 then the system gets an accuracy value is 77.43%, while K=5 then the system gets an accuracy value is 73.69%, while K=6 then the system gets an accuracy value is 81.68%, while K=7 then the system gets an accuracy value is 65.6%, while K=8 then the system gets an accuracy value is 76.19%, while K=9 then the system gets an accuracy value is 77.43%, while K=10 then the system gets an accuracy value is 73.69%.

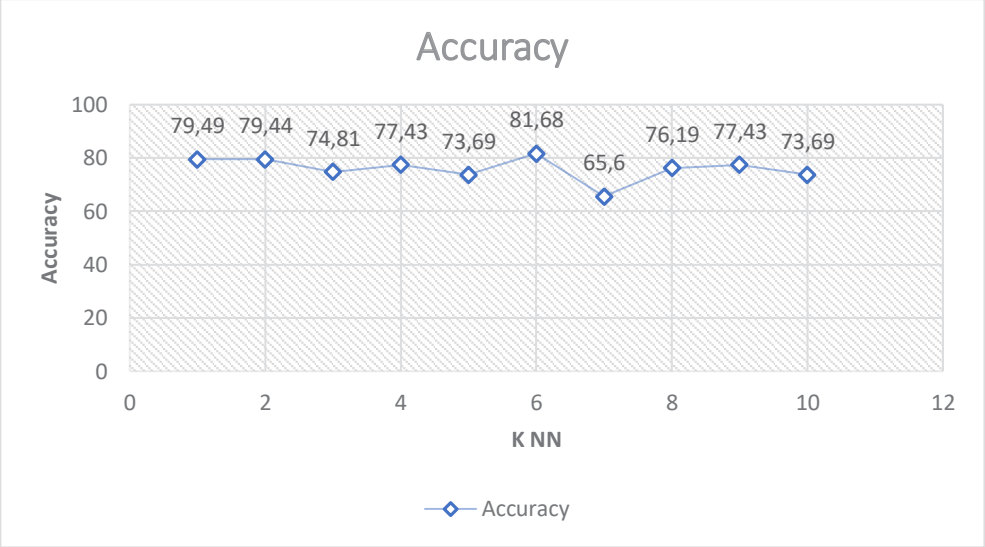


Figure 1: Instance based classifier Vs Accuracy

The above diagram shows that the highest accuracy value is 81.68% which is while applying the=7k=6 and the lowest accuracy value is 65.6% when apply the k=7

Table 1: Instance based classifier Vs Precision

S.No	K	Precision
1	1	81.68
2	2	73.69
3	3	78.14
4	4	79.32
5	5	79.49
6	6	80.44
7	7	74.81
8	8	77.43
9	9	73.69
10	10	74.81

The above table clearly shows that the instance based classifier is producing the precision value levels are different while doing the parameter tuning like K parameter. In this dataset we implemented the lazy classifier while K=1 then the system gets a precision value is 81.68%, while K=2 then the system gets a precision value is 73.69%, while K=3 then the system gets a precision value is 78.14%, while K=4 then the system gets a precision value is 79.32%, while

K=5 then the system gets a precision value is 79.49%, while K=6 then the system gets a precision value is 80.44%, while K=7 then the system gets a precision value is 74.81%, while K=8 then the system gets a precision value is 77.43%, while K=9 then the system gets a precision value is 73.69%, while K=10 then the system gets a precision value is 74.81%.

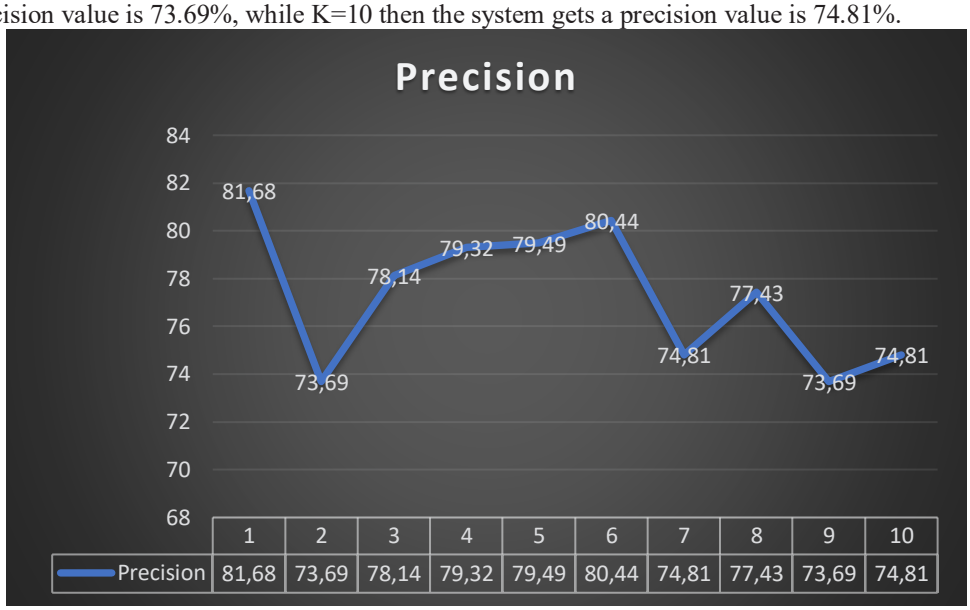


Figure 2: Instance based classifier Vs Precision

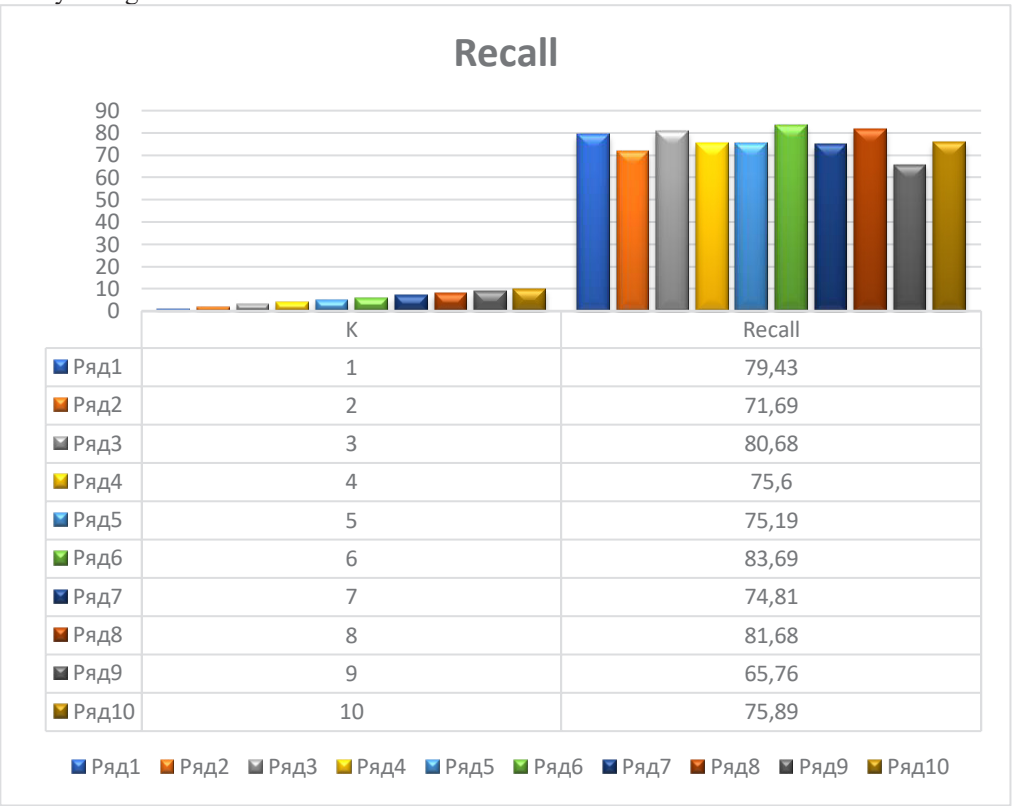
The above diagram clearly shows that the highest precision value is 81.68% while applying the k=1 and very lowest precision value is 73.69% lies on k=2 and k=9.

Table 2: Instance based classifier Vs Recall

S.No	K	Recall
1	1	79.43
2	2	71.69
3	3	80.68
4	4	75.6
5	5	75.19
6	6	83.69
7	7	74.81
8	8	81.68
9	9	65.76
10	10	75.89

The above table 2 clearly shows that the instance based classifier is producing the recall value levels are different while doing the parameter tuning like K parameter. In this dataset we implemented the lazy classifier while K=1 then the system gets a recall value is 79.43%, while K=2 then the system gets a recall value is 71.69%, while K=3 then the system gets a recall value is 80.68%, while K=4 then the system gets a recall value is 75.6%, while K=5 then the system gets a recall value is 75.19%, while K=6 then the system gets a recall value is 83.69%,

while K=7 then the system gets a recall value is 74.81%, while K=8 then the system gets a recall value is 81.68%, while K=9 then the system gets a recall value is 65.76%, while K=10 then the system gets a recall value is 75.89%.



	K	Recall
Ряд1	1	79,43
Ряд2	2	71,69
Ряд3	3	80,68
Ряд4	4	75,6
Ряд5	5	75,19
Ряд6	6	83,69
Ряд7	7	74,81
Ряд8	8	81,68
Ряд9	9	65,76
Ряд10	10	75,89

Figure 3: Instance based classifier Vs Recall

The above figure 3 the highest recall value is 83.69% which is produced by while applying the parameter k=6, the lowest recall value is 65.76% while applying the parameter k=9.

Table 3: Instance based classifier Vs Time

K	Time taken to build model(In Seconds)
1	0.19
2	0.21
3	0.49
4	0.25
5	0.23
6	0.91
7	0.24
8	0.14
9	0.36

10	1.24

The above table 3 clearly shows that the instance based classifier is taking the time consumption to build the model is different while doing the parameter tuning like K parameter. In this dataset we implement the lazy classifier while K=1 then the system takes a time consumption to build the model is 0.19 seconds, while K=2 then the system takes a time consumption to build the model is 0.21 seconds, while K=3 then the system takes a time consumption to build the model is 0.49 seconds, while K=4 then the system takes a time consumption to build the model is 0.25 seconds, while K=5 then the system takes a time consumption to build the model is 0.23 seconds , while K=6 then the system takes an a time consumption to build the model is 0.91 seconds, while K=7 then the system takes an a time consumption to build the model is 0.24 seconds, while K=8 then the system takes an a time consumption to build the model is 0.14 seconds, while K=9 then the system takes an a time consumption to build the model is 0.36 seconds, and finally while K=10 then the system takes an a time consumption to build the model is 1.24 seconds.

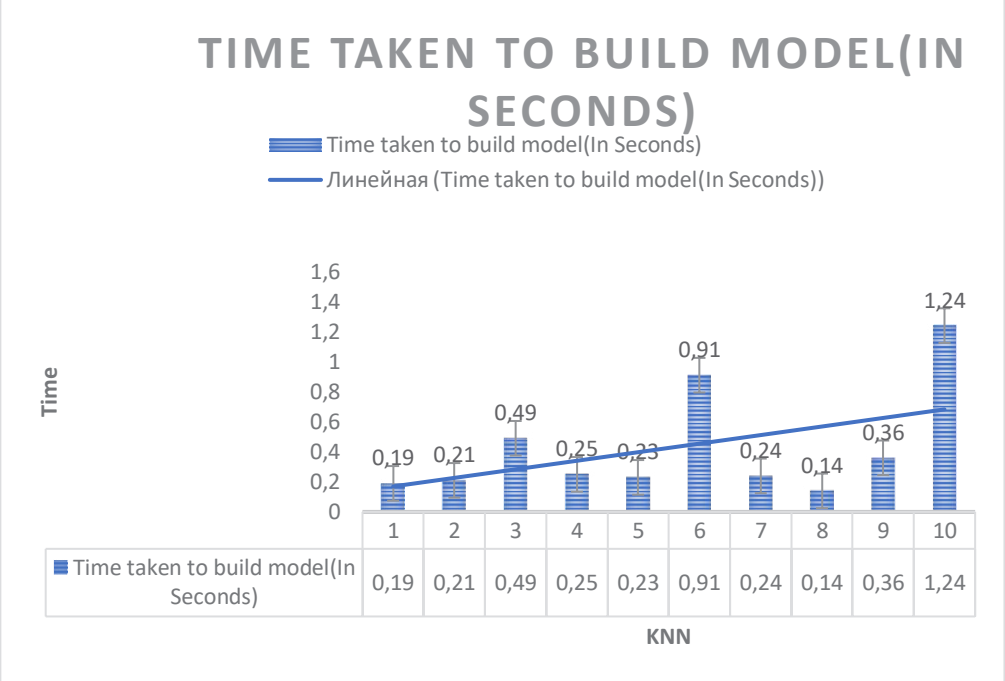


Figure 4: Instance based classifier Vs Time Consumption

The above figure 4 shows that the K=10 model takes more time to build the model is while applying the k=10 and very low time consumption model is k=8.

4Conclusions

The System concludes that the highest accuracy value is 81.68% which is while applying the=7k=6 and the lowest accuracy value is 65.6% when apply the k=7. The highest precision value is 81.68% while applying the k=1 and very lowest precision value is 73.69% lies on k=2 and k=9.The highest recall value is 83.69% which is produced by while applying the parameter k=6, the lowest recall value is 65.76% while applying the parameter k=9. The K=10 model takes more time to build the model is while applying the k=10 and very low time consumption model is k=8.

References

[1] Robert H. Cofield Total shoulder arthroplasty with the neer prosthesis J Bone Joint Surgery, 66 (6) (1984), pp. 899-906

[2] Jia Deng, Wei Dong, Richard Socher, Li-Jia Li, Kai Li, Li Fei-FeiImagenet: a large-scale hierarchical image database 2009 IEEE Conference on Computer Vision and Pattern Recognition, Ieee (2009), pp. 248-255

[3] Simonyan Karen, Zisserman Andrew, Very deep convolutional networks for large-scale image recognition. ArXiv Preprint ArXiv:1409.1556; 2014.

[4] Kaiming He, Xiangyu Zhang, Shaoqing Ren, Jian Sun Deep residual learning for image recognition Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (2016), pp. 770-778

[5] Gao Huang, Zhuang Liu, Laurens Van Der Maaten, Kilian Q. Weinberger Densely connected convolutional networks Proceedings of the IEEE Conference on computer vision and pattern recognition (2017), pp. 4700-4708

[6] Barret Zoph, Vijay Vasudevan, Jonathon Shlens, Quoc V. Le Learning transferable architectures for scalable image recognition Proceedings of the IEEE Conference on computer vision and pattern recognition (2018), pp. 8697-8710

[7] EuijoonAhn, Ashnil Kumar, Jinman Kim, Changyang Li, Dagan Feng, Michael Fulham X-ray image classification using domain transferred convolutional neural networks and local sparse spatial pyramid 2016 IEEE 13th International Symposium on Biomedical Imaging (ISBI), IEEE (2016), pp. 855-858

[8] Juan Wang, Huanjun Ding, FateMehAzamian, Brian Zhou, Carlos Iribarren, SabeeMolloi, Pierre Baldi Detecting cardiovascular disease from mammograms with deep learning IEEE Trans Med Imaging, 36 (5) (2017), pp. 1172-1181

[9] Shuchao Pang, Zhezhou Yu, Mehmet A Zhezhou, Orgun A novel end-to-end classifier using domain transferred deep convolutional neural networks for biomedical images Computer Methods Programs Biomed, 140 (2017), pp. 283-293

[10] Gregor Urban, PriyamTripathi, TalalAlkayali, Mohit Mittal, FaridJalali, William Karnes, Pierre Baldi Deep learning localizes and identifies polyps in real time with 96% accuracy in screening colonoscopy Gastroenterology, 155 (4) (2018), pp. 1069-1078

[11] Juan Wang, Zhiyuan Fang, Ning Lang, Huishu Yuan, Su. Min-Ying, Pierre Baldi A multi-resolution approach for spinal metastasis detection using deep siamese neural networks Computers Biol Med, 84 (2017), pp. 137-146

[12] P. Baldi Deep learning in biomedical data science Ann Rev Biomed Data Sci, 1 (2018), pp. 181-205

[13] Gregor Urban, Kevin Bache, Duc TT Phan, Agua Sobrino, Alexander K. Shmakov, Stephanie J. Hachey, et al. Deep learning for drug discovery and cancer research: automated analysis of vascularization images IEEE/ACM Trans ComputBiolBioinform, 16 (3) (2018), pp. 1029-1035

[14] Aaron Defazio, Francis Bach, Simon Lacoste-Julien Saga: A fast incremental gradient method with support for non-strongly convex composite objectives Advances in Neural Information Processing Systems (2014), pp. 1646-1654
[15] Leo Breiman Random forests Mach Learn, 45 (1) (2001), pp. 5-32
[16] Jerome H. Friedman Greedy function approximation: a gradient boosting machine Ann Statistics (2001), pp. 1189-1232
[17] Thomas M. Cover, Peter E. Hart, et al. Nearest neighbor pattern classification IEEE Trans Inform Theory, 13 (1) (1967), pp. 21-27
[18] http://sfsu-dspace.calstate.edu/handle/10211.3/204021
[19] https://www.sciencedirect.com/science/article/pii/S2001037019304179?via%3Dihub
[20] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.
[21] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9
[22] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.
[23] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020
[24] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2
[25] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.
[26] Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

Removal Of High Quality Video Noise Through Modified First Order Neighborhood Mean Filter

[1] V.Sujith, [2]B.Karthik
{pcnsujith@gmail.com[1], karthik.ece@bharathuniv.ac.in, karthikguru33@gmail.com[2]}

Research Scholar, ECE, Bharath Institute of Higher Education and Research, Chennai[1],
Associate Professor, Department of ECE, Bharath Institute of Higher Education and Research, Chennai.[2]

Abstract. In this paper, a hard and fast of regulations is designed to put off the random valued impulsive noise (pepper and salt) from corrupted shade movies. In beyond years researchers suggested many algorithm to take away the impulse noise however they fail to present higher outcomes at immoderate noise density i.E. 80%-90%. The suggested algorithm MFONMF works on ranges the first stage is to stumble upon the noisy pixel and the second one degree is to update the noisy pixel. This set of policies considers changed first order community pixels for detecting the noisy pixel and propose clear out is used for de-noising. Color films are denoised by means of manner of extracting the every and everybody from video, then the frames are splitting into R, G and B channels and then they're denoised one at a time after which merged collectively another time to shape the shade video. All the opposite algorithm are compared with the suggested algorithm and discovered that the suggested algorithms has accurate noise elimination skills at excessive densitie. The supplied set of rules indicates higher result than Progressive Switched Median Filter (PSMF), Standard Median Filter (SMF), Decision Based Algorithm (DBA), Modified Decision Based Algorithm (MDBA), Adaptive Median Filter (AMF),Modified Decision Based Unsymmetrical Trimmed Median Filter (MDBUTMF), and Modified Non-Linear Filter (MNF). Different color movement snapshots are examined via the use of the algorithm and it gave better Peak Signal Noise Ratio (PSNR) and Image Enhancement Factor (IEF) at low, medium and immoderate noise densitie.

Keywords: Noise Removal, Video, MFONMF, SNP..

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1 Introduction

Commotion evacuation is one of the greatest vital elements to get real video from phenomenally corrupted video. The video can be spoiled with commotion eventually of transmission from uproarious channel, sensors or in view of some ecological circumstances. This make the video outwardly revolting. Unwary commotion may also emerge sooner or later of transmission which shockingly defiles the video. photograph improvement is one of the significant levels for preparing the photo in computerized picture handling area. photo upgrade is the method of making pictures more noteworthy valuable and it additionally progresses the outstanding of photo. The purpose why picture upgrade is done on the grounds that it features exciting realities in the image gets freed of clamor from the image and makes the photo outwardly alluring. There are broad classes of photo improvement procedures spatial region approach and recurrence space technique. Spatial locale procedures works immediately on the control of photograph pixels while recurrence territory depends on upgrading the Fourier or wavelet change of photograph. On the off chance that control is done quickly on picture pixels and if the photo is loud this implies any undesirable records is conveyed to the picture then de-noising is executed in added substances identification of clamor and end of that one of a kind commotion. Commotion typically comes from sensors, ecological circumstances (downpour, snow, easing up and a lot of others.) and transmission through uproarious channel. De-noising is accomplished on account of reality the image may be outwardly revolting, terrible pressure or awful assessment. There are one-of-a-type commotion types autonomous of spatial area and spatially settled. The clamors that are fair-minded of spatial region are imprudent commotion and AWGN (Additive white Gaussian commotion) and the spatially based commotion thinks about intermittent clamor. Motivation commotion is again of type's consistent value drive clamor that is furthermore recognized as pepper and salt and arbitrary value motivation commotion. fixed expense motivation clamor has given this call due to reality the power cost of picture is transformed to nothing or 255 while the image is ruined through commotion. Pepper and salt name is utilized for reliable charge commotion as 0 alludes to pepper since of the truth it's far a dark speck and 255 alludes to salt due to the fact of the matter it's far a white spot. within the sight of this clamor the image gets ruined. Along these lines, this type of clamor is to be wiped out as it's miles basic for the extraction of precise and dependable insights from the pics. Channels are better decision to put off commotion from the image as they're smooth to place into impact on equipment.

Hue picture preparing is likewise refined for shading depictions it could be separated into two areas: pseudo-conceal photo handling and full-shading picture handling. Pseudo-conceal picture handling is utilized to enrich the grayscale pictures with conceal though whole shading photo preparing is utilized to upgrade the shade pictures. There are stand-out conceal models which is likely used in shading photograph preparing RGB, CMY and HSI. these designs are equipment orientated models. shading pictures additionally are ruined by means of utilizing commotion and are denoised to get outwardly good photograph. shading photograph is a virtual picture that comprises of data about each and each shade pixel. it's far provided 3 shading channels for every pixel the ones are deciphered as directions in some shading model. RGB tinge form is regularly utilized in PC shows. In this exemplary purple, unpracticed and navybright is added all things considered in assorted methods to convey exhibit of tones. De-noising of a shading photograph wrapped up by transforming them to dark picture, denoised the picture and get gotten back to shading photograph. realities could no doubt get lost while re-converting dark equal to shading photo. The data of tinge previews are kept up with the guide of removing the R, G and B pixel uproarious picture denoised them independently and consolidated them to shape the shade photo.

2 Literature Review

For setting off the commotion from the debased picture separating is accomplished in which special sorts of channels are utilized for clamor end.these channels smother the clamor from the photograph and make the picture commotion free. various channels have been suggested with the guide of the utilization of exceptional specialists for disposing of the clamor from the pictures which can be defiled by drive commotion and they might be the gigantic decision to wipe out commotion as they might be not difficult to place in power on equipment. uncommon channels that have been utilized include middle channel out, exhort wipe out, changing middle wipe out, alpha managed prompt channel, un-symmetric managed middle clear out and so forth Numerous scientists have advised various separating procedures for putting off pepper and salt commotion. among the ones well known Median channel out (SMF) is easy to place in power and is likewise dependable. in any case, its fundamental downside is that this channel is powerful handiest at low thicknesses. while thickness stage is extended more than half then the edge data of bona fide photograph isn't saved [4]. to win over this drawback a few strategies have been projected to eliminate pepper and salt commotion at greatthicknesses. Separating with 3x3 veils is utilized for holding the calculation season of execution least. Utilization of little sifting window for disposing of commotion is lacking. Thus, Adaptive Median channel (AMF) has been suggested wherein the separating window length is broadened pixel by means of the use of pixel to get clamor loosened pixel. This channel out achieves appropriately at low densitie. anyway at radical thicknesses the development of window period prompts obscuring of photo [5]. After that scientists have conveyed Switching Median channel [6], [7]. This channel out utilizes pre-defined limit charge for improving the undermined picture. overwhelming drawback of this channel out is that characterizing powerful choice is problematic and data and edges are not recuperated at radical thicknesses commotion degree. to vanquish the above channels impediment decision based calculation (DBA) has been suggested [8]. on this arrangement of rules picture is denoised the utilization of 3x3 window. here the pixel is handled fine if its charge is both zero or 255 in any case it's miles left unaltered. At extreme thickness commotion confirmation this

impacts in middle worth of 0 or 255 that is again uproarious. In such case network pixel is utilized for a promising circumstance. anyway the rehashed substitution of adjoining pixel produces streaking sway [9]. with the goal to stay away from this detriment, choice based absolutely Un-symmetric Trimmed Median channel (DBUTMF) [10] is suggested. This channel out has a place with the DBA intimate. on this reasonable out instead of disposing of from network pixel un-symmetric managed middle rate is taken. At extreme densitie in the event that the picked window fuses every one of the 0 or 255 or each, managed middle cost cannot be utilized. So this outcomes dreadful at unreasonable densitie this is at eighty% to ninety%. To avoid this we stream for changed determination fundamentally based Un-symmetric Trimmed Median channel (MDBUTMF) [11]. the entirety of the above calculations do now not perform pleasantly at high densitie. to defeat changed Non-Linear channel (MNF) [12] is suggested. It surrenders higher give result at unnecessary densitie. It yields preferable outcomes over all past calculations at radical densitie with better pinnacle signal-to-Noise Ratio (PSNR) and photo Enhancement component (IEF) values. in any case, the yield stop results isn't a deal glad and the suggested calculation gives tons higher outcome than the entirety of the recently planned calculations.

III. PROPOSED ALGORITHM

The suggested upheaval end the usage of changed First Order social class mean channel (MFONMF) estimation techniques every single pixel of the packaging through distinguishing the noisy pixel inside the assortment of video. This game plan of rules is basically established commonly on windowing approach so a least period window 3 x 3 is taken from each packaging of video to decrease the unpredictability. here the pixel of redirection is the center pixel known as dealing with pixel P (I, j). Dealing with pixel is checkered whether it's miles loud or uproar disengaged through affirming that the pixel lies among by and large (255) and least (zero)grey stage regards. Accepting the pixel is in a critical number of the extent of faint testament, the pixel is without upheaval in some other case the pixel is demolished pixel and it's far took care of to get displaced with the clatter free pixel cost. Unadulterated pixels that exist in the compass are left unaltered.

FLOW CHART

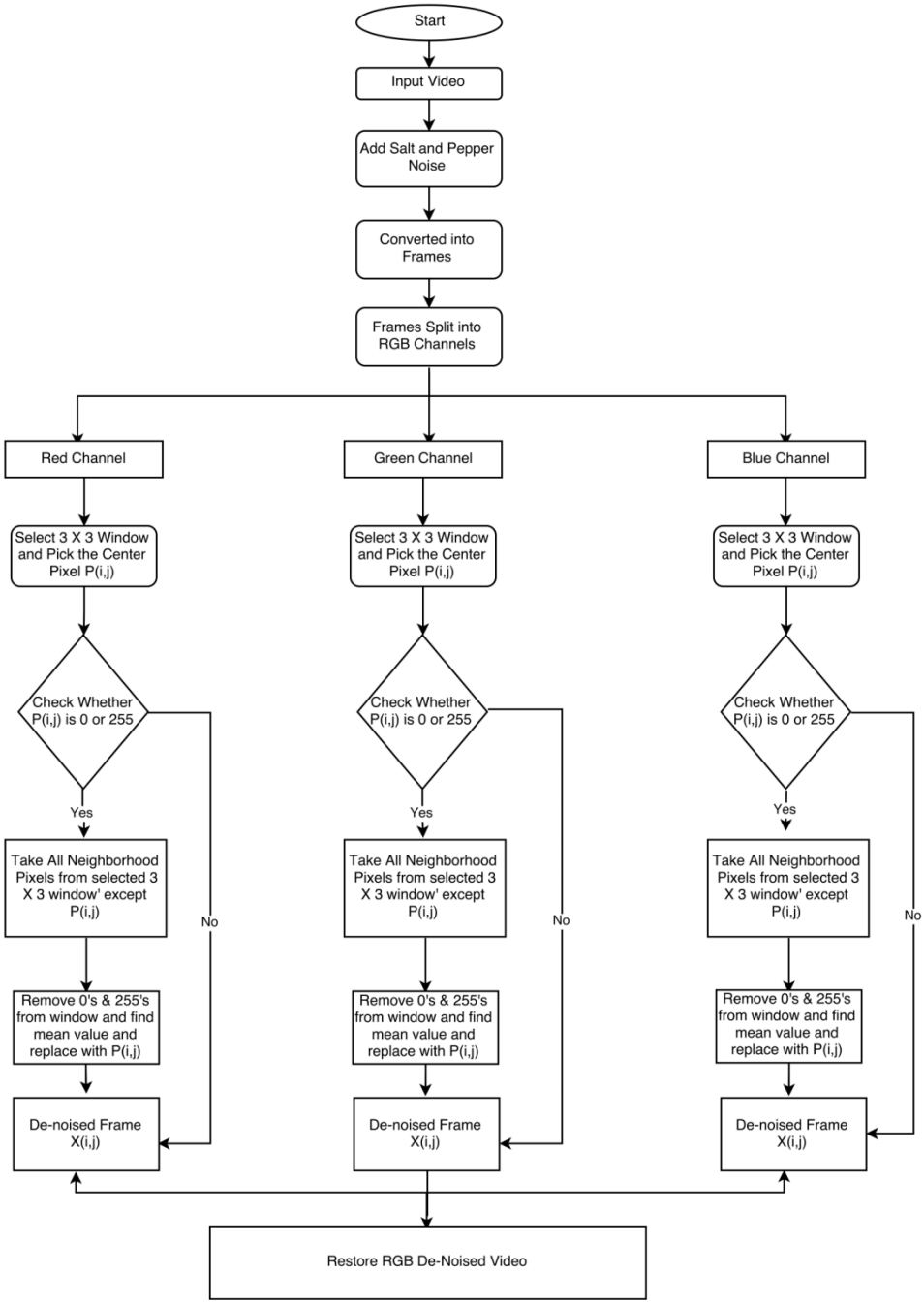

Figure 1. Flow Chart

3 Procedure For MFONMF

The stairs for the algorithm are as monitors:-

Step 1: First we take an preliminary coloration body from video and observe on it regular cherishedcompulsion noise (Pepper and salt noise). This colour body is delivered as Y [1] and similarly all processing frames are stored within the form of array Y.

Y [1: No of frames].

Step 2: inside the 2nd step cut up the body into RGB thing. by using taking crimson, inexperienced and Blue pixels for examination noise.

Step 3: Now in 0.33 step the pixel is study and administered with the aid of the use of the subsequent steps:-

Step 3.1 first of all take a look at whether or now not the pixels are among 0 to 255 degrees or not, right here instances are engendered. If the dispensation pixel lies in among zero and 255 (zero in any other case Case 2 is trailed. here l(i, j) is the photo treating pixels.

Case 1- If Pixels are amongst 0 be noise free and bypass to repair the photograph.

Case 2- If the pixel does not untruth in the variety then they're enthused to step three.2.

Step 3.2: in the second step we can work on noisy pixel of step3.1 now choose a window W (i, j) of size 3 x 3. Expect that the dispensation noisy pixels are X (i, j), that is treated within the next step.

Step three.3: If the desired window incorporates now not all element as 0's and 255's. Then cast off all of the zero's and 255's from the window, and discover the recommend of the last pixels. Then circulate the desired window across one step of all four directions (left, proper, top, and backside) as proven in underneath parent. Now discover the mean price for all windows then replace X with the calculated over all suggest price from all windows. This noise uninvolved frame reinstates in denoised frame on the final step.

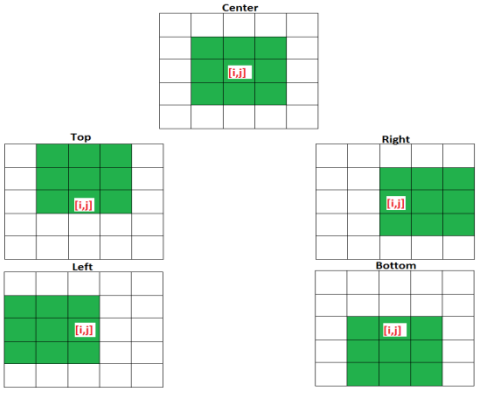

Figure 2. Sample window selection for de-noising

Step 4: Recurrence step 3.1to 3. 3 for RGB apparatuses. For green the noisy pixel are characterized via using m (i, j) and for blue the noisy pixel are characterized by way of n (i, j). additionally the reinstated frame is signified by using Y (i, j) and Z (i, j) correspondingly.

Step five: complete manner is completed until all pixels red, inexperienced and blue within the entire body are treated. And sooner or later the RGB additives are compound to get the very last denoised frame.

Step 6: Extracted frames are merged into the denoised color video.

subsequently a higher denoised video is received with upgraded PSNR, IEF and moreover indicates a higher video with very low distorting and enhanced visible and human notion.

CASES HANDLED BY MFONMF

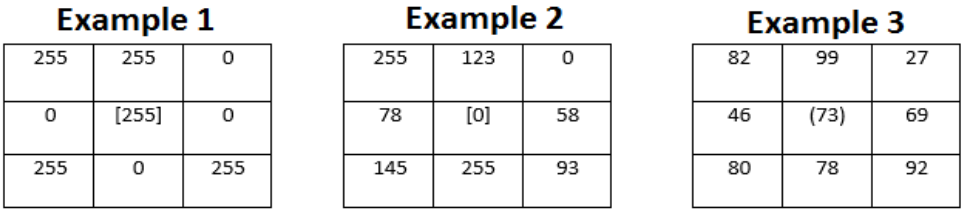

Figure 3 CASES HANDLED BY MFONMF

Case I): In the present circumstance after the 3x3 window is chosen the handling pixel is checked and assuming the preparing pixel incorporates 0 or 255 pixel rate, that pixel is uproarious pixel for example Pepper and salt commotion. Presently if the preparing pixel is loud the organization pixels are checkered in the event that the entirety of the adjoining pixels esteem additionally are 0 or 255, mean of the including pixels are determined and changed with the cost of handling pixel. In the event that middle of the enveloping pixel is taken, it'd some other time offer a noisy pixel charge for example 0 or 255. In this way, prompt is liked in contrast with middle. The grid structure for the case is checked above in model I. The exceeding network comprises of a ran line square shape that is the picked 3x3 window where '255' is the preparing pixel and every one of the various qualities encompassing the handling pixel are0 or 255.

Case ii): In this model if the chose 3x3 window comprises of preparing pixel as 0 or 255 and the local area pixels are not every one of the zero or 255 then the handling pixel is loud and it must be supplanted so the pixel is altered through utilizing winning one dimensional exhibit of the network. the present circumstance framework shape is appeared in example II in which the ran line square shape show the picked 3x3 window with 'nothing' as the handling pixel and now not the entirety of the organization pixel are 0 or 255. Presently to wipe out commotion we're equipped for take one dimensional exhibit of the nearby pixel here in model II the cluster may be [255123 0 78 0 58 145 255 93]. At that point zero and 255 are eliminated from the cluster so the exhibit transforms into [123 78 58 145 93].Now propose of the qualities are determined and handling pixel is changed with the suggest of the qualities in cluster. Presently the handling pixel cost is commotion loosened and not, at this point zero or 255.

Case iii): The preceding case show that if the chose window covers a commotion free pixel not 0 or 255 anyway the expense among 0 to 255 because of the reality the preparing pixel then it does at this point don't need any vicissitudes and it's extreme left unaltered. As exhibited in occurrence III the ran line demonstrations the 3x3 settled on window with preparing pixel as '73' that is a commotion loosened pixel. since it a commotion free pixel it does now not need any preparing and left unaltered. every one of the three cases are checkered for every and each pixel esteem afterward 3x3 window is molded and the handling of the pixel is accomplished as refered to in unquestionably one of a sort times. This handling offers the clamor free body with out a boisterous pixel. here commotion way pepper and salt as we are seeing loud pixel 0 or 255.

4 Formula

Presentations are quantitatively unhurried with numerous noisesthicknesses for peak-signal-to-Noise Ratio (PSNR), suggest rectangular blunders (MSE) and image Enhancement element (IEF) described (1), (2) and (3) correspondingly:

$$PSNR = 10\log_{10}\frac{(255)^2}{MSE} \qquad (1)$$

$$MSE = \frac{\sum_{i=1}^{m}\sum_{j=1}^{n}\{Y(i,j)-\hat{Y}(i,j)\}^2}{m\times n} \qquad (2)$$

$$IEF = \frac{\sum_{i=1}^{m}\sum_{j=1}^{n}\{\eta(i,j)-Y(i,j)\}^2}{\sum_{i=1}^{}\sum_{j=1}^{}(\hat{Y}(i,j)-Y(i,j))^2} \qquad (3)$$

Here m x n is the dimensions of the image. Y (i, j) characterizes the authentic photo and Y ̂(i, j) characterizesdenoised photo and η (i, j) characterizes noisy photo. The noise thickness is diverseinto 10% to 90%. The consequences illustration advanced presentation.

5Results

Figure 4

Figure 5

Figure 6

Figure 7

TABLE I: Comparison of PSNR Values of Different Algorithms

Suggested Filter	Noise Density (%)								
	10	20	30	40	50	60	70	80	90
MF	28.49	25.75	21.84	18.40	14.73	12.23	9.98	8.02	6.57

A M F	21.98	21.92	21.47	21.40	20.65	18.40	14.85	11.29	8.06
P S M F	23.34	22.13	21.47	19.02	16.45	14.67	11.90	10.9	9.07
D B A	25.75	21.84	18.40	17.73	17.23	12.98	11.02	9.09	6.99
M D B A	27.89	26.45	24.56	23.45	22.13	21.47	20.04	17.23	15.56
MDBUTMF	28.98	25.67	24.73	22.13	21.47	21.40	20.65	18.40	16.85
M N F	35.09	33.45	30.34	28.90	27.90	25.67	24.73	22.13	21.47
M F O N M F	42.12	40.03	38.12	36.23	32.01	28.98	25.67	24.73	22.13

TABLE II: Comparison of IEF Values of different Algorithms

Suggested Filter	Noise Density (%)								
	10	20	30	40	50	60	70	80	90
M F	23.42	21.12	13.32	11.21	10.3	9.08	8.09	7.78	6.12
A M F	19.43	18.1	17.78	16.0	13.32	11.2	10.23	9.08	8.09
P S M F	29.56	26.78	21.84	18.40	14.73	12.23	9.98	8.02	6.57
D B A	31.23	28.49	25.75	21.84	18.46	14.73	12.23	12.01	10.34
M D B A	33.65	29.56	26.78	21.84	16.0	13.32	11.2	10.23	9.08
MDBUTMF	34.54	32.56	28.78	24.84	18.40	18.21	14.73	12.23	9.98
M N F	37.67	36.76	32.3	30.05	24.75	20.02	18.40	14.73	12.23
M F O N M F	**54.72**	**53.77**	**51.30**	**49.16**	**47.41**	**42.20**	**42.10**	**40.01**	**38.27**

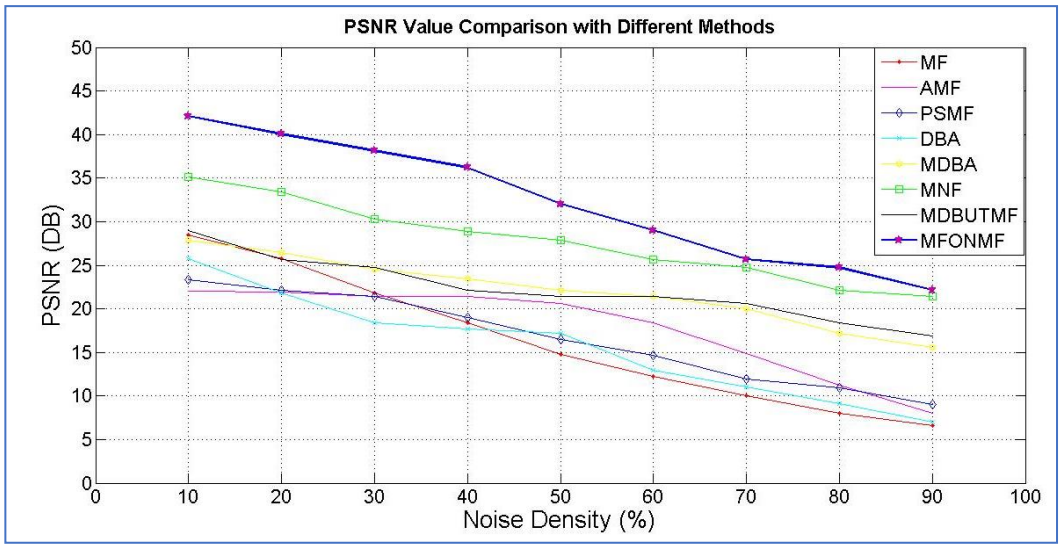

Figure 8 Noise density versus PSNR (db)

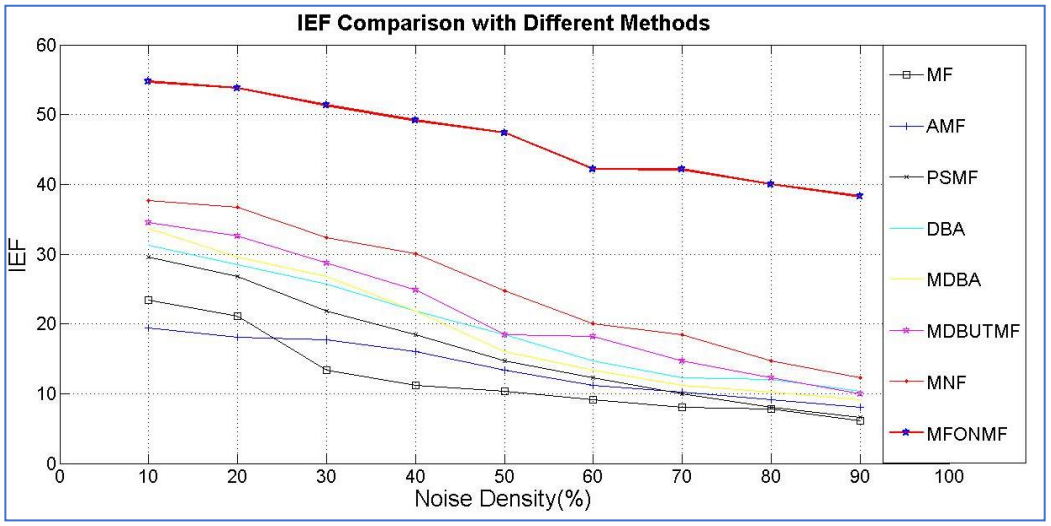

Figure 9 Noise density versus IEF

5Conclusion

A new set of procedures (MFONMF) has been suggested for random noise elimination at better thicknesses noise eighty% to ninety%. This algorithms give higher consequences than PSMF, DBA MF,MDBAAMF and extra present algorithm in phrases of IEF andPSNR. Future paintings can be removing the random noise instead of impulse noise from excessive great movies with better PSNR values.

References

[1] T.A. Nodes and N.C. Gallagher, Jr., "The output distribution of median type filters," IEEE Trans. Communication, 32(5): 532-541, 1984.

[2] H.Hwang and R.A.Haddad, "Adaptive median filters: new algorithms & results," IEEE Transactions on image processing, Vol. no:4, pp.499-502, 1995.

[3] J.Astola and P.Kuosmaneen, Fundamentals of Nonlinear Digital Filtering, 1997.

[4] S.Zhang and M.A. Karim, "A new impulse detector for switching median filters," IEEE signal Process.Lett., vol. 9, no. 11, pp.360-363, Nov. 2002.

[5] Karthik, B., Kumar, T.K., Dorairangaswamy, M.A., Logashanmugam, E., Removal of high density pepper and salt noise through modified cascaded filter, Middle - East Journal of Scientific Research, 2014, 20(10), pp. 1222–1228

[6] Fanzhi Kong, Wenbin Ma, "A Fast adaptive Mean Filtering Algorithm,", 2nd International Conference on Industrial and Information Systems, IEEE 2010.

[7] P.E. Ng and K.K.Ma, "A switching median filter with boundary discriminative noise detection for extremely corrupted images," IEEE Trans. Image Process., vol. 15, no. 6, pp. 1506-1516, Jun 2006.

[8] K.S. Srinivasan and D.Ebenezer, "A new fast and efficient decision based algorithm for removal of high-density pepper and salt noise in image," EURASIP J. Adv. Signal Process, 2010.

[9] Karthik, B., Kiran Kumar, T.V.U., Noise removal using mixtures of projected gaussian scale mixtures, World Applied Sciences Journal, 2014, 29(8), pp. 1039–1045

[10] K.S. Srinivasan and D.Ebenezer, "A new fast and efficient decision based algorithm for removal of high-density impulse noises," IEEE Signal Processing Letters, vol. no:14 pp.189-192, 2007.

[11] V. Jayaraj and D. Ebenezer, "A new switching-based median filtering scheme and algorithm for removal of high-density pepper and salt noise in image," EURASIP J. Adv. Signal Process. 2010.

[12] K.S. Srinivasan, V.Jayaraj and D.Ebenezer, "A new and efficient algorithm for removal of high-density pepper and salt noise in images and videos," Second Int. Conf. Computer Modeling and Simulation, 2010, pp. 409-413.

[13] Karthik, B., Krishna Kumar, T., Vijayaragavan, S.P., Sriram, M., Removal of high density pepper and salt noise in color image through modified cascaded filter, Journal of Ambient Intelligence and Humanized Computing, 2020

[14] S.Esakkirajan, T.Veerakumar, AdabalaN.Subramanyam, and C.H.PremChand, "Removal of high Density Pepper and salt Noise Through Modified Decision Based Unsymmetric Trimmed Median Filter," IEEE Signal Processing Letters, vol. 18, no.5, May 2011.

[15] T.M.Benazir and B.M.Imran, "Removal of High and Low Density Impulse Noise From Digital Images Using Non Linear Filter," International Conference on Signal Processing, Image Processing and Pattern Recognition, [ICSIPR) 2013.

[16] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.

[17] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9

[18] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.

[19] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020

[20] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2

[21] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.

[22] Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

Robust Image Authentication Using Optimized Haralick Features Based on Genetic Algorithm

K.Alice[1]
{k_alice_suresh@yahoo.com[1]}

Department of IT, Bharath Institute of Higher Education and Research,
Selaiyur,Tambaram,Chennai, Tamilnadu, 600 073, India.[1]

Abstract. Recent development in multimedia data increases the role of digital images in many applications. As a result,content based image authentication with an aid of feature extraction techniques has a great impact. It suffers a serious drawback of increased computational complexity due to the availability of irrelevant and interdependent features, which contains no useful information about the image. In the proposed authentication system to decrease the complexity, not all haralick features are used but only the most influencing features that contain critical information about the image is used in hash generation. Feature selection based on chaotic genetic feature selection optimization algorithm is used to optimize the haralick features without compromising the accuracy of the system. A comparison on the system performance with all the features and with optimized features is performed. Experiment results shows resultsusing optimized features are similar to the results of using all the features..

Keywords: Genetic Algorithm, Optimized Haralick Feature, Chaotic Genetic Feature Selection optimization algorithm, Circular Blocks, Rotation invariance, Authentication system..

1 Introduction

The widespread use of digital images in multimedia data increased the need for image authentication which validates the uniqueness of image. For an image, it is enough to authenticate the content of the image rather than the image as a whole. Image authentication is highly essential in various applications like medical images, court evidence images, property documents, quality control images, military target images etc., where alteration in image cause severe damage.Schneider et al [17] used histogram as image features to generated hash code which suffered a drawback of long signatures. Nilesh et al [13] in his paper generated hash using fuzzy color histogram and it fails to detect color pixel manipulation. Another useful feature to represent image is edges as proposed by Canny [3] and it does not report recover of lost data. DCT,DWT and wavelet transform Storck et al[19], Wu et al[23], Lin et al[10],Sun et al[20]are also used to represent image content but it cannot recover lost data. In Kailasanathan et al [8] uses statistical measurese to generate lengthy hash code. Moments are global descriptors [9] are set of values that represent the information contained in the image.

Two or more hash generation techniques are mixed up in hash code generation process. Seyedamir [18] uses strict and selective authentication using AMAC. Tri.H.Nguyen et al[21] combines SVD and DWT to generate watermark but problem of localization and tamper recover was addressed. Lima Sebastian et al [9] and Yan Zhao et al[24] use global and local features to produce hash and does not address image recover in case of even accidental loss of data.Obaid et al [14] generated a watermark usinginformation of spatial and frequency domain also partial recovery of lost content is addressed using RS codes. M.F.Hashmi at el [11], combines SVM and HMM classifiers to calssify the image as authentic or not.

The basic requirement of a good authentication system can be given as follows [2]: Robustness- The system should tolerate content preserving transformations. Security- The system should be able to protect the data from malicious attack. Sensitivity- The system should detect any content modifications or manipulations. Localization - The system should be able to locate the area of tampering. Recovery- The system should be able to reconstruct the tampered regions. Complexity - The system must be neither complex nor slow. Portability- The system should be able to hold image and its signature together.Features are used to describe the content of an image. Not all the features contain useful information about the image. Feature selection [7] is an optimization process that reduces the dimensionalities in the underlying feature space. Suppose there are n numbers of features then there will be 2^n possible subsets for that feature set.

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Feature selection is the process of selecting k < n features from that feature subset that are most influencing features and that best describe the image without compromising the accuracy of the system. Feature selection process removes irrelevant and interdependent features, thereby reducing the time complexity in features analysis and training. Also it reduces the overall computational model.

Optimization problem is a mathematical term that is used to either maximize or minimize any given objective function. Objective function is problem specific. Many optimization algorithms are widely used now a day; which include both local and global optimization. Unlike local optimization which uses a single design point, global optimization uses a set of design points to find an optimum solution. Global optimization algorithms are much preferred since they provide a global optimal solution rather than converging to a local optimal solution. The most commonly used global optimization algorithm [6] includes

- Genetic algorithm
- Particle swarm optimization
- Colony optimization
- Harmony search
- DIRECT deterministic algorithm
- Tabu search
- Evolutionary programming
- Genetic programming etc.

Out of the above mentioned algorithm, each having its own advantages and limitations, Genetic algorithm is the most commonly used algorithm because it is a probabilistic, robust and heuristic search algorithm that depends on natural selection. It is a transparent algorithm that always provides a sub optimal solution. It can be applied to any search space in any domain. Premature convergence is a major problem of genetic algorithm that increases the number of iterations in achieving global optimal solution.Many advanced versions of genetic algorithm are also introduced by researchers to eliminate the problem of premature convergence.Chaotic Genetic optimization algorithm is one such advanced algorithm that has the potential to provide global optimal solution by introducing chaotic variables in GA processes thereby eliminating local convergence.

The paper is organized as follows: Section II gives a brief description about Genetic Algorithm and Chaotic Genetic algorithm. Section III explains our proposed work. Section IV provides a performance analysis based on the requirement of authentication system. Section V concludes the paper.

2 Methods and Materials

Genetic Algorithm (GA)

Genetic Algorithm is a bio inspired optimization algorithm that works on the principle of survival of the fittest. The basic idea of GA is borrowed from the biological process of survival and adaptation. GA is different from classical search algorithms in the following ways: There is no limitation in the search space;it uses natural selection criteria, parallel computation of the population of solutions.GA uses a simple chromosome like data structures and applies techniques inspired from natural evolution like selection, mutation and crossover to these data structures so as to retain the critical information.

The general steps in genetic algorithm are as shown in Figure 1.

Step 1: Randomly create initial population

Step 2: The population is ranked based on fitness function

Step 3: Parents are randomly selected for reproduction. While selecting the parents higher ranked individuals are given preference usually

Step 4: Create children by randomly mixing the selected parents by process called crossover and mutation.

Step 5: Calculate the fitness function for the children and check whether desired solution is obtained. Otherwise if children fitness is better than parent remove parent from the population and add children

Step 6: Repeat steps 3 and 4 with the newly generated population until optimal solution is reached.

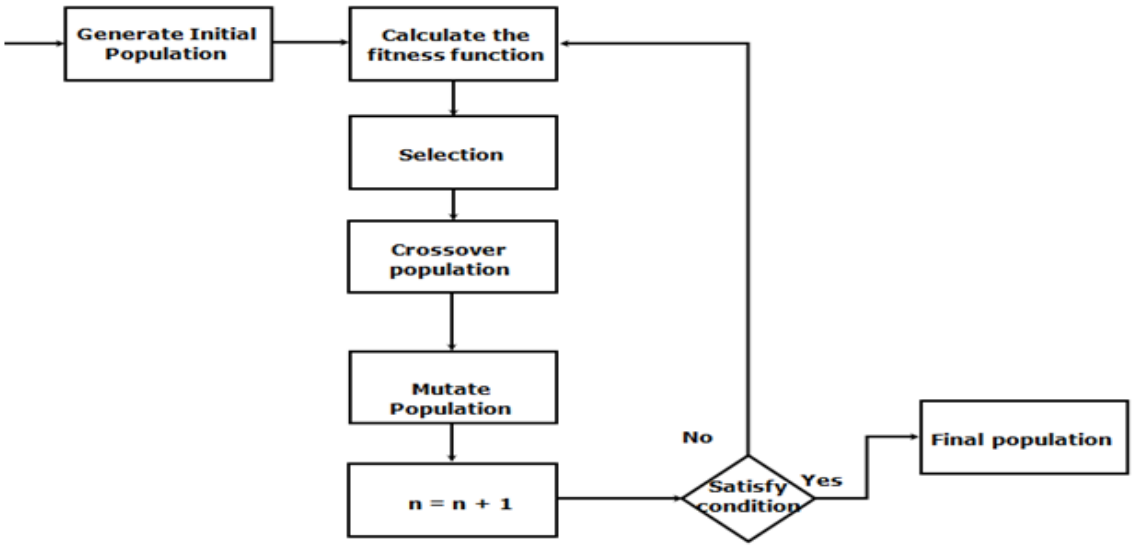


Figure 1: Basic Block diagram of Genetic Algorithm

If Pc (probability of crossover) is too large, then the genetic pattern is damaged easily and individual structures with high fitness value will be destroyed soon [12]. If Pc is very small, the convergence becomes slow. If Pm (probability of mutation) is too large, GA becomes similar to random search algorithm. if Pm is too small, it will be very difficult to produce new individual structures. If the population size is increased, this will reduce the number of iterations required for global optimum.GA is probabilistic and not deterministic. It is evolved into a better and better solution in each iteration. It works with the coding of solution and not with solutions themselves. The presence of a feature in a feature subset is encoded as 1 it is encoded otherwise as 0. Genetic algorithm suffers a serious drawback of converging to either local maxima or local minima. Due to this drawback of premature convergence the number of iterations for global optimal solution is also increased. This problem of premature convergence can be avoided by using advanced genetic algorithm like chaotic genetic algorithm which introduces chaotic variables to create diversity in population so as to avoid local convergence.

Chaotic genetic Algorithm (CGA)

Chaos is a confusing behavior of a nonlinear dynamic system that depends on initial conditions and is described using deterministic algorithm. Chaos feature is very important that improves the efficiency of Genetic Algorithm. The three main properties [15] of chaotic behavior are Ergodicity, Randomness, and high sensitive to initial condition. Ergodicity property allows the chaotic variables to travel in all states without repetition in a certain range of space and hence avoid falling into local minimum solution in optimization problems. Sensitivity to initial condition maintains population diversity, that is, no two identical new populations are very close.

Chaotic genetic algorithm is similar to ordinary genetic algorithm but to introduce chaotic behavior instead of random sequence used for crossover and mutation, logistic map output sequences is used for crossover and mutation. The basic steps in CGA are as shown in figure 2. And by comparing figure 1 and figure 2 the difference shows that the chaotic behavior in CGA is implemented using logistic chaotic function. The logistic chaotic function provides the necessary chaotic behavior that maintains population diversity, Randomness, and Ergodicity and has the potential to produce global optimal solution.

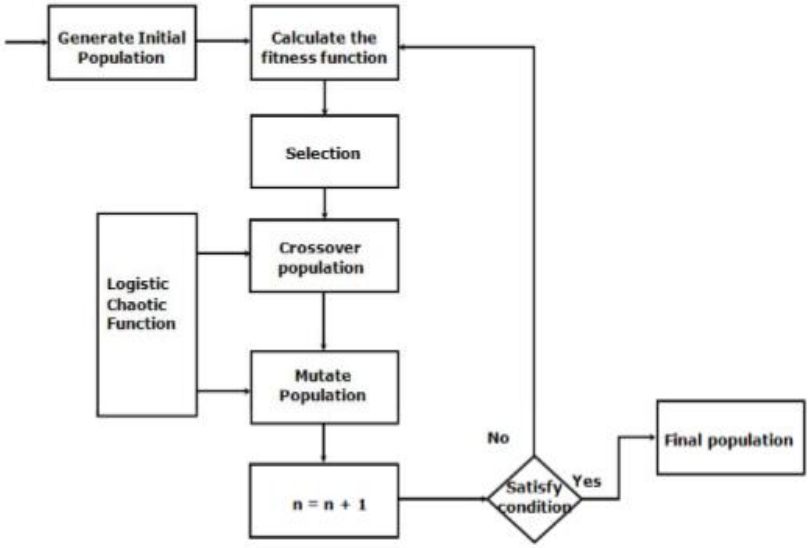


Figure 2: Basic Block Diagram of Chaotic Genetic Algorithm

Logistic Chaotic Function

The simplest form of chaotic map is the logistic map [7]. This map is a polynomial mapping of degree 2 given as

$$Z_{n+1} = r\, Z_n(1-Z_n) \quad \text{where } Z_n \in \{0,1\}$$

Here 'r' should take values between 0 and 4. If r € {0,3}, the behavior is convergent. If r € {3,3.5}, then periodic. If r € {3.5 ,4}, it represents chaotic behavior. So to ensure chaotic behavior r should be taken as 4.

3 Proposed Image Authentication System

Pre-processing

In preprocessing stage the image is converted to a standard 512 X 512 square image using bilinear interpolation which is done to reduce computational complexity. Since color information is not an important discriminating parameter, the image is converted to gray scale image. Then a low pass Gaussian filter is applied to remove any unnecessary additive noise. The size of the image is fixed to have uniform complexity in handling all images.

Next the preprocessed image is subjected to image division to generate local features. Instead of dividing the image into square blocks to achieve rotation invariance the image is divided into equal area circular blocks. The division of blocks algorithm is [25]as shown below

Step 1: The center (x_c,yc) for the set of circular blocks is given as where m=512 is the size of image

$$if\ m = even \begin{cases} x_c = \frac{m}{2} + 0.5 \\ y_c = \frac{m}{2} + 0.5 \end{cases} \quad if\ m = odd \begin{cases} x_c = \frac{(m+1)}{2} \\ y_c = \frac{(m+1)}{2} \end{cases}$$

Step 2: The radius r_k(k=1,2,3,….n) of each concentric circle from the center is given as where n is the number of rings and is 64

r_1.radius of the inner circle = $\sqrt{\frac{\mu_A}{\pi}}$. Where $\mu_A$is the average area of each ring and is given as A/n

r_n.radius of the outer circle=floor(m/2).

r_k .radius of the intermediate circle r_k(k=2,3,….n-1) = $\sqrt{\frac{\mu_A + \pi(r_{k-1})^2}{\pi}}$.

Step 3: The distance from $q_{ij}(x_i,y_j)$ to the image center x_c,y_ccan be measured using Euclidean distance

$d_{ij} = \sqrt{(x_i - x_c)^2 + (y_j - y_c)^2}$.

The set of pixels that form each ring block can be obtained using

$R_1=\{q_{ij}|d_{ij} \leq r_1\}$and $R_k=\{q_{ij}|r_{k-1} < d_{ij} \leq r_1\}$ where k={2,3…n}

Now each R_k for k= {1,2,3….n} will contain the set of pixels of the circular blocks of equal area that forms the image .

First the center of the image is calculated in step 1. Then the radius if n concentric circular blocks are calculated in step 2 and then the collection of pixels that form a specific circular block is identified based on the distance of radius in step 3. The result of this algorithm is a group of 64 blocks of pixels grouped together to form 64 circular block

Feature Extraction

The image features are extracted using first 13 Haralick features [16] as listed in Table 2. Haralick features are texture features that best represent the content of the image. They have proven to provide good results in literature. The Maximal Correlation Coefficient feature is not used in feature representation to reduce computational complexity.

Table 1: Haralick Features

Sl	Haralick Features		
1	Angular ond Moment	8	Sum Entropy
2.	Contrast	9	Entropy
3	Correlation	10	Difference variance
4	Sum of ares: Variance	11	Difference Entropy
5	Inverse ference ment	12	Information Measures correlation 1
6	Sum Average	13	Information Measures correlation 2
7	Sum of iance	14	Maximum Correlation efficient

The proposed system combines these haralick features with circular blocks to improve the hash performance. For an image, 13 haralick features are extracted. But always, not all features will contain the critical information. So the most influencing feature that contains the critical information about a particular image has to be selected using a proper feature selection algorithm.

Feature Selection

Features are used to describe the content of an image. Feature selection is also called as attribute selection [7] is an optimization algorithm.The “Curse of Dimensionality” is the common term used to refer the more large number of features available in the dataset and makes the methods or algorithms to struggle in clustering or classification. Feature selection is a way to filter the irrelevant and redundant features available in the data without compromising the accuracy of actual feature representation. Feature selection is a problem of finding a reduced feature subset while retaining the accuracy in representing the original features. Genetic algorithm is the most commonly used feature selection algorithm. Many advanced versions of genetic algorithm is introduced by researchers to eliminate the problem of permeating convergence. Chaotic Genetic Feature selection optimization (CGFSO) algorithm [7] is one such algorithm that has the potential to provide global optimal solution thereby eliminating local convergence by introducing chaotic variables in GA processes.

Chaos Genetic Feature selection optimization (CGFSO) Algorithm

The input will be a set of all 13 Haralick features. Features will not be used directly by the algorithm instead coding of feature subset is given as input. Each individual is represented as ($a_1,a_2,a_3,…a_n$) where each $a_i$corresponds to the ith feature. If a_i=1, feature is selected; else a_i=0. For each individual, fitness function will be evaluated. The two key factors used in designing the fitness function are classification accuracy and feature cost.

Individual with high classification accuracy and low feature cost has the high probability to be in the next generation. Fitness function [6] identifies the suitability of the solution. Fitness function is given as follows.

$$f(x) = \sqrt{Precision(x)^2 + Recall}(x)^2 - \lambda \times \frac{\delta(x) \times cost(x)}{Precision(x) + Recall(x) + 1} + cost_{max}$$

Where Precision (x) - test precision ratio
Recall (x) - test recall ratio
Cost(x) - sum of measurement cost of the feature subset represented by x
λ - the weighing factor ranges from 0 to 1.
$Cost_{max}$ - the sum of all outcomes measured with all 14 features and is the upper bound value.
$\delta(x)$ = 1 then x feature is included otherwise 0.

The search in the feature space, CGFSO algorithm works as follows. By taking a single image at a time, the following operations were done:

Algorithm

- Input to algorithm is set of 13 Haralick Features, P_m (Probability of mutation)and P_c(Probability of crossover)
- Step-1 Initial Population P(0) is a non-empty subset of all Haralick features and iteration K=0
- Step-2 Evaluate the fitness function f(x) for the population
- Step-3 Select 1/3rd of population that has top most fitness value and let his be P(k+1)
- Step-4 Perform logistic chaotic crossover operation for P(k) to produce C(k) and perform logistic chaotic mutation operation to C(k) to produce M(k)
- Step-5 Calculate the fitness value of M(k) and if fitness value is improving then the next population is P(k+1)=C(k) U M(k)
- Step-6 if the fitness value is reached the desired level or number of iterations the current population is returned as feature set otherwise increment k and proceed to Step-2.

The output of this algorithm is a set of k <13 most influencingfeatures that best describe the image.

1.1 Hash Code Generation

From the result of CGFSO algorithm the result of most useful K features are selected for each circular block of image and mean is calculated for each block and is represented as a row vector of size [1 X 64] and is stored in HF. Then the hash code is generated using the formulaH1= (HF + K1) mod 256 with a randomly generated key K1 containing values on range of 0-255

Hash Verification Phase

The hash code of trusted image H1 and the Hash code of received image H2 are compared to check for similarity using correlation coefficient measure. The image is authentic as far the content of the image is preserved.so pixel by pixel verification is not required. If correlation coefficient is greater than .95 it is authentic.

4 Experimental Set Up

Table 2: Experimental set up for CGFSO

S.No	Parameter	Value
1.	Population size	2^{13}-1
2.	Length of chromosome	13
3.	Pc	0.7

4.	Pm	0.2
5.	Subset Selection Method	Rank method
6.	Number of subset selected in each iteration	1/3rd of the population size
7.	Encoding	Binary
8.	Number of Iterations	100
9.	Desired fitness value	0.1
10.	Weighing factor	0.3

The result is measured by precision, recall, accuracy, sensitivity, specificity, and F measure.

5 Results and Discussion

A data set of 2000 image is utilized in performance measure. These images are downloaded from the web and for 50 unique image content preserving transformation like scaling, turn, watermark inserting, contrast change, Gamma remedy and zero mean Gaussian function are applied as recorded in Table 3. Thus, for each image 40 variations of images arises. The images are assaulted utilizing adobe Photoshop and MATLAB. The performance of the system is analyzed based on the requirements of a good authentication system.

For experiments two different datasets are used. First set contains 2000 images with all Haralick features and the second dataset contains 2000 images with 4 most influencing Haralick features obtained as a result of optimization being used.The results of Accuracy, sensitivity, specificity and F measure is as shown in Table.4.

Table 4: Result Summary

Criterion	Number of Features	
	All haralick Features	Optimized Haralick features
Classification accuracy	0.9625	0.9600
Sensitivity	0.9629	0.9737
Specificity	0.9629	0.9737
F Measure	0.9578	0.9689

Table 3: List of Content Preserving Manipulations

Content Preserving manipulation	Luminance	Geometric Distribution			Additive Noise	Watermarking
	Brightness and Contrast	Rotation	Scaling	Gamma Correction	Zero mean Gaussian noise	Text watermarking of length 10
Measured in ranges	Scale [+10,-10,+20,-20]	Degree [1 to 300]	% [0.5 to 2.5]	% [0.75 to 1.25]	Variance [0.3 to 0.9]	Opacity [10 to 100]
Number of Images	4	14	4	4	4	10

Figure 3 – 6 show the graphs for results shown in Table 4.After performing all the steps in CGFSO for all images, the most selected features are listed.The feature selection gives that energy homogeneity, correlation, contrast and entropy are most influencing features. It is observed that more than 96% of all the hash pairs have a correlation coefficient value of above .95. This result is similar to the results of using all features [1].

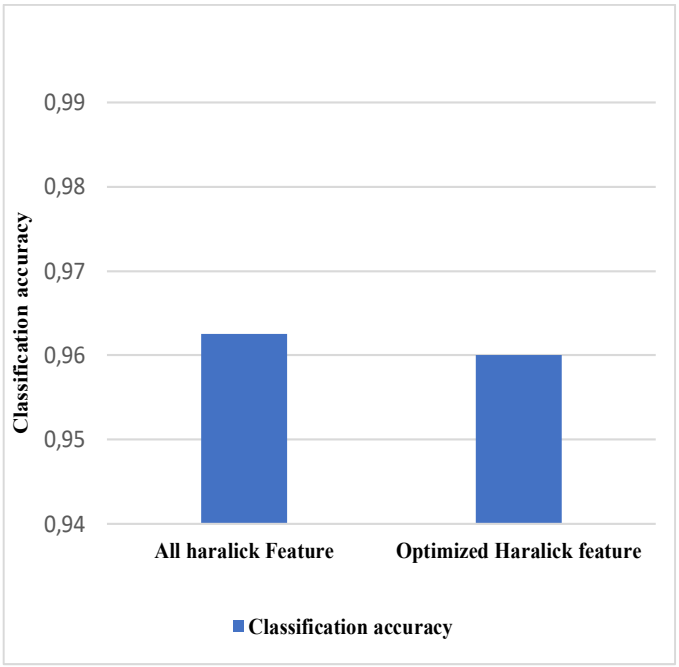


Figure 3: Accuracy of the proposed System

From Figure 3, it is clear that the proposed system using all Haralick features has higher classification accuracy by 0.25% compared to the system that uses optimized Haralick feature.

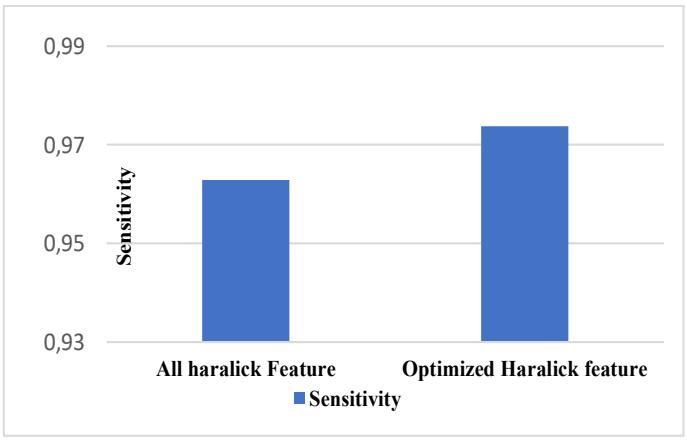


Figure 4: Sensitivity of the proposed System

From Figure 4, it is clear that the proposed system using optimized Haralick feature has higher sensitivity by 1.08 % compared to the system that uses all Haralickfeatures.

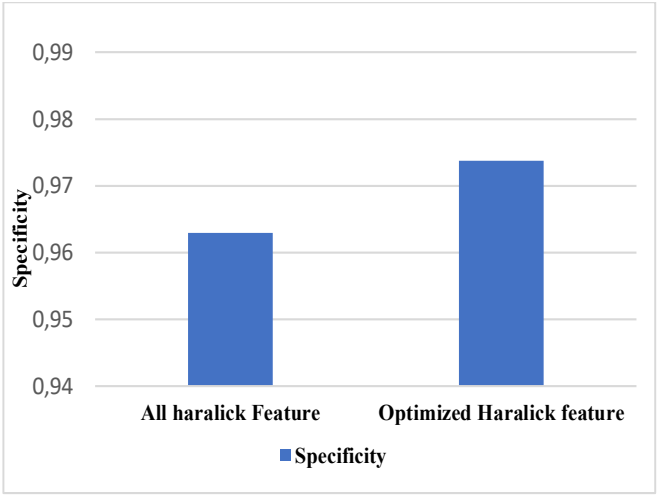


Figure 5: Specificity of the proposed System

From Figure 5, it is clear that the proposed system using optimized Haralick feature has higher specificity by 1.08 % compared to the system that uses all Haralick features.

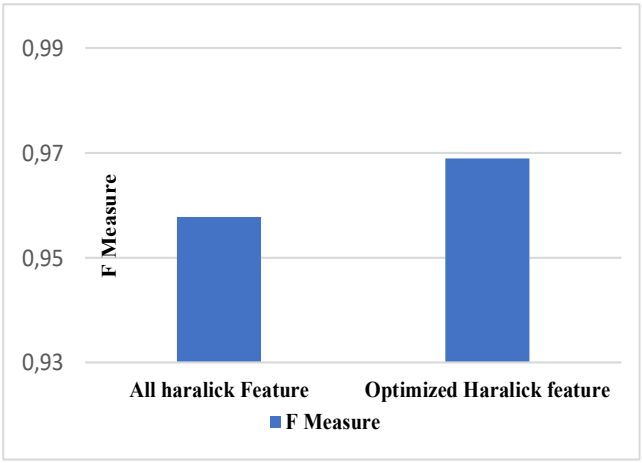


Figure 6: F Measure of the proposed System

From figure 6, it is clear that the proposed system using optimized Haralick feature has higher F measure by 1.11 % compared to the system that uses all Haralick features.

1.2 Robustness

Robustness is a measure of tolerance of the authentication system to content preserving manipulation. To measure the robustness of the proposed system a set of 5 standard images as shown in Figure 7 is taken.The result of Correlation Coefficient for various attacks for a set of 5 standard image processing images is graphically shown in Fig 8(a) -(f) and a comparison for the same with system using all Haralick features [1] is also shown. It is observed that the Correlation Coefficient S is above .95 for all types of attack listed in Table 2 except for rotation which is above .93.

1.3 Sensitivity

It refers to the ability of system to correctly specify forged image as forged. Our system correctly classifies images as authentic and forged. We observe that more than 96 % of all the hash pairs using reduced feature set have a correlation coefficient value of above 0.95.

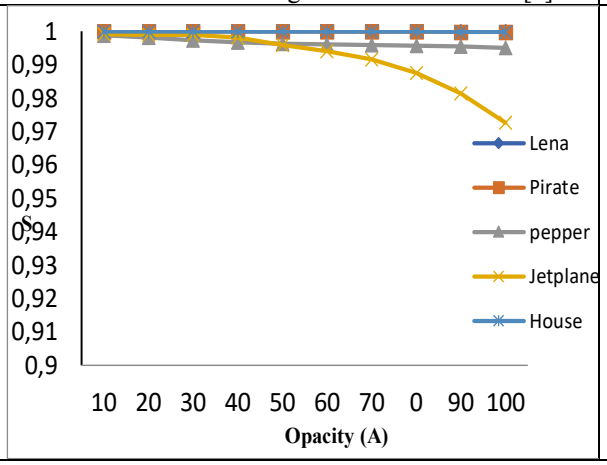
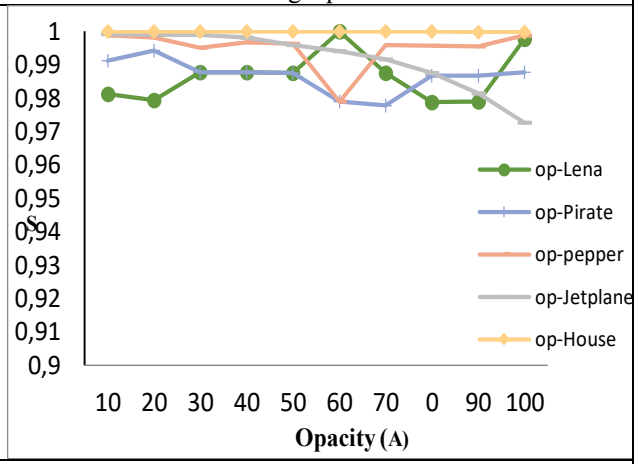
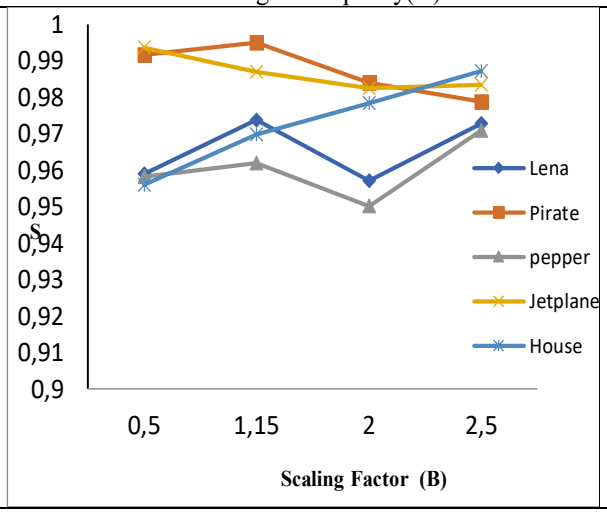
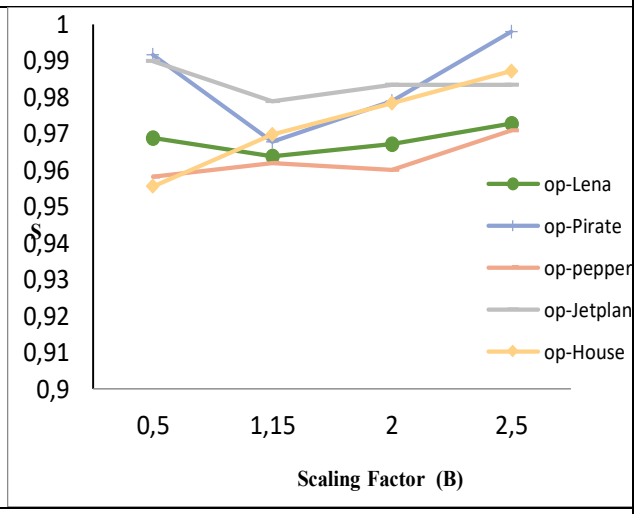
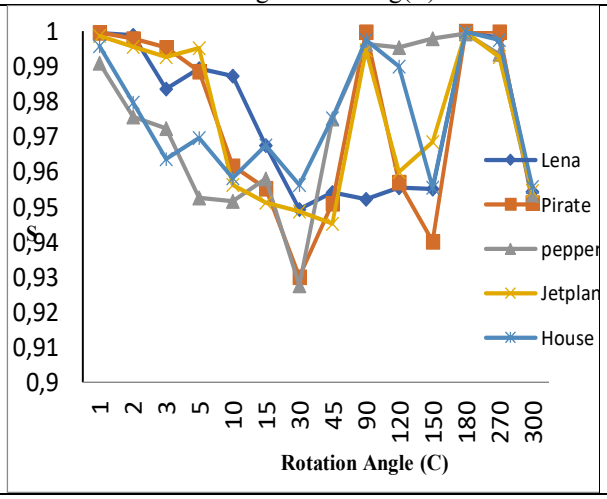
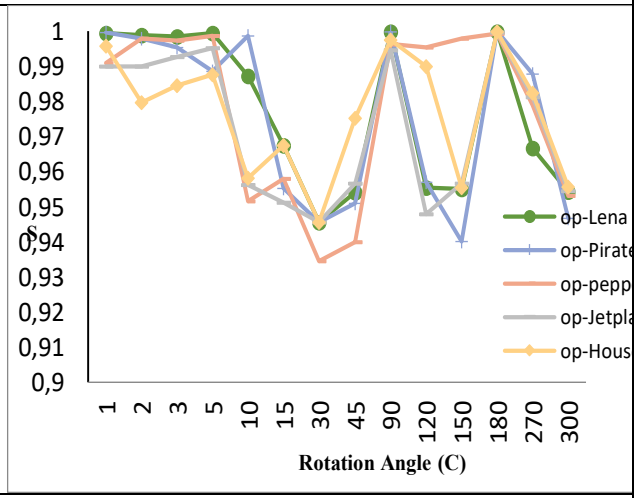
Figure 7: Set of 5 Standard Images taken for Robustness validation (a) House (b) Lena (c) Pepper (d) Pirate (e) Plane

Table 5: Comparison of Hash Performance

	Features Used	Hash Length	Robustness validation against				Ability to detect small area forgery	Ability to locate forged area
			additive Noise	slight cropping	small angle rotation	large angle rotation		
VWD method of [4]	Local	250 bits	Yes	Yes	Yes	No	No	No
NMF-NMF method of [22]	Local	64 – floating point numbers	Yes	Yes	No	No	Yes	No
Wavelet based method of [5]	Local	7168 bits	Yes	No	No	No	Yes	Yes
Proposed method	Local	320 bits	Yes	Yes	Yes	Yes	Yes	Yes

The purpose behind this lack is principally because of rotation, since it normally looks unusual when turned to bigger points. Since the rotated image has a critical extension and a few regions might be padded with dark or white pixels, so only the central part of the image of size 403 x 403 is considered for hash code.

The Classification performance is visualized using Receiver operating characteristic (ROC) curve where true positive rate and false positive rate are measure of robustness and sensitivity respectively. ROC curve is shown in Figure 9. Table.5 compares the proposed system with [4], [5], [22] all of these system uses local features for hash generation. This comparison reveals that our results outperforms in tolerating rotation to larger angles retaining tolerance to other content preserving transformation.

Robustness Validation using all Haralick Features[1]	Robustness Validation using Optimized Haralick Features
	
Robustness Validation against Opacity(A)	
	
Robustness Validation against Scaling(B)	
	
Robustness Validation against Rotation(C)	

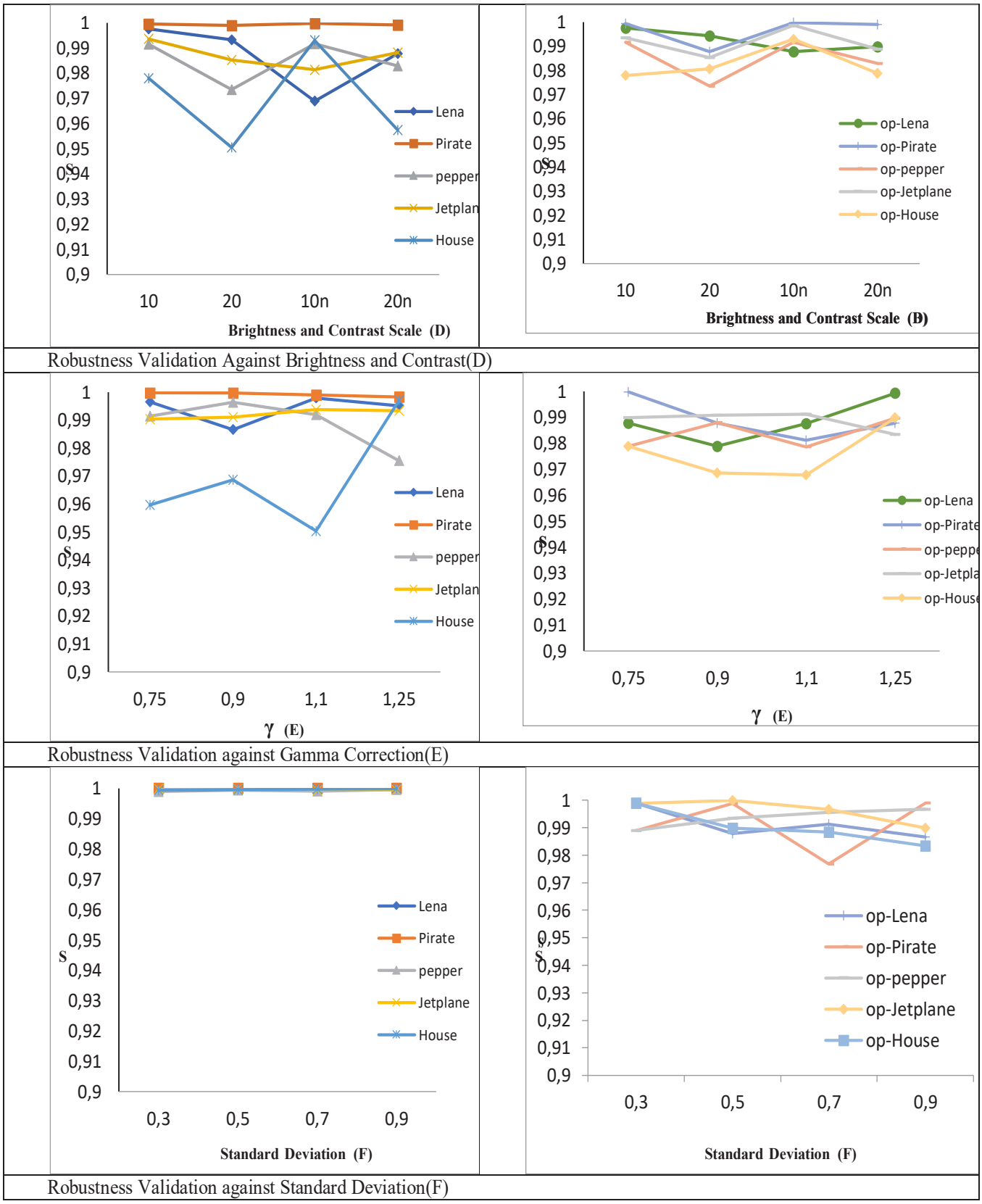


Figure 8: Robustness Validations against (a). Opacity (b).Scaling (c).Rotation (d).Brightness and Contrast (e).Gamma Correction (f). Standard Deviation

Tamper detection and localization

The proposed system has a 100 % achievement rate in localization and tamper detection. The threshold τ is taken as 0.95.The tampered circular block can be detected by from change in position of the hash code and by comparing the values of R_k of circular block we can locate the change in pixel value and from its corresponding d_{ij} we can locate the exact location of change in pixel value. From this we can locate the tampered regions successfully.

Table 6: Comparison of Average Time and Hash length

Algorithm	Average time (s)	Hash Length
[22]	1.153	64 decimal digits
[25]	*0.437*	64 decimal digits
[26]	1.429	42 decimal digits
[1]	2.563	*320 bits*
Proposed System	*0.739*	*320 bits*

The average run time required to generate hash code for 200 different images is compared with [22], [25], [26] and is shown in Table 6. The bold text in Table 6 represents optimum results.The average run time of [25] is 0.437optimum as it uses only one low complexity entropy as feature for describing images and for ours it is 0.739.The average run time of optimized Haralick features isimproved over all Haralick features [1] because of feature selection. Considering the space complexity in terms of hash storage, the hash length proposed system is optimum with only 320 bit.

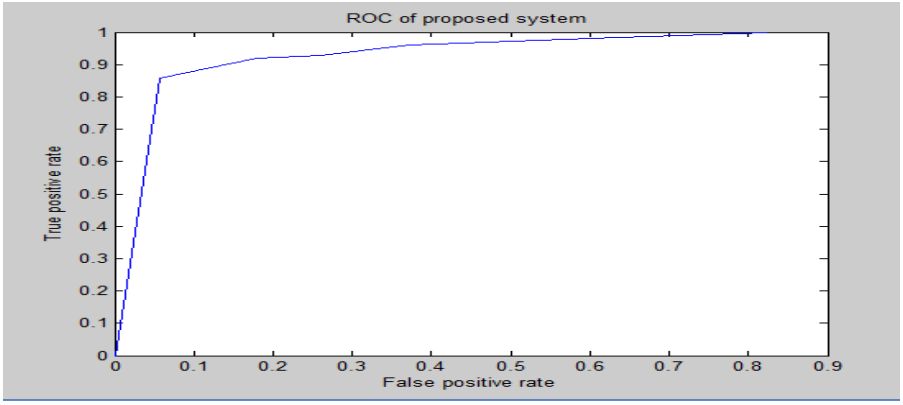


Figure 9: ROC Curve

Conclusion

The main purpose of feature selection is to eliminate irrelevant and interrelated features without reducing the accuracy of the system under consideration. The removed features add no useful information but they actively hinder the authentication process.In the proposed work, Image authentication was done by using hash functions. The circular blocks were used for HF feature extraction and most influencing HF was selected by Chaos Genetic Feature selection Optimization. Then the results were compared with the hash functions by using all HF. The experimental outcomes have shown that,results obtained by selected 4 features such as energy homogeneity, correlation, contrast and entropy are similar to those of using all the features.

References

[1] Alice, K, Ramaraj, N &Rajagopalan, SP 2020, "Rotation Invariant image authentication using haralick features" , *Multimedia tools and Applications,* Springer , Vol 79 no 1 pp 17211-17 225, Mar 2020

[2] A.Haouzia, R Noumeir, "Methods for image authentication A survey" ,*Multimedia tools and Applications*, Springer Vol 39no 1 pp1-46, 2008.

[3] Canny JF,"A computational approach to edge detection.",*IEEE Trans Pattern Anal Mach Intell*Vol 8 No6 pp 679–698,Dec 1986

[4] F.Khelifi and J.Jiang , " Preceptual image hashing based on virtual watermark detection,"*IEEE Transaction on Image Processing*, Vol 19, no 4, pp 981-994 Apr 2010.

[5] F.Ahmed, M.Y.Siyal, and V.U.Abbas, "A Secure and Robust hashing scheme for image authentication,"*Signal Processing,* vol.90 no.5 pp 1456-1470,2010.

[6] Gerhard Venter "Review of Optimization Techniques", *Encyclopedia of Aerospace Engineering in 2010 by John Wiley & Sons, Ltd.* Dec2010

[7] Hao Chen, Wen Jiang, Canbing Li, and Rui Li (2013),"A Heuristic Feature Selection Approach for Text Categorization by Using Chaos Optimization and Genetic Algorithm", *Hindawi Publishing Corporation Mathematical Problems in Engineering* Vol 2013, Article ID 524017, 6 pages ,2013

[8] Kailasanathan C, Safavi-Naini R, OgunbonaP ,"Image authentication surviving acceptable modifications". *IEEE-EURASIP, workshop on nonlinear signal and image processing*June 2001

[9] Lima Sebastian,AbrahamVarghese,Manesh.T ," Image Authentication by content preserving robust image hashing using local and global features",*Procedia Computer Science* Vol 46 pp 1554 – 1560 2015

[10] Lin CY, Chang SF,"A robust image authentication method distinguishing JPEG compression from malicious manipulation". IEEE Transactions On Circuits And Systems Of Video Technology, Vol. 11, No. 2, Feb 2001

[11] M.F.Hashmi,A.R.Hambarde,A.GKeskar, "Robust image authentication based on HMM and SVM Classifiers" , *Engineering letters* 22: 4 El-22-4-04-Nov 2014.

[12] Mohammad Javidi , RoghiyehHosseinpourfard, " Chaos Genetic Algorithm Instead Genetic Algorithm ", *The International Arab Journal of Information Technology,*, Vol. 12, No. 2, pp 163 - 168,Mar 2015.

[13] Nilesh,Dalton,Badal,Saroj,"Robust perceptual image hashing using fuzzy color histogram", *Multimedia Tool Applications*, Springer Vol. 77 No 23, p30815-30840 Dec 2018.

[14] Obaid Ur Rehman, S. Amir Hossein A.E. Tabatabaci, NatasaZivic,ChristophRuland, "Spatial and frequency domain complementary watermarks for image Authentication and Correction",*SCC 2015; 10th International ITG Conference on Systems, Communications and Coding*, Feb 2-5 2015

[15] Petra Snaselova ,Frantisek Zboril,(2015) " Genetic Algorithm using Theory of Chaos ",*ICCS 2015 International Conference On Computational Science , ProcediaComputerScience, Elsevier,* Vol51, pp 316–325,2015
[16] Robert M.Haralick, K.Shanmugam,Its'hakDinstein,"Textural features for image classification*",IEEE transaction on sytems , man and cybernetics*,vol 3. No 6. pp 610-621 Nov 1973.
[17] Schneider M, Chang S-F,"A robust content based digital signature for image authentication". *In: Proceedings of the IEEE international conference on image processing*, pp 227–230 1996
[18] Seyed Amir "Secure and robust two-phase image authentication", *IEEE transaction on multimedia*, Vol 17, No 7, ppno 945 -956 July 2015.
[19] Storck D,"A new approach to integrity of digital images". *In: Proceedings of the IFIP conference on mobile communication*, pp 309–316 1996.
[20] Sun Q, Chang SF,"Semi-fragile image authentication using generic wavelet domain features and ECC". *In: Proceedings of the ICIP*Vol 3 Sep 2002
[21] Tri.H.Nguyen,Duc.M.Duong,Duc.A.Doung,"Robust and High Capacity watermarking for image based on DWT-SVD", *IEEE RIVF, International conference on computing and communication Technologies Research Innovation and Vision for Future(RIVF)* 2015.
[22] V.Monga and M.K.Mihcak,"Robust and secure image hashing via non negative matrix factorizations",*IEEE Transaction on Information Forensics and Security*, vol 2, no 3 pp 376-390,Sep 2007.
[23] Wu CW,"On the design of content based multimedia authentication systems". *IEEE Transaction on Multimedia*Vol 4 No 3 pp 385–393, 2002
[24] Yan Zhao,ShuozhongWang,Xinpeng Zhang and Heng Yao "Robust Hashing for Image Authentication using Zernike Moments and Local features ",*IEEE Transactions on Information Forensics and Security*,Vol 8,No 1, pp 55-63, 2013
[25] ZhenjunTang,XianquanZhang,LiyanHuaug,Yumin Dai "Robust image hashing using ring based entropies", *Elsevier Signal processing*Vol 93 pp 2061-2069 ,2013.
[26] Z.Tang,Y.Dai,X.Zhang,"Perceptual hashing for color images using invariant moments", *Applied Mathematics and information sciences* Vol 6 pp 6435-6505,2012.

K.Alice received her PhD Degree in Information and Communication Engineering from Anna University,India in 2020, and the M.E Degree in Computer Science and Engineering from SathyabamaUniversity,India in 2005 and the B.E Degree in Computer Science and Engineering from MaduraiKamaraj University,India in 1999. She is currently working as an Associate Professor in Bharath institute of Higher Education and Research Chennai, India. Her research interests are in image processing, Deep learning and information Security

Remote Sensing Satellite Image Classification Using Neural Network

G.Karthik[1], M.Sangeetha[2], B.Karthik[3]
{[1]gkarthik7087@gmail.com, [2]sang_gok@yahoo.com,[3]karthikguru33@gmail.com}
[1]Research Scholar, Department of Electronics & Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, India
[2]Professor, Department of Electronics & Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, India
[3]Associate Professor, epartment of Electronics & Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, India

Abstract. Continuous monitoring of the geographical area of the Earth has become a necessity. Either to develop the infrastructure or to protect the resources of a region the right analysis of the geographical distribution has to be detected. Hence processing of satellite image of the region is the best solution. This paper proposes an approach for refining the detection and classification of various geographical regions like land, water, forest etc., in an area. Here the Convolutional Neural Network (CNN) classifier of deep learning technique is applied for processing the satellite image of the region under study using Matlab platform.

Keywords: Satellite, Classification, Convolution Neural Network, deep learning, Matlab.

1 Introduction

Global warming, Climatic changes, Industrial development, and Urbanization has made several changes to the landforms of the Earth. To know about the changes happened to a particular geographic region or to establish a makeover to a region terrain mapping is important. To study about the landforms like vegetation, water bodies, buildings present in a region an eagle eye view of that region is important. Remote sensing plays a major role for detection of physical features of the environment from a distant place like satellites. In satellite image processing the photograph of a particular region is captured in digital format and processed using machine vision to get the information required. It is a form of remote sensing where the pixel values are calculated for analysis. Multiple techniques and algorithms are developed to process the image, extract the facts required from the image and to classify them. Machine learning and deep learning are the trending techniques with multiple modules for categorizing an image with high range of accuracy. In remote sensing the common classification types are supervised classifiers, unsupervised classifiers and object based classifiers. The convolutional neural network classifier applied in this paper comes under both supervised and unsupervised category.

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2 Literature Survey

Due to the increasing need of terrain mapping many methods are developed and studied. Here, Vizireanu et al., 2017 [1] presents a study for comparing satellite images of three different resolution. Here the satellite image of Constanta city in Romania captured by three satellites namely Spot -5 Supermode, Landset 7 and Spot Multi-spectral are analysed by object-based classification using the software DefinienseCognition. The segmented images are classified based on the values obtained by defining the pixels of the images by fuzzy approximation. The results attained by comparing the classification of the images of three different resolution are tabulated. This output concludes that the accuracy of an image calculation directly depends on how well the resolution of the image is presented.

For the applications used for urban planning, a study of framework of the environment of an area is very important. But the data required for this purpose is not widely available due to its acquisition cost. Adrian Albert et al., 2017 [2] proposes a method which makes use of the large scale satellite images available from third party source. The use of convolutional neural network is examined in the environmental analysis of similarity and variability of 6 cities in Europe with 10 land classes. Here initially the land classes are predicted then this categorization is inserted with the factors obtained from convolution classifiers and converted into a continuous spectrum. Using this method any given image of the nearest area can be identified from the features extracted from the convolution method.

Nandhini, 2019 [3] describes about the various methods for classification of satellite images using cellular automata concept. Cell automation is the idea of arithmetic depiction of set of cells in matrix format. It is the recent technique used in simulation of images obtained using remote sensing. Here the processes involved in the execution of the basic classification types such as supervised, unsupervised and object orientated classifiers along with the techniques practiced are also outlined briefly. The aim of this paper was to infer the user about the type of classifier to be chosen to meet their requirement.

Eric Ariel et al., 2019 [4], proposes a novel idea for classifying agricultural system using random forest classifier algorithm based on the data set obtained from space view. Though many machine learning methods are used to define and analyse the hyperspectral data the accuracy is not fully guaranteed due to large bandwidth,. This may to lead to loss of data. In order to rectify this three new improved algorithms are developed and tested based on Moment Distance index. The execution of the algorithms are done on publicly available data set and obtained an improved accuracy range. This process is also considered to be time efficient.

Forest resources are widely destructed due to Forest fire. So the detection of this type of accident has to be monitored continuously for to take immediate action for rectification. Hence satellite images play a important role in this process. SreeSouthry et al., 2019 [5] proposed Supervised Multi-Model Image Classification Algorithm for immediate and accurate detection of forest fire. Here the before and after forest fire satellite images are obtained, pre-processed for noise removal and compared to get the difference values. Then it is segmented using Finite Image Clustering Segmentation algorithm and the features are extracted using Multi Spatial Feature Extraction method. The resulting dataset is classified using the SMICA technique. The implementation results show lower rate of error in detection of forest fire.

For image classification based on remote sensing, texture based classification features exhibits better results than vision based features. YinghuiQuan et al., 2020 [6], has formulated two types of modules for forest disaster management. In the first one, for feature extraction two types of widows are used instead of the traditional single window method. As the size of

the widow determines the accuracy, one small enveloped by one large window is used. The extracted features are given to random Forest classifier for further processing. In the second type, from the features obtained only the important features are trained to be fed to classifier to decrease the computational time based on the decision tree classifier techniques.

In determination of the land boundaries the analysis of the historical maps is important. Here comes the satellite image processing techniques to aid this process. Anju Asokan et al., 2020, [7], has surveyed about various studies used for processing the satellite images to get the required data. A detail review of the types of techniques used and a clear roadmap of the tasks performed during the process is elaborately explained in this paper. Each system has its own unique way of proceedings and this determines the accuracy of the result. To avoid the complexity and challenges involved like low resolution of images, misapprehension of pixels etc., machine learning techniques are used. The paper concludes that further more researches have to be conducted to improve the robustness of the findings.

To analyse the environment of a geographical area many image processing methods have been developed. Here Anand et al., 2020 [8] proposes a method for detection of water level, crops, buildings in an area using the Support Vector Machine classifier algorithm in Matlab platform. The various steps involved in the detection process are explained here.

3 Proposed System

Classification of a surface type from an aerial image of a particular region involves three major steps like pre processing of image, segmenting and classifying based on the features. The following diagram represents the block diagram of our proposed system.

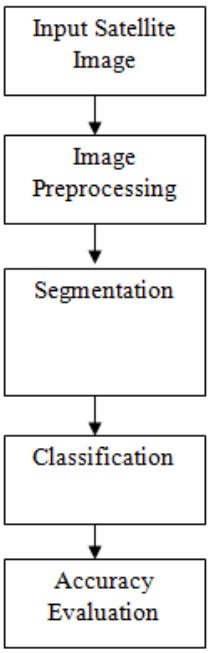

Fig 1: Proposed System Block Diagram

Preprocessing:

To gain high accuracy results high resolution images have to be used in image processing. Considering this as a thumb rule, high quality satellite images of the area to be investigated can be obtained from any free data source like Google Map API. Cropping/ scaling of the original image is done to remove unwanted data and to reduce the complexity in handling large data. This cropped colour images undergoes colour normalization by converting the RGB bands to gray scale. In remote sensing the common disturbance in image acquisition is speckle noise which arises due to the environmental conditions. A non linear digital filter namely, the median filter is used here to remove the speckle noise. The median filter works by running through each signal entry and by interchanging it by the median of the nearby entry. It is widely used in image processing as it only removes the noise and does not alter the edges. The output of a median filter at any instant t is the median of the input value corresponding to the instant next to t

$$y(t) = \text{median}((x(t-T/2), x(t-T_1+1), \ldots, x(t), \ldots, x(t+T/2)). \quad \text{-------- (1)}$$

Where x – input, y – output, t – window size of the filter. The filtered image is enhanced to highlight the details so that the required data can be used efficiently during segmentation.

Segmentation:

Image segmentation is an important part of image processing. Here the images are partitioned into multiple regions based on the problem arising and this sub dividing process stops when the required objects are separated. Though many segmentation algorithms are present, the selection of the algorithm depends on the type and purpose of the image. In this paper thresholding technique is used for segmentation. This technique is classified into two types as global thresholding and local thresholding, where the former is sub classified as traditional, iterative and multistage thersholding. Here this segmentation splits the image into pixels based on the gray scale values to define the boundaries. It is expressed as,

$$T=T[x, y, p(x, y), f(x, y] \quad \text{------ (2)}$$

$$g(x,y)=\begin{cases} 1 & \text{if } f(x,y) > 1 \\ 0 & \text{if } f(x,y) \leq 0 \end{cases} \quad \text{-------(3)}$$

Here x, y are co –ordinate points, T is threshold values, p(x,y) and f(x,y) are the points of gray scale image pixels then g(x,y) defines the threshold image.

Classification

Image classification is the process of segregating the pixels based on certain aspects required to fulfil the purpose of the experiment conducted. Classification of image mainly depends on the prior extraction of the required constraints. But in Convolutional Neural Network (CNN), both extraction and classification falls under single frame. This makes CNN alluring as only the much needed features are extracted to perform categorization task. CNN comes under deep learning neural network and its functions represents the function of human brain carrying the signals through multi branched neurons for object recognition and classification. CNN is a multilayered function consisting of input layer, hidden layers and output layer. The hidden layers comprises of the following layers:

Covolutional layer: In this layer convolution operation is applied to the input data and the obtained data is passed to the next layer

$$(f * g)(t) \stackrel{\text{def}}{=} \int_{-\infty}^{\infty} f(\tau) g(t - \tau)\, d\tau$$
$$= \int_{-\infty}^{\infty} f(t - \tau) g(\tau)\, d\tau.$$

Convolution is the process of combing two functions 'f' and 'g' by integration. Here one function is used to modify the other one.

Relu and Pooling layers: The Relu is used to remove the non linearity and the pooling is used to merge the output of bunches of neuron into a single neuron of the preceding layer**.**

Fully connected layer: This connects every neuron in a layer to each neuron in the next layer.

The last fully connected layer gives the majority values reqiured for classes. In CNN hundreds of hidden layers are present which trains the features during operation. Based on the detected and trained features the classification id done.

4 Results and Discussion

Let us see in detail about the results of our proposed system. Figure 2 represents the input image that we are going to analyze. Figure 3 represents the preprocessing stage where our input image will be converted into grey scale image. Figure 4 represents the presence of speckle noise which has to be removed before segmentation as it will reduce the accuacy in predicting the segmented areas. Figure 5 represents the denoised image using adaptive filtering technique. Figure 6 represents the segmented image which is been obtained using threshold technique. Figure 7 represents the classified results obtained using Convolution Neural Network.

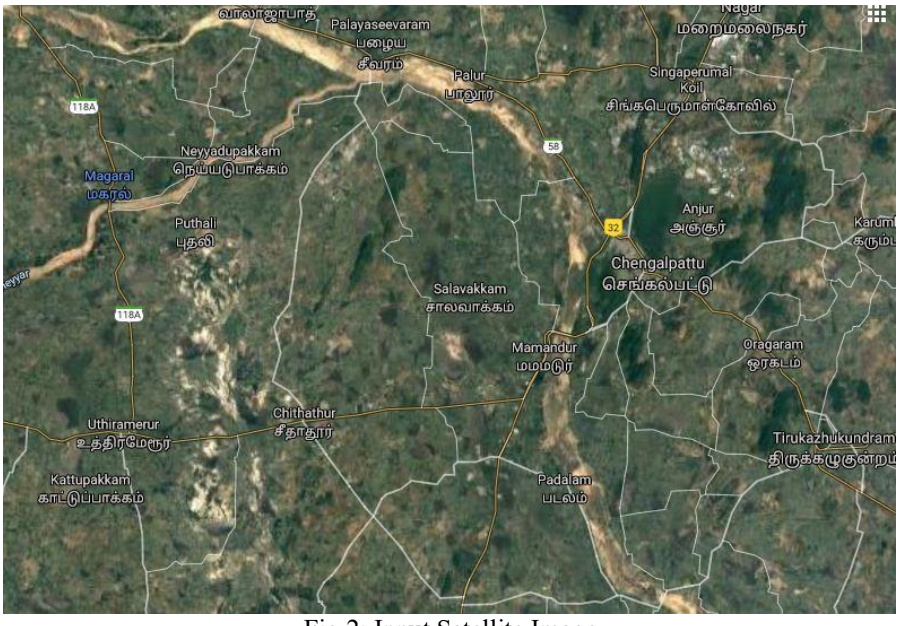

Fig 2: Input Satellite Image

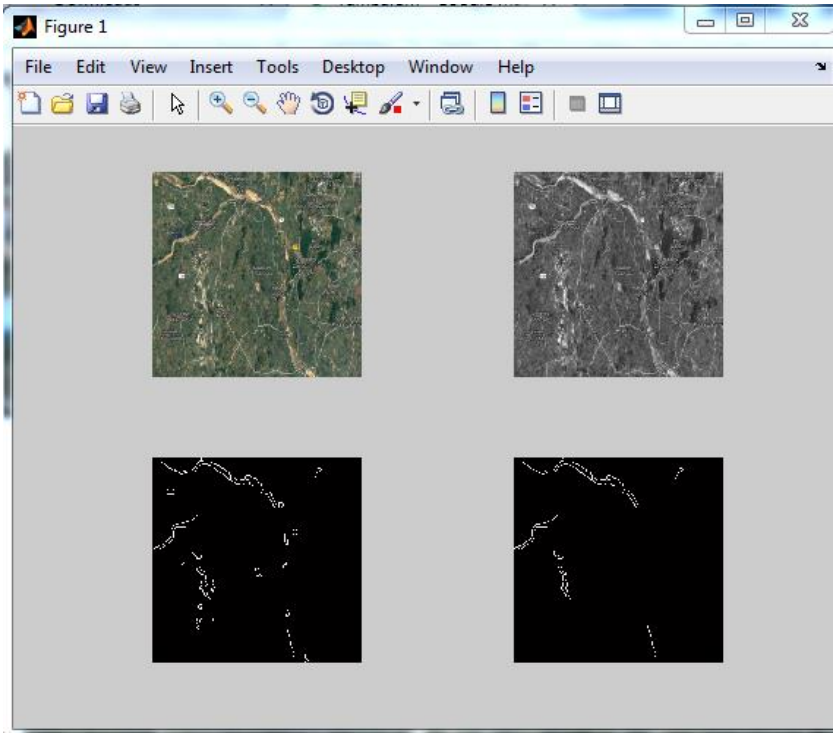

Fig 3: Preprocessing Stage

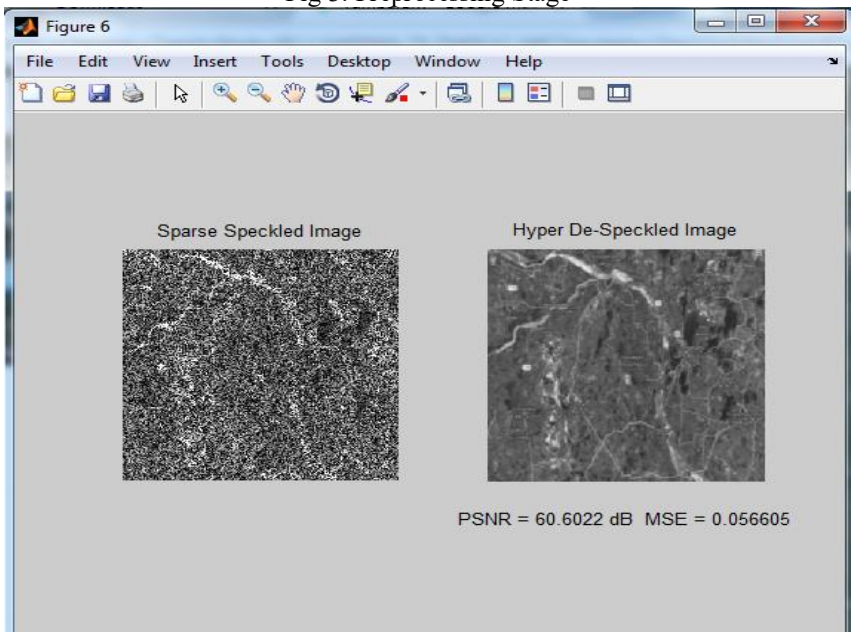

Fig 4: Presence of Noise

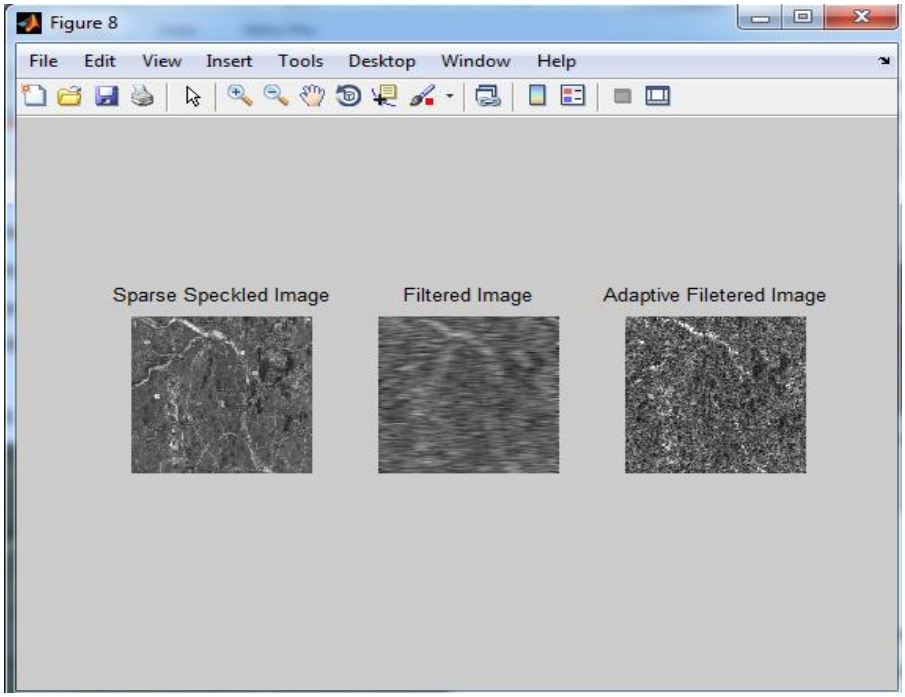

Fig 5: Denoised Image

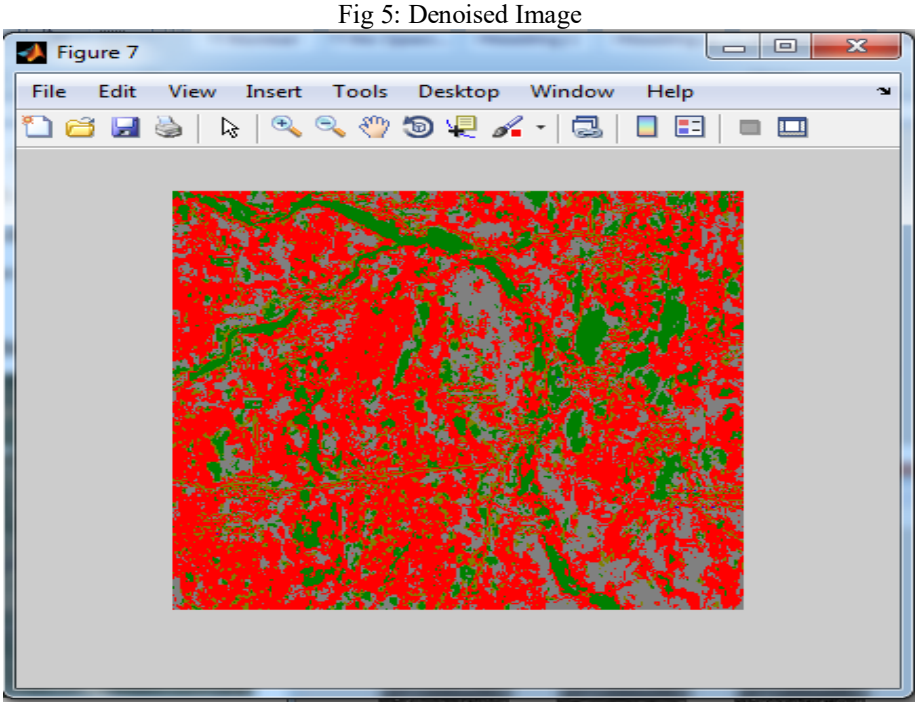

Fig 6: Segmented Image

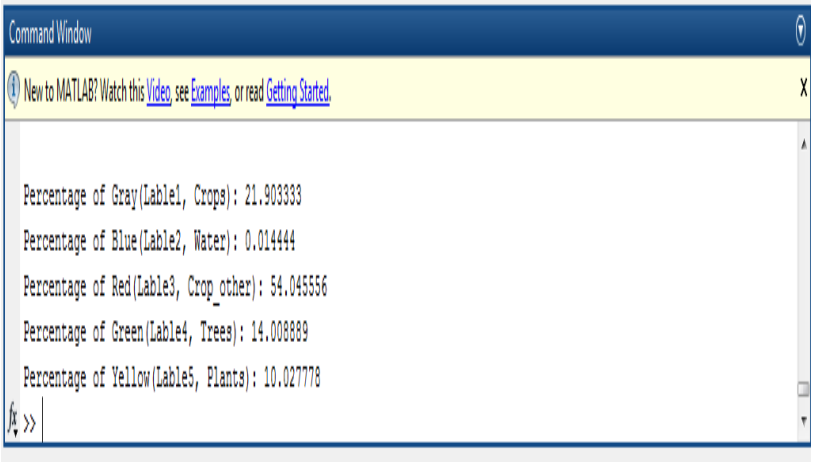

Fig 7: Output classification using CNN

Conclusion

This paper has explored the operation of convolutional neural networks for classification of satellite image for analysing the environmental changes. It proves our proposed system is very efficient in noise removal and segmentation is also done in better manner. The output of classification is too better than any other classification methods.

References

[1] Vizireanu. I , Mateescu.R, Golumbeanu.M, Benciu.S, Slave.C (2017), "Environmental Applications of Object-Based Classification Techniques in Time Series Analysis of Different Resolution Satellite Images", Journal of Environmental Protection and Ecology 18, No 1, pp.181–190

[2] Adrian Albert, Jasleen Kaur, Marta C. Gonz´alez (2017), "Using Convolutional Networks and Satellite Imagery to Identify Patterns in Urban Environments at a Large Scale", Proceedings of the 23rd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, DOI:10.1145/3097983.3098070

[3] Nandhini (2019), "Classification of satellite images using cellular automata ", International Journal of Advance Research, Ideas and Innovations in Technology, Vol. 5, Issue 3 ISSN: 2454-132X

[4] Eric Ariel L. Salas, Sakthi Kumaran Subburayalu (2019), "Modified shape index for object-based random forest image classification of agricultural systems using airborne hyperspectral datasets", PLOS.ONE | https://doi.org/10.1371/journal.pone.0213356

[5] SreeSouthry, S. Vinayagapriya, A. Ayub Khan, P. Srinivasan (2020), "A Highly Accurate and Fast Identification of Forest Fire Based on Supervised Multi Model Image Classification Algorithm (SMICA)", Journal of Critical Reviews, Vol 7, Issue 6, ISSN- 2394-5125

[6] Karthik, B., Kumar, T.K., Dorairangaswamy, M.A., Logashanmugam, E., Removal of high density salt and pepper noise through modified cascaded filter, Middle - East Journal of Scientific Research, 2014, 20(10), pp. 1222–1228

[7] YinghuiQuan, Xian Zhong, Wei Feng, Gabriel Dauphin , Lianru Gao, Mengdao Xing (2020), "A Novel Feature Extension Method for the Forest Disaster Monitoring Using Multispectral Data", Remote Sensing, doi:10.3390/rs12142261

[8] Anju Asokan, J. Anitha, Monica Ciobanu, Andrei Gabor, AntoanelaNaaji, D. Jude Hemanth, (2020), "Image Processing Techniques for Analysis of Satellite Images for Historical Maps Classification—An Overview", Applied Sciences. 2020, 10, 4207; doi:10.3390/app10124207
[9] Karthik, B., Krishna Kumar, T., Vijayaragavan, S.P., Sriram, M., Removal of high density salt and pepper noise in color image through modified cascaded filter, Journal of Ambient Intelligence and Humanized Computing, 2020
[10] Anand.R, Dhinakaran K, Dharani.G, Gayathri.P, Laila.Y, (2020), "Satellite Image Classification and Segmentation For Environmental Analyses And Safety", International Journal of Advance Science and Technology, Vol. 29, No. 10S, (2020), pp. 7318-7322, ISSN: 2005-4238
[11] Mohammed Abbas Kadhim and Mohammed Hamzah Abed, (2020), "Convolutional Neural Network for Satellite Image Classification", https://doi.org/10.1007/978-3-030-14132-5_13
[12] Goutham Reddy, L. Rama Parvathy, (2020), "Satellite Image Classification for Environmental Analysis using Image Processing", International Journal of Innovative Technology and Exploring Engineering, Vol.-9 Issue-3, ISSN: 2278-3075
[13] Karthik, B., Kiran Kumar, T.V.U., Noise removal using mixtures of projected gaussian scale mixtures, World Applied Sciences Journal, 2014, 29(8), pp. 1039–1045

Adaptive Image Steganalysis: Adaptive Image Segmentation using Enhanced Canny Edge Detection Algorithm

B Yamini[1] [0000-0003-3531-108X], S. Madhurikkha[2] [0000-0002-4188-5330], Shahul Hameed Chettali[3] [0000-0002-9761-0432], Mercy Theresa M[4] [0000-0002-3245-1215], A. Jesudoss[5] [0000-0001-8515-7530]
{yamini.subagani@gmail.com[1], madhurikkha@jeppiaarcollege.org[2], in.hameed@gmail.com[3], mercyjesudossa@gmail.com[4], jesudossas@gmail.com[5]}

Assistant Professor, Department of CSE, College of Engineering and Technology, SRM Institute of Science & Technology (SRMIST), Kattankulathur, Tamil Nadu, India[1]., Assistant Professor, Department of CSE, Jeppiaar Engineering College, Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai, Tamil Nadu, India[2]., Assistant Professor, Institute of CSE, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Tamil Nadu, India[3]., Associate Professor, Department of ECE, Prince Shri Venkateswara Padmavathy Engineering College, Chennai, Tamil Nadu, India[4], Associate Professor, Department of CSE, Sathyabama Institute of Science and Technology, Chennai, Tamil Nadu, India[5]

Abstract. An expertise method to conceal secret messages in blameless mediums such as videos, audios, texts and digital images by cheating the Human Visual System (HVS) is termed as steganography. Blind Steganalysis is the striking technique to identify, excerpt hidden information from multimedia file with concealed secret information called stego media. To conceal the hidden message, adaptive image steganography determines the exact color adaptive regions or payload locations of the image. Adaptive image steganography's reverse in return is adaptive image steganalysis, in which the secret messages are dig out from the image's color adaptive regions for a familiar or unfamiliar steganographic algorithm that was used for steganography. In the first phase of the adaptive image steganalysis, the adaptive regions of the image are segmented in such a way that the color intensity values of the pixels are compared and grouped to form a region. Enhanced canny edge detection operator outperforms other segmentation algorithms. In the second phase, the statistical features of the pixels are extracted from the spatial domain region using Histogram of Oriented Gradient (HOG) and MatriX Quadtree (MX Quadtree) method. Feature selection from the extracted feature vector subset is done based on distance correlation coefficient method and Markov Random Field (MRF) Cliques method along with a ranking based wrapper approach. In the third phase, classification of images as stego or cover image is done by a binary classifier, Support Vector Machine (SVM). Classification of stego images in the proposed system is done first and then the content extraction of the concealed information from payload locations of the stego images are obtained. This can be achieved by using effective adaptive image segmentation called Enhanced Canny Edge Detection algorithm and feature extraction method. Then, the images are classified by better performing classifier Support Vector Machine as cover or stego images which results in 96.72% of classification accuracy.

Keywords: Adaptive Image Steganalysis, Enhanced Canny Edge Detection, Histogram of Oriented Gradient, MatriX Quad tree, Markov Random Field, Support Vector Machine.

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1 Introduction

Statistical pattern recognition approach includes Face recognition, Speech recognition, automatic target recognition and Image classification. Statistical pattern recognition approach in color image steganalysis system has three parts: Image Segmentation, Feature Extraction, Feature Selection and Classifier Selection.

1.1 Image Segmentation

Image Segmentation in adaptive image steganalysis renders a most important part in identifying adaptable regions in images by considering the intensity values of the pixel and the pixel value differences in order to group them into a single region from a seed point. Once these adaptive regions are identified clearly in the input image, then it makes the rest of the system works effectively to classify the image as color image or stego image by extracting the hidden messages that are embedded during steganographic process.

1.2 Feature Extraction

Feature extraction in image steganalysis task is the key step to analyse the characteristics of the image to identify whether the input image is a cover image or stego image. Principles of feature extraction steps are as follow:

- **Discrimination:** Features of set of selected adaptive regions of the same image should have knowingly different values.
- **Reliability**: Features should have similar values which were grouped under a same single region as adaptable region.
- **Independence**: Features from the adaptive regions should not be strongly correlated to each other which may lead to confusion.
- **Optimality**: Feature selection, plays a vital role in identification of the stego images. This feature selection results in information rich content for classification.

1.3 Significance of Feature Selection methods:

- Enhances classification accuracy of the classifier by dropping the computational difficulty.
- The features should be selected in such a way that it should not be redundant while combining the feature set.
- Decreases the number of features considered for achieving the task efficiently by speeding up the process.
- "Curse-of-Dimensionality" (CoD) problems are addressed by feature selection methods.
- Interpretations of the features that are selected for processing becomes easier.

1.4 Image Classification

Classification of the image as cover image or stego image is performed efficiently by appropriate classifier selection. However, no matter, how worthy the applied feature extraction process is, if a poor classification design is implemented and this collapses the whole system. The differentiation between one classification method and another, resides in their ability to identify the stego images exactly. In the training or learning stage, learning methods are categorized as Supervised and Unsupervised learning.

2 The State of Art

The analysis of several literatures discussed in this segment is focused upon several systems for image segmentation, feature extraction, Classification, payload location identification and hidden message extraction process of steganalysis. Deep research analysis has been conducted in expansion of automated steganalysis using color images to support in the field of social networking sites, forensic and defense. Wide-ranging literature analysis has been completed in associated with this research and significant features of relevant contents are defined here. Different techniques have been used in the field of image steganalysis.

2.1 Image Segmentation Algorithm

Region identification and segmentation identifies Region of Interest (ROI) during image steganalysis. The different types of Image segmentation methods [1] are discussed in image steganalysis are reviewed for performance. The image segmentation methods are as follows established on: Threshold, Edge, Region, Cluster, Partial Differential Equation and Artificial Neural Network.

2.2 Threshold Based Image Segmentation.

The various threshold methods in image segmentation are discussed [2]. According to the application, image segmentation was done by detecting, recognizing and feature measurement. The image was segmented into meaningful regions. Non contextual method called thresholding was used in the gray-scale image to convert it into a binary image. Histogram Dependent Technique (HDT) that uses the thresholding such as global thresholding, local thresholding and adaptive thresholding was analyzed for the performance.

2.3 Edge Based Image Segmentation.

The various Edge detection operators for image segmentation are proposed for identifying edges of the image [3]. The authors discussed about Roberts's edge detection for its simplicity with two dimensional array formations of pixels which results in quick response and simplicity compared to other edge detectors. Since two dimensional pixel values were considered for comparison, clear and deep evaluation of pixel values with neighboring pixels were done.

The region identification method using the color planetary intensity is the better way of fining adaptive color regions [4]. The identified regions were used to embed the message, in relevant to intensity of colored region. Image got splitted into three channels on which the canny edge detection was applied for edge mapping and better performance.

2.4 Region Based Image Segmentation.

The image segmentation based image steganalysis and the content features of the JPEG images were used to segment the images [5]. Texture complexity of the images was used to create the number of segmented sub images. A perfect classifier was built to classify the sub images as stego images or cover images based on similar texture complexity. Weighted fusion system estimated the better detection accuracy.

2.5 Cluster Based Image Segmentation.

A most powerful method called clustering in image segmentation was discussed [6]. The clusters were formed as disjoint sets of an image. Various clustering techniques and its improved versions as k-means, Enhanced k-means, Improved Fuzzy C-Mean algorithm (IFCM) and Fuzzy C-Means (FCM) were proposed. Performance of the grouping methods were analyzed and evaluated using statistical parameters such as Rand Index (RI), Global Consistency Error (GCE), Boundary Displacement Error (BDE) and Variations of information (VOI). Authors concluded that the performance of Enhanced Fuzzy c-means clustering was

better while compared with other clustering methodologies in terms of convergence rate, performance and accuracy in cluster formation.

2.6 Watershed Based Image Segmentation.

The region based approach by using watershed transformation method was discussed in which the gray-scale images were used to perform the watershed approach by flooding process [7]. Watershed transformation method combines the pre-processing and post-processing approach to identify large number of regions for embedding message. The author explained the image processing applications of watershed algorithm that can be applied to gray-scale images, binary images and Texture based image processing.

2.7 Partial Differential Equation Based Image Segmentation.

A new method for denoising using Partial Differential Equation (PDE) by an isotropic diffusion technique and total variation technique features were combined and the weighted combinations were obtained [8]. The weighted combinations were used in finding the deviations of the pixels for segment identification. The performance of method resulted in efficient denoising of image by preserving the texture feature and edge data of an isotropic diffusion and total variation methods.

2.8 Artificial Neural Network Based Image Segmentation.

There are various methods of Artificial Neural Network (ANN) to detect the hidden information [9]. The Artificial Neural Network methods such as Back Propagation Algorithm (BPA), Functional Update Back Propagation Algorithm (FUBPA) and Radial Basis Function (RBF) were used for steganalysis. Ensemble of back propagation algorithm (BPA) and radial basic function (RBF) called as back propagation algorithm radial basic function (BPARBF) and similarly functional update back propagation algorithm (FUBPA) with radial basic function (RBF) called as Functional Update Back Propagation Algorithm Radial Basic Function (FUBPARBF). The author proved that the ensemble features of FUBPARBF perform better in identifying the hidden information with less number of iterations.

3 Proposed Work

This proposed work on the adaptive image steganalysis has three main parts as shown in Figure1. They are image segmentation, adaptive features extraction and Image classification. Detailed framework of proposed system is given in Figure 2.

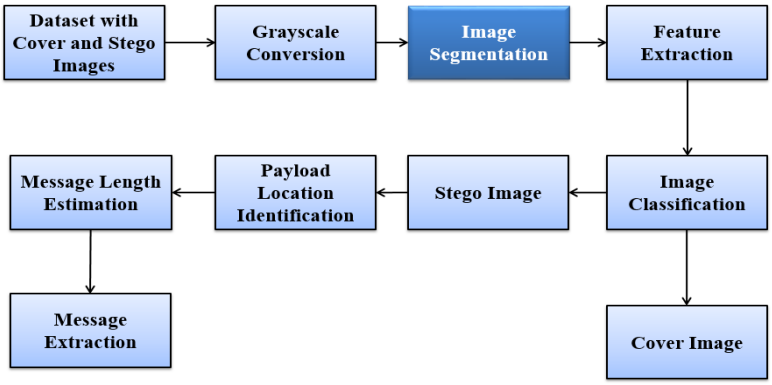

Figure 1: Block Diagram of Proposed System for Adaptive Image Steganalysis

To generate the dataset of stego images, the standard steganographic algorithms called virtual steganography laboratory (VSL), openstego, outguess and steghide have been applied. The JPEG color images of research interest should be converted to gray scale images. A set of cover and stego images is applied as input to the image segmentation process. Adaptive region of interest is identified using the image segmentation method. The feature vector combinations are extracted from the identified regions using histogram and MX Quadtree approach. Feature selection method called Filter approach and Wrapper approach is used for Feature Subset Generation and Subset Evaluation respectively. This makes the working complexity of the Support Vector Machine Classification very simple and efficient for stego image separation. From the identified stego image, payload location for extracting the hidden message by estimating its length should be identified and measured.

The enhanced wrapper approach works on feature selection from feature combination vector depending on adaptability of features in the region. To improve the performance of the wrapper approach, the classifications based on adaptability of the features are done in the wrapper approach itself. This helps in selecting the appropriate classifier, which is simpler and efficient for the proposed system. From the classified stego images payload locations are identified to extract the hidden messages.

4 Adaptive Image Segmentation

In adaptive image steganalysis, there are numerous transforms to be applied on digital images to analyze the images. The first and foremost image processing for adaptive image steganalysis is adaptive region identification by image segmentation. These color images are further used for processing after converting it into its gray scale value. The methods used and analyzed for effective adaptive image segmentation are as follows:

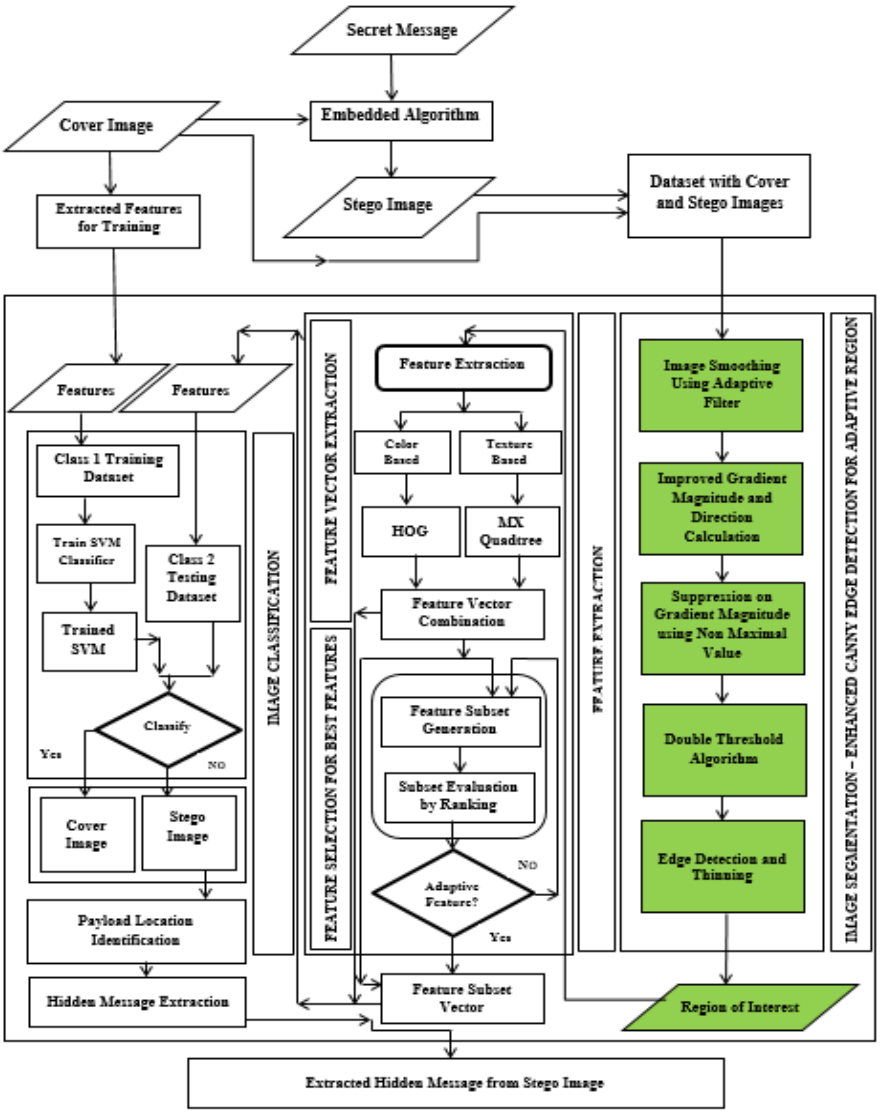

Figure 2: Framework of the Proposed System for Adaptive Image Steganalysis

4.1 Adaptive Region Identification

Homogeneity property of the similar pixels tends these pixels to form a region [10] [11] [12]. The pixels that are grouped under a region imply that they are more similar to the pixels in the same group. The adaptive regions of the image are identified during embedding process to hold maximum capacity of the messages that are to be hidden and the same is more unnoticeable to HVS. The adaptive regions in proposed method are computed by having a seed point probably a pixel and then grouping the pixels that are very similar to the seed pixel. If the neighboring pixel is sufficiently close enough to the seed point, then the pixel belongs to the same region or else to a different region.

Homogeneity identification and region splitting gets stopped when no more pixels can be added into the group and the adjacent eight regions cannot be merged further. The computational complexity of the proposed adaptive image steganalysis system lies on the initial step called the adaptive region identification by image segmentation. This identification of region helps the feature extraction method to concentrate on a particular region rather than every pixel of the image

4.2 Edge Detection Algorithm

The diversity in intenseness of images is marked as edges. Edges are the points that split the images into regions. The regions are separated based on the homogeneity of the pixel's intensity value. This separation of regions helps to define adaptable region of image called interested regions to retrieve the features. In the recommended methodology, adaptable areas are recognized by edges. Geometrical events such as object edges; surface edges and non-geometrical events such as inter reflections; specular shadows are used to identify the edges in an image. Position of the pixel, Intensity level of the pixel, edge directions are described by the edge descriptors. Edges are modeled as edge, ridge, ramp and roof edges by considering its intensity level. Implementation of enhanced canny edge detection algorithm in this work lead to the description of basic methodology named canny edge detection algorithm along with enhanced canny edge detection operator. First, the basic canny edge detection algorithm is explained in detail along with its drawbacks in identification of the edges. Later, implemented concept called enhanced canny edge detection is explained.

4.3 Canny edge detection algorithm.

This traditional methodology identifies edges with lower error rate. Over marking of edges are avoided to detect true edge point by avoiding false edge points. Figure 3, defines the step by step process for canny edge detection algorithm

Gaussian Filtering.

Image de-noising is done to categorize the factual edges of the adaptive regions in the image. Gaussian Masking and regular convolution method is used during filtering to smoothen the image. Mask width, assumed for the Gaussian mask determines the reactivity of the noise. Greater the width of the Gaussian mask, lower the noise detection and produces higher error rate. Measured standard deviation (σ) value results in sharpness of the intensity transitions. The values of standard deviation (σ) are positive real numbers ranges from 0 to 3.

The Gaussian kernel size of $(2n+1)^2$ is given by the equation (1) in canny edge for the two points (x,y) and gradient vector is given in equation (2).

$$G(x,y) = \frac{1}{2\pi\sigma^2}\exp^{\left[-\frac{x^2+y^2}{2\sigma^2}\right]} \quad (1)$$

Gradient vector ∇G_v is computed as

$$\nabla G_v = \begin{bmatrix} \partial G_v/\partial x \\ \partial G_v/\partial y \end{bmatrix} \quad (2)$$

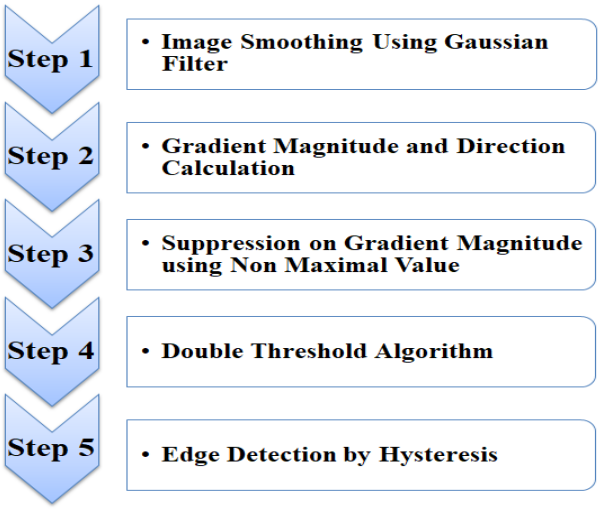

Figure 3: Stepwise Representation of Canny Edge Detection Method

This Gaussian low-pass filter eliminates high incidence components of image and this leads to missing of edges that are weak. Hence, there is a need of an improved filter approach in enhanced canny edge detection algorithm.

Gradient Intensity Comparison degree (Magnitude) and Orientation (Direction) Calculation.

Once the image smoothing is done, the gradient intensity comparison degree and orientation is computed for individual points by first order linear partial differential operator [13]. The partial derivatives of the point (m,n) for any two instances (i, j) are given in equation (3) and (4) as follows,

$$D_m(i,j) = [I(i,j+1) - I(i,j) + I(i+1,j+1) - I(i+1,j)]/2 \quad (3)$$

$$D_n(i,j) = [I(i,j) - I(i+1,j) + I(i,j+1) - I(i+1,j+1)]/2 \quad (4)$$

The Gradient intensity comparison degree (magnitude) and Gradient orientation (direction) of the point i, j

$$M(i,j) = \sqrt{((D_m\text{^}2\ (i,j) + D_n\text{^}2\ (j,j))} \quad (5)$$

$$\theta(i,j) = \arctan(D_m(m,n)/D_n\ (m,n)) \quad (6)$$

M (i, j) stands for Gradient magnitude in equation (5) and $\theta(i,j)$ stands for angle direction in equation (6) at M (i, j). The angle direction represented here is the rounded four angles i.e. Horizontal angle, Vertical angle and two diagonal angles.

The Non Maximal Suppression.

Gradient magnitude and direction have interpolation with respect to canny operator. Canny (edge detection) operators have interruption to gradient intensity comparison (magnitude) and orientation (direction)[13]. The edge point is identified in a manner, when M (i, j) is superior to two subsequent interlude in the orientation of $\theta(i,j)$ at (i, j), if not, then it is treated as non-edge point. Suppression of the gradient magnitude using the non-maximal value is an edge thinning method. This method helps in find the principal edge. Suppression is done on every gradient values except local maximal value. This local maxima value is the accurate change in intensity value. The steps for suppression on gradient magnitude using non-maximal value are given as,

1. Positive gradient and negative gradient directions strength are compared with strength of the current pixel edge.

2. Subdue value, if strength of current pixel edge is lesser than other considered one else preserves the value.

The directions are given as four angles and they are given by the Table 1,

Table 1 Gradient angle and Direction

Direction Number	Rounded Gradient Angle	Directions	Description
1	0°	East and West	The gradient magnitude is higher than the angles at pixels
2	90°	North and South	
3	135°	North-West and South-East	
4	45°	South-West and North-East	

Double Threshold Algorithm.

Two thresholds namely high and low threshold values are selected to filter the fake edge pixels. Strong edge pixels are identified using the gradient pixel's value. When the High threshold is lower than the edge gradient then it is referred as strong edge pixel. Similarly, when the High threshold is higher than the edge gradient and Low threshold is lower than the edge gradient then pixel can be referred as weak edge pixels. Based on the input image, threshold values may vary. Algorithm 1, explains Double threshold algorithm.

Input : Suppressed gradient intensity comparison using non-maximal value.

Method : Selection of two threshold values namely high and low threshold values are used to find the strong or weak edge pixels.

Output : Edge Points

Algorithm 1: Double Threshold Algorithm

Step 1: Select the Low Threshold (T_l) and High Threshold (T_h) values.

Step 2: Consider a pixel (i,j) at any point and note the edge and non-edge point.

a. if Gradient intensity comparison called magnitude is higher $M(i,j) > T_h$, then mark as edge identified point, else if Gradient magnitude $M(i,j) < T_l$, then mark as non-edge points

b. Pixel positions are marked as suspect point, if and only if when Gradient magnitude M (i, j) value lies in between T_h and T_l.

Step 3: Mark the Strong edge points.

Edge Detection by Hysteresis.

Strong edge points are the true or final edge points in the image. Usually weak edges are not considered for the edge detection which is eliminated, but in this case analysis is done to evaluate the strength of the weak points that are originally generated by the true edges. The weak edge points and its neighboring 8 pixels are compared to make a decision to preserve this weak point or not. This analysis produces accurate true edge points to be considered.

4.4 Proposed Enhanced canny edge detection algorithm

Though detection of edges by canny operator performs better, Major reasons for choosing the enhanced canny operator for edge recognition for recommended system are as follows,

- Traditional recognition of edge by canny algorithm intended for smoothing noise in the image but it also smooth out the high frequency featured edges. When the edges get smoothen, there raise a problem of breaks in the edge occurrences by leaving the weak point edges.
- Gradient amplitude calculation uses 2x2 matrixes of pixels as window size to compute finite variance mean value. This computation failed to identify the real edges rather than false edges.
- To find the real edges of different images, different threshold values are needed instead of high threshold value and low threshold value. Thus different threshold values increase the computational complexity of the system.
- Multi-point responses disturb the accuracy of selecting the edge point.

In enhanced canny edge detection weak point edges with high frequency feature are considered to avoid the break in real edges. It uses the adaptive filters for image smoothing. Improved gradient magnitude and direction calculation is done using curvature concept. Gradient magnitude suppression, Double threshold and edge detection are similar to canny edge detection. Edge thinning is done at last to find the perfect real edge points in the image. Figure 4 and Algorithm 2 shows the step by step process for enhanced canny edge detection Method.

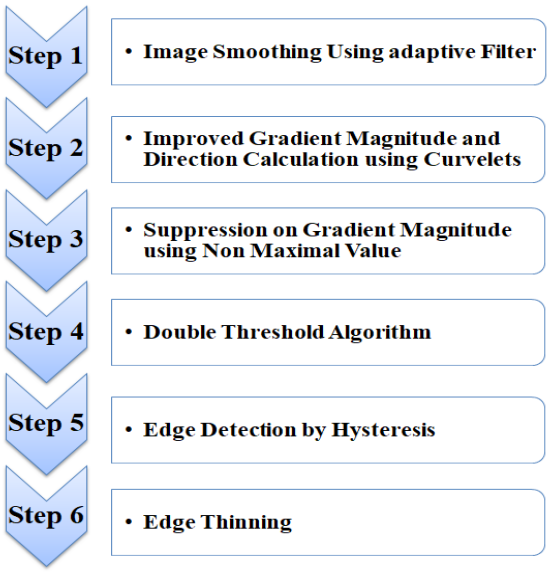

Figure 4: Stepwise Representation of Enhanced Canny Edge Detection Method

Input : Gray scale representation of color image.

Method : Adaptive filters are applied and then Selection of two threshold values namely high and low threshold values are used to find the strong or weak edge pixels.

Output : Edge Points.

Algorithm 2: Edge Detection by Enhanced Canny Operator

Step 1: Adaptable filter is utilized for input image smoothing.
Step 2: **for** every pixel positions, Compute Improved gradient magnitude $M\ (\ \mathrm{i}, j)$and Improved gradient Direction $\theta(\mathrm{i}, j)$
Step 3: Calculate Double threshold called higher threshold (T_h) and lower threshold (T_l).
Step 4: Assume edge location be (i, j) to locate non-edge and edge cation.
Step 5: Strong edge positions are mentioned as edge locations, if and only if suppressed gradient magnitude $M\ (i,j) > T_h$
Step 6: Weak edge positions are mentioned as non - edge location, if and only if Gradient magnitude(amplitude change)$M\ (i,j) < T_l$
Step 7:Positions noted as irregular once Gradient (amplitude change) magnitude $M\ (i,j)$ lies in between T_h and T_l
Step 8: Join all founded Edge positions
Step 9: Perform edge thinning
Step 10: **repeat** from step 2 for detecting adaptable region.

Image Smoothing Using Adaptive Filter.

Smoothing image noise rather than edges are the chief goal of adaptable filters. To accomplish the goal higher weight value is assigned to the filter. Peaking the disjointedness, the lessened the weight is assumed for smoothing. Contrarily, lower the disjointedness between the gray scale levels, higher the weight is assumed for filtering. Adaptable filtration is summarized as follows,

1. **For** 'n' iteration and 'h' be edge amplitude constant with K=1.
2. Compute the gradient value $G_m(m, \mathrm{n})$ and $G_n(m, \mathrm{n})$
3. Estimate the weight by equation 7 and 8:

$$\mathrm{D}(m, \mathrm{n}) = \sqrt{G_m\ (m,n)^2 + G_n\ (m,n)\text{^}2} \tag{7}$$

$$\mathrm{W}(\mathrm{m}, \mathrm{n}) = exp\left(-(\frac{\sqrt{D(m,\mathrm{n})}}{2h^2})\right) \tag{8}$$

4. The adaptive filter is given by equation 9:

$$f(m,n) = \frac{1}{N}\sum_{p=-1}^{1}\sum_{q=-1}^{1} f(m+p, n+q)W(m+p, n+q) \tag{9}$$

5. If K reaches the last iteration 'n' then stop the iteration else increment K by 1 and proceed from step 2.

Improved Gradient intensity change (Magnitude) and Orientation (Direction) Calculation.

Improved canny operator for a 3*X*3 range is concerned with eight levels i.e. horizontally and vertically dual edge points and diagonally two dual edge points. Improved amplitude and orientations are computed as follows in equation (10) and (11)

$$M_x(s,t) = \begin{bmatrix} I(s+1,t+1) + I(s-1,t+1) + I(s+1,t) \\ +I(s,t+1) - I(s-1,t-1) \\ -I(s+1,t-1) - I(s-1,t) - I(s,t-1) \end{bmatrix} \Big/ 2 \tag{10}$$

$$M_y(s,t) = \begin{bmatrix} I(s+1,t-1) + I(s+1,t) + I(s+1,t+1) \\ +I(s,t+1) - I(s-1,t-1) \\ -I(s-1,t) - I(s-1,t+1) - I(s,t-1) \end{bmatrix} \Big/ 2 \tag{11}$$

Gradient amplitude change (magnitude) and orientation (direction) is computed by equation 12 and 13 as follows,

$$M(s,t) = \sqrt{((M_x\ (s,t)\text{^}2 + M_y\ (s,t)\text{^}2\ ))} \tag{12}$$

$$\theta(s,t) = arctan(M_x(i,j)/M_y\ (i,j)) \tag{13}$$

For representing the smoothened images, curvelet are the basic concept to identify the perfect edges of the images. Curvelet with greater resolution value is considered to define the attributes of the image.

Suppression, Double Threshold and Edge Detection Algorithm.

The high threshold value is obtained by applying Otsu's method on non-maximal suppressed image gradient magnitude and direction. Low threshold value is half of the high threshold value. Threshold of dissimilar sets of images find strong edges. Except fixing of the threshold values, the rest of the steps are implemented as it is discussed in previous section.

Thinning of Edge.

Thinning of edge is to concentrate on weak point edges with high frequency feature. As the weak point edges may get preserved for further processing by comparing the weak edge point pixel with rest of the eight neighbor pixels. If any of the pixel among the eight pixel matches with the weak edge point, then the pixel should be preserved. Local sharpening of the weak edge is done to avoid breaks in the detected boundaries of the image [14].

4.5 Otsu's Method

Local adaptive region variance of every pixel is calculated by using the threshold values in the Otsu's method. Computed local adaptive region variance becomes equivalent to the global adaptive region variance (Sezgin et al. 2004). Once the histogram of the gray scale image is computed then Otsu's method can be performed immediately on the histograms of the gray scale values [12]. The method gets directly applied on the histograms values because it is a faster method comparative to other algorithms. Algorithm 3, explains Otsu's Method.

Uniform illumination of the pixel values helps in detecting the adaptive region by assuming the image and the histogram value as bimodal [15]. Behavioral analysis based on the intensity of every pixel is done by considering various intensity levels. The weighted Local Adaptive Region is computed by the sum of products of Local adaptive region probabilities and Local adaptive region variance.

Input : Gray scale representation of color image.

Method : Assume a seed point and the intensity level of the selected seed point gets compared with adjacent pixels by applying adaptive region variance.

Output : Identified adaptive regions for the selected seed points.

Algorithm 3: Otsu's Method

Step 1: Consider the input Gray scale image.
Step 2: Calculate statistical features of each pixel's intensity level.
Step 3: Assume a seed point, 3x3 matrixes of pixels
Step 4: **for** individual seed point, calculate the aggregate variance **do**
- 4.1 Calculate adaptive region variance
- 4.2 Estimate the aggregate adaptive region variance as represented.
- 4.3 Compare adaptable region based on threshold value to
- 4.4 Form cluster or else discard.
- 4.5 Repeat step 3 until an adaptive region is formed.

Step 5: Return the region of interest.

4.6 Watershed Algorithm

The Watershed algorithm segments the adaptive regions of the image by using morphology based mathematical operators. Figure 5 explains watershed segmentation algorithm.

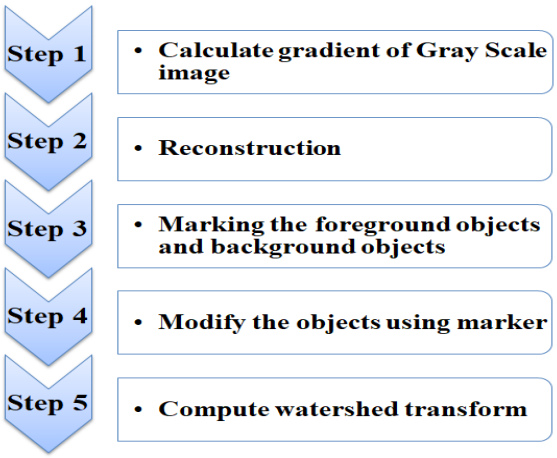

Figure 5: Stepwise Representation of Watershed Algorithm

Gray scale of image gradient is calculated and reconstructed by morphological mathematical operator. In the reconstructed image, compute regional maxima by marking foreground and background objects. Constant intensity 't' of the pixels are connected to form a regional maxima and the pixel's intensity outside the boundary is less than t. Based on the foreground and background marker, modify the gray scale image gradient. Once the regional minimal of a location is obtained then apply the watershed transformation algorithm.

4.7 Real Time Adaptive Color Image Segmentation

The concept of region based image segmentation identifies the region based on the matches found in the color complexity of the pixels. Region based image segmentation has two different approaches and they are,

1. Split and Merge
2. Region Growing

Split and Merge Image Segmentation.

Until a uniform region in the image is obtained, the non-uniform regions are split repeatedly. Maximal uniform region is obtained by merging the subdivided regions further.

Region Growing Based Image Segmentation.

Seed value is assumed for clustering the region. The neighbor pixel's color complexity is considered for region growing. The absolute region shaped is the adaptive region based on its color. Region growing not only considers the seed point complexity with neighbor pixel but also it compares the neighboring adaptive region for its unions or adaptability of the clusters.

Boundary relaxation based Image segmentation of color images is done. Segmentation can also be agglomerative grouping of analogous neighborhoods. Color image segmentation can be RGB Space based or Watershed Segmentation in region growing technique. Real-time adaptive color image segmentation is an extension lead by Real-time color image segmentation [16]. This real time adaptive image segmentation also works for image steganalysis in finding the hidden information. An 8 by 2-pixel consideration window around every seed point is divided into two unequal sub ranges in 8 different orientations.

Algorithm 4, explains the real time adaptive image segmentation as follows,

Input **:** Pre-processed Image.

Method : Comparing seed point with neighboring pixels.
Output : Segmented image based on color adaptability of the seed pixel.

Algorithm 4: Real-time adaptive colour image segmentation

Step 1: Consider the pre-processed image.
Step 2: Select the seed point and then form a 3 X 3 matrix by considering the neighbor pixels.
Step 3: **fo**r every seed point, usually the pixel that refers to (x_2, y_2) of 3 X 3 matrix of pixels **do**
Step 4: Split the 3 X 3 matrix into 8 by 2 windows.
Step 5: Form two sub-samples for the 3 X 3 matrix of pixels as XandY.
Step 6: Apply comparison function $f(x, y)$ for ever pixel in the sub-sample X with the pixel in the sub-sample Y.
Step 7: If the compared pixel colour adaptability doesn't go beyond the thresh old of comparison function, then group the pixel to form same single region.
Step 8: Else discard the pixel for other seed point or segment.
Step 9: Repeat step 3 until grouping of similar pixels under the same group is done.
Step 10: Return the Segmented image.

5 Analysis of the Proposed Adaptive Image Segmentation System

In this section the performances of the image classification system using image segmentation is discussed. The image segmentation methods such as Enhanced canny edge detection, Canny edge detection, Otsu's method, Watershed method and Real time adaptive color image segmentation used by the proposed system is evaluated in Figure 6 and it describes the identification of adaptive region using various image segmentation methods. From the figure, it is clear that Improved canny operator for detection of edge performs well in Identification of adaptable region.

Though the Watershed process also produces better results comparative to the segmentation methods, it is not considered for implementation because watershed algorithm identifies and splits the region very specifically into minute regions. This minute separation of region decreases the overall performance of region identification and the same is represented in Figure 7 as follows,

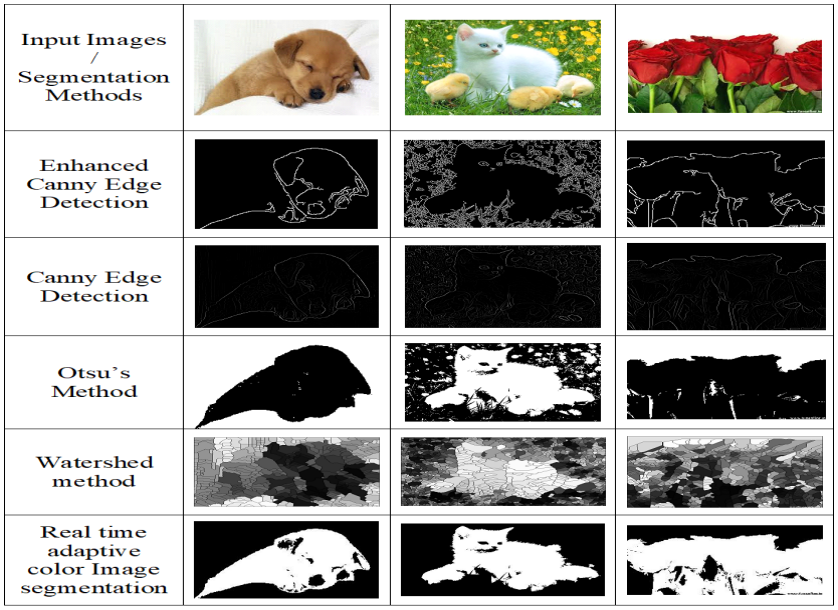

Figure 6: Adaptive Region Identification by Different Segmentation Methods

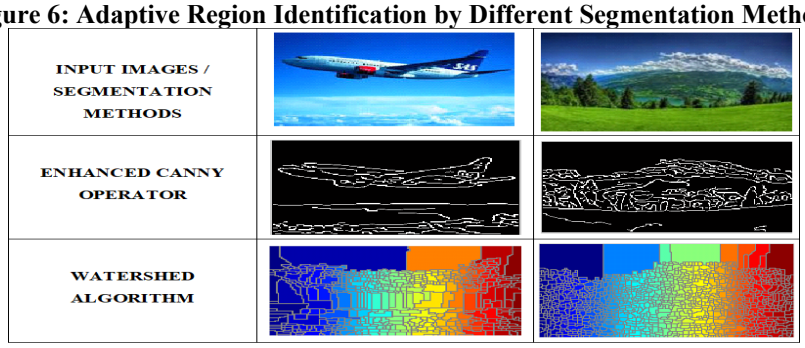

Figure 7 Adaptive Region Identification

The classification accuracy of different image segmentation methods is shown in table 2 and Figure 8. It implies that the proposed enhanced canny edge detection algorithm outperforms the other segmentation methods.

Table 2 Classification Accuracies for Different Segmentation Methods

Segmentation Method	Classification Accuracy
Enhanced Canny Edge Detection	96.72%
Canny Edge Detection	95.23%
Otsu's Method	93.16%
Watershed Method	96.30%
Real Time Adaptive Color Image Segmentation	95.10%

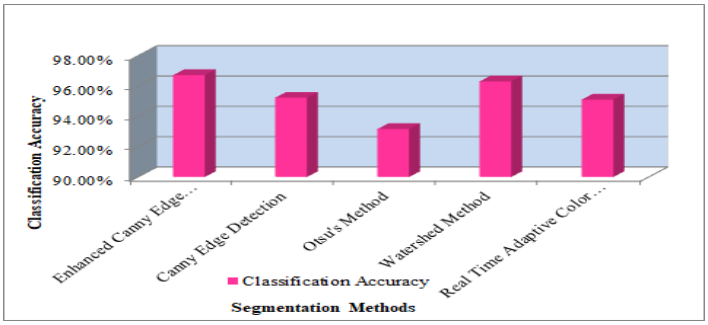

Figure 8: Graph Showing Classification Accuracies for Different Segmentation Methods

6 Conclusion

This Conclusion explains about the frame work of the proposed method and the image dataset used. It also investigated five different methods to identify the suitable adaptive color image segmentation method which was otherwise called as enhanced canny edge detection algorithm for giving better input to the next phase called the feature extraction by experimental analysis. This method perfectly segments the Region of Interest from where the features can be extracted for further processing. The first step in enhanced canny edge detection algorithm uses an adaptive filter for image smoothing. The adaptive filter usage helps to include the weak signal points with high frequency into preserved list. Improved gradient magnitude and four gradient directions used to verify the pixel belongs to which cluster. Double threshold called low and high threshold severs as boundaries for selecting the pixel in the range. Edge thinning is local sharpening of the pixel to be considered in preserved list. The experimental analysis results in perfect segmentation by watershed algorithm as like enhanced canny edge detection algorithm. Though the results of watershed algorithm are more accurate for segmentation, the segmentation methodology considered for adaptive image steganalysis is edge identification by enhanced canny operator with 96.72% of accuracy. The recommended method segments perfect adaptive region. The results imply that the number of pixels in the adaptive region increases above a threshold value worsens the feature extraction accuracy and if within the threshold value the segmentation works perfectly for identifying the adaptive color region of interest.

References

[1] Dilpreet Kaur and Yadwinder Kaur (2014), "Various Image Segmentation Techniques: A Review", International Journal of Computer Science and Mobile Computing, Vol.3, No. 5, pp. 809-814.

[2] Bhargavi, K. and Jyothi, S. (2014), "A Survey on Threshold Based Segmentation Technique in Image Processing", International Journal of Innovative Research and Development, Vol. 3, No. 12, pp. 234-239.

[3] Muthukrishnan, R. and Radha (2011), "Edge Detection Techniques for Image Segmentation", International Journal of Computer Science and Information Technology (IJCSIT), Vol. 3, No. 6, pp. 259- 267.

[4] Ehsan Nadernejad, Sara Sharifzadeh and Hamid Hassanpour, (2008), "Edge Detection Techniques: Evaluations and Comparisons", Applied Mathematical Sciences, Vol.2, No.31, pp.1507-1520.

[5] Wang Ran, Xu Man-Kun, Ping Xi-Jian and Zhang tao (2014), "Steganalysis of Spatial Images Based on Segmentation", ActaAutomaticaSinica, Vol. 40, No. 12, pp. 2936-2943.
[6] Sathya, B. and Manavalan, R. (2011), "Image Segmentation by Clustering Methods: Performance Analysis", International Journal of Computer Applications, Vol. 29, No. 11, pp.27-32.
[7] Amandeep Kaur and Aayushi (2014), "Image Segmentation Using Watershed Transform", International Journal of Soft Computing and Engineering, Vol. 4, No. 1, pp.5-8.
[8] Tan, J. and Yahya, A. A. (2012), "A Novel Partial Differential Equation Method Based on Image Features and It's Applications in Denoising", 4th International Conference on Digital Home (ICDH), pp. 46-51.
[9] Sujatha, P., Purushothaman, S. and Rajeswari, R. (2014), "Performance Study of Combined Artificial Neural Network Algorithms for Image Steganalysis", Proceedings of International Conference on Internet Computing and Information Communications, Part of the Advances in Intelligent Systems and Computing, Vol. 216, pp. 441-451.
[10] Shiuh-Yung Chen, Wei-Chung Lin and Chin-Tu Chen (1991), "Split-and-merge image segmentation based on localized feature analysis and statistical tests", CVGIP: Graph. Models Image Process, Vol. 53, No. 5, pp. 457–475.
[11] Wu, ZY (1993), "Homogeneity testing for unlabeled data: A performance evaluation", CVGIP: Graph. Models Image Process, Vol. 55, No. 5, pp. 370-380.
[12] Ross Beveridge, J., Joey Griffith, Ralf R. Kohler, Allen R. Hanson and Edward M. Riseman (1989), "Segmenting images using localized histograms and region merging", International Journal of Computer Vision, Vol. 2, No. 3, pp. 311-347.
[13] Ping Zhou, Wenjun, Y.E. and Yaojie Xia and Qi Wang (2009), "An Improved Canny Algorithm for Edge Detection", International Journal of Computational Information System, Vol.7, No. 5, pp. 1516-1523.
[14] Mallat, S. and Zhong, S. (1992), "Characterization of Signals from Multi scale Edges", IEEE Trans on PAMI, Vol. 14, No. 7, pp. 710-732.
[15] Zhang, T.X., Peng, J.X. and Li, Z.J. (1996),"An Adaptive Image Segmentation Method with Visual Nonlinearity Characteristics", IEEE Trans. on SMC-Part B, Vol. 26, No. 4, pp. 619 -627.
[16] Ramakant Nevatia (1977), "A Color Edge Detector and Its Use in Scene Segmentation", IEEE Transactions on Systems, Man, and Cybernetics, Vol. 7, No.11, pp. 820-826.

Elimination of High Quality Video Random Noise through Modified First Order Neighborhood Mean Filter (MFONMF)

V.Sujith[1], B.Karthik[2]
{pcnsujith@gmail.com[1], karthik.ece@bharathuniv.ac.in, karthikguru33@gmail.com[2]}

Research Scholar, ECE, Bharath Institute of Higher Education and Research, Chennai[1],
Associate Professor, Department of ECE, Bharath Institute of Higher Education and Research, Chennai.[2]

Abstract. Noise elimination is one amongst the foremost necessary elements to urge distinctive video from hugely corrupted video. The video could also be corrupted with noise for the period of broadcast from crying channel, sensors or thanks to various ecological circumstances. This constructs the video illustration ugly. Random noise also can rise up throughout transmission that staggeringly corrupts the video. During this paper a formula is meant to eliminate the random from corrupted color films. In earlier period investigator projected several algorithms to urge obviate the random noise however they be unsuccessful to produce higher effects at high noise density example 80%-90%. The projected formula machinery on levels initial level is to return across the crying picture element and also the second stage is to update the crying picture element. This set of rules considers modified initial order neighborhood picture elements for sleuthing the crying pixel and imply filter is employed for de-noising. Color movies area unit de-noised with the helpful resource of extracting the each and every frame from video, then the frames area unit rending into R, G and B channels once that they are de-noised one by one once that united conjointly once more to make the color video.

Keywords: Video, Denising, Random Noise, MFONMF.

1 Introduction

Image sweetening is individual among the ranges for process the picture in digital picture process location. Image sweetening is that the device of constructing pictures additional helpful and it additionally get better the marvelous of photograph. the explanation why image sweetening is completed for the reason that it highlights attention-grabbing information inside the picture graph gets obviate noise from the representation and construct the photo visually attractive. There area unit immense directions of photograph sweetening ways spatial space approach and frequency place approach. Spatial fieldpractice works unswervingly on the exploitation of photograph pixels when frequency neighborhood is predicated entirely on written material the Fourier or wave renovate of image. If treatment is meted out quickly on picture pixels and if the picture is vociferous this shows any superfluous statistics is introduced to the picture then de-noising is dead in additives exposure of noise and elimination of that specific noise. Noise ordinarily comes from sensors, ecological things and transmission via vociferous channel. De-noising is accomplished thanks to the truth the

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photograph is perhaps visually ugly, awful compression or terrible assessment. There are unit exclusive noise sorts freelance of spatial place and spatially structured. The noises that area unit freelance of spatial neighborhood area unit impulsive noise and AWGN and therefore the spatially dependent noise considers periodic noise.

2. Literature Review

For casting off the noise beginning the dishonored photograph filter is done where distinct sorts of sieve are used for noise elimination. These filters hold back the noise from the representation and make the photo noise loose. Several filters planned by means of way of remarkable researchers for disposing of the noise from the pictures which might be corrupted by using way of desire noise and they will be the most excellent choice to dispose of noise as they're easy to position into effect on hardware. Dissimilar filters that have been used embody middle filter, suggest clean out, toggle median filter, alpha trimmed mean clear out, un-symmetric trimmed median clear out and so on. Numerous researchers have advised numerous filtering strategies for eradicate salt and pepper noise. Among those SMF is easy to execute and is likewise dependable.

Drawback: Nevertheless, its critical downside filter is effectual high-quality at squat down density. When concentration stage is accelerated over 50% then the brink statistics of specific photograph isn't preserved [4]. To triumph over this disadvantage several techniques have been projected to do away with salt and pepper noise at excessive density. A Fast Adaptive Mean Filtering Algorithm

3. Proposed Algorithm

The proposed clamor evacuation the utilization of MFONMF set of rules systems each and every pixel of the body by utilizing recognizing the uproarious pixel in the casing of video. This arrangement of principles is construct absolutely with respect to windowing strategy so a minimum length window 4 x 3 is taken from each collection of video to diminish the unpredictability. Pixel of intrigue is the inside pixel called preparing pixel P (1, j). Preparing pixel is checkered whether it's miles uproarious or commotion free with the helpful asset of confirming that the pixel lies between most (255) and insignificant (0) dark degree esteems. On the off chance that the pixel is in the middle of the assortment of dim level then the pixel is without commotion generally the pixel is adulterated pixel and it is handled to get supplanted to clamor free pixel expense. Innocent pixels that lounge inside the variety are left unaltered.

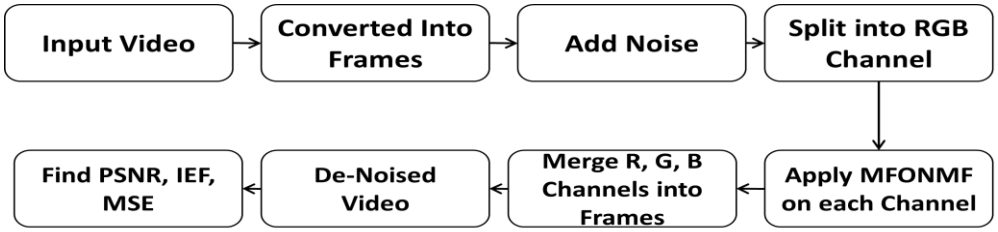


Figure 1- Block Diagram of MFONMF

Flow Chart

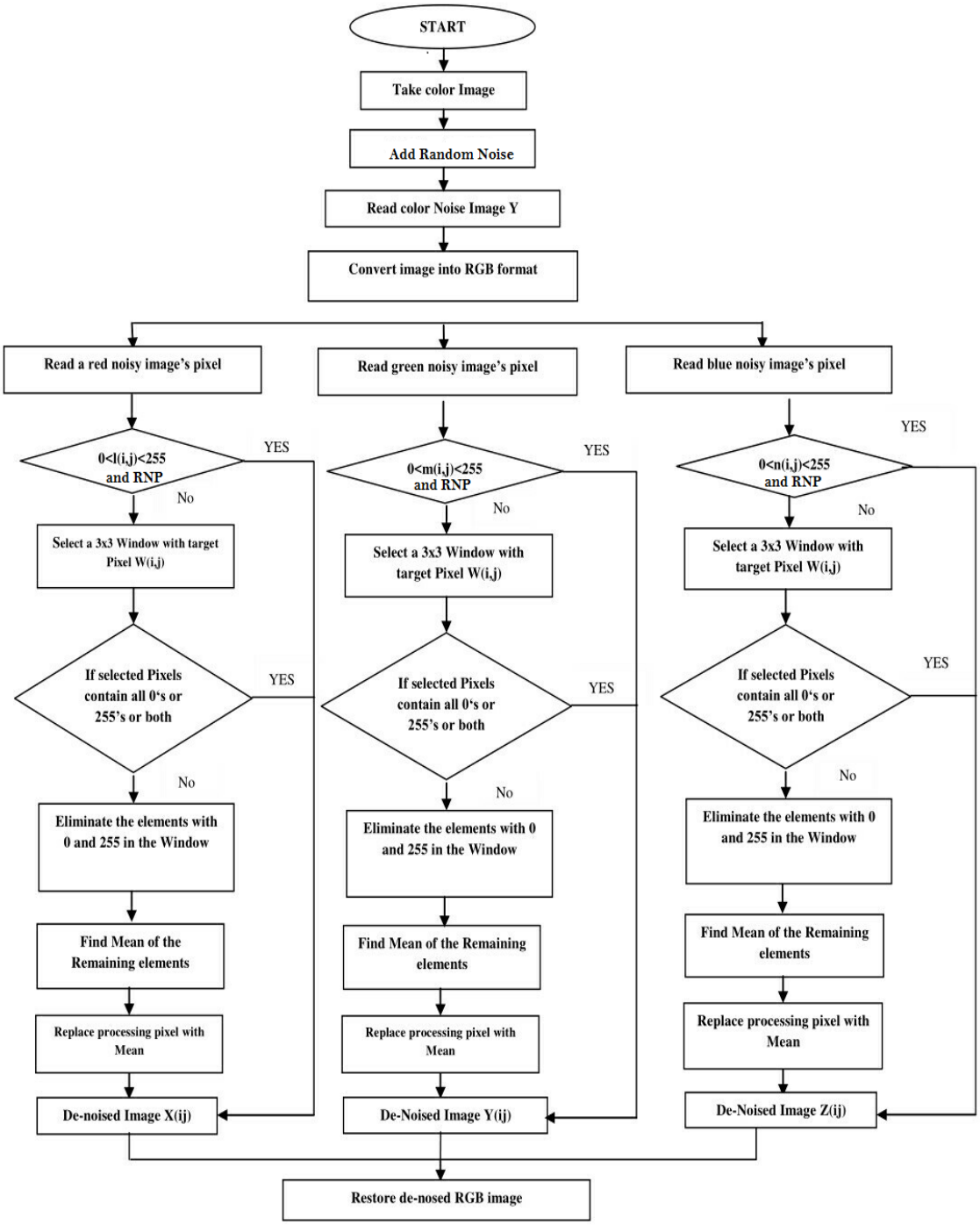


Figure 2. Flowchart of Proposed Algorithm MFONMF

Procedure for MFONMF

The steps for the algorithm are as follows:-

The steps for the algorithm are as follows:-

S1: First we take an preliminary shade frame from video and be appropriate on it constant appreciated impulse noise. This colour frame is read as Y [1] and similarly all processing frames are stored within the form of array Y.

Y [1: No of frames].

S2: In the 2nd step break up the frame hooked on RGB thing. Captivating BGR pixels for inspection noise.

S3: In 3rd step the pixel is examine and progression with the aid of the usage of the subsequent steps:-

S 3.2: 2nd step we determination exertion on noisy pixel of S3.1 now pick a window W (i, j) of size 2X2 . Take for granted that the dispensation noisy pixels are X (i, j), this is process within the subsequent step.

Step 3.3: Then circulate the desired window across one step of all four directions (left, proper, top, and backside) as proven in underneath parent. Now discover the mean price for all windows then replace X with the calculated over all suggest price from all windows. This noise removed frame restores in denoised frame on the final step.

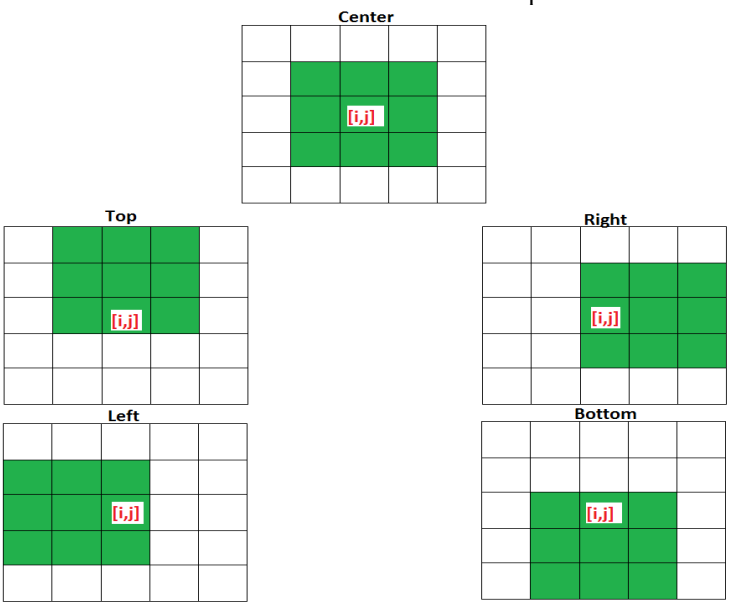


Figure 3. Sample window selection for de-noising

Step four: Replicate S3.I to 3.3 for BGR additives. Noisy pixel are correspond to by using m (i, j) and for B noisy pixel are correspond to by n (1, j). Also the re-establish body is represent by Y (1, j) and Z (1, j) correspondingly.

Step 5: Complete development is achieved until all pixels pink, G and B within the entire frame are development. And subsequently the BGR mechanism are compound to get the ultimate denoised frame.

Step 6: Extracted frames are merged into the denoised coloration video.

Hence a better denoised video is obtain with improved PSNR, IEF and additionally indicates a higher video with extremely stumpy blur and stepped forward visible and human perception

Formula

Performance are quantitatively calculated with numerous noise density for PSNR, MSEand IEF defined (1), (2) and (3) correspondingly:

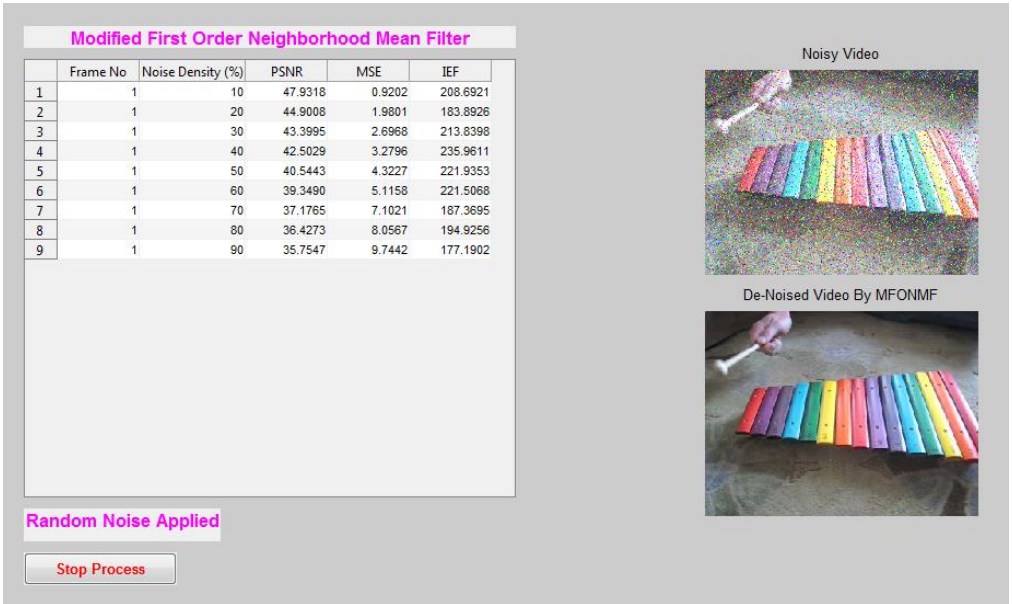
$$PSNR = 10\log_{10}\frac{(255)^2}{MSE} \quad (1)$$

$$MSE = \frac{\sum_{i=1}^{m}\sum_{j=1}^{n}\{Y(i,j)-\hat{Y}(i,j)\}^2}{m\times n} \quad (2)$$

$$IEF = \frac{\sum_{i=1}^{m}\sum_{j=1}^{n}\{\eta(i,j)-Y(i,j)\}^2}{\sum_{i=1}\sum_{j=1}(\hat{Y}(i,j)-Y(i,j))^2} \quad (3)$$

Here k x l is the dimensions of the pictureture. Y (i, j) symbolize the unique image and Y ϒ(i, j) symbolize denoised photo and η (i, j) symbolize noisy picture. The noise concentration is speckled from 10% to 90%. The consequences display advanced presentation.

4. Results



	Frame No	Noise Density (%)	PSNR	MSE	IEF
1	1	10	47.9318	0.9202	208.6921
2	1	20	44.9008	1.9801	183.8926
3	1	30	43.3995	2.6968	213.8398
4	1	40	42.5029	3.2796	235.9611
5	1	50	40.5443	4.3227	221.9353
6	1	60	39.3490	5.1158	221.5068
7	1	70	37.1765	7.1021	187.3695
8	1	80	36.4273	8.0567	194.9256
9	1	90	35.7547	9.7442	177.1902

Figure 7 Proposed filter Output

Figure 8 Proposed filter Output

Table 1: Comparison of PSNR Values of Different Algorithms

Proposed Filter	Noise Density (%)								
	10	20	30	40	50	60	70	80	90
MF	28.49	25.75	21.84	18.40	14.73	12.23	9.98	8.02	6.57
AMF	21.98	21.92	21.47	21.40	20.65	18.40	14.85	11.29	8.06
PSMF	23.34	22.13	21.47	19.02	16.45	14.67	11.90	10.9	9.07
DBA	25.75	21.84	18.40	17.73	17.23	12.98	11.02	9.09	6.99
MDBA	27.89	26.45	24.56	23.45	22.13	21.47	20.04	17.23	15.56
MDBUTMF	28.98	25.67	24.73	22.13	21.47	21.40	20.65	18.40	16.85
MNF	35.09	33.45	30.34	28.90	27.90	25.67	24.73	22.13	21.47
MFONMF	**48.12**	**45.03**	**42.12**	**39.23**	**38.01**	**36.98**	**36.67**	**35.73**	**34.13**

Table 2: Comparison of IEF Values of different Algorithms (Phase 2)

Proposed Filter	Noise Density (%)								
	10	20	30	40	50	60	70	80	90

MF	23.42	21.12	13.32	11.21	10.3	9.08	8.09	7.78	6.12
AMF	19.43	18.1	17.78	16.0	13.32	11.2	10.23	9.08	8.09
PSMF	29.56	26.78	21.84	18.40	14.73	12.23	9.98	8.02	6.57
DBA	31.23	28.49	25.75	21.84	18.46	14.73	12.23	12.01	10.34
MDBA	33.65	29.56	26.78	21.84	16.0	13.32	11.2	10.23	9.08
MDBUTMF	34.54	32.56	28.78	24.84	18.40	18.21	14.73	12.23	9.98
MNF	37.67	36.76	32.3	30.05	24.75	20.02	18.40	14.73	12.23
MFONMF	**248.72**	**235.7**	**231.3**	**223.1**	**220.4**	**200.20**	**192.1**	**180.0**	**176.27**

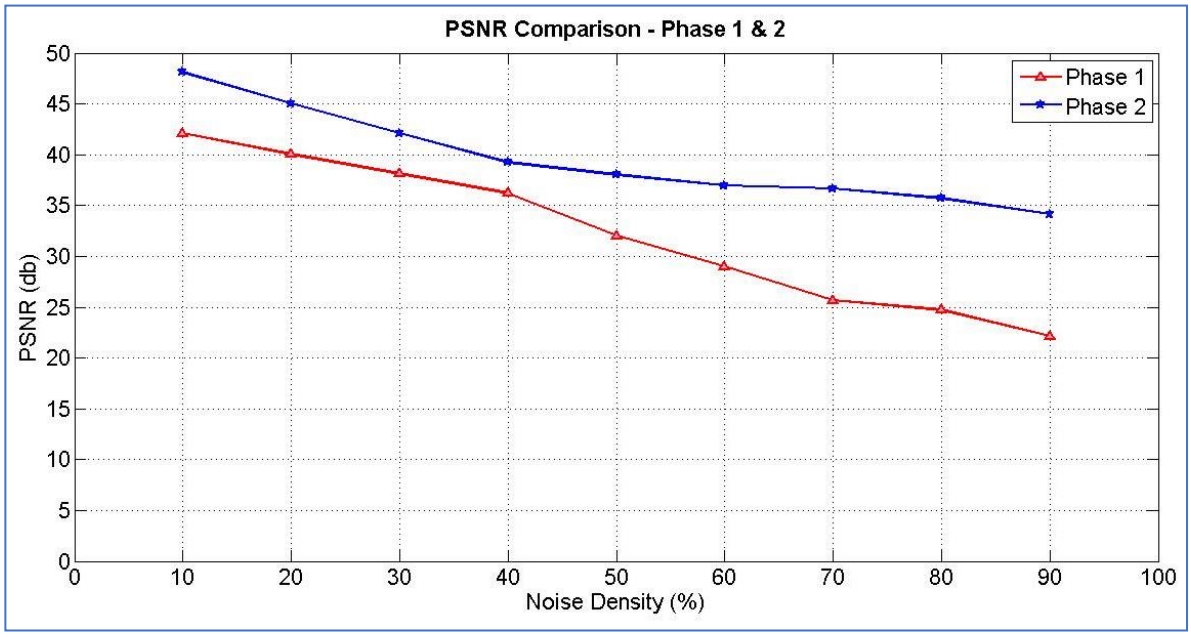


Figure 11 **Noise density versus PSNR (db)**

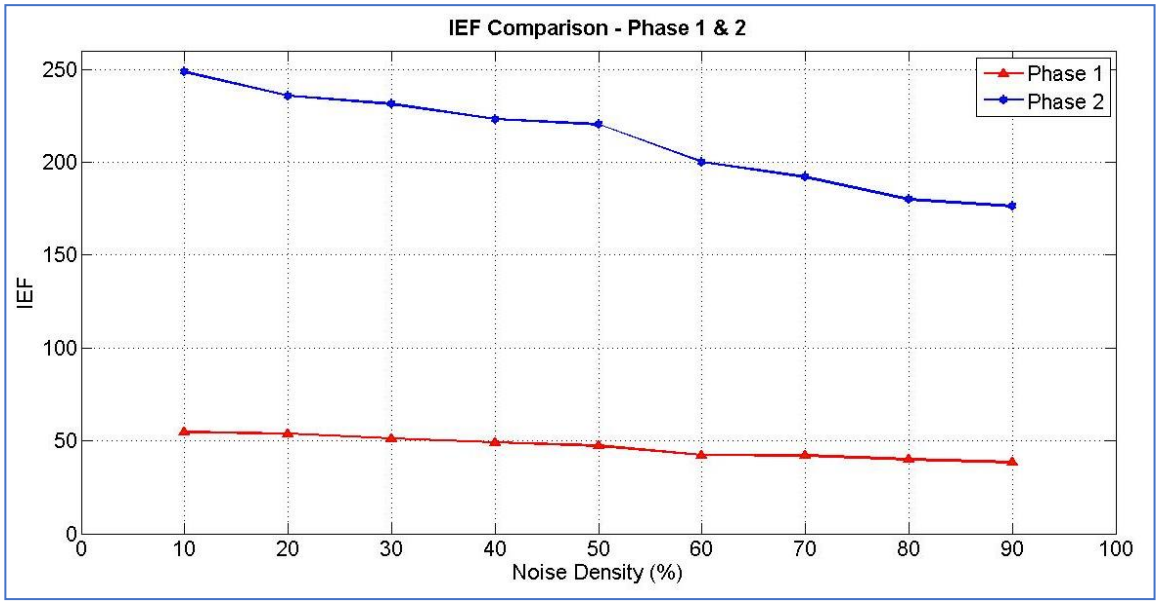


Figure 11 Noise density versus IEF

Conclusion

A new set of rules (MFONMF) has been projected for random noise elimination at advanced compactness noise eighty% to ninety%. This set of rules offers better effects than MF, PSMF, MDBA, AMF, DBA, and different current algorithms in stipulations of IEF and PSNR.

References

[1] T.A. Nodes and N.C. Gallagher, Jr., "The output distribution of median type filters," IEEE Trans. Communication, 32(5): 532-541, 1984.

[2] H.Hwang and R.A.Haddad, "Adaptive median filters: new algorithms & results," IEEE Transactions on image processing, Vol. no:4, pp.499-502, 1995.

[3] J.Astola and P.Kuosmaneen, Fundamentals of Nonlinear Digital Filtering, 1997.

[4] S.Zhang and M.A. Karim, "A new impulse detector for switching median filters," IEEE signal Process.Lett., vol. 9, no. 11, pp.360-363, Nov. 2002.

[5] Fanzhi Kong, Wenbin Ma, "A Fast adaptive Mean Filtering Algorithm,", 2nd International Conference on Industrial and Information Systems, IEEE 2010.

[6] P.E. Ng and K.K.Ma, "A switching median filter with boundary discriminative noise detection for extremely corrupted images," IEEE Trans. Image Process., vol. 15, no. 6, pp. 1506-1516, Jun 2006.

[7] K.S. Srinivasan and D.Ebenezer, "A new fast and efficient decision based algorithm for removal of high-density salt and pepper noise in image," EURASIP J. Adv. Signal Process, 2010.

[8] K.S. Srinivasan and D.Ebenezer, “A new fast and efficient decision based algorithm for removal of high-density impulse noises,” IEEE Signal Processing Letters, vol. no:14 pp.189-192, 2007.

[9] V. Jayaraj and D. Ebenezer, “A new switching-based median filtering scheme and algorithm for removal of high-density salt and pepper noise in image,” EURASIP J. Adv. Signal Process. 2010.

[10] K.S. Srinivasan, V.Jayaraj and D.Ebenezer, “A new and efficient algorithm for removal of high-density salt and pepper noise in images and videos,” Second Int. Conf. Computer Modeling and Simulation, 2010, pp. 409-413.

[11] S.Esakkirajan, T.Veerakumar, AdabalaN.Subramanyam, and C.H.PremChand, “Removal of high Density Salt and Pepper Noise Through Modified Decision Based Unsymmetric Trimmed Median Filter,” IEEE Signal Processing Letters, vol. 18, no.5, May 2011.

[12] T.M.Benazir and B.M.Imran, “Removal of High and Low Density Impulse Noise From Digital Images Using Non Linear Filter,” International Conference on Signal Processing, Image Processing and Pattern Recognition, [ICSIPR) 2013.

[13] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.

[14] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, “Automation systems in smart buildings: a review”, Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9

[15] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, “Gabor filter and machine learning based diabetic retinopathy analysis and detection”, Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.

[16] Vijayan T, SangeethaM, Karthik B, “Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application,” International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020

[17] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, “Development of air quality monitoring (AQM) models using different machine learning approaches”, Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2

[18] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, “Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis,” Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.

[19] Vijayan T, Sangeetha M, Karthik B, “Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture,” Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

Soft Switched Bi-directional Power Converter for Photo Voltaic System

L. Sahaya Senthamil[1], R.Sivapriyan[2], C.V. Mohan[3], P. Sundaramoorthi[4]

{elsahayam@gmail.com[1], sivapriyan@gmail.com[2], mohan_eee@sirmvit.edu[3], sundarped.sundar66@gmail.com[4]}

[1]Professor, Department of Electrical and Electronics Engineering, PSNA College of Engineering and technology, Dindigul, India, [2]Associate Professor, Department of Electrical and Electronics Engineering, Sir MVIT, Bangalore, India, [3]Associate Professor, Department of Electrical and Electronics Engineering, Sir MVIT, Bangalore, India, [4]Associate Professor, Department of Electrical and Electronics Engineering, Nehru College of Engineering and Research Centre, Thrissur, India

Abstract. This work proposes the implementation of a bidirectional current-fed soft switched converter for solar photo voltaic system is examined and covered with information. Effective function of the bi-directional buck-boost topology is guaranteed by continuous-duty buck-boost circuit under large voltage spectrum. In battery charger mode, phase shift modulation and pulse width modulation control are employed. In order to allow the MOSFETs to have zero voltage switching, a feedforward loop was applied to the charging mode of the battery. Compared with the conventional bidirectional soft switched converter, this one would definitely be better suitable for designing such magnetic components. This bi directional converter is implemented for a solar structure and experiment results are obtained.

Keywords: Bi Directional Converter, Solar Photo Voltaic, Soft Switching, Maximum Power Point Tracking.

1 Introduction

The application of solar photovoltaic is a modern concept and therefore must be applied by different method and technique. Electronic controls are used for the operation of thermal power plants. It is important to contain high performance transformer. Boost converters have lots of uses in high current, heavy loads settings. Solar photovoltaic power generation module is a strong choice for high voltage bus systems since it transforms sunlight into electricity. Since Converters that are actually feeding current are more powerful than conventional Converters that are actually feeding voltage, they have less limitations. Present limiting feature is important when interacting with very broad currents. This is that the former has more flaws than the latter. Transformer parasitic are very efficient in addressing Switching issues. and heavy switching losses of LCC. The earliest mechanical coupling between trains is a soft switched converter. There are different forms of soft switched series and parallel converters. This new breakthrough can be implemented by the researchers in many forms. The major categories of LC resonating converters are LCF-type, LC-type, LLC-type, LCC-type, CLLC-type, etc. The frequency varies to balance the rate of usage.

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2 Solar Photovoltaic System

The proposed topology for solar PV scheme can be seen in Figure 1. The most critical aspects of the device are solar panel and MPPT/ Bi directional loop.

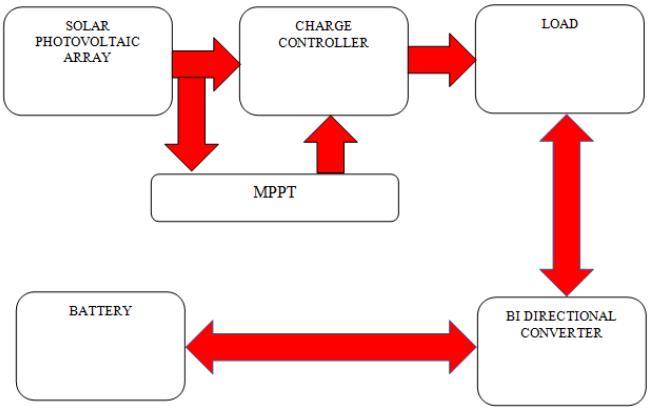

Fig. 1. Block diagram of proposed system with bi directional converter

3 Modelling of Solar PV Module

The sun's power density at 50 km altitude is roughly 1,373 kilowatts per square metre. part of the electricity provided to the world by the Planet is emitted into the environment by radiation. The solar lighting decreases to I kW/m2 at the surface of Earth at noon in the tropics. Solar panels turn sunlight into electricity. A photovoltaic device is the fundamental feature of a solar cell. Solar cells will take sunlight's energy directly and turn it into electrical electricity. Solar power is technologically used to transform sunlight into electrical energy. Solar photovoltaic cells (PV) generate electricity. Electricity may be used to power anything such as tv, microwave, drinking water pumping, illumination etc. A simpler alternative circuit of a solar cell is seen in figure 2. A solar cell generator is paired with a variable resistor. Current is flowing through the diode when the contacts are connected. The light hitting at the cathode induces photocurrent (Iph). The largest existing threshold for solar cell is 1/second. If the diode junction voltage rises, a percentage of the output current passes into the diode, where the voltage falls by the equal number. Output voltage is zero when load resistor is not attached. From Diode Parameter Equation, at RDS=0 relationships can be determined.

Currently, one photovoltaic cell produces a photovoltaic dc in the form of a shifting dc. For converters to operate properly, each panel must be attached in parallel. Solar installation consisting of more than one solar cell and one solar cell module. The equations governing solar cell are

$$I_D = I_0\left(e^{\frac{V_{PV}}{\propto V_T}} - 1\right) \quad (1)$$

$$I_{PV} = I_{SC} - I_0\left(e^{\frac{q(V_{PV}+I_{PV}.R_S)}{\propto KT}} - 1\right) - \frac{V_{PV}+I_{PV}.R_S}{R_{Sh}} \quad (2)$$

$$V_{PV} = \propto V_T ln\left[\frac{(I_{SC} - I_{PV})}{I_0} + 1\right] \quad (3)$$

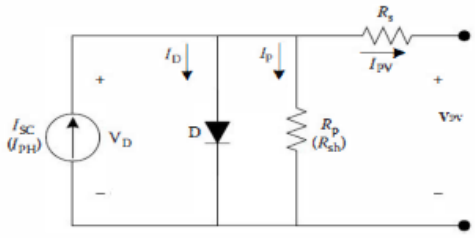

Fig. 2. Solar photovoltaic cell equivalent circuit

Where,
I_D = Current flowing through the diode
T = photovoltaic cell temperature
I_0 = reverse bias current under saturation
V_{PV} = voltage of the solar panel
K = Boltzmann's constant =1.380 × 10^{23}
V_T = voltage at a particular temperature
I_{PV} = panel current
Q = charge of electron
V_T = KT/q
I_{SC} = current of the photon
α = factor of ideality

When it comes to the production of current and voltage from solar electricity, the output depends on the temperature and irradiance. The solar PV module is designed to work at a specific performance under ideal conditions. The full power drawn from the PV cell is critical to enhancing the efficacy of the solar cell. Several studies have been performed on MPPT methods for estimating maximum solar panel power. The voltage technique under open circuit is the most affordable one and economic ways to be applied. Therefore, the open circuit voltage system shall be used in execution.

3.1 Constant Voltage MPPT Algorithm

The ultimate aim may be realized by controlling current or voltage or both. The fastest and cheapest way of applying the LED lighting is with the constant voltage method. Figure 3 represents the MPPT voltage algorithm.

Vpv and Vmp have a direct bond that gives Vpv = kVmp Anywhere Vmp is the maximum power point voltage. The k factor has a range of 0.71 to 0.78, which helps one to use the above formulas to calculate the VMPP and set it as a guide. The panel is measured by calculating the

immediate voltage input from the solar panel and then matching it with the locus voltage. Next, the discrepancy between the two is used to evaluate whether there is some defect.

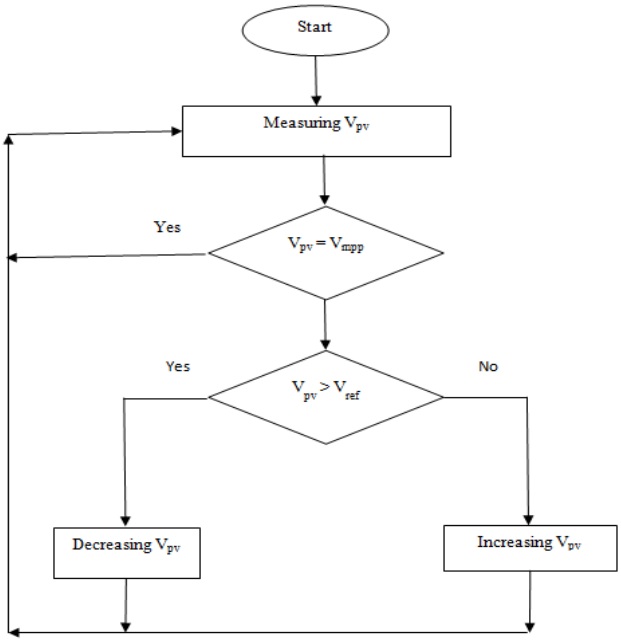

Fig. 3. Constant Voltage MPPT Algorithm

3.2 Bi-directional DC- DC converter

The CFBRC comprises a series attached buck boost converter and a soft switched converter circuit for discharging battery. In action, the soft switched converter with LLC tank converts into a soft switched converter when attached to a constant voltage source, as seen in Fig. 1. The pairs of switches S1, S2 and S3, S4 form two complete full-bridge circuits. The two buck-boost circuits are composed by linking Lb1 and Lb2 to the ends of the legs of the bridge. As with interleaved systems, the two boost-buck converters operate 180° out of phase. Meanwhile, a full-bridge transformer consisting of a soft switched inductor, a soft switched capacitor, and a magnetizing inductor is formed by utilizing a series inductor, a series capacitor and a series magnetizing inductance. The auxiliary-capacitor is charged from the battery and is the voltage that powers the engine. Same Voltage over the bus. In the figure, duty period D is operated by Service S1 and complementary Service S4 .

S1 and S3 have the same job period, but are based off each other 180°. Voltage of the battery would still stay the same. Besides, at this period the secondary side changes, S5~S8 are synchronously rectified and the oscillation frequency of the open-circuit voltage is changed. φ1 is having the angular phase-shift for charging battery in this mode. The angular phase change between S5 and S8 lies between S5 and S1Through using feed-forward method to handle the latest ZVS converter can be run in a typical context. In comparison, the capacitor voltage and battery voltage are both the same.

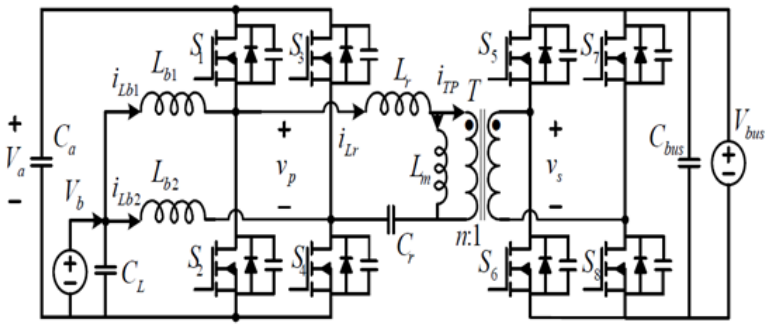

Fig. 3. Bi-directional Converter Circuit

This can be monitored to manage φ1 and task cycle D. In order to determine the operational conditions of the mode of charge and discharge, it is reasonable to conclude that D<0.5.

3.3 Preventive and monitoring technique.

Control technique such as the battery charging and discharge mode of the CFBRC is applied in this section. PWM power and switching frequency is equivalent to the soft switched frequency f. Charge current is regulated to maintain DC voltage bus stable as the battery voltage varies. The sinusoidal wave is an indicator of the reciprocating current. In this way, the CFBRC can function optimally over the diverse input voltage range. We use phase shift power in the charging mode of the battery. To reduce switch frequency, the step between S5 and S8 is established as a persistent rate to ensure the soft switching of the lagging switches at the same time. Regulation of the battery voltage is utilizing step φ1 between C5 and A1.

4 Experimental Results

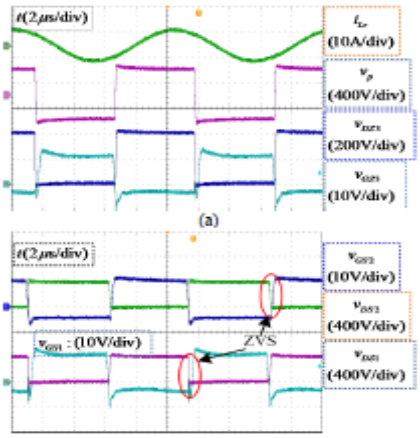

Fig. 5. Waveforms in discharging mode with Vb=200V

To prepare for this experiment, a 1500-W micro-grid prototype was constructed with range of battery voltage from 150V to 240 V, 400V voltage bus and capacitor voltage rated 400V.

During battery discharging, the frequency decreases from 85 kHz to 95 kHz, and in battery charging, it goes from 125 kHz to 145 kHz. The voltage rule for a battery is represented in Figure 5 and figure 6.

This indicates that when the lights were switched on, the drain-to-source voltage had already gone down. ZVS can be mutually realized by all the participants of the discussion. Currently, the flipping frequency spectrum is between 85 kHz and 95 kHz and the soft switched frequency has maximum functionality. Figure Image. This graph reflects the hypothetical effects of charging at a voltage of 200V. The two voltages at the monitor will be ZVS. Within the range from 125kHz ~ 145kHz, the switch frequency band significantly decreases the electrical signal distortion.

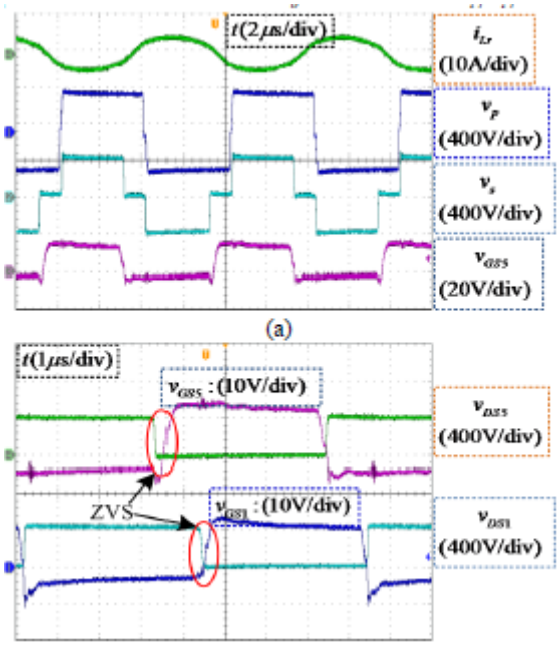

Fig. 6. Waveforms in charging mode with Vb=200V

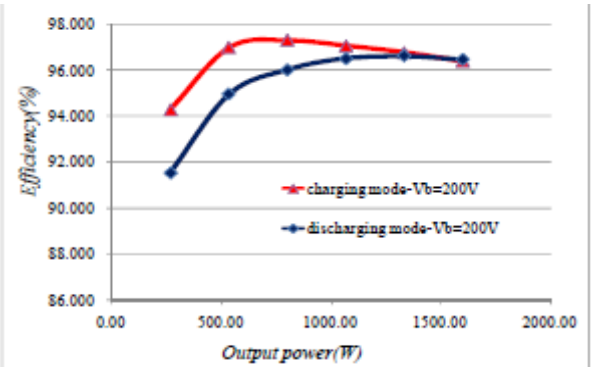

Fig. 7. Battery discharge/charge performance tested

The downside of the SRC's broad frequency spectrum variation. Experimental results help the theoretical study. Figure 7 shows the battery performance under tested condition. These graphs show that at 11 V, the battery is working dramatically. The converters in the entire load range will function reliably

5 Conclusion

The projected current fed soft switched bi directional converter performance is experimented and evaluated. This converter has reduced switching frequency, soft switching for all switches, minimum switching loss and wide range of gain related to other soft switched converters. The soft switched tank circuit of the converter acts as an integrated part of transformer causing reduction in power circulating in the converter and excellent efficiency. Thus, this passive bi directional converter is much suitable for solar photo voltaic application.

References

[1] S. B. Kjaer, J. K. Pedersen and F. Blaabjerg, "Power inverter topologies for photovoltaic modules—A review", *Proc. 37th IEEE-IAS Annu. Meeting*, vol. 2, pp. 782-788, 2002-Oct.-13–18.

[2] Juan Manuel Carrasco, Leopoldo Garcia Franquelo, Jan T. Bialasiewicz, Eduardo Galván, Ramón C. Portillo Guisado, Ma. Ángeles Martín Prats, José Ignacio León, and Narciso Moreno-Alfonso, "Power-Electronic Systems for the Grid Integration of Renewable Energy Sources: A Survey", IEEE Transactions on Industrial Electronics, Vol. 53, no. 4, August 2006.

[3] M. Jamil, B. Hussain, M. Abu-sara, R. Boltryk and S. Sharkh, "Microgrid Power Electronic Converters: State of Art and Future Challenges", *2009 Proceedings of the 44th International*, pp. 1-5, Sept. 2009.

[4] G-J Su, D. J. Adams, F. Z. Peng, and H. Li, "Experimental evaluation of a soft-switching DC/DC converter for fuel cell vehicle applications" IEEE Power Electronics in Transportation, 2002, pp. 39-44.

[5] Shigenori Inoue, Hirofumi Akagi, "A Bi-Directional DC/DC Converter for an Energy Storage System," in Proc. IEEE APEC, 2007, pp. 761-767.

[6] A. Kirubakaran, S. Jain and R. K. Nema, "A review on fuel cell technologies and power electronic interface", *Elsevier Renewable and Sustainable Energy Reviews*, vol. 13, no. 9, pp. 2430-2440, 2009.

[7] R. Y. Chen, R. L. Lin, T. I. Liang, I. F. Chen and K. C. Tseng, "Current-fed full-bridge boost converter with zero current switching for high voltage applications", *Conf. Rec. IAS Annu. Meeting*, vol. 3, pp. 2000-2006, 2005.

[8] V. Vaisanen, T. Riipinen, J. Hiltunen and P. Silventoinen, "Design of 10 kW soft switched push-pull DC-DC converter for solid oxide fuel cell applications," in Proceedings of the 2011-14th European Conference on Power Electronics and Applications (EPE 2011), 2011.

[9] G. Ma, W. Qu, G. Yu, Y. Liu, N. Liang and W. Li, "A zero-voltage-switching bidirectional dc–dc converter with state analysis and soft-switching-oriented design consideration", *IEEE Trans. Ind. Electron.*, vol. 56, no. 6, pp. 2174-2184, Jun. 2009.

[10] Y.-C. Chuang, Y.-L. Ke and S.- Y. Chang, "Highly-efficient battery chargers with parallel-loaded soft switched converters", *Industry Applications Society Annual Meeting 2009. IAS 2009. IEEE*, pp. 1-10, Oct 2009.

[11] S. Samanta and A. K. Rathore, "Analysis and design of current-fed (L)(C) (LC) converter for inductive wireless power transfer (IWPT)", *Proc. IEEE Energy Convers. Congr. Expo. (ECCE)*, 2015.
[12] F. Musavi, M. Craciun, D. S. Gautam, W. Eberle and W. G. Dunford, " An LLC soft switched DC–DC converter for wide output voltage range battery charging applications ", *IEEE Trans. Power Electron.*, vol. 28, no. 12, pp. 5437-5445, Dec. 2013.
[13] M.K. Kazimierczuk and D. Czarkowski, "Soft switched Power Converters", *Power*, vol. 7, pp. 632, June 2012.
[14] T. Zhao, G. Wang, S. Bhattacharya and A. Q. Huang, "Voltage and power balance control for a cascaded H-bridge converter-based solid-state transformer", *IEEE Trans. Power Electron*, vol. 28, no. 4, pp. 1523-1532, Apr. 2013.
[15] S. Inoue, and H. Akagi, "A Bi-Directional dc/dc converter for an energy storage system," Twenty Second Annual IEEE Applied Power Electronics Conference, 2007.

A Comprehensive Review on FPGA based PWM techniques for DC-DC converters

R. Vimala[1], M. Joe Marshell[2], D. Sathish Kumar[3], Sujesh P Lal[4]

{vimala79@gmail.com[1], itsjoemarshell@gmail.com[2], sathish.cse@sairam.edu.in[3], sujeshlal@gmail.com[4]}

[1]Professor, Department of Electrical and Electronics Engineering, PSNA College of Engineering and Technology, Dindigul, India
[2]Assistant Professor, Department of Electrical and Electronics Engineering, RVS College of Engineering, Dindigul, India
[3]Assistant Professor, Department of Computer Science and Engineering, Sri Sairam Engineering College, Chennai, India
[4]Assistant Professor (Special Grade), Department of Computer Applications, Federal Institute of Science and Technology, Ernakulam, India

Abstract. Pulse Width Modulation (PWM) modules are immensely significant in the design of real power converters. Mainly, the variable duty cycle pulses generated from the PWM module vary the average dc voltages across the load in the power converter circuits. All the regulator and dc/dc converter ICs include the clock, MOSFET switch and the PWM control module apart from the external components such as resistor, inductor and capacitor, diodes, and the transformers. In this review article, the five different PWM generation methods include using a free-running counter, up/down counter, hardware accumulator, two de-bounced push button switches and swapping bits method. The PWM wave generation modules are implemented on an Altera FPGA device using Quartus II synthesis software tool. The performance metrics such as the logic elements (LEs) utility, the clock speed, and the power dissipation are analyzed in detail. Also, Matlab/Simulink and the DSCH/Microwind tools are used to generate the PWM wave.

Keywords: Accumulator, de-bounced push buttons, FPGA, free-running counter, Microwind, PWM, Simulink.

1 Introduction

PWM techniques have been the topic of demanding exploration in the past few decades. The PWM is the widely used technique for controlling DC power to ambiguous electrical devices in sophisticated electronic power switches. Moreover, AC choppers exploit PWM techniques. For instance, the overall current delivered to the load is controlled by the switch's position and state (duration). If the ON time of the switch is higher than the OFF time, the more power will be delivered to the load. For example, if the PWM wave contains the duty cycle of 80%, then the load would receive higher power. Hence the PWM wave's switching frequency plays a vital role in delivering power to the load in the modern electronic power supplies (Guellal et al. 2015).

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More importantly, in the era of power electronics, the demand for AC motor speed control with a variable frequency supply is that the input voltage or current signals accommodate the least possible distortion. The inverter is the optimal solution through the generation of three sinusoidal signals of aligned phasor proportions (Aravind et al. 2014). But the drawback is that the device cost (expensive) requires more number of switching elements. The PWM technique can generate such sinusoidal motor voltage waveforms effectively. In the ac power measurement, the circuits such as PAM and PWM can be used effectively to incorporate multiplier (Aravind et al. 2016).

Most of the power-electronic circuits do have PWM block as the core one. An amplitude signals are encoded into a rectangular signal using the PWM technique with varying pulse-width. Primarily, there is a need of PWM wave in switched-mode power supplies (SMPS) such as servo-motor drivers, DC-DC converters, and power amplifiers. PWM methods would enhance the power efficiency results in more than 95% in some of the recent power-electronic circuits (Karaca et al. 2018).

The PWM waveform generation is either directly or indirectly exploited in the biomedical instrumentation field. For instance, in the typical biomedical instrumentation, successive-approximation ADC using PWM is the widely used technique to obtain digital control signals. Also, the PWM output using either microcontroller or digital signal processor or Field-Programmable Gate Array (FPGA) can generate the ECG signal. For example, in speciic clinical applications, the arbitrary waveform generator using PWM is often used in ultrasound research applications. The PWM based lock-in bioimpedance measurement is widely used in implantable biomedical devices, such as, in pacemakers. The photonic biomodulator often exploits the PWM frequency meter for its measurement. The PWM modules are often used in the phototherapy system.

2 PWM using Simulink

Figure 1 show the generation of the PWM wave using a Simulink model. Here, the instantaneous voltage of the triangular wave is added with a constant, for instance, with 0.8, as illustrated. Then the result is compared to zero, that is, if the adder output is higher than zero, the PWM output becomes zero else becomes one. Figure 2 shows the PWM output wave.

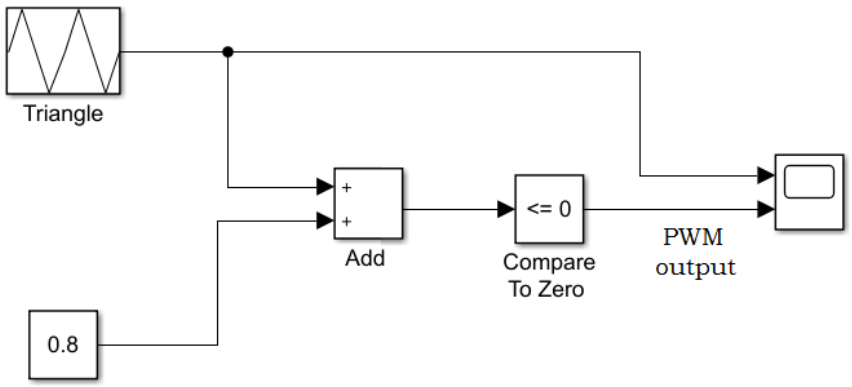

Fig.1 PWM Generation using a Simulink Model

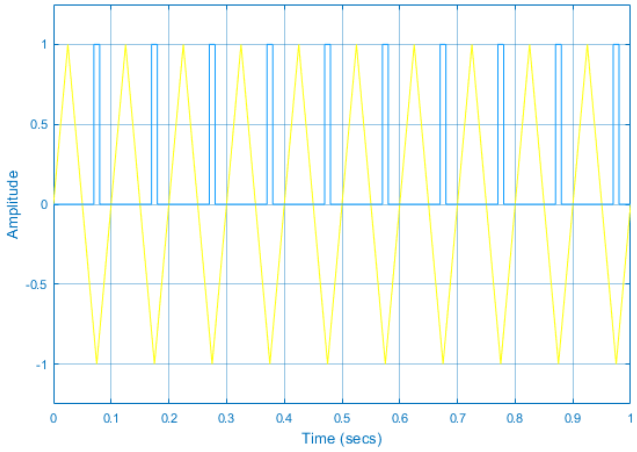

Fig.2 PWM Output Wave

2.1 PWM using Free-Running Counter

Here, as illustrated in Figure 3, the counter output is compared with the PWM_in data. If the counter value is higher than the PWM_in data, then the PWM output becomes one, or the result becomes zero. The RTL schematic of the PWM generation using the free-running oscillator is shown in Figure 3. Figure 4 shows the functional simulation of the same using the Quartus II synthesis software tool.

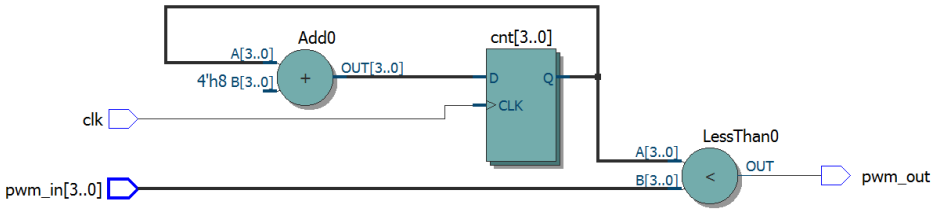

Fig.3 The RTL schematic of the PWM generation using a free-running counter

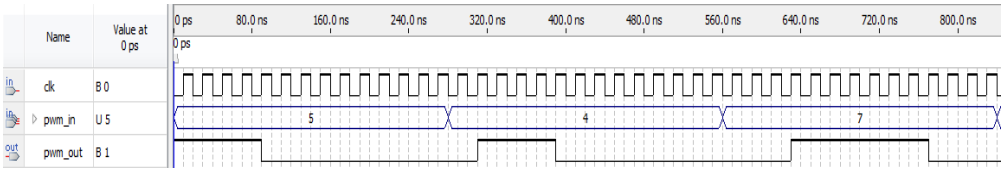

Fig.4 The functional simulation results with the PWM output

2.2 PWM using an Up-Down Counter

Figure 5 illustrates the RTL schematic view of a much-sophisticated design, a loadable up-down counter with the absence of comparator at the output. Since it has got 17 states rather than 16 as in the previous case, the PWM out varies from 6% (1/17) to 94% (16/17).

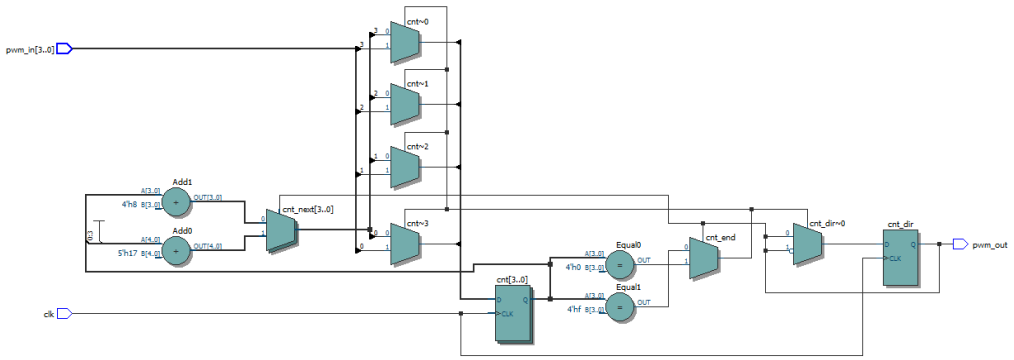

Fig.5 RTL schematic of the PWM generation using an up-down counter

2.3 PWM using Digital-to-Analog Converter

Using an accumulator, the simple first-order sigma-delta DAC can be designed, as shown in Figure 6. If there is an overflow in the hardware accumulator, the PWM_out becomes '1' or else becomes '0'. One such sample functional simulation result is shown in Figure 7.

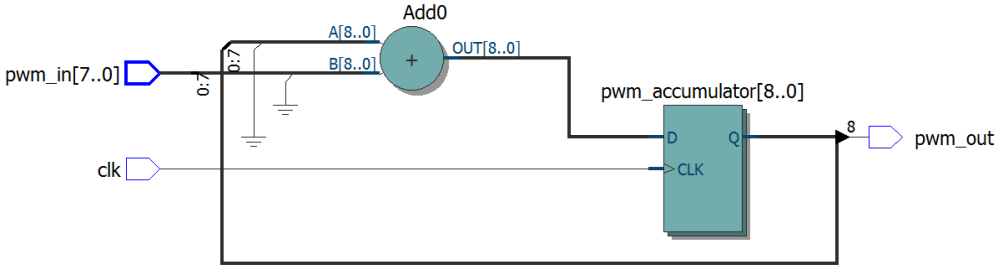

Fig.6 PWM generation using the hardware accumulator

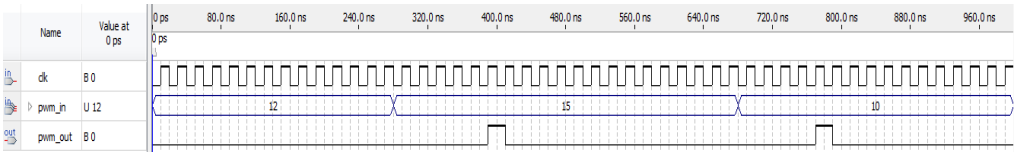

Fig.7 PWM out using functional simulation results

2.4 PWM using two de-bounced push-buttons

PWM output can be generated using two de-bounced push-buttons – one is to increase the duty cycle by 10%, and the other is to decrease the duty cycle by 10%. Thus the variable duty cycle during the PWM generation can be achieved. Figure 8 shows the RTL schematic view (portion) of the PWM generation using two de-bounced push buttons.

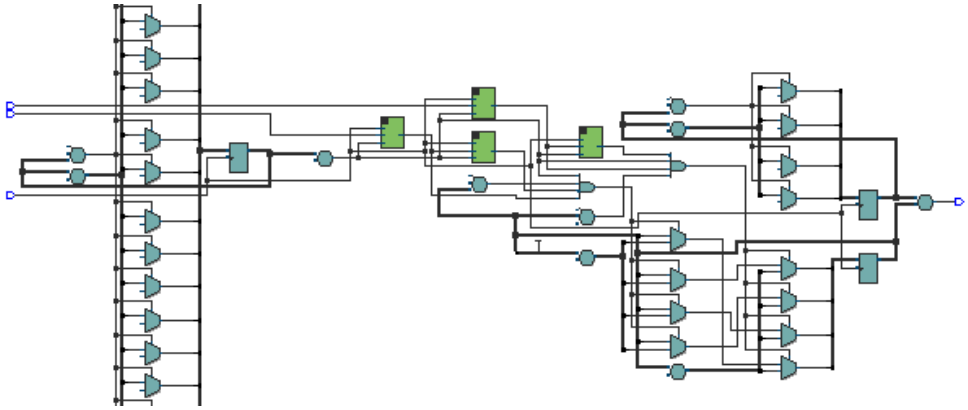

Fig.8 Portion of an RTL schematic view of PWM generation using a variable duty cycle approach

2.5 PWM generation with higher performance

The performance of the PWM generation can be improved by swapping all the bits in the binary comparator. That is, the most significant bit (MSB) is wired to the least significant bit (LSB), the LSB is wired to the MSB, and so on. No additional hardware components such as registers and logic circuits are required due to only rewiring (EDN 2007). Figure 9 shows the RTL schematic view of the PWM generation by exchanging the LSB-to-MSB bits approach.

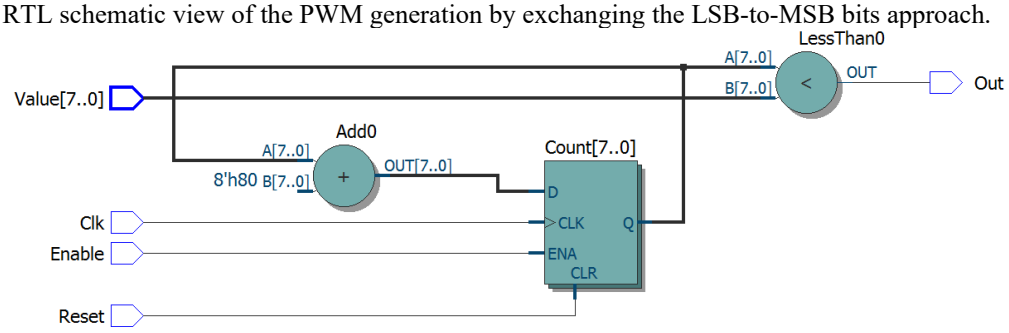

Fig.9 RTL schematic view with the rewiring (LSB-to-MSB) method

3 Simulation Results and Discussion

We experiment with our methods using the Altera Quartus II synthesis software tool. The design implementations were performed on an Altera FPGA device EP4CE115F29C7. A laptop (Dell Vostro 1540) is used in this study, configured as a 2.5 GHz CPU and 4GB RAM. For ASIC implementation, the digital schematic (DSCH) and the layout editor (Microwind) are used. Also, one method demands to use the Matlab R2018a tool, with a Simulink companion software package.

3.1 Resources Utilization

In general, FPGAs include prefabricated logic blocks, input/output blocks, and interconnect resources. We can estimate the number of logic elements (LEs) required for the design using

the device utilization summary obtained from the Quartus II synthesis tool. Figure 10 shows one such report using the methods involved in this study. From the results, the PWM wave generation using two-de-bounced push-buttons requires more number of LEs (56) than others due to the hardware complexity in the design. On the other side, the PWM wave generation using the simple hardware accumulator approach requires only lower LEs (6) than others.

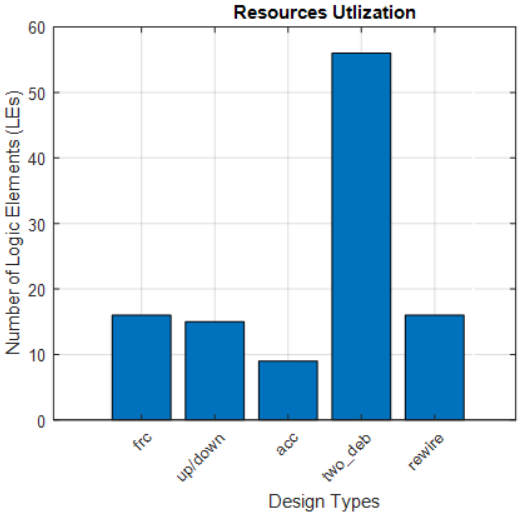

Fig.10 Results on Resources Utilization

3.2 Performance

The critical path is the path that holds a maximum delay in the complete design. Using the Altera Quartus Time Quest Time Analyzer tool, this critical path can be found. The performance or clock speed of the design is calculated by computing the reciprocal of the critical path delay. For instance, the critical path delay of the PWM wave generation using the rewiring method is 2.15 ns, and hence the performance becomes 463 MHz, as illustrated in Figure 11. It is evident from the results that the "accumulator" method obtains better performance (481 MHz) than others.

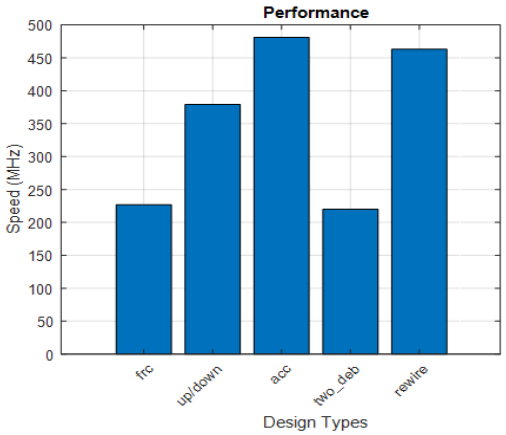

Fig.11 Results on Clock Speed

3.3 Power Dissipation

The power dissipation is one of the significant design parameters with FPGA implementation. It is broadly classified into two categories, namely the static power dissipation and the dynamic power dissipation. The static power is not design-dependent and will be determined by the number of unused logic elements in the design; also, it is called “leakage power”. But the dynamic power dissipation is the design dependent. That is, the used logic elements, the clock frequency, and other resources such as an embedded multiplier, RAM, and PLL in the design will determine the switching activity of the circuit, and hence the dynamic power appears in the circuit.

Figure 12 shows the total power dissipation used by the PWM generation methods used in this study. For instance, the PWM generation using the rewiring method consumes the total power dissipation as 131.04 mW. In contrast, the static power yields 98.46 mW, the I/O power produces 31.09 mW, and the dynamic power yields 1.49 mW.

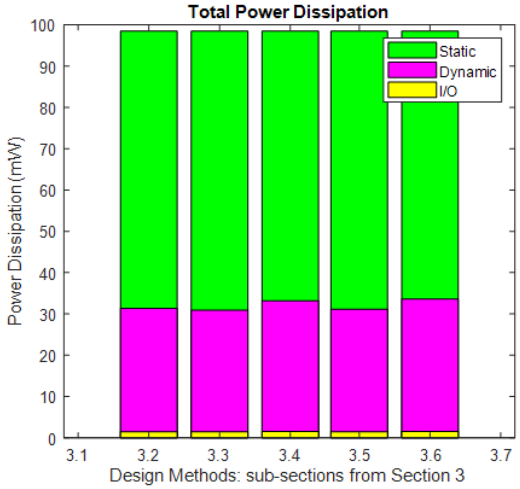

Fig.12 Results on Power Dissipation

4 Conclusion

PWM generation modules are used in many applications such as audio/video amplifiers, telecommunication systems, smart lighting systems, synthetic ECG signal generators, implantable medical devices, etc. This article’s main motive is to analyze the different methods of PWM wave generation and to implement them in an Altera FPGA device. The tools such as Matlab/Simulink, DSCH/Microwind, and Altera Quartus II synthesis software tools are used to generate the PWM wave. The six different PWM methods such as free-running counter, up/down counter, accumulator, two de-bouncing switches, swapping bits, and modified counter are explored, and the results are analyzed in detail.

References

[1] Guellal A, Larbes C, Bendib D, Hassaine L, Malek A (2015) FPGA based on-line artificial neural network selective harmonic elimination PWM technique. International Journal of Electrical Power & Energy Systems 68:33–43.

[2] Yazdani MR, Farzanehfard H, Faiz J (2011) Classification and comparison of EMI mitigation techniques in switching power converters—a review. Journal of Power Electronics 11:767–777.

[3] Aravind Britto KR, Vimala R, Baskaran K (2014) Randomized Sigma-Delta Pulse Width Modulation using FPGA for Conducted EMI Reduction in Flyback Converter. International Review of Electrical Engineering 9(1):1–7.

[4] Mainali K, Oruganti R (2010) Conducted EMI mitigation techniques for switch-mode power converters: a survey. IEEE Transactions on Power Electronics 25(9):2344–2356.

[5] Bhargava A, Pommerenke D, Kam KW, Centola F, Lam CW (2011) DC–DC buck converter EMI reduction using PCB layout modification. IEEE Transactions on Electromagnetic Compatibility 53:806–813.

[6] Chariag D, Sbita L (2020) Implementation of different randomized PWM schemes using Atmega328p microcontroller for EMI reduction in boost converter. Electrical Engineering 102: 1063–1071.

[7] Kapat S (2016) Reconfigurable periodic bifrequency DPWM with custom harmonic reduction in dc–dc converters. IEEE Transactions on Power Electronics 31(4):3380–3388.

[8] Vimala R, Baskaran K, Aravind Britto KR (2011) Modeling of Conducted EMI in Switching Power Converters using Equivalent Circuit Model. International Journal of Electrical Engineering 4(1):59–74.

[9] Karaca T, Auer M (2018) Digital pulse-width modulator with spread-spectrum emission reduction. Elektrotechnik und Informationstechnik 135:48–53.

[10] Karaca T, Auer M (2017) A class-D output bridge with dynamic dead-time, small delay and reduced EMI. In 2017 IEEE international symposium on circuits and systems (ISCAS), Baltimore, USA, May, pp.1–4.

[11] Aravind Britto KR, Vimala R (2016) FPGA based sigma delta modulation for DC-DC flyback converter. International Journal of Advanced Engineering Technology 7(2):1–5.

FPGA Based Dual Controller Design for EMI Reduction in Dc-Dc Converters

[1]K.R.Aravind Britto, [2] S.Saravanan, [3]M.Krishna kumar, [4]C.Kannika Parameshwari, [5]G.Ramprabu
{krbritto1975@gmail.com[1], saravananjask@gmail.com[2], krishna18innet@gmail.com[3], kannikackp@gmail.com[4], dr.g.ramprabu@gmail.com[5]}

[1]Professor, Department of ECE, PSNA College of Engineering and Technology, Dindigul. [2]Assistant Professor, Department of ECE, PSNA College of Engineering and Technology, Dindigul. [3]Assistant Professor, Department of ECE, Grace College of Engineering, Tiruchendur Road, Mullakkadu. [4]Assistant Professor, Department of ECE, NPR College of Engineering and Technology, Dindigul. [5]Professor, Department of ECE, Bonam Venkata Chalamayya Institute of Technology & Science, India.

Abstract. In high frequency electronic power converters, the suppression of Electromagnetic Interference (EMI) and the improvement of Electromagnetic Compatibility (EMC) have become important. Field Programmable Logic Array (FPGA) has become a low-cost platform offering the ability for power electronics to create unique EMC control techniques. In FPGA, however, it is complicated to accomplish some of the features required in the power electronic control system. The key difficulties are related to the operation of the fixed point, and the need to change the dynamic number range. Constructing filters to comply with the EMI limits is a significant part of the production cost of power converters. Therefore, a simple yet powerful dual controller based FPGA is therefore discussed to provide a substantial motor control for noise reduction. A model of a prototype has been tested and hardware findings indicate a substantial drives with low performance requirements. In terms of speed and torque, the theoretical algorithms, hardware information and experimental findings are presented and discussed.

Keywords: Field Programmable Logic Array, DC-DC Converters, Electromagnetic Compatibility, Electromagnetic Interference..

1 Introduction

The rapid growth of the electronics sector, the challenge of circuit design is rising and the preparation time for designing devices is shrinking due to competition. The DC-DC converters are critical for the supply of DC power from a DC power supply such as batteries, photovoltaic cells and fuelling in portable electronic devices such as tablets, laptops or electric vehicles, such as mobile phones. Such electronic devices also include many sub-circuits, each of which requires a specific level of voltage varying from the one given by the source Trong *et al*. [2017]. Designers usually create DC/DC switch mode converters using analogue components to monitor the feedback loop and provide Pulse-Wide Modulation (PWM) necessary for switching. For use of analogue components like these, a range of considerations have to be taken into account in ensuring design reliability, such as tolerances, electrical stress, ageing drift and temperature drift.

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A common misconception is that if all the control systems pass varying emitted, implemented and traditional noise requirements in the agency, the system also passes required noise standards Jalnekar *et al*. [2015]; Elrefay *et al*. [2017]. The noise conducted by the drivers connecting the transducers to the input source, the load or any control signals is detected. A system does not have the requisite noise standards. The emitted noise is the radiation noise emitted by the voltage, current or magnetic flux switches by the convertor au *et al*. [2016]. Because of parasitical elements such as input/output power, leakage inductance, and insulation resistance, common-mode noise is common to the converter input and output. The adverse effects of parasites on the power changer have led power designs to deploy resonance transversals and other designs which are part of the circuit with ever growing frequency variation and power densities. Switching on the input switching transistor at zero voltage or zero current decreases input noise and increases performance.

Null-voltage or null-current converters regulate the frequency of switching to retain power. However, large filters are needed for noise reduction in DC-DC convertors Park *et al*. [2015]. The significant amount of electromagnetic interference produced by repeated switching operations is generated by power electronics converters. EMI spectrums are especially concentrated on several critical switching frequencies. The significant amount of switching losses is caused by the electromagnetic interference power converter. The output of EMI sensitive products is influenced by switching losses in converter topologies. EMI noise reductions are achieved in the early days by traditional methods that cause additional cost effects on power converters. The new randomized sigma delta modulation, which is effectively accomplished by randomization of switching cycle parameters, reduces current electromagnetic interference.

Variations in switching frequency, duty ratio and pulse location result in an important effect on the density of the power spectrum. But on the other hand, negative feedback is used in traditional sigma delta modulators to monitor a system's nonlinear response and to realize the attenuation of the signal band quantization noise due to noise shaping Wu *et al*. [2015]; Benhadda *et al*. [2018]. Now, the FPGA will replace the conventional analog solution with an inexpensive low-performing FPGAs combined with analogue to digital converters. FPGA is a semiconductor system not limited to pre-characterized equipment works; it is used exceptionally well and could be arranged in accordance with its structural specifications by the implanted framing engineer. For the installation of custom equipment FPGAs use pre-constructed logic blocks and programmable channels depending on how built framework developers arrange those components. FPGA is an appealing design choice for hardware Sulaiman *et al*. [2009]; Monmasson *et al*. [2011]; Aridhi *et al*. [2012].

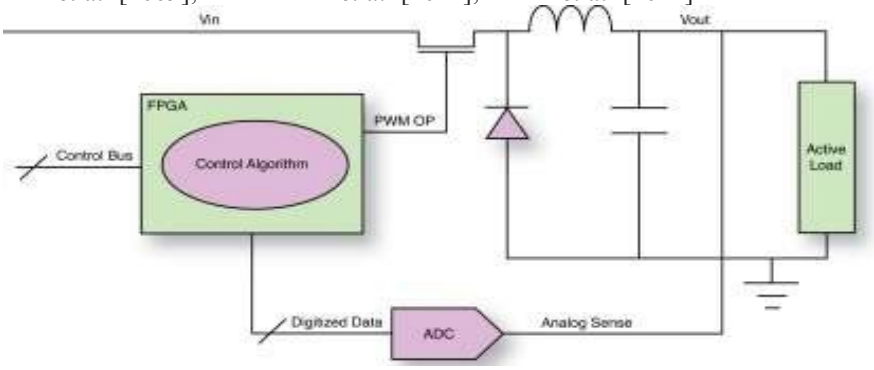


Fig 1. DC - DC regulator using FPGA

For a fine review of traditional and recent FPGA technical advances that concentrate on the application of industrial control systems. Although FPGA is now commonly deployed in a variety of military, defense and signal processing applications, it is versatile rather than analogue control, becoming less cost-effective and applicable for applications in power supply. Using FPGA-based digital controllers, implementation of the noise reduction systems can be achieved. Figure 1 depicts the FPGA-based framework comprising PWM generation and error calculation as well as a control algorithm for the adaptation of the PWM. The FPGA offers several distinct advantages at the same time, most of which are conveniently accessible inside the FPGA itself, except for a bit of HDL coding. This technique requires an analog-to-digital transition scheme to transfer the current output voltage back into FPGA, either using the ADC-based or some other solution, to promote the ability of the control algorithm to adapt to the output of the PWM Sinha roy *et al*. [2019]. One of the most special capabilities of the FPGA is reconfiguration to fully exploit FPGA. This allows for the recovery of a part of the FPGA while the remainder of the FPGA still functions normally. This technology has been widely used in computer vision and communications, but researchers in power conversion have recently become interested in it Kourfali *et al*. [2019]. Therefore, in this analysis, an FPGA with a reconfiguration is used to implement two controllers - vector power, and frequency - voltage control (f/Hz). This configuration shows that a stable and potentially noise-reduction transition between controls can be achieved Gandhare *et al*. [2019]; Shimoda *et al*. [2019]. The main contribution of the present work is,

1. To design a dual controller based FPGA to provide a substantial motor control for noise reduction.
2. To demonstrate the hardware findings that indicates substantial drives with low performance requirements.

Section II exploits the dual control schemes. Section III depicts the proposed system design of hardware VHDL implementation. Section IV demonstrates the simulation and testing results followed by conclusion in Section V.

2 Dual Control Schemes

The normal method for control of triphase motors is still vector energy control while torque control is being used more and more in the industry; however, this method has numerous failure points as it uses sensors to obtain feedback. In high performance controls, sensor less open-loop controls are usually not preferred, but if the operation of engines is vital to safety, it is desirable to use as a safeguard to maintain control over loss of control. Due to its prominence in the frequency industry, vector power control was therefore chosen as a backdoor device. The vector control system tries to control the engine torque. This is normally done by regulating the engine currents, which align the flow of the stator to regulate the torque. Figure 2 demonstrates the configuration used in this work. The method can be divided into the conversion to control variables and the control of these parameters.

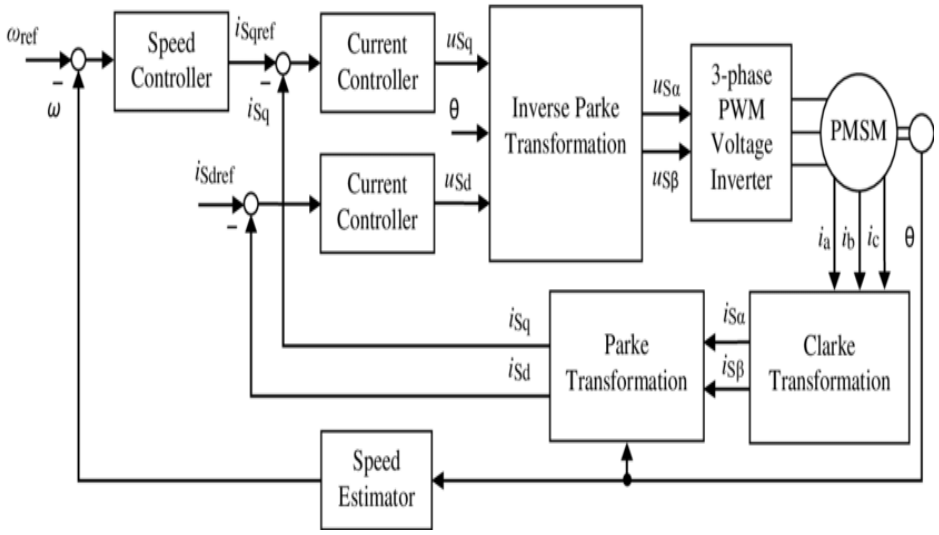


Fig 2. Block diagram of Vector power control

The aim of the first step is to convert the instantaneous current (i) in two phases, time-independent, and a stationary reference context (u) from the rotating frame of the engine. Due to their frequent changes, the input triplet is very hard to monitor but the changes allow a more regulated pair of values,

$$\begin{bmatrix} iS\alpha \\ iS\beta \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ \frac{1}{\sqrt{3}} & \frac{2}{\sqrt{3}} \end{bmatrix} \begin{bmatrix} iq \\ id \end{bmatrix} \quad (1)$$

$$\begin{bmatrix} uSq \\ uSd \end{bmatrix} = \begin{bmatrix} cos\theta & sin\theta \\ -sin\theta & cos\theta \end{bmatrix} \begin{bmatrix} iS\alpha \\ iS\beta \end{bmatrix} \quad (2)$$

$$\begin{bmatrix} uS\alpha \\ uS\beta \end{bmatrix} = \begin{bmatrix} cos\theta & -sin\theta \\ sin\theta & cos\theta \end{bmatrix} \begin{bmatrix} uq \\ ud \end{bmatrix} \quad (3)$$

$$\begin{bmatrix} uS\alpha \\ uS\beta \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -\frac{1}{\sqrt{2}} & \frac{\sqrt{3}}{2} \end{bmatrix} \begin{bmatrix} uS\alpha \\ uS\beta \end{bmatrix} \quad (4)$$

The transformation starts in the order shown in equations (1) and (2) of the Clarke and Park transformations. To make the system simpler, the system was presumed to be balanced, thereby reducing the number of sensors required for final implementation by removing the need to complete one of the three transition phases. θ is the park transformation, where the rotor is rotated. The results (i_{sq}) are then moved to the Proportional Integral (PI) controller. i_s the motor flow control effective and i_q controls the engine torque effectively. In order to obtain the desired torque the PI control tries to hold the id value closer to 0 and the iq value near a defined value. The PI controller manufactures a couple of voltage values (uS_{qd}), but always in the revolving reference frame, depending on time. The reverse park and Clarke transformations, in this order shown in Equation 3 and Equation 4 respectively, are passed by to achieve a three-phase, time-dependent, stationary control voltage (u_{abc}) frame collection. The results are moved to the PWM generator.

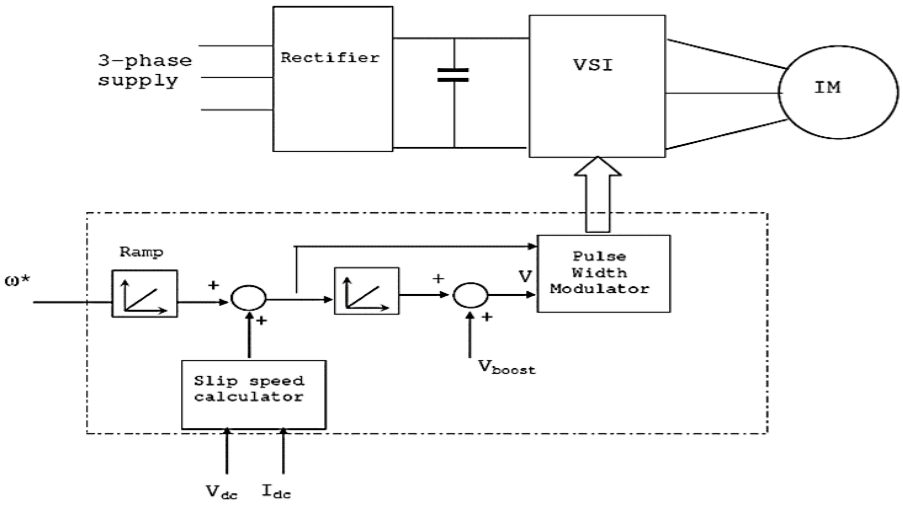


Fig 3. Block diagram of Frequency - voltage control

The frequency-voltage regulates the engine speed while the applied torque is being maintained continuously. This approach primarily preserves the voltage and frequency movement of the motor, as can be seen from the block diagram shown in Figure 3. The explanation for this is that the motor functions continuously in the linear magnetic region if the motor operates. The phasor equation σ_c for the magnetizing current is,

$$\sigma_c = \frac{2\pi f}{v} \quad (5)$$

This implies that if the $f = v$ ratio remains constant; the stator flow will remain constant. Thus, when that ratio is constant, the speed of the motor will adjust while maintaining constant flux. This results in just slip speed determination of the torque. Without a justification, a slip speed controller was not introduced because this added complexity.

3 System Design

3.1 PWM Generator

This work has been carried out using the PWM generator to work with the two-way control algorithms $\frac{f}{v}$ as well as with the vector power.

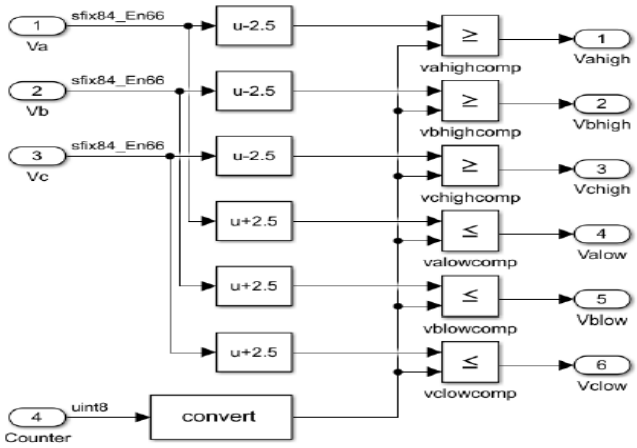


Fig 4. Block diagram of PWM generator

Figure 4 shows the basic diagram of the block. This is a basic PWM generator, in which the incoming signal is simply compared to the triangular shape of the PWM. The Triangle Waveform was developed as a controller which ranged from 0 to 50 and then from 50 to 0 as the device had been binary configured. Thus, the entering waveforms were centered at 25 before the triangle shape was compared. Prior to the actual comparators, they moved the incoming waveform to the lower and downwards to add dead times in the PWM to stop shootings in the inverter. The waveforms were contrasted. The inclusion of the larger and smaller comparators ensured a minimum performance delay between comparator pairs. To compare incoming signals with the generator, a triangle wave is required. This wave generator was configured as a counter up/down with a specimen-fitting upper limit. For that job, it was reset to 50, started counting to 0, and repeated. This counter counts the defined limit. The carrier wave was then used to produce the PWM.

3.2 Dual Control Reconfiguration

In the top-level design, the controller was left as a black box with only inputs and outputs listed. The controllers were deployed and the netlists were produced separately from the high standard design to ensure both controllers had the same inputs and outputs, even if they needed foreign ones. Upon completion of the design, the Xilinx PlanAhead Analysis and Design Tool was used to assign the FPGA resources and set clock requirements for generating final bit files Svyd *et al*. [2019]. In the tool it can be described as a reconfigurable partition for the black box configuration of a top-level module design. The programme can then be allocated to the Black-Box several netlists, for example the vector controller and the *f*/v controller. This empty implementation has been used to speed up initial configuration and provide the reprocessing configuration controller with a known starting point Usmani *et al*. [2019]. The programme uses these configurations to ensure that the user has the minimum hardware specifications for the repository. This partition is defined by the user and shows whether the requirement for the resource was complied with.

Table 1. Address verification of dual controls

Control	Logic Elements	Pins	Memory Bits	9 Bit Multipliers
Vector Power	2836	368	0	34
f/v	1499	50	516 128	41

The programme uses these configurations to ensure that the user has the minimum hardware specifications for the repository. This partition is defined by the user and shows whether the requirement for the resource was complied with. The consumer synthesises the initial configuration, the empty partition in this case. The other confidence configurations are then synthesized and combined with the initial configuration, enabling the new confidence configuration to use the same static confidence. The results of each synthesis are then compared to each other to indicate that the static portions are the same. Upon completion, the bit streams are created for each configuration. This provides a complete configuration image for null, vector, and f/v, and even minimal bit files for reconfiguration. After this, the device is ready for testing and putting on FPGA Aubakirov *et al*. [2019].

3.3 Reconfiguration Control

A black box portion where the shifting system is situated must be introduced with the top level system. This prohibits standard tools from synthesizing and restricting preliminary debugging to syntax checks and generating a netlist. In particular, around this black box a filter needs to be introduced to stop signals entering or leaving the reconfiguration segment during configuration. In the controller's top-level architecture, a set of disabled registers were implemented around the engine algorithm black box, output all of the zeros, while the reconfigure was being used.

3.4 VHDL Hardware Control

AD7822's standalone Operation portion of the AD7822 data sheet has been developed with the FPGAs interface to the current sensors. In this mode, the system begins a conversion with a single signal and has only one signal when the conversion is complete.

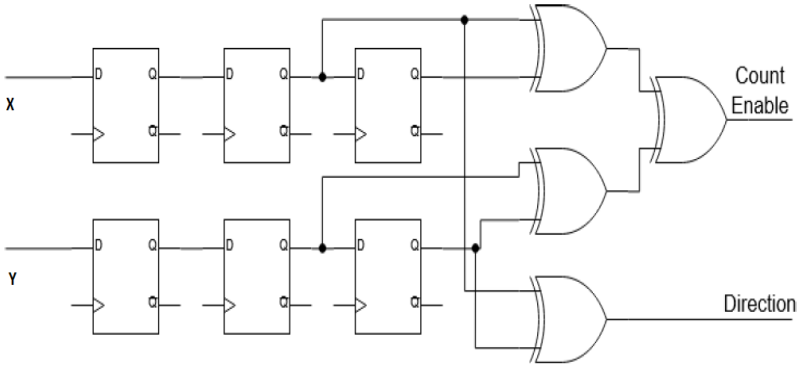


Fig 5. Decoder design

The way the conversion signal was mounted in VHDL was to turn on/off from the internal clock and save the data into a register when the transmission signal is activated at the end. The encoder outputs consist of two quadrature signals. Both these two signals indicate the location of a magnet in the encoder. These are near each other, but physically slightly offset. This allows the direction of the signal to be determined first. This information can be connected to an up/down counter to determine the position of the encoder. The circuit shown

in Figure 5 is one way to extract direction and allow signals by using hardware. In each transformation of the inputs it is called a 4x decoder, which calculates 4 times per transition. The FPGA includes all the logic of control and reconfiguration. The optoisolators and the engine driver lie between the FPGA and the engine. Opto-insulators are supplied to isolate the responsive FPGA from the high-voltage motor driver electrically. The control system transforms the FPGA signals to low-power signals that drive the engine. The sensors provide information on phase current and motor location for the control algorithms. The memory modules include the partial bit, which defines the FPGA control algorithm. Interface boards are also available to make logical level adjustments for communicating FPGA / memory modules. Partial bit files are accessed as part of the reconfiguration process. The partial bit files used by the standard EEPROM interface have been stored on the flash memory.

Table 2. FPGA Time Performance

Modules	**Latency**	**Computation time**
A/D Interface	256	0.4μs
Park transformation	14	0.35μs
Inverse Park transformation	14	0.35μs
PWM	4	0.1μs
Execution time	292	7.3μs

4 Simulation and Results

The physical test design was developed in a way that regulated the torque by the motor at a constant speed. In the simulation, the motor block was connected to a constant speed input in the experiment. The DC motor is fed inputs to drive it at constant speeder speed in physical simulation Banik *et al*. [2019].

Table 3. DC-DC converter simulation setup

Parameter	**Value**	**Parameter**	**Value**
V_{IN}	12V	Inductance (L)	1μHz
Efficiency	0.9	Capacitance (C)	8840 μF
Frequency	530 KHz	Maximum Output Current I_{max}	60(A)
V_{OUT}	1.30 V	R_L	2.3mΩ

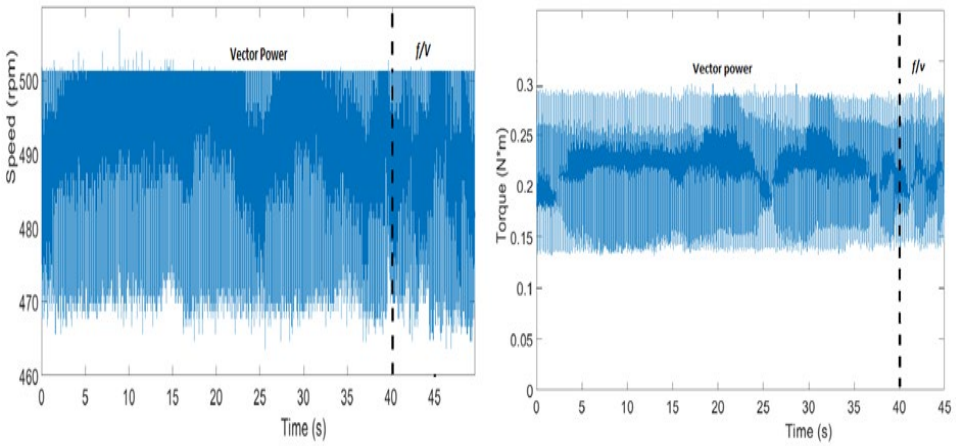
A DSPACE DS1104 controller was used to drive the DC engine and to track the system's real-time speed and torque characteristics. The dSPACE interface was designed via MATLAB Simulink to deploy a simple DC speed controller along with a device to read the DC motor current, voltage and speed to show and measure torque using equation 5.

$$\rho = \frac{60p}{2\pi r} \quad (5)$$

Where ρ is torque, p is power and r is rotational speed.

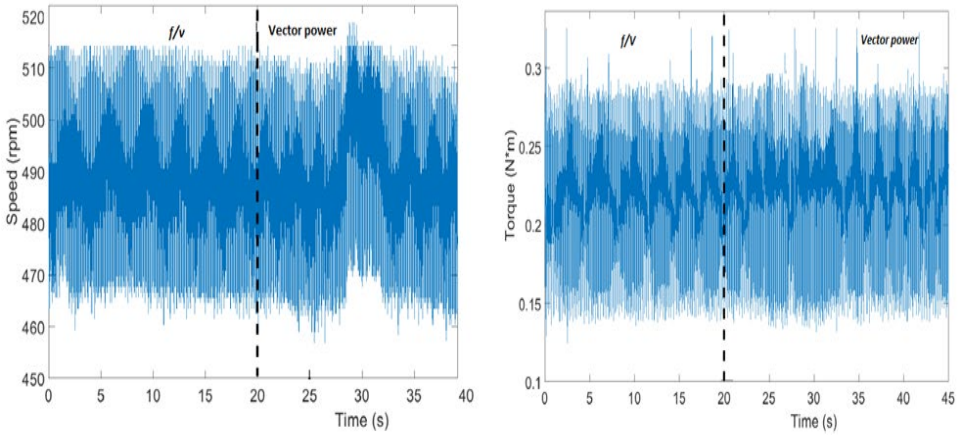
Table 4. FPGA Hardware quality results

Stage	**Cycle Latency**	**Clock frequency**	**Deterministic Latency**
Initial	800	150MHz	5.33μs
Optimized	450	210MHz	2.14μs



(a) **(b)**

Fig 6. (a) Speed transition between vector power and *f*/*v* at 600 rpm; (b) Speed transition between vector power and *f*/*v* at 600 rpm.



(a) **(b)**

Fig 7. (a) Speed transition between *f*/*v* and vector power at 600 rpm; (b) Torque transition between *f*/*v* and vector power at 600 rpm.

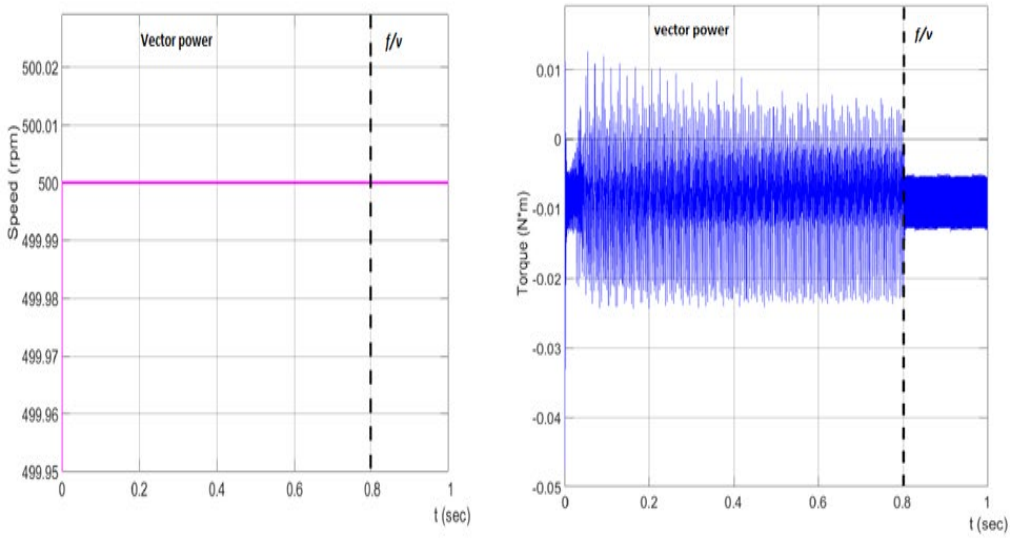


Fig 8. (a) Simulated speed transition between vector power and *f/v* at 600 rpm; (b) Simulated torque transition between vector power and *f/v* at 600 rpm.

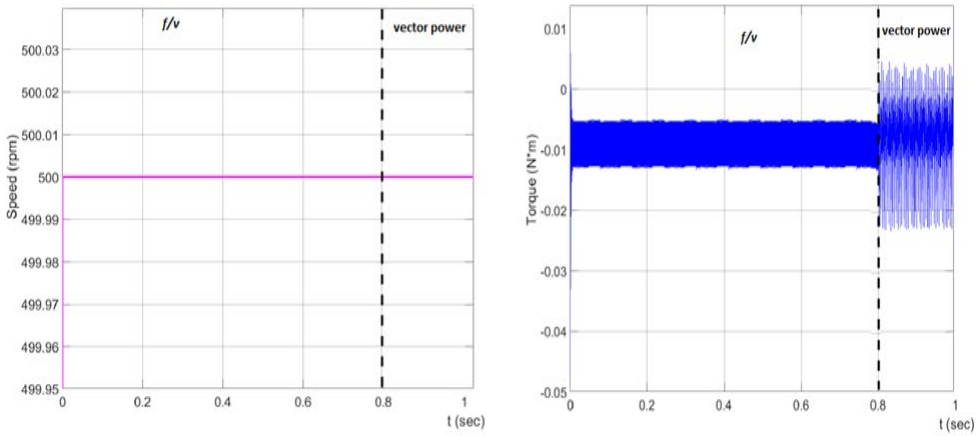


Fig 9. (a) Simulated speed transition between *f/v* and vector power at 600 rpm; (b) Simulated torque transition between *f/v* and vector power at 600 rpm.

Figure 6 shows the speed transitions from vector power to f/v at 600 rpm. Figure 7 depicts the torque transitions from vector power to f/v at 600 rpm. Figure 8 shows the speed transitions from f/v to vector power at 600 rpm. Figure 9 depicts the torque transitions from f/v to vector power at 600 rpm. The primary source of the noise was the constant-speed DC-engine, so it didn't have a constant impact on the driver. The DC motor had speed oscillations around the desired speed, so the calculations were carried out with the constant driver average speed. At higher speeds, the effects of the transformation are clearer. In each of these outcomes, a dramatic shift follows immediately after the transfer, signalling the completion of the reconfiguration process and the takeover of the new controller. The machine was tested at three speeds: 200 rpm, 400rpm, 600 rpm and 800 rpm to accurately reflect the switching

controller. Tests may have been conducted at higher speeds, but a great deal of error was observed given the maximum rated speed of 2000 rpsm and the potential for unknown behavior. In a switch between the controllers, each speed was evaluated to ensure the behavior corresponded with the simulated results.

5 Conclusion

Most of the research on FPGAs engine controls uses it as a new type of microcontroller for the work. Furthermore, much of the work on motor controls in general is to produce large and complex motor controls which work well under various conditions. This study suggested dual controller-based reconfiguration is a special function of FPGAs that enables a part of its material to be recalculated while the FPGA remains working. This work has shown that a double controller could provide the vector power and f/v controllers with a stable transition and it suggest that this could lead to other changes between different controllers. In addition, consideration should be given to the conditions under which controllers switch, for example, the conditions under which controller switching is controlled. Although this work means that smooth transitions between other controllers are possible, this area still requires confidence. Furthermore, this work did not concentrate on the output of each controller, which may also be an area of potential inquiry for the development of dual controllers.

References

[1] Aubakirov, Rafail & Strekopytov, Dmitry & Aubakirov, Rafael & Kaleev, Dmitry. (2019). Research on the Implementation of the AGC Loops Unit on the FPGA. 1692-1695. 10.1109/EIConRus .2019. 865 6645.

[2] Aridhi, Emna & Abbes, Mehdi & Mami, Abdelkader. (2012). FPGA Implementation of Predictive Control. 191-196. 10.1109/MELCON.2012.6196411.

[3] au, Huynh & Joo, Soyeon & Kim, Soyoung. (2016). An experimental study of EMI reduction of DC-DC converter with frequency hopping technique. 107-109. 10.1109/EDAPS.2016.7893138.

[4] Banik, Shukla & Roy, Suchismita & Sen, Dr. Bibhash. (2019). Test Configuration Generation for Different FPGA Architectures for Application Independent Testing. 395-400. 10.1109/VLSID. 2019. 00086.

[5] Benhadda, N. & Bendaoud, Abdelber & Chikhi, Nawel. (2018). A conducted EMI noise prediction in DC/DC converter using a frequency-domain approach. Elektrotehniski Vestnik/ Electrotechnical Review. 85. 103-108.

[6] Elrefay, Mohamed & Tawfiq, Kotb & Youssef, Hossam & El-kholy, Elwy. (2017). Speed Control of DC MOTOR Using DC- DC Buck Converter.

[7] Gandhare, Shubham & Karthikeyan, B.. (2019). Survey on FPGA Architecture and Recent Applications. 1-4. 10.1109 /ViT ECoN.2019.8899550.

[8] Jalnekar, Rajesh & Jog, K. (2015). Pulse-Width-Modulation Techniques: A Review. IETE Journal of Research. 46. 175-183. 10.1080/03772063 .2000. 1141 6153.

[9] Monmasson, E. & Idkhajine, Lahoucine & Naouar, Mohamed. (2011). FPGA-based controllers. Industrial Electronics Magazine, IEEE. 5. 14 - 26. 10.1109/MIE.2011.940250.

[10] Park, Ju-Hyun & Kim, Sung & Lee, Joo & Park, Sang & Lee, Ju & Kim, Sang & Kim, Hong & Lee, Kang-Yoon. (2015). Output Noise Reduction Technique Based on Frequency Hopping in a DC-DC Converter for BLE Applications. IEIE Transactions on Smart Processing and Computing. 4. 371-378. 10.5573/IEIESPC.2015.4.5.371.

[11] Shimoda, Masayuki & Sada, Youki & Kuramochi, Ryosuke & Nakahara, Hiroki. (2019). An FPGA Implementation of Real-Time Object Detection with a Thermal Camera. 413-414. 10.1109/ FPL.2019.00072.
[12] sinha roy, Sujoy & Turan, Furkan & Järvinen, Kimmo & Vercauteren, Frederik & Verbauwhede, Ingrid. (2019). FPGA-Based High-Performance Parallel Architecture for Homomorphic Computing on Encrypted Data. 387-398. 10.1109/HPCA.2019.00052.
[13] Svyd, Iryna & Maltsev, Oleksandr & Zubkov, Oleg & Saikivska, Liliia. (2019). Matlab Use in Design of Digital Systems on the FPGA in CAD Xilinx VIVADO. 29-30. 10.35598/mcfpga.2019.010.
[14] Sulaiman, Nasri & Obaid, Zeyad & Marhaban, Mohammad Hamiruce & Hamidon, Mohd Nizar. (2009). Design and Implementation of FPGA-Based Systems -A Review. Australian Journal of Basic and Applied Sciences. 3.
[15] Trong, Thang. (2017). The Control Structure for DC Motor based on the Flatness Control. International Journal of Power Electronics and Drive Systems (IJPEDS). 8. 1814. 10.11591/ijpeds. V8.i4. Pp 1814-1821.
[16] Usmani, Atiya & Taslima, Eram & Khan, Shuaib. (2019). Design of FPGA based phase reconfiguration technique. 1-5. 10.1109/IEMENTech48150.2019.8981037.
[17] Wu, Cunxue & Li, Xu & Zhang, Qian & Xu, Zhongming. (2015). EMI characteristics and noise control methods of a DC/DC converter in electric vehicles. International Journal of Electric and Hybrid Vehicles. 7. 375. 10.1504/IJEHV .2015.074676.
[18] K.R.Aravind Britto, R.Vimala, "FPGA based Sigma Delta Modulation for DC-DC Flyback Converter", International Journal of Advanced Engineering Technology, ISSN 0976-3945, Vol. 7, No.2, 2016, pp. 1096-1100.
[19] K.R.Aravind Britto, M.Joe Marshell, R.Vimala, G.Suriya, "FPGA based Pipelined Sigma Delta Modulation for EMI Reduction in Flyback Converter", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE), ISSN (Online): 2278 – 8875, ISSN (Print): 2320 - 3765, Vol. 4, Special Issue 2, 2015, pp. 79-88.
[20] Kiran Kumar, T.V.U., Karthik, B., Improving network life time using static cluster routing for wireless sensor networks, Indian Journal of Science and Technology, 2013, 6(SUPPL5), pp. 4642–4647
[21] Thamarai, P., Karthik, B., Kumaran, E.B., Optimizing 2:1 MUX for low power design using adiabatic logic, Middle - East Journal of Scientific Research, 2014, 20(10), pp. 1322–1326

A Survey on Narrow Band Power Line Carrier Communication for Efficient and Secure Data Transmission in Smart Grid Applications

Chandralekha M[1], Sumathi S[2]
{chandralekha85@gmail.com[1], sumathisrinivasan1@gmail.com[2]}

RNS Institute of Technology, Bengaluru 560098, India[1,2]

Abstract. The Power line carrier communication (PLCC) is in existence for many years but still is an active research area, mainly because it offers economical, geographical and technical advantage as it uses the electric grid for transmitting the data. To reduce the consumption of carbon-based fuel for power generation and its impact to the environment, the world is moving towards an efficient distributed energy production and management system called the smart grid. In smart grid the requirement of a consistent communication setup is very high, as it requires two-way information flow for efficient management of distributed energy resources in order to provide quality power to the consumers. In smart grid architecture, as many automation, controlling and monitoring systems are interconnected, the security is another challenging issue. Among different communication technologies, PLCC is the only alternate which could be compared to the wireless technology due to the duple usage of power line to transfer both power and data. In this context, PLCC is gaining wide acceptance as it can contribute in establishing smart grids in both developed and developing nations. In this paper we provide an overview of PLCC technology, power line channel modelling, coding schemes, modulation techniques and the application of PLCC.

Keywords: Power line carrier communication, OFDM (Orthogonal Frequency Division Multiplexing), forward error correction (FEC), mapping, smart grid, channel modelling.

1 Introduction

The basic principle of PLCC involves superimposing a high frequency carrier signal which contains the data at low energy levels over the 50 Hz power signal and then transmitted through power line. The carrier signal is received by PLCC receiver located on the same electrical network and then decoded to retrieve the transmitted data.

The history of PLCC is dated late 1920s, the power line communication was initially used in high voltage power lines for telecommunication application over long distance. The preliminary implementation of PLCC in medium voltage and low voltage power line are seen in 1950s and the solution was based on ultra-narrowband PLCC for applications like remote street light control [1]. Usage of medium and low voltage power distribution line for data transmission started in early 1990s. From late 2000s to date witnessed lot of research work in this technology, low data rate narrowband PLCC were evolved during this time. During last decade, next generation broadband PLCC technology is being introduced with high data rate

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up to 200MB/s utilizing frequency band of 1.5MHz to 30MHz[18]. Broadband PLCC find application in last mile internet services and high-speed in-house networking.

There are two classification in PLCC technology, first based on the distance it covers and the second based on the frequency range. Based on coverage there are three categories of PLCC [2],

- Short range – for short distance ranging from 0 to 80km.
- Medium Range – for distance between 80 to 250km.
- Long range – for distance greater than 250km.

Classification based on the bandwidth of the frequency with which PLCC operate are [2],

- Ultra-narrowband (UNB) PLCC – Offers low data rate of up to 100b/s and operates in band 300hz to 3Khz.
- Narrowband PLCC – There are two types in this, low data rate (LDR) and high data rate (HDR) and operates in the rage from 3Khz to 500Khz. As the name suggest the first one offers low data rate transmission whereas the later offers transmission rate ranging from few kilo bytes per second up to 500 kbps.
- Broadband PLCC – This provides high data transmission up to 200 megabytes per second and operates in the frequency band 1.5Mhz to 30Mhz.

In present days, high data rate (HDR) narrowband PLCC (NB PLCC) offering data rate up to 500kb/s is gaining interest as it finds specialized application in smart grid (SG). In this paper the focus is on HDR NB PLCC.

2 Regulation in PLCC technology

This section focuses on standards and regulation governing HDR NB PLCC. Like any other technology, the need for standardizing in PLCC technology is very high. With existing and future advanced modulation technologies, it is expected that more and more PLCC devices from different manufacturers will be sharing the same power line for data transmission. Without standardization in place, devices working for various application in the same power grid will interfere with one another resulting in inferior service to all stakeholders. Another importance aspect of standardisation in PLCC technology is to offer interoperability among PLCC devices in the network which are made to different PLCC standard. It may be also needed for the PLCC device to interact with devices of other communication protocol (wireless) for last mile connectivity. It is also required to comply to electromagnetic compatibility limits as the PLCC device coexist with other telecommunication equipment in its environment [3][4].

In different counties there are different guidelines which regulates the PLCC devices. The main governing body that regulate the use of the NB PLCC devices are: European Committee for Electrotechnical Standardization (CENELEC), Association of Radio Industries and Businesses (ARIB), Standardization Administration of People's Republic of China (SAC) and Federal Communications Commission (FCC). Table 1 shows the government regulations for PLCC in different regions.

Europe is advancing in implementing PLCC and is a prominent market for PLCC equipment. BS EN50065-1 standard is followed in Europe which specifies the requirements a PLCC equipment shall adhere. This standard specifies general requirements, the band of frequency and electromagnetic disturbances requirements to operate PLCC devices in low

voltage power lines. The standard specifies the frequency rage range from 3kHz to 148.5kHz which is further sub divided into four bands namely CENELEC-A, CENELEC-B, CENELEC-C and CENELEC-D band respectively. A-band (3-95 kHz), is dedicated for utility firms for the control and monitoring of power grid. There is no regulatory restriction for the usage ofB-band (95-125 kHz). The standard allots C-band (125-140 kHz) home/building automation and D-band (140-148.5 kHz), is meant for annunciation and security application. Electromagnetic compatibility for PLCC devices is regulated by BS EN50561- 1 standard, this specifies the limits and methods of measurement.

Table 1. Government regulation for PLCC[6].

Country	Standard	Frequency Range	Regulatory Body
Europe	CENELEC - EN 50065-1	3 kHz to 148.5 kHz	European Committee for Electrotechnical Standardization
Japan	ARIB STD-T84	10 kHz to 450 kHz	Association of Radio Industries and Businesses
USA/ Canada	FSS Section 15	10 kHz to 490 kHz	Federal Communications Commission
China	GB/T 31983.11-2015	3 kHz to 500 kHz	Standardization Administration of People's Republic of China

In United States of America (USA), the Title 47 in code of Federal Regulation defines the operating frequency band of NBPLCC from 9kHz to 490kHz [7]. Section 15 of [7] defines a ‘power line carrier communication system’ as a system employed by utility firms which couples radio frequency signal with electric power lines for data acquisition and supervisory control of components in power grid. The coupling of radio frequency signal is by conduction and is transmitted to the receiver through transmission line. Under section 15.113 code of Federal Regulation, regulates the usage of transmission line for non-interfering power line carrier communication in the frequency band 9 - 490 kHz [8].

The Association of Radio Industries and Businesses (ARIB) is the regulatory body in Japan which regulates the usage of transmission line for power line carrier communication. The frequency band defined for PLCC ranges from 10kHz to 450 kHz. The electro-mechanical requirements and the measuring methodology for the PLCC devices is defined in the standard ARIB STD-T84. The limits of electromagnetic interference are regulated through Article 46 of Regulations for Enforcement of the Radio Act [9].

In China, standard GB/T 31983.11-2015 regulates the PLCC equipment in the frequency range 3kHz to 500kHz. The standard specifies the frequency band, the output level at each sub frequency band, the conducted and radiated emission limits and also specifies the measurement method [10].

3 Standards in HDR NB PLCC

An outline of active HDR NB PLCC standards developed for smart grid application is reviewed here. Most HDR NB PLCC uses multicarrier modulation mainly Orthogonal Frequency Division Multiplexing (OFDM).Standards developed by Standard development organizations (SDO) International Telecommunication Union (ITU) and the Institute of Electrical and Electronics Engineer (IEEE) which uses OFDM is reviewed here.

ITU-T G.9901 [11] titled "Narrowband orthogonal frequency division multiplexing power line communication transceivers – Power spectral density specification." This standard defines the control limits for spectral content, power spectral density (PSD) and masking requirements. It provides means to aid the saving of transmission PSD. The measurement methodology of PSD over transmission electric power line is defined in the standard. Further, the standard also specifies the limit of radio frequency signal energy for a constant terminal impedance. The system architecture, physical layer (PHY), and data link layer (DLL) defined in this standard is in line with the specifications given in ITU-T G.9904 (PRIME), ITU-T G.9902 (G.hnem) and ITU-T G.9903 (G3-PLC) [11].The transmitted output voltage specification of CENELEC frequency ranges from 3-148.5 kHz in accordance with EN50065-1 is applied. This defines the frequency range for different application and terminal output voltage in the operating band.

ITU-T G.9902 [12] titled "Narrowband orthogonal frequency division multiplexing power line communication transceivers for ITU-T G.hnem networks". This standard provides the detailed specification of PHY layer and DLL for the OFDM based PLCC transmitter and receiver operating over both direct current (DC) and alternating current (AC) power lines. The frequency is up to 500 kHz for G.hnem network. This standard caters to both in-home and outdoor communications. The standard applies to communication in low voltage (LV) and medium-voltage (MV) power lines. It has defined the provisions for communication across distribution transformer in both LV-MV and MV-LV direction. This standard is used for smart grid applications like advanced metering infrastructure (AMI), control metering of electric vehicles charging, building automation and in-home network communications [12]. The coexistence mechanism defined under clause 5.1.2.3 of specification enable ITU-T G.9902 to coexist with multiple PLCC technology operating in the same power line channel.

ITU-T G.9903 Narrowband orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks. Like ITU-T G.9902, ITU-T G.9903 standard provides the detailed specification of PHY layer and DLL for the OFDM based PLCC transmitter and receiver operating over both direct current (DC) and alternating current (AC) power lines. The frequency is up to 500 kHz for G3-PLC network. This standard caters to both in-home and outdoor communications. The standard applies to communication in low voltage (LV) and medium-voltage (MV) power lines [13]. Through frequency division and via the preamble-based coexistence mechanism, the standard provides means of coexistence with other NB PLCC technologies.

*ITU-T G.9904 Narrowband orthogonal frequency division multiplexing power line communication transceivers for PRIME networks.*Like ITU-T G.9902 and ITU-T G.9903, standard provides the detailed specification of PHY layer and DLL for the OFDM based PLCC transmitter and receiver operating over both direct current (DC) and alternating current (AC) power lines. The frequency is up to 500 kHz for Powerline Intelligent Metering Evolution (PRIME). This standard caters to both in-home and outdoor communications. The standard applies to communication in low voltage (LV) and medium-voltage (MV) power lines [14]. There is no mention about coexistence.

IEEE 1901.2 [5] IEEE Standard for Low-Frequency (less than 500 kHz) Narrowband Power Line Communications for Smart Grid Applications. This standard contains requirement for the PHY/MAC layer, coexistence and electromagnetic compatibility for narrowband PLCC devices via alternating current (AC), direct current (DC), and non-energized electric power lines. IEEE P1901.2 is OFDM based in the frequency range 10kHz to 490 kHz. It provides coexistence mechanisms by dynamically changing the frequencies used as data carriers, at the same time it allows transceiver to be configured with different parameters for proper transmission of signal [5]. Depending on the application and network conditions, data rates up to 500 kb/s could be achieved. IEEE 1901.2 standard being a late entrant in the design of NB PLCC, most of the requirement are similar to ITU-T G.9903. Applications includes but not limited to advanced metering, SG automation, charging of electric vehicle (EV), In-home networking, street lighting control and solar panel degree control. The standard clearly defines the mechanism through which the coexistence between all devices connected in the same grid is guaranteed. This standard focuses on all different low-frequency narrowband Standard Developing Organisation (SDO) technologies, minimising interference for less than 500 kHz. The standard specifies the security requirements to ensure privacy and allow integration of security sensitive devices in the grid. Power line channel (PLC) is detailed to test different models developed using this standard. The channel parameters are altered according to the field condition such that a real-life simulation is possible with the channel model proposed in the standard. Electromagnetic compatibility measurement requirements in the standard specifies that it shall be in conformance with CENELEC EN55022.

4 Coding and Modulation Schemes

The physical (PHY) frame consists of preamble, PHY frame header (PFH), channel estimation symbols (CES) and information (data). Basic channel estimation and synchronization is achieved with the aid of Preamble and CES and it does not contain any data [12]. In the beginning of each PHY data frame, the PFH or the frame control header (FCH) is transmitted. PHY frame header holds information like the frame type, mapping, frame length, etc.

The OFDM modulator converts the incoming stream of data into a time domain samples. After adding the preamble and CES, the data is transmitted through the analogue front end (AFE) to the medium (power line channel). At receiver, incoming frames from the medium are demodulated and decoded. The preamble and CES are processed to retrieve the transmitted information. The preamble is prefixed to every PHY frame. This is used at receiver to sense the frame, for optimizing the boundary of frames, and for acquiring the channel estimation parameters and to identify the OFDM signal. To protect against Inter-Symbol Interference (ISI), a cyclic extension is used. It provides guard interval between two adjacent OFDM symbols to avoid inter-symbol interference (ISI).

The windowing function involves determining the boundaries of transmitted signal between the cyclic prefix and the last sample of the Inverse Discrete Fourier transform (IDFT) output. Shaping of Power Spectral Density (PSD) of OFDM modulator is defined by windowing. It allows sharp spectral notches intended to reduce out of band PSD. The frequency up-shift is intended to offsets the spectrum of transmitted signal to the subcarrier frequency.

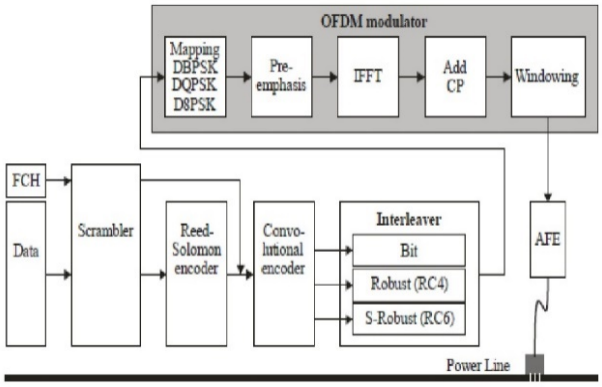

Fig. 1.OFDM transceiver block diagram [13].

The medium here is electric transmission line and hence is very harsh communication medium. Properties and characteristics of power line channel depends on many factors like frequency, environment, time and number of connected loads in the grid. Another issue associated with this type of wired communication medium is the electromagnetic interference offered by different type of equipment connected in the grid and is prominent at lower frequency band ranging from 10 - 200 kHz. The power line channel has background noise and is also subject to impulsive noise frequently appearing on power signal frequency of 50Hz. The channel experiences group delays of few hundred microseconds [13].

Such being the nature of power line channel, for reliable communication it is necessary to have a communication system with combination of advanced coding technique multi-carrier modulation technique for efficient use of available narrow bandwidth. Thus, with advanced channel coding techniques and OFDM as proposed in standards ITU-T G.9903 and IEEE 1901.2 it is possible to build a very reliable communication system over electric transmission line. Block diagram of OFDM transceiver proposed in standard ITU-T G.9903 [13] is shown in Figure 1.

The offered bandwidth in OFDM is separated into numeral sub-channels, which are independently modulated using Phase Shift Keying technique in non-interfering (orthogonal) dissimilar subcarrier frequencies. Advanced coding techniques, Convolutional and Reed-Solomon coding is employed to offer redundancy for the transmitted data and it helps the decoder to recuperate the missing data due to impulsive and background noise in the power line channel. To reduce the noise resulting from interference of two adjacent carriers, an interleaving coding algorithm is used [13].

Each sub carrier frequency signal after necessary coding shall undergo differential mapping. Followed by mapping, OFDM signal is obtained by accomplishing inverse fast Fourier transform (IFFT) on differentially modulated complex signal. Further it is modulated in phase shift keying scheme to individual subcarriers. The group delay in power line channel can result in interference between successive OFDM symbol, a cyclic prefix of appropriate length is added at the starting of each block generated by IFFT to avoid interference between adjacent OFDM carriers. Further out of band transmission is avoided by windowing [13]. The OFDM modulator converts the incoming stream of data into a time domain samples. After adding the preamble and CES, the data is transmitted through the Analog Front End (AFE) to

the medium (power line channel). At receiver, incoming frames from the medium are demodulated and decoded. The preamble and CES are processed to retrieve the transmitted information [12].

The Power Spectral Density (PSD) and the frequency band for different modulation and transmission scheme is defined in ITU-T G.9901 [11], hence for a total of 128 subcarriers, the resulting IFFT size will be 256 [13]. The interleaving frequency bandwidth between the OFDM subcarriers is given by Fs/N, where N is the IFFT size and Fs is the sampling frequency. For CENELEC band and FCC band it evaluates to 1.56 kHz and 4.69 kHz respectively. Practically to avoid the inter-carrier interference (ICI), the number of actual subcarriers used will be much less than the theoretical value of 128. As per ITU-T G.9903 [13], the number of usable subcarriers is defined as 36 for the CENELEC-A band, 16 for the CENELEC-B band and 72 for the FCC band.

There are two modes in which the transceiver system works, normal and robust modes [13]. In normal mode, the forward error correction (FEC) is performed using Reed-Solomon (RS) coding and a convolutional encoder and differential modulation schemes DBPSK, DQPSK, and D8PSK is employed. In robust mode, for FEC in addition to Reed-Solomon and convolutional encoders a repetition coding is also employed to make the symbol robust.

The power line channel characteristic changes as on when an equipment is connected and withdrawn from the grid. Thus, an adaptive Channel estimation algorithm is desired. A feedback system is employed, wherein the receiver sends a feedback to transmitter about the quality of the received signal. Based on this feedback, the transmitter decides appropriate modulation scheme for transmission of subsequent packets of data to the receiver. It is also possible for the system to differentiates the subcarriers with low signal to noise ratio (SNR) and won't transmit data through that sub carrier [13].

4.1 Forward Error Correction Coding

In normal mode, the FEC encoder consists of a Reed-Solomon (RS) and convolutional encoding. A repeat by four encoders is employed in robust mode of FEC, where the output bits from convolutional encoder is repeated by four times to improve the redundancy. There is one more option called the super robust mode, where the output bits from convolutional encoder is repeated by six times [5][13].

Reed-Solomon Encoder. The base of RS encoder is Galois Field Arithmetic. The data from scrambler is coded in short systematic coding using Galois Field [13]. The polynomial for the code generation is given by equation (1) [13],

$$g(x) = \prod_{i=1}^{2T}(x - \alpha^i) \quad (1)$$

where

T is the number of correctable symbol error, T=8 for normal mode and T=4 for robust mode.

α is the primitive element that satisfies the field generation polynomial equation p(x) given by equation (2) [13],

$$p(x) = x^8 + x^4 + x^3 + x^2 + 1 \quad (2)$$

The Galois field 2^8 element of a data byte (d^7, d^6,….,d^0) for primitive element α is identified as $d^7\alpha^7 + d^6\alpha^6 \ldots + d^1\alpha + d^0$.

The standard ITU-TG.9903 allows the splitting of packets into two RS block, in such case the "TwoRSBlocks" bit is set as one in the FCH. In such case the data packet from scrambler is divided into two equal RS blocks. The two equal blocks are then pass through two RS encoder individually and same is the case with convolutional encoding that it shall be encoded separately. If needed shall be separately repetition coded and separately zero bit padded and then interleaved as a whole. Thus, repeat RS encoding increases the complexity but reduce the number of lost bits. Both differential and coherent modulation schemes can be adopted.

Convolutional Encoder. Convolutional encoder adds redundant bits in to the input stream in order to increase the likelihood of detecting the transmitted sequence reliably even if errors have occurred during transmission [15]. Based on the logic function defined in the encoder, the input stream of data bits convolves to form the output. Thus, the output stream depends on previous input bits stored in memory. In convolutional code generation, the stream of data bits is sent through a linear shift register. The linear shift register consists elements which perform the logic coding. The three parameters of convolutional code are the size of shift register (K),

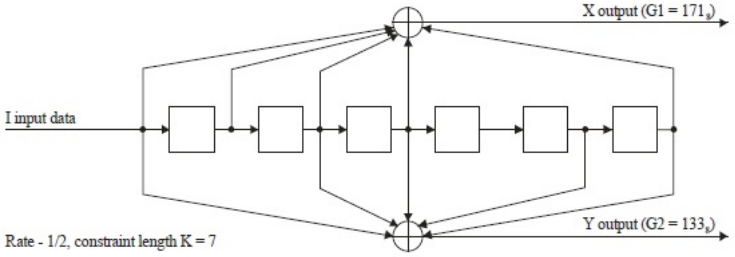

Fig. 2. Convolutional Encoder [13].

the number of encoder output (n) and the number of bits entering the encoder in one cycle (k). R = k/n is the code rate [16]. According to ITU-TG.9903 the output bit streams from RS block is encoded with a convolutional encoder with rate ½ and constraint length K=7 as shown in Figure (2) [13]. Tail bits of six zeros is added to improve the error probability at decoder.

Robust (RC4) and Super Robust (RC6) coding modes. In repetition coding by four (RC4), the output bits from convolutional encoder is made recurring four times thus making the system robust against power line channel noises. As per ITU-TG.9903 either DBPSK or BPSK modulation scheme shall only be employed.

In super robust mode or repetition coding by six, the output bits from convolutional encoder is made recurring six times in order to enhance the redundancy. ITU-TG.9903 specifies the DBPSK modulation scheme.

4.2Interleaver

There are two source of errors that needs attention in PLCC, burst error and deep fade. The interleaver is meant to provide protection for the same. When a very few consecutive OFDM symbols are corrupted is called as burst error. When a large number of adjacent OFDM symbols are corrupted it is called as frequency deep fade. Interleaving is a two-stage operation. In stage-1, each row is shifted circularly and in stage-2 each row is shifted

circularly. Thus, preventing frequency deep fade error and burst error to occur. Both elementary and block interleaver can be chosen according to the legacy mode.

4.3Coherent and Differential Mapping schemes

Conformance of transmitted symbol to the tone map and mask specified by the standard is ensured by mapping algorithm. The static system parameters, the start, stop and notch frequencies is predefined in tone mask. Adaptive selection of modulation based on channel estimation algorithm for communication between two modems is defined in tone map. The standard proposes two types of modulation mapping, coherent and differential mapping. In coherent modulation, data bits are mapped using the preamble phase vector ϕ of the same carrier as its reference. In differential modulation scheme, the data bits are mapped using the phase vector of same sub carrier and the previous symbol as its phase reference.

Table 2. Mapping and bit rate comparison.

Mapping	Bits per constellation symbol	Bit rate
BPSK	One	1 bit rate
QPSK	Two	½ bit rate
8PSK	Three	1/3 bit rate
16QAM	Four	¼ bit rate

Modulation size of mapping algorithm is the number of bits per symbol in constellation diagram. As the number of bits per symbol increases in mapping algorithm, the gap between the points in constellation diagram decreases and thereby increasing the interference resulting in data errors. Comparison of different mapping and symbol rate is given in Table 2.

Table 3. Encoding table for different mapping schemes.

Mapping Scheme	Input Bit Pattern	Output phase
BPSK/DBPSK	0	Ψk
	1	$\Psi k + \pi$
QPSK/DQPSK	00	Ψk
	01	$\Psi k + \pi/2$
	11	$\Psi k + \pi$
	10	$\Psi k + 3\pi/2$
8PSK/D8PSK	000	Ψk
	001	$\Psi k + \pi/4$
	011	$\Psi k + \pi/2$
	010	$\Psi k + 3\pi/4$
	110	$\Psi k + \pi$
	111	$\Psi k + 5\pi/4$
	101	$\Psi k + 3\pi/2$
	100	$\Psi k + 7\pi/4$

The data encoding for coherent and differential mapping is given in Table 3. ψk is the output phase of the kth subcarrier. In case of differential mapping, the last bit in input bit pattern is from the previous symbol (from first interleaver matrix in case of first data symbol). In binary phase shift keying, “0” is represented by zero degrees and binary "1" is represented by a phase shift of 180 degrees. In the case of quadrature phase shift keying, the two bits are mapped such that the binary "00", "01", "11" and "10" is represented by phase shifts of 00, 900, 1800 and 2700 respectively. Similarly, in 8PSK 3 bits is mapped for the phase shifts of 00, 450, 900, 1350, 1800, 2250, 2700 and 3150 to indicate 000, 001, 011, 010, 110, 111, 101 and 100 respectively.

In case of 16QAM, 4 bits are mapped, such that two amplitude levels are used. Thus, QAM modulation scheme can carry more data per symbol but is not suitable for noisy medium. The encoding table for 16 QAM is given in Table 4.

Table 4. Encoding table for 16 QAM as per ITU-TG.9903[13]

Bits [d3d2]	Q	Bits [d1d0]	I
00	-3	00	-3
10	-1	10	-1
11	1	11	1
01	3	01	3

In standard ITU-T G.9904[14], mapping scheme used are DBPSK, DQPSK and D8PSK. The constellation diagram is shown in Figure 3.

Ring constellation is used for mapping, the equation for M-ary differential PSK constellation is given by equation (3) [14],

$$s_k = Ae^{j\theta_k} \quad (3)$$

where,

s_k= modulator output for the k-th subcarrier.

A= Ring radius from centre of the constellation.

θ_k = the absolute phase of the modulated signal and is given by equation (4) [14],

$$\theta_k = \left(\theta_{k-1} + \left({}^{2\pi}/_{M}\right)\Delta b_k\right) mod 2\pi \quad (4)$$

where,

Δb_k = coded information.

M=2,4 and 8 for DBPSK, DQPSK and D8PSK respectively.

OFDM signal in mathematical form is given by equation (5) [14],

$$c_i(n) = \left\{ \sum_{k=86}^{182} s(k-85,i) exp\left(\frac{j2\pi 2}{512}(n-N_{CP})\right) + \sum_{k=330}^{426} s(427-k,i) exp\left(\frac{j2\pi 2}{512}(n-N_{CP})\right) \right\} \quad (5)$$

where
i is the time index representing the i^{th} OFDM symbol; i=0,1,….M+1
n is the sample; $48 \leq n \leq 55$.
s(k,i) is the complex value of the modulation block.
N_{CP} is the number of cyclic prefixes.
Modulation and mapping schemes in different standards operating in NB-PLCC is compared in Table 5.

Table 5. Comparison of FEC and modulation schemes

`	Mapping	Modulation	Mapping
ITU-T G.9902	Reed Solomon, Convolutional Code	OFDM	BPSK, QPSK and 16QAM
ITU-T G.9903	Reed Solomon, Convolutional Code and Repetition coding	OFDM	DBPSK, DQPSK, and D8PSK (In CENELEC Band) BPSK, QPSK, 8-PSK and 16-QAM (In FCC band)
ITU-T G.9904	Convolution coding	OFDM	DQPSK or D8PSK, DBPSK
IEEE 1901.2	Reed Solomon, Convolutional Code and Repetition Coding	OFDM	DBPSK, DQPSK, D8PSK, BPSK, QPSK, 8-PSK and 16-QAM

5 Coupling circuit

A coupling circuit is proposed in the standard ITU-T G.9903, the coupling circuit is meant for merging high frequency carrier signal from analogue front end (AFE) to the power line carrying 50Hz power signal. The basic purpose of the coupling device is to pass allow high frequency signal to pass through but it shall reject the power signal component. Also, it shall isolate the communication equipment from power signal and transient voltages due to switching of equipment in the grid. The basic coupling circuit proposed in the standard is shown in Figure 4.

The circuit shown above is not complete, in addition we shall have line trap in the power line and line matching circuit with coupling circuit.

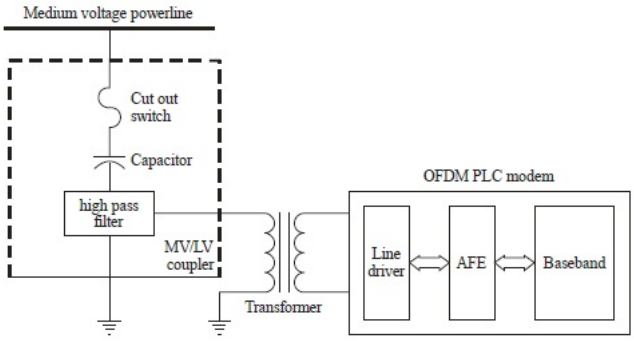

Fig 4. Coupling circuit as per ITU-TG.9903[13].

6 Power line channel modelling

When we consider power line as a medium of communication, built in simulation tools for noise and channel characteristics available in most simulation software fails. This is mainly because the power line channel is a very hostile medium and it can take many forms depending on the actual installation of the grid. Also, it is very difficult to predict the type of equipment (load) and time at which each of these loads would be connected/disconnected from the grid. Such being the case modelling of power line channel is still a research area. Several studies are ongoing to capture the field data and characterising the same for building the models for simulation purpose, however IEEE STD 1901.2 [5] has proposed few models for validating the devices which claims to meet this specification.

When a device in MV side needs to communicate with a device in LV side, the transmitted signal has to cross the transformer where it will experience severe attenuation. To compensate this loss the transmitter shall have the mechanism to adjust the signal level and at the receiving end, a gain control mechanism is employed to compensate the attenuation caused by crossing of MV/LV transformer. Another option provided by the standard is to provide repeater at LV side where the repeater decodes the signal and then repenetrate in LV network at an amplified signal level for compensating the losses caused by MV/LV transformer.

There are two aspects in power line channel modelling, the physical power line channel and different types of noises injected by devices connected in the grid. There are two channel models proposed in IEEE STD 1901.2 [5], the first one, a fading model based on field trials and is based on equation (6) [5] given by,

$$S_r(f) = S_t(f).H(f) + \eta_c(f) + \eta_{imp}(f) \qquad (6)$$

where
$S_r(f)$ = Received signal.
$S_t(f)$ = transmitted signal.
H(f) = fading channel given by equation (7)
$\eta_c(f)$ = Background noise
$\eta_{imp}(f)$ = Impulse noise.

The fading channel H(f) is given by equation (7) [5],

$$H(f) = \left(\sum_{i=1}^{N} g_i e^{-(a_0 + a_1 f^k) d_i} \cdot e^{-j2\pi f \frac{d_i}{v_0}} \right) \tag{7}$$

where
d_i = Gaussian random variable representing length of propagation paths.
v_0 = wave propagation speed.
k = slope of attenuation with respect to frequency.
a_0 and a_1 = attenuation parameters based on characteristics of transmission line.
g_i = Gaussian random variable representing reflection and transmission of propagation paths
N = number of transmission paths.

The second model uses ABCD parameters based on transmission line theory for the characterising the PLC channel [5]. This is a realistic tool as one can build the model based on actual components in the network. For use in RF simulation software, modelling based on s-parameter is also proposed.
The s-parameter is given by equation (8) for incident wave a_k and reflected wave b_k at port k.

$$\begin{bmatrix} b_1 \\ b_2 \end{bmatrix} = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix} \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} \tag{8}$$

Similarly, ABCD parameter for a two-port network is given by equation (9),

$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_2 \\ -I_2 \end{bmatrix} \tag{9}$$

The net ABCD parameter can be calculated by multiplying ABCD parameter of each components in the network.

7 Noise

Modelling of noise in PLC network is still an active area of research, there are mainly five types of noises that shall be considered.

- Background noise: This is present throughout the frequency range. The energy level of this noise is low [5].
- Narrowband noise: This noise is originated due to interference from other transmitting stations [5].
- Asynchronous Periodic impulsive noise: This is introduced by operation of Switch Mode Power Supply (SMPS). The period varies from 50 kHz to 200 kHz [5].
- Synchronous Periodic impulsive noise: This noise is introduced by rectifying diodes in connected loads and is short in duration [5].
- Asynchronous impulsive noise: This noise is a result of transients caused by plugging/unplugging of equipment in power grid. It is highly random and its value can go up to 50 dB more than the background noise [5].

The proposed model in IEEE STD 1901.2 is given in equation (10) [5],

$$\eta_{imp}(t) = \sum_{i=0}^{N} A_i . imp\left(\frac{\left(t - t_{g,i}\right)}{t_{w,i}} \right) \tag{10}$$

where,

N = total number of burst noise pulses in the observation window
$t_{a,i}$ = average inter-arrival time of all N burst noises
$t_{w,i}$ = average width for burst noise
A_i = amplitude of the impulsive noise
imp = rectangular pulse with varying duration representing a burst of noise

7 Application

Market analysis place an important role in understanding the application and reach of PLCC. PLCC market is segmented based on component, the frequency band, modulation technique and coverage distance [20]. NB-PLCC is gaining attention among the market stakeholder as smart cities and smart grid has become a need of the time.

7.1 PLCC in smart grid

Figure 5, is a representative diagram of application of PLCC in smart grid [21]. PLCC is a premier choice for the management of generating stations, remote-main units (RMU), Electric Vehicle (EV) charging stations, MV substations, homes and distributed energy resources (DER). The NB PLCC discussed in the paper finds application in MV and LV section of the grid. Achieving secure and a reliable communication is a challenge in this hostile network topology as lot of equipment are interconnected in the grid generating lot of noises in the form electromagnetic interference and also the attenuation caused by the network. Applications of PLCC is mainly related to energy management and monitoring system. Few of the application includes Advanced Metring Infrastructure (AMI), control of EV charging stations, Remote monitoring of loads and control applications and DER management and smart metering systems[17][19].

7.2PLCC in Building Automation System

For building a smart home/building, a distributed control system capable of communicating with intelligent devices in required. PLCC technology is a good candidature to aid the communication between intelligent devices. LonWorks is one such protocol which employs a flat system architecture to build automation system for buildings at reduced cost for implementation, management and maintenance. In building automation system, each device has an intelligent embedded system which follows a common communication protocol to communicate each other for performing control and monitoring function. Each device in the communication network will have a transceiver and an Analog front end to couple the radio frequency signal from transceiver to the power line [23]. Application of this technology includes HVAC system, efficient energy management system, common area lighting, smart metering and security systems. With recent development it is possible to use this technology for infant monitoring systems [22].

7.3PLCC for In-Vehicle communication

The automobile industry is witnessing the transformation from conventional mechanical system to intelligent systems. The modern vehicles contain a variety of smart electronic devices which requires a reliable data exchange for interconnectivity. Typically, the communication is achieved by laying dedicated communication wires e.g., CAN-bus. This

wiring is not only adding to overall weight of the vehicle but also occupies space for laying. In case of ships, weight of electric wiring is about 20% of the total weight [24]. In-vehicle PLCC refers to applications of PLCC to establish communication link inside any means of transportation, i.e., cars, ships, planes, or trains. Thus, adding weight to any motorised vehicle will have an impact to its performance and overall efficiency. In this context NB-PLCC can be a candidate to provide reliable data link by exploring the existing In-Vehicle power cable for data transmission.

8 Conclusion

In this paper, we have outlined the classification of PLCC technology and the importance of NB-PLCC in particular. A review on the regulations and standards revolving around the NB-PLCC technology is provided. Forward error correction (FEC), mapping and modulation schemes proposed for the design of PLCC transceivers by industrial standards are briefed. Coupling circuit and power line channel characterization is also examined. NB- PLCC technology is a future rich enabler in the vision of smart grid, in-home and in-vehicle communication system.

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References

[1] Hrasnica, H., Haidine, A. & Lehnert, R., Broadband Powerline Communications: Network Design, Dresden University of Technology, Germany, John Wiley & Sons Inc., June 2004.

[2] Ferreira HC, Lampe L, Newbury J, Swart TG. Power Line Communications: Theory and Applications for Narrowband and Broadband Communications over Power Lines. John Wiley & Sons, May 2010.

[3] IEEE Standard for Broadband over Power Line Networks: Medium Access Control and Physical Layer Specifications," in IEEE Std 1901-2010, vol., no., pp.1-1586, 30 Dec. 2010, doi: 10.1109/IEEESTD.2010.5678772.

[4] IEEE Standard for Broadband over Power Line Networks: Medium Access Control and Physical Layer Specifications -- Amendment 1: Enhancement for Internet of Things Applications," in IEEE Std 1901a-2019 (Amendment to IEEE Std 1901-2010) , vol., no., pp.1-118, 19 June 2019, doi: 10.1109/IEEESTD.2019.8710016.

[5] IEEE Standard for Low-Frequency (less than 500 kHz) Narrowband Power Line Communications for Smart Grid Applications," in IEEE Std 1901.2-2013, vol., no., pp.1-269, 6 Dec. 2013, doi: 10.1109/IEEESTD.2013.6679210.

[6] CENELEC EN50065-1:2011 Accessed: 10.Oct.2020[Online]. Available: https://www .cenelec.eu/dyn/www/f?p=104:110:333400217698501::::FSP_ORG_ID,FSP_PROJECT,FSP_LA NG_ID:1258815,55894,25

[7] US Federal Communications Commission (FCC), Title 47 of the Code of Federal Regulations, part 15, Accessed: 11.Oct.2020. [Online]. Available: https://www.fcc.gov /wireless/bureau-divisions/technologies-systems-and-innovation-division/rules-regulations -title-47

[8] Lutz Lampe, Andrea M. Tonello & Theo G. Swart, Power Line Communications: Principles, Standards and Applications from Multimedia to Smart Grid, 2nd Edition, John Wiley & Sons Inc., June 2016, ISBN: 978-1-118-67671-4.

[9] ARIB STD-T84, Accessed: 5. Oct.2020 [Online], Available: https://www.arib.or.jp/english/std_tr/telecommunications/desc/std-t84.html
[10] SAC GB/T 31983.11-2015, Accessed: 3.Oct. 2020[Online]. Available: https://books.google.co.in/books?id=N6n8DwAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
[11] Narrowband orthogonal frequency division multiplexing power line communication transceivers – power spectral density specification, ITU-T, G.9901, Jun. 2017. [Online]. Available: https://www.itu.int/rec/T-REC-G.9901-201706-I/en
[12] Narrowband orthogonal frequency division multiplexing power line communication transceivers for ITU-T G.hnem networks, ITU-T G.9902, Oct. 2012. [Online]. Available: https://www.itu.int/rec/T-REC-G.9902-201210-I/en
[13] Narrowband orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks, ITU-T G.9903, Aug 2017. [Online]. Available: https://www.itu.int/rec/T-REC-G.9903-201708-I/en
[14] Narrowband orthogonal frequency division multiplexing power line communication transceivers for PRIME networks, ITU-T G.9904, Oct. 2012. [Online]. Available: https://www.itu.int/rec/T-REC-G.9904-201210-I/en
[15] V. Kavinilavu, S. Salivahanan, V. S. K. Bhaaskaran, S. Sakthikumaran, B. Brindha and C. Vinoth, "Implementation of Convolutional encoder and Viterbi decoder using Verilog HDL," 2011 3rd International Conference on Electronics Computer Technology, Kanyakumari, 2011, pp. 297-300, doi: 10.1109/ICECTECH.2011.5941609.
[16] Convolutional encoder Accessed: 7.Oct. 2020[Online] https://www.tutorialspoint.com/error-correcting-codes-binary-convolutional-code
[17] Sendin, Alberto & Berganza, Inigo & Arzuaga, Aitor & Osorio, Xabier & Urrutia, Iker & Angueira, Pablo. (2013). Enhanced Operation of Electricity Distribution Grids Through Smart Metering PLC Network Monitoring, Analysis and Grid Conditioning. Energies. 6. 539-556. 10.3390/en6010539.
[18] "IEEE Standard for Medium Frequency (less than 12 MHz) Power Line Communications for Smart Grid Applications," in IEEE Std 1901.1-2018 , vol., no., pp.1-192, 14 May 2018, doi: 10.1109/IEEESTD.2018.8360785.
[19] T. A. Papadopoulos, C. G. Kaloudas, A. I. Chrysochos and G. K. Papagiannis, "Application of Narrowband Power-Line Communication in Medium-Voltage Smart Distribution Grids," in IEEE Transactions on Power Delivery, vol. 28, no. 2, pp. 981-988, April 2013, doi: 10.1109/TPWRD.2012.2230344.
[20] “Power Line Communication Market Analysis”, Accessed [Online] on 12 Oct 2020, Available: https://www.maximizemarketresearch.com/market-report/power-line-communication-market/2560/
[21] “Communication network solutions for transmission and distribution grids” Accessed [Online] on 12 Oct 2020, Available: https://assets.new.siemens.com/siemens/assets/api/uuid:8b4809cf50679ccae32f511471c3eb92d064c814/version:1501223616/cgem-160662-communication-network-solutions-16-seiter-row-lowres-v080rz.pdf
[22] “ LonWorks and PLCC”, Accessed [Onlone] on 15 Oct 2020, Available: https://megachips.com/bacnet-lonworks-and-hd-plc-choosing-the-best-open-protocol-for-your-building-automation-system/
[23] “Introduction to the LonWorks® Platform”, Accessed [Onlone] on 15 Oct 2020, Available: https://www.echelon.com/assets/blt893a8b319e8ec8c7/078-0183-1B_Intro_to_LonWorks_Rev_2.pdf
[24] Pittolo, Alberto & De Piante, Marco & Versolatto, Fabio & Tonello, Andrea. (2016). In-Vehicle PLC: In-Car and In-Ship Channel Characterization. IEEE Vehicular Technology Magazine. 1-1. 10.1109/MVT.2015.2480098.3

Novel Control Method on Unified Power Quality Conditioner (UPQC) for Harmonic Distribution Using PSO-Fuzzy Logic

Y.Mallikharjuna Rao [1], B Sarath Chandra[2,] Dr.N.C.Kotaiah[3]
{ymallieee@gmail.com[1], sarath.boppudi@gmail.com[2], nellurikotaiah@gmail.com[3]}

Assistant Professor, Department of EEE, RVR & JC College of Engineering, Guntur, A.P, India[1,2]
Professor, Department of EEE, RVR & JC College of Engineering, Guntur, A.P, India[3]

Abstract. In this paper novel control method on unified power quality improvement for harmonic distribution using PSO-Fuzzy logic is implemented. There are various types of compensators such as parallel power quality compensator and series power quality compensatorwhichimproves the power quality. In this proposed work, control algorithm is developed on unified power quality conditioner. The entire algorithm is divided into three stages, in stage -1 all the parameters will be initialized and in stage-2 process computing the upper and lower boundary's of X and Y is done. At last in stage-3 the process of commuting value of z is done and output is obtained. The simulation results show that fuzzy controller based particle swarm optimization will improve the accuracy, effectiveness and superiority.

Keywords: Unified power quality conditioner (UPQC); optimal volt-ampere (VA) rating/loading; displacement angle control (DAC); reactive power sharing; voltage leak and swell.

1 Introduction

In modern daysnon-linear loads are increasing amazingly and many of the loads to a great extent reliant on it. Non-linear loads are TVs, bend heaters, printing and fax machines, microwaves, rectifiers, inverters, electronic contraptions, speed drives, AC, and so on. All these non-linear loads present in the linesare of power quality issues [1]. The steadiness of any electrical gadget is to a great extent represented by the gracefully voltage and flow waveforms. In this event the principal waveform is sinusoidal, and its sounds are sinusoidal too then these happen in vital products of the central waveform thus provided power is weakening. Because of these consonant distribution produced by nonlinear loads, a few issues are caused in the machines which are utilized in our motivation like overheating of the engine, increment in misfortunes, changeless harm of gear is the most pessimistic scenario, high mistake in meter perusing, and so on. Subsequently alleviation of non-liner loadonload side or source side is a major test for a power engineer.

Because of the sounds presentation in the lines by the nonlinear load's different issues are produced, for example, voltage swell, voltage droop, glimmer happening in voltage, and so on therefore proficiency of intensity gracefully corrupts. In past, detached channels utilizing tuned LC segments were in especially use to improve the nature of intensity by expelling

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voltage and current sounds. However, its utilization is restricted these days since they have a significant expense, reverberation, enormous size. Some of the issues can be compensated using Active powerfilter (APF) which has been in pattern these days [2].

In electrical power framework power gadgets assume a significant job. In dispersion framework it has three viewpoint initial one is that presents important modern and household types of gear, second one is that makes issues, third one is that help to take care of issues [3]. Presentday's cutting edge semiconductor exchanging gadgets, for example, controlled rectifiers, Uninterruptible Power Supplies (UPS), curve heaters and so on are generally utilized especially in local and mechanical loads. These non direct loads make power quality issues, for example, voltage list, voltage swell, voltage interference, voltage glimmers, and voltage spikes and so on. Such poor power quality causes increment in power misfortunes and other noteworthy variations from the norm in appropriation sides.

Along these lines, it is essential to keep up an elevated requirement of intensity quality. Prior uninvolved channels were utilized to take care of intensity quality issues. Anyway due to certain confinements of aloof channels, present day's custom power gadgets are utilized to take care of intensity quality issues in circulation side. The remunerating custom power gadgets are utilized for dynamic sifting, load adjusting, power factor improvement and voltage controlling (droop/swell).There are three sorts of custom power gadgets: Distribution Static Compensator (DSTATCOM), Dynamic Voltage Restorer (DVR) and Unified Power Quality Conditioner (UPQC) [4-5].

Earlier, there is staggering utilization of complex frameworks with innovatively propelled part, for example, non-direct load, uninterruptable power flexibly, rectifier loads, power hardware gadgets in household just as mechanical territory. These parts influence the source as well as unclean the power gracefully with their characteristics. This will repeat the age of different power quality unsettling influences, for example, commotion, voltage sounds, current music, homeless people, and so forth. The impact of all these power quality issues are consistently relies on reason for unsettling influences and its occurrence.IEC and IEEE plan different universal gauges for power quality wellbeing and mindfulness.

The answers for all the power quality systems will likewise relies on its reasons for events, area, timespan impact, recurrence of event. These all adjustments is based on conduct of flexibly framework likewise influence on the end clients hardware. The present power framework is for the most part as three stage three wire or three stage four wire bringing with huge cutoff to voltage source with source impedance and having a blend of different kinds of loads. According to the IEEE guidelines and perspective on perfect state of intensity frameworks an unadulterated and equalization three stage voltage of steady greatness tought to be furnished to customer with as less as conceivable power quality issues.

Anyway with the utilization of intensity hardware gadgets and a few non-direct loads, responsive, single stage and unbalance three stage load making structure of framework progressively complex with a few power quality issues. At a similar side in ongoing year a few dynamic techniques for improving power quality have been featured with their quick reaction and little structure, for example, extraordinary dynamic power channels and bound together power quality conditioner which can be utilized to evacuate power quality issues for both arrangement and shunt side of the frameworks.

2 Upqc General Block Diagram Configuration

The dependability of force is progressively worried about power providers and end-users. In the last part of the 1980s, power electronic gadgets, creating the new stacking supplies and microchip dependent on controls which accomplished a few premises for improving power quality. Further spotlight on the presentation of force age frameworks which has been given to the proceeding with expansion in the gadgets, like high proficiency, variable speed engines and shunt capacitors, because of expanding power factor to decrease power misfortune. Therefore, symphonious levels of the force frameworks are expanding and numerous individuals stress over future effects on the ability of the framework [2].

End clients are more mindful of issues with nature of the force. Utilities clients are better mindful of issues like breaks, interferences, difficulties and transient changes to improve the force supply. So all PCs in the organization are interconnected. Incorporated cycles simply that stacking hardware has undeniably more significant ramifications for disappointment of every segment. Strangely, the gadgets that are introduced for expanded efficiency likewise regularly influence extra force quality issues to the gadget that is the most influenced by the gadgets and basic force disturbances.

The effective activity and control of the machines is progressively reliant upon the nature of the energy when all cycles are robotized. Force quality can be portrayed as a force supply that permits a legitimate working of the electric gadget. Truly client driven issue and the end client reference point is liked for the nature of force [3]. Subsequently any force issues that show in current or recurrence, breakdown of client gear or voltage deviations that bring about disappointment can be grouped into the nature of the force supply issues.

Current Flexible Alternating Transmission System is utilized to give straightforward and unadulterated force, for example the waveform of unadulterated sinusoidal voltage. In the flow electrical organization, there is utilization of various transmission devices; those are Interline Power Flow Controller (IPFC), Unified Power Quality Controller (UPQC), Static Synchronous Compensator (STATCOM) and Static Synchronous Series Compensator (SSSC, etc. Transmission gadgets were intended to work the transmission framework which are refreshed.

These are utilized on the force conveyance frameworks as "Custom Power Devices". Active Filter (AF), Dynamic Voltage Restorer (DVR), Static Synchronous Compensator (DSTATCOM) and Unified Power Quality Conditioner (UPQC) are probably the most generally utilized force gadgets. With the assistance of these gadgets, the quality issues were significantly limited, in light of lower cost and the more modest size of its quick reaction of DVR made it as amazing and dependable gadgets [4]. Dissemination frameworks are having such countless issues like sounds, swell, drifters and holes. In the dispersed framework, issues are prompts voltage spill. The schematic outline of UPQC is introduced in Fig. 1. The UPQC comprises of three modules, which are shunt converter, arrangement converter, and transformer. The shunt converter manages the current remuneration.

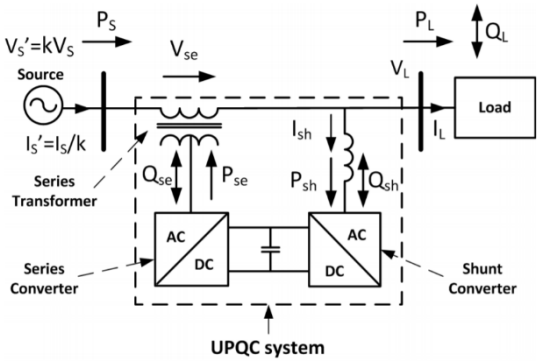

Fig. 1: UPQC general block diagram configuration

The course of action converter can source voltage. The transformer handles the course of action induced voltage. Due to the satisfactory execution in compensating all voltage and current PQ issues, UPQC gets perhaps the most engaging plans. Experts have considered about restricting the total voltage loadings of the UPQC system using different procedures. The improvement of the hard and fast voltage loadings is refined to the impediment of growing the assessments of the overall UPQC system. Actually, the assessing part of the UPQC structure has seldom thought to be the force electronic converters and transformers.

3 Upqc Based Sources of Power Qulity

3.1. Power Electronic Devices

The nonlinear load power electronic gadgets are given as Choppers, Rectifiers, Inverters and so on. All these will leak the volatge if they are not protetcted. Simialry, harmonic distortion is created for these types of loads.

2.IT and Office Equipment

IT and office equipments consists of Switch Mode Power Supply (SMPS) which creates an harmonic distortion to aviod the voltage leaks. In the third, fifth and seventh level the harmonics are distributed in triple way storage system. `

3. Arcing Devices

In this devices electric arcing gadgets, electric circular furnaces and electric discharge lighters will be availble which are basically known as non direct charges. The arcing devices are moderated with each other based on the adjustment of circular segment furnances. They work with devices under different variant modes. The devices are frequently triggered when nearby systems are tolerated and electronic systems are protected very effectively.

4.Switching of Load

Transient operation is obtained based on the exchange of effect of the voltage. An impact is obtained based on the huge single-stage stack which is a transient. The loads are controlled based on the different mechanical systems which are controlled electrically.

5. Starting of Large Motor

Large motor is utlized based on the concept of acceptance machines which is an vigrourus cocept. The current standrad will increase the load while the motor is operating. Leaks of voltage are organised by the impedance of system.

6.Sensitive Equipment

The power quality is variated very slowly when the equipment is manufactured and arranged in particular format. The power quality events consists of different types of issues based on the hardware systems.

7. Different Damages in Environment and Storm

Light strikes are a wellspring of transient overvoltage's, regularly bringing about disappointments in the force supply organization. There is no requirement for the nearby organization to acquaint the homeless people lightning with strike a conductor. In the event that close to place of the conductor strikes the lightning, drive can be delivered. A close by strike will push up the nearby ground expected prompts nonpartisan current coursing through a far off surface to earth.

4 UPQC For Harmonic Distribution Using Pso-Fuzzy Logic

The below figure (2) shows the flow chart of UPQC for harmonic distribution using PSO-fuzzy logic. The entire algorithm is divided into three stages, in stage -1 all the parameters will be initialized and in stage-2 process of computing the upper and lower boundary’s of X and Y is done. At last in stage-3 the process of commuting value of z is done and output is obtained.

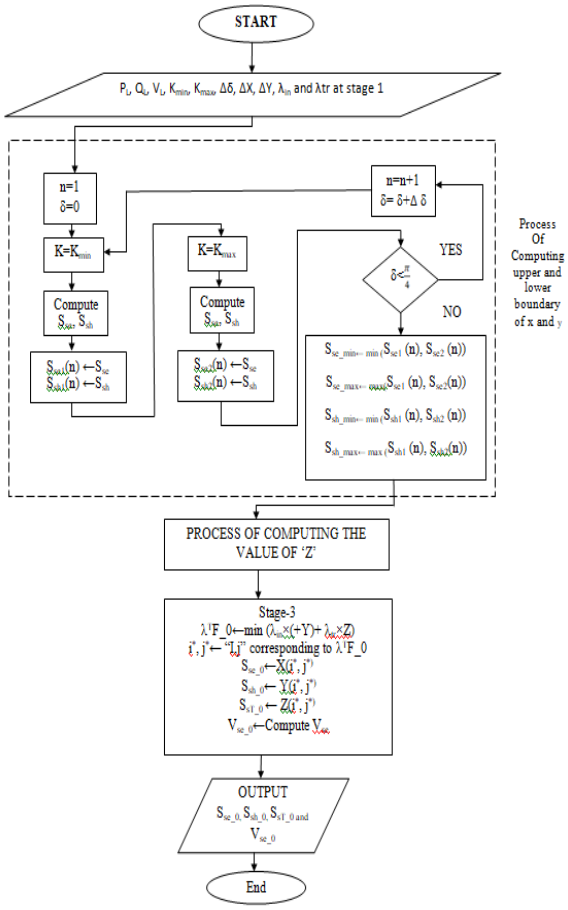

Fig. 2: Flow Chart of Upqc for Harmonic Distribution Using Pso-Fuzzy Logic

Kennedy and Eberhart introduced the Particle Swarm Optimization algorithm technqiue. This technqiue mainly computes the evolutionary behaviour of system in effective way.

The below shows the steps of UPQC operation where mainly 3 parameters of fuzzy controller is involved:

1) A random initial value is assigned to increase the speed and location of every area after the dividing of entire solution intially $\theta_i = [k_e , k_{ec}, k_u]^T$. The intial copndition value is represented as p_{Best} which is nothing but individual extreme value. Minimum error value is obtained for the global extreme value g_{Best}. All the values of area are recorded at the same time

2) Calculation of Velocity Vi(t+1) of particle i is done.

3) Particle i is updated as Positioning vector Xi(t+1).

4) Positioning vector p_{Best} is set to g_{Best} when If fitness function min (e) θi is better than before.

5) The operation will be stop when iteration reaches to the pre-determined one at the same token level. In fuzzy controller the values of ke, kec and ku is optimized.

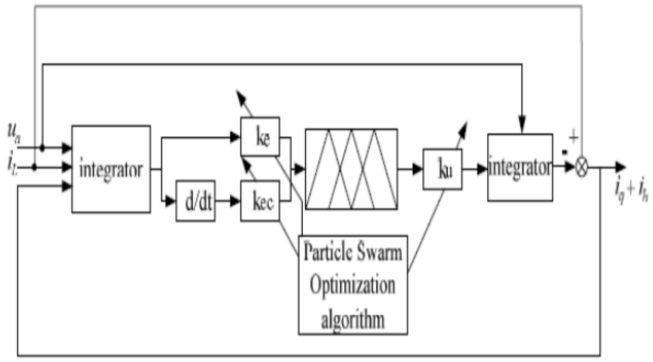

Fig. 3: Principle Of Pso-Fuzzy Controller

Figure (3) shows the principle of PSO-FUZZY controller. In this integrators are used for boost up of signals. PSO algorithm will improve the performance of system.

5 Results

The below figure (4) shows the comparison of accuracy for UPQC and UPQC for harmonic distribution using PSO-fuzzy logic. Compared to normal UPQC design, the proposed design gives high accuracy.

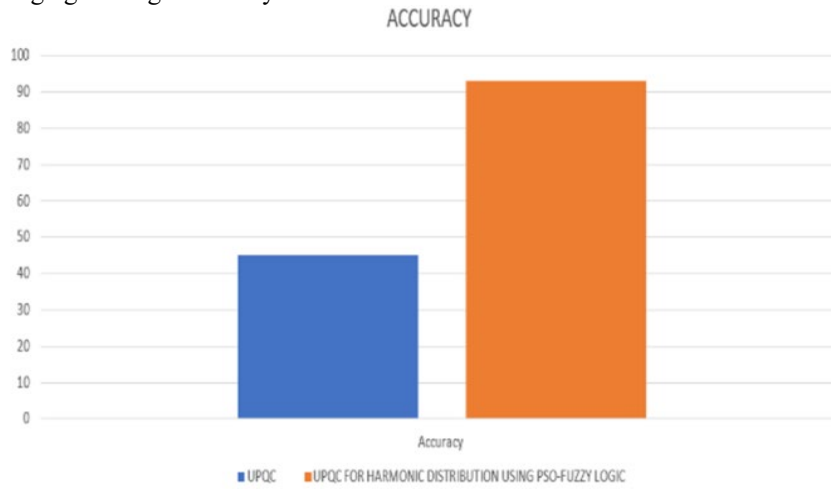

Fig. 4: Accuracy Comparison

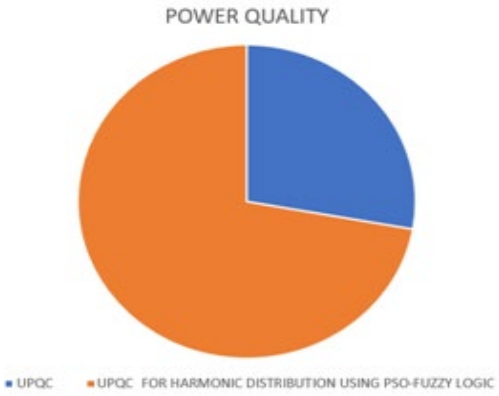

Fig. 5: Power Quality Comparison

The above figure (5) shows the comparison of power quality for UPQC and UPQC for harmonic distribution using PSO-fuzzy logic. Compared to normal UPQC design, the proposed design has good power quality.

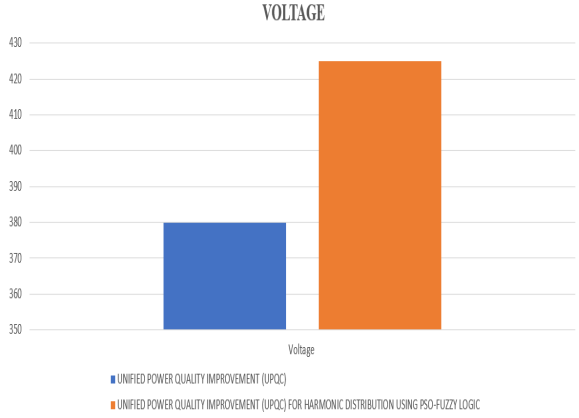

Fig. 6: Comparison of Volatge

The above figure (6) shows the comparison of voltage for UPQC and UPQC for harmonic distribution using PSO-fuzzy logic. UPQC takes 380 V and UPQC for harmonic distribution using PSO-fuzzy logic is 425 V.

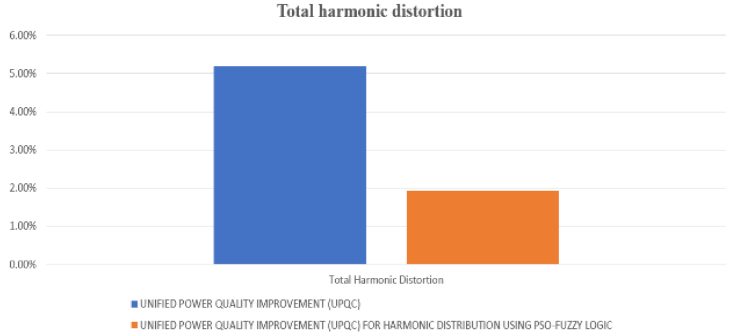

Fig. 7: Total Harmonic Distortion

The above figure (7) shows the total harmonic distortion of power quality for UPQC and UPQC for harmonic distribution using PSO-fuzzy logic.

In UPQC for harmonic distribution using PSO-fuzzy logic, will maintain the capacitor voltage, terminal voltage of line, reactive power and active power. By using the reference values parameters are controlled and compared with each other. Figure 8(a), (b) and (c) shows the membership function of FC where error, change in error and output is given. Fuzzification, Nonuniform fuzzifier is utilized in the present work. Change is errors are obtained very small when the exact values of error are obtained. Similalry, the the values are divided coarsely when the exact values are large.

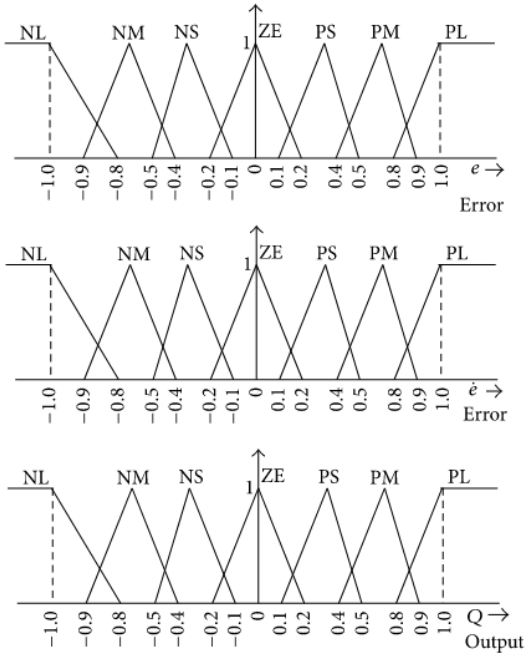

Fig. 8: Membership Function Of Fc: (A) Error (B) Change in Error and (C) Output

6 Conclusion

In this paper novel control method on unified power quality improvement for harmonic distribution using PSO-Fuzzy logic is implemented. The entire system is dependent on the Harmonic distortion and voltage control execution which is distribution network. Harmonic voltages are generated by using the harmonic current proliferation in the power systems. DSTATCOM will actually reduce by the use in distribution systems based on nonlinear diode rectifier load. Accuracy, effectiveness and superiority will be improved based on the fuzzy controller based particle swarm optimization.

References

[1] Aziz Tashkori, seyyed hosseyn, “Power quality improvement using power electronic transformer based DVR”, IEEE Transactions on Power Electronics 2018.

[2] Ray, O, Adda, R, Mishra, Joshi & SK, “Synchronous- Reference- Frame- Based Control of Switched Boost Inverter for Standalone DC Nano grid Applications”, IEEE Transactions on Power Electronics, vol. 28, no. 3, pp. 1219-1233, A 2013.

[3] Barbir, F, “PEM Fuel Cells Theory and Practice 2nd Edition”, Elsevier Academic Press, New York, 2012.

[4] Bhumkittipich, K & Mithulananthan, N, “Performance Enhancement of DVR for Mitigating Voltage Leak/Swell using Vector Control Strategy”, Energy Procedia, vol. 9, pp. 366-379, 2011.

[5] Bhuvaneswari & Charles, S, “Comparison of Three Phase Shunt Active Power Filter Algorithms”, International Journal of Computer and Electrical Engineering, vol. 2, no.1, pp. 1793-8163, G 2010.

[6] Kalyan kumar, B & Mishra, MK, Anil kumar, R, Siva kumar, G, “Compensation of voltage leaks with phase-jumps through DVR with minimum VA rating using PSO based ANFIS controller”, International Journal of Swarm Intelligence Research, vol.1, no.3, pp.19-33, 2010.

[7] AlRashidi, MR & EI-Hawary, ME, “A Survey of Particle Swarm Optimization applications in Electrical power systems”, IEEE Transactions on Evolutionary Computation, vol. 13, no.4, pp. 913-918, 2009.

[8] Aredes, M, & Watanabe, EH, Akagi, H, “Instantaneous Power Theory and Applications to Power Conditioning”, John Wiley & Sons, New Jersey, 2007.

[9] H, Akagi, “Modern active filters and traditional passive filters”, Bulletin of the polish academy of sciences Technical Sciences, vol. 54, no. 3, pp. 255-269, 2006.

[10] H, Akagi, “Active Harmonic Filters”, Proceedings of the IEEE, vol. 93, no. 12, pp. 2128-2141, H 2005.

Gravity Drainage Process For Miscible and Immiscible Co2 Injection Process

Ahammad Sharif Mohammed [1], Dr. C.V.Subramanyam [2]
{ahmedsharif.chem95@gmail.com[1], cvsrvr@gmail.com[2]}

Research Scholar, Acharya Nagarjuna University, Guntur 522001, India &
Assistant Professor, GIET college of Engineering, Rajahmundry, 533294, India[1],
Professor, RVR&JC College of Engineering, Guntur 522001, India [2]

Abstract. In this paper, CO2 injection for enhancing oil recovery assisted by gravity drainage using reservoir simulation (using CMG's IMEX and GEM simulators) for a miscible and immiscible process is studied. The reservoir pressure declines with time and reaches a point where the fluids from the reservoir will not flow into the wellbore. Then the reservoir is assisted by additional pressure support under secondary recovery methods by gas injection or water flooding. For the conditions where the reservoir is having immobile oil due to relation of fluid and rock properties enhanced oil recovery techniques are adopted. CO2 is used under gas injection techniques is one of the most efficient and economic method to recover the oil. The gravity drainage process of CO2 when injected into the reservoir is observed in this paper. To understand and analyze the process of gravity drainage under miscible and immiscible CO2 injection a 50°API gravity oil was selected to study under simulation model of selected grid size. The analysis was made for seven different cases and their relations with time, production of water and GOR are represented.

Keywords: CO_2 injection, gravity drainage, gas injection, miscible and immiscible flow, API gravity, reservoir simulation.

1 Introduction

Enhanced oil recovery is to recover the immobile oil when the reservoir pressure declines and flow of oil ceases. There are various EOR techniques used to recover the left-over oil. Gas injection technique is the most efficient economic method of enhancing the recovery rates. The gas injection is carried out as a miscible displacement or immiscible displacement based on the reservoir. The miscibility of an injected gas directly depends on the MMP(Minimum Miscibility Pressure). The CO_2 injection being the one of most efficient enhanced oil recoveries, the field studies indicate that there are no investigations on the gravity drainage process for immiscible & miscible CO_2 injection. There is also a lack of research on the gravity drainage process for 50 °API gravity oils. An attempt was made to study the CO_2 – assisted gravity drainage to understand the mode of miscibility development, gas injection, molecular diffusion and heterogeneity through grid refinement studies. Thus, a study is carried out by using Computer Modeling Group (CMG), IMEX and GEM simulator by selecting compositional models based on equation of state and pseudo-miscible. To avoid premature breakthroughs and viscous fingering through oil zones the injection rates are maintained below the critical levels.

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To study CO_2 – assisted gravity drainage enhanced oil recovery method's, miscibility development and recovery performance on 50 °API gravity oils compositional models a set of seven combinations of CO_2 injection rates and production rates of oil. This process considers maintaining the process at void balance conditions. In this study, the data is considered from optimized oil recovery of vertical injection of CO_2 and horizontal oil production from a regular well. A period of 132 years set for reservoir simulation for miscible and immiscible CO_2 injection.

Table 1. Rate Constraints of The Wells

CASE	Rate Constraints/ Well		
	iCO_2 MMSCFD		Q_o, BPD
	Immiscible	Miscible	
I	1.50E+06	2.09E+06	4000
II	3.32E+06	4.70E+06	9000
III	5.62E+06	7.80E+06	15000
IV	1.00E+07	1.40E+07	20000
V	2.00E+07	2.74E+07	52500
VI	3.00E+07	4.10E+07	80000
VII	4.00E+07	5.60E+07	108000

2 Comparing

- **INCREMENTAL OIL RECOVERY**

The production of oil that was left for secondary recovery is incremental oil recovery.

$$\text{Incremental EOR} = \frac{\text{Incremental Oil Recovered in } CO_2 \text{ – Assisted Gravity Drainage}}{\text{Oil-In-Place at the start of } CO_2 \text{ injection}}$$

The immiscible and miscible rate constraints of the incremental oil recovery performance of CO_2 injected with respective pore volumes are represented by figures 1 & 2.

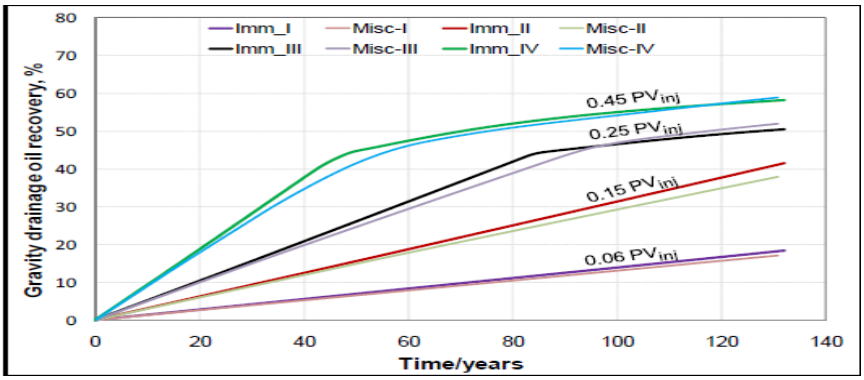


Fig. 1: Comparison between incremental miscible and immiscible gravity drainage assisted by CO_2 oil recovery in rate-constraints from Case-I to Case-IV

From the figure 1 graph, it is clear that the recovery rates are less for miscible compared to immiscible for a case I & II low rate constraints. But for cases III & IV there is a marginal cross for miscible over immiscible recovery. For Case – V the incremental recovery showed relatively higher for miscible compared to the immiscible process. The same was seen for Case-IV but there was an early flood front 30 years before.

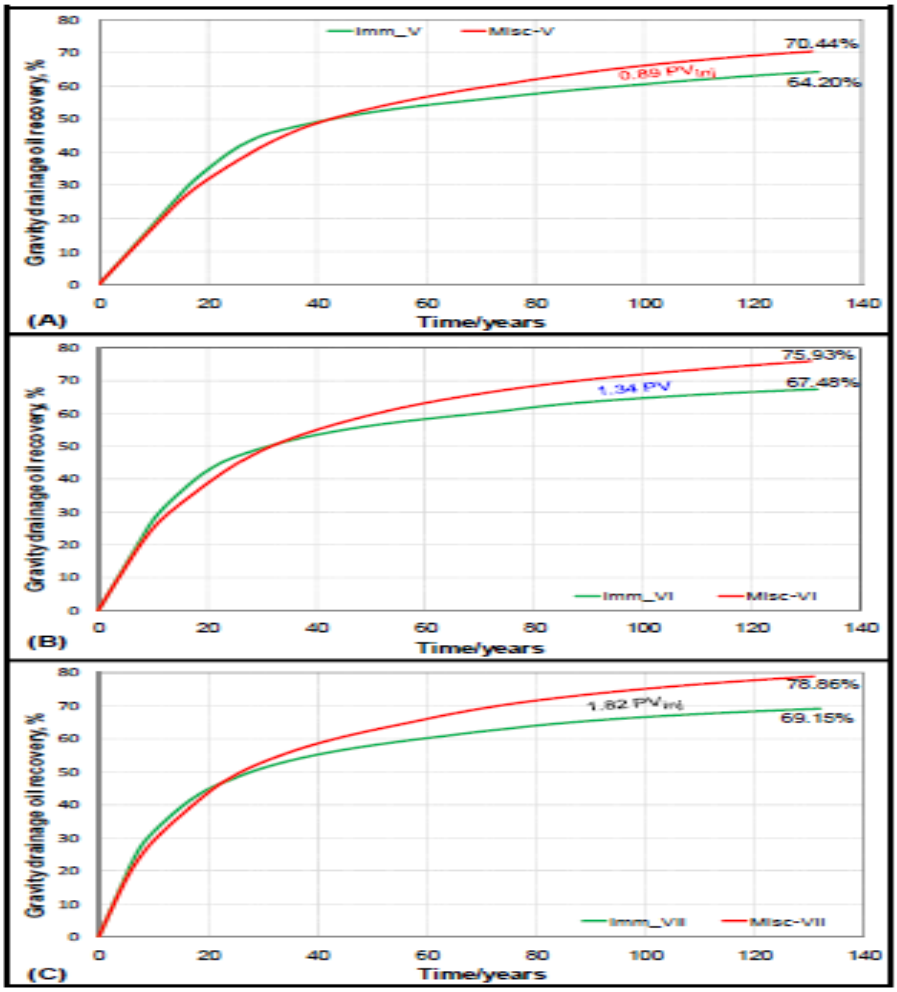


Fig. 2: Comparison - Incremental CO_2-assisted gravity drainage oil recoveries in both the immiscible and miscible process from Case-V to Case-VII

For Case – VII there was the highest incremental recovery from the higher CO_2 injection rates that accounted a 79%. This is 10% more than the immiscible flood for the same conditions in Case-VI.

From a detailed understanding of the above curves, it is clear that the immiscible recovery projected higher levels than miscible till the CO_2 flood front is achieved.

- **GOR:**

The GOR (Gas Oil Ratio) of Case IV – Case VII for the taken rate constraints showed a thinning curve for the miscible process and thick curves for the immiscible process. For Case-VII immiscible process had a maximum of 96000 GOR and 85875 for the miscible process. GOR in miscible tends to stay low due to the injected high-pressure gas compress the condensate gas. But as the selected oil is of 50 ^{o}API gravity which is a light oil that may produce condensate gas. This will show gas production after a breakthrough.

- **WATER PRODUCTION:**

For Case IV-VII the water production from the water breakthrough by the aquifer below the oil zone for miscible and immiscible is zero or negligible. This is as the horizontal reservoirs are perorated and produced at parallels. The vertical injection of CO_2, the proper selection of producing zone and correct selection of control or completely nullify the chances of water coning.

- **RESERVOIR PRESSURE:**

As the reservoir pressure declines with time as production happens, the study of the average pressure decline for the life of the reservoir is critical and highly needed. From the set of data combinations, there was a decrease of 60 psia till the drainage area achieved CO_2 flood front in the horizontal production well which is a 2.2 psi/year decline by 2022. The drop in oil production and the rise in GOR indicate the CO_2 flood front arrival. The average pressure for Case -IV, VI & VII after production for 132 years under immiscible process is observed a decline of 22,70 and 100 psi respectively. The wells with high-rate constraints have more pressure drops than low rate well constraints. For the three cases of IV, VI & VII the pressure drops are as 0.17 psi, 0.54 psi, and 0.77 psi per year correspondingly which explains that the wells with low-rate constraints have less pressure drop.

3 Study Of Mechanism

- **IMMISCIBLE**

For immiscible CO2 gas injection assisted by gravity drainage EOR method block (21,20,7) is selected to evaluate the contributing mechanisms are demonstrated by figure 3 are changes that are associated with properties over 132 years of production which is done by understanding the oil saturation profile by combining with pressure in reservoir and GOR. The oil saturation in case-V and VII for 16 and 7 years respectively in a block (21,20,7) remains constant at 0.82.

- **MISCIBLE**

From earlier comparative studies it is shown that the incremental recovery of the miscible flood was high than the immiscible process. The responsible mechanisms that aided high recovery are illustrated by understanding oil saturation, gas saturation, and oil viscosity properties.

To sum up, the average reservoir pressure is the dominating mechanism that contributed to oil recovery by EOR process of gravity drainage assisted by CO_2 under miscible and immiscible process. This is well understood by collaborating oil rate Barrel Per Day (BPD),

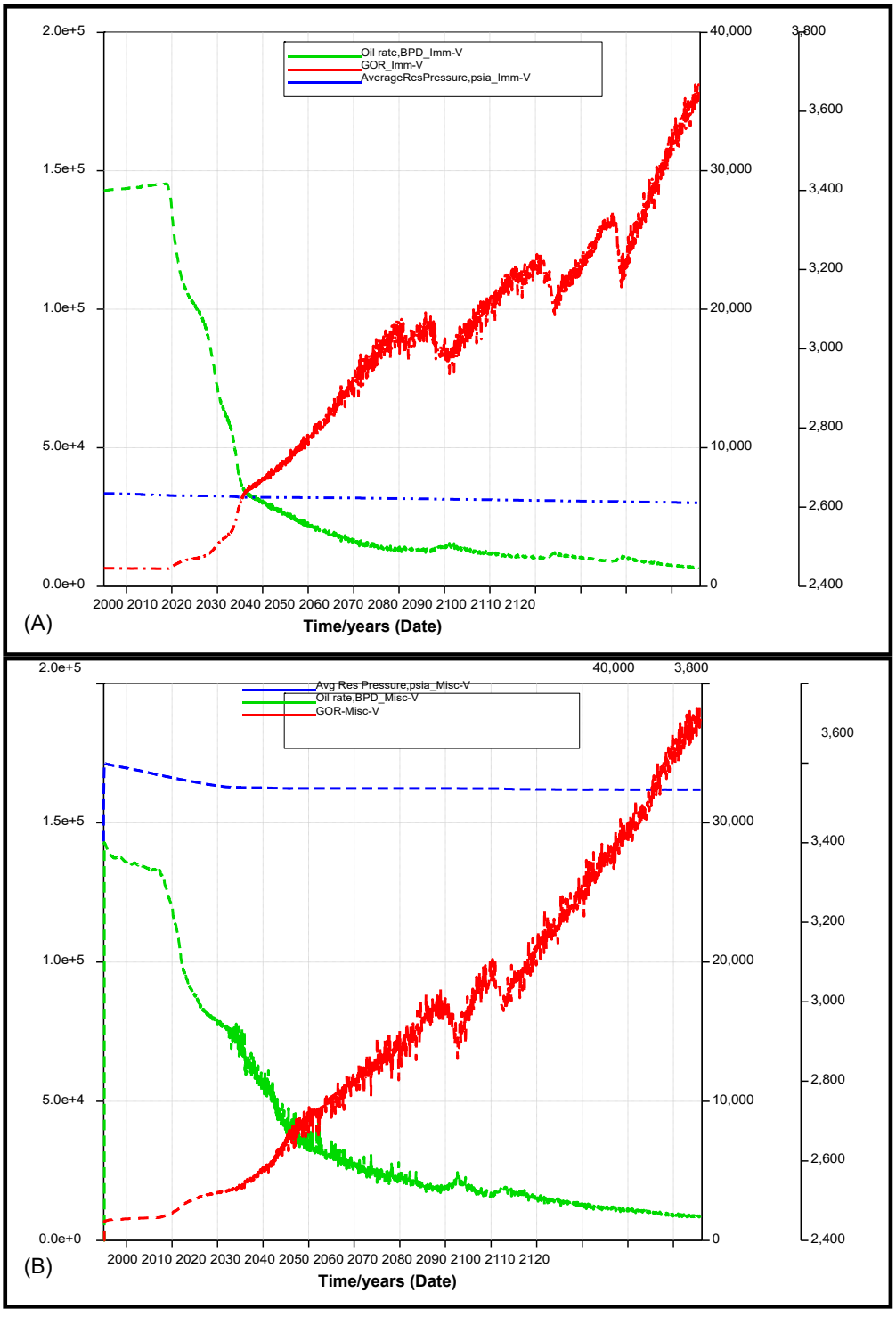
GOR (ratio of gas oil) and average pressure in reservoir for the miscible and immiscible process are discussed in detail.

3.1 OVERALL MECHANISMS: IMMISCIBLE AND MISCIBLE PROCESS

In EOR process for both the miscible and immiscible gravity drainage assisted by CO_2, the average pressure in reservoir is the parameter which itself explains the involved mechanism of oil recovery. Figure 3 shows the oil rate per barrel per day, GOR (ratio of gas oil) and the average pressure in reservoir in both miscible and immiscible process in Case-V were plotted in order to understand.

At initial stage of immiscible flood of CO_2 the average pressure in reservoir is 2633 psia in March 1995 but at end (April 2126), it is nearly 2598 psia (see in Figure 3A**)**. This was dropped by only 35 psia, with 026 psia rate of average every year in 132 years of simultaneous production and immiscible CO_2 injection. The production of oil begins just after the injection of CO_2 (see in figure 3A**).** In the secondary flood of CO_2 it was observed that the single phase oil flow and the water phase was immobile. The difference in the higher density between gas and oil at the time of secondary immiscible flood and that promotes the under gravity oil drainage behind the flood front of CO_2. This type of drained oil joins with oil bank formed earlier the flood front of CO_2 for further contribution of oil-displacement which takes place before the flood front of CO_2.

The majority of oil was in oil bearing zone in oil bank. In respect with the sharp drop in saturation of gas the saturation of oil in block (25, 14, 6) is slowly increased in 8 years of miscible process from the start of miscible in 1995 was shown in figure 3. Once the arrival of gas front to upper block, then that was an immediate proximity to the gas cap, and the saturation of oil retains its normal value of 0.80 (see in Figure 2A) and which will remain/stands there for total 65 years (until 2070). Corresponding saturation of oil slowly falls to the value of 0.10 and it continues to fall gradually while producing very slow recovery of oil (see in Figure 2C). Even though with 65 years of S_g constant profile, the viscosity of oil continues to increase. It indicates that medium components and heavy components were extracted from block in oil reservoir, which leads to increase in viscosity and reduction in oil-volume. The block (25, 14, 6) which witness a complete recovery of oil is indicated by zero values of oil viscosity in year 2087 (see in Figure 2B). The maximum saturation values of oil shown in Figure 2A and respective zero saturation oil shown in figure 2C and this is done by the gravity drained oil's trailing edge.


Oil rate,BPD_Imm-V
GOR_Imm-V
AverageResPressure,psia_Imm-V
2.0e+5
1.5e+5
1.0e+5
5.0e+4
0.0e+0
40,000
30,000
20,000
10,000
0
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100 2110 2120
Time/years (Date)
(A)
Avg Res Pressure,psia_Misc-V
Oil rate,BPD_Misc-V
GOR-Misc-V
2.0e+5
1.5e+5
1.0e+5
5.0e+4
0.0e+0
40,000
30,000
20,000
10,000
0
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100 2110 2120
Time/years (Date)
(B)

In the year of 2013, it was observed that sudden fall of oil saturation and sharp increase in gas saturation in the block (25, 14, 7). It is pointed by the gas flood front arrival. During this time oil reservoir can experience both minor extraction and oil swelling represented by corresponding rise and fall of oil viscosity in figure 2B**.** But after the arrival of gas flood front, viscosity of oil experiences only its rise, indicating that the the mechanism which is used to recover the reservoir oil which was left behind the flood front of CO_2 takes important role. At this time the values of oil saturation remains stable at values about 0.04 (figure 2C). Once oil in reservoir is gravity drained downward from upper blocks (25, 14, 6), saturation of oil starts to fall gradually earlier than its complete recovery in the year of 2120 (nearly over 32 years after gas flood front arrival). Abrupt vertical drop in the values of viscosity indicated by trailing edge in leaving (25, 14, 7) block of oil which is gravity drained.

Same oil viscosity, oil saturation and gas saturation profiles are shown in block (25, 14, 8). The arrival of flood front in gas is indicated by the reduction in oil saturation and rise in gas saturation. The viscosity of oil will experienced its decline which is coming from swelling earlier than arrival of CO_2 flood front but rise in its consistent later. These results again indicate that the oil in reservoir behind leading edge of gas flood front was recovered by the mechanism used to extract, along with gravity drainage mechanism.

For further confirmations, the observations are recorded by the sectional-views of oil saturation, gas saturation and oil viscosity properties in these following blocks and are represented symbol of ‘star’ in Figure 4A via figure 4L for variations occurred in following properties from begin (1996) to the last part (2126) of the Case-VII in secondary flooding in miscible of CO_2. The layers of oil zone is indicated by the red numbers on the top left of right in figure, and top down in production is target zone and it also indicates the horizontal and vertical production (layer-8) wells. The starting properties of this block (25, 14, 6) at initial stage of miscible flood that is in the year of 1995 are shown by symbol star in figure 4A, 4B, and 4C. The majority of oil recovery **(**figure 4F) effected the gas saturation that is increased by a value which is higher than 0.80 was shown in Figure 4D and this is by using B-L type displacement. Though the oil components are extracted from this block (figure 4E**)** is indicated by corresponding rise in viscosity of oil in layer-6.

After reaching the block (25,14,8) the gas flood front in the year of 2024 that was shown in figure 4G and then it is followed by the front of miscible. Due to the continued gas production, the viscosity of oil in the year looks like rise in some blocks and in some upper blocks in layers 7 and 6 seems reduced, nearly zero values (figure 4H**)**. The zero values indicates that the oil was completely recovered that was behind the flood front of gas by extracting the components of oil. It has to be remember the oil was not completely recovered from these layers. figure 4J shows that the increase in gas saturation not attain the values in 2126 that are observed in the year 2024, it was when first breakthrough of gas occurred. As shown in figure 6-8K, The values of viscosity of oil drops to zero in almost of the layers 6 and 7. It’s values reached higher in 2126 than (in layer-8) those observed before in 2003, 24. This explains the further extraction process at the time of downward movement in the zone miscible along continuing to drain the oil present under gravity which was from upper layer. figure 6-8L shows the respective saturation of oil at final stage of miscible flood of CO_2.

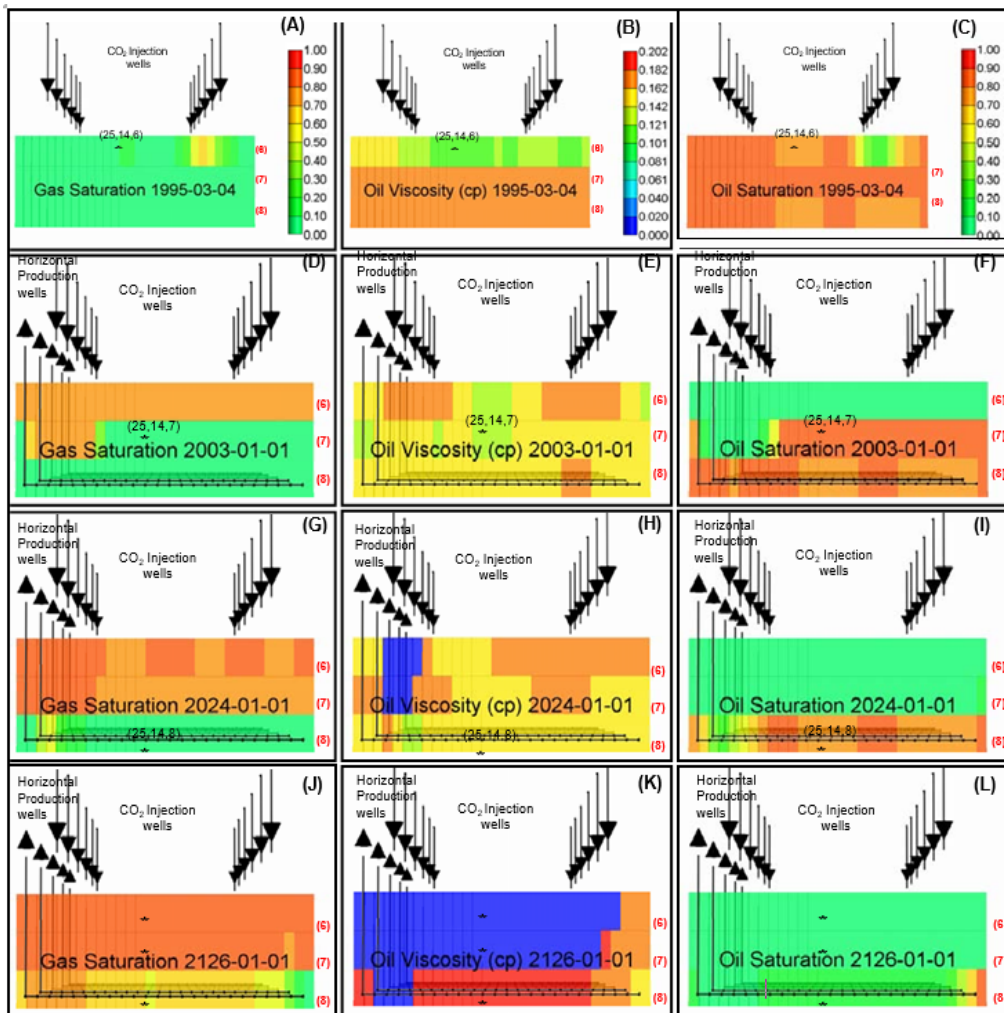
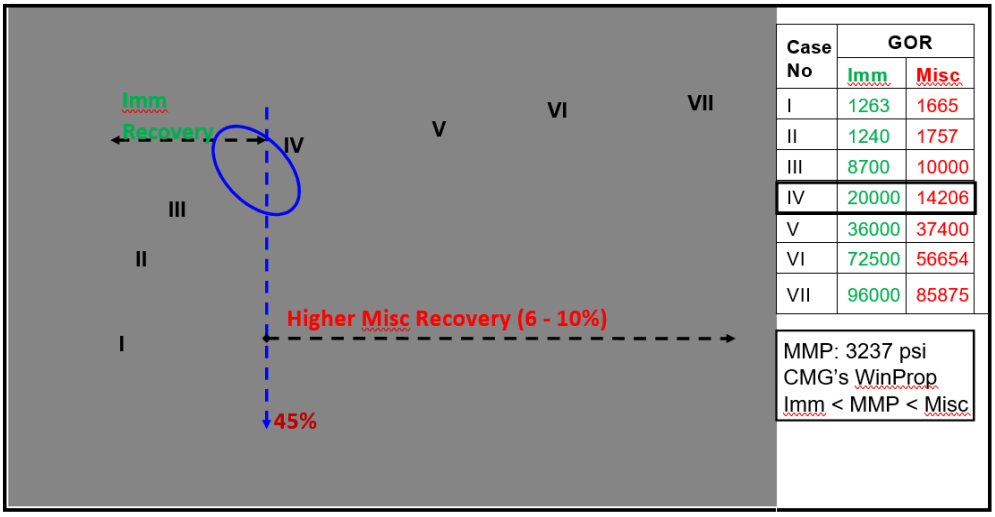


Fig. 3. Mechanisms for Oil recovery except the mechanism of gravity drainage in blocks (25, 14, 6), (25, 14, 7) and (25, 14, 8) in top-down EOR process of gravity drainage assisted by CO_2 . Process Selection Map: Miscible vs. immiscible EOR process of gravity drainage assisted by CO_2.

To obtain optimized oil recovery from miscible or immiscible CO_2 injection, the ultimate incremental oil recoveries of selected well rate constraints of Case I – VII vs incremental pore volumes of CO_2 injected is shown in figure 4.



Case No	GOR	
	Imm	Misc
I	1263	1665
II	1240	1757
III	8700	10000
IV	20000	14206
V	36000	37400
VI	72500	56654
VII	96000	85875

Fig. 4. General selection map for immiscible Vs. miscible process - Case-I via Case-VII

From the plot of ultimate recovery vs pore volume, CO_2 injected (PV_{CO2}) for Cases I, II & III, the immiscible recovery is high over miscible. For Case IV of the pore volume of 0.45 CO_2 injected (PV_{CO2}) achieved identical oil recovery with immiscible at 58.25% and miscible at 58.88% of CO_2 -assisted gravity drainage EOR processes. This scenario reversed for Cases V, VI & VII well constraints. They have shown 70.44, 75.93 and 78.86% for Case-V, Case-VI and Case-VII respectively with ultimate recoveries of 64.20%, 67.48% and 64.20%.

GRID REFINEMENT: For reservoir with 50 °API Oil

As there are no investigations on the recovery of gravity drainage oil assisted by CO_2 a base model (50 × 30 × 10: 600 × 400 × 150) considered for the above studies to conclude the miscible and immiscible CO_2 injection above 132 years can yield optimum recovery of oil of 78.85% and 69.15% respectively in process of EOR gravity drainage assisted by CO_2. The effects of the grid – size and grid – thickness for miscible CO_2 injection are tabulated below considering the base model of the grid (50 x 30 x 10) for Case – VII & Case – IV with each grid size of (600ft x 400ft x 150ft).

EFFECT OF GRID SIZE

To understand the effect of grid size on the incremental recovery of oil the base model is reduced to two dimensions (x and y). So that initially the base model (600ft x 400ft) is reduced to half (300ft x 200ft) and one fifth (120ft x 80ft). The incremental recovery of half base model (300ft x 200ft) for Case – VII is 79% which is identical to the two dimensions base model (600ft x 400ft). The same incremental recovery for Case IV was achieved at 45% of CO_2 injected PV (Pore Volume).

Table 2. Details of grid thickness (layers) and grid size studies for both the Case-VII and Case-IV

	Case	Number of grid blocks (i, j, k)	Grid dimensions (x, y, and z)	Comments	Comparison parameters
Grid size	I	50 × 30 × 10	600 ft × 400 ft × 150 ft	Base Model	Incremental EOR, GOR and water cut vs. PVCO2inj; and years of production
		50 × 30 × 10	300 ft × 200 ft × 150 ft	x & y dimensions Reduced	
	II	50 × 30 × 30	600 ft × 400 ft × 50 ft	Base Model	
		50 × 30 × 30	120 ft × 80 ft × 50 ft	x and y dimensions reduced	
Grid Thickness	I	50 × 30 × 10	600 ft × 400 ft × 150 ft	Base Model	
		50 × 30 × 30	600 ft × 400 ft × 50 ft	Layer thickness Reduced	

4 Conclusion

It is an attempt in order to optimize recovery of oil by using EOR process in gravity drainage assisted by CO2. The aim of these all investigations is (1) To identify best mechanism and to develop one general method selection map in order to choose in between the miscible and immiscible recovery process; (2) For study grid size effects using grid-refinement. Lastly, operational mechanisms which are used to recovery of oil in gravity drainage of all gravity methods which are assisted by CO_2 are identified.

In every study on reservoir simulation, to satisfy/agree the injection rates of CO_2 are kept smaller than the stable and critical rates of gas injection.

The selection of miscible and immiscible EOR process of gravity drainage assisted by CO_2 is guided by the map which is generated by the use of numerical simulations in base model (50 × 30 × 10: 600 ft × 400 ft × 150 ft) (figure 4). Furthermore, it was suggested that base model produces the optimum recovery of oil is 78.85% and 69.15% in miscible and immiscible process respectively about 132 years of injected CO_2.

The dimensions of x and y are reduced nearly half (300 ft × 200 ft) of the original base model dimensions (600 ft × 400 ft) in case of both IV, VII in well rated constraints combination while studying the grid size effect in the incremental recovery. Figure 1 concludes that at 180 pore volumes of injected CO_2 produces similar incremental recovery of oil of 79% by the reduced grid size (300 ft × 200 ft × 150 ft) and original base model (600 ft × 400 ft × 150 ft). At injected 45% PV_{CO2} in case-IV of same profile of oil recovery (60%) was attained. From these results it is clear that in good rated constraint combination indicates the effect of grid size has negligible in incremental recovery at reservoir scale using EOR

process of gravity drainage assisted by CO_2. Identical outcomes are presented by Gillham and Fassihi (1993) in the studies of air injection but they varied just the length of x-dimension.

The thickness of grid is minimized to 50 ft when compared with the base model has thickness of 150ft. The performance of the gravity drainage incremental recovery of oil assisted by CO_2 which points out reduced model produces 6-16% (Case-VII), (case-IV) of incremental recovery of oil when compared to base model. By these results it is clear that with smaller grid models yields a better incremental profile of EOR even at lower volumes of pore with injected CO_2. It provides the effective oil drainage which has gravity-drained from upper to beneath layers. Furthermore, the oil present in these blocks is not allowed. This really matters in layer in which horizontal production well was completed. According to the outcomes of Gillham and Fassihi (1993) and Ypma (1985) concluded that for the optimizing the recovery of oil the layers in the bottom most must be thinner. The investigations in present study suggested that the thin layers can facilitate the optimum recovery of oil in gravity drainage also in upper layers.

The optimized grid recovered 98.4% (50 × 30 × 30: 120 ft × 80 ft × 50 ft) at 9 PV_{CO2inj} (over 132 years) and also 94% at 3 PV_{CO2inj} (over 40 years) recoveries which are incremented in the process of miscible at one-fifth low rate of oil production. Due to this higher recovery leads to utilization of optimized grid for all remaining simulations. Diffusion effects that are present in homogeneous reservoir (k_V/k_h=1.0) are neglected in these studies.

References

[1] Ali Farouq, S.M. and Thomas, S. 1996. The promise and problems of enhanced oil recovery methods. *Journal of Canadian Petroleum Technology,*,**35**(7).

[2] Alston, R.B., Kokolis, G.P. and James, C.F. 1985. CO_2 Minimum Miscibility Pressure: A Correlation for Impure CO2 Streams and Live Oil Systems. *SPE 11959, SPE Journal*: 268-274..

[3] Backmeyer, L.A., Guise, D.R., MacDonell, P.E. and Nute, A.J. 1984. The Tertiary Extension of the Wizard Lake D-3A Pool Miscible Flood. *SPE 13721; presented at the SPE 59th Annual Technical Conference and Exhibition held in Houston, Texas*.

[4] Bon, J. and Sarma, H.K. 2004. A Technical Evaluation of a CO2 flood for EOR Benefits in the Cooper Basin, South Australia. SPE 88451 - SPE Asia Pacific Oil and Gas Conference and Exhibition Perth, Australia, October, 18-20.

[5] Cardenas, R.L., Alston, R.B., Nute, A.J. and Kokolis, G.P. 1981. Laboratory Design of a Gravity Stable, Miscible CO_2 Process. *SPE 10270: presented at 56th Annual Fall Technical Conference and Exhibition of the SPE of AIME, held in San Antonio, TX*.

[6] Cardwell, W.T. and Parsons, R.L. 1949b. *Gravity Drainage Theory*. *Trans. AIME*, **179**: 199-215.

[7] Dake, L.P. 2001. *The Practice of Reservoir Engineering (Revised Edition)*. Developments in Petroleum Science. Elsevier Science B.V., Amsterdam.

[8] Emera, M.K. and Sarma, H.K. 2005a. Genetic Algorithm (GA)–based Correlations Offer More Reliable Prediction of Minimum Miscibility Pressures (MMP) between the Reservoir Oil and CO2 or Flue Gas. CIPC 2005-003, presented at the Canadian International Petroleum Conference (CIPC), 56th

[9] Farouq Ali, S.M. and Thomas, S. 1996. The promise and problems of enhanced oil recovery methods. *Journal of Canadian Petroleum Technology*,**35**(7).

[10] Glasø, Ø. 1985. Generalized Minimum Miscibility Pressure Correlation. *SPE 12893-PA, SPE Journal*, **25**(6): 927-934.

[11] Hagen, J. and Kvalheim, B. 1990. Oseberg Field. In: M. Halbouty (Editor), Giant Oil and Gas Fields of the Decade: 1978-1988. The American Association of Petroleum Geologists, Stavanger, Norway, pp. 417-428.
[12] Ho, C.K. and Webb, S.W. 2006. *Gas Transport in Porous Media*. Theory and Applications of Transport in Porous Media, 20. Springer.
[13] Holtz, M.H., Nance, P.K. and Finlay, R.J. 1999. Reduction of Greenhouse Gas Emissions through underground CO_2 sequestration in Texas Oil and Gas Reservoirs, The University of Texas, Austin.
[14] Howes, B.J. 1988. Enhanced Oil Recovery in Canada: Success in Progress. *Journal of Canadian Petroleum Technology*, **27**(6): 80-88.
[15] Lewis, J.O. 1944. Gravity Drainage in Oil fields. *AIME Petroleum Transactions*, **155**(133). Li, H., Schechter, D.S. and Grig, R.B. 2000. Experimental Investigation of CO_2 Gravity Drainage in a Fractured System. SPE 64510 - SPE Asia Pacific Oil and Gas
[16] Mathiassen, O.M. 2003. *CO_2 as Injection Gas for Enhanced Oil Recovery and Estimation of the Potential on the Norwegian Continental Shelf*, Norwegian University of Science and Technology, Trondheim/Stavanger.
[17] Moritis, G. 1995. Impact of production and development RD&D ranked. *Oil and Gas Journal*, **93**(44).
[18] Rao, D.N. 2006b. Gas Assisted (CO2) Gravity Drainage IOR; The Process and a Louisiana Field Project, invited talk at the Independents Day @ IOR 2006, Tulsa, OK.
[19] Ruark, A.E. 1935. Inspectional Analysis: A Method Which Supplements Dimensional Analysis. *Journal of Elisha Mitchell Scientific Society*, **51**.
[20] Sajadian, V.A. and Tehrani, D.H. 1998. Displacement Visualization of Gravity Drainage by Micromodel. SPE 49557, presented at the 8th Abu DhabiInternational
[21] Sharp, J.M. 1975. The potential of Enhanced Oil Recovery Processes. *Society of Petroleum Engineers of AIME: SPE 5557*.
[22] Shook, M., Li, D. and Lake, L.W. 1992. Scaling Immiscible Flow through Permeable Media by Inspectional Analysis. *In-Situ* **4**:311-349.
[23] Terwillinger, P.L., Wilsey, L.E., Hall, H.N., Bridges, P.M. and Morse, R.A. 1951. *An Experimental and Theoretical Investigation of Gravity Drainage Performance*. *Petroleum Transactions, AIME*, **192**: 285 - 295.
[24] Vilela, M.J., Gharsalla, M., ElGhmari, M. and Majdoub, A. 2007. Performance Evaluation of a Reservoir under EOR Recovery: Intisar 'D' reef, Concession 103, Lybia. SPE 104619, presented at the 15th SPE Middle East Oil and Gas Show and Conference, Bahrain, March 11-14.
[25] Whitson, C.H. 1983. Characterizing Hydrocarbon Plus Fractions. *Society of Petroleum Engineers Journal*: pp. 683-694.
[26] Wylie, P.L. and Mohanty, K.K. 1999a. Effect of Wettability on Oil Recovery by Near Miscible Gas Injection. *SPE Reservoir Evaluation and Engineering: SPE 59476*, **2**(6).
[27] Yellig, W.F. and Metcalfe, R.S. 1980. Determination and Prediction of CO2 Minimum Miscibility Pressures. *SPE 6548, Journal of Petroleum Technology (SPE6548)*: 160-16

Solar Panel Cleaning System Using Voltage Comparison

R.Sivaprasad[1], Pradeep Krishna K [2],Keerthivasan A[3], Akash S P[4], Navin Sarveswaran S A[5]
{ sivaprasad.eee@sairam.edu.in[1], e7ee062@sairamtap.edu.in[2], e7ee021@sairamtap.edu.in[3],
e7ee088@sairamtap.edu.in[4], e7ee089@sairamtap.edu.in[5]}

Associate Professor,
Department of Electrical and Electronics Engineering
Sri Sairam Engineering College
Chennai, India[1], Undergraduate Student
Department ofElectrical and Electronics Engineering,
Sri Sairam Engineering College
Chennai, India[2]

Abstract. The pollution not only causes harm to the surroundings but also deposits on the solar panel. Besides pollution dust and debris carried by the wind also deposit on solar panel's surface. Soiling reduces the amount of sunlight incident on the surface of the panel thereby reduces the output produced. To avoid that manual cleaning is done at present. But the process is not continuous and not done periodically so there is a loss of output voltage and current produced from the panel. Thus an automatic solar panel cleaning system is designed, which detects dust by comparing the reference voltage and present voltage measured and cleans by itself until the dust removed.

Keywords: Automatic, Solar Panel, Cleaning System, Voltage Comparison.

1 Introduction

Our proposal's main intent is to clean solar panels automatically to increase the efficiency of panels. It is proven that the efficiency of solar panel may be reduced to 10% from soiling alone. Some articles says about reduction in output by soiling reduces the revenue of an individual using solar panel. It would cost higher for commercial works hence, we used small sized panel of 20V.There were several considerations taken when designing this system. In case of residential use, solar panels are usually placed on the roof or terrace to receive the maximum amount of sunlight. But cleaning the panels by climbing up is dangerous. The proposed system is designed should be automatic to avoid men labour for cleaning it. A large research is made on it by comparing our idea to the existing systems. The Ecoppia E4 and Heliorex sprinkler systems are mostly employed to clean the panels. The Ecoppia E4 system needs manual supervision and it is too costly to install which is not affordable for middle class. The other hand Heliotex wastes large amount of water by sprinkler. The drones and robots are the other pick for cleaning the system. The proposed system is an automated system cleans the solar panel whenever dust formed on the panel. Water spitter is used to control the temperature. The voltage drops when the dust is formed, this is the idea used in this system here we refer that as set point. This is a fully automated system which works as per the set point. When the set point comes, the system automatically turns on the water spitting and then

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automatically the movement of the shaft is started. By this way, our solar panel cleaning system by Arduino is done.

2 Objectives

- The solar panel must be cleaned effectively.
- The manual work should be avoided.
- The problems by soiling must be avoided.
- The overall panel efficiency should be improved.
- The cleaning system should be more affordable.

3 Literature Review

- Masuda S. et. al, This paper explains that, the solar panel is coated with a semiconducting film and theelectrodes are attached to a single phase AC signal or to a multiphase AC signal that produces a travelling electromagnetic wave. This is a transparent technique used for solving the problem.

- Williams R B. et. al, This paper says that, an Electro Dynamical Screen based system requires a HV external power source for its operation, but the EDS can be made self-sustainable with the power output from the PV cell itself. The cleaning is made such a way a transparent EDS with a PV array as its power source to make it more effective.

Hardware Required
- Solar panel(20 V)
- Photo Resistor(5V)
- Arduino UNO
- DC Motor 12V
- Water pump motor
- 12V Battery
- Two channel relay
- Worm drive
- Silicone pipes
- 1 inch square tube(mild steel)
- 16mm mild steel rod
- Table Wiper
- Voltage divider(using Resistors)

Software Required
- Arduino IDE
- Silvaco

Designing Of Model

Fig 0.1 Setup for the Solar Panel

The base for holding the solar panel is made of 1 inch square tube inclined at 45° as shown in Fig 0.1. Mild steel is used to withstand the weight of solar panel and the above apparatus.

4 Methodology

The solar panel cleaning system consists of following units.

1. Solar Panel Unit
2. External Monitoring Unit (Photo Resistor Circuit)
3. Processing Unit (For Checking Condition)
4. Cleaning unit

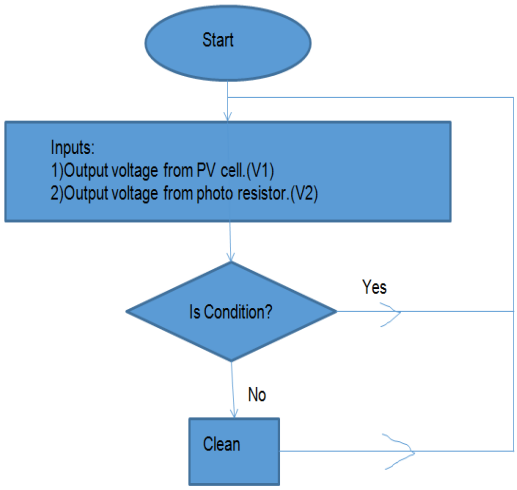

Fig 1.1 Flow Chart for Proposed System

The above Fig 1.1 shows the flowchart of our model. The output of the Solar Panel unit and the output of the EMU (External Monitoring Unit) are compared based on a condition. We referred the condition as setpoint which will be discussed later. If the condition is satisfied there is no need of activating the cleaning system but in another case the cleaning system cleans the entire system.

4.1 Solar Panel Unit

The Solar Panel unit varies from different usages. For our model we have used 20V, 10W Solar Panel.

Fig 1.1.1 Solar Panel used in our System

The voltage output of the solar panel with respect to light intensity is not linear. The various outputs of the solar panel are monitored by using Silvaco software.

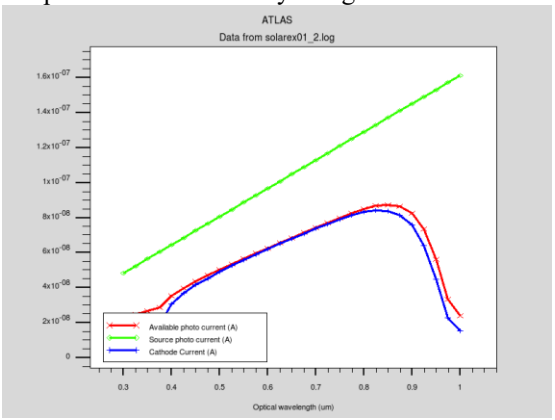

Fig 1.2 Opt. Wavelength vs Current

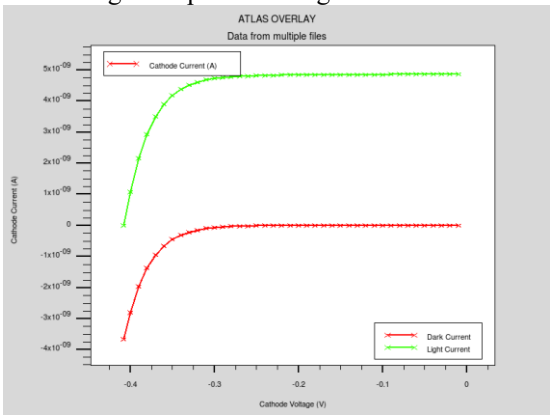

Fig 1.3 Cathode Voltage vs Cathode Current

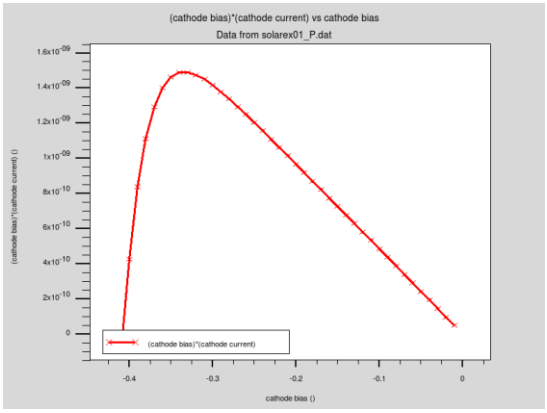

Fig 1.4 Cathode Bias vs Cathode Bias*Cathode Current

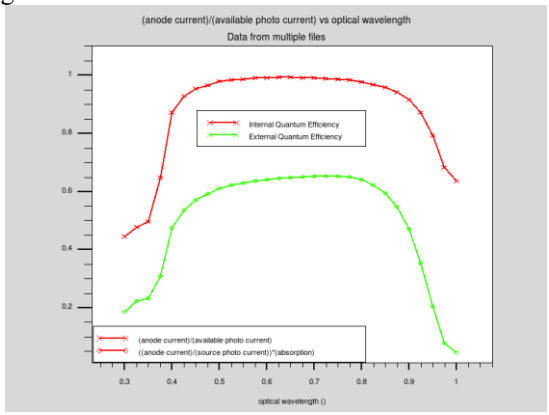

Fig 1.5 Opt. Wavelength vs Current Efficiency

From the two graphs Fig. 1.2 and Fig. 1.3 it is noted that the voltage increases with respect to increase in light intensity up to a particular level called saturated level. After this level the output voltage remains unaltered even in increase in light intensity. Whenever the dust is formed or the temperature of the panel rises, the saturated level decreases. The output of the solar panel is too high to damage the microprocessor and components; hence we need to step down the voltage of the solar panel. So, we have used voltage divider made of resistors.

Thus by fixing the values of R1 and R2 as 15kΩ and 5kΩ respectively we get the output voltage in terms of 5V by below.

$$V_{out} = V_{in}\left(\frac{R_2}{R_1 + R_2}\right)$$

$$V_{out} = 20\left(\frac{5000}{15000 + 7000}\right)$$

$$V_{out} = 5V$$

Thus the output voltage will be in the range of 0 to 5V.

4.2 External Monitoring Unit

The peak saturated value cannot be fixed; it changes with the external light intensity. Thus EMU is used for analyzing the external light intensity to keep that as reference voltage which

is to be compared with the solar panel output voltage. Photoresistors are kept in a way such that it represents the light intensity falling on solar panel and external light intensity.

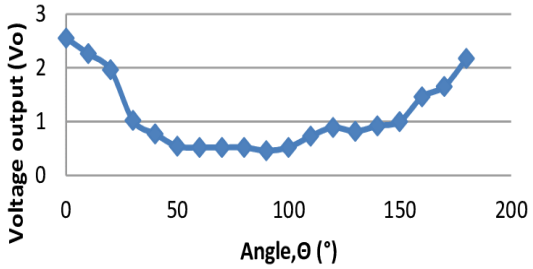

Fig 1.6 Output Voltage of PR vs Angle of incident light

Table 1 Output Voltage of PR with respect to light intensity

PR(Lux)	PR intensity	Output Voltage(V)
0.1	11	3.2545
10.1	372	2.9655
20.1	520	2.5379
30.1	607	1.8174
40.1	667	0.0538

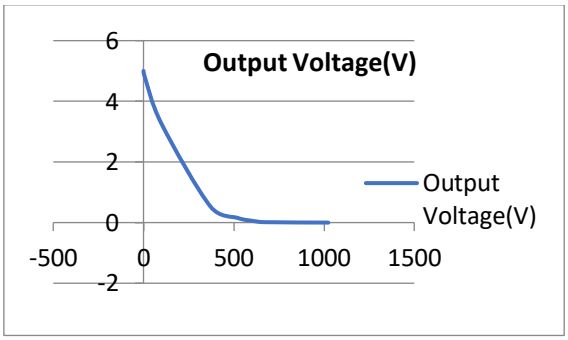

Fig 1.7 Curve obtained for above Table 1

The voltage output of the PR is varied with the angle of sunlight and also with the light intensity. Fig 1.6shows that the output voltage of PR is varied with the angle of sunlight incident on the surface. The maximum voltage is obtained in the angle 0°. The above Table 1.1 shows the change in output voltage of PR with the change of light intensity which shows that lower the light intensity higher the output voltage. The equation obtained from the curve plotted in Fig 1.7 is given as,

$$V_{PR} = \frac{C}{L+1} + M$$

V_{PR} – Photoresistor Voltage
C – Proportionality Constant
L – Light intensity
M – Magnitude Constant

At dark environment the value of L =0 and V_{PR} is at maximum value whereas at bright light the value L is maximum and V_{PR}=0.Thus we get,

$$M = V_{PR,max}/L_{max}$$

$$C = \left(1 - \frac{1}{L_{max}}\right) V_{PR,max}$$

In our system L_{max}=1024 and $V_{PR,max}$=5V.

4.3 Processing Unit

The outputs of SPU and EMU are compared in this processing unit based on a condition and a signal is sent to operate the cleaning unit. The processing unit consists of a microcontroller for that purpose Arduino is used.The complex condition can be formulated from the graphs Fig 1.2, Fig 1.3, Fig 1.6 and the Table 1.1. On basis of analysis of these graphs we get the three dimensional curve which is shown below.

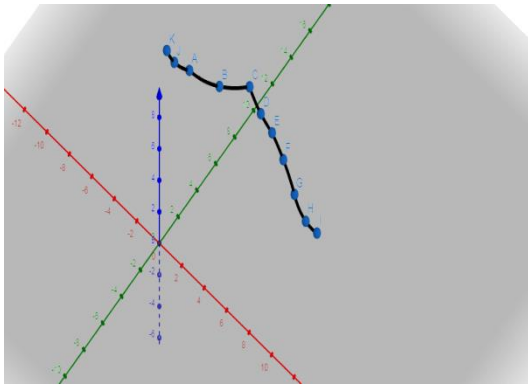

Fig 1.8 Top view of resultant curve

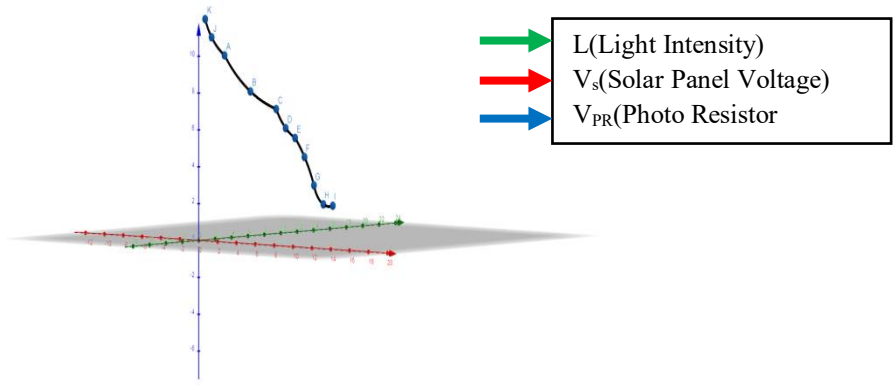

Fig 1.9 Side view of resultant curve

The point C in the curve (can be seen clearly in Fig 1.8) is referred as setpoint from which the solar panel attains saturation as shown in section 1.1. The equation is obtained by the equations in the Solar Panel Unit and External Monitoring Unit which is given below.

$$V_{PR} = \left(\frac{C}{\left(\sqrt{(V_S^2 + aL^2)} \right) + 1} \right) - M$$

C – Proportionality Constant

a – Light intensity multiplier (V^2/lumens^2)

M – Magnitude Constant

The values of C and M are found using dark environment and bright light. At dark environment the values of L,V_S are 0 and the value of V_{PR} is at maximum value $V_{PR,max}$,whereas at bright environment the values of L be at maximum value $L_{max}$and V_S be at saturated voltage V_{sat} but the value of V_{PR} is at 0.

$$M = \frac{V_{PR,max}}{\sqrt{(V_{sat}^2 - aL_{max}^2)}}$$

$$C = \left(1 + \left(\frac{1}{\sqrt{(V_{sat}^2 - aL_{max}^2)}} \right) \right) V_{PR,max}$$

These data are fed to Arduino by entering the above expressions in Arduino IDE.

4.4 Cleaning Unit

The cleaning unit consists of a DC motor,12V battery,helical worm gear unit, Wiper, Water pump and Two channel relay for controlling both. The shaft of DC motor is coupled with helical gear unit. This unit consists of a worm shaft and a gear.

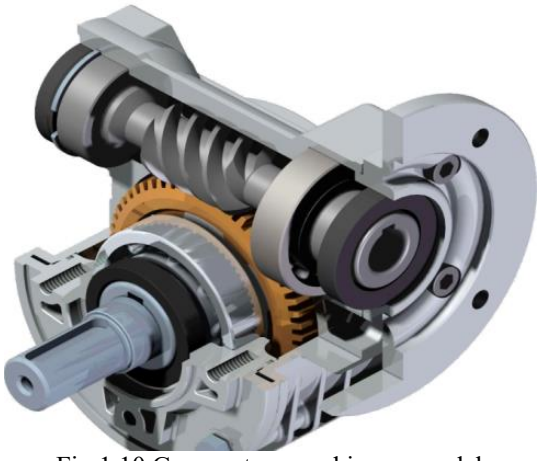

Fig 1.10 Gear system used in our model

The rotational to linear motion is done by a crank shaft which is connected to a slider. The slider is flat plate consists of two bushes which passes two rods by giving a sliding mechanism. The torque acquired by the slider is very huge thus helical worm gear unit is used.

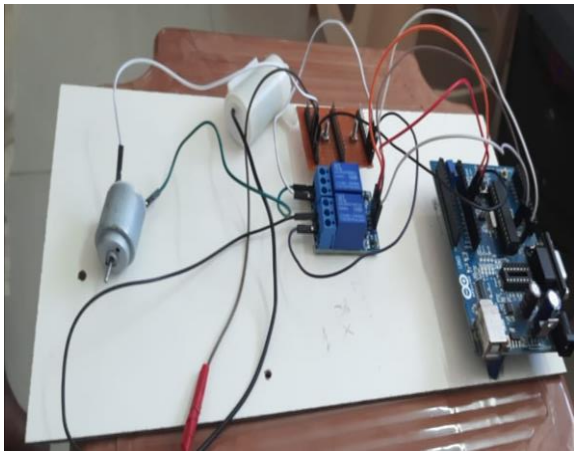

Fig 1.11Circuit to control Motor actuation

This unit activates when the condition signal from the Processing Unit becomes false as shown in Fig 1.1. The water sprayer is not only used for cleaning purpose but also used for controlling the temperature.

Fig1.4.3 Full image of Working Model

5.Testing And Results

Light intensity (L)	Solar Panel Voltage (V_S)	Photo resistor Voltage (V_{PR})	Dust Accumulated	Expected Action (Clean/ Skip)	Results (Clean/ Skip)
1024	7.3321	0	No	Skip	Skip
1024	6.2132	0	Yes	Clean	Clean
667	3.4376	0.0538	No	Skip	Skip
667	3.4376	0.0538	Yes	Clean	Clean

Table 2.1Parmeter Values noted and the output prescision

The output of the solar panel on regular cleaning with our model has an increased efficiency to 27.2% than that of which is not cleaned properly.

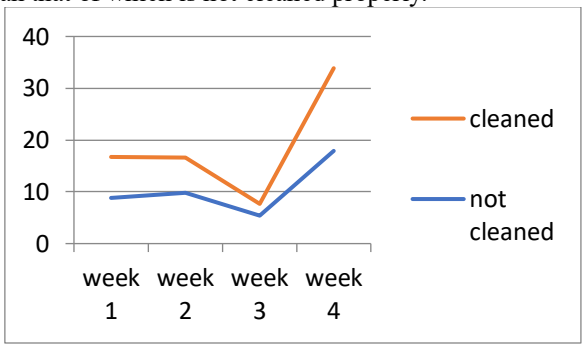

Fig 2.1 Weekly observance of the output difference

6 Conclusion

The designing of solar panel cleaning system was first taken into consideration. The base for the solar panel is made by mild steel for bearing the weight of solar panel and the other weights. The choice of motor to actuate the crank shaft was a little confusing thing. The idea of comparing voltages was easy at first but it was gone tedious on proceeding to next steps because the voltage curves are not linear and the resulting curve to be fed in microcontroller was been a great task. Then the motor and wiper is checked for a long time to fit the solar panel surface.

References

[1] Sayyah, A,. Horenstein M., and Mazumder M. (2016) 'Mitigation of Soiling Losses in Concentrating Solar Collectors.' IEEE 39th Photovoltaic Specialists Conference(PVSC)404-408. Print.

[2] Burton, D., and Bruce H. King. (2016) 'Spectral Sensitivity of Simulated Photovoltaic Module Soiling for a Variety of Synthesized Soil Types.' IEEE Journal of Photovoltaics IEEE J. Photovoltaics 4.3 890-98. Print.

[3] Creyts, J., and Guccione, L. (n.d.), (2016), 'The Economics of Grid Defection (Rep.).' from Rocky Mountain Institute website:
[4] http://www.rmi.org/electricity_grid_defection#economics_of_grid_defection
[5] Allen McFarland (2016)'California First State To Generate More Than 5% Of Electricity From Utility-Scale Solar -Today In Energy - U.S. Energy Information Administration (EIA)'.
[6] http://www.eia.gov/todayinenergy/detail.cfm?id=20492
[7] Tavares, S. (2016) 'Dirty Detail: Solar Panels Need Water' LasVegasSun.com. N. http://lasvegassun.com/news/2009/sep/18/dirty-detail-solar-panels-need-water/
[8] Boyle L., Flinchpaugh H., and Hannigan M. (2013) 'Impact of Natural Soiling on the Transmission of PV Cover Plates.' IEEE 39th Photovoltaic Specialists Conference (PVSC)
[9] Cabanillas R.E. and Munguia H. (2011), "Dust accumulation effect on efficiency of Si photovoltaic modules" Journal of Renewable and sustainable energy 3, 043114 Print
[10] Park Y B, Im H, Im M, et al.(2011) 'Self-cleaning effect of highly water-repellent microshell structures for solar cell applications.' Journal of Materials Chemistry,; 21:633–636.
[11] Zhu Jia, Hsu Ching Mei, Yu Zongfu, et al. (2010) 'Nanodome solar cells with efficient light management and self-cleaning'. Nano Letter, 10:1979–1984.
[12] Liu G Q, Marshall J S,(2010) 'Effect of particle adhesion and interactions on motion by traveling waves on an electric curtain.' Journal of Electrostatics, 68:179-189.
[13] Sharma R, Wyatt C A, Zhang Jing, et al. (2009) 'Experimental evaluation and analysis of electrodynamic screen as dust mitigation technology for future Mars missions.' IEEE Transactions on Industry Applications; 45(2):591-596.
[14] Williams R B, Tanimoto R, Simonyan A, et al., (2007) 'Vibration characterization of self-cleaning solar panels with piezoceramic actuation.' Collection of Technical Papers - 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference , pp. 512-520.
[15] Kimber, A., L. Mitchell, S. Nogradi, and H. Wenger. (2006) 'The Effect of Soiling on Large Grid-Connected Photovoltaic Systems in California and the Southwest Region of the United States.' IEEE 4th World Conference on Photovoltaic Energy Conference
[16] Tomoaki Yano, Tomohiro Suwa, Masato Muraxami And TakujiYamamotq (1997), 'Development of a Semi Self-contained Wall Climbing Robot with Scanning Type Suction Cups' Intelligent Robots and Systems, IROS '97., Proceedings of the 1997 IEEE/RSJ International Conference
[17] El-Shobokshy MS, Hussein FM. (1993) 'Degradation of photovoltaic cell performance due to dust deposition on to its surface.' J Renew Energy (6/7):585e90.
[18] El-Shobokshy MS, Mujahid A, Zakzouk AKM.(1985) 'Effects of on the performance of concentrator photovoltaic cells', IEE Proc;132(1). Pt. I.
[19] Masuda S, Aoyoma M. (1971), 'Characteristics of electric dust collector based on electric curtain.' Proceedings of the General Conference of the Institute of Electronic Engineers. Japan, No. 821 Proc. of Albany Conference on Electrostatics .
[20] http://www.mbl-energy.com/santa-clara-university.html
[21] http://www.ecoppia.com/ecoppia-e4
[22] http://www.solarpanelcleaningsystems.com/about-us.html

PV System based Zeta Converter with Three-Phase Inverter For High-Speed BLDC Motor Applications

Dr B Meenakshi[1], G Jayaprakash[2], N Logeswari[3]
{meenakshi.eee@sairam.edu.in[1], jayaprakashjp1794@gmail.com[2], logeswari.ece@sairam.edu.in[3]}

[1]Professor/ EEE Department, Sri Sairam Engineering College; Chennai, India, [2]PG Student, Sri Sairam Engineering College ,Chennai, India, [3]Assistant Professor/ ECE department, Sri Sairam Engineering College, Chennai, India

Abstract. In this paper, for BLDC drive based configuration the sliding mode control scheme, power converter based renewable system is presented in this paper. The PV system is proposed to provide input source for the SMC based system. The proposed control method is used based on the vector control. According to this, the drive system behaviour of the speed control capacity is enhanced. To improve the system input source which fed from PV system, the ZETA converter is proposed. The speed and torque of the motor can be controlled by the SMC method based on vector control. The results of the proposed system are obtained and verified using the MATLAB/Simulink.

Keywords: Zeta converter, PV system, BLDC drive, sliding mode controller, speed control.

1 Introduction

For our everyday lives, electricity is important. In tradition, power generation requires the burning of fossil fuels, resulting in serious problems for humans and for the atmosphere of planet Earth. Consequently, efforts have increasingly been centered on seeking solutions for producing power from sunlight. PV systems are an extremely reliable and relatively cheap alternative solution for electricity generation, particularly in areas with multiple sunshine hours per day.

Even so, in recent times a substantial decrease in the manufacturing and installation costs of panes has led not only to solar power cultivation by panel rooftop systems but also to a move towards wide photovoltaic systems in several countries around the world. PV systems have been commonplace in power system applications over the past few years and played a large role in new century electricity generation. Whenever the sun light rays enter the PV module, the PV system transforms sunlight directly into electricity. The efficiency of the solar photovoltaic system strongly relates factors such as the geometric position of the sun, the atmospheric temperature and sunlight.

Sunlight can be turned into electric power which can be used, saved or linked immediately to the grids by photovoltaic (PV) systems. The actual cost of installing PV systems is generally reasonably large. Moreover, the power transmission process is relatively poor in PV systems. Solar energy is the greatest source of clean, inexhaustible electricity. When correctly used, it will satisfy much of the world's energy requirements. The power of the world is around 1.8 x 1011 MW from the sun. It is however quite difficult how to reliably

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assess the performance properties of photovoltaic cells and optimize the output of photovoltaic systems under different weather conditions. The full power point control activity is also referred to as MPPT.

The key downside of a PV system, however, is poor performance. Thus multiple MPPT approaches are developed to derive full power from the PV module. The MPPT algorithms are also available. The P&O adaptive approach radically adjusts the step size depending on the disparity in power between two disturbances. Even so, the ratio of the step-size and power differential must be calculated as per the particular model to obtain the best results. The converter will differ with the duty ratio by adjusting the input amplitude. If the output impedance of a PV system is aligned with the input signal of the regulator, the maximum power could be improved.

In the industrial and vehicles sectors the speed drives are normally used. The PMSM motors are used in those drives for recent years. BLDC's fuel consumption is very low, and is therefore used in green vehicles. Electric and hybrid car recognition boosts PMSM due to their high efficiency, excessive power density, compact structure and fast dynamic response, Permanent Magnet Synchronous Motor was an increasing number of uses in electric vehicle applications. The PMSM motors are used in many fields of automation, and applications such as precision machining, metal cutting, robot etc.

The speed of the PMSM can be controlled by many methods of control up to now PID control, adaptive control method etc., are used. In the conventional systems, the PMSM motors used digital signal processor (DSP) in most literatures. But the DSP systems are affected due to the resource exhaustion in CPU development with long time. Many control techniques are used in PMSM motors possibly for the applications with high performance where the DC drives were conventionally used. Previously the vector control is utilized to control the PMSM as the operation of the DC motor which have separately excitation with the armature of current regulation. Here the armature current and torque in directly proportional with the flux of excitation. In this motor, the component of torque current can be controlled to accomplish the torque control with independently control of the component of flux current.

2 Related works

PV systems have become indispensable part in the field of electric power generation. Time to time there have been a series of improvement made in this field. A novel auto balancing control for magnetically suspended high speed motor which attenuates unbalanced vibration at high precision was proposed by Zheng [1]. The use of ZETA converter to feed the BLDC drives for hysteresis to speed control is implemented [2]. The idealistic use of storing kinetic energy in batteries instead of wasting it using proportional integral controller and fuzzy logic controller results in smooth transition and efficient energy conservation [3]. The performance analysis of SMC based rotor and stator have yielded better thermal capability. The magnetic field, flux distribution and current density of the core also increased in performance [4]. The interleaved boost converter coupled directly with the inductors have drastically reduced the ripple [5]. The use of 3 phase switching with TAF to reduce switching number in sampling period and commutation torque ripple [6]. The Solar Power Technology has a great viable economic impact as it can provide maximum intermediate power tracking and maximum electricity supply to the grid [7]. Sun in his paper proposed a SSRM with exciting and auxiliary stator pole and discrete series of rotor segments which improved the

performance like higher output torque, lower ripple etc [8]. The Fault tolerance control (FTC) is very critical in terms of safety especially in a system involving actuators such as EVs. AFTSMFTC is the used to eliminate such faults caused by the actuators. It also not only self-adjusts but also reduce chattering resulting in higher accuracy [9]. By reducing the voltage stress across the power switch using a activated switch load capacitor block the DC-DC boost converter have been proven theoretically could generate a 70 times higher voltage than that of its input [10]. The jumping behaviour can cause various consequences hence these parameter estimations must be done. The use of switching controller based on switching model reduce parameter dependence and fast response [11]. The switching performance of the switch can be improved by using a lossless snubber cell for Buck boost converter. This proposed method by Joo& Han have enabled BBC to operate at high switching frequencies with higher efficiencies [12]. These concurrent improvements in technologies have direct influence over the years which is not only being separated as such from production and distribution but also includes on its applications especially motors.

3 Proposed System

In this proposed system the drive is controlled by SMC regulator which is utilized to provide efficient robust control for dynamic and complex system that is working depends on the varying conditions. As shown in fig. 1 the SMC controller based proposed BLDC drive is controlled and the Anfis control signals are provided to the high gain zeta converter. The feedback voltage from the inverter is fed to the proposed SM controller to generate switching signals for the power switching devices which are used in VSI. The pulse generation leads the BLDC motor operating performance through the voltage and current control.

In this proposed system, BLDC motor is used in electric vehicle with the speed and torque control of the SMC control which performs the motor control through providing VSI converter using park and Clarke transformations and vector control. The SMC control is achieving dynamic response control of system by means of change of flux reference as well as obtained flux rotor position. The proposed BLDC based control of speed is shown in fig. 1 with block diagram. The ZETA converter is used to achieve the improvement of the DC link voltage of the proposed system. The DC supply is given to the BLDC motor along with the voltage source inverter and the power conversion of zeta converter which is used to achieve high DC link voltage at the input of the inverter.

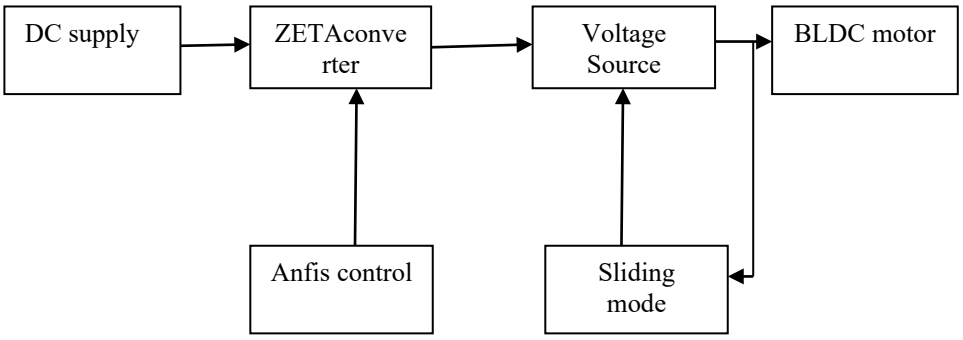

Fig 1: Block Diagram of the proposed system

3.1 PV Source:

A photovoltaic system is an arrangement of components designed to supply usable electric power for a variety of purposes, using the Sun as the power source as shown in Fig. 2. This shows the widely used PV solar cell equivalent circuit. The present source's intensity is exactly equal to the cell light. As the load resistance increases, the solar cell cannot sustain a fixed current.

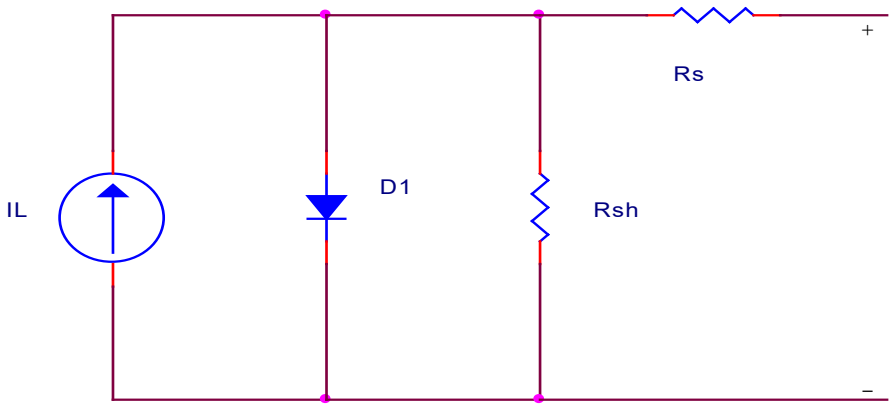

Fig 2: PV Single Diode Model

3.2 ZETA converter:

In this system, the ZETA converter is proposed as shown in fig. 3 to control the DC link voltage regulation and the output response of the converter is fed to the inverter which is providing AC voltage for induction motor. The proposed converter comprises of two capacitors as well as inductors. High voltage gain is achieved through the power switch duty cycle and dc link capacitor operation. The operation of converter is when the power switch is conducting, the D is turned to off state then in this charging mode the V_s providing current to the L1 and L2 inductors. During the switch S turned off, D comes to conduction the stored power in the inductor L2 is fed to load.

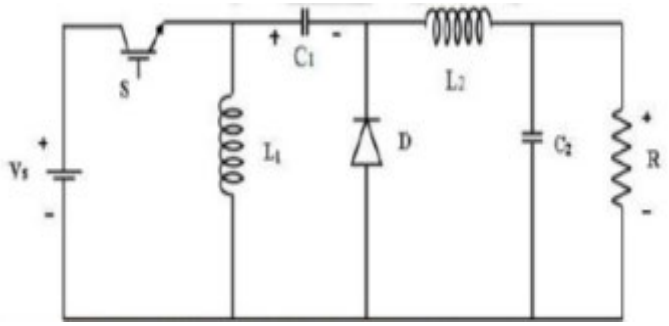

Fig 3: circuit of ZETA converter

ZETA is a fourth-order, multi-real, dynamic poles and zeros converter. The ZETA converter has no right-half plane zero with the exception of the SEPIC converter and could be more conveniently offset for greater loop efficiency and improved load transfer performance for lower output power values.

Control method:

In this proposed system the drive is controlled by SMC regulator which is utilized to provide efficient robust control for dynamic and complex system that is working depends on the varying conditions. The proposed control of SMC based system is shown in fig.4. This control method is efficiently maintaining the system performance with consistent and better stability. The SMC surface is derived as,

$$\sigma(x) = \left(\frac{d}{dt} + \lambda\right)^{r-1} (x^* - x)$$

The sliding mode controller architecture involves choosing the sliding base, as well as the control rules. If the system states reach the sliding phase, the dynamics of the mechanism are defined by the chosen sliding surface and are robust to all the disruptions and variations in the parameters. Because SMC refers to the first-order method, the SMC uses the noise-sensitive acceleration signal. At every time, the status of such switching signals is defined by the direction of the rotor, the error in speed and the winding currents. The magnitude and frequency of the output voltage of the inverter depends on the switching signals produced by the control hysteresis.

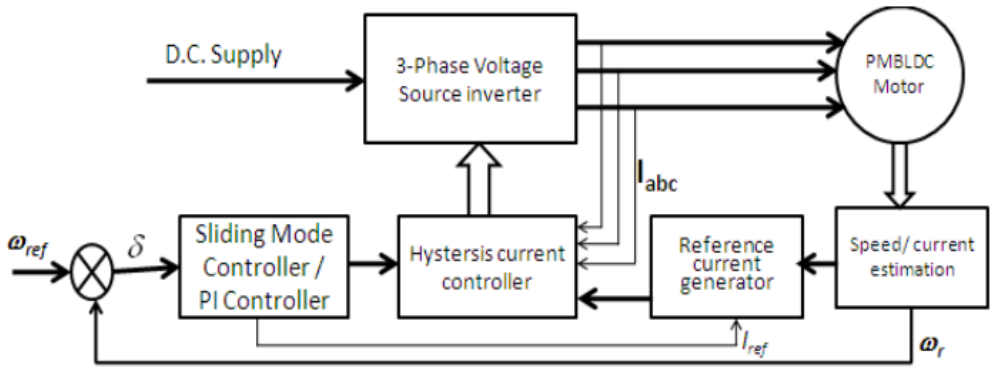

Figure 4: Block diagram of the planned system control of SMC

4 Simulation and Results

The fig.5 shows that the proposed BLDC drive based on the voltage source inverter SMC control simulation for speed and torque range control. The DC supply is given as a input source 12V. The given input source is fed to propose zeta converter which consists of reduced amount of active components that improve the source voltage as well as that ensures the constant DC link voltage. The anfis control is used to proposed converter power switch of conversion side that means DC-DC conversion. In the simulink model of the proposed system contains the DC source for zeta converter which has a switching device and is controlled by the pulse generator. The PWM signals are generated by using the pulse generator block. The

output of the converter is stored in DC link voltage. The below part of the model is representing the proposed controller design.

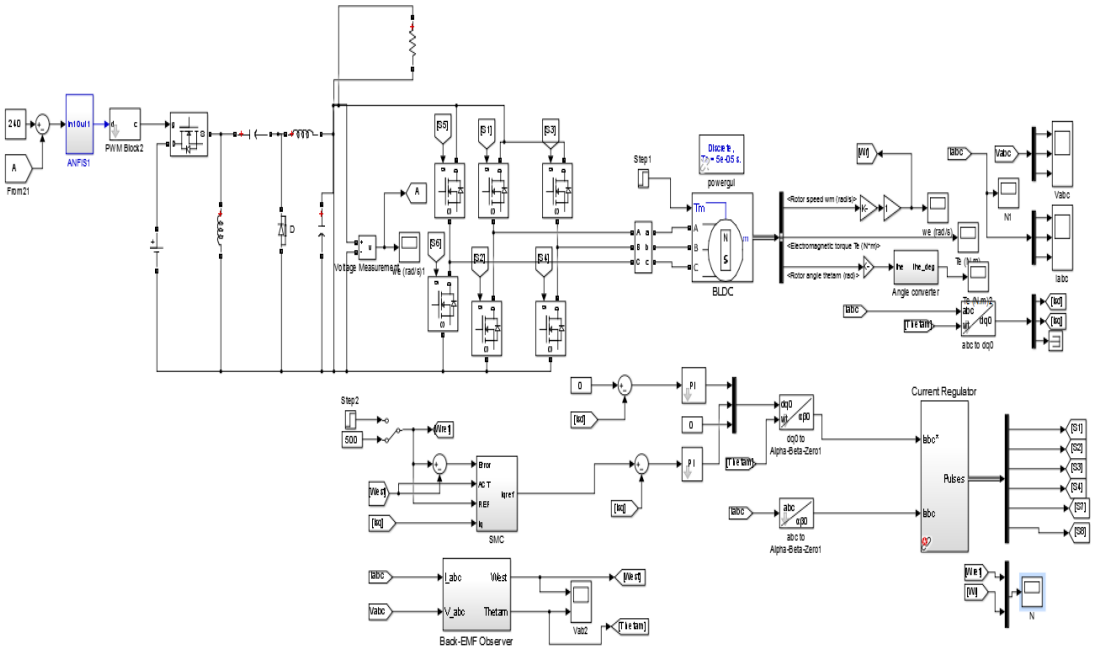

Fig 5: Proposed System Simulation

The six power switches of the inverter side are controlled by using the proposed back emf estimation method. According to this method, the speed of the drive and torque range can controlled widely. The waveforms for the input voltage, Dc bus voltage, inverter voltage, and drive speed are shown in following figures.

The input supply voltage for the given input source is 12V as shown in below fig. 6 and the supply voltage is after improved by the DC- DC zeta converter as shown in fig. 7.

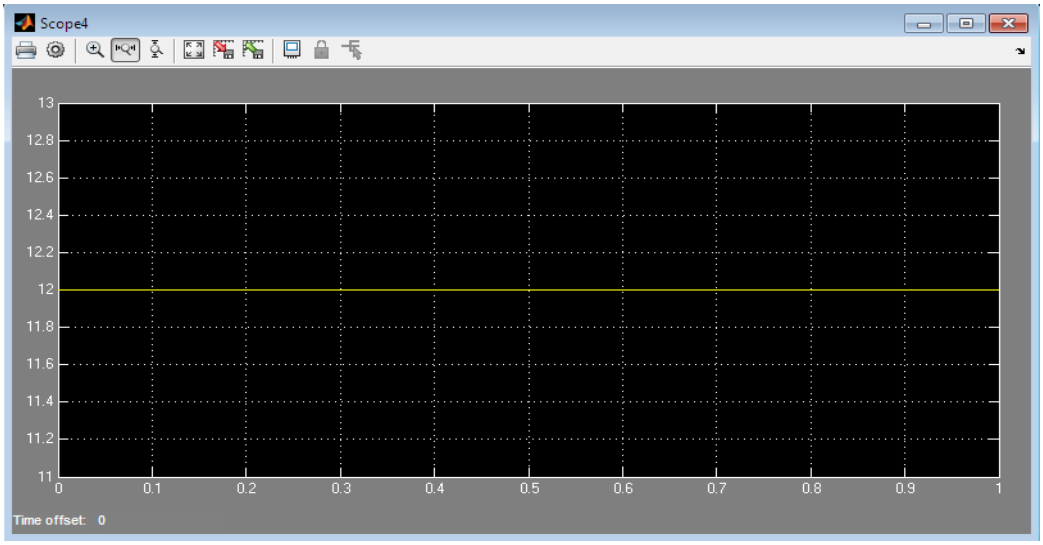

Fig 6: Proposed System Input Voltage

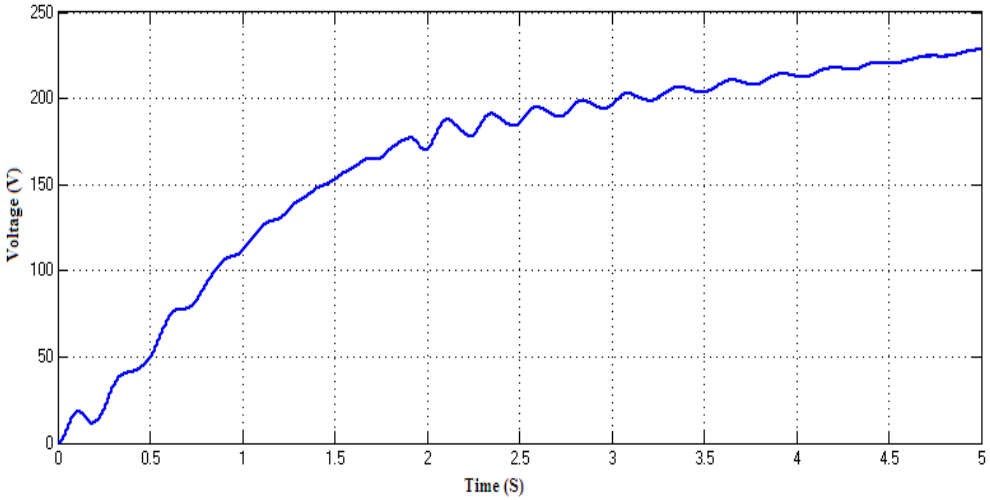

Fig 7: DC link bus voltage

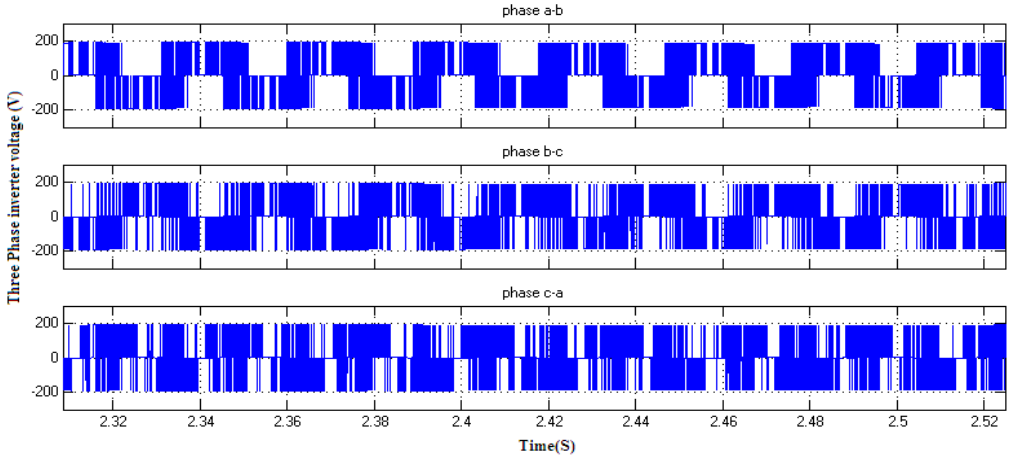

Fig 8: Inverter Output voltage

The inverter output is shown in fig. 8 the output of the proposed inverter is before using LC filter. The fig. 9 illustrates the drive stator current.

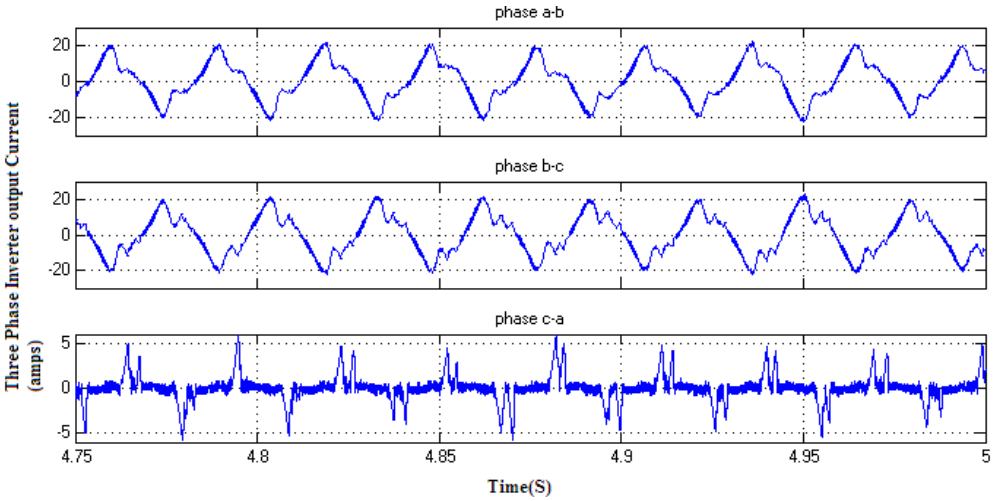

Fig 9: Stator Current of BLDC motor

The speed of the proposed system is controlled and the speed of the BLDC motor is 500 revolution per minute (RPM). The motor speed is settled in quickly by means of SMC controller. The settling time of the proposed system is 0.7 sec. The ripples also reduced. The fig. 10 is showing that the BLDC drive speed which is controlled and settled quickly. The fig.11 torque of the proposed drive.

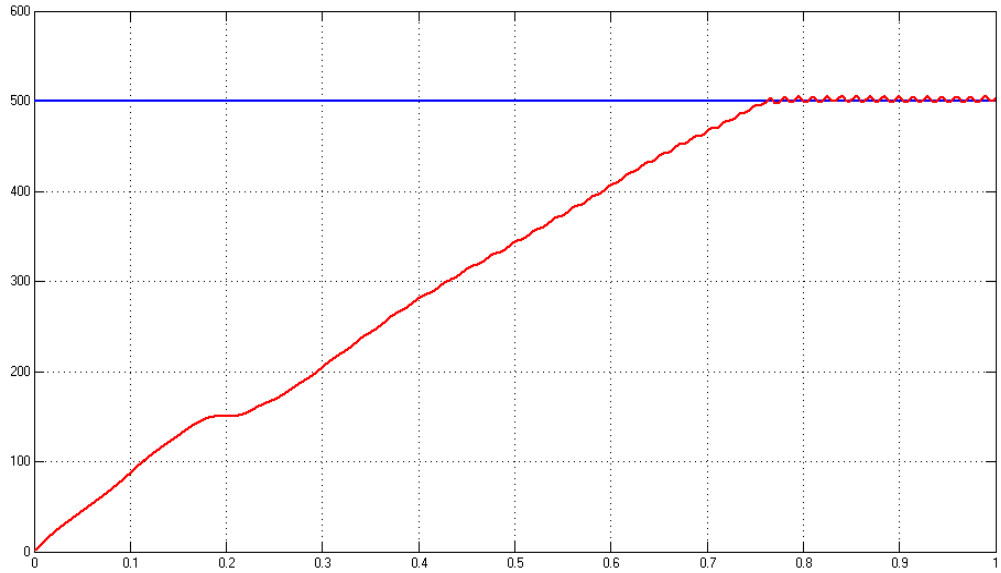

Fig 10: Speed of the BLDC drive

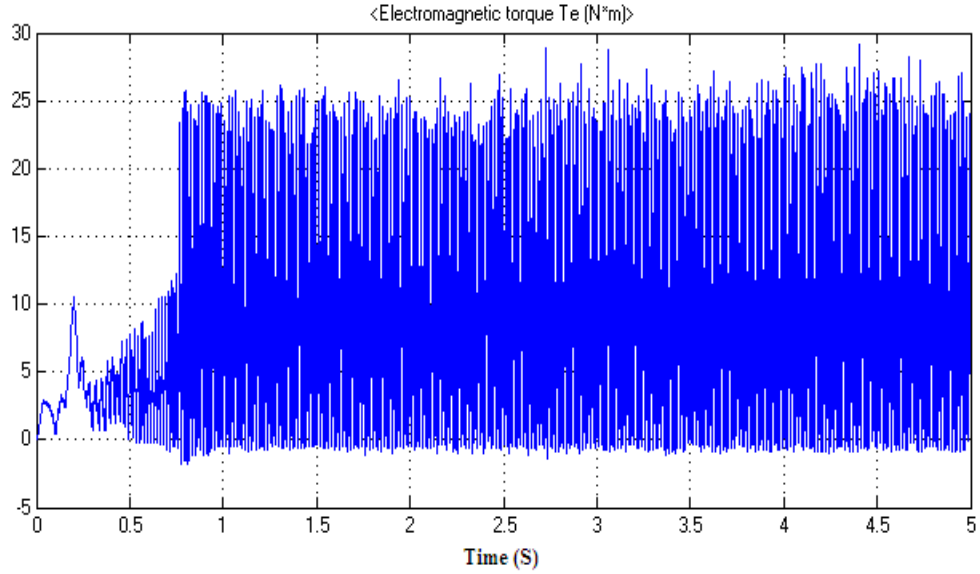

Fig 11: Torque of the BLDC drive

5 Conclusion

In this paper, the BLDC drive based on zeta converter is implemented with the sliding mode control is proposed. The speed of the drive can be regulated using with proposed controllers. The drive speed and efficiency is improved and the dc supply voltage is improved

by zeta converter. The voltage boosting method and the efficiency of this proposed method is high while compared with traditional systems. The results for the proposed system are obtained successfully using simulink model and shown the output of the input voltage, output of the BLDC motor speed which controlled using sliding mode system. The results are verified and examined in MATLAB/Simulink and it shows that motor torque range and speed enlargement.

References

[1] Zheng, S., Han, B., Feng, R., & Jiang, Y. (2015). Vibration suppression control for AMB-supported motor driveline system using synchronous rotating frame transformation. IEEE Transactions on Industrial Electronics, 62(9), 5700-5708.

[2] Manie, N., &Pattanaik, B. (2019). Zeta DC-DC converter based on MPPT technique for BLDC application. International Journal of MC Square Scientific Research, 11(2), 1-12.

[3] Anjana, R. (2019, Feb). Fuzzy and PI Based Speed Control of BLDC Motor using Bidirectional Converter for Electric Vehicle Application. Trends in Electrical Engineering, 8(3), 35-45.

[4] Rajkumar, S., Sundaram, C. S., Sedhuraman, K., &Muruganandhan, D. (2019, March). Performance Analysis of Hub BLDC Motor Using Finite Element Analysis. In 2019 IEEE International Conference on System, Computation, Automation and Networking (ICSCAN) (pp. 1-5). IEEE.

[5] Ramaprabha, R., Balaji, K., Raj, S. B., &Logeshwaran, V. D. (2013). Comparison of interleaved boost converter configurations for solar photovoltaic system interface. The Journal of Engineering Research [TJER], 10(2), 87-98.

[6] Yadav, D., Parekh, U., Patel, K., Parmar, R., & Prakash, M. (2019). Application of Modified Three Phase Conduction Method to Minimize Torque Ripple in BLDC Motor. IJRAR-International Journal of Research and Analytical Reviews (IJRAR), 6(1), 155-156.

[7] Balachandra, P., &Manjula, P. (2019, March). Maximum Intermediate Power Tracking for Renewable Energy Service. In International Conference on Emerging Current Trends in Computing and Expert Technology (pp. 462-468). Springer, Cham.

[8] Sun X, Diao K, Yang Z. Performance improvement of a switched reluctance machine with segmental rotors for hybrid electric vehicles. Computers & Electrical Engineering. 2019 Jul 1;77:244-59.

[9] Guo B, Chen Y. Robust adaptive fault tolerant control of four wheel independently actuated electric vehicles. IEEE Transactions on Industrial Informatics. 2019 Jan 1.

[10] Qi, Q., Ghaderi, D., & Guerrero, J. M. (2021). Sliding mode controller-based switched-capacitor-based high DC gain and low voltage stress DC-DC boost converter for photovoltaic applications. International Journal of Electrical Power & Energy Systems, 125, 106496.

[11] Taheri, A., Ghasemian, A., &Ren, H. P. (2020). Sliding mode control of Boost converter with jump flow switched system. Journal of the Franklin Institute, 357(18), 13734-13752.

[12] Joo, H. I., & Han, S. K. (2020). Lossless Snubber Cell for a Soft-Switched Bidirectional Buck–Boost Converter. IEEE Access, 8, 165708-165719.

Improving the Efficiency of a Photovoltaic Module by Fault Diagnosing, Cleaning & Dual Axis Solar Tracking Using Internet of Things (IOT)

Seema Srinivas[1], Dr.D.G.Anand[2], Dr. H.G. Chandrakanth[3]
{[1]seemasrinivas01@gmail.com, [2]dga.ece.rgit@gmail.com, [3]ckgowda@hotmail.com}

[1] Research Scholar, Global Academy of Technology, Bangalore
[2] Professor & Rector-Research, Rajiv Gandhi Institute of Technology, Bangalore,
[3] Principal, Sambram Institute of Technology, Bangalore, Karnataka,
Visvesvaraya Technological University, Belagavi, Karnataka

Abstract. A Photovoltaic array monitoring system with wireless sensors are integrated to the PV modules and transfer the status statistics to monitoring field. These sensors are employed for fault detection and observe misbehavior of the cells. In this work we are focusing on voltage, current, irradiance and temperature of individual photovoltaic array and its parameters are studied along with transfer of data's to the controlling unit. The lab view and aurdino boards are used for the development of storing and displaying along with controlling data received from wireless sensor. These received information are used to study the array conditions including fault finding, shades on the panel, loading.

Keywords: Aurdino board, Stepper motor, dual axis tracker, PV Module, Self-Cleaning

1. Introduction

In the present world, electricity has become a part of our basic need in our life. The energy consumption is rising as our population is increasing while energy production is reducing. The failure of energy has significant socio-economic implication on consumers. In order to balance the shortage of electrical energy, it is diverted look upon other media to generate clean energy. Due to the pollution and environmental issues related to using conventional fuels and limitations in the sources, renewable energy systems are recommended in various applications for the sake of providing clean energy. In the recent study, it results in reducing the carbon dioxide emission.

Solar Photovoltaic (PV) is used as renewable energy generator to facilitate consumers. This solar photovoltaic cells convert's freely available, unlimited sunlight to electrical energy without pollutants like corbondioxide. This PV generation has been integrated to power grids to produce required quantum of energy. But it has the drawback of occupying larger area for the installations and unpredictable weather conditions. So, it is observed to generate more reliable, effective energy with minimal cost of producing single is very low.
The energy system must be reliable i.e. Secured System with system adequacy. The Photovoltaic Cells are composed of many chemical and electronics components which are mainly depend on the temperature, energy loss, larger space, dust free zone, longer life span of solar panels etc.
These PV cells don't have any moving parts for generating power, but still it faces the failure in interconnections of panels, invertors, batteries & conditioning components and it's operating and maintenance cost is very nominal. Most of these issues must be resolved at the earliest since it leads to the loss in the production of solar energy .In order to overcome these issues and for the improvement of power generation, PV monitoring and methods are proposed. [1-5], In general, these photovoltaic arrays which are installed at remote places are monitored manually which normally consumes more time and also prone to errors .Thus Photovoltaic array monitoring requires automation for data acquisition, storing and also for controlling. This set of monitoring arrangement and Healthy PV system arrays, significantly improves the overall production of power with efficiency of each panel may be achieved. [6]

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2. Role of Solar Energy

The renewable energy is playing vital role in the present scenario as, importing fuels stimulating the Indian economy. The initial investment for the installation of the equipment will be very high. But the energy falling on the earth from the sun is good enough throughout the year to meet the need & demand of the growing population

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& industry. Our country easily utilize the solar power. The second advantage of using solar power is it generates employment to the youth of this great nation. Inview of the same, this proposed solar powered energy integrated with the recent development in IOT which is used as a caretaker of the instruments, to improve the permanence of equipment and production to its best.

3. Need for PV Monitoring System and Performance Analysis

The main objective of any PV system is the monitoring section used to study the performance of the PV system regularly. The proposed monitoring used employ Internet of Things sensors to monitor and study its performance of PV plants under Test.
In the field of solar PV systems, sometimes more difficult to locate the fault so effectively, which may leads to whole system failure. Due this reason, in the PV arrays, fire hazards have been reported because of overheating of solar panels or due to the mismatch of the installed solar panels

3.1 Overview of PV system faults.

These are subject to a variety of faults, which includes partial shading (PS)conditions which intern have impact on the output power of the PV system, the maximum Power point tracking (MPPT) units, PV hot spots, and PV micro cracks.

3.2 Factors influencing the performance of PV modules

- **PV micro cracks :** The PV micro cracks , This PV micro cracks occurs in the PV panels due to environmental conditions, manufacturing defects , variations in temperature and humidity. These micro cracks in the module reduces the efficiency by 8% to 9%.
- **Hot Spots :** This is one of the important factor, which reduces the output power of PV modules. Therefore, hotspots detection technique is of very much importance in these setups. This power loss could be reduced by taking corrective mitigating techniques to reduce its impact on the performance of PV panels.
- **Faulty PV Modules :** This refers to the PV module which is totally disconnected from that PV arrays. In other words, a faulty panel refers to a short circuited PV arrays.

4. Need for Internet of Things (IOT) in Solar PV Monitoring

A low cost IOT system consisting of wireless sensor network deployed with solar PV monitor system plays an important in collecting PV solar array information. These received data's through Internet at remote place helps in studying the health condition of solar array, machines used in installation with electrical fixtures, failure status and regular maintenance along with quality and quantity of solar efficiency.

5. Scope of the Work

This research work focuses on reliability of energy system with renewable power generation. To investigate the effects of various key factors like temperature, climatic condition, pollution and other parameters related with energy generation in terms of these elements impact on the system reliability. The evaluation of PV sources and its effect on other related parameters issues which effects on overall performance of the system.

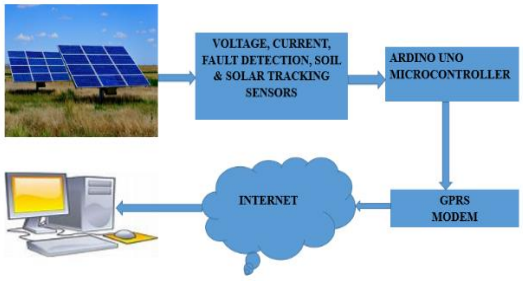

Fig 1.Concept of smart PV monitoring system

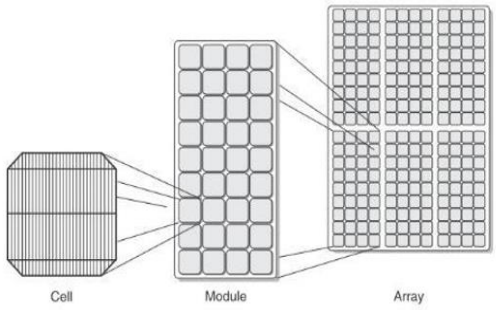

Fig 2. Solar Cell, Module & Array

6. Background Theory

The sun tracking is a device that rotate in up & down along with right to left direction. This arrangement can be PV panels, lenses, mechanical arrangements for fixing / tracking system. This trackers role is to trace the sun and also to check the angle of incidence, so as to have the best radiation falls on the PV panels by taking care of temperature coefficient. The direct beam falls on the panel delivers 90% of the energy. As the majority of the energy is collected in this angle, the focusing is to have same energy as long as sun is in clear sky. Using the ingrated dual axis sun tracker is employed to track the solar system which has azimuth & altitude tracing.

7. Literature Survey

The single axis tracker for tracking the sun along the horizontal direction and other vertically was presented. The energy was focused using lens & mirror into narrow beam, then this energy was converted into electrical current using photoelectric phenomenon. The output increased from 26% to 38% compared to standard fixed mode of operation on normal days [7].
Normally, PV system will have sensing device like current sensors and voltage sensors with inverters. Sun tracking system was developed to work effectively and also to receive the related parameters from sensors. This developed two –axis sun tracking has been installed with microcontrollers based electronic controlling arrangement. This tracker based arrangement delivered best performed by 26% on normal days and 21% on cloudy day [8]

A PV array panel tracking system was developed to track sun. This arrangement had the advantage of auto tracking system at random time to diagnose and face towards sun. After 180° rotation, aligned to receive quantum of solar energy, it used to go for rest mode. It had the advantage of stepper motor for the rotation /tracking for ensuring very high vitality improvement. [9]

Divya, proposed a system to overcome the drawback of reduction in producing solar energy due to dust & pollution [10]. The system designed and developed an automated system for sensing and clearing at regular interval. This was developed using AurdinoUNO. This work had the advantage of increase in energy production over non cleaning PV array.

In Ref. [11], designed and developed an integrated system which includes tracking sun on both azimuth axis and altitude axis along with automated cleaning technology to achieve optimum efficiency of the system. They developed an experimental setup to monitor the system using various sensors. The authors observed the improved efficiency of the solar energy compared to previous arrangements.

8. Problem Definition

The Output power of Photovoltaic (PV) panel directly proportional to the irradiation & inversely to the temperature. Hence if temperature during sunny days improves, current improves with decreasing in voltage & intern net power also decreases. Secondly, majority of PV panels are installed in outdoor which definitely in harsh, remote environment, which affects by system fault. This may be due to the shading, overheating of system, electrical system –cabling or invertor or due to aging factor. So, monitoring of all parameters for conditioning of PV panels & also fault diagnosis of PV cells and related arrangement are very much essential for better reception of PV system and better production of solar energy.

9. Hardware Implementation of the Tracker

The conversion efficiency of a solar panel is directly proportional to the amount of direct solar irradiance that is absorbed. Irradiance is the amount of solar radiation that strikes the surface of a solar cell or panel and it is expressed in kW/m^2. The irradiance multiply by time is a measure of solar insolation.

The peak sun hours is the number of hours per day when the solar insolation $=1kw/m^2$.A solar tracking system is an arrangement made or adjust the direction and height of the solar PV panels to face towards the sun. The sun's position changes with day and seasons as the sun moves across the globe. These solar panels absorbs energy from the sun better in perpendicular direction to the sun. Hence the solar tracking system is an important activity in power generation and illustrated in fig 3. The energy genera rated from the fixed solar array will improved by employing tracking system. Various factors are to be studied includes the azimuth angle of installation, climatic condition, and cost of installation & maintenance of the tracking arrangements among others.

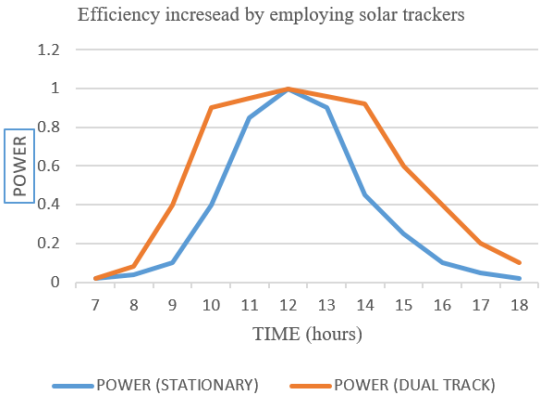

Fig.3 . Efficiency increased by employing solar trackers

In this paper, to monitor the real-time data like electrical PV array voltage, current, solar irradiance and temperature of the panels are collection, we have developed prototype model at our research Centre. This prototype could be utilized to find out the PV panels health monitoring by integrating additional diagnosing electrical equipment and connections along with inverter board.

10. Working of Proposed System

This work presents a solar array plant based on Internet of Things [IOT] with Aurdino Uno board, sensing arrangement for gathering the data along with computing facilities. Here, we are employing many types of sensor nodes for sensing various parameters such as soil, humidity, temperature and voltage and current. These parameters are very much required to understand the performance of the solar array, stepper motors, inverters etc. for diagnosis of all related components performance and electrical system along with self-cleaning arrangements to clear & clean the PV module at regular intervals. This fault finding or health checkup of solar panels and related devices through IOT by data acquisition & controlling helps to produce more energy and also to avoid breakdown by taking preventive measures.
The user can check & monitor the environmental parameters stored in cloud, thereby the receiver can avail all related values through wireless sensor nodes & internet wherever & whenever it is required.

11. Efficiency Calculation

A. For Clean Panel

For calculation of solar panel efficiency,
Efficiency = P_{lax} / (Radiation Intensity * Area)
$P_{lax} = A_{max} * I_{MAX}$
Area of Panel = Length * Breadth
Thus, Efficiency = P_{lax} / (Area of the Panel *Radiation Intensity) = X_{CLEAN}

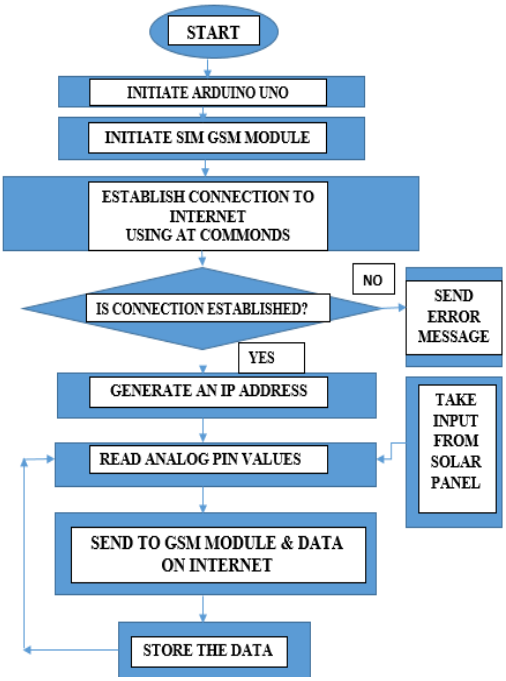

Fig 4. Flow Chart

B. For Unclean Panel

For calculation of solar panel efficiency,
Efficiency = P_{max} / (Radiation Intensity * Area)
$P_{max} = V_{max} * I_{max}$
Area of Panel = Length * Breadth
Thus, Efficiency = P_{max} / (Area of the Panel *Radiation Intensity) = $Y_{UNCLEAN}$

Percent Decrease

The formula used to calculate Percent Decrease in efficiency is,
Percent Decrease = [(Efficiency of Clean Panel - Efficiency of Unclean Panel) / (Efficiency of Clean Panel)] * 100
Thus, Percent Decrease = $[(X_{CLEAN} - Y_{UNCLEAN}) / X_{CLEAN}] * 100 = Z\ \%$
Above calculations proves that due to the continuous accumulation of dust on solar panel surface area, the efficiency of panel decreases by Z %.

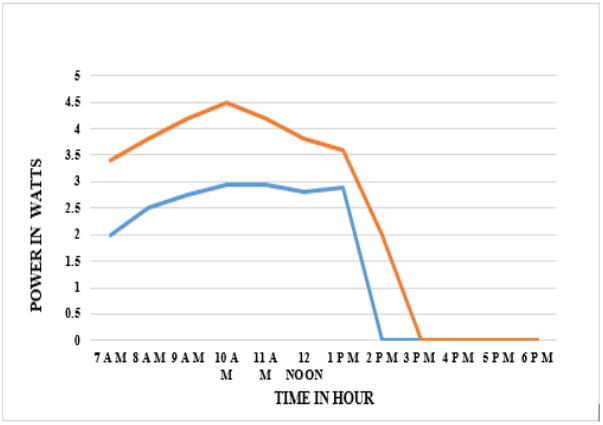

Fig 5. Power comparison between fixed & tracking solar system on cloudy day

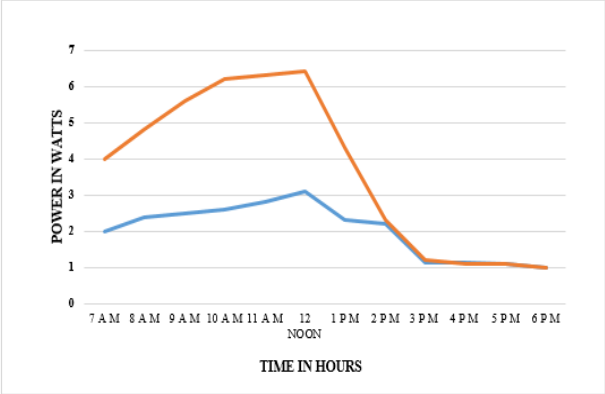

Fig 6. Power comparison between fixed & tracking solar system on summer day

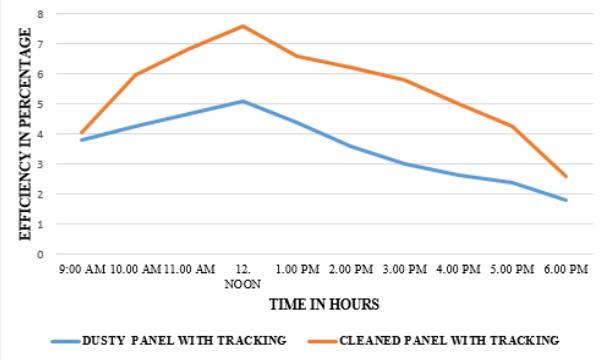

Fig 7. Comparison between dusty panel with tracking & clean panel

12. Results

We have recorded the values of voltage and current at regular intervals both on sunny day & also on cloudy day. This has been represented in the figures 5, 6 & 7 which proves that the efficiency can be improved by cleaning of panels with dual tracking arrangements. The power efficiency on sunny day yielded the best result. We have also recorded and compared readings between uncleansed dusty PV panel & automated wiper cleaned PV panel. The comparative study between shows that the cleaned PV panel produced better efficiency.

13. Conclusion

This work has many advantages since it is the integration of cleaning, fault diagnosing along with solar tracking. We have shown that this arrangement will be working throughout the year & in all climatic conditions and also deliver best result. Now at present good number of researchers are working on these issues to monitoring the PV array using sensor network with different chemical structures and also monitoring techniques to avoid failures by supervising the system for the better energy efficiency. Hence main challenge is will be to derive a mechanism for excellent diagnosing system that can detect and diagnose all the PV system failure along with accurate results. Hence the proposed arrangement delivers the improvement in energy status.

References

[1] **www.bluesystem.ca. :** Laurent Mingo, "A Cost-effective Solution for Photovoltaic Panels Performance Monitoring Using NI Lab VIEW", Blue System Integration Ltd

[2] **International journal of hydrogen energy :** Dimitris Ipsakisa, Spyros Voutetakisa, Panos Seferlisa, Fotis Stergiopoulosa, & Costas Elmasidesb, "Power management strategies for a stand-alone power system using renewable energy sources and hydrogen storage", vol 34, pp. 7081–7095, 2009.

[3] **Proc. World Renewable Energy Congress** : M.B. Zahran, & O.A. Mahgoub, "Photovoltaic Battery (PVB) Stand-alone System Control Signals Estimation", VI, 2000, pp. 2119–2122.

[4] **ISESCO Science and Technology Vision** : Mohammad Zakir Hossain, & A.K.M. Sadrul Islam, "PV wind Hybrid System Modelling for Remote Rural Application", vol. 3(4), November 2007, 59-64.

[5] **Electronics** Kashia Jived ,Harpoon Asha ,Raj veer Singh ,S.M. Shall Husain and Tasha Slim Stun , "Design and Performance Analysis of a Stand-alone PV System with Hybrid Energy Storage for Rural India", 2019, *8*(9), 952;

[6] **Computer Geoscience,** P.S.Dahl, A PC and Lotus-based data acquisition/reduction system for an ICP spectrometer, 16(7), 2000, 881–892.

[7] **International Journal of Scientific & EngineeringResearch :** K.S.Madhu, B.R.Wadekar, Finavivya, Chiragkumar.V, Gagan.T.M,"Intelligent Two Axis Solar Tracking System with Mechanical Application" vol. 3, 2229–5518, 2012.

[8] **International Journal of Advances in Science Engineering and Technology:** Adarsh S., Abhishek Anand, Jayant Singla "Increasing the efficiency of a PV system using dual axis solar tracking " ISSN: 2321-9009 Volume- 3, Issue-2, April-2015

[9] **International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES) :** S.Sowmya, Dr.M.Yohan "Sun tracking solar panel by coupled with a stepper motor",e-ISSN: 2455-2585 Volume 4, Issue 09, September-2018

[10] **International Journal of Advance Research, Ideas and Innovations in Technology:** R. Divya, K.Sheeba, J.Gayathri dhevi & S.Sandhiya "Automatic Cleaning of Solar Panel with Maximum Power Tracking by using Aurdino", Volume 4, Issue 2,PP 324-328,2019

[11] **International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering:** Sujata Shivashimpiger, Sri Lakshmi C.S. "A Combined approach Towards the Efficiency Improvement of Solar Photovoltaic Panel " Vol. 6, Issue 6, June 2017, pp. 4903-490.

IOT Based Smart Energy Meter Design for Home with Energy Consumption Limit

M. Rupesh[1], Dr.N.Anbu Selvan[2]
{Roopeshroop97@gmail.com[1] anbu.1324@gmail.com[2]}

UG Scholar[1], , Department of Electrical and Electronics Engineering, Saveetha School of Engineering, Saveetha Institute of Medical And Technical Science, Chennai
Assistant Professor[2], Department of Electrical and Electronics Engineering, Saveetha School of Engineering, Saveetha Institute of Medical And Technical Science, Chennai

Abstract. The Communication technology development is increased day by day. Due to the development of communication technology every products are manufactured with smart activities. From the past decade most of the electric devices executed automatically using remote control. Internet of Things (IoT) is used to connect the various devices easily with the help of sensors. All the connected devices are working automatically without any human interventions. The roles of human beings are only to manage and control the connected devices from remote location. Electric meters also using the concept of IoT. In this paper describes about smart meter device. The main purpose of this system is read the amount current consumption units automatically with the help of LED light calculate the amount and display the messages to the user's web site and user's smart phone. This system also issues the alert message to the user when the current consumption unit cross the limited level.

Keywords: Smart Energy Meter, Electric board, LED, IoT, GSM, Wi-Fi, webpage.

1 Introduction

Now the growth of population is increased day by day. Due to this reason the residential places and industries need large amount of current. Various systems are already introduced to save energy from residential electric meter devices. In traditional days, the energy meter device fit inside the users premises. The consumption rate was taken by human being and updated into the system. This system was extremely dependent on operator. The operator went to the users locations for collecting the information. It is the very difficult process. To avoid this condition the proposed system is used to measure current consumption rate automatically. This system is used to collect the current consumption value and provide the alert message to the user with the help of IoT. The IoT concept permits physical devices to be measure and managed vaguely across already available network connection, create a direct communication between the real world and computer system. The result of the IoT technique is getting accurate result and avail financial benefit. This technology has developed from it starting stage and currently using this concept. Electricity is important in everyone life. Without electricity the people cannot able live in this current world.

This proposed system is used to collect the data from the user's location and use this information for bill calculating process. The measure value will be stored on the server and it is used for amount calculation also. This system measures the current consumption units

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accurately. This system totally removes the human intervention. This proposed system display the real time current consumption data on the LCD screen. Wi-Fi modem can be used to check the consumed units and give threshold unit level via webpage.

The paper is divided into various parts. Section II describes same work available in existing study. Section III presented current system architecture. The new proposed system was practically implemented and tested and the offered results shown in section IV. At last section discussed about the conclusion of the proposed system.

2 Literature Survey

BirendrakumarSahani et al., explained about the traditional meter reading system. In existing meter reading system a human can come from electricity board and stand in front of the electric meter to measure the current consumption units. This is used for calculate electricity bill. The main disadvantage of this traditional system was the human go to the users location, measure the units consumed and handover the bill to the consumers. Based upon their calculation the users pay the amount. In sometime extra amount will be added with the electricity bill by human's mistake. To avoid this problem the authors constructed a new system using IoT and Arduino concept. In this proposed work Arduino controller was used. Because it uses less power and fast processing capability compared with other controllers. This proposed system was embedded with the existing system. GSM concept was used to send the messages to the user[1].

Mrs.Geetha.R M.E et al., says that in the existing system the electricity people directly went to the users location and note the meter readings. Based upon the value of unit consumed the electricity bill was created and give to the user. Here the authors proposed a new system to read the meter reading automatically by using Arduino controller. This system was providing the privilege to check the energy consumption and the bill amount using Wi-Fi module. This system will be reduce the human energy and prevent the machines from repair [2].

A.Subba Rao et al., provide a new architecture to measure and control the electric meters in residential places continuously. Finally they constructed a new system controlled from remote location. This proposed architecture can able to transfer the information to the server and send the SMS using GSM concept. This frame work has been implemented by using ARM processor controller with some set of sensor [3].

Amrita Singh et al, constructed new system for measure power usages. This system entirely avoids person interruption during the power measurement stage. It was constructed by using the new concept IoT. This technology is used to create the connection in physical objects with the help of various software and sensor devices. Using this IoT concept every devices are able to transfer the data between them. This smart meter is used to automatically read the electrical consumption from the users meter device and transfer the data to the server. Using this data the bill will be calculated and send to the user and the current readings will be displayed on the screen. This proposed system will be used to produce the accurate result and proper amount [4].

Mr. Samarth Pandit et al., explained about the various disadvantages of the existing meter reading system. This proposed system measure the current consumption rate automatically at small level. The main objective of this proposed system was reducing the power usages in

various appliances. This project was implemented by using Arduino UNO micro controller and IoT techniques. If any critical conditions are measured this system automatically cut the power supply [5].

Pooja D Talwar et al., described about the monitor the power consumption in domestic places and calculate electricity bill with the help of current telecommunication technologies. The main aim of this system was to decrease the human resource in electrical department. The electricity bill was calculated in automatic manner and send directly to the consumers with the help of IoT. The electricity bill has seen anywhere from the world. All information sent by using IoT and stored in web server [6].

Saha, S et al., explained about grid techniques used in electric products. Smart electric meter is constructed by using advanced metering infrastructures. This new systems are extensively spread and organized to the newly connected network. Now power producing systems also affected by various attacks. The presented system was operated based on IoT using using Arduino controller [7].

Himanshu K. Patel, et al., construct and implement a new system used to avoid person intervention in electric meter reading and generating electric bill. The major benefit of this proposed system was avoid corruption in electric power usages and generating electric bill. This system is constructed by using GSM approach , Arduino controller combined with LDR sensor module and relay capability. Here the LDR sensor integrated with the LED light on the meter box tool and transfer the data to the microcontroller using GSM module. This system is also used to send the SMS to the concern users[8].

Anirudh Kumar et al., says that smart electric meters are talented in the direction of boost in energy competence. But the installation of this proposed system was very difficult compare with an existing traditional system. In this smart meter the LDR sensor was used to measure the LED blinking frequencies. Normally the number LED blinks directly proportional to the normal power stored in the traditional meter device. The sensed data from the LED blinker will be stored on the web server for future purpose [10].

S. Imran et al., developed a new electric meter using the concept of IoT. In this system LDR sensor is used to calculate the frequency of the LED blinks. According to the number of blinks the electric bill will be calculated. The microcontroller collect the data from the LDR sensor and display the result on the LCD screen connected with the controller [11].

Shaista Hassan Mir designed a advanced electric meter using Arduino micro controller and GSM technology. This smart meter is used to generate the electric bill automatically and send the bill to the user automatically via GSM modem [12].

F. Abate et al., says that the number of smart devices increase day by day. These smart devices are used to making everything as a smart working. It allows making the city as a smart city, home as the smart home etc. The smart meter consists of various hardware parts and software. The most of the parts in the smart meter are constructed by using chips that computes the attributed used to evaluate energy usage. Mostly the parts of smart meters are based on a chip that calculates the parameters needed to energy usage [13].

3 Proposed Method

This proposed smart meter is used to measure the energy consumption automatically and calculate the bill automatically with the help of IoT and GSM techniques. This system is developed by using Arudino microcontroller. All the devices are integrated with the micro

controller. The following figure represents the actual architecture diagram of the proposed system. Here the energy consumption units measured from the user's location and calculate the bill. The generated bill send to the user smart phone through SMS service

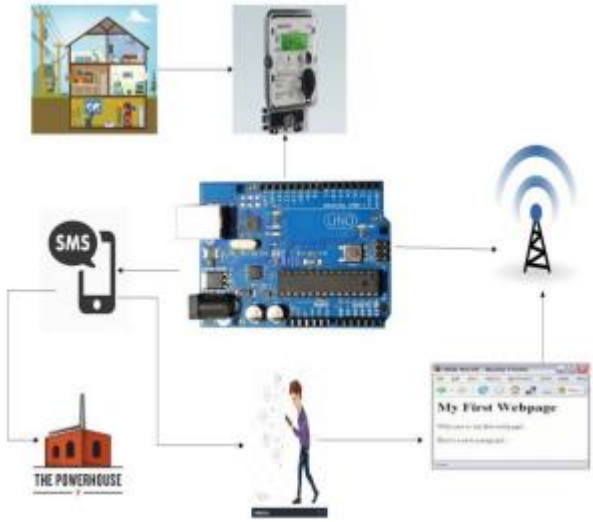

Fig 1 Architecture diagram of Proposed System

4 Results And Discussions

This proposed system is used to measure the electric current consumption automatically. The unit count will be based on number of blinks of LED light. The LED light is already available in the smart meter. The LDR sensor is connected with the LED light. Based upon the frequency of the LED blinks the unit of electric current will be calculated by the controller. After the calculation process the controller send the bill to the concern user. At the same time the bill will be updated on the user's web site using WiFi module also. If the user crosses the limited range the system will automatically produce the alert SMS message to the user's smart phone. This system is developed by using Arduino micro controller. The following figure 2 shows the flow diagram of proposed smart meter system.

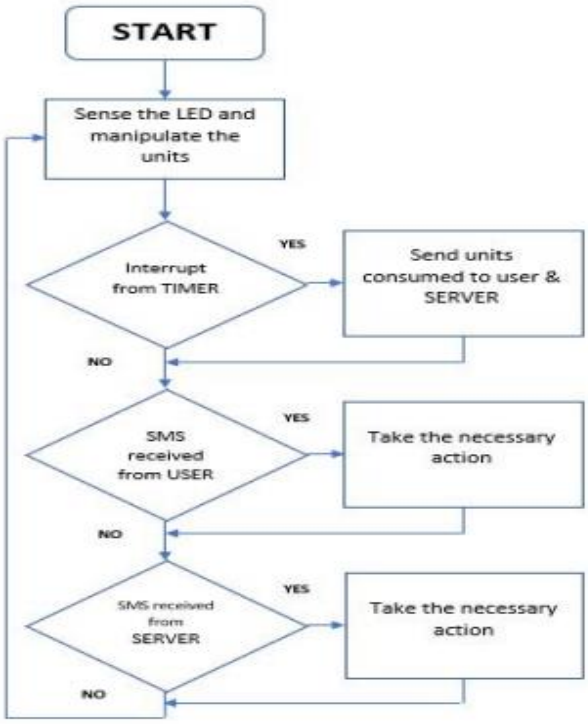

Fig 2 Flow Diagram of Proposed System.

The following screen shot shows the sample output of the proposed system. Based upon units consumed the amount will be calculated.

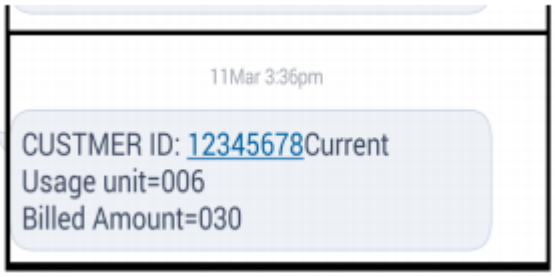

Fig 3 Output Screen 1

This proposed system also provides the alert message to the user if the consumed electric power cross the limit. The following figure 4 shows the alert and awareness message displayed to the user.

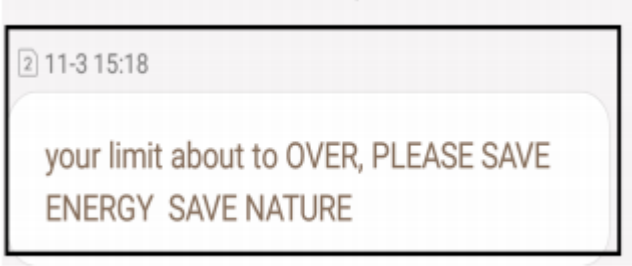

Fig 4 Output Screen 2

5 Conclusion

An advanced energy meters that measures electrical energy consumption in an accurate manner and also provides extra information as compared to a conventional energy meter. The main advantage of smart meter is it alerts us when our energy consumption crosses the actual limit by sending a message. These smart meters can measure the reading and send the information to the customers within small interval of time.

References

[1] BirendrakumarSahani, Tejashree Ravi, AkibjavedTamboli&RanjeetPisal(2017)," IoT Based Smart Energy Meter", International Research Journal of Engineering and Technology (IRJET), Vol. 04, No. 04, ISSN: 2395-0072, pp. 96-102.

[2] Geetha.R ,Abhishek.D&Rajalakshmi.G(2018), "Smart Energy Meter Using IoT ",International Journal of Recent Trends in Engineering & Research (IJRTER) Conference on Electronics, Information and Communication Systems (CELICS'18), ISSN: 2455-1457, pp. 235-239.

[3] A.Subba Rao & Sri VidyaGarige(2019), "IOT Based Smart Energy Meter Billing Monitoring and Controlling the Loads", International Journal of Innovative Technology and Exploring Engineering (IJITEE), ISSN: 2278-3075, Vol. 8, No. 4, pp. 340-344.

[4] Amrita Singh & Ravi Gupta, "IoT based smart energy meter", International Journal of Advancement Research and Development, Vol. 3, No. 3, pp 328-331.

[5] Samarth Pandit ,SnehaMandhre&MeghanaNichal(2017)", Smart Energy Meter using internet of Things (IoT) ", VJER-Vishwakarma Journal of Engineering Research, Vol. 1, No. 2, ISSN: 2456-8465, pp 222-229.

[6] Pooja D Talwar& S B Kulkarni," Iot Based Energy Meter Reading", International of Journal Recent Trends in Eginerring and Research, pp.586-591

[7] Saha, S., Mondal, S., Saha, A &Purkait, P. (2018). Design and Implementation of IoT Based Smart Energy Meter., 2018 IEEE Applied Signal Processing Conference (ASPCON), pp 19-23.

[8] Patel, H. K., Mody, T., & Goyal, A. (2019), " Arduino Based Smart Energy Meter using GSM", 2019 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU)

[9] Al-Ali, A. R., Landolsi, T., Hassan, M. H., Ezzeddine, M., Abdelsalam, M., &Baseet, M. (2018), " AnIoT-Based Smart Utility Meter", 2018 2nd International Conference on Smart Grid and Smart Cities (ICSGSC).

[10] Kumar, A., Thakur, S., &Bhattacharjee, P. (2018), "Real Time Monitoring of AMR Enabled Energy Meter for AMI in Smart City - An IoT Application|, 2018 IEEE International Symposium on Smart Electronic Systems (iSES), pp 219-222.

[11] S. Imran & K. Prahlada Rao(2017), " IOT BASED ELECTRICITY ENERGY METER READING THROUGH INTERNET", International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES), ISSN: 2455-2585, Vol. 3, No.11, pp. 34-40.
[12] Shaista Hassan Mir , SahreenAshruf , Sameena , Yasmeen Bhat & Nadeem Beigh(2019), "Review on Smart Electric Metering System Based on GSM/IOT", Asian Journal of Electrical Sciences, ISSN: 2249-6297, Vol. 8, No. 1, pp. 1-6.
[13] F. Abate, M. Carratù, C. Liguori& M. Ferro(2018), "Smart Meter for the IoT".
[14] K. Anuradha& S. Nirmala SugirthaRajini(2019), "Analysis of Machine Learning Algorithm in IOT Security Issues and Challenges", Jour of Adv Research in Dynamical & Control Systems, Vol. 11, No. 9, pp. 1030-1034.

Homogenous Charge Compression Ignition (HCCI) combustion control by controlling the CNG parameters

S.Vignesh Eswaran[1], Dr. P.Naveen Chandran[2]
{isbar2807@gmail.com[1], asiriyan@gmail.com[2]}

Research scholar, Bharath Institute of Higher Education and Research, Chennai[1], Professor of Automobile Dept., Bharath Institute of Higher Education and Research, Chennai[2]

Abstract. Homogenous Charge Compression Ignition (HCCI) is a incineration manner that produces actual small nitrogen oxides has high thermal performance. it's far one few answers reachable appears very auspicious to address the concerns at the atmospheric air pollution and depleting fossil fuel assets aggravated with the aid of growing electricity intake of the arena. but, presently there is no set up method HCCI incineration controller and it has high HC and CO emissions. This paper, CNG straight injection became suggested as a tool for HCCI combustion manage. Section of fuel and CNG pour prices and diploma of stratification of CNG have been recognized as ability parameter for HCCI combustion manipulate. role of CNG straight injection on HCCI incineration manage and consistent consequences on presentation and emission traits have been experimentally examined. Sizes of fuel and CNG and degree of stratification of CNG have been observed actual method of incineration manage within sure restrictions of engine load and CO and HC releases can be drastically decreased. It become determined that warmth released by means of gasoline HCCI combustion occasioned within the following incineration of CNG engine load can accelerated using various CNG injection charge..

Keywords: HCCI Combustion control, CNG Parameters, engine load, air pollution control..

1 Introduction

The innovation of motor is a significant achievement in the transport of materials and man and it prompted a stupendous jump in the financial advancement of individuals of this earth. Notwithstanding, when it was presented the fundamental specialized contemplations for the plan of the motors were to fill the need of transport with great burden conveying limits at higher paces. The effectiveness of energy change and the outflow attributes of a motor were of smallest importance for the general public of car architects and fashioners.

Albeit world energy utilization got the petroleum products plummeted altogether 2009 interestingly after 1981 because of the monetary emergency, it is accounted for that it would arrive at a lot more significant levels in 2035 because of the fast financial improvements in specific districts of the world [1].

Use of energy utilizing the right now accessible innovations brings about emanation of hurtful poisons and ozone harming substances that bring about an unnatural weather change and disintegrated nature of environmental air. The inside burning motor, the most generally

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utilized sort of motor for car applications, utilizes airborne as functioning average and as a wellspring of oxygen ignition of fuel[2]. The system of transformation of warmth into effort begins with the freedom of warmth energy limited in the fuel by the ignition cycle. The cycle of ignition is perplexing with many transitional substance responses including a few segments fuel. Burning creates hurtful gas side-effects regularly framed particularly because of deficient compound responses. A portion of the significant poisons produced motors are oxides of carbon, sulfur oxides, oxides of nitrogen, and hydro-carbons actual fuels. This additional significant subject seems confine utilization IC motors later on [3].

In this paper, another methodology is suggested for regulatory double fuels HCCI burning. The methodology mix changing extents of gas and CNG shifting the level of CNG delineation gas air combination.

2. Related Works

The HCCI ignition can measure up to the hot bulb motors [4] created in the beginning phases of advancement of inward burning motor. The hot bulb motors utilized a helper chamber that could be remotely warmed for startup. The fuel was infused into the entry that associated the warmed cavity and the primary burning cavity. As the fuel was infused throughout the initial piece of the pressure hit, it had sufficient opportunity to get blended in with the air in the wake of being disintegrated by the exteriors of the warm bulb. This brought about the development of same custody in the chamber and the motor was working on the burning with same custody and auto start.

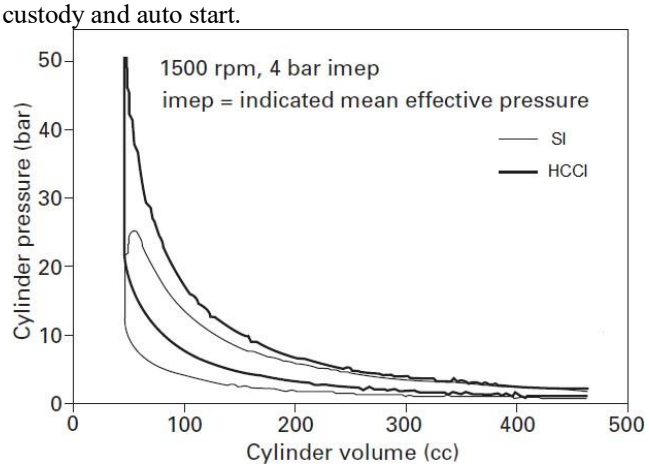


Fig 2.1 Pressure traces of SI and HCCI combustion at same operating conditions [14].

Fig 2.1 demonstrations distinctions weight increase paces HCCI and SI ignition similar motor speed and burden [14]. The pressing factor increase level because of some technique for ignition is restricted to 10 CAD/ bar by the material presently utilized for structure the motors [15]. To restrict the high warmth discharge rate and keep away from auto start at an initial case throughout pressure blow, the motor must be worked with very lean blends. Similar diesel motors, HCCI motor is worked at totally open choke and heap on a HCCI motor is encountered by expanding fuel fixation noticeable all around. Since the HCCI motor must be

worked at far more slender than the stoichiometric disorder to oversee high warmth discharge rates, the heap range that can be taken care of is exceptionally restricted when contrasted with motors of similar size working on SI or CI burning. All in all, the greatest burden treatable with HCCI burning is low, regularly dwindling inside 30% of the pinnacle force or IMEP achieved SI or CI ignition [16].

3. Methodology

Dual Fuel HCCI Combustion

The motor utilized for this exploratory investigation houses the fuel arrangement of straight infusion of compacted flammable gas (CNG) or a vaporous fuels and great pressure proportion reasonable for activity CNG fuel flash start. This motor, momentarily referenced as CNG DI Engine theory from now on, is a solitary chamber water air-conditioned motor joined electric dynamometer utilized turning over the motor and estimating the footbrake force created motor. Fig 3.1 demonstrations a diagram sketch CNG DI motor.

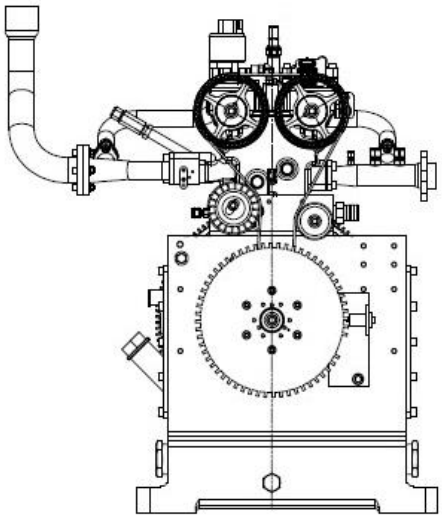


Fig 3.1 The single cylinder CNG DI research engine [38]

Features of the CNG DI Engine

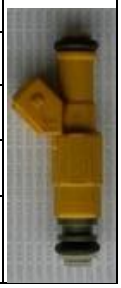
CNG DI motor essentially intended activity vaporous fills specific consideration regarding activity CNG. The CNG advanced octane evaluation resources healthier thump obstruction when combusted with sparkle start, the motor has been intended to have a great pressure proportion of 14:1 in order to help flash start and to understand the advantages of higher warm proficiency.

3.1.3 Gasoline Fuel Injection System

An extra gas source framework tailored CNG DI motor to work CNG and gas at the same time so the motor might happen the prerequisite of double fuel capacity examination. The fuel was infused complex at an area around 44cm admission faucet. The coldness among mark gas

infusion and admission spigot was reserved long to guarantee same blending of gas and air [38, 39]. The gas complex infusion includes two frameworks; the essential fuel source framework and an electronics controller framework that is coordinated CNG DI motor.

Table 3.2 Specifications of the gasoline injector.

Make/Part Number	Bosch/ 0 280 155 710	
Type	High Impedance	
Fuel injection Pressure	3 bar	
Fuel flow rate	191.8 cc/min	
Power Supply	12V DC	

Control of the Gasoline Fuel Injection using LabVIEW

Fig 3.2 demonstrations the Fig portrayal switch arrangement of infusion. The assignment of regulatory the infusion cycle can be isolated into: ID of TDC, recognizable proof of the force stroke and estimation of wrench point.

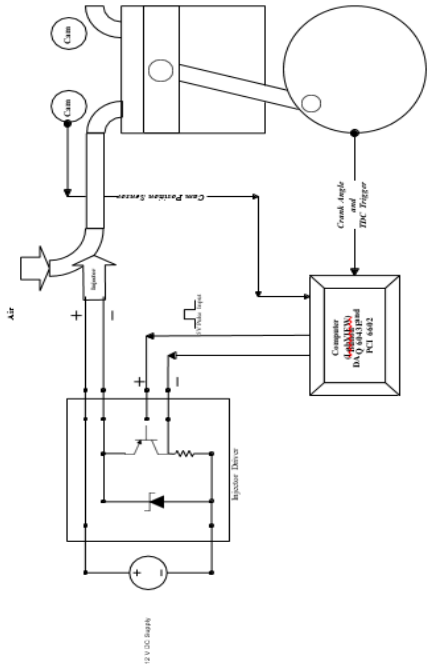


Fig 3.2 LabVIEW based control system of gasoline injection

4. Results And Discussion

The fundamental target of this paper is to consider CNG straight infusion as a device for regulatory HCCI ignition. Ignition regulator by CNG shortest infusion can be accomplished utilizing two distinct systems;

Homogeneous blending:

As CNG has a advanced octane sum gas, its expansion combination an essential fuel (gas) and air resolve bring about a postponement in the start judgment and an increment in the ignition length. Consequently, burning staging constrained by shifting the extent of the CNG into combination. This can accomplished regulatory infusion span CNG and gas.

Variable delineation:

It is for the most part acknowledged that fuel delineation significantly affects the HCCI burning. Definition of CNG a consistently premixed gas air custody in the chamber can be accomplished finished a mix of CNG direct infusion a uniquely machine channel cylinder top. The level of definition differed altering the CNG infusion judgment.

The two systems were utilized in this examination and their consequences for the presentation of pressure start of CNG and gas air blend are talked about in this part.

Scope of Operable Loads at Different Engine Speeds

The greatest burden treatable discovered subject equality proportion of fuel and infusion control or level of CNG delineation. The base and greatest burdens treatable deprived of thumping or failure to discharge at all gas comparability proportions and CNG infusion judgments are appeared in Fig 4.1.

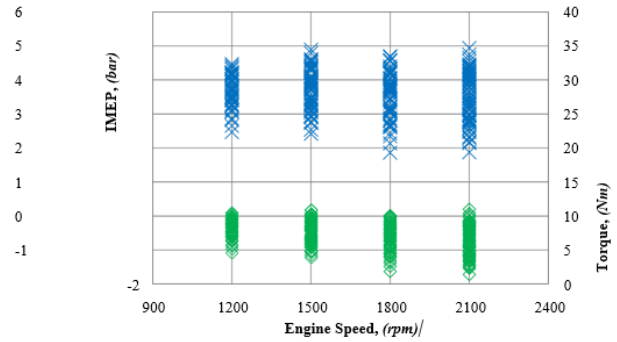


Fig 4.1 Load range operable with dual fuel HCCI combustion

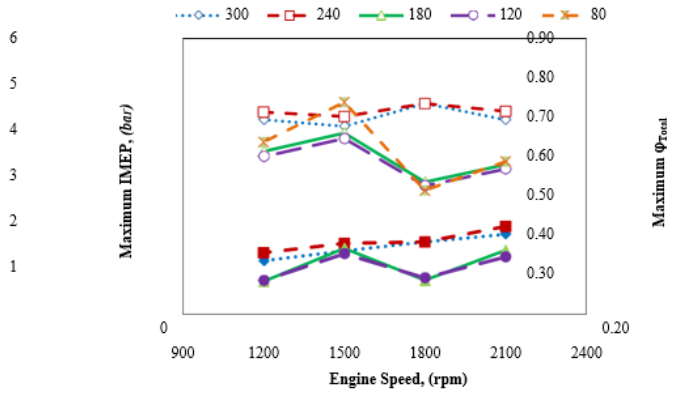


Fig 4.2 Maximum load range obtained at φ_g=0.20.

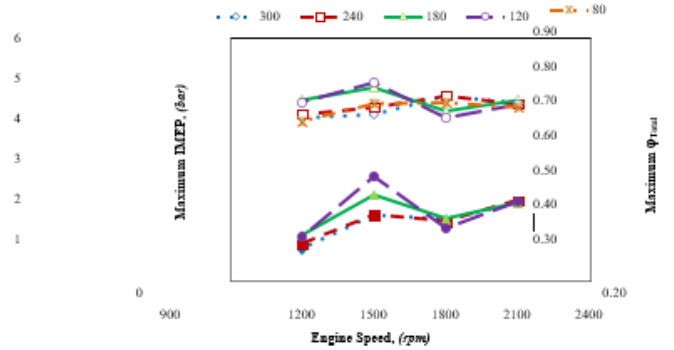


Fig 4.3 Maximum load range obtained at φ_g=0.22.

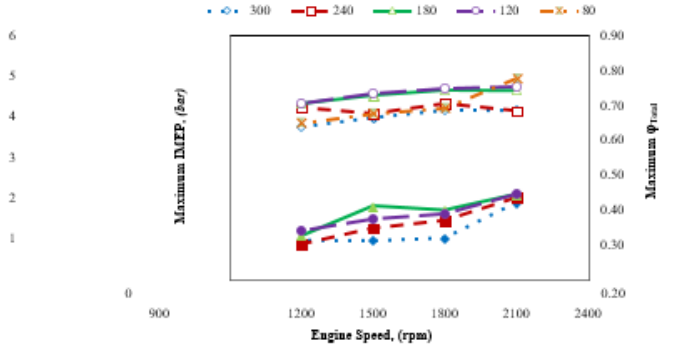


Fig 4.4 Maximum load range obtained at φg=0.24.

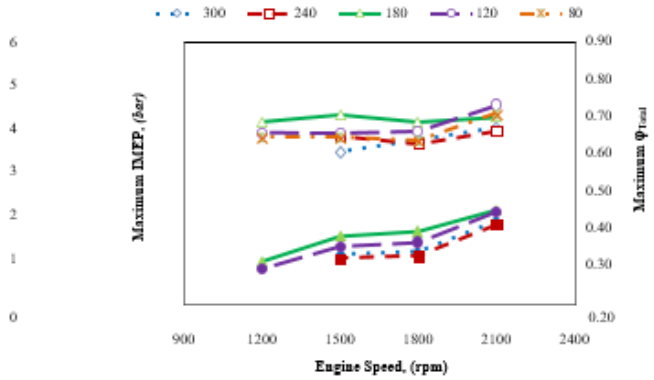


Fig 4.5 Maximum load range obtained at φ_g=0.26.

Likewise, most extreme ,least loads achieved subject to motor speed. The most extreme scope of burdens might be accomplished at 2100 rpm and 1200 rpm curable burden variety restricted.

Overview of Engine Load Range and Operation

Gas assumes a critical part commencement and attributes of HCCI ignition of a double fuel combination of gas , CNG. As referenced before, there occurs a base equality proportion fuel just exceeding HCCI burning accomplished at admission responsibility temperature 300°C driving force of mathematical pressure proportion of 14:1. It seen that double fuels activity, the warmth freed ignition of gas was fundamental for the burning of CNG. an intently coordinating with disorder and illustration of Lively Thermo Atmosphere Burning as the thermodynamic air came about because of the HCCI burning of fuel advances the start of CNG and affirmed to writing [40,41]. In this manner, it is imperative to consider the impacts of individual gas equality proportion on the attributes of the double fuel HCCI ignition.

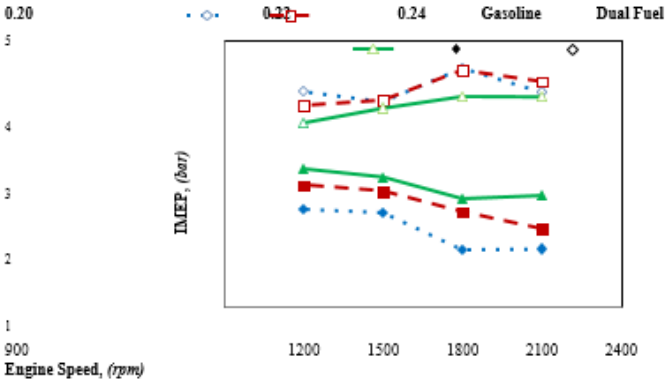


Fig 4.6 Maximum operable load range at dissimilar φ_g and engine speed at 300° BTDC.

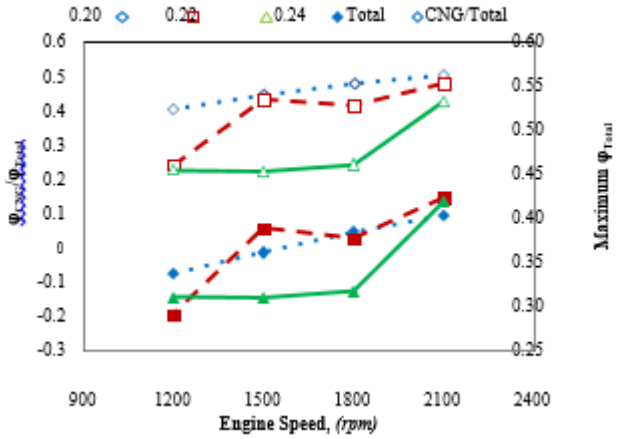


Fig 4.7 Maximum limits of φ_{CNG} /φ_{Total} and φ_{Total} at different φ_g and engine speed at 300° BTDC.

The greatest burden collection treatable was subject to separate equality proportion gas assumed motor haste. Fig 4.6 demonstrations the most extreme lots that might be worked deprived of thumping, fizzle, or fractional consuming at different fuel equality proportions of φg = 0.20; 0.22 and 0.24. At the point when CNG was infused it expanded the all out identicalness proportion at a steady gas comparability proportion (φg). What's more, the φg was discovered to be a huge factor in characterizing the maximum furthest reaches IMEP possible. Fig 4.6, very well may understood most elevated IMEP was gotten at 1800 rpm practically similar for φg = 0.20 and 0.22 velocities.

From Fig 4.7, the most extreme measure of CNG (φCNG/φTotal) that could be infused was at φg = 0.20 and 2100 rpm. At 2100 rpm, the impact of φg on the greatest complete comparability proportion operable was less observable.

It merits recollecting motor speed expanded time span pivot 1 level wrench point (1° CAD) diminished. thump boundary touchy warmth delivery & pressing factor increase charges per CAD, activity at higher rates are great for fast ignition, for example, in HCCI burning.

Impacts of Gasoline Equivalence Ratio (φg) with Homogeneous Mixture of Gasoline and CNG

The ignition of CNG is started by the warmth delivered by the burning of gas. Subsequently, the measure of fuel present in the general combination fundamentally influences the attributes of the ignition. This segment talks about the impacts of gas stream rates that are addressed as far as proportionality proportion of gas. As the most elevated absolute comparability proportions worked at the motor speeds of 2100 rpm, outcomes speed careful examination.

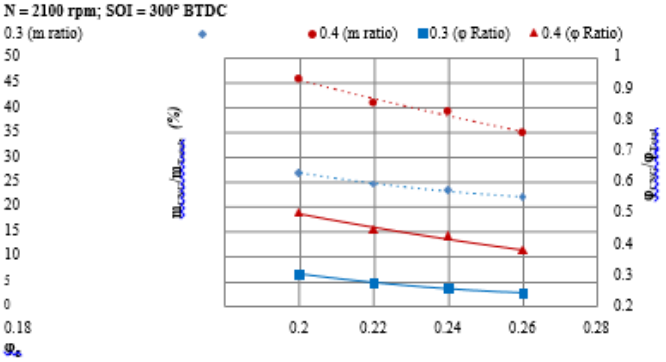


Fig 4.8 The range of φCNG/φTotal and mCNG/mTotal at φTotal = 0.3 and 0.4.

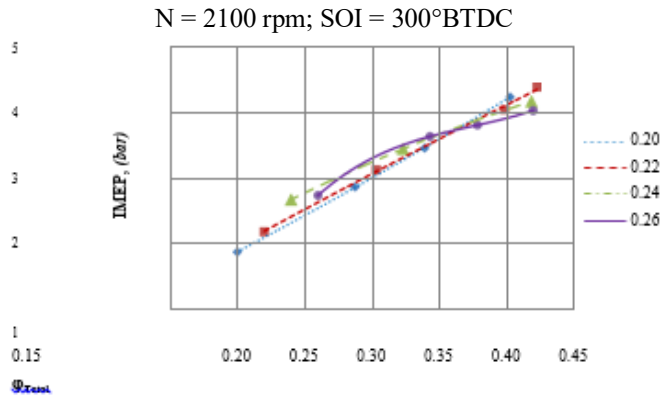


Fig 4.9 Effect of φ_g *on the IMEP obtained at various total equivalence ratios*

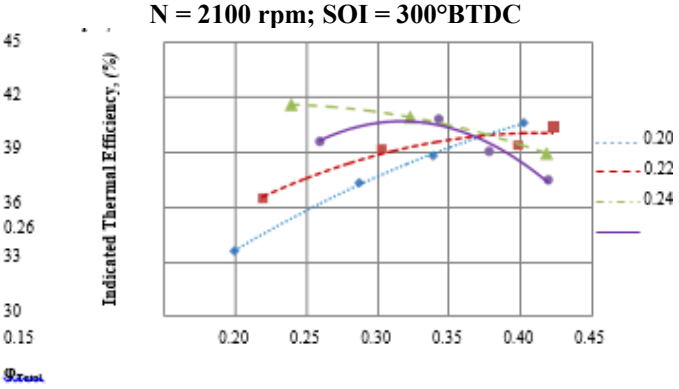


Fig 4.10 Indicated thermal efficiency at different φ_g

The relating upsides of demonstrated warm effectiveness trail the pattern of IMEP as demonstrated in Fig 4.10. At φg = 0.20 and 0.22, the showed warm effectiveness expanded with an increment in CNG infusion rate. At φg = 0.24, warm productivity diminished

expansion in CNG infusion rate. At φg = 0.26, warm effectiveness expanded at first yet again diminished at around φTotal = 0.32 because of cutting edge start as exposed Fig 4.11.

N = 2100 rpm; SOI = 300°BTDC

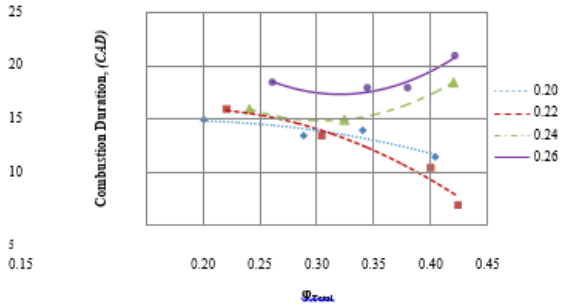


Fig 4.12 Effect of φ_g and the total equivalence ratio on the combustion duration

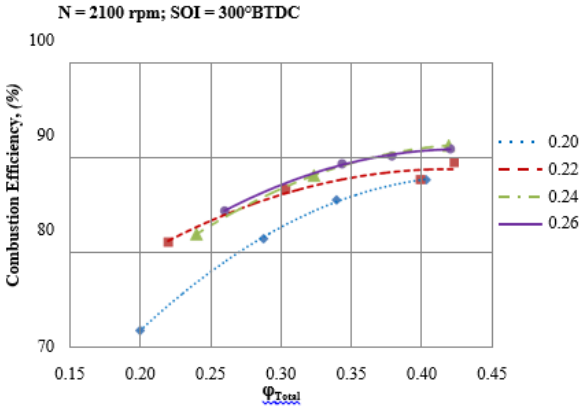
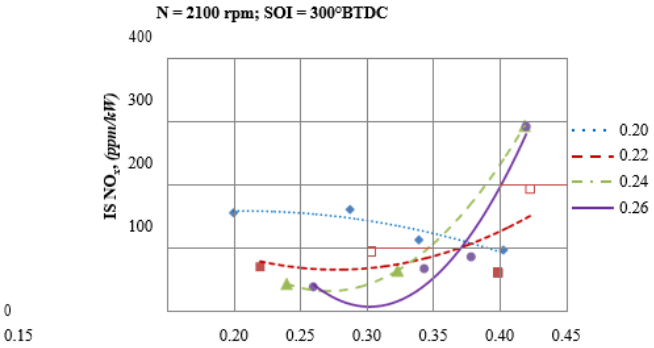


Fig 4.13 Effect of CNG injection rate and φg on combustion efficiency.

Fig 4.13 demonstrations the meaning of gas equality proportion on ignition productivity against complete comparability proportion. With an increment in φg, ignition proficiency expanded and the most minimal burning effectiveness was acquired at φg = 0.20 because of low fuel fixation. At φg > 0.22, there was a minimal expansion in burning proficiency with an increment in φg. Also, the impact of fuel comparability proportion turned out to be less critical at high upsides of φTotal and burning proficiency was more subject to φTotal than φg at extraordinary lots and affirmed the discoveries of Cinakr et al. [40], Macuk et al. [47] and Yaoi et al. [43] expansion extent little auto start temperature gasoline recovers the burning productivity great auto start temperature



fuel.

Fig 4.14 Effect of CNG injection rate and φ_g *on the NOx emissions.*

Fig 4.14 demonstrations NOx outflows expanding CNG infusion degree at different gas equality proportions. At φg = 0.20, the most noteworthy NOx was noticed, be that as it may, the distinctions were peripheral. Above φTotal = 0.40, NOx discharges would in general increment dramatically, following the common pattern of HCCI [14, 16]. In any case, the NOx discharges were under 300 ppm/kW for all cases.

5. Conclusion and Future work

The investigation did in this articles needs conversation on the burning marvels like blend arrangement, start spot, and temperatures and pressing factor accounts in the chamber etcetera. Consuming these as a primary concern, an ignition representation education would be more significant. A suggested system for nonstop activity of the motor at ideal state of motor speed and burden while utilizing CNG definition would be helpful. The impact of admission temperature on the burning attributes and outflows with CNG delineation may prompt a superior comprehension of arrangement of NO2 and other temperature delicate toxins.

References

[1] Alex M.K.P. Taylor, "Science review of Internal Combustion Engines," J. of Energy Policy, vol. 36, pp. 4657-4667, 2008.

[2] L. E. Doman, "International Energy Outlook 2010," U.S. Energy Information Administration, Washington DC DOE/EIA -0484 (2010), July, 2010.

[3] "World Energy Outlook," International Energy Agency, Parice OECD/IEA (2009), 2009.

[4] O. Erlandsson, "Early Swedish Hot-Bulb Engines-Efficiency and Performance Compared to Contemporary Gasoline and Diesel Engines," SAE Paper 2002-01-0115, 2002.

[5] S. Onishi, Hong Jo, S., Shoda, K., Do Jo, P., and Kato, S., "Active thermo- atmosphere combustion (ATAC) - A new combustion process for internal combustion engines," SAE Paper 790507, 1979.

[6] M. Noguchi, Tanaka, Y., Tanaka, T., and Takeuchi, Y., "A study on gasoline engine combustion by observation of intermediate reactive products during combustion," SAE Paper 790840, 1979.

[7] P. M. Najt and D. E. Foster, "Compression-ignited homogeneous charge combustion." vol. SAE Paper 830264, 1983.

[8] R. H. Thring, "Homogeneous-charge compression-ignition (HCCI) engines," SAE Paper 892068, 1989.

[9] M. Stockinger, Schapertons, H., and Huhlmann, P., "Investigation on a Gasoline Engine Working with Self-Ignition by Compression," MTZ Vole. 53, vol. 2, pp. 80-85, 1992.
[10] H. Zhao, Jian Li., and N. Ladommatos, "Performance and Analysis of a 4- Stroke Multi-Cylinder Gasoline Engine With Cai Combustion," SAE Paper 2002-01-0420, 2002.
[11] J. Lavy, J. C. Dabadie, C. Angelberger, P. Duret, A. Juretzka, J. Schäflein, T.H. Ma, Y. Lendresse, A. Satre, and C. Schulz, "Innovative ultra-low NOx controlled auto-ignition combustion process for gasoline engines: the 4-space project," SAE Paper 2001-01-1837, 2001.
[12] L. Koopmans and I. Denbratt, "A Four-Stroke Camless Engine, Operated in Homogeneous Charge Compression Ignition Mode With Commercial Gasoline," SAE Paper 2001-01-3610, 2001.
[13] R. H. Stanglmaier and C. E. Roberts, "Homogeneous charge compression ignition (HCCI): benefits, compromises, and future engine applications," SAE Paper 1999-01-3682, 1999.
[14] H. Zhao, HCCI and CAI engines for the automotive industry. Cambridge: Woodhead Publications, 2007.
[15] M. Lida, M. Hayashi, D. E. Foster, and J. K. Martin, "Characteristics of homogeneous charge compression ignition (HCCI) engine operation for variations in compression ratio, speed, and intake temperature while using n- butane as a fuel," Journal of engineering for gas turbines and power, vol. 125, pp. 472 - 478, 2003.
[16] K. Epping, S. M. Aceves, R. L. Bechtold, and J. E. Dec, "The potential of HCCI combustion for high efficiency and low emissions," SAE Paper 2002- 01-1923, 2002.
[17] M. Christensen and B. Johansson, "Influence of mixture quality on homogeneous charge compression ignition," SAE Paper, 982454, 1998.
[18] Z. Zheng and M. Yao, "Numerical simulation of the effects of charge stratification on combustion and emissions," Energy Fuels, vol. 21, pp. 2018- 2026, 2007.
[19] G. S. Jung, Y. H. Sung, B. C. Choi, and M. T. Lim, "Effects of mixture stratification on HCCI combustion of DME in a rapid compression and expansion machine," International Journal of Automotive Technology, vol. 10, pp. 1-7, 2009.
[20] R. Schießl and U. Maas, "Analysis of endgas temperature fluctuations in an SI engine by laser-induced fluorescence," Combustion and Flame, vol. 133, pp. 19-27, 2003.
[21] Z. Wang, W. Jian-Xin, S. Shi-Jin, and F. Zhang, "Numerical simulation of HCCI engine with multi-stage gasoline direct injection using 3D-CFD with detailed chemistry," SAE Transactions, vol. 113, pp. 367-380, 2004.
[22] M. Sjoberg, L. O. Edling, T. Eliassen, L. Magnusson, and H. E. Angstrom, "GDI HCCI: Effect of Injection Timing and Air Swirl on Fuel Stratification, Combustion and Emissions Formation," SAE Paper 2002-01-0106, 2002.
[23] C. D. Marriott and R. D. Reitz, "Experimental investigation of direct injection gasoline for premixed compression-ignited combustion-phasing control," SAE Paper 2002-01-0418, 2002.
[24] B. Kim, M. Kaneko, Y. Ikeda, and T. Nakajima, "Detailed spectral analysis of the process of HCCI combustion," Proceedings of the Combustion Institute, vol. 29, pp. 671-677, 2002.
[25] J. Kashdan and G. Bruneaux, "Mixture Preparation and Combustion in an Optically-Accessible HCCI, Diesel Engine," Oil & Gas Science and Technology, vol. 61, pp. 25-42, 2006.
[26] H. Kim, J. Ryu, and K. Lee, "A study on the characteristics of spray and combustion in a HCCI engine according to various injection angles and timings," Journal of mechanical science and technology, vol. 21, pp. 133- 140, 2007.
[27] Z. Huang, S. Shiga, T.Ueda, H. Nakamura, T. Ishima, T. Obekata, M.Tsue, and M.Kono, "Effect of Fuel Injection Timing Relative to Ignition Timing on the Natural-Gas Direct-Injection Combustion," Journal of engineering for gas turbines and power, vol. 125, pp. 783-790, 2003.
[28] J. Ma, X. Lu, L. Ji, and Z. Huang, "Evaluation of SCCI potentials in comparison to HCCI and conventional DICI combustion using n-heptane," Energy & Fuels, vol. 22, pp. 954-960, 2008.

[29] T. Ishiyama, H. Kawanabe, K. Ohashi, M. Shioji, and S. Nakai, "A study on premixed charge compression ignition combustion of natural gas with direct injection," International Journal of Engine Research, vol. 6, pp. 443-451, 2005.
[30] M. Canakci and R. D. Reitz, "Effect of optimization criteria on direct- injection homogeneous charge compression ignition gasoline engine performance and emissions using fully automated experiments and microgenetic algorithms," Journal of engineering for gas turbines and power, vol. 126, pp. 167 - 178, 2004.
[31] Z. Wang, S. J. Shuai, J. X. Wang, and G. H. Tian, "A computational study of direct injection gasoline HCCI engine with secondary injection," Fuel, vol. 85, pp. 1831-1841, 2006.
[32] Z. Wang, J. X. Wang, S. J. Shuai, G. H. Tian, and X. L. An, "Experimental and computational studies on gasoline HCCI combustion control using injection strategies," Journal of engineering for gas turbines and power, vol. 129, pp. 870-876, 2007.
[33] K. Yoshizawa, A. Teraji, H. Miyakubo, K. Yamaguchi, and T. Urushihara, "Study of high load operation limit expansion for gasoline compression ignition engines," Journal of engineering for gas turbines and power, vol. 128, pp. 377-388, 2006.
[34] K. Lee and C. Lee, "An Experimental Study on the Combustion Characteristics Using the Stratified Charge Compression Ignition in a Direct Injection Gasoline Engine," JSME International Journal, vol. 49, pp. 864- 868, 2006.
[35] C.H. Lee and K. H. Lee, "An experimental study on the combustion and emission characteristics of a stratified charge compression ignition (SCCI) engine," Energy Fuels, vol. 21, pp. 1901-1907, 2007.
[36] J. Chang, Z. S. Filipi, T. W. Kuo, D. N. Assanis, P. M. Najt, and R. B. Rask, "Investigation of Mixture Preparation Effects on Gasoline HCCI Combustion Aided by Measurements of Wall Heat Flux," Journal of engineering for gas turbines and power, vol. 130, pp. 61- 69, 2008.
[37] M. Canakci, "An experimental study for the effects of boost pressure on the performance and exhaust emissions of a DI-HCCI gasoline engine," Fuel, vol. 87, pp. 1503-1514, 2008
[38] D. Law, D. Kemp, J. Allen, G. Kirkpatrick, and T. Copland, "Controlled combustion in an IC-engine with a fully variable valve train," SAE Paper 2001-01-0251, 2001.
[39] G. Kontarakis, N. Collings, and T. Ma, "Demonstration of HCCI using a single-cylinder, four-stroke SI engine with modified valve timing," SAE Paper 2000-01-2870, 2000.
[40] C. Cinar, O. Can, F. Sahin, and H. S. Yucesu, "Effects of premixed diethyl ether (DEE) on combustion and exhaust emissions in a HCCI-DI diesel engine," Applied Thermal Engineering, vol. 30, pp. 360-365, 2010.
[41] L. Ji, X. Lu, J. Ma, C. Huang, D. Han, and Z. Huang, "Experimental study on influencing factors of iso-octane thermo-atmosphere combustion in a dual- fuel stratified charge compression ignition (SCCI) engine," Energy & Fuels, vol. 23, pp. 2405-2412, 2009
[42] Y. Tsutsumi, A. Iijima, K. Yoshida, H. Shoji, and J. T. Lee, "HCCI combustion characteristics during operation on DME and methane fuels," International Journal of Automotive Technology, vol. 10, pp. 645-652, 2009.
[43] M. Yao, Z. Chen, Z. Zheng, B. Zhang, and Y. Xing, "Study on the controlling strategies of homogeneous charge compression ignition combustion with fuel of dimethyl ether and methanol," Fuel, vol. 85, pp. 2046-2056, 2006.
[44] M. Yao, Z. Zheng, and J. Qin, "Experimental study on homogeneous charge compression ignition combustion with fuel of dimethyl ether and natural gas," Journal of engineering for gas turbines and power, vol. 128, pp. 414- 423, 2006.
[45] M. A. Kalam, H. H. Masjuki, M. A. Maleque, M. A. Amalina, H. Abdesselam, and T. M. I. Mahlia, "Air-Fuel Ratio Calculation for a Natural Gas-Fuelled Spark Ignition Engine," SAE Paper 2004-01-0640, 2004.
[46] M. U. Aslam, H. H. Masjuki, M. A. Kalam, H. Abdesselam, T. M. I. Mahlia, and M. A. Amalina, "An experimental investigation of CNG as an alternative fuel for a retrofitted gasoline vehicle," Fuel, vol. 85, pp. 717-724, 2006.

[47] J. H. Mack, R. W. Dibble, and D. L. F. B. A. Buchhholz, "The effect of the Di-Tertiary Butyl Peroxide (DTBP) additive on HCCI combustion of fuel blends of ethanol and diethyl ether," SAE Paper 2005-01-2135, 2005.

[48] L. Xingcai, H. Yuchun, Z. Linlin, and H. Zhen, "Experimental study on the auto-ignition and combustion characteristics in the homogeneous charge compression ignition (HCCI) combustion operation with ethanol/n-heptane blend fuels by port injection," Fuel, vol. 85, pp. 2622-2631, 2006

An Assessment of PR and HC controlled Bootstrap Converter Fed SVM Inverter based Induction motor drive

Lavanya R[1], Jayalakshmi V[2]
{maillavanya83@gmail.com, jayas_1979@yahoo.co.in}

Research Scholar, Bharath Institute of Higher Education and Research, Chennai[1]
Associate Professor, Bharath Institute of Higher Education and Research, Chennai[2]

Abstract. This task depends on bootstrap converter with SVM inverter. This work is wanted to improve the speed-guideline of bootstrapped converter-inverter took care of Induction Motor drive (BSCSVM-IIM) using Hysteresis Control. This work oversees assessment among PR-PR and PI-hysteresis controlled BSCSVM-IIM frameworks. The BSC is recommended among rectifier and SVMI to upgrade the voltage-pick up .HC is proposed to improve-the-dynamic reaction of BSC-SVMIIM. The goal of this work is to improve the reaction of BSC-SVM-IIM framework utilizing appropriate regulator in closed-loop. Open loop BSCSVM-IIM framework with disturbance, closed two loop PR-PRC and PI-HC based BSCSVM-IIM frameworks are formed; shown and simulated using Simulink and their results are presented. Assessment is done regarding settling time and SSE. The assessments exhibit the unmatched execution of controlled-BSC-SVMIIM framework. The proposed framework has inclinations like minimal consonant substance and quick reaction. After reenactment examines, some trial aftereffects of-BSC-SVM-IIM are given to check the adequacy of the proposed converters.

Keywords: BSC-SVMIIM, SVM inverter, PR-PR and PI-hysteres, Bootstrap Converter Fed SVM Inverter.

1 Introduction

Presently a-days, research is centered around Multi Level Inverters (MLI's), on the grounds that they can produce voltage waveforms with less contortion than customary inverters dependent on 2level geographies. The upsides of fell MLIs are unmistakable for engine drives and for the utility applications. Due to the incredible interest on medium voltage highpower inverters, the cascaded inverters has gained more interest. As the quantity of levels expands, the integrated yield waveform has more advances delivering a flight of stairs wave that moves toward the ideal waveform

Multiplication of 3phase diode and S.C.R. connect rectifiers for D.C. power -supplies and as front-end-converters for inverter –based- applications, for example, customizable speed –drives and uninterruptible force supply, has brought about genuine symphonious, receptive force, gleam and reverberation issues in modern applications and in transmission/appropriation frameworks. A voltage mutilation because of current-harmonics is a significant issue for utilities. PQissues likewise incorporate uneven and sub-simultaneous recurrence flows which add to voltage hangs and floods, and are the most widely recognized reasons for 'disturbance' stumbling of the movable speed drives.

YongKeun and JongKwang proposed examination of bootstrap circuit activity with a modified PWMdrive plot for a 3phase inverter which is for a brushless dc engine drive[1-2]. A bootstrap circuit for working the high-side protected door bipolar semiconductor of a 3phase inverter for a brushless-dc engine drive was examined hypothetically to maintain a strategic distance from under voltage lockout by limiting the release of a boot-strap capacitor (BSC). Madhusoodhanan proposed a plan and assessment for medium voltage converter relevance's by providing a separated entryway driver power supply. The business gate-drivers were accessible upto 6.5 kV IGBTs. With the advances in the SiC, power gadgets evaluated past 10 kV were being investigated. A medium voltage power converters are used in these gadgets. Business gatedrivers appraised for large- voltages were not accessible. These force gadgets had extremely high dv/dts . High dv/dt acquire difficulties in the entryway driver-design[3]. Yutian explained improved bootstrap strategies for fueling gliding door drivers of flying-capacitor staggered

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converters and mixture exchanged capacitor -converters. By utilizing the inalienable properties of staggered converters, these techniques can beat the restriction of traditional boot-strap strategy and make it conceivable to move ground-referred to capacity to the entirety of the coasting -switches[4].

Lei and Liu set a logical technique to assess and plan crossover exchanged capacitor and staggered converters. This explored the utilization of staggered transformation in dc--dc-applications that require an enormous voltage change. A strategy that can fill in as a manual for think about and plan staggered geographies for enormous transformation proportion applications was introduced. The proposed technique kept the conduction misfortune and exchanging misfortune consistent across the various converters[5].

Zhu and Liu focused on the Low-voltage-stress BBC with a high-voltage change pick up. The ordinary BBC had the benefits of straightforward structure, minimal effort, and the capacity to accomplish both voltage venture all over. Be that as it may, because of the negative effects of the parasitic boundaries of the gadget, the voltage change gain of the customary buck-help converter was enormously restricted. Pouladi and Farzanehfard actualized a Single-switch delicate exchanging LED driver appropriate for battery-worked systems[6-8].

Another LED-driver circuit was given dependent on the buck converter coupled inductors for car relevance's. Delicate exchanging condition was accommodated the switch by means of a uninvolved full circuit joining the spillage inductance of the coupled inductors. Sun and Dai proposed Multimode smooth exchanging methodology for dispensing with the operational no man's land in non-reversing buck-boost converter. The presence of operational no man's land during mode exchanging in non-upsetting buck-help converter brings about wavering of the yield voltage and flimsiness of the frame work[9].

The system and impact of the operational dead land were examined, and a multimode smooth exchanging control methodology which can totally dispense with the operational dead land was proposed. Progressed 4mode-adjustment based 4switch non-transforming BBC activity was presented in[10].

Yang explained Analysis demonstrating and execution of an exchanging bi-directional BBC dependent on electric-vehicle cross breed energy stockpiling for V.2.G framework. Battery worked delicate exchanging full BB-LED driver with single attractive component recommended in[11-12]. Another circuit plan of 2switch buck-boost converter was introduced by Jung. A traditional 2switch buck-support (TSBB) converter can work in buck, lift, and buck-boost modes. This

presented another geography for a two switch buck-help converter with similar activity modes. In any case, the proposed TSBB converter had less conductions and exchanging parts than the ordinary TSBB converter, which lessens the force losses[13].

Precise induction of dead land end procedures for the non-transforming coordinated BBC was presented by Zhang.Bidirectional 3-stage DAC converter with implanted DDC converter and transporter based PWM procedure was recommended by Wang. Katherine proposed propels in framework associated PV-power-transformation frameworks. Applications in environmentally friendly power and its control (parc) - corresponding full regulator for semi converter 3phase VSI took care of IMD to upgrade time responses[14-17]. This exertion manages closed-loop semi converter3 stage acceptance engine drive(SCTPIMD) utilizing PI, FOPID and PRregulator. This exertion proposed PR regulator for SCTPIMD. PR-Fuzzy control improvement of doubly took care of enlistment generator during framework issues was proposed by Mohammad Reza[18-19].

Vector control strategy for IMD dependent on hysteresis regulator and pi regulator near examination was introduced by Shiny[20]. Other technique depended on SVM calculation. Query table DTC technique experienced high waves in force, motion and current just as shifting exchanging recurrence. Then again, SVM based DTC creates equivalently low force, transition and current waves and exchanging recurrence was looked after steady. Tangle at Hysteresis -current control of IMdrives utilizing dSPACE-DSPcontroller[21-22]. Hysteresis current control was moderately a straightforward strategy for PWM procedure with relatively great current circle reaction. This work introduced the equipment usage of hysteresis current control for vector controlled acceptance engine drives utilizing dSPACE-DSP. The examination was centered around the impact of hysteresis data transmission to the engine current quality.

2 Research -Gap

The exceeding effort doesn’t include the simulation of PI-hysteresis controlled BSCSVM-IIM frameworks. Hence, this work deal with the simulation of PI-hysteresis controlled BSCSVM-IIM frameworks

3 Proposed System

BlockDiagram of PRC-PRcontrolled-BSC-SVMI-system is outlined in Figure 1. Speed of IMis sensed and it is evaluated -with the reference-speed to get speedError (SE). This SE is directed to a PR-PRcontroller. The 'yield of PRC' is used to obtain reference current. The reference current is compared with actual-current and the current-error is applied to a PRC-PR. The output of current PRC is used to adjust the Pulse-Width (PW) of BSC.

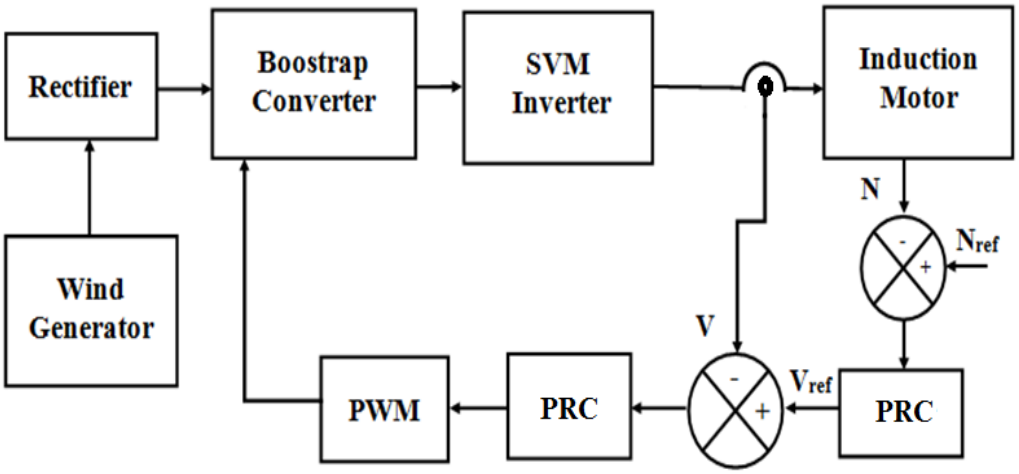

Figure 1: The Block Diagram of PRC-PR controlled closed two loop Bootstrap converter with SVM inverter

Block-Diagram of PI-Hysteresiscontrolled BSC-SVMIsystemis delineated in Figure 2.

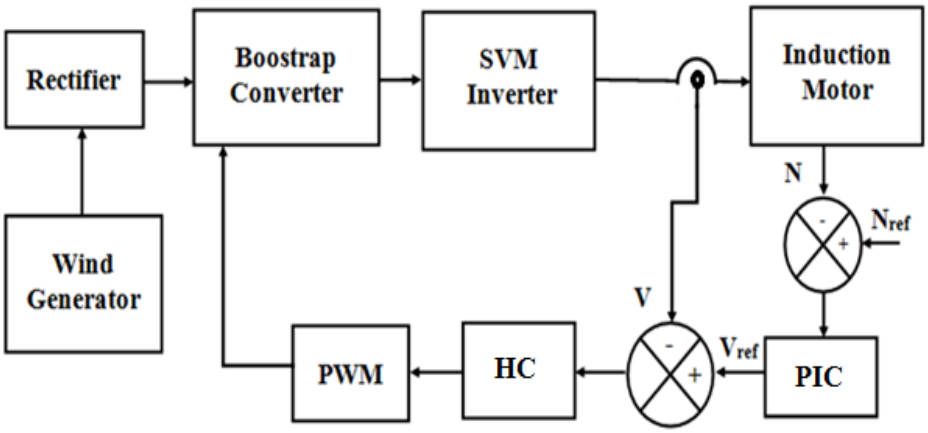

Figure 2: The Block Diagram of PIC-HC closed two loop Bootstrap converter with SVM inverter

4 Simulation Results

The designed converter was first-simulated using MATLAB and then built in the laboratory to authenticate the analysis, design, &enactment of the converter. Open loop BSCSVMIIM with load disturbanceis delinated in Figure 3.

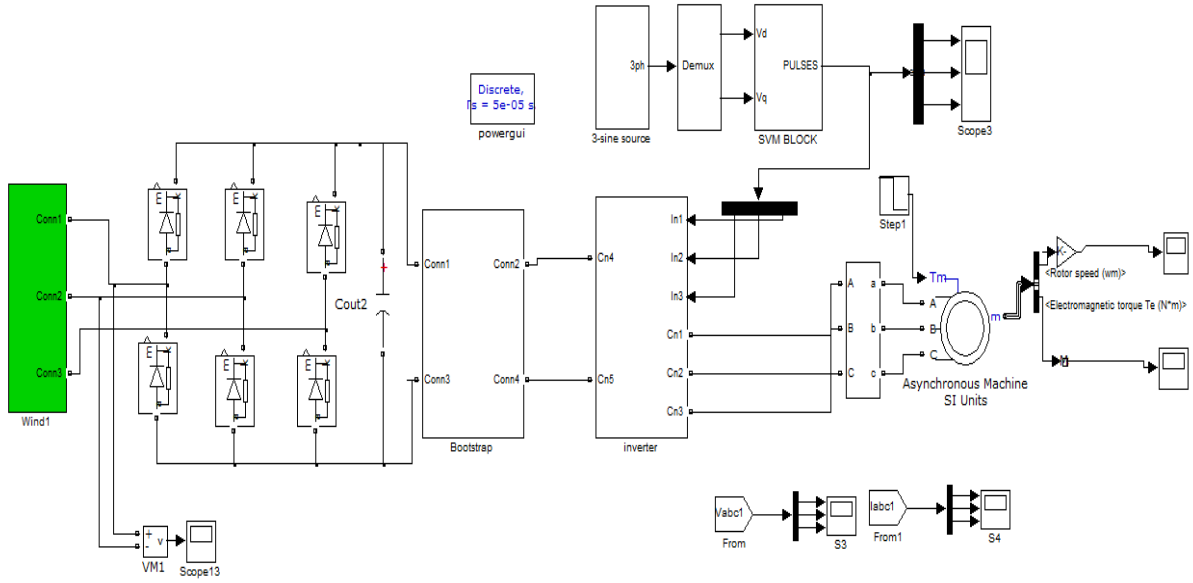

Figure 3: Circuit-diagram -of open looop BSCSVMIIMwith load disturbance

Input-voltage of BSCSVMIIM is shown in Figure 4 and the input voltage is 70V. The Circuit diagram of bootstrap converter is outlined in Figure 5.

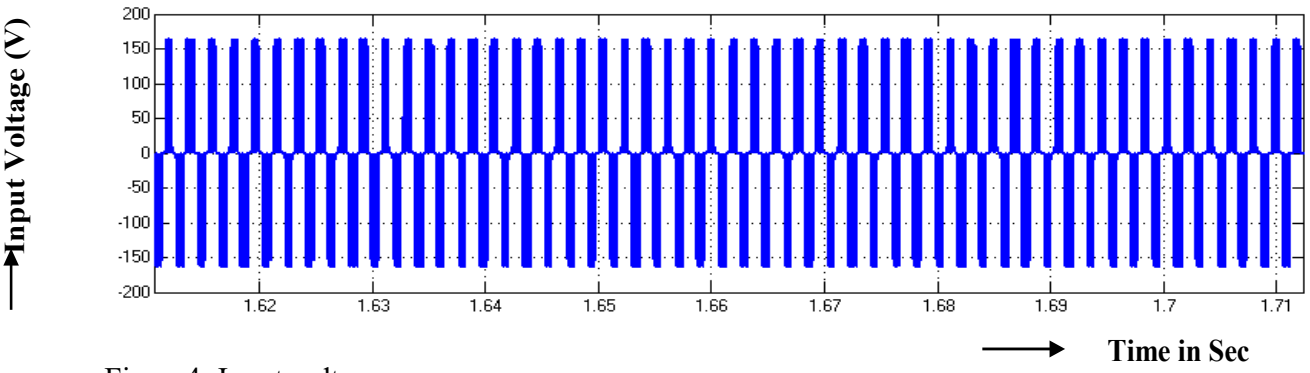

Figure4: Input voltage

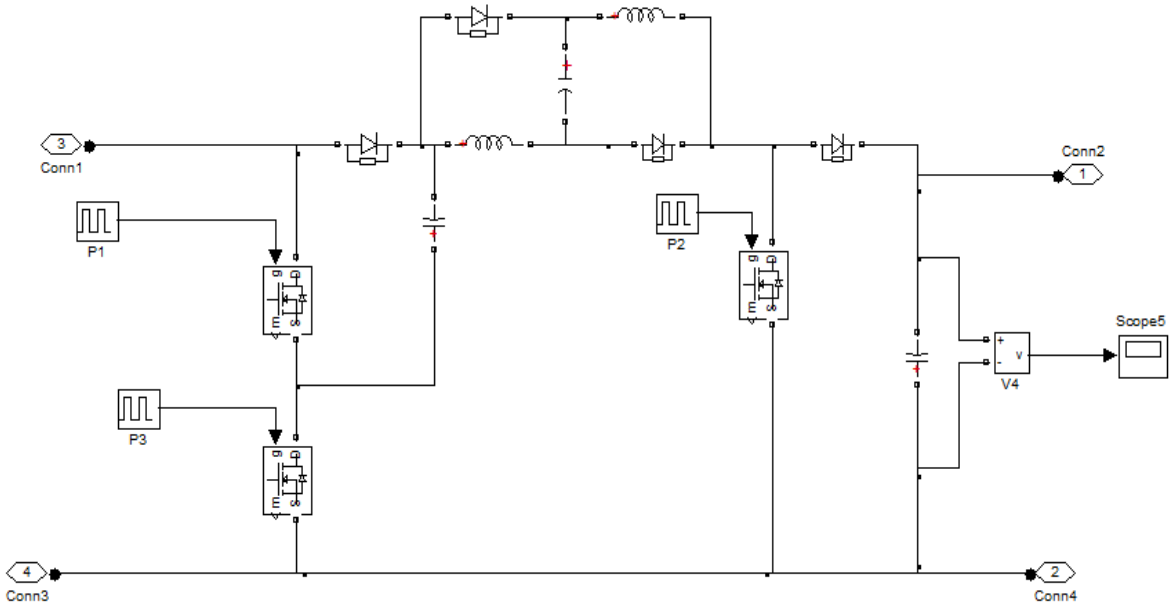

Figure5: Circuit diagram of bootstrap converter

Voltage across bootstrap converter with Bootstrap converter with SVM is presented here. Voltage across bootstrap converter is value is 410 Volts. Voltage across the motor load is 450 Volts and it is indicated in Figure 7.

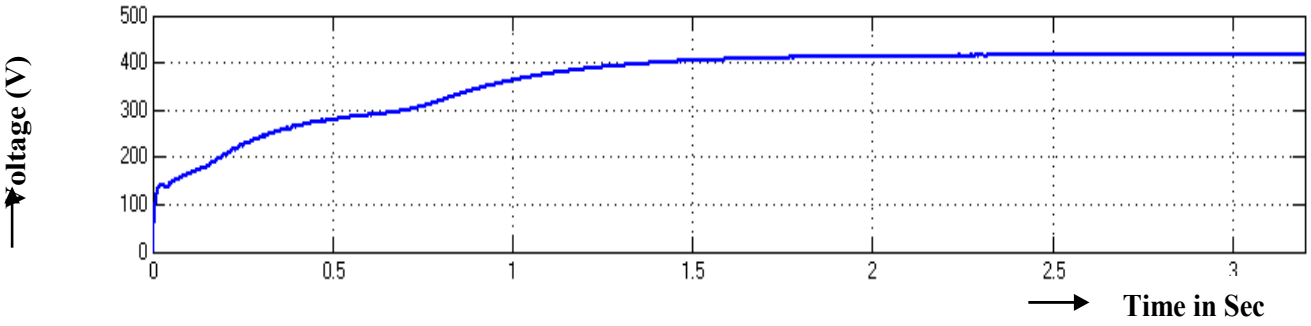

Figure6: Voltage across bootstrap converter

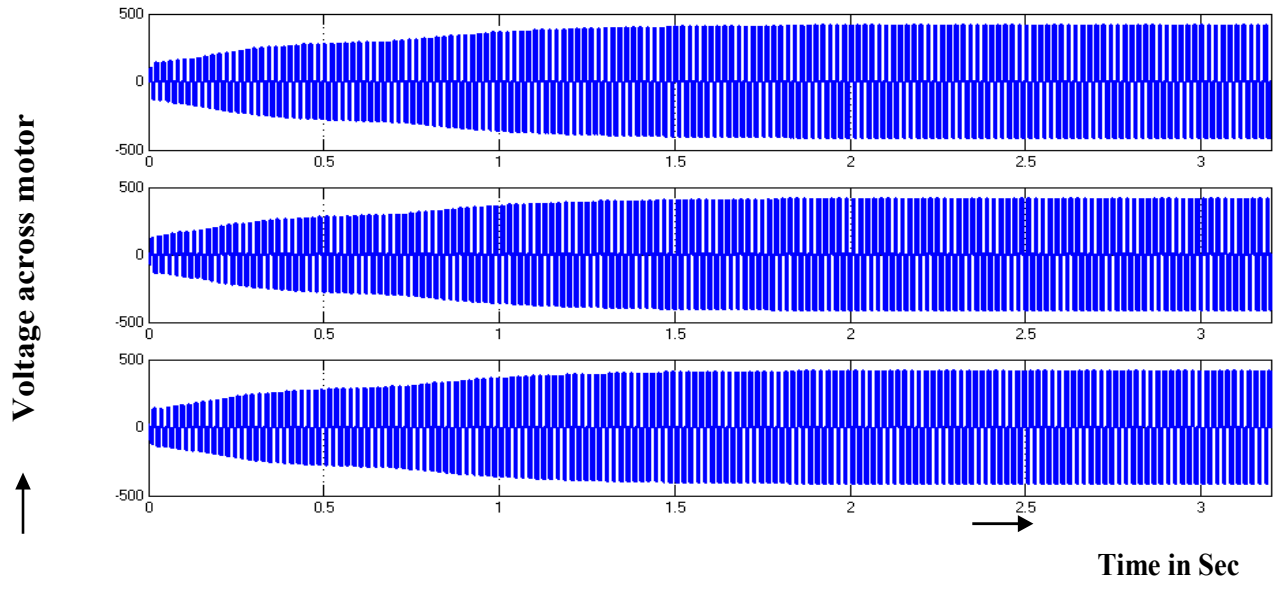

Figure7: Voltage across motor load

Motor speedwithBootstrap converter and SVM is indicated in Figure 8.The value of Motor speed 1300 RPM.

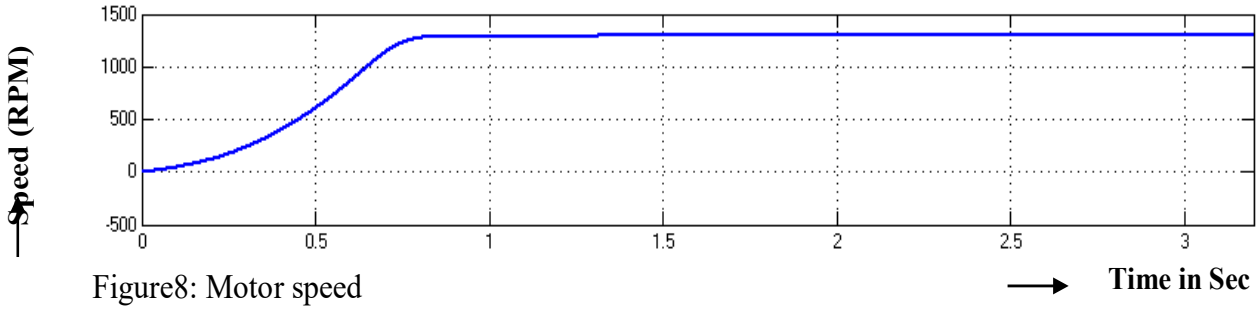

Figure8: Motor speed

The Motor speed ofBootstrap converter with SVM is sketched in Figure 9.The value of Motor speed is 1294 RPM. MotorTorqueofBoot-strap converter along with SVM is sketched in Figure 9.The value of Motor Torqueis 1 N-m.

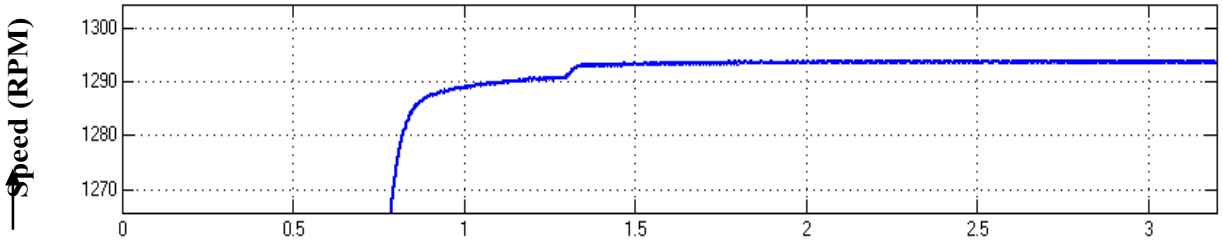

Figure9: Motor speeds zoom out

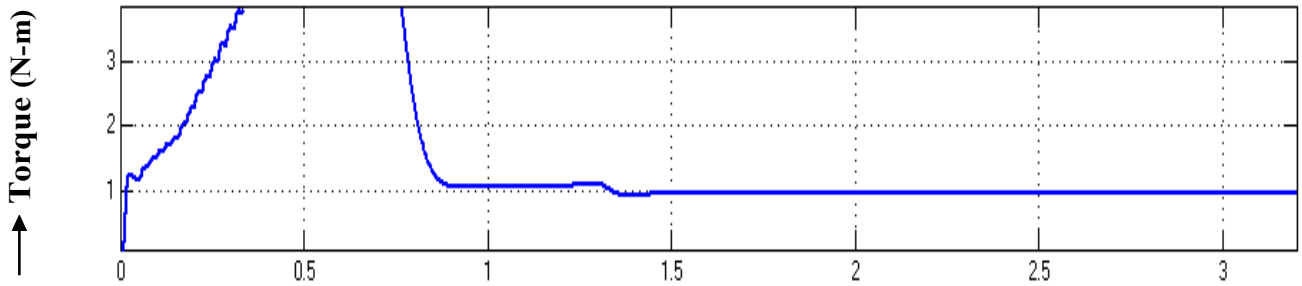

Figure10: Motor Torque

Circuit-diagramof PR-PRcontrolled closed two loop Bootstrap converter with SVM inverteris appeared in Figure 11.

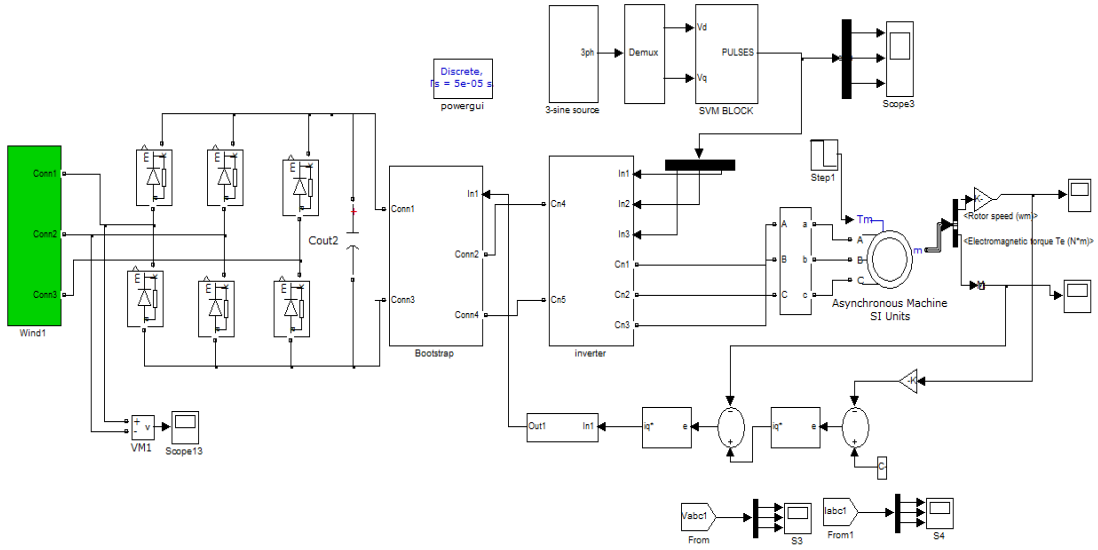

Figure11: Circuit diagramof PR-PR controlled closed two loop Bootstrap converter with SVM inverter

Input voltageofBSCSVMIIM is outlined in Figure 12. The value of input voltage is 175 Volts. Circuit diagram of boot-strap converter is shown in Figure 13.

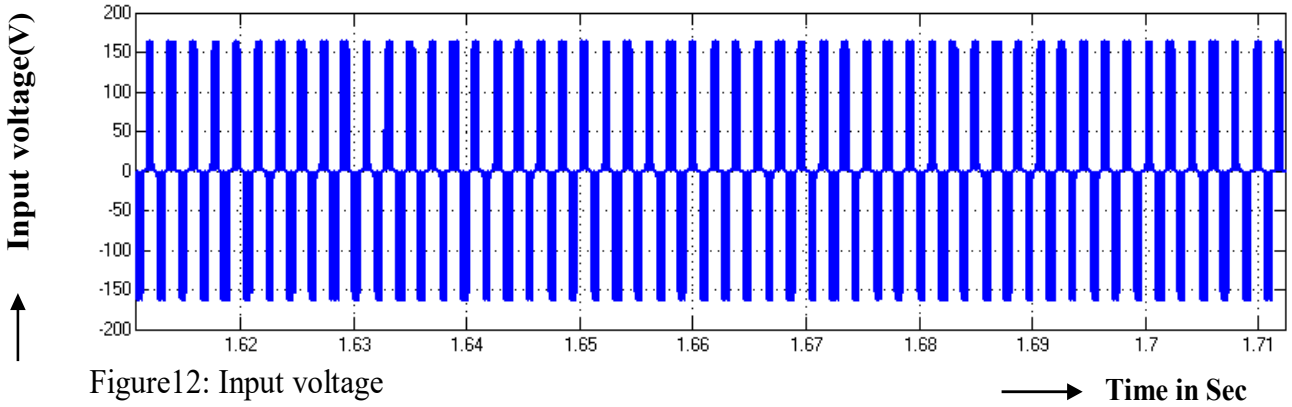

Figure12: Input voltage

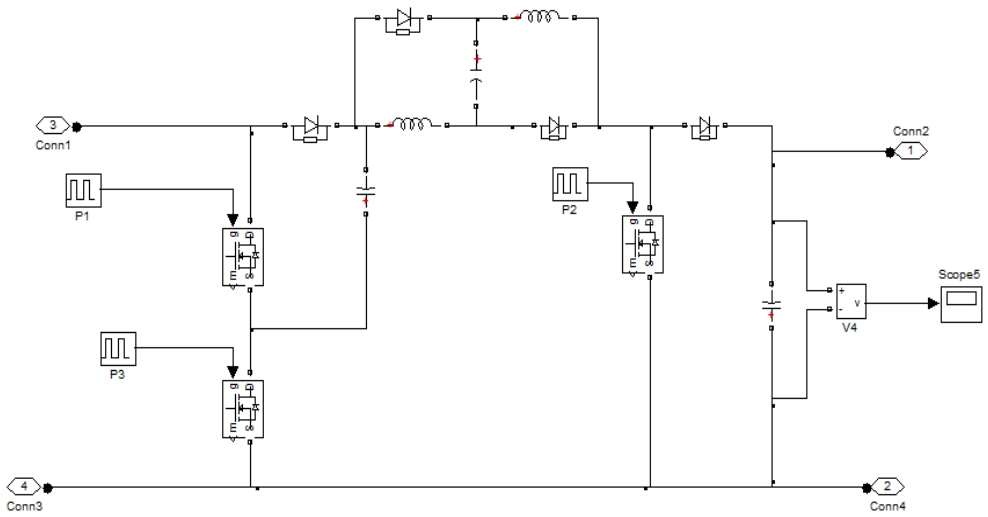

Figure13: Circuitdiagram of bootstrap converter

The Voltage across boot-strap converter and the motor load are figured in Figure 14 and 15. The Voltage across bootstrap converter is 399 Volts and Voltage across motor load value is 400 Volts.

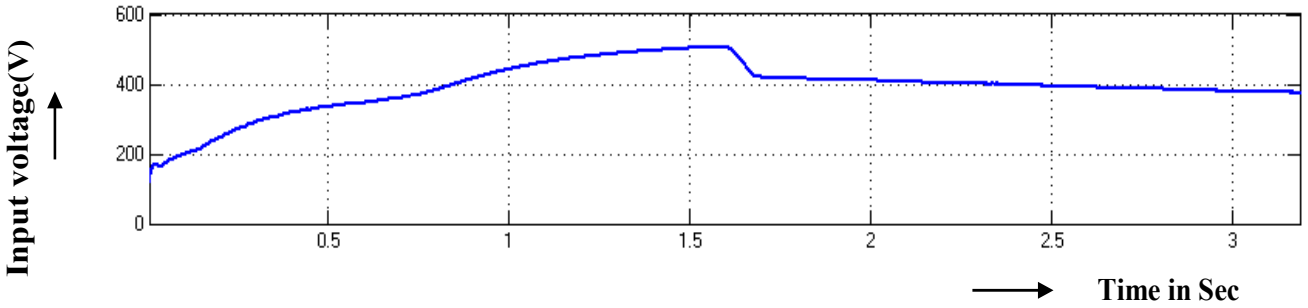

Figure14: Voltage across boot-strap converter

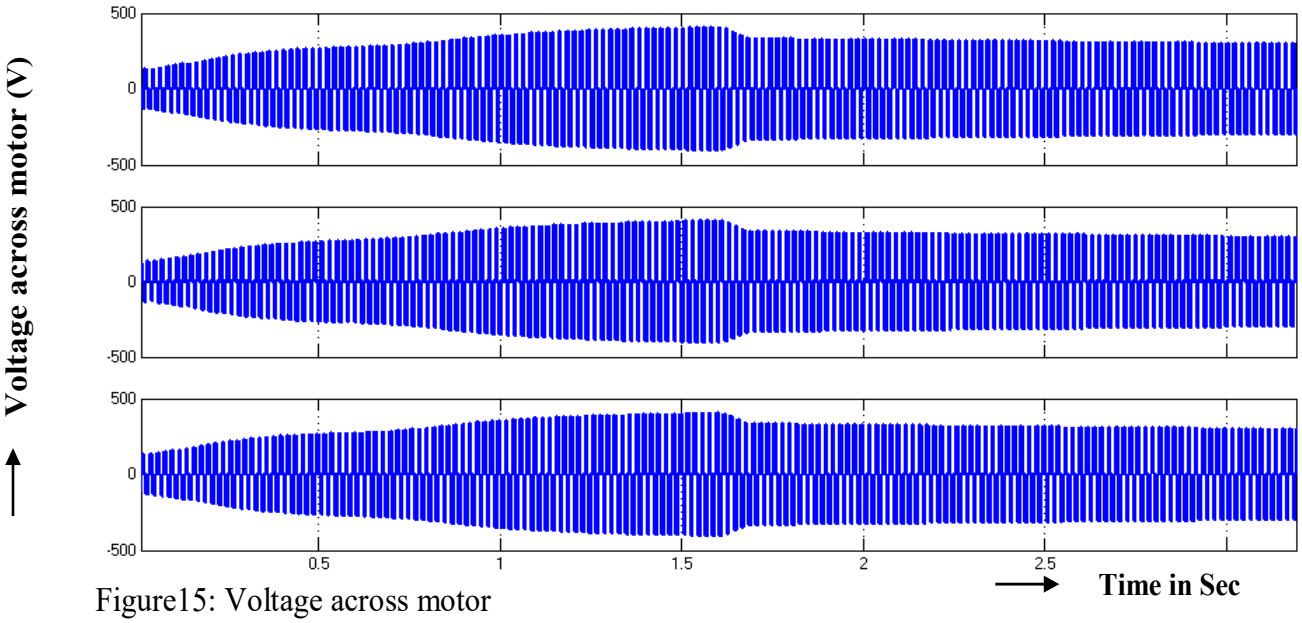

Figure15: Voltage across motor

Motor speedofBSCSVMI-IMis 1450 RPM and is appeared in Figure 16. Motor speed zoom out ofBSCSVMI-IM is 1289 RPM and is appeared in Figure 17. The Motor Torqueis 0.9 N-m is sketched in Figure 18.

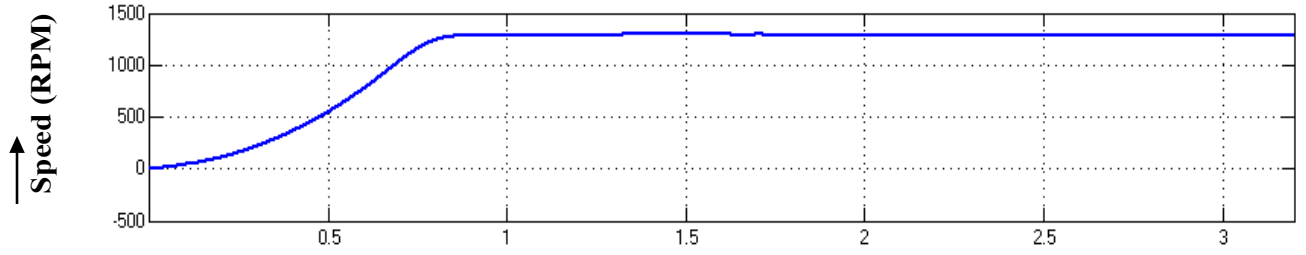

Figure16: Motor speed

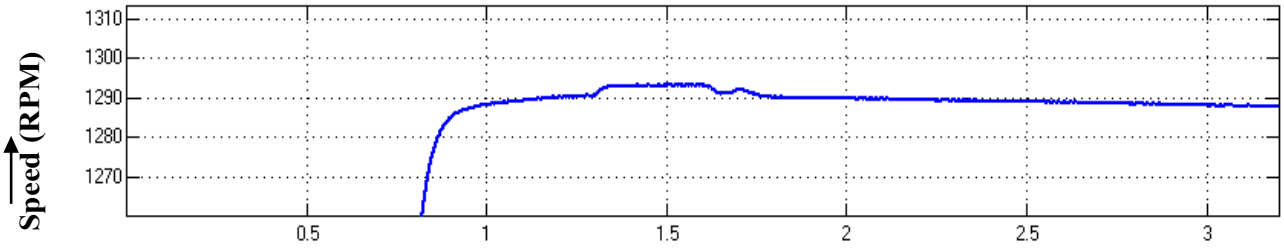

Figure17: Motor speeds zoom out

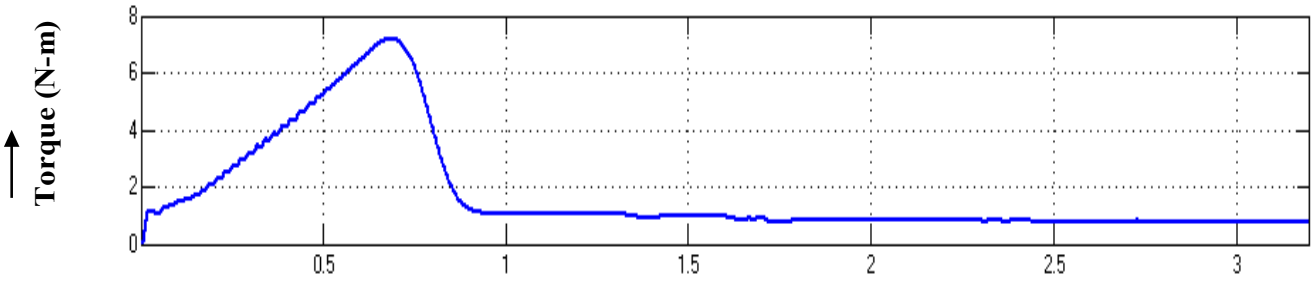

Figure18: Motor Torque

Circuit-diagramof PI-Hysteresis controlled closed two loop Bootstrap converter with SVM inverter is appeared in Figure 19.

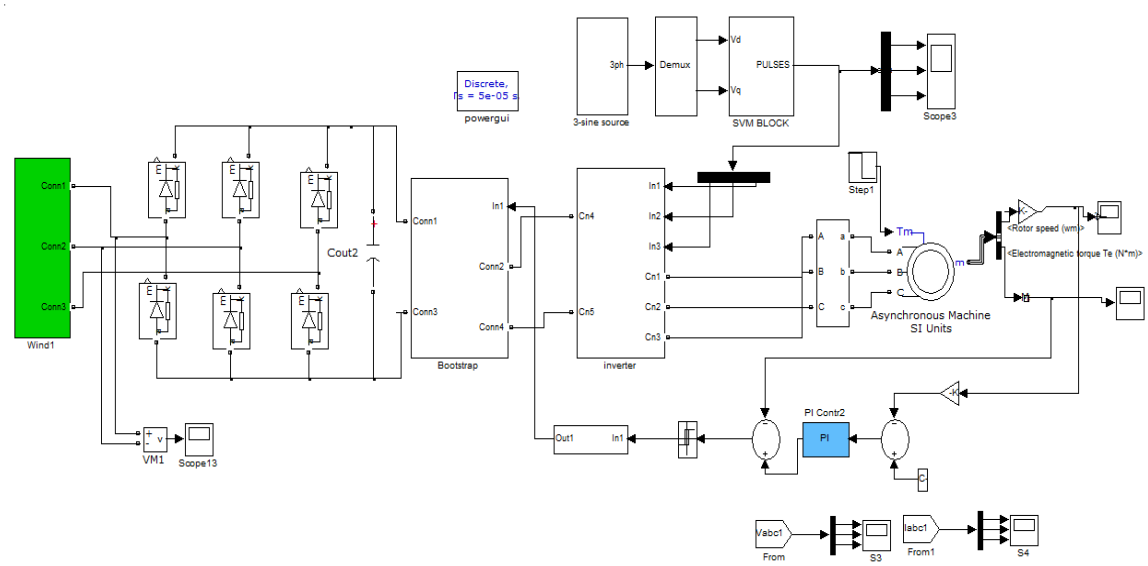

Figure19: Circuit diagram of PI-Hysteresis controlled closed two loop Bootstrap converter with SVM inverter

Input voltageofclosed two loopBSCSVMIIM with PI-Hysteresis controller is sketched in Figure 20. The value of input voltage is 170 Volts. The Circuit diagram of boot-strapconverter is ketched in Figure 21.

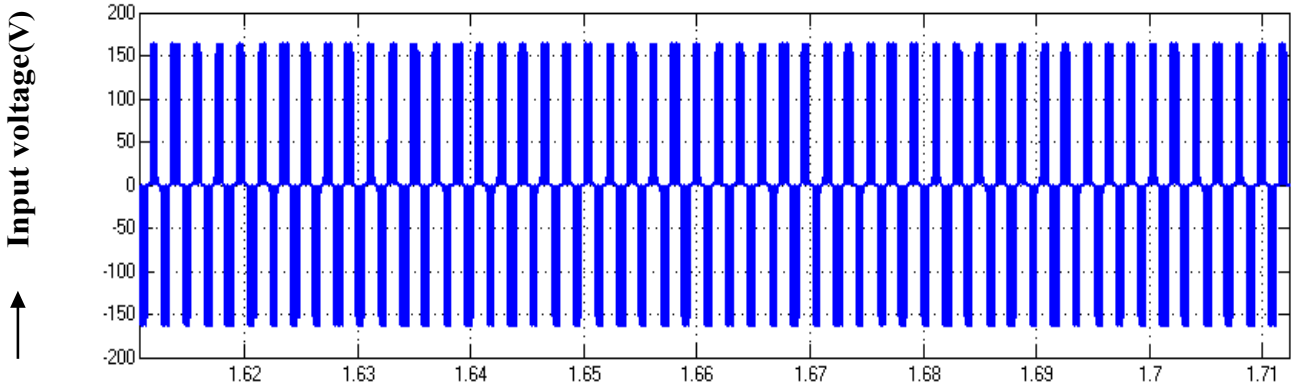

Figure20: Input voltage

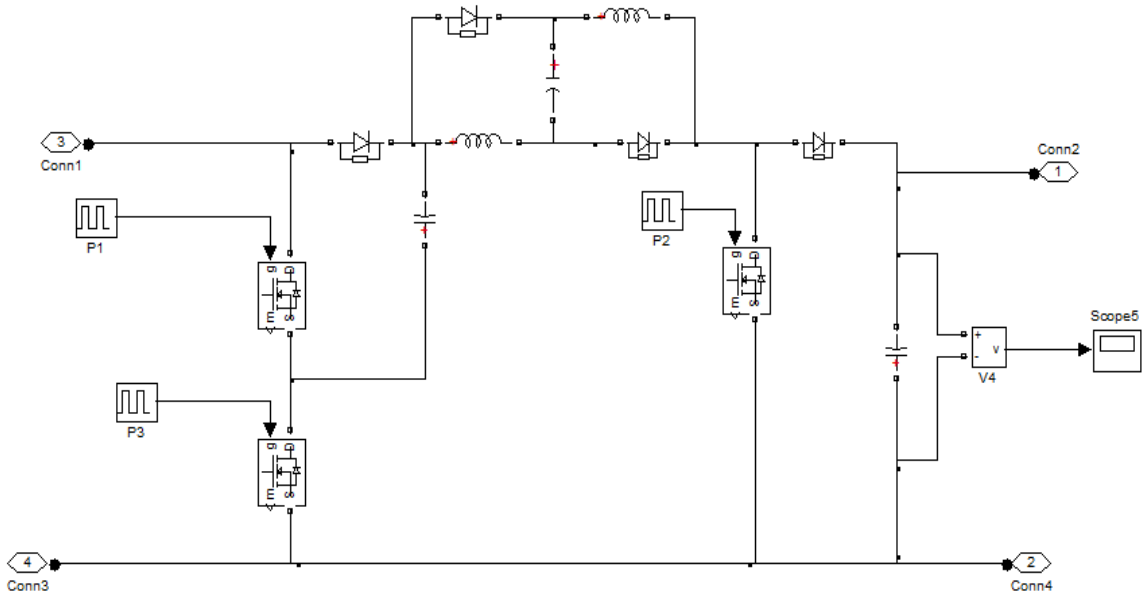

Figure21: Circuit diagram of bootstrap converter

The Voltage across bootstrap converter and the motor load are indicated in Figure 22 and 23. The Voltage across bootstrap converter is 480 Volts and Voltage across motor load value is 400 Volts.

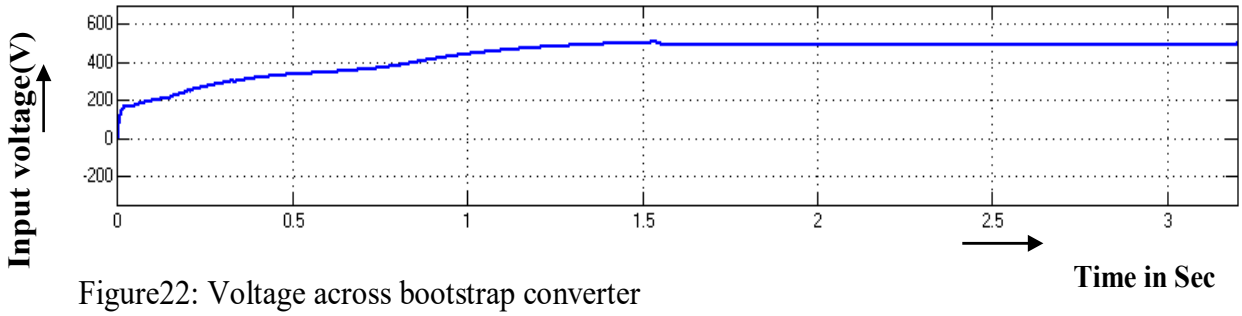

Figure22: Voltage across bootstrap converter

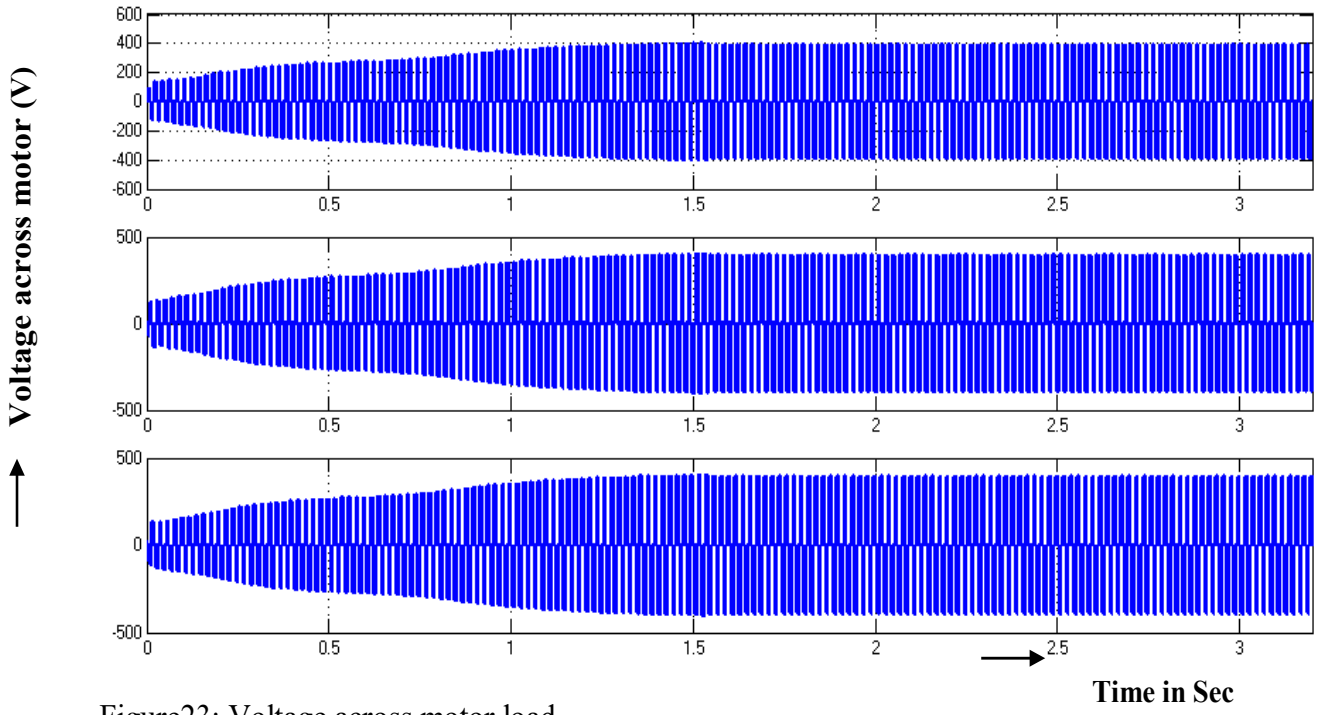

Figure23: Voltage across motor load

Motor speedwith SVM inverter ofclosed two loopFOPID controller is 1290 RPM and it is sketched in Figure 24. Motor speed zoom out along with SVM inverter of closed two loopFOPID controller is 1290 RPM and is sketched in Figure 25. The Motor Torque is sketched in Figure 26.

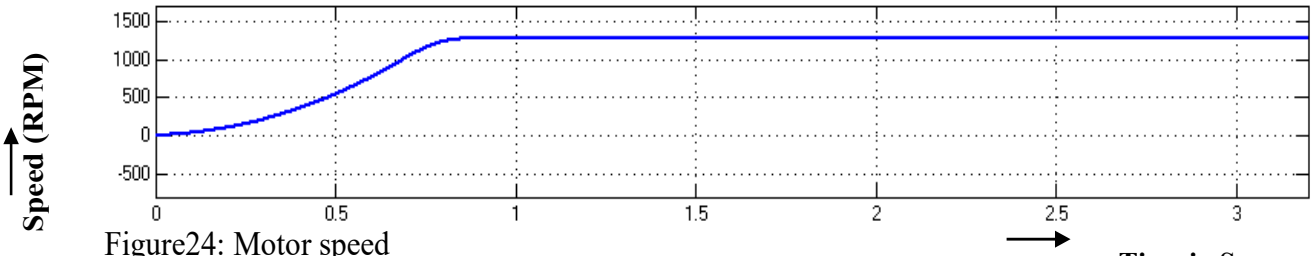

Figure24: Motor speed

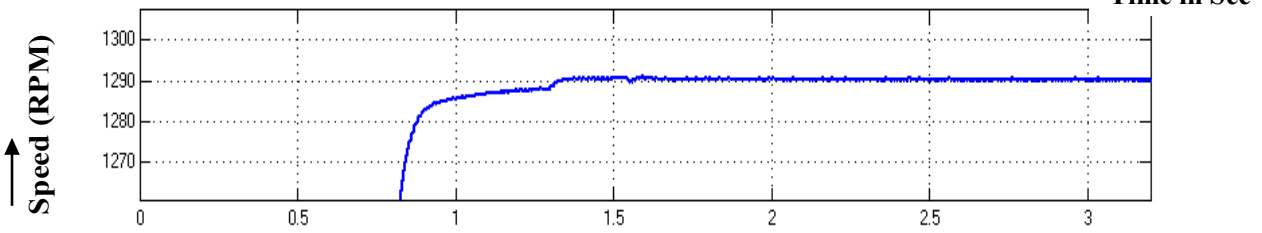

Figure25: Motor speeds zoom out

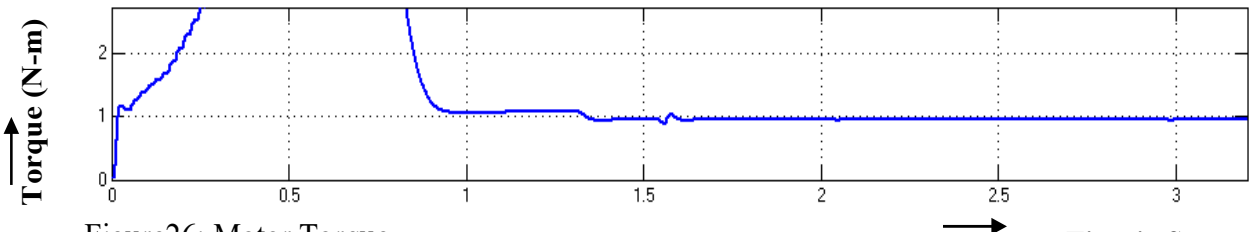

Figure26: Motor Torque

Figure 27 outlines the BarChartof motor speed using PIC and HC along with its various TimeDomain Parameters. The table-1 explains the comparative relation of TimeDomain-Parameters for motor-speedusing PIC-HC and PR-PR, the 'Tr (rise-time)' is lessened from 1.34

Sec to 1.32 Sec; ‘Ts (Settling-time)’ is lessened from 1.75 Sec to 1.60 Sec; ‘Tp (peak-time)’ is lessenedfrom1.55 Sec to 1.47 Sec; ‘Ess (Steady-stateerror)’ is lessened from 0.5 RPM to 0.3 RPM.

Table-1

The comparative relation of Time Domain Parameters for motor speed using PI-HC and PR-PR

Controller	Tr(S)	Ts(S)	Tp(S)	Ess(RPM)
PR-PR	1.34	1.75	1.55	0.5
PI-HC	1.32	1.60	1.47	0.3

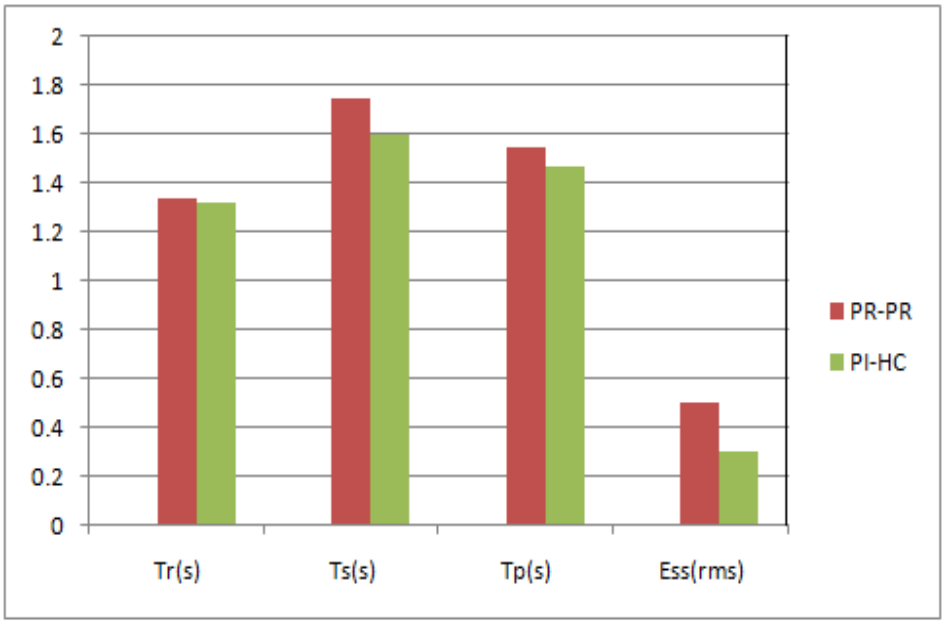

Figure 27.BarChartof Time Domain Parameters (Tr, Ts, Tp, Ess) for motor speed using PIC-HC and PR-PR

Figure 28 outlines the BarChartof motor torque using PIC-HC and PR-PR along with its variousTimeDomainParameters. The table-2 explains the comparative relation of Time Domain-Parameters for motor-torque using PIC-HC and PR-PR.By using PIC-HC, the ‘Tr (rise-time)’ is lessened from 1.35 Sec to 1.33 Sec; ‘Ts(Settling-time)’ is lessened from 1.82 Sec to 1.67 Sec; ‘Tp (peak-time)’ is lessenedfrom 1.71 Sec to 1.67 Sec; ‘Ess (Steady-stateerror)’ is lessened from 0.3 N-m to 0.1 N-m.

Table-2

The comparative relation of Time Domain Parameters for motor torque using PI-HC and PR-PR

Controller	Tr(s)	Ts(s)	Tp(s)	Ess(N-m)
PR-PR	1.35	1.82	1.71	0.3
PI-HC	1.33	1.67	1.39	0.1

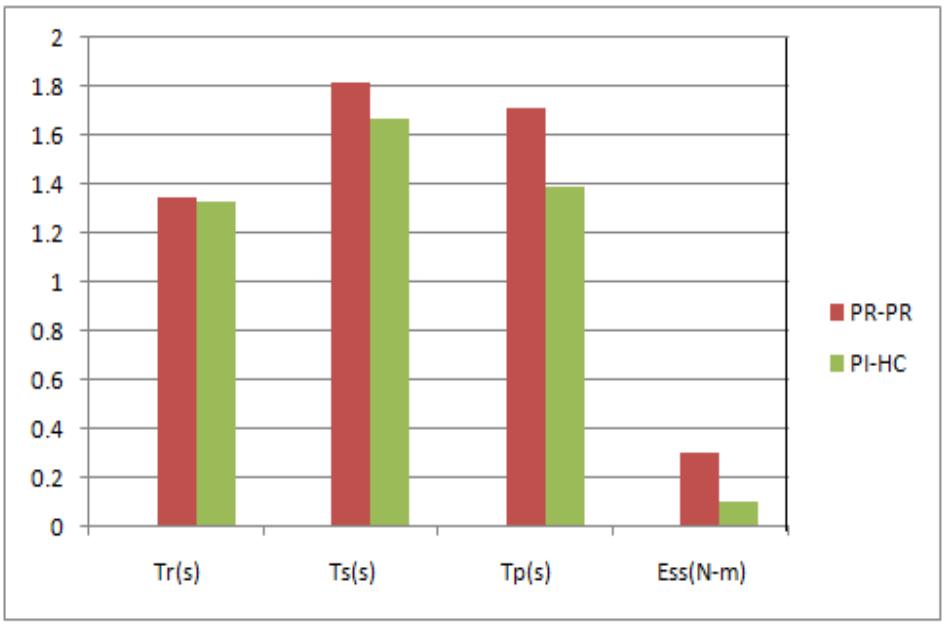

Figure 28.BarChartof Time Domain Parameters (Tr, Ts, Tp, Ess) for motor Torque using PI-HC and PR-PR

5 Experimental Results

Hard-ware snap-shot of IM based Boot-strap converter with SVM invertersystem is sketched in Figur29. The hardware of BCSVMI consists of Motor load,inverter panel, BCB,control panel and RBC panel. The snap shot of the input voltage is outlined in Figure30.

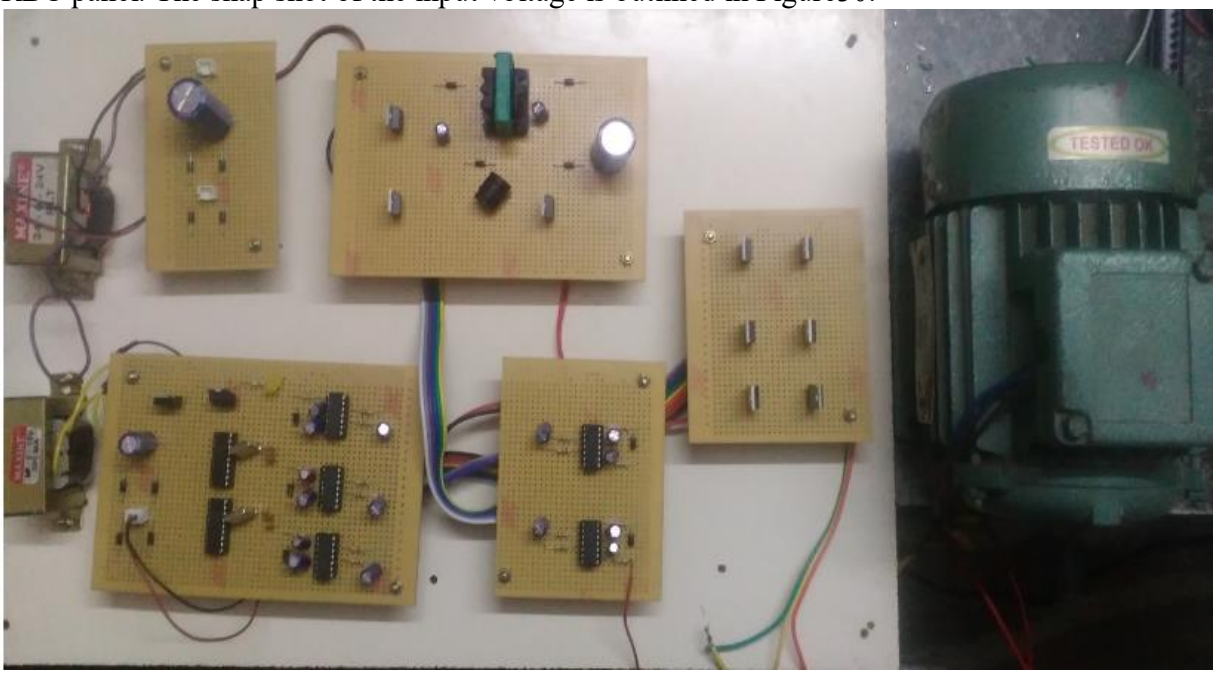

Figure29: Hardware snap shot

The Switching pulse for bootstrap converter across S1 and S2 is appeaed in Figure 30.

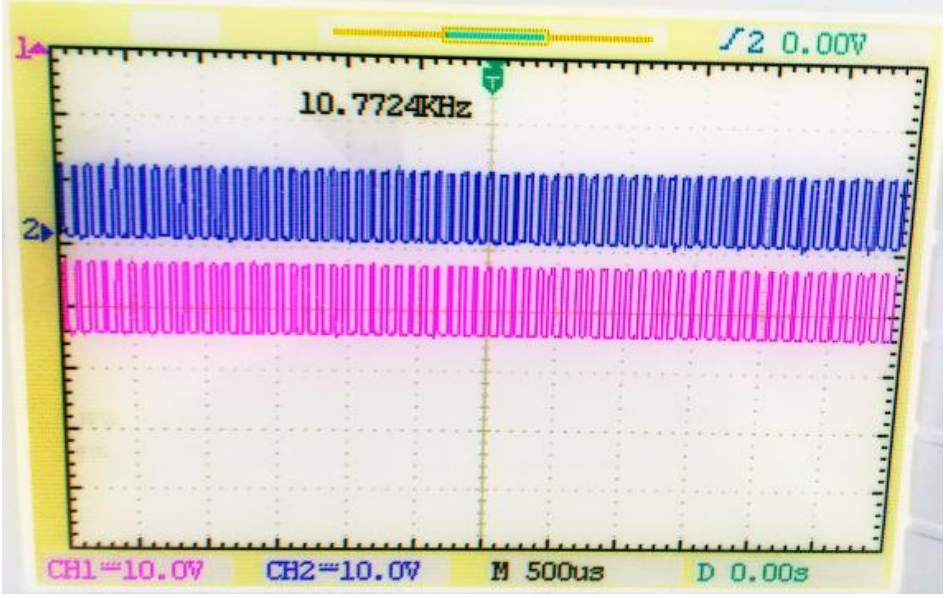

Figure 30: The Switching pulse for bootstrap converter across S1and S2,

Switching-pulse for inverter M1, M2and M3, M6are outlined in Figure 31 and Figure 32 respectively. From Figure31 it is clear that its peak to peak value is increased.

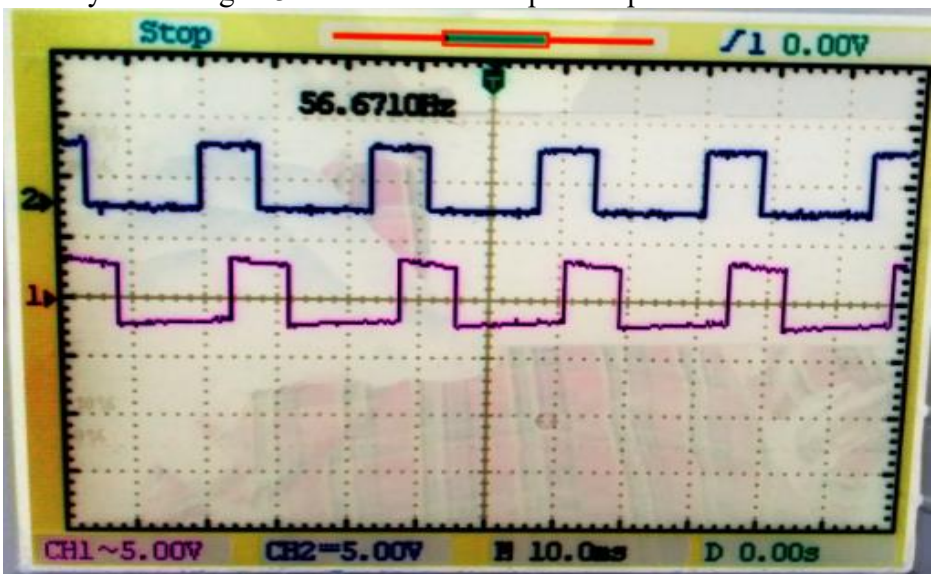

Figure31: Switching pulse for inverter M1,M2

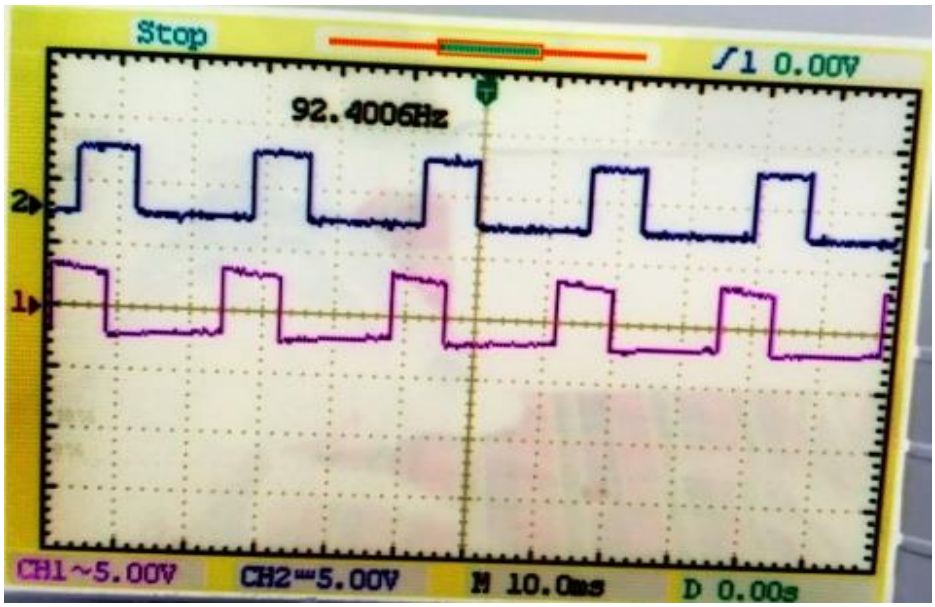

Figure32: Switching pulse for inverter M3,M6

The Motor load voltage and the motor current areoutlined in Figure 33 and 34 respectively.

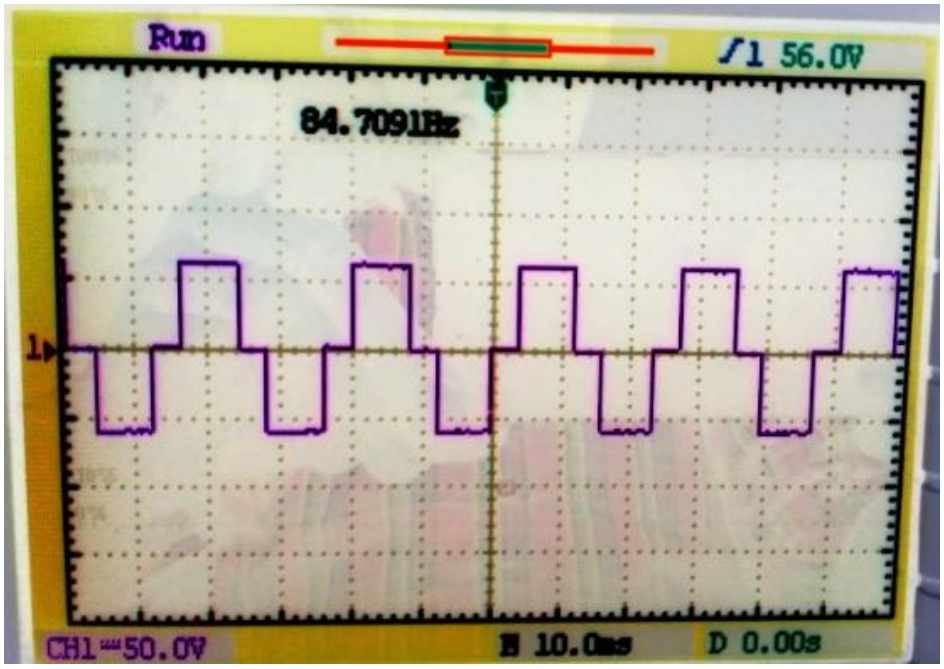

Figure33: The motor load voltage

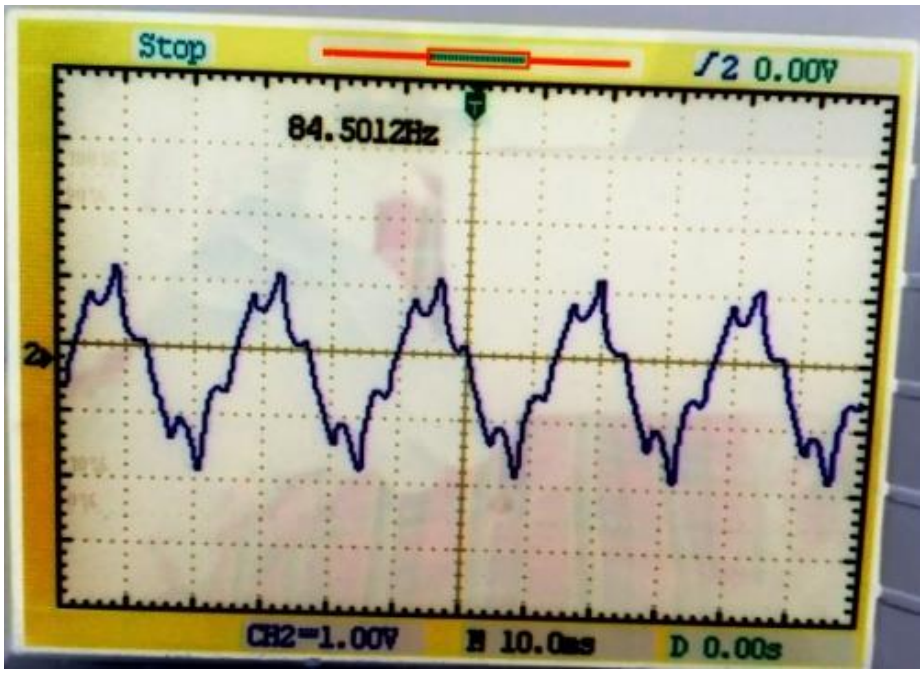

Figure34: The motor load current

6 Conclusion

The Closed two loop BSC- SVMI systems along with PR-PR and PI-HC are designed andsimulated using the simulation tool Mat-labSimulink. The outcomes of the simulations for the closed two loop systems with PR-PR and PI-HC are tabulated. The time domain parameters are obtained and the values are compared and represented using bar chart. The Ts(settling time) is reduced to 1.67 Sec and Ess(steady state error) is reduced to 0.1N-m by using HC(Hysteresis controller). From the obtained response of outcome of PI-Hysteresis Controller system is better than thePR-PRcontrolled system. The hard-ware of BSC-SVMI is fabricatedand tested. The experimental results of SVMI have been presented for validation purpose. The proposed system has few benefits like fast responseandlow harmonics. The downside of bootstrap converter is that it is appropriate for low power. The presentwork brings out the performance of PI-hysteresis controlled BSC-SVMIIM. The investigations on Slide Mode controlled BSC-SVMIIM will be done in future.

References

[1]. YongKeun-Lee,JongKwangKim(2019), “Analysis of bootstrap circuit operation with an inverted PWM drive scheme for a three phase inverter for a brushless dc motor drive” Canadian Journal of Electrical and Computer Engineering (Volum-42, Issue1, winter2019). 10.1109/CJECE.2019.2891850.

[2]. "DIPIPM application note bootstrap circuit design manual" in Dual in Line Package Intelligent Power Module, Tokyo, Japan: Mitsubishi ElectronicCorp, 2016.

[3]. K.Mainali, S.Madhusoodhanan, A. Tripathi, K.Vechalapu, A.De and S.Bhattacharya, "Design and evaluation of isolated gate driver power supply for medium voltage converter applications", Proc. IEEEAppl. Power Electron. Conf. Expo., pp1632-1639, 2016.

[4]. Ye, Zichao; Lei, Yutian; Liu, Wen Chuen; Shenoy, Pradeep S.; PilawaPodgurski, Robert Carl Nikolai (2019). Improved bootstrap methods for powering floating gate drivers of flying capacitor multilevel converters and hybrid switched capacitor converters. IEEE Transactions on PElectronics, 1–1. doi10.1109/TPEL.2019.2951116

[5]. Y.Lei, W.Liu and RCN. PilawaPodgurski, "An analytical method to evaluate and design hybrid switched capacitor and multilevel converters", IEEE Trans. Power Electron., vol33,no.3,pp 2227-2240, Mar2018.

[6]. BZhu, SHu, GLiu, YHuang and XShe, " Low voltage stress buck boost converter with a high voltage conversion gain", IEEE Access, vol8,pp:95188-95196, May2020.

[7]. FPouladi, HFarzanehfard, EAdib and HLeSage, "Single switch soft switching LED driver suitable for battery operated systems", IEEE Trans. Ind. Electron., vol 66 no. 4, pp. 2726-2734Apr2019.

[8]. ShasanpourA, Baghramianand HMojallali, IEEE Trans. PElectron., vol35, no. 8, pp:8088-8101,Aug2020.

[9]. L.Jia, X.Sun, Z.Zheng, X.Ma and L.Dai, Multimode smooth switching strategy for eliminating the operational dead zone in non-inverting buck–boost converter",IEEE Trans. PElectron., vol35, no.3, pp. 3106-3113, Mar2020.

[10]. GZhang, Yuan, S.SYu, NZhang, YWang and YZhang," Advanced-four-mode-modulation based four switch non inverting buck-boost converter with extra operation zone", IET-Power Electron., vol. 13,no. 10,pp. 2049-2059, Aug2020.

[11]. SLiu, XXieand LYang, " Analysis modeling and implementation of a switching bi-directional buck-boost converter based on electric vehicle hybrid energy storage for V2G system", IEEE Access, vol 8, pp. 65868-65879,Apr2020.

[12]. FPouladi, HFarzanehfard and EAdib, "Battery operated soft switching resonant buck-boost LED driver with single magnetic element", IEEE Trans. PElectron., vol34, no.3, pp.2704-2711, Mar2019.

[13]. HYJung, SHKim, BMoon and SHLee, " A new circuit design of two switch buck-boost converter",IEEEAccess, vol.6, pp. 47415-47423, Aug2018.

[14]. NZhang,

[15]. GZhang and KWSee, "Systematic derivation of dead zone elimination strategies for the non-inverting synchronous buck–boost converter", IEEE Trans Power Electron., vol. 33, no.,4, pp. 3497-3508,Apr2018.

[16]. JWang, HWu, TYang, LZhang and YXing, " Bidirectional three phase DC-AC converter with embedded DC-DC converter and carrier based PWM strategy for wide voltage range applications", IEEE Trans. IElectron., vol. 66,no. 6, pp. 4144-4155, Jun2019.

[17]. YonghengYang, AKatherine, KimFredeBlaabjerg and AriyaSangwongwanich, Advances in Grid ConnectedPhotovoltaicPowerConversion Systems, Woodhead Publishing, Aug2018.

[18]. Geeta,; Aspalli,MS. [IEEE 2020 International conf., on power electronics &iot applications in renewable energy and its control(PARC) Mathura, UttarPradesh, India(2020.2.28-2020.2.29)]2020Intern. Conf., onPElectronics&IoT Apps inrenewableenergyanditscontrol(PARC)proportionalresonantcontrollerforsemiconverter-three phase VSI fedinductionmotordriveto enhancetimeresponse 169174. doi:10.1109/parc491932020236584.

[19]. Premila,TR;KrishnaKumar,R (2019). Proportional resonant control of PV fed cascaded boost reboost inverter system. The International Journal of Electrical Engineering& Education, 002072091988379, doi10.1177/0020720919883799.

[20]. Omrani, Siamak; Azizian, Mohammad Reza (2019). [IEEE2019 Iranian Conference on RenewableEnergy&Distributed Generation (ICREDG)Tehran, Iran (2019.6.11-2019.6.12)]2019, Iranian Conference on RenewableEnergy&DistributedGeneration (ICREDG)PR FuzzyControl Improvement of Doubly Fed InductionGeneratorDuring Grid Faults. , 1–6. doi:10.1109/-ICREDG47187.2019.190165.

[21]. GauriA.; Vinod, B.R.; ShinyG. (-2019). [IEEE 2019 International Conference on Electrical, Computer and CommunicationTechnologies (ICECCT) Coimbatore, India (2019.2.20-2019.2.22)] 2019 IEEE InternationalConferenceon Electrical, Computer and Communication Technologies(ICECCT)VectorControl Method for Induction Motor Drive Based on HysteresisControllerandPIControllerComparative Study,1–6. doi:10.1109/-ICECCT.2019.8869497.

[22]. Talib, MHN.; IsaSN. Mat; HamidonHE.; IbrahimZ.; RasinZ. (2016). [IEEE2016 InternationalConference on Power and Ener. PECon) Melaka, Malaysia (2016.11.28-2016.11.29), IEEEInternational Conference on Power and Energy(PE Con) Hysteresis current control of induction motor drives using dSPACE DSP controller, pp. 522–527.-doi10.1109/PECON.2016-7951617.

[23]. MdHairulNizamTalib, SitiNoormizaBintiMatIsa “Hysteresis current control of induction motor drives using dSPACE DSP controller” 2016, IEEE International Conferenceon Power and Energy(PECon), Nov.2016, DOI: 10.1109/PECON2016-7951617.

Hardware Implementation of Hybrid Renewable Energy Source for Integrated Fed Micro-Grid

Dr. Balachandra Pattanaik [1], Dr.K.Sakthivel[2], Dr.S.Priya[3]
balapk1971@gmail.com[1], sakthivelk.eee@bharathuniv.ac.in [2],
priya.s@ametuniv.ac.in [3]

Bule Hora University, Ethiopia,Africa [1], Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India [2], AMET Deemed to be University, Chennai, Tamil Nadu, India [3]

Abstract. Because of the rapid development progress of Power natural philosophy strategies, applications with electrical phenomenon (PV) power and wind generation are swollen basically the employment of sun supercharged And wind energies severally wouldn't offer an immersed yield voltage that the solar power and Wind energy square measure consolidated can improve the characteristics of every alternative. To diminish the ability demand on the normal power age space, we have a tendency to propose this method. Various ways square measure by and by for age of intensity utilizing Solar-Wind Hybrid System with most electrical outlet pursuit (MPPT). Steady voltage strategy is used for much extreme power exchange. This strategy has to be compelled to have some key highlights to create the potency. Above all this article proposes a completely unique technique for implementing MPPT controller in our hybrid renewable energy generation system known as FLC rule for higher potency than alternative strategies. The higher than explained system is intended and modeled for output results were obtained.

Keywords: Fuzzy Logic(FL) algorithm, Maximum Power Point Tracking (MPPT).

1 Introduction

A making system with a solitary power supply non-traditional energy [6] doesn't provide power needed due to warming, new energy sources ought to be utilized for instance, sun destined and wind energy property power supply is planning to be additional vital. Sun destined and Wind energy is while not contamination and endless. All districts of the globe have inexhaustible assets of some kind. Hybrid system could be a high performance compared to unconventional supply. As brooding about these 2 energy assets, the yield is not certain due to ecological or day and night circumstances [9-12]. That's the yield of Solar-Wind power is not certain one could offer additional power and different could offer less power or no power. Thus it needed to balance out yield voltage from this method. These 2 systems associated parallel to every different, that within the event that one supply is not accessible, at that time the opposite one will modify the system [15]. During this manner, these 2 systems will work on an individual basis and at constant time moreover. During this paper a replacement technique mistreatment FLC algorithmic rule for the planned MPPT for the hybrid grid is enforced for providing higher potency and dependableness.

2 Proposed Hybrid System

During this paper a noval methodology for MPPT controller is enforced for the aim of higher potency from each wind and alternative energy system the tactic used here is formal logic Controller (FLC) formula. The turbine used here is magnet Synchronous Generator (PMSG) with parallel affiliation of electrical phenomenon power generation with battery bank for providing higher dependableness.

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The electrical converter used here is electrical phenomenon supply electrical converter that is controlled by PI controller the facility from our hybrid grid is reborn from DC to AC through ZSI (Z-Source Inverter) and also the extracted power is in addition to the grid and may be provided to the specified load if required.

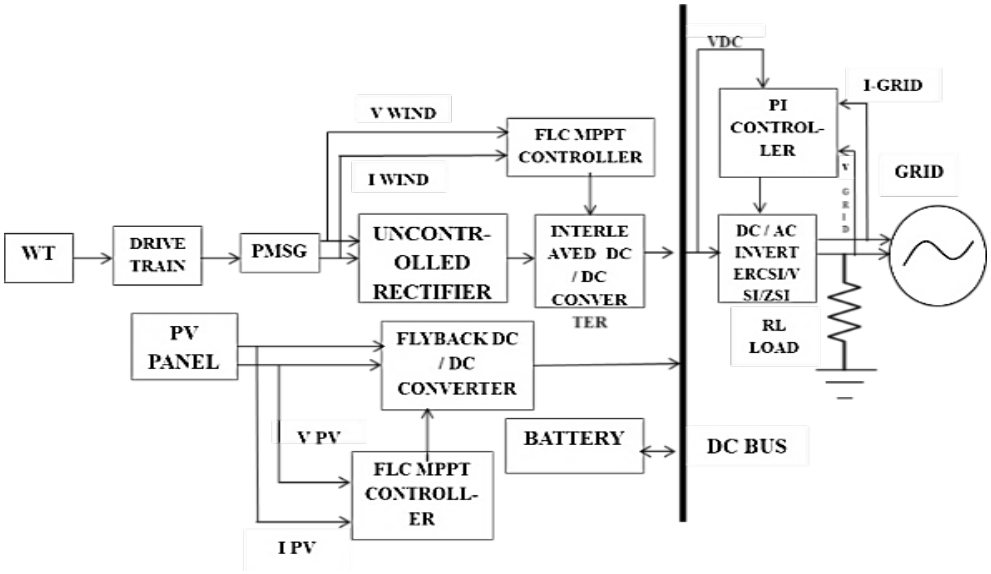

Fig.1 Block illustration of planned Hybrid Renewable Energy Fed micro-grid

2.1 Microgrid

Microgrid represents a completely new approach to desegregation Distributed Energy Resources (DER), particularly tiny generators, into utility distribution systems. Ancient approaches for desegregation DER specialize in the impacts on grid performance of 1, two, or a comparatively tiny variety of on an individual basis interconnected micro generators. An important feature of the Microgrid is its presentation to the encompassing distribution grid as one manageable system. Key to the present characteristic is reliance on the flexibleness of advanced power natural philosophy that controls the interface between micro sources and therefore the close AC system.

The central advantage of a Microgrid is that it will be considered a controlled part inside the facility system which will be operated as one dispatchable load, which is able to respond in seconds to distribution system desires. Customers additionally get pleasure from a Microgrid that's designed to fulfill their native desires, e.g., for uninterruptible power supply/enhanced native dependability, reduced feeder losses, supported native voltages/correction of voltage sag, and exaggerated potency through use of waste heat.

2.2 Fuzzy Logic Controller

Fuzzy Logic may be a specific space of concentration within the study of computer science and relies on the worth of that data that is neither undoubtedly true nor false. No inheritable information is a robust weapon to combat the unsought effects of the system response. In most applications there are some points that are the common space. Data that lies among the common space needs to be studied, stored, and accustomed quantify and to classify the information. This enables for good manipulation of the information structure so as to form illation to an answer. Data that falls in this common space will be stratified, aged, and "best guess" created when analysis of this "gray" data.

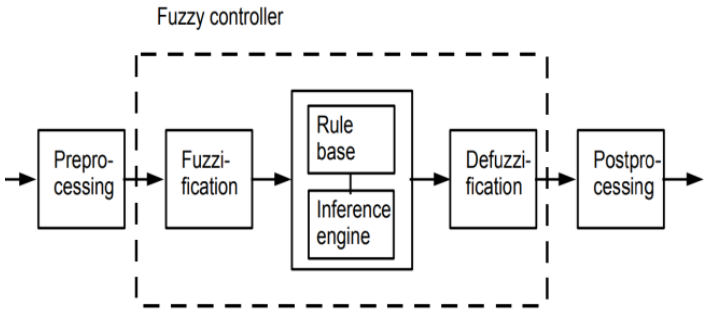

Fig.2 Fuzzy controller Working Method

2.3 Interleaved boost converter

An Interleaved boost converter ads further benefits like reduced ripple currents in each the input and output circuits. Higher potency is complete by ripping the output current into 2 ways, well reducing I2R losses and electrical device AC losses. Figure one shows the fundamental interleaved boost topology. When s1 activates, current ramps up in L1 and slope reckoning on the input voltage, storing energy in L1. D1 is off throughout this point since the output voltage is bigger than the input voltage. Once s1 turns off, D1 conducts delivering a part of its keep energy to the load and therefore the output condenser. Current in L1 ramps down with a slope keen to the distinction between input and output voltage. One half a switching later, s2 conjointly activates finishing identical cycle of events. Since each power channels are combined at the output condenser, the effective ripple frequency is double that of a traditional single channel boost regulator.

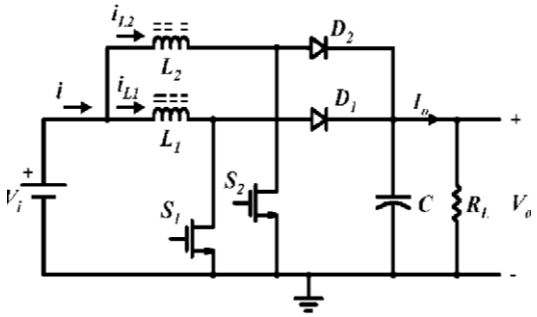

Fig.3 Interleaved boost converter

The interleaved boost converter will increase the voltage output to the twice the amount from the input voltage. This unique quality makes this converter more efficient but it has its own draw backs as it has two semiconductor switches will increase semiconductor loss.

3 Designing and implementation of proposed method for maximum power extraction

This proposed maximum power extraction system consists of various elements to tune the system for better performance, those techniques which were explained above is implemented in hardware. The total proposed system hardware model is shown in the figure 4. The power

generated from solar and wind power is fed into interleaved boost converter and it is further sent to inverter circuit where the proposed PWM technique is used to give gate pulse to the semiconductor devices present in the circuit. The method used for improving the dc voltage from solar is MPPT controller. The solar MPPT model is modeled with PIC microcontroller as shown in the figure 4.

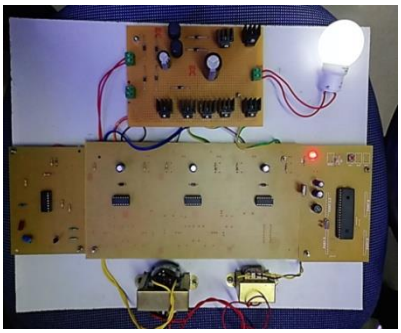

Fig.4. Simulation model for proposed hybrid wind solar generation system

The wind power system consists of PMSG (permanent magnet synchronous generator) which is a synchronized steady output at variable input to get constant power output the simulation model of proposed PMSG based wind turbine.

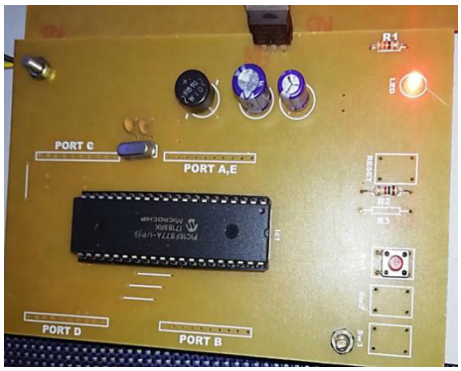

Fig.5 PIC Microcontroller hardwired Model

The power generated by solar and wind power system is coupled to the interleaved boost converter which is controlled using a centralized FLC controller as shown in the figure 5.The Hardware model is the MPPT with FLC implementation for the generation of pulse for boost converter.

The voltage converter DC/DC will boost the voltage for the required level using the pulse from MPPT-FLC combination technique which produces an efficient way of dc output voltage generation. The gate driver circuit diagram is as shown in the figure 6.

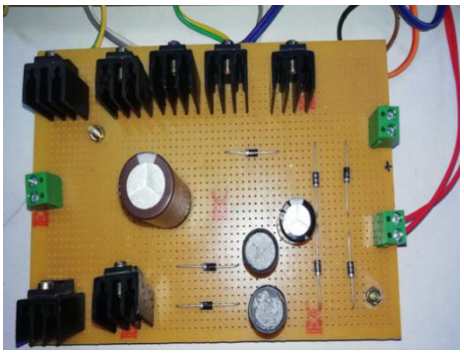

Fig.6 PMSG base wind turbine simulation model

4 Hardware Model Results

The Hardware is done through power electronics component it gives good platform for engineering design in mathematical. The project is designed and modeled using power electronics components and the output is made through millimeter and CRO. Input solar DC voltage waveform is as shown in the figure 7.

Fig.7. Solar output voltage waveform

The wind power is modeled as single phase AC output voltage waveform is as shown in the figure 8.

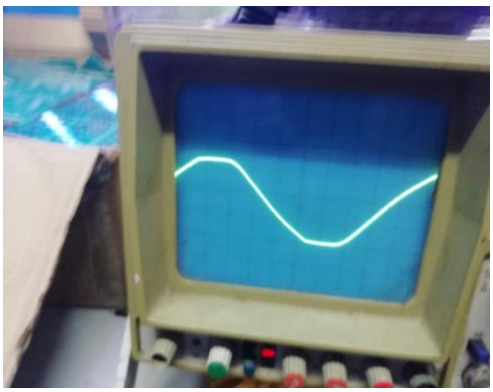

Fig.8 Wind output voltage waveform

The PWM pulse waveform is as shown in the figure 9.

Fig.9. PWM pulse output

5 Conclusions

From then on top of simulation results and output graphs we are able to return to a conclusion that out projected methodology of hybrid wind and solar energy generations output voltage is proscribed because of its nature. This condition is overwhelmed with the help of our proposed MPPT controller with FLC implementation in interleaved boost converter. This proposed technique has proved to be the best technique as compared to the traditional way of extracting maximum power from the hybrid wind solar generation system. The voltage gathered from wind and solar to be less as of 12 volt which is increased to about 113 volt as shown in the simulation diagram. This proposed method provides less ripple and harmonics which is also verified using the simulated proposed system. The scope of this project can also expanded to very lengthy extent as the application of renewable energy poses good innovative technology in upcoming days.

References

[1] S. Prakash & S.P.Vijayaragavan, “Design and Optimization of High Efficient Charge Controller for a Solar Photovoltaic System Power Generation”, International Journal of Pure and Applied Mathematics, Volume 119 No. 12 2018, 4057-4065.

[2] S. Prakash & V.Jayalakshmi, “Hybrid Solar-Wind Energy System with Mppt Using Cuk- Sepic Fused Converter”, International Journal of Pure and Applied Mathematics, Volume 119 No. 12 2018, 6851-6859.

[3] S. Prakash & K.Sakthivel, “APWM Based Multiple Output ZVS DC/DC Converter”, International Journal of Pure and Applied Mathematics, Volume 119 No. 12 2018, 7665-7671.

[4] S. Prakash & K.Sakthivel, “Battery Energy Storage System for A Stand Alone Windmill -Based On State Of-Charge (SOC) Balancing Control”, International Journal of Pure and Applied Mathematics, Volume 119 No. 12 2018, 7691-7700.

[5] Balachandra Pattanaik,“Maximum Intermediate Power Tracking For Renewable energy Service” to publish in published in Springer Lecture Notes on Data Engineering and Communications Technologies (ISSN: 2367-4512),2020,pp462-468

[6] Balachandra Pattanaik, etal. ,”Zeta DC-DC Converter Based on MPPT Technique for BLDC Application”MC Square Scientfic Resarch Vol. 11,No.2,2019pp. 1-12

[7] Balachandra Pattanaik, etal. “Fault Detection and Recovery in Automotive Embedded System using Rough and Fuzzy Rough Sets” LNNS SPRINGER PUBLICATION, SINGAPORE Pte Ltd. 2018Volume – 1, pp. 233-242.

[8] Balachandra Pattanaik, etal. “SEPIC converter with PV system BLDC motor control for bidirectional power grid using sliding mode controller”, www.jcreview.com/index.php?mno ISSN-2394-5125 VOL 7, ISSUE 11, 2020, pp. 3962-3967

[9] Balachandra Pattanaik, etal. International Conference on “Fault Detection in Embedded System Using Rough and Fuzzy Rough Sets” WSEAS-2011,ACM Digital library (paper reference number 659-549),pp. 405-411.

ANN Application of the APF Improved for DG Unit System Reliability

T.Santhosh kumar[1], Dr.J.Shanmugam[2]
{santhoshkmr562@gmail.com1, jshanmugam@yahoo.com[2]}

Research Scholar Dept of EEE, Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu India. [1], Professor Dept of EEE, Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu India.[2]

Abstract. Generally, Power Quality is the chiefworry in the present power system. It mainly effects due to sudden changes in load, other environmental conditions. Power Quality main effects on system voltage and current. To compensate the problems in system voltage a series active filter is proposed and also for mitigating system currents a active shunt filter is implemented. The gate signals required for series and shunt filters is designed with help of system parameters and dc-link voltage of filter. To get better quality and harmonic distortion, an artificial neural network is executed to control the dc-link voltage of both filters. This system is verified using Matlab/Simulink and evaluated the results with conventional controller.

Keywords: 3-Level Inverter, ANN Controller, Series and shunt active Filters, Power Quality and Harmonic Distortion..

1 Introduction

In recent years, vegetation associated fossil energy like petroleum coal and gas offers a vital position to convene the load requirement. The key problem associated with above vegetation is this vegetation might source the global affectionate, contamination and discharges carbon di-oxide which is unsafe to living things and foliage. The renewable energy scheme is the answer to power stations to conquer above tribulations. The suitable consistent DG systems are Photo Voltaic and storm as liberally accessible in environment, vastly competent and cost-effective [1].

The distributed energy system is used to drive dissimilar load circumstances. The discrepancy in load alters causes unbalanced power operation which affects the power quality of the power system. This power quality affected in view of voltage and current quality [2]. These papers focused to enhance the power quality perfection by reducing the harmonics in system currents affected due to load variation. To nullify these troubles, a convention power tool called as active filters is employed to grid allied DG scheme. The managing structure for these filters is intended with the dc-voltage manager and reference currents for three phase system are created using unit vector practice. Also, the Artificial Neural Network (ANN) planner scheme is recommendable to normalize the dc-voltage of CPD to progress the power quality [3]. For higher-voltage and higher-power appliances, multi-level inverter takes part in a chief role and contains more advantages compared to existing inverters. These inverters progress the potential superiority and ability to decrease the over voltage stress. Currently,

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multilevel inverters raised more striking for design engineers due to its benefits compared to existing three-level pulse width-modulate (PWM) inverters. This work focused the implementation of series and shunt active filters in neutral-point clamped (NPC) based multi-level inverter. A PWM controller is designed for proposedNPC converter to obtain correct switching outline.

2 Proposed system:

A mixture of high power electronic tool works as a regulator and a condenser works as a nullifier named as tradition power device (CPD) is used to provide a eminence of power to clients [8]. This converters are intended as potential resource converters mostly, due to itsability of self-supporting of dc-bus potential controller. CPD are broadly categorized into two types such as a) balance form and b) network structural type.

In general, the power superiority troubles happenmostly due to dissimilarity of load, system constraints and on off circumstances. In present work, the grid scheme with PV is designed and functional to operate for dissimilar load circumstances such as, uneven and non-linear loads. The subsequent are the categorizations of nullifying type CPD's a) Series Filter, b) Shunt Filter. To nullify the transients generated with uneven non-linear loads both sequence and parallel controllers [8] [9] are designed in this paper. The construction of proposed system is shown in figure 1.

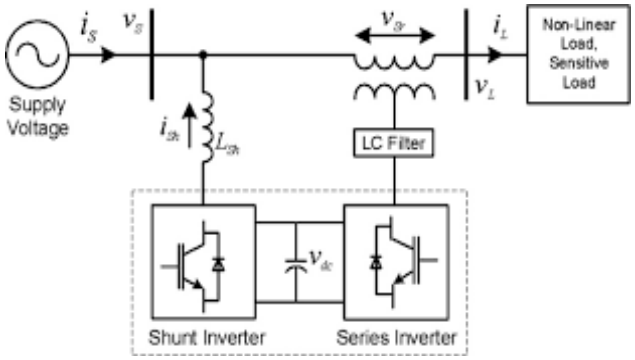

Figure 1 Block diagram of grid linked Shunt and Series inverter with SPF.

3 NPC Topology:

Figure2. shows the methodology proposed in NPC three-stage inverter with LC channel at the yield side. Each leg in the design contains four IGBTs associated in arrangement [10] [11]. The NPC-3 stage inverter utilizes two divided capacitors in arrangement for DC connection, and creates zero voltage level. In this manner, the voltage fall on the IGBT will be $U_{dc}/2$ which is one-a large portion of that of the regular two-stage inverter, where U_{dc} is the all out potential of DC connects. This element creates is progressively appropriate for the application with higher DC transport potential. Furthermore, the NPC inverter has a fewadditional great highlights together with lower basic mode voltage and lower yield current wave for a similar

exchanging recurrence contrasted and the traditional two-level inverter [12]. Thus, a littler yield channel is required contrasted with an equal evaluated two-stage inverter.

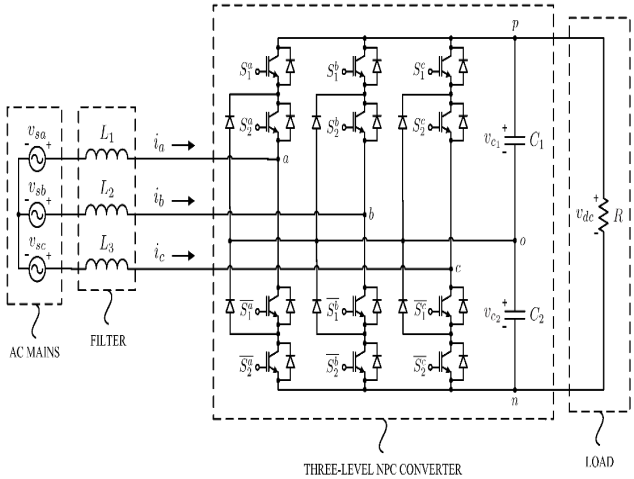

Figure 2: The NPC three-stage inverter topology

4 Active Series Power Filter:

The design of active series filter is shown in figure 3. The design circuit comprises the three stage NPC, a series insertion transformer and coupling capacitor. Neutral point converter is employed to produce three stage potentials and organizing scheme voltages for various loadcircumstanceslike sag and swell and potential turbulence.

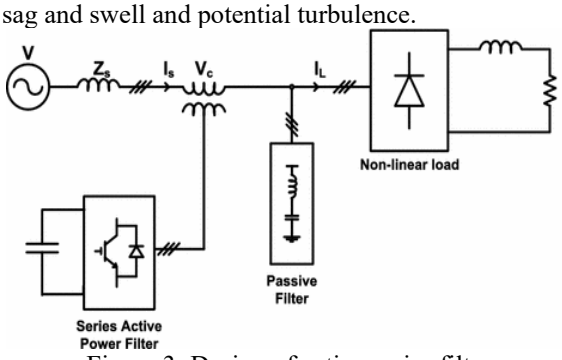

Figure 3: Design of active series filter

The series controller is designed and employed to manage the oscillations in the system potentials like sag, swell and turbulences. The control signals are necessary for series controller which aids to producethe dc-link voltages of the APF and grid potentials. These generated potentials are converted in to multiple-phase coordinate i.e, dq-axis casing. After necessary evaluation of these voltage signals are given to PWM converter to produce input signals [13]. The designed arrangement of active series filter control scheme is observed in figure 4.

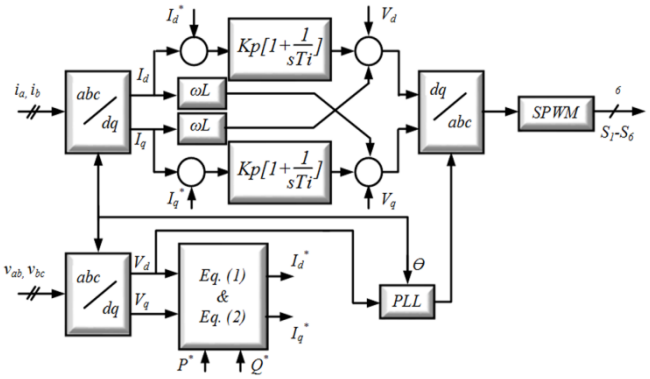

Figure 4: Design structure scheme of PSO base GSC manage diagram

The potential conceded in cause and load current of single stage may be uttered in the subsequent equations,

$V_s(t) = V_m \, cos \, cos\omega_s t$ (1)

$I_{\propto 1}(t) = I_{\propto 1} \, cos \, cos\omega_s t$ (2)

The nullifying current provided by active power shunt filter is written as,

$i_c(t) = i_L(t) - i_{\propto 1}(t) = i_L(t) - I_{\propto 1} \, cos \, cos\omega_s t$ (3)

5 Shunt APF controller

The Shunt APF is solitary of the elements in parallel APF organizer unit. It consists of a capacitor along with VSI converter allied in parallel in connection by existing system. The reason of application of shunt APF in circuit system is to obtain the nullified bus potential sag by getting or supplythe reactive power in distribution system. The design diagram of shunt APF is observed in figure 5.

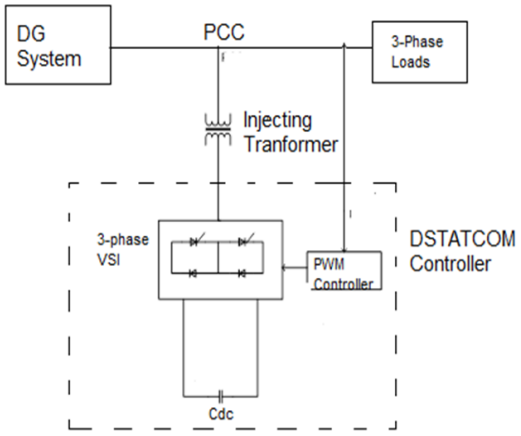

Figure 5: Shunt inverter control structure

6 ANN Controller

The present work is also aimed to design and application of stabilized active shunt power filter using ANN by back proliferation algorithm. ANN is an artificial neural network mayreplicates theorganicintelligence system. Basic principle of ANN scheme is shown in the following figure 6,

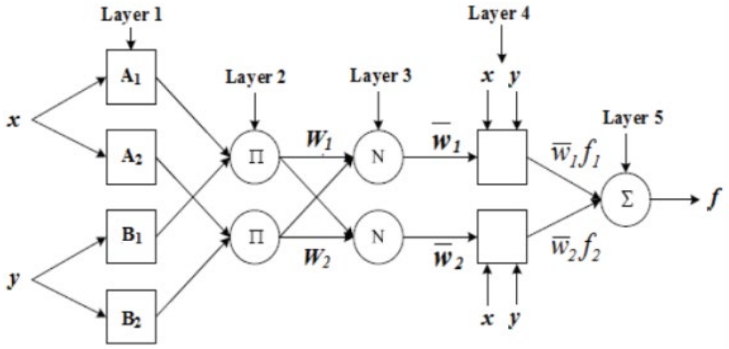

Figure 6: Design Architecture of Artificial Neural Network

Figure 6 shows the artificial neural network architecture. In this paper, feed forward neural network is chosen.

There are numerousmethods have been employed for controlling the SAPF, among that all ANN control scheme have the advantages as fairly accurate utility mapping, high amount of fault lenience with little calculation time. In the organizing tactic, the DC capacitor was examined and offered with the given allusion value. The designfiguredemonstrates the functioning main of active shunt power filter with ANN controller.

The input in the proposed ANN is uttered by the equation and is specified to the position exchanger.

$u = [V_{dc}^{*} V_{dc}]^{T}$ (4)

Couple of states is generated by the creator block, X_1 and X_2as follows,

$$X_1 = V_e(k)$$
$$X_2 = \frac{\delta X_1}{\delta k} \quad (5)$$

Where$V_e(k) = V_{dc}^{*} - V_{dc}(k)$and $Z_{(k)}$is the output error embody as,

$Z_{(k)} = V_0(k) - V_0(k-1)$ (6)

The output$V_0(k)$is fed back to the output state to estimate $I_{\propto 1}$.

Scheming signal is produced by the Neuron cells through consistentmeeting as,

$u(k) = u(k-1) \sum_{i=1}^{2} W_i(k) x_i(k)$ (7)

Here Wi referred as weight of the scheme. Neuron at kth moment achieve by exercising neuron via hebb's rule [11], is specified as follows,

$W_i(k+1) = (1-c) W_i(k) + \eta r_i(k)$ (8)

$r_i(k) = z(k) u(k) x_i(k)$ (9)

Here r_i - Progressive gesture
η – Hebb's study ratio
c- Constant
Substituting (4) and (5) to the equation (3), then
$\Delta W_i(k)i(k) = W_i(k+1) - W_i(k) = -c[W_i(k) - \eta z(k)u(k)x_i(k)/c$ (10)

Weight at the k^{th} step is given in $\Delta W_i(k)$.Based on the Hebbs assumption, weights of the neurons are tuned. Weights are represented by,
$W_1(k+1) = W_1(k) + \eta I^z(K) + x_1(k)$ (11)
$W_2(k+1) = W_2(k) + \eta I^z(K) + x_2(k)$ (12)

Assessment of the balanced current finished by the control stricture whenever the ANN[12], begins working. These initialization of ANN organize constraints using offline type training is shown in figure 7

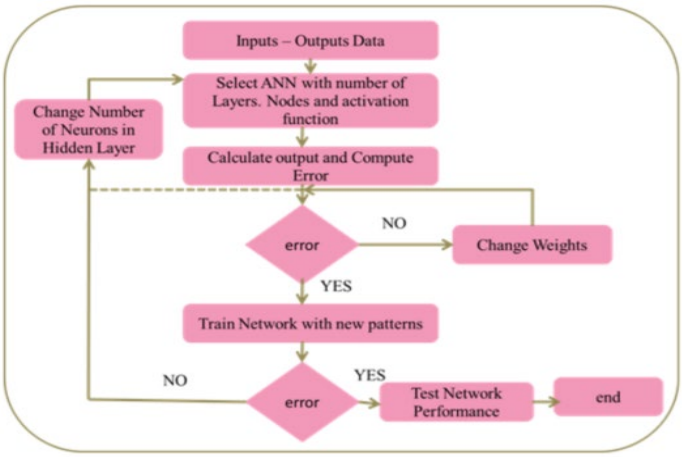

Fig7. Flow chart of the ANN algorithm.

These networks basically contains of three stages explicitly input layer, hidden layer and output layer. The inputs of ANN is called neurons [14] [15]. Here, each input is divided into 5 neuron values named as {MP, SP, Z, SN, MN}. This neurons at input layer is occupied with weights and bias to generate outputs. The outputs at first stage is acts inputs to the second stage and then to third stage (output stage). After train the feed forward network, the simulation block will generate with the help of 'gensim' command [16].

7 Simulation Results &Discussions

The projected work is implemented in Matlab /Simulation software tool and the corresponding simulation results are observed in figure 8 to 23.

Case-1: With PI Controller

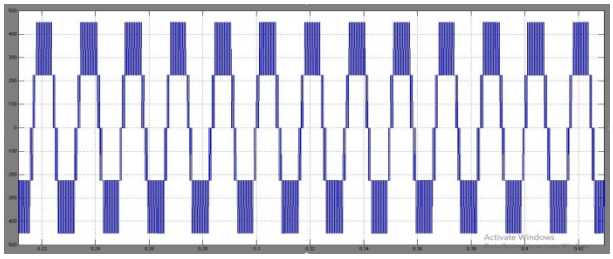

Figure 8: Three level voltages of proposed converter

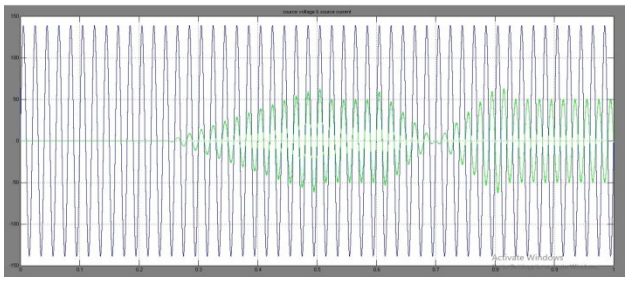

Figure 9: Source potential & Current with Three Level Series and Shunt Converter with PI Control System

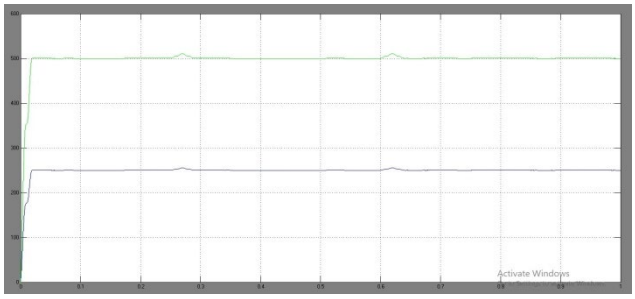

Figure 10: Dc potential of series & shunt converters

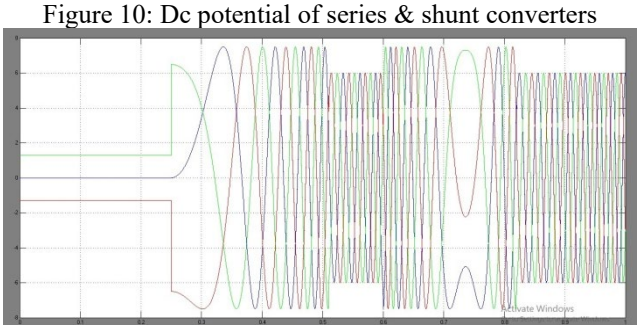

Figure 11: Unbalanced load currents at motor using PI controller

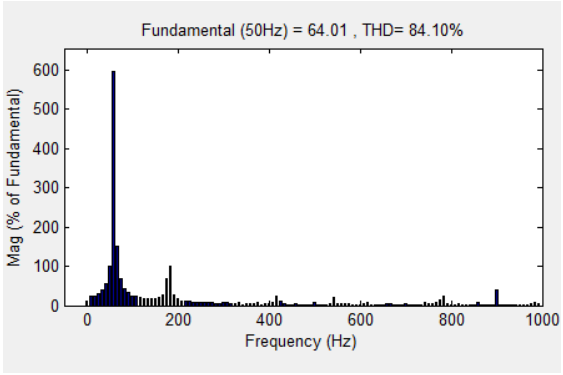

Figure 12. THD for NPC potential using PI Controller without SPF

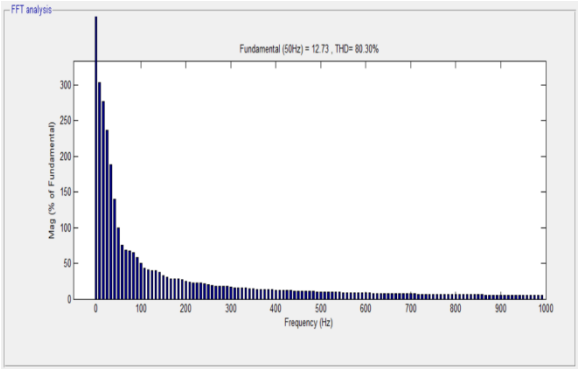

Figure 13: Figure 12: THD for NPC potential using PI Controller with SPF

Case-2: With Fuzzy Controller

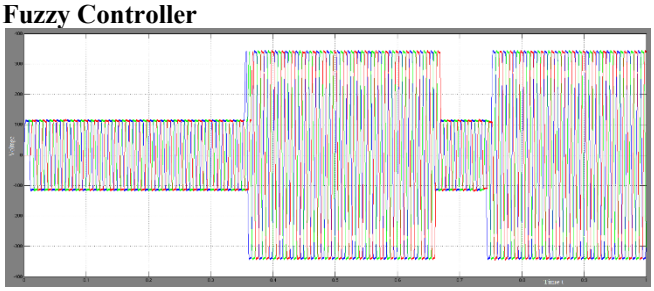

Figure 14: Series & Shunt Converter voltages using FUZZY Control System without SPF

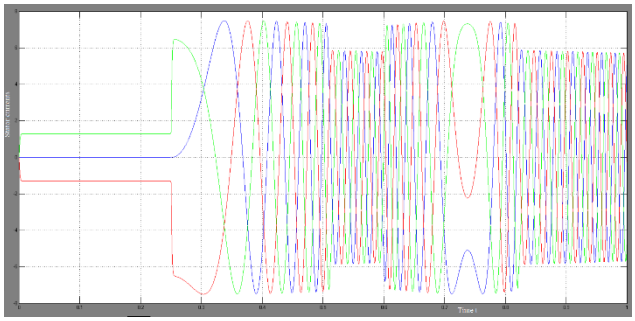

Figure 15: Unbalanced load currents at motor using FUZZY controller

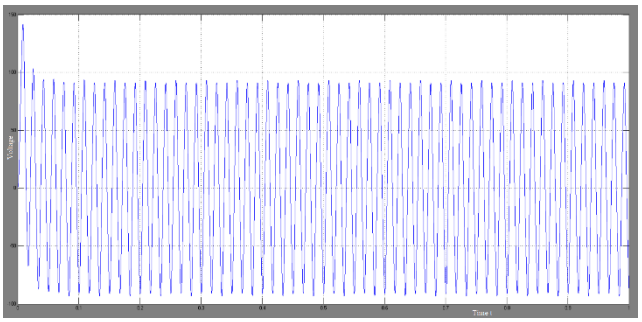

Figure 16: Series & Shunt Converter voltages using FUZZY Control System with SPF

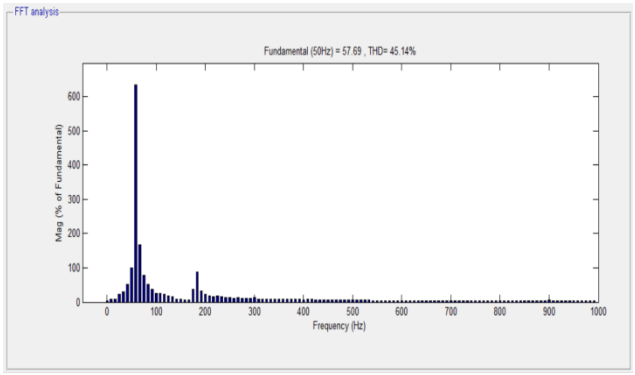

Figure 17: THD for NPC voltage using FUZZY Controller without SPF

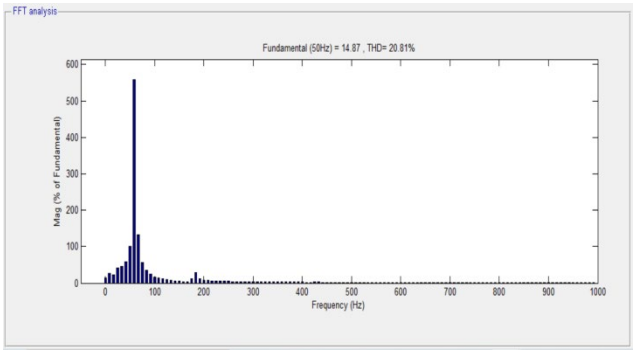

Figure 18: THD for NPC voltage using ANN Controller with SPF

Case-3: With ANN Controller

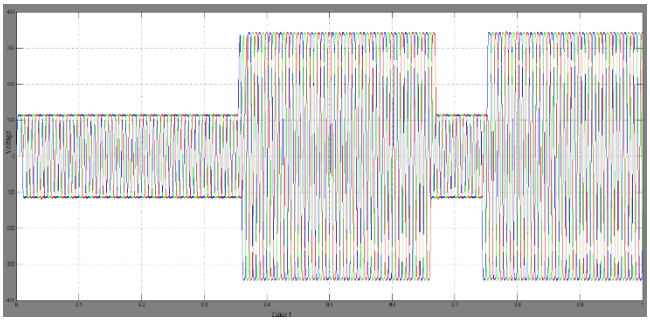

Figure 19: Series & Shunt Converter voltages using ANN Control System without SPF.

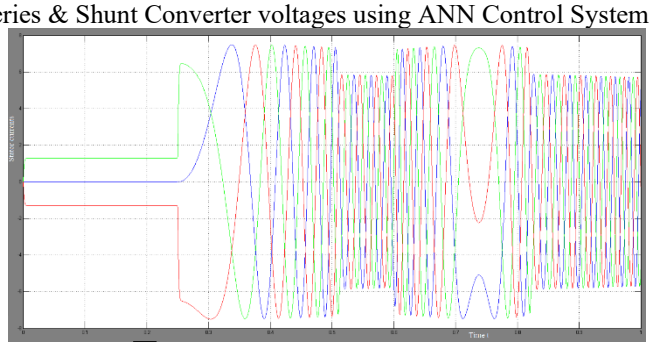

Figure 20: Unbalanced load currents at motor using ANN controller

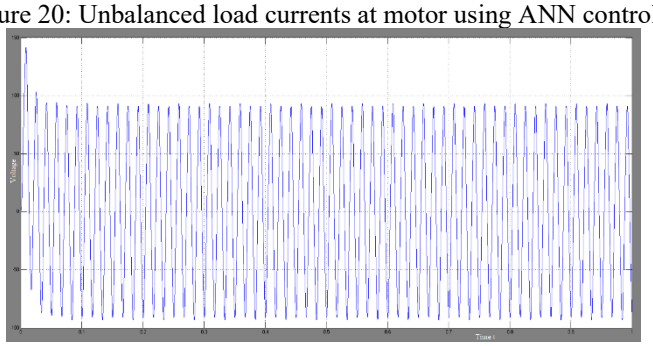

Figure 21: Series & Shunt Converter voltages using ANN Control System with SPF

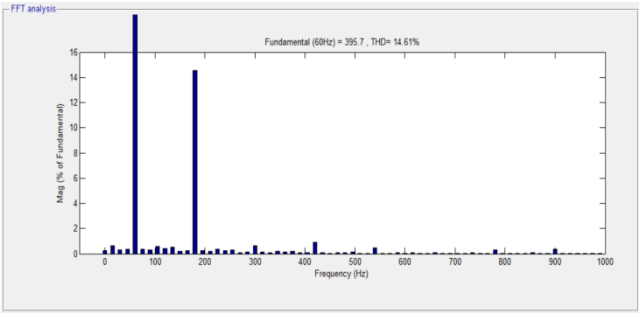

Figure 22: THD for NPC voltage using ANN Controller without SPF

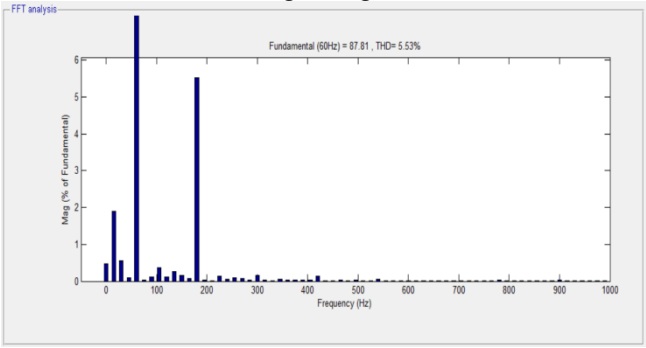

Figure 23: THD for NPC voltage using ANN Controller with SPF

CONCLUSION:

To achieve enhanced improved power quality of distributed system, an ANN based active series and shunt filters are implemented in this paper. To achieve improve voltage imbalances the series and shunt converters are designed by using 3-level neutral point clamped converters.

Table I Comparisons of THD using different controllers and with shunt and series SPF.

Controllers	Without SPF	With SPF
PI	84.10%	80.30%
FUZZY	45.14%	20.41%
ANN	14.61%	5.53%

The organizing illustration for couple of filters is executed using dc-link potential and structure constraints. To achieve enhanced power eminence of the designed system, the control structures are employed by 1) conservative PI manager 2) Fuzzy regulator and 3) ANN organizer. The simulation outcomes carried out shown under variable load conditions. From the results presented above, the ANN based design structure system provides superior power quality in comparison of existing PI and Fuzzy controllers.

References

[1] T. S. Kumar, M. R. Nayak, R. V. Krishna and K. P. Rao, "Enhanced Performance of Solar PV Array-Based Machine Drives Using Zeta Converter," 2020 IEEE International Conference on Advances and Developments in Electrical and Electronics Engineering (ICADEE), Coimbatore, India, 2020, pp. 1-5, doi: 10.1109/ICADEE51157.2020.9368937.

[2] V. G. Agelidis, D. M. Baker, W. B. Lawrance, and C. V. Nayar, "A multilevel PWM inverter topology for photovoltaic applications," in Proc. Int. Symp. Ind. Electron., Jul. 1997, vol. 2, pp. 589–594.

[3] G. J. Su, "Multilevel DC-link inverter," IEEE Trans. Ind. Appl., vol. 41, no. 3, pp. 848–854, May–Jun. 2005.

[4] M. Calais, L. J. Borle, and V. G. Agelidis, "Analysis of multicarrier PWM methods for a single-phase five level inverter," in Proc. Power Electron. Specialists Conf., 2001, vol. 3, pp. 1351–1356.

[5] C. T. Pan, C. M. Lai, and Y. L. Juan, "Output current ripple-free PWM inverters," IEEE Trans. Circuits Syst. II, Exp. Briefs., vol. 57, no. 10, pp. 823–827, Oct. 2010.

[6] T. C. Neugebauer, D. J. Perreault, J. H. Lang, and C. Livermore, "A six-phase multilevel inverter for MEMS electrostatic induction micro-motors," IEEE Trans. Circuits Syst. II, Exp. Briefs, vol. 51, no. 2, pp. 49–56, Feb. 2004.

[7] A. Nabae, I. Takahashi, and H. Akagi, "A new neutral-point-clamped PWM inverter," IEEE Trans. Ind. Appl., vol. IA-17, no. 5, pp. 518–523, Sep. 1981.

[8] M. F. Escalante, J. C. Vannier, and A. Arzandé, "Flying capacitor multilevel inverters and DTC motor drive applications," IEEE Trans. Ind. Electron., vol. 49, no. 4, pp. 809–815, Aug. 2002.

[9] M. Malinowski, K. Gopakumar, J. Rodriguez, and M. A. Pérez, "A survey on cascaded multilevel inverters," IEEE Trans. Ind. Electron., vol. 57, no. 7, pp. 2197–2206, Jul. 2010.

[10] M. R. Nayak and S. A. Mujeer, "New Computational Method for Study of Ionic Current Environment of HVDC Transmission Lines," 2020 IEEE International Conference on Advances and Developments in Electrical and Electronics Engineering (ICADEE), Coimbatore, India, 2020, pp. 1-5, doi: 10.1109/ICADEE51157.2020.9368934.

[11] S. N. Rao, D. V. A. Kumar, and C. S. Babu, "New multilevel inverter topology with reduced number of switches using advanced modulation strategies," in Proc. Int. Conf. Power, Energy Control, Feb. 2013, pp. 693–699.

[12] N. A. Rahim, M. F. M. Elias, and W. P. Hew, "Transistor-clamped H-bridge based cascaded multilevel inverter with new method of capacitor voltage balancing," IEEE Trans. Ind. Electron., vol. 60, no. 8, pp. 2943–2956, Aug. 2013.

[13] M. Raja Nayak, I. Rahul, T.Santhosh Kumar, "Experimental Investigations to Study the Corona Generated Ionic Current Environment of HVDC & HVAC Transmission Lines" Journal of Advanced Research and Dynamic Control, vol 11, NO.5, pp: 158-165, November 2019.

[14] M. Raja Nayak,P.V.SAditya, S.Kirankumar, M. NarayanaNayak "Optimization of Grading Rings for Suspension Type Composite Insulators used in UHVDC Transmission System", Journal of Advanced Research and Dynamic Control Systems, vol 10 special issue, pp: 2575-2580, November 2018

[15] E. A. Mahrous, N. A. Rahim, and W. P. Hew, "Three-phase three-level voltage source inverter with low switching frequency based on the two-level inverter topology," IET Electric Power Appl., vol. 1, no. 4, pp. 637–641, Jul. 2007.

[16] P. R. Kumar, R. S. Kaarthik, K. Gopakumar, J. I. Leon, and L. G. Franquelo, "Seventeen-level inverter formed by cascading flying capacitor and floating capacitor H-bridges," IEEE Trans. Power Electron., vol. 30, no. 7, pp. 3471–3478, Jul. 2015.

Optimal reactive power support for distributed Micro Grid through PV-Grid connected inverter

G. Vijai[1] and P. Selvam[2]
{*reachvijaigopal@gmail.com*[1], *sumatselvam@gmail.com*[2]}

[1]Ph.D. Scholar, Department of Electrical and Electronics Engineering, Vinayaka Mission's KirupanandaVariyar Engineering College, Vinayaka Mission's Research Foundation (Deemed to be University), Salem, India
[2]Professor, Department of Electrical and Electronics Engineering, Vinayaka Mission's KirupanandaVariyar Engineering College, Vinayaka Mission's Research Foundation (Deemed to be University), Salem, India

Abstract. Now a day, Distributed Generation in Micro Grids plays a major role in extracting energy at convenient places and distributing with much ease and efficiently. Under such circumstances maintaining the Voltage levels at the point of distribution or point of common coupling (PCC) is an important task as demanded by the loads. Hence balancing or sharing the real and reactive power among the connected inverters is a challenging task. Droop control strategies play a better role in sharing the power among the inverters, although in many circumstances maintaining the node voltages at the system network is an arduous task. In order to improve the voltage level at the distribution points/PCC of the inverters a simple technique is presented in this paper, which measures the deviation of the voltage level at PCC and feed accordingly the reactive power to boost the voltage. However, the real power sharing is undisturbed. The method is schemed and simulated using MATLAB Simulink environment. The simulated results are encouraging that the intended technique has very good efficacy in maintaining the voltage level and agreed with the expected results.

Keywords: Micro Grid, Grid connected Inverter, Distributed Generation, PR controller, PV Inverter, Parallel connected Inverters, Real Power flow, Reactive Power flow.

1 Introduction

Distributed generation in Micro Grids plays a significant role by the way of sharing real power and reactive power among various sources connected to improve system efficiency, stability, quality etc. Since the distributed generation on account of the use of renewable sources profusely forming decentralized Micro Grids providing good quality of power and reliability [1]. Generally, PV inverters which are connected to the grid operates as a current source, where the inverter works in synchronism with the grid, taking the grid reference with the help of PLL circuit. The inner current control loop ensures the inverter to work as a current source [2]. While transferring power to the grid, the quality of power transfer is an important factor thus ensuring minimal distortion thereby avoiding injection of harmonics. Under such cases current control inverter plays a crucial role on the quality of the current supplied to the grid by the PV inverter [3].

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Voltage support to the grid is done by pumping reactive power to the grid. Many controls to pump real and reactive power to the grid is configured using droop control technique such that all the inverters share the power in proportion to their rating. Such control basically requires the inverters connected to the grid to work in voltage control mode. In many cases reactive sharing is influenced by the line impedance resulting errors in sharing reactive power among the inverters.

This paper concentrated in pumping all the real power as what obtained from the PV array to the grid, in addition to this, the inverter will pump appropriate magnitude of reactive power ensuring good voltage support at the point of common coupling. The inverter control proposed in this paper makes it to work as a gird feeding inverter, however the reactive power feed is controlled interactively upon the variation in the grid voltage at the point of common coupling. Hence sharing of reactive power is mandated by the change in the grid voltage at PCC. In another method [4], the reactive power sharing is made to the grid by the available current capability of the grid feeding inverter without delimiting the current capacity of the inverter.

Sharing of Real and Reactive power shall be implemented through many techniques, however in the case of grid connected PV inverters sourcing from PV sources, the prime objective will be transferring, the available irradiation dependent maximum possible power from the PV array to the grid. Hence under such circumstances conventional or any optimized sharing of powers shall not be possible. However, the PV grid connected inverters could support the grid voltage by pumping appropriate magnitude of reactive power. Under conventional control techniques for sharing power among the connected inverters in a micro grid, proper sharing of real and reactive power should be carried out, otherwise inverters with small capacities having reached their control limits, may have a chance to overload thereby tripping out of service [5][6]. In the case of control presented in this paper, the PV based grid connected inverter shares reactive power in correlation to the magnitude deviation of grid voltage from the nominal value without crossing the kVA capacity of the inverter, making the inverter to work safely.

2 Structure of the proposed Grid connected Inverter

The proposed structure of PV sourced grid connected inverter with LCL filter is shown in Fig. 1. The proposed structure consists of a string of Photovoltaic modules connected to a Boost converter which is controlled by a Maximum Power Point controller in order to extract maximum possible irradiation dependent power from the PV array. The output power from the Boost converter feeds the inverter through a DC link. The inverter is controlled in such a way that the power available at the DC link is completely processed and fed to the grid. This optimal power flow into the grid from the DC link is made by maintaining the DC link voltage at a pre-determined voltage level. A general-purpose Phase Locked Loop is used to synchronize the inverter with the grid and the power flow is managed with the help of a current controller.

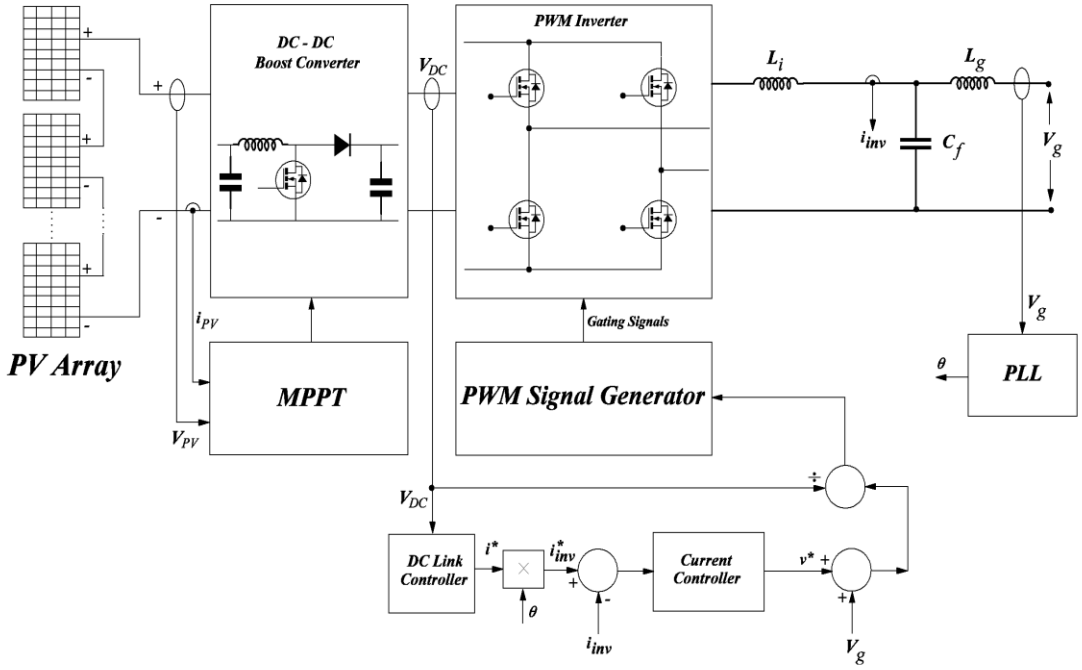

Fig 1. Structure of proposed Grid connected Inverter

The Maximum Power Point tracking algorithm used in this scheme is Perturb and Observe method with uniform level of irradiation. The MPP algorithm operates the Boost converter in such a manner that the PV array operates at the optimal operating point even when the level of irradiation changes. The DC link voltage controller is playing a crucial part so that the available power in the Dc link is completely transferred to the grid by maintaining a constant DC link voltage. The DC link voltage controller sets the real part power to be pumped into the grid.

The grid voltage is sensed and the deviation of the grid voltage from the desired magnitude is computed. Based on the magnitude of deviation, the reactive power to be pumped into the grid is determined. While determining the magnitude of reactive power, care is taken that under any circumstances the kVA rating of the inverter should never be exceeded. The real power from the current component estimate from the DC link voltage controller and the reactive power current component estimate from the reactive power estimation is combined with the help of PLL and a current reference is generated. This generated current reference makes the current controller to follow it such that the desired amount of real and reactive power flows into the grid.

Real Power Support from the Inverter

The real power support by the inverter depends solely on the level of irradiation on the PV array. As the irradiation changes time to time the real power support is also changing accordingly. From the inverter point of view the real power to be pumped into the grid is computed by maintaining the Dc link voltage which in turn depends on the Power fed in to the DC link by the Boost converter.

Reactive Power Support

The reactive power estimation is done based on the grid voltage and the available volt-ampere capacity left over after deducting the real power current component. The grid voltage is sensed and the reactive power current component is estimated based on the equation (1) [7].

$$i_q^* = \frac{\Delta V}{X_g} = \frac{V_g^* - V_g}{\omega L_g} \quad (1)$$

If the estimated current is accommodated within the kVA capacity of the inverter, the net reference current is computed otherwise the estimated reactive power current component is scaled down such that the rated kVA of the inverter is not exceeded. The reactive power current component is estimated based on the expression presented in equation (2).

$$i_q^* \le \sqrt{i_{rated}^2 - i_p^{*2}} \quad (2)$$

3 Scheme of control of the proposed method

The execution of the proposed scheme is based on estimation of the real power component of current and the reactive power component of current. The real power component of current is solely depending on the level of irradiation and is given by the DC link voltage controller. The reactive power component of current depends on two factors such as grid voltage magnitude and the inverter rating.

At every sampling the grid voltage is sampled and the reactive power component of current is estimated to bring the grid voltage to the rated magnitude and this estimated magnitude is then correlated with the rated current capacity of the inverter. If no violation is found the estimated value will be taken granted otherwise the estimation will be scaled such that the rating of the inverter should not be exceeded.

The scheme of control of the presented technique is illustrated in Fig. 2.

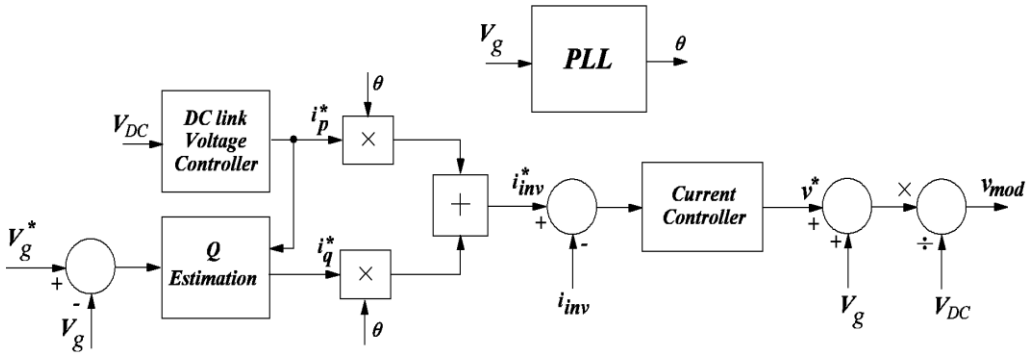

Fig 2. Control algorithm of the proposed technique

The obtained real and reactive component magnitudes of the reference current are combined with the help of the grid angle generated from the Phase Lock Loop. The reference

current thus obtained is compared with the actual inverter current from the current sensor and the difference is passed to the Proportional and Resonant Controller [8], tuned to the grid frequency. The PR controller tracks the reference current in such a way that the desired real power and reactive power will flow to the grid.

As the reference current produced for the inverter is sinusoidal in nature, the tracking performance offered by the PR controller tuned at the grid frequency is excellent [9,10].

Synchronization

In order to successfully inject the desired magnitude of real and reactive power to the grid, the reference current generated should be exactly matched with the grid frequency and phase. Hence the grid angle is a mandatory component to successfully generate the reference current from the computed real power component and the estimated reactive power component of current. The grid angle is extracted from the grid with the help of a general-purpose Phase Locked Loop incorporating a moving average filter, digital PI controller and a digital integrator. The scheme of the PLL used is illustrated in the Fig. 3 as below.

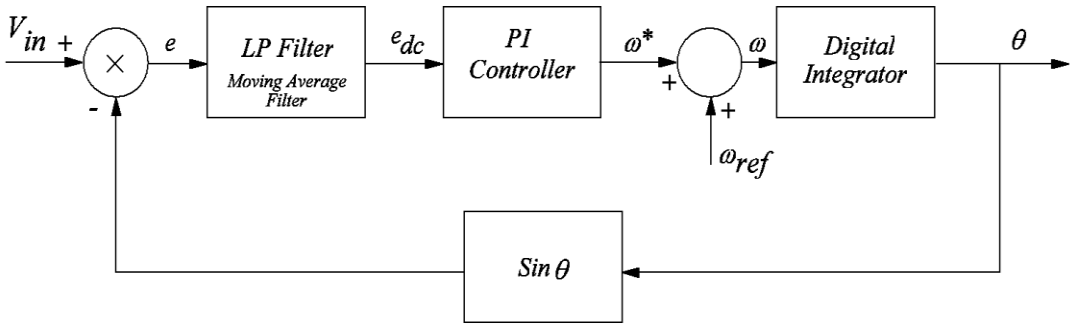

Fig 3. Digital Phase Locked Loop for Grid Synchronization

4 Computer Simulation and Verification

The methods behind proposed technique of optimal reactive power support are verified with the help of Simulink software from MATLAB®. The scheme used to verify the proposed concept consists of two inverters connected in parallel, wherein one of the inverter supply energy from a battery source and acts as a grid forming inverter and the other inverter is fed from the PV source acts as grid feeding/supporting inverter [11]. The grid feeding inverter is connected with the grid through a digital phase locked loop and fed from a Boost converter, which acts as, in coordination with the controller, a Maximum Power Point Tracker. The power output from the Boost Converter is fed to the Dc link. The grid feeding/supporting inverter is operated in such a way that all the real power pumped into the DC link by the boost converter is in turn supplied to the grid, by maintaining a constant voltage, which is in this method is 400V DC. The scheme of the proposed method contemplated in Simulink is illustrated in Figure x.

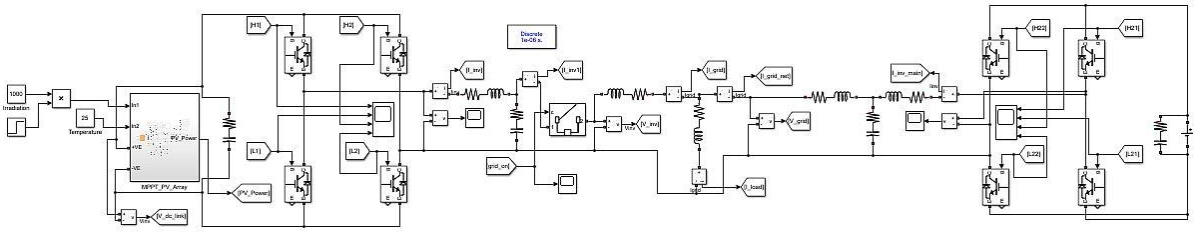

Fig 4. Simulation scheme for computer verification

The PV moduled used in the PV array for verification of the proposed technique is TSMC Solar TS-110C, which is in-built in Simulink package. In order to obtain the desired DC link voltage the number of P modules connected in series is found to be 10. With the 10 numbers of PV modules in the array, the maximum power that can be delivered by the PV array at an irradiation of 1000W/m^2, with a temperature at 25^{o}C is 1098.71 Wp. The algorithm used to track maximum power point in the implementation is Perturb and Observe. The verification is done under uniform irradiation. The MPPT function is configured using MATLAB function.

The entire coding for the proposed method of optimal recative power support is implemented using S-function builder, which includes Digital PLL, proposed algorithm, PR controller. Discrete mode of simulation is used in the simulation model. With the help of S-functions, excellent performance is obtained in grid synchronization and the outcome of the proposed technique.

A common load of having real power and reactive power capacities 2000W and 1500Vars respectively is used in verifying the proposed technique through simulation. Two conditions of the grid voltage magnitude are used to verify the efficacy of the presented technique. In the first condition the grid voltage is set at a nominal magnitude of 230V rms and in the second condition the grid voltage magnitude is reduced to a value of 228V rms to verify the reactive power contribution from the grid feeding/supporting inverter.

The response of the two inverters under the first condition (Grid Voltage = 230V rms) is plotted in the figure illustrated in Figure 5 and Figure 6. It is clear that the real power supplied from the Grid is 1000W and the real power pumped by the feeding/supporting inverter is also 1000W as the PV array is set at 1000W/m2. However the reactive power support from the feeding/supporting inverter is 100Vars and the reaming 1400Vars are supplied by the Grid.

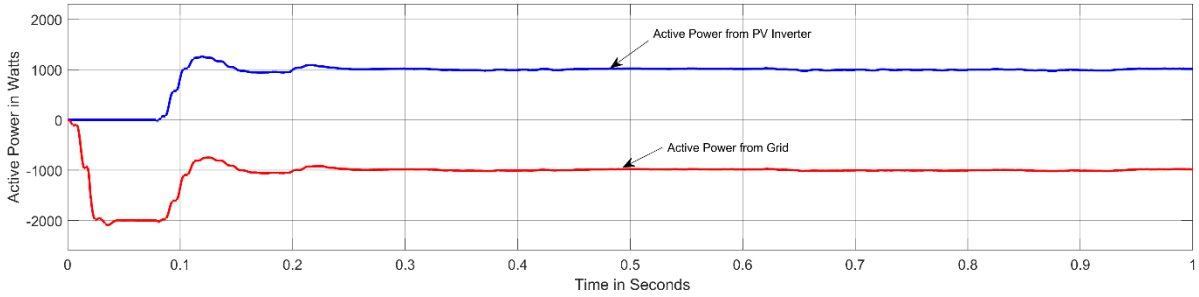

Fig 5. Real power sharing between the inverters (V_{grid} is 230Vrms)

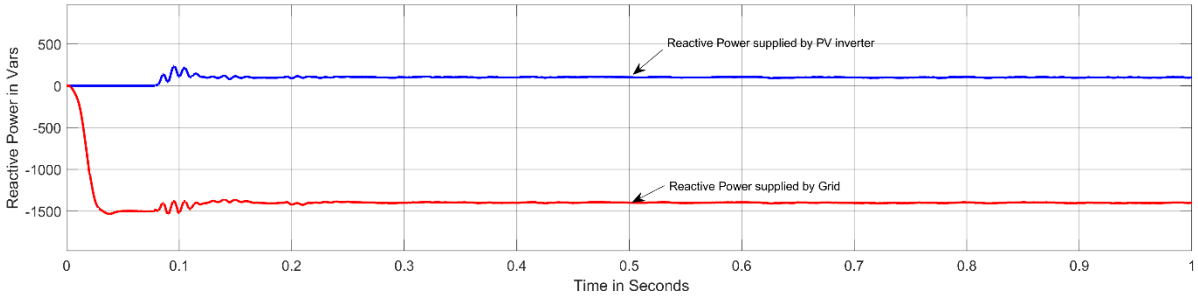

Fig 6. Reactive power sharing between the inverters (V_{grid} is 230Vrms)

Under second condition (Grid Voltage = 228V rms), the response is quite obvious that the algorithm works fine. The response of both the inverters under this condition is plotted in the figures illustrated in Figure 7 and Figure 8. In this case the algorithm senses that there is a decrease in the grid voltage and the difference is compensated by pumping sufficient reactive power by the feeding/supporting inverter in order to maintain the nominal magnitude of 230V rms. The reactive power contribution from the feeding/supporting inverter to bring nominal grid voltage at the point of common coupling (PCC) is 540Vars. The remaining reactive power is shared by the Grid.

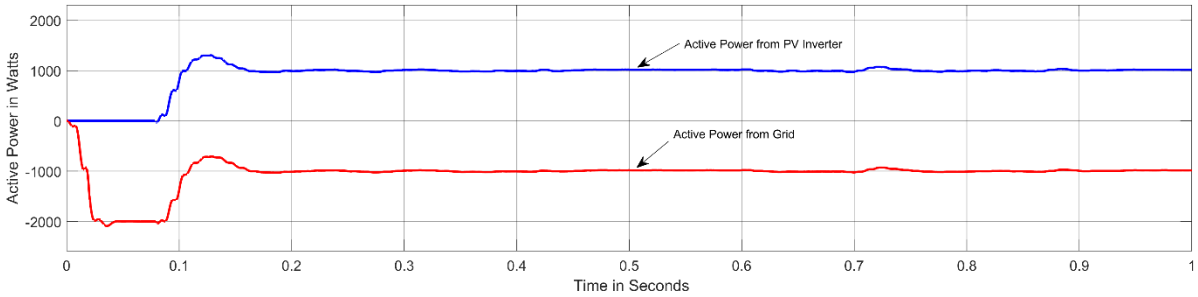

Fig 7. Real power sharing between the inverters (V_{grid} is 228Vrms)

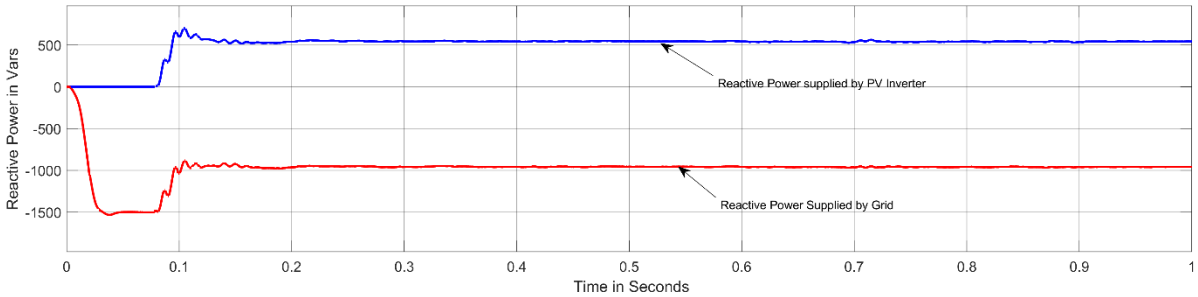

Fig 8. Reactive power sharing between the inverters (V_{grid} is 228Vrms)

From the above discussions it is clear that the proposed algorithm works fine in compensating the voltage dips at the point of common coupling by injecting the required level of reactive power. Moreover, it also clear that the power pumped by the feeding/supporting

inverter is constant irrespective of grid voltage and also there is no sensible change in the sharing of real power from the grid under small dip in the grid voltage.

Conclusion

An optimal reactive power support of grid feeding/supporting inverter is presented in this paper. The complexity of the so constructed technique is simple. The efficacy produced by the algorithm presented is effective in sharing of real and reactive powers as well as compensating the voltage dip at the point of common coupling. The reliability of the proposed technique is sufficiently good as it doesn't require communication techniques for sharing of powers. The simulation results produced through computer ratifies the efficiency and the efficacy of the proposed technique.

References

[1] Xuehua Wang et. al.,"Full Feedforward of Grid Voltage for Grid-Connected Inverter With LCL Filter to Suppress Current Distortion Due to Grid Voltage Harmonics", IEEE TRANSACTIONS ON POWER ELECTRONICS, VOL. 25, NO. 12, DECEMBER 2010

[2] Juan C. Vasquez et. al., "Voltage Support Provided by a Droop-Controlled Multifunctional Inverter", IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 56, NO. 11, NOVEMBER 2009

[3] Daniel Zammit et. al., "Design of PR current control with selective harmonic compensators using Matlab", Journal of Electrical Systems and Information Technology 4 (2017) 347–358

[4] G. Vijai ,P. Selvam, “A Simple control of interactive voltage supporting PV-Grid connected inverter for distributed Micro Grid”, Solid State Technology, Vol. 63 No. 6 2020.

[5] Yusuf Gupta et. al., "Optimal DG Allocation and Volt-var Dispatch for a Droop Based Microgrid", IEEE Transactions on Smart Grid, Volume: 12, Issue: 1, Jan. 2021, 169 - 181.

[6] Zhiyuan Tang et. al., "Distributed Coordinated Reactive Power Control for Voltage Regulation in Distribution Networks", IEEE Transactions on Smart Grid, Volume: 12, Issue: 1, Jan. 2021, pp 312 - 323.

[7] Josep M. Guerrero et al., “Control of Distributed Uninterruptible Power Supply Systems”, IEEE Transactions on Industrial Electronics, Vol. 55, No. 8, 2008.

[8] Tao Ye et. al., “Analysis, Design, and Implementation of a Quasi-Proportional-Resonant Controller for a Multifunctional Capacitive- Coupling Grid-Connected Inverter”, IEEE Transactions on Industry Applications, Vol. 52, No. 5, Sep/Oct 2016.

[9] R. Teodorescu et al., "Proportional-resonant controllers and filters for grid-connected voltage-source converters", IEE Proc.-Electr. Power Appl., Vol. 153, No. 5, September 2006.

[10] JaumeMiret et al., “Selective Harmonic-Compensation Control for Single-Phase Active Power Filter With High Harmonic Rejection”, IEEE Transactions on Industrial Electronics, Vol. 56, No. 8, 2009.

[11] J. Rocabert, A. Luna, F. Blaabjerg and P. Rodríguez, "Control of Power Converters in AC Microgrids," in IEEE Transactions on Power Electronics, vol. 27, no. 11, pp. 4734-4749, Nov. 2012

Protection of Capacitor Bank Against Switching Transients: An Overview

Vishal V. Vashikar[1] Dr. S. Prakash[2]
{[1]vishalvashikar@gmail.com, [2]prakashacademics@gmail.com}

[1]Research Scholar EEE Dept., BIHER, Chennai [2]Supervisor, Professor, EEE dept., BIHER, Chennai, TN, India.

Abstract. In today's world, everyone is tried to make the system faster. To make the system faster, power electronics devices play an important role. The normal industry possesses 80% of inductive load and has a lagging power factor. The use of electronic equipment in the system causes power quality disturbances. The electricity demand is increasing day by day and it is necessary to serve power with low losses. To overcome this situation switched capacitors are used in the system. But during the switching of capacitors transients are produced in the system and leads to the failure of power electronic equipment. The proposed paper focused on capacitor bank protection against switching transients.

Keywords: Capacitor Operation, Transient Current and Voltage, Capacitor Protection Techniques, Reactors.

1 Introduction

The electricity demand is increasing nowadays and it is a challenge to serve generated power more effectively and efficiently with low losses. In other words, it is important to improve power quality at the consumer end. The capacitor plays a vital role in power quality improvement. For smooth operation of power system it is necessary to connect or disconnect capacitor bank as per power quality issues, this is possible with the automation only.

When this operation takes place or when the capacitor bank came into operation, it creates switching transients and may lead to failure/damage of highly sensible devices at the consumer end. We cannot avoid the role of power electronics devices which are responsible for the fast operation of the system. So the detailed study of capacitor bank protection against switching transients is proposed in this paper.

The static reactive power can be compensated with the help of switched capacitor banks at the sub-transmission or distribution level. By utilization of capacitor bank, power losses are minimized and power quality improved. [1][2]

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2 Capacitor Switching Technique:

The Capacitor is formed by separating the two plates of conducting material by a dielectric medium, and which is capable to store, and gives electrical output as a charge. the various operations that take place in the power grid are responsible for transient voltages and currents. the sudden opening or closing of the circuit breaker changes the circuit parameters and this is responsible to change the values of the current and voltage. All the transients in the power system are seen due to the making and breaking of the contacts of electric components, insertion of energy in the grid, lightning stroke, and static discharge.

The capacitor bank switching at the consumer end is the traditional operation and that may cause the occurrence of transient current and voltage. However, there may be a possibility that the low-frequency transients become severe transients if an end-user has a power factor correction unit, power electronics load, or drives. In other words, the capacitor switching causes damage to customers' equipment like the abnormal operation of speed drives or production lines, malfunction in current or voltage surge protector, a communication network, and results in power quality disturbances.

3 Capacitor Bank Switching Transients:

The capacitor voltage is not changed immediately since the switching on of a capacitor, the voltage appeared at the terminals is zero. Activation of a capacitor bank affects the system voltage and instantaneously voltage is dropped toward zero to attempt fast voltage recovery and finally, a fluctuating voltage overlap/affects the system frequency. During the immediate activation or under abnormal conditions the observed voltage is 2 times larger than the regular peak voltage. it means that the voltage peak value is associated with instantaneous system voltage. At the distribution level, the overvoltage value varies from 1.1 to 1.6pu.

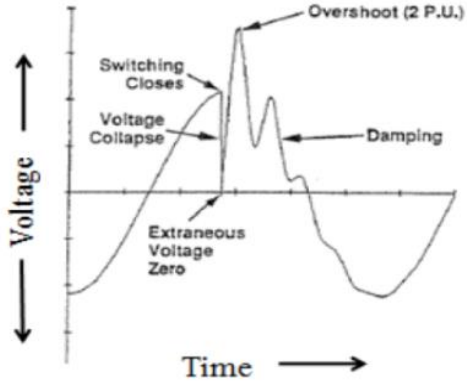

Fig.1. Switching Transient

The current drawn by the electric equipment during energization is called the Inrush current. When the supply is on, the current is set into the circuit, this current attempts the peak value and is greater than the normal operating current value. Then the current value decreases gradually and sets up to its normal value. if the equipment is operated with inrush current it may be overheated and breakdown takes place. this failure depends on the value of inrush current and duration.

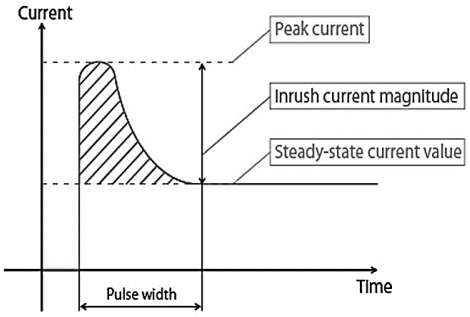

Fig.2. Inrush current production

After insertion of the capacitor bank, when it energized the first time the value of the inrush current is greater than the normal value. This is due to the high initial current drawn by the capacitor for charging. To limit this initial current fuses and circuit breakers are used.

A transient is a phenomenon that is generally seen by abnormal operations of the power system, which concludes into a negative impact on the consumer. The abnormal operations of the power system include lightning strokes, various faults, and switching operations, etc.

The common causes for the production of Inrush Current in the power system are,

- Transformer impedance, high distance cable lay.
- Low response of the power factor correction unit.
- High nonlinear loads or increased use of power electronic devices.
- frequently transformer switching.
- frequently capacitor bank switching.

Due to all the above reasons, the production of inrush current takes place and is harmful to the power system and its equipment. The common effects are,

- Heating of the power system equipment.
- Increased losses.
- Decreases the efficiency of the system.
- Abnormal operation of the equipment which results in shut down or maintenance.

4 Capacitor Bank Protection Techniques:

4.1 Insertion of resistance

The insertion of resistance in between the system and capacitor banks is one of the common methods is used to protect the bank. capacitor bank plays a vital role to improve power factor and power quality. During the switching of the capacitor bank, the excessive voltage is dropped in the resistor. And the system is isolated from power quality issues. To maintain the power factor and avoiding the penalty from system utility the capacitor banks are used. The insertion of the resistor prevents the capacitor bank damage as well as the nearby connected equipment. [3][4][5]

4.2 Protection against transients

Most of the industry possesses inductive load. So the poor power factor and power loss are generally seen at this load. To improve the power factor and reduction of losses the

capacitor banks are inserted. But during the capacitor bank energization, switching transients have occurred. These transients will affect the nearby connected equipment. By using the reactor we can limit the transient values within the permissible limit. [6]

4.3 Protection against overvoltage

The protection of the capacitor bank against overvoltage is required to avoid permanent damage to the bank. The abnormal conditions or faults may result in overvoltage. This will affect the thin conducting material of the capacitor bank. To avoid internal failure of the capacitor bank resistance or reactances are used to suppress the overvoltage. [7]

4.4 Current limiting reactors(CLR)

The reactor is one of the best solutions to limit the voltage and current transients. The Reactor is formed by a coil with a large number of turns and has a high value of resistance. The reactors also limit the value of the short circuit current by which the power system equipment gets protected. The reactors also help to protect the circuit breakers with various ratings used in the power system. According to the strength of the circuit breaker, it is capable to limit the value of the short circuit current. During the modification of the power system, if we don't want to replace the existing circuit breaker, we can put a reactor of proper rating which saves time and money.

5 Conclusion

To reduce the power loss and improve the power quality, the capacitor banks are introduced at the consumer end. Meanwhile, it maintains the system's stability. During the switching operation of the capacitor bank, the generated transients are suppressed by introducing a reactor or resistor into the system. The current limiting reactor is one of the best solutions to control switching transients during capacitor bank operation. In this paper, the economical growth, as well as the efficient way of capacitor bank utilization, is considered.

References

[1] M.S.Javadi, A.E. Nedzad, Pierlugi Siano and M.S.khan, "Shunt capacitor placement in radial distribution networks considering switching transient decision-making approach," Elsevier, Electrical Power and Energy Systems 92(2017)167-180.

[2] A. A. Jambukar and M. F. A. R. Satarkar, "Simulation Analysis of Switching of Shunt Capacitor Bank in 220/22 kV Substation," 2018 Second International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2018, pp. 1554-1559, doi: 10.1109/ICCONS.2018.8663055.

[3] L. V. Teli and H. T. Jadhav, "A Review on Protection of Capacitor in Power Quality Industry," 2018 International Conference on Current Trends towards Converging Technologies (ICCTCT), Coimbatore, India, 2018, pp. 1-5, doi: 10.1109/ICCTCT.2018.8550935.

[4] B. Sreewirote and A. Ngaopitakkul, "Analysis of power quality issue in arc furnace capacitor bank system," 2016 19th International Conference on Electrical Machines and Systems (ICEMS), Chiba, Japan, 2016, pp. 1-5.

[5] S. Jahdi and Loi Lei Lai, "Affects of TCSC usages on Distance protection and Voltage profile of a system; a novel," 2011 IEEE 33rd International Telecommunications Energy Conference (INTELEC), Amsterdam, Netherlands, 2011, pp. 1-9, doi: 10.1109/INTLEC.2011.6099829.

[6] M. Devi Atluri, B. R. Kumar and U. V. Reddy, "Comparative study of passive transients controlling methods during capacitor bank switching," 2016 International Conference on

Signal Processing, Communication, Power and Embedded System (SCOPES), Paralakhemundi, 2016, pp. 131-134, doi: 10.1109/SCOPES.2016.7955676.

[7] J. Wang, M. Ibrahim, Z. Gajić and M. M. Saha, "Internal failure detection and protection on capacitor banks," 13th International Conference on Development in Power System Protection 2016 (DPSP), Edinburgh, UK, 2016, pp. 1-6, doi: 10.1049/cp.2016.0017.

[8] A. Dzionk and R. Małkowski, "Activity coordination of capacitor banks and power transformer controllers in order to reduce power losses in the MV grid," 2016 10th International Conference on Compatibility, Power Electronics and Power Engineering (CPE-POWERING), Bydgoszcz, Poland, 2016, pp. 27-32, doi: 10.1109/CPE.2016.7544153.

Practical Investigations on SCR Based HVDC Power Transmission Systems

Ilampoornan.M.K[1], and Prakash S[2]
{ ilampoornan.eee@bharathuniv.ac.in1; prakashacademics@gmail.com2}

Professor, EEE Department, BIHER, Chennai,India[1,2]

Abstract. HVDC power transmission based converter uses both 6 pulse and 12 pulse schemes system. It is constructed mainly using the semiconductor devices for transfer of bulk amount of electric power, so that transmission cost reduces and efficiency increases. The AC power at the input of the HVDC transmission system is converted into high voltage dc for transmission. At the receiving end, this HVDC is converted back to high voltage AC using inverter technology. The conversion of AC input into dc output is done by SCR and IGBT.A high current and high power thyristor is employed in phase controlled rectifier circuit for converting AC input power into dc output power. This is used to provide variable voltage output DC and variable DC load current. The average output load voltage is controlled by varying the thyristor triggering angle. The IGBT based inverter is used with a set of LC filters to reduce output harmonics for load endurance protection and for elimination of various harmonics related problems. Here the degree of freedom is 2 because one phase voltage is reference and other two relative voltages are free to control. So the IGBT based 3 phase invetrter converts the HVDC into HVAC at the output. The output voltage is controlled by varying thyristor triggering angle. In the SCR based converter both 6 pulse and 12 pulse schemes are employed.

Keywords: HVDC,Converter,SCR,IGBT,Triggering Angle.

1 Introduction

HVDC transmission system predominantly use the converter for the converting AC to DC at the transmitting end also known as rectifier, it is converted back to DC at the receiving end also know as inverter. This converters are of two configuration either it is 6 pulse or 12-pulse arrangement, with valves connected in a three phase star- delta, star-star formation to the AC networks.The convertor has a reactor and dc capacitor for reactive power compensation. The AC filters are used for filtering harmonics. The converters are connected through the DC transmission lines which is either overhead line or submarine cable,when used in nearby locality back-to-back configuration is employed. Power electronics advanced technology contributes for the evolutiono of HVDC systems The fabrication and synthesis of most efficient semiconductor devices finds its application in the HVDC converter topologies. The fully controlled semiconductor devices available today for high-voltage high-power converters can be based on either thyristor or transistor technology. In this paper, the discussion is about rectifier side of the HVDC transmission system. Silicon controlled rectifier that is SCR is used for converting input AC to DC. This High voltage DC is given to the transmission line. In SCR based converter we use both 6 pulse and 12 pulse schemes. The basic block diagram of a HVDC transmission system is shown below in Figure 1.

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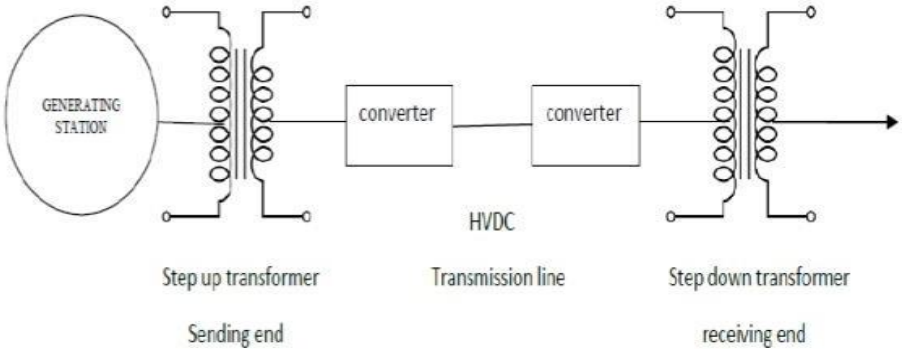

Fig. 1. General block diagram of HVDC power transmission system

To study the operation of SCR based converter, output is taken after the rectification for both 6 pulse and 12 pulse conditions. The basic diagram of SCR based converter is given below in **Figure 2.**

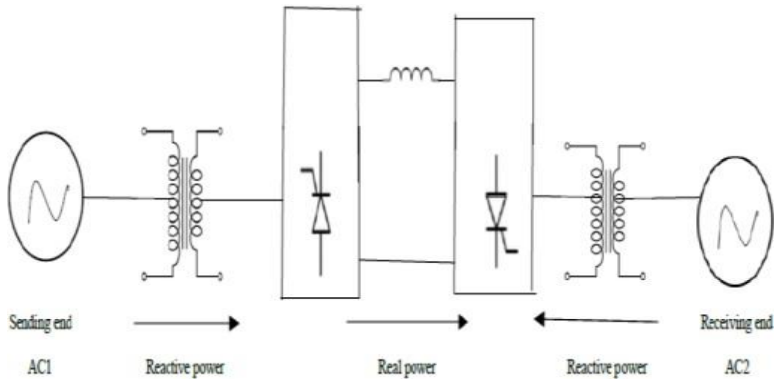

Fig. 2. SCR Based Converter

The rectification, i.e., the convertion of AC to HVDC is done here. which is then given to the transmission line.

2 Six pulse operation

The rectifier station consists of a full bridge 3 phase converter, one of three phase three winding transformer. In the AC side of the converter, higher order harmonics are generated. We use filters in both AC and DC side to reduce harmonic contents on input side and to reduce ripples in output DC voltage. PIC 4011 is used to provide gate pulse for thyristor. We use a single 6 SCR rectifier. The firing angle of rectifier can be varied from 0 to 120 degree and at each firing angle, DC voltage output can be taken from the rectifier.

3 Twelve pulse operation

The thyristor based full bridge three phase converters is used in rectifier station for voltage transformation two three phase three winding transformer is used. (ie, it has one three

phase primary and two three phase secondary windings; one is star connected and the other is delta connected with phasors having 30 degree phase shift). The 12 pulse HVDC converter has odd current harmonics of order 11,13,23,25, even higher order are also generated on the alternating current side. Filters are installed to reduce the harmonics level to a level required by the network. The filters oin both AC and DC side are employed to reduce harmonic contents on input side and to reduce ripples in output DC voltage. PIC 4011 is used to provide gate pulse for thyristor. Two 6 SCR rectifiers whose firing angle can be varied from 0to30 degree and at each firing angle, DC voltage output can be taken from the rectifier.

4 PWM(pulse width modulation)

Pulse Width Modulation or PWM is a technique to get analogue output withdigital input. Using digital control, a square wave is created which can make a signal switched between on and off. The swiching frequency of the PWM has to be much higher than that would affect the load. The rate at which power supply switch can vary greatly according to load and application.The advantage of PWM is that power loss in the switching devices is very low. PWM has also been used in certain communication systems where its duty cycle is used to convey information over a communication channel.

5 Equipment and methods

The experiment was conducted on a HVDC transmission line analyzer which consists 4 parts. The first one is a generating station model in which 3 input voltages can be given in all 3 phases. The output of that is given to an SCR based rectifier station which converts the input AC into HVDC. In this paper,it is verified the HVDC output at both 6 pulse and 12 pulse operations. The remaining parts are simulated 650KV HVDC Transmission line and an IGBT based inverter. The Prototype of generating and rectifier stations are shown in the **Figure 3. and Figure 4.** Respectively. The Prototype of 650kV transmission line and invertor station are shown in the **Figure 5. and Figure 6.** Respectively.

Fig. 3. Prototype of generating station

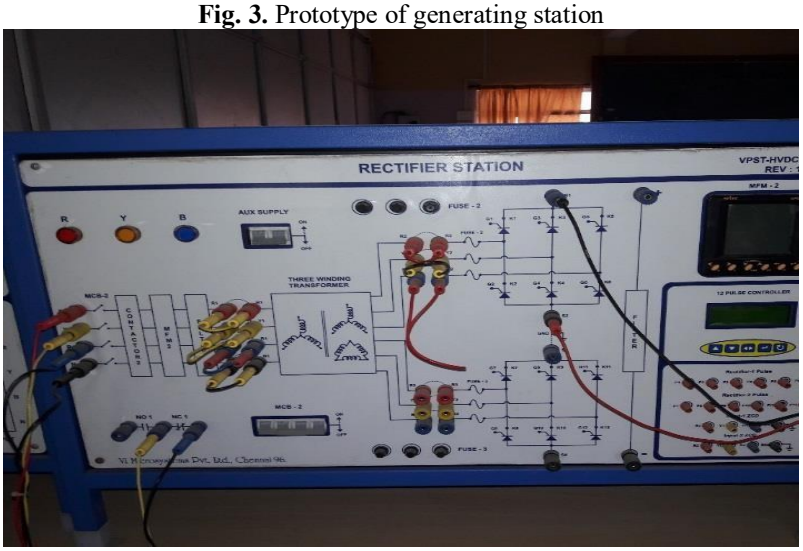

Fig. 4. Prototype of Rectifier station

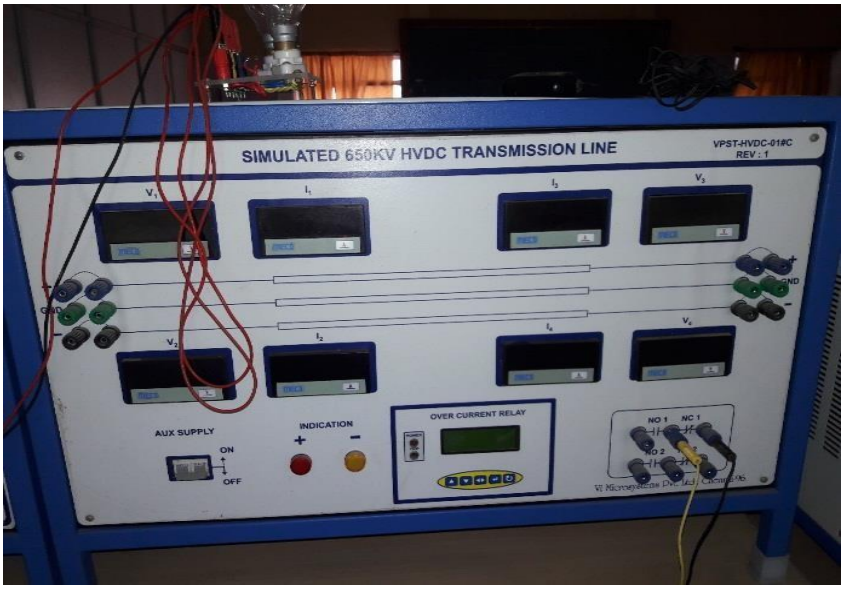

Fig. 5. Prototype of Simulated 650kV HVDC Transmission Line

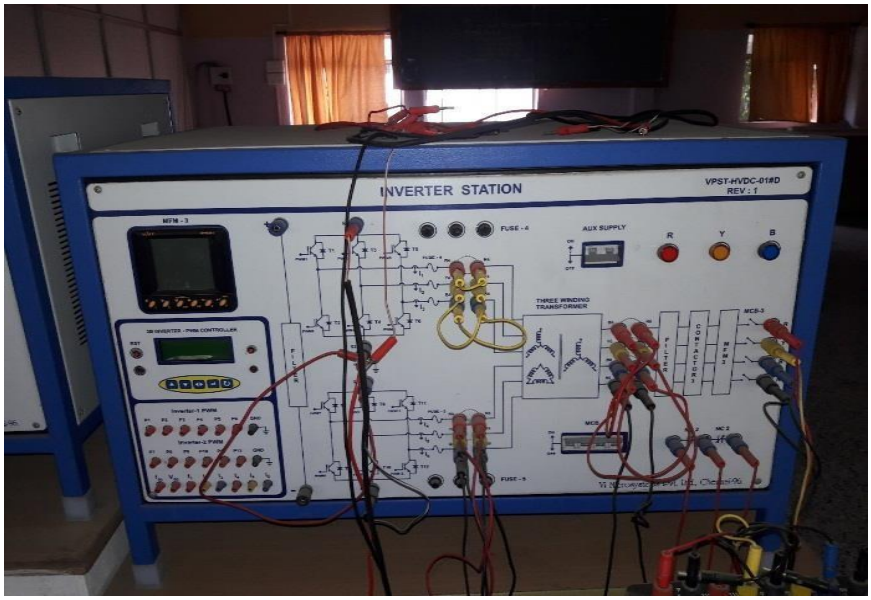

Fig. 6. Prototype of Inverter Station

The input voltage is kept constant at 110 KV in each phase of the generating station and is given to SCR based converter(rectifier).The output is measured for this converter at firing angle from 0 to 120 on 6 pulse operation and 0 to 30 on 12 pulse operation. Then the comparison is made for the operation at 6 pulse and 12 pulse at firing angle 0 to 30degree.

6 Results and discussions

The 6 pulse operation is used to calculate the output of SCR based convertor at firing angle from 120 to 0 obtained values of DC voltage are tabulated in the Table.1 and graph of firing angle vs DC voltage is shown in **Figure 7.**

Table 1. Details of 6 pulse operation

FIRING ANGLE	**MEASURED DC VOLTAGE**
120	148.5
110	185
100	220
90	244
75	254
70	275
65	264
60	280
55	202
50	224
45	193
40	280
35	264
30	230
25	236
20	248
15	254
10	259
5	263
2	264

1	264
0	280

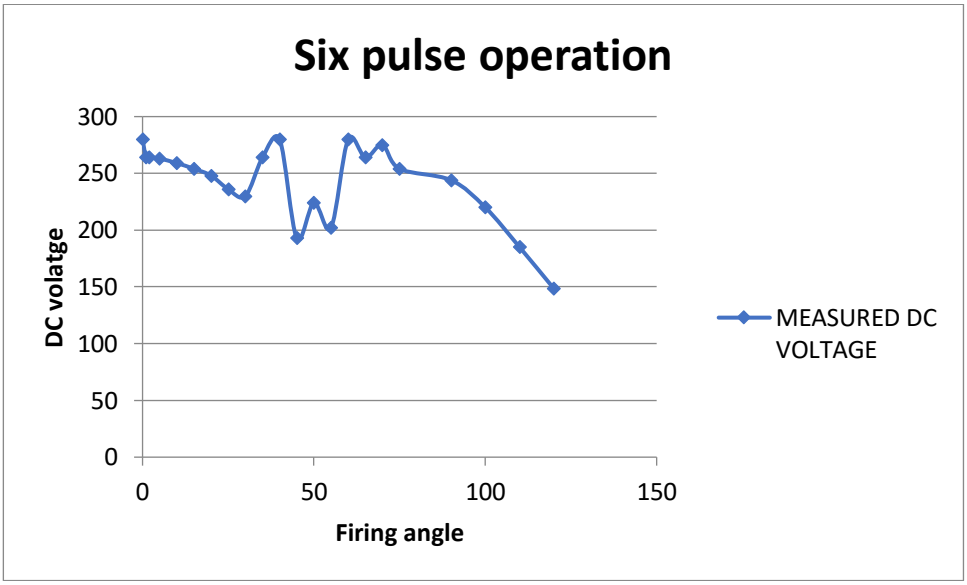

Fig. 7. Firing angle vs DC voltage(6 pulse)

Results for output DC voltage where firing angle is o to 30 degree is then taken for 12 pulse operation and shown in the Table 2. and graph of firing angle vs DC voltage is shown in **Figure 8.** The comparision between 6 pulse and 12 pulse is shown in the Table 3. and corresponding graph is shown in **Figure 9.**

Table 2. Details of 12 pulse operation

FIRING ANGLE	**MEASURED DC VOLTAGE**
30	436
25	451
20	466
15	473
10	475
5	454
1	425

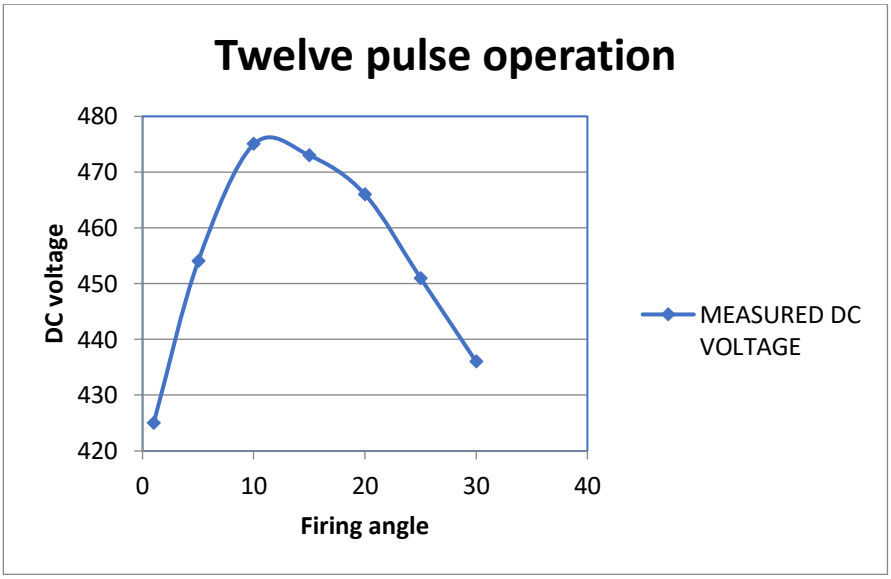

Fig. 8. Firing angle vs DC voltage(12 pulse)

Table 3. comparision of 12 and 6 pulse operation

FIRING ANGLE	DC VOLTAGE (6 PULSE)	DC VOLTAGE (1 2 PULSE)
30	230	436
25	236	451
20	248	466
15	254	473
10	259	475
5	263	454
1	264	425

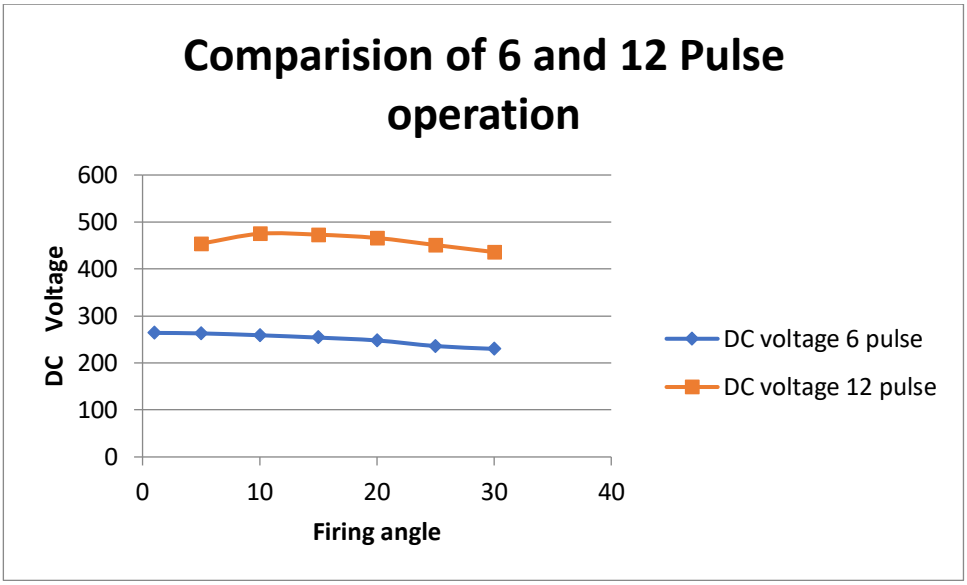

Fig. 9. Firing angle vs DC voltage(6 &12 pulse)

From this it is clear that at 12 pulse operation, voltage is almost doubled compared to 6 pulse operation. The output voltage is more steady and efficiency is more.

7 Conclusion

The output of the 6 pulse operation of the SCR based converter varies continuously and also produces lesser output voltage. Here losses are more and efficiency is less. In 12 pulse operation The output of SCR based converter is almost double of 6 pulse operation. Here losses are very less,output steadily varies according to firing angle and efficiency is more. The only advantage of 6 pulse operation over 12 pulse is that in 6 pulse operation, variation of firing angle from 0 to 120 degree is possible. But in 12 pulse, firing angle variation ranges from 0 to 30 degree. so in an SCR based converter 12 pulse operation is more preferable.

References

[1] Oluwafemi E. Oni, Kamati Mbangula, and Innocent E. Davidson. “A Review of LCC-HVDC and VSC-HVDC Technologies and Applications”

[2] Daniel Ludois and Giri Venkataramanan. “An Examination of AC/HVDC Power Circuits for Interconnecting Bulk Wind Generation with the ElectricGrid”

[3] Roberto Rudervall J.P. Charpentier Raghuveer Sharma ABB Power Systems World Bank ABB Financial Services Sweden United States Sweden. “High Voltage Direct Current (HVDC)Transmission Systems Technology ReviewPaper”.

[4] Sharad Chandra Rajpoot,Prashant Singh Rajpoot,Kishan Gupta, Durga Sharma. “Analysis of Hvdc Power Transmission Line with Unique Power ControlRoom”

[5] International Research Journal of Engineering and Technology (IRJET) . Tanay Rastogi, Mohd. Tabish Siddiqui Prof. R.Sudha, Prof. K. Govardhan, VIT University, Vellore, Tamil Nadu. “Analysis

Design and Realization of an Isolated DC-DC Converter with Regenerative Snubber circuit using Tertiary Winding Transformer

Lakshmi S[1], Karthikeyan B[2], Vinoth KumarP[3]
{lakshmi.eee@bharathuniv.ac.in[1], karthikeyanb@saec.ac.in[2],vinothkumarp@skcet.ac.in[3]}

Bharath Institute of Higher Education and Research, Chennai - 600 073[1], S. A. Engineering College, Chennai 600077[2], Sri Krishna College of Engineering and Technology, Coimbatore 641008

Abstract.A novel isolated dc-dc forward converter with a regenerative snubber circuit is introduced in this paper. Regenerative operation is achieved by effective utilization of the tertiary winding transformer. Due to easy control of the turn's ratio of the transformer, the capacitor gets easily charged which in turn improves the overall efficiency of the converter. The performance of the circuit is analyzed by simulation and using hardware. The proposed converter also achieves ZVS without any additional circuitry

Keywords: Forward Converter, snubber circuit, zero voltage switching, dc-dc converter, tertiary winding.

1 Introduction

The forward converter is type of dc-dc converter that steps up or steps down the voltage based on the transformer turns ratio and also provides galvanic isolation for the load [1]. It performs the same operation as the fly back converter, but is generally more energy efficient. Two types of converter with galvanic isolation are Flyback converter and Forward converter. Forward converter is one of the classification of SMPS that provides a constant and controlled dc output. The gyrator model and its corresponding equivalent circuit model of the integrated transformer is derived. Three transformers wounded on a single core forms the transformer. Wide ranges of output voltage, reduced ripples, faster response are some of the highlights of the converter and hence it is highly suitable for low voltage and high current applications [2].

In forward converter topology described in [3], without utilization of a active switch, just by the use of the snubber circuit in the primary side, efficiency has been improved. The converter has an output for 40 W with a maximum efficiency of 91% producing 3 V and 4 A at the output which is best suitable for telecommunication systems. Theoretical analysis on an unique topology of forward converter with two diodes that realizes magnetizing reset recycling magnetizing energy is proposed. Here the transformers are parallel connected such that the power losses are equally distributed. It also uses interleaving architecture such that current ripple at the output side is minimized with maximum power density [4]. Nevertheless the voltage stress causes more losses in the circuit, hence [5] examined the parameters that

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affect the clamp voltage and from which critical parameters are identified and arrived at a mathematical solution for the clamp voltage. In [6], author designed a snubber circuit which is composed of inductance, capacitance and diodes which is basically non-dissipative instead of using capacitors and resistors. The non-dissipative feature reduces the switching loss of the converter. The working operation of a forward converter with LC snubber is studied and the energy loss is evaluated. Based on the resultant values, the design of snubber circuit is carefully undergone to reduce the losses which are explained in [7]. The converter proposed operates at high switching frequencies with wide operating ranges of voltage and power. Effect of voltage spikes and losses due to residual energy is investigated for a RCD snubber circuit. The selection of resistor in RCD snubber is performed by a new design procedure to make an optimal commutation between CM noises and losses [8].

Various features of a forward converter with energy saving snubber circuit for different topologies have been discussed by various authors. It can be observed that reduced ripples and low power loss can be obtained however there is still the presence of voltage spikes, higher dv/dt which is mainly due to the leakage reactance in the transformer that causes more power loss. In this paper a new topology of forward converter with same snubber circuit but with tertiary winding transformer is proposed. Hence due to the tertiary winding the loss due to leakage reactance is much reduced.

2 Text formatting

The objective of the project is to design, simulate and implementing forward converter with regenerative snubber.

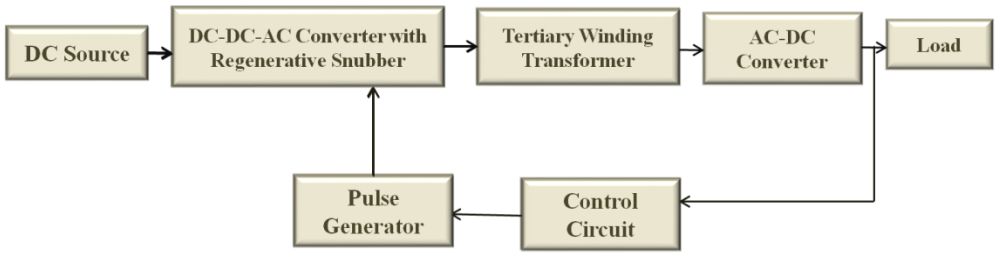

Fig. 1. Block diagram of the proposed forward converter

The circuit diagram of the forward converter with regenerative snubber and tertiary winding is shown below.

Diode, capacitor and tertiary transformer winding forms the snubber circuit. Transformer core and winding polarity arrangement are the arrangements that make the forward converter different from a Flyback converter. The conduction of the input and output is also different in both the converters.

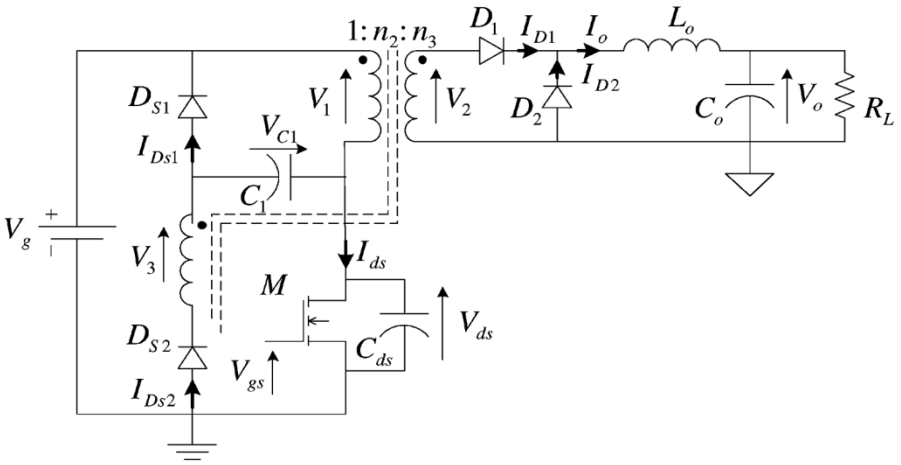

Fig. 2. Circuit diagram of the proposed Forward converter regenerative snubber

3. OPERATION OF FORWARD CONVERTER

The transformer is central to analyzing the operation of the forward converter with the proposed regenerative snubber. The analysis to follow relies on the three winding transformer model, shown in Fig. Here, the transformers 'magnetizing and the leakage inductances are all referred to the primary.

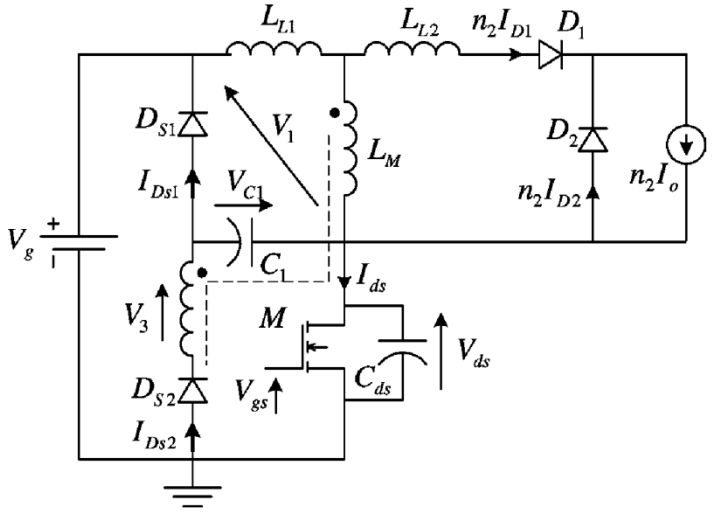

Fig. 3. Equivalent circuit of the forward converter with regenerative snubber

The equivalent circuit explains the effect of transformer leakage reactance on the circuit. Resonance condition appears on the transformer inductance and snubber capacitance. The circuit operates in different modes of operation that are functions of duty cycle and the switching frequency.

4. DESCRIPTION - MODES OF OPERATION

Mode 1 (t_0–t_1): This mode gets initiated by turning ON the power switch. Voltage is fed to the primary winding of the transformer by turning on the power switch. In this mode the diode D_2 is turned on and diode D_1 is off. Now the capacitor discharges its stored energy to the tertiary winding through the diode D_{S2}. The energy gets transferred to the capacitor C_1 as the reactance at L_{L1} and L_{L3} resonates. Now there is a polarity change in the capacitor C_1 and D_1 turns ON.

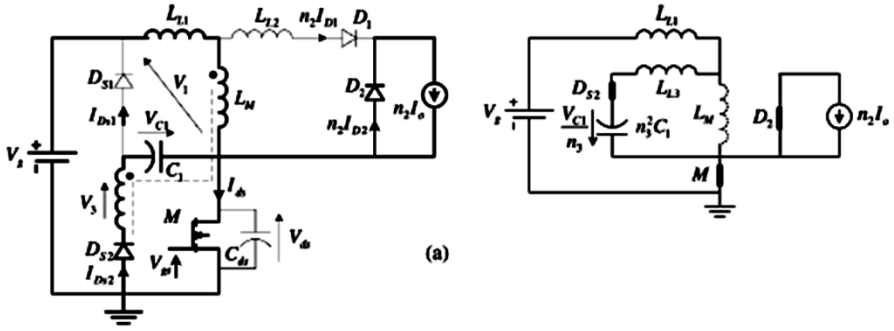

Fig. 4. Equivalent circuit in Mode 1

Mode 2 (t_1–t_2): This mode initiates when D_1 turns on. Resonant condition occurs in all three inductance. This mode continues to be active till the capacitor C_1 voltage reaches $-V_g$. In this condition diode locks the voltage across C_1. At this condition, the inductance stores the excess energy. Capacitor C_1 gets charged by clamping the snubber capacitor which exhibits zero voltage turn off in the power switch.

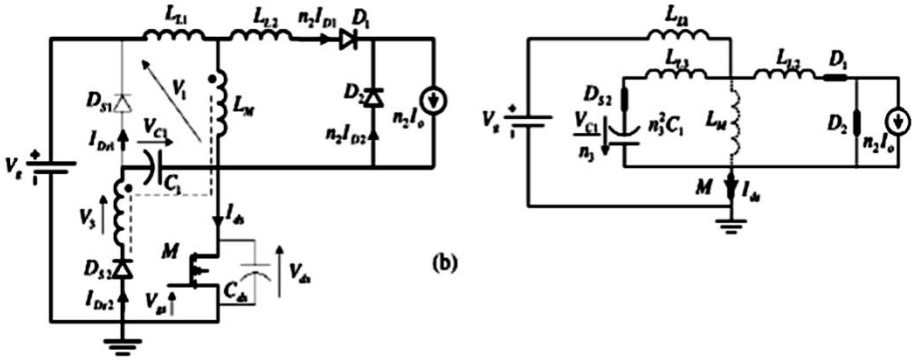

Fig. 5. Equivalent circuit in Mode 2

Mode 3 (t_3–t_4): This mode initiates when the snubber diodes D_{S1} and D_{S2} is turned on such that there exists a current flow path for the winding to the supply. Now in this condition, the supply voltage appears across the transformer winding. The turns ratio of the transformer is less than one thus making the generated voltage higher than the source voltage. The stored energy in the leakage inductance is discharged to the source by the snubber circuit causing a regenerative action. In this condition, based on the turn's ratio the voltage across the secondary increases. Due to this, a voltage (n_2/n_3 *V_g) appears across the diode D_2. This mode continue till the energy stored in the inductance are completely discharged and the snubber diodes are turned off completely.

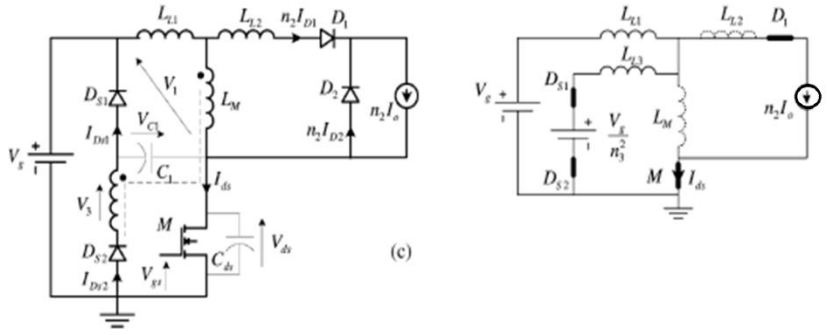

Fig. 6. Equivalent circuit in Mode 3

Mode 4 (t_4–t_5): In this mode, the diodes D_{S1} and D_{S2} are turned off. Figure 7 shows the equivalent circuit of the operating mode 4. In this mode, transformer gets charged there is a ramp occurring in the magnetizing current. This mode is said to be active till the transistor is switched off by an external signal.

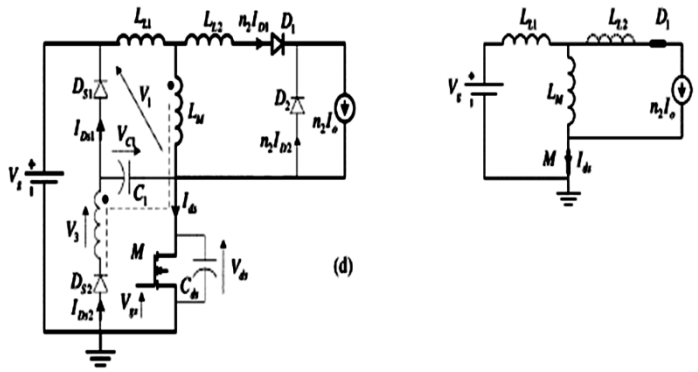

Fig. 7. Equivalent circuit in Mode 4

Mode 5 (t_5–t_6): This operating mode is active when the transistor is tuned off. Figure 8 shows the equivalent circuit for mode 5. The diode D_{S1} is turned on by the magnetizing current of the transformer. In this mode the capacitor gets charged to $-V_g$ and thus turning off the power

switch. Now the stored energy in C_1 is released to the load by the magnetizing current. Due to the negative voltage across C_1, diode D_1 is in on condition as the load current flows through the primary winding of the transformer. Due to decrease in voltage across C_1, switch capacitance C_{DS} voltage increases. This mode continues its operation till the voltage across the snubber capacitor C_1 reverses that makes diode D_2 to turn off. The snubber capacitance gets discharged easily under full load condition and the vice versa during light load condition.

$$C_S = C_1 + C_{DS} \quad (1)$$

$$\Delta t_5 \leq \pi/ 2 \sqrt{(L_m + L_{L1})C_S} \quad (2)$$

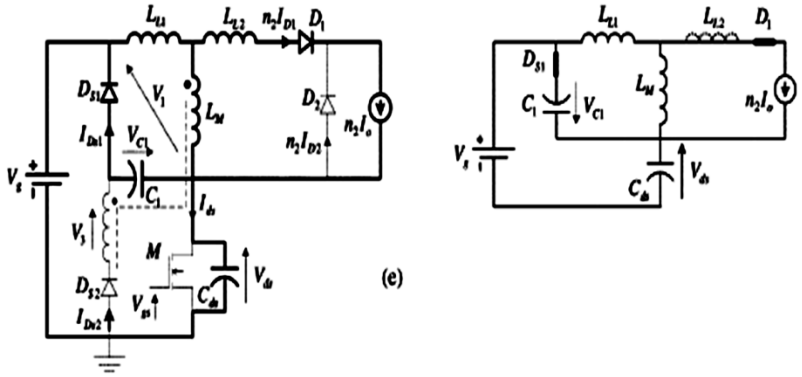

Fig. 8. Equivalent circuit in Mode 5

Mode 6 (t_6–t_7): In this mode the diode D_2 is switched on. Figure 9 show the equivalent circuit in mode 6. The magnetizing current of the transformer resonates between the capacitor C_1 and C_{DS} with the inductance L_{L1} and L_{L2} respectively. Under this condition, the current flowing through D_1 decreases while D_2 increases. This mode continues till D_1 is switched off and D_2 is switched on. Time taken for mode 6 operation is less than ¼ th of the leakage resonant period.

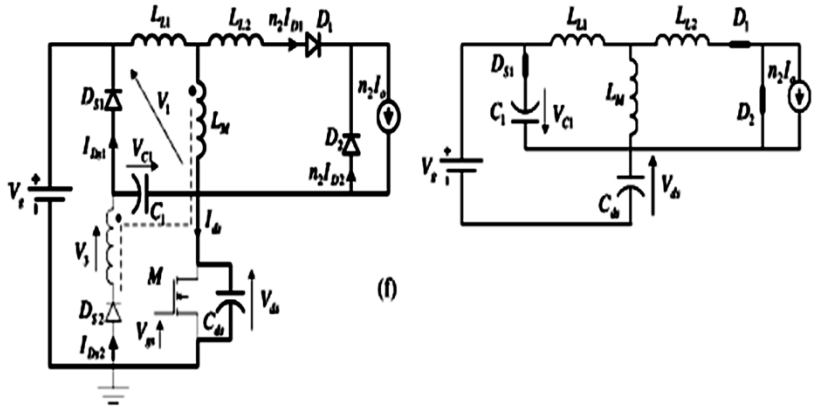

Fig. 9. Equivalent circuit in Mode 6

$$t_6 < \pi/2\sqrt{(L_{L1} + L_{L2})C_S} . \quad (3)$$

Mode 7 (t_7–t_8): This mode is active when the diode D_1 is turned off. Here the snubber capacitor C1 resonates with C_{DS} and the inductance L_{L1} and the magnetizing inductance L_m. This mode continues to be active until the magnetizing current drops to zero and D_{S1} is switched off. Now the transformer is again reset to its initial condition once the energy in the magnetizing component is transferred to the snubber capacitance. This snubber capacitance C_S resonates with the transformer inductance until it reaches ¼ th of the total resonant period. The duration of Mode 7 can be expressed as

$$\Delta t_7 \approx \pi/2\sqrt{(L_m + L_{L1} * L_{L2})}\, C_S \quad (4)$$

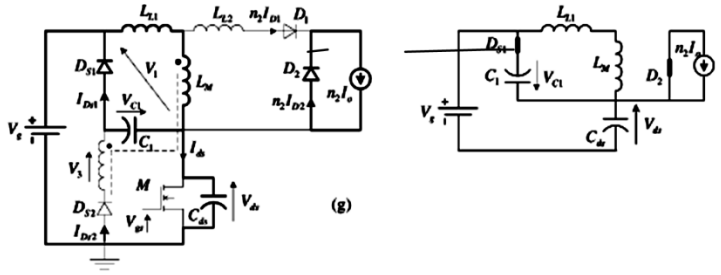

Fig. 10. Equivalent circuit in Mode 7

Mode 8 (t_8–t_9): In this mode the diode D_{S1} is switched off. Fig.11 shows its equivalent circuit. The capacitor C_{DS} is completely charged till it reaches the supply voltage V_g. In this mode there is a resonating condition between the capacitor C_{DS}, inductance L_{L2} and the magnetizing inductance L_m. At the same time, partial energy stored in C_{DS} is fed to the source. This mode continues till the energy across the capacitance is reduced and diode D_{S1} starts to conduct. This mode operating duration is ¼ the total resonating period and the same is determined by the magnetizing inductance and capacitance C_{DS}.

$$\Delta t8 \approx \pi/2\sqrt{(L_m + L_{L2})C_{DS}} \quad (5)$$

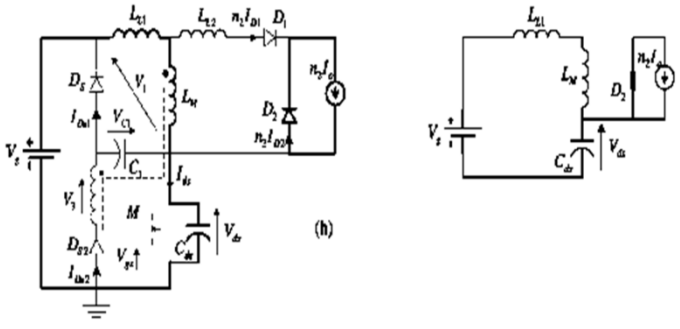

Fig. 11. Equivalent circuit in Mode 8

Mode 9 (t_9–t_{10}): This mode gets active when diode D_{S1} is switched on. In this mode the stored energy of the snubber capacitance gets discharged through the transformer winding. The stored energy is fed to the source performing regenerative action. In this mode, the windings are in series thus making the equivalent inductance to be $(1 + n_3)^2 L_m$. This is the last operating mode for the proposed system. The figure 12 shows the equivalent circuit of the proposed system in Mode 9.

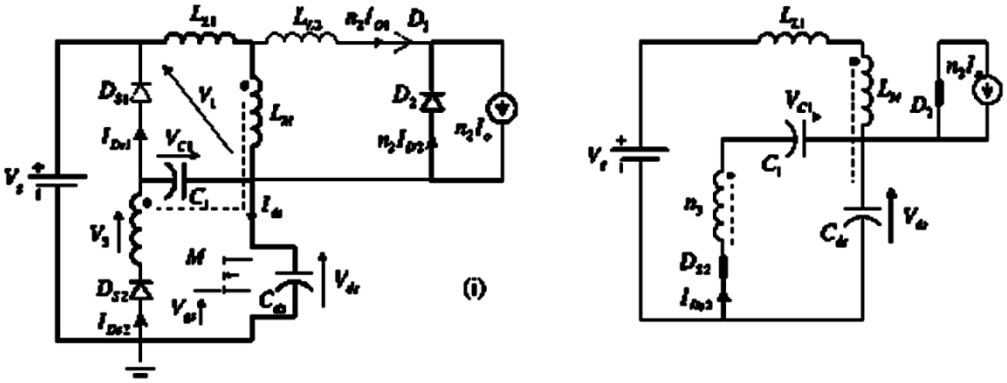

Fig. 12. Equivalent circuit in Mode 9

4. a. SIMULATION FOR PROPOSED FORWARD CONVERTER-R LOAD

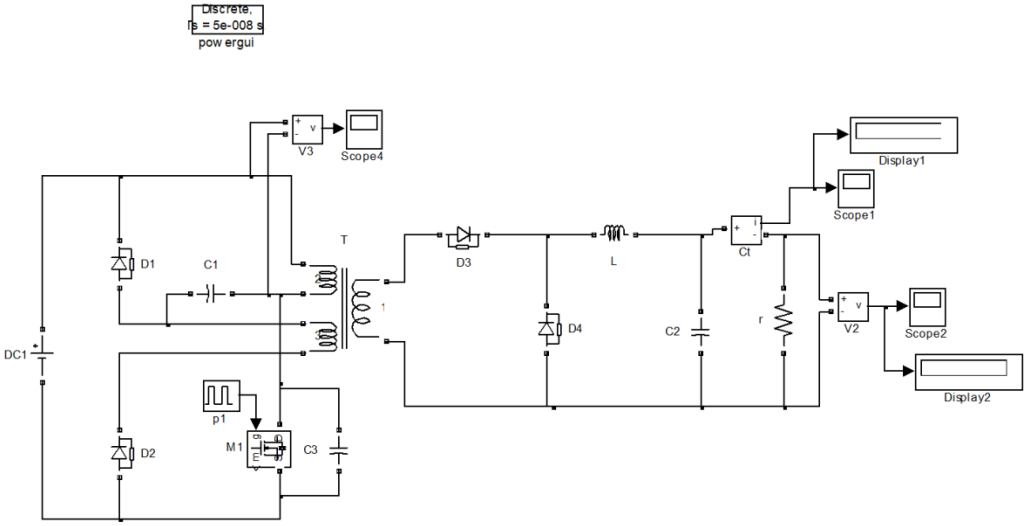

Fig. 13. Matlab simulation diagram for Proposed Circuit with R Load

4. b. Simulation results of the proposed system with R load

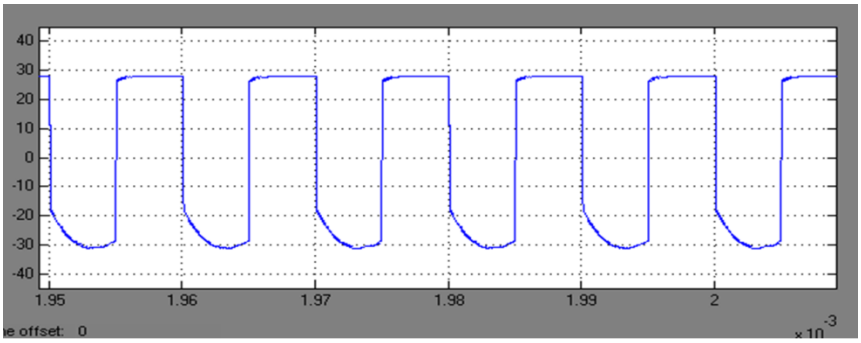

Fig 14. Simulated Results of the Output Voltage

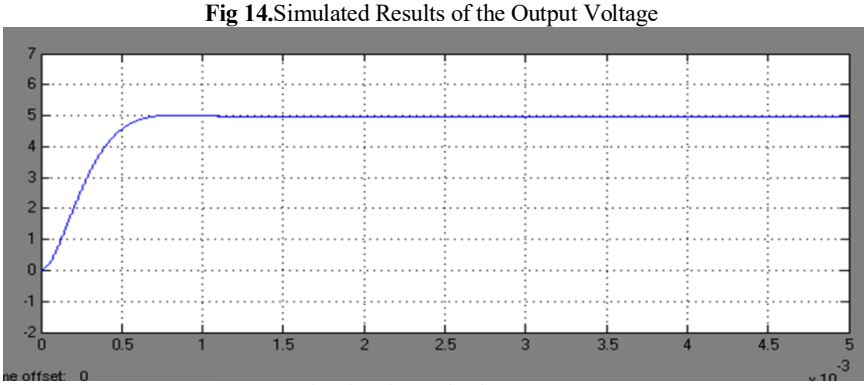

Fig. 15. Simulated Results for Output Current

4. c. Simulation model of the prposed circuit using motor load

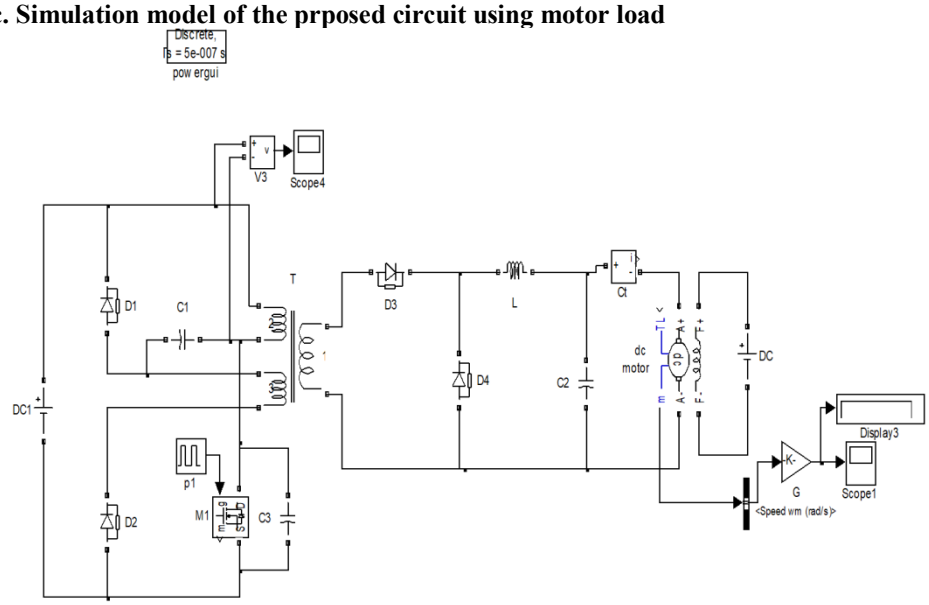

Fig. 16. Simulated models for forward converter with motor load

4. d. Simulation results of the proposed system with motor load

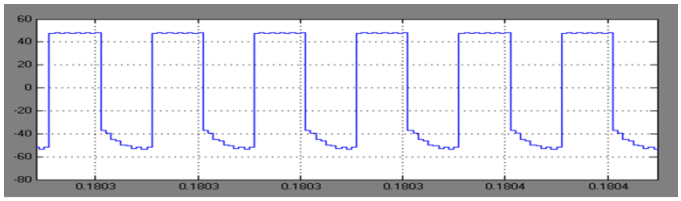

Fig. 17. Simulated results for inverter output voltage

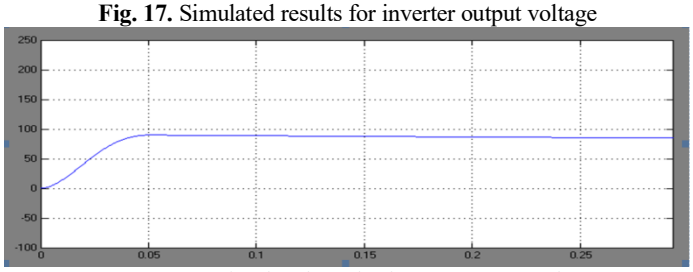

Fig. 18. Simulated results for armature speed

The output results for with conventional and proposed system is simulated using MATLAB. The results obtained through the simulation of proposed forward converter and conventional circuit using MATLAB is to be analyzed in this chapter.

5. Comparison of Conventional And Proposed Circuit

Figure 19 shows the comparison between the models. From the graph it is observed that the output power in proposed circuit is higher than the conventional one.

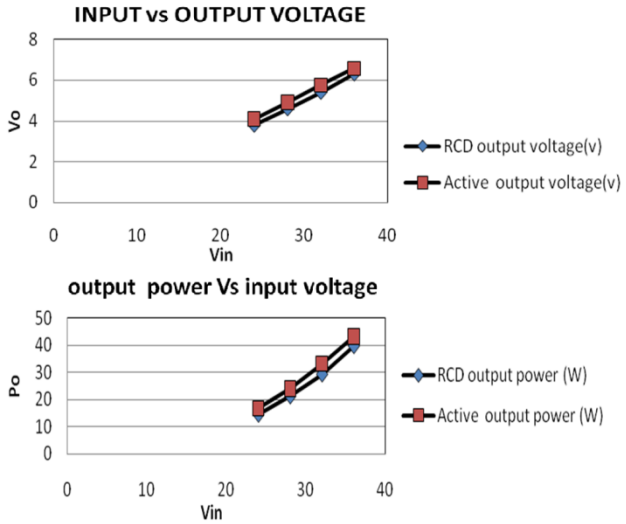

Fig. 19. Comparison of conventional and proposed circuit i/o voltages & i/o power

TABLE I. Comparison of output voltages & power

Input voltage (v)	RCD output voltage(v)	Active output voltage(v)	RCD output power (W)	Active output power (W)
24	3.8	4.1	14.44	16.81
28	4.6	4.9	21.16	24.1
32	5.4	5.76	29.2	33.2
36	6.3	6.57	39.6	43.2

6.Design Details

Flux of the motor used Φ = 10μwb
Frequency F_s = 25 KHz
Output Voltage V_o = 5V
Input voltage V_{in} = 28V
Output Current I_o = 5A
ripple factor =4 X10-5

Transformer Design:(Ferrite core)

Formulae used:
E1 = 4.44 N1 Φ F
E2 = 4.44 N2 Φ F
E3 = 4.44 N1 Φ F

N1 = 30 TURNS
N2 = 5 TURNS
N3 = 30 TURNS

Design of transformer leakage reactance

S=L/Aų
S=45* 106
L_{L1}= N_2/ S
L_{L2}= N_2/ S
L_{L3}= N_2/ S

R_L=V_0/I_O
Output Power:
P_o= I_{O2}*R

Design of filter component:
Ripple (r) =1/4√3fC_R
C=100 μF.
Ripple (r)= √3/ ω2LC
L = 260μH

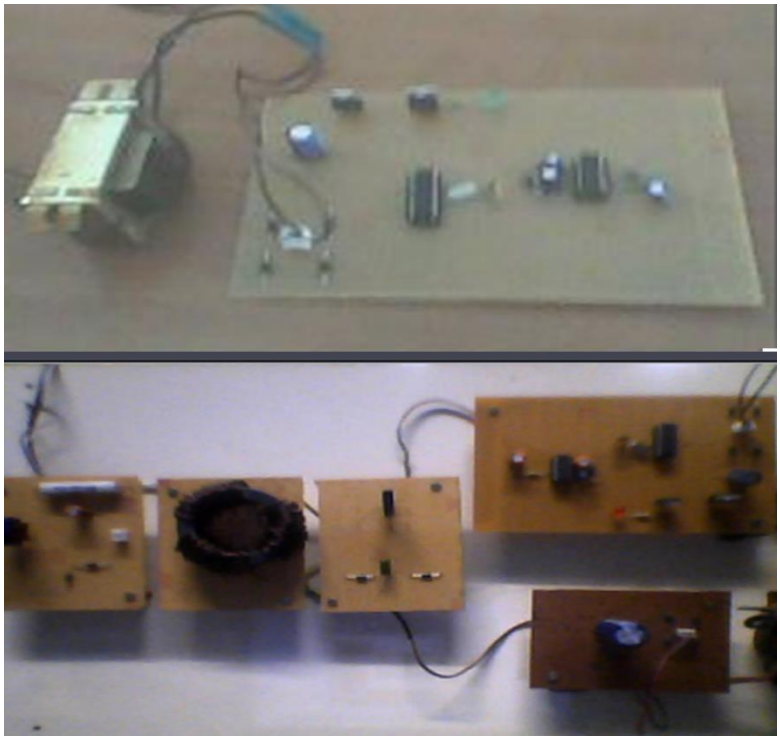

Fig. 20. Hardware implementation of the control circuit & Power circuit

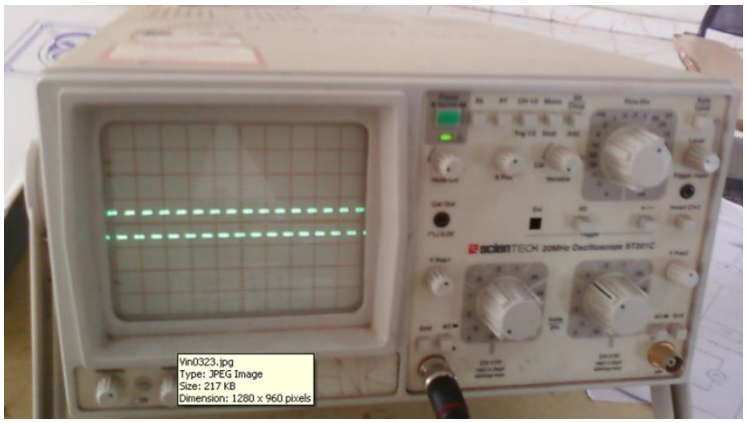

Fig. 21. Generated pulse from PIC controller

7. Conclusion

The proposed system utilizes a tertiary transformer winding that regenerates the transformer leakage reactances. There is flexibility in the control of the turn's ratio of the tertiary winding so that the snubber capacitor can be completely charged till it reaches the supply voltage. This

gives a high degree of freedom in the control part. Due to this accidental changes in mode can be avoided. The proposed system offers a ZVS with a wide range of operating conditions which makes the circuit suitable for various applications

References

[1] C. Zhao, X. Wu, P. Meng and Z. Qian, "Optimum Design Consideration and Implementation of a Novel Synchronous Rectified Soft-Switched Phase-Shift Full-Bridge Converter for Low-Output-Voltage High-Output-Current Applications," in IEEE Transactions on Power Electronics, vol. 24, no. 2, pp. 388-397, Feb. 2009, doi: 10.1109/TPEL.2008.2005269.

[2] Leung-Pong Wong, D. K. -. Cheng, M. H. L. Chow and Yim-Shu Lee, "Interleaved three-phase forward converter using integrated transformer," in IEEE Transactions on Industrial Electronics, vol. 52, no. 5, pp. 1246-1260, Oct. 2005, doi: 10.1109/TIE.2005.855680.

[3] M. Jinno, "Efficiency improvement for SR forward converters with LC snubber," in IEEE Transactions on Power Electronics, vol. 16, no. 6, pp. 812-820, Nov. 2001, doi: 10.1109/63.974379.

[4] T. Jin, K. Zhang, K. Zhang and K. Smedley, "A New Interleaved Series Input Parallel Output (ISIPO) Forward Converter With Inherent Demagnetizing Features," in IEEE Transactions on Power Electronics, vol. 23, no. 2, pp. 888-895, March 2008, doi: 10.1109/TPEL.2007.914813.

[5] C. D. Bridge, "Clamp voltage analysis for RCD forward converters," APEC 2000. Fifteenth Annual IEEE Applied Power Electronics Conference and Exposition (Cat. No.00CH37058), New Orleans, LA, USA, 2000, pp. 959-965 vol.2, doi: 10.1109/APEC.2000.822805.

[6] S. D. Johnson, A. F. Witulski and R. W. Erickson, "Comparison of resonant topologies in high-voltage DC applications," in IEEE Transactions on Aerospace and Electronic Systems, vol. 24, no. 3, pp. 263-274, May 1988, doi: 10.1109/7.192094.

[7] W. Zhang, Y. Lei, X. Zhang and Y. Liu, "Small Signal Analysis of a dual-switch forward Converter with non-ideal transformer in Current-Programmed Control," 2007 7th International Conference on Power Electronics and Drive Systems, Bangkok, 2007, pp. 49-52, doi: 10.1109/PEDS.2007.4487676.

[8] L. H. S. C. Barreto, A. A. Pereira, V. J. Farias, L. C. de Freitas and J. B. Vieira, "A boost converter associated with a new nondissipative snubber," APEC '98 Thirteenth Annual Applied Power Electronics Conference and Exposition, Anaheim, CA, USA, 1998, pp. 1077-1083 vol.2, doi: 10.1109/APEC.1998.654031.

Reliability Improvement in backup protection schemes using wide area measurement systems

Dr. S. Prakash[1], Dr.S.Jayaprakash[2], Dr.A. Suresh[3]
{prakashacademics@gmail.com[1], jayaprakash.eee@sathyabama.ac.in[2], asuresz@gmail.com [3]}

Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India [1], Sathyabama Institute of Science and Technology, Chennai, Tamil Nadu, India [2], AMET Deemed to be University, Chennai, Tamil Nadu, India [3]

Abstract. The proposed project envisages a new adaptive scheme of protection that provides a centralized monitoring mechanism using PMU inputs, to achieve the following objectives for a real-time power system : i) to provide assertive trip signal for genuine faults detected in the protected line. i) to provide a blocking signal for spurious faults / load encroachments in the zones of protection. ii) in the absence of PMU data (due to communication failure / equipment failure), the protection schemes will continue to be in service using local measurements. This will enable to overcome certain drawbacks of the traditional protection system which work with local measurements, thereby helping in considerable improvement of security and reliability of monitoring and protection of the electric system. The essential target of any back-up insurance is to give a second line of assurance to clear any blame on the framework. To achieve this goal, the back-up defensive framework must have the option to fulfill the meet the accompanying useful necessities: (1) It ought to catch the life of all issues which emerge inside its endorsed district of wellbeing. (2) It must find the disappointment of the essential wellbeing to clean any blame as intentional. In clearing the flaw from the machine, it need to play out the ensuing highlights : a) start the stumbling of the base assortment of circuit breakers. B) Operate sufficiently fast (reliable with coordination necessities) to safeguard System security, in this manner forestalling unbalanced contraption harm, and protect a recommended level of transporter congruity.

Keywords: Phasor measurement unit, Backup protection, zone 3 relay, Wide protection area, control and measurement systems, Wide Area monitoring Systems(WAMS).

1 Introduction

Continuous development of modern power system leads to complex interconnected systems. This has prompted the advancement of Wide region interconnection which may thus cause significant power outages those outcomes in genuine consequences for the framework. Over the most recent couple of many years the danger of blackouts has been a genuine worry because of low security and absence of transmission improvement. To beat all these, New advances like sharp matrices has added new norm for insurance, control and following machine to build the security of intensity frameworks, reduce the bothersome power outages, quick response to the extraordinary changes in the electric machine, offer unwavering quality to electric strength, recognition of shortcoming and contraption recuperation as right on time

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as practical. In any case, once in a while extremely minor aggravations can be increment via the chain of exercises fundamental to gadget immense results.

So here, wide area wellbeing and oversee checking contraption is vital for energy control framework. Different deficiencies happen at the transmission line in light of which the device may crumble. There are particular situation like burden infringement, straightforward flaws, islanding and power swings due to this device get influenced comprehensively.

The Wide Area Measuremen introduces a mechanism for adaptive protection putting, backup safety and to come across screw ups etc. A WAMS includes improve statistics tools, dimension technology and it is installation by way of set up of PMUs. The control and expertise of the enlargement of the complex strength system are strengthened using WAMS.During the event of a straightforward flaw at the gadget it is expressed to be the underlying degree of shortcoming and the design of the machine depends on N-1 requirement and works with first deficiency persistently. On the off chance that all the while two events emerge, the gadget is changed to N-2. The auxiliary deficiency as a result of human blunder, guarded transfers or inaccurate examination. Burden infringement is considered as second deficiency circumstance in the machine. Shortcoming happens when burden increments out of nowhere and can cause extreme blackouts. A vivacious blackout power because of over-burden is moved to different lines. Force swing is alluded as third shortcoming condition. Because of Power swing in strength contraption, third territory glitch of distance transfer happens in distance wellbeing. Islanding mode is alluded as fourth deficiency condition. Framework voltage self-destruct and strength contraption experience the blackout During the event of a basic shortcoming at the gadget it is expressed to be the underlying degree of deficiency and the format of the machine depends on N-1 imperative and works with first issue ceaselessly. On the off chance that at the same time two events emerge, the gadget is changed to N-2. The auxiliary shortcoming in view of human mistake, protective transfers or wrong investigation. Burden infringement is considered as second issue circumstance in the machine. Flaw happens when burden increments abruptly and can cause extraordinary blackouts. An exuberant blackout power because of over-burden is moved to different lines. Force swing is alluded as third shortcoming condition. Because of Power swing in strength device, third territory glitch of distance hand-off happens in distance security. Islanding mode is alluded as fourth shortcoming condition. Framework voltage self-destruct and strength contraption experience the blackout condition during the islanding method of activity Generally, transmission energy grids are complicated and transmission traces paintings inside the limits. Backup safety structures do no longer rely on Wide Area Measurements as it uses best local dimension. This necessitates backup safety scheme to enhance the safety and reliability.

Phasor Measurement Unit (PMU) is estimating instrument. Utilizing Global Positioning System (GPS), it prepares the synchronized estimations of voltage phasors and current phasors with time tagged. Consideration of the framework conditions, a way for power framework insurance particularly for reinforcement security has been found. On contrasting the magnitude of flows when issue with synchronized current phasor estimations the separation point and area are recognized. A plan utilizing positive grouping synchrophasor information for flaw discovery by contrasting the differential flows determined through PDC has been proposed.

The paper is organised as follows: In Section II Distance protection Relay in malfunction of third zone is discussed. Section III shows wide area Monitoring systems (WAMS). Then in Section IV, The Proposed Supervised Zone-3 Distance Protection SectionV , Differential

Protection Logic,Section VI. Actual Cases of Spurious operation in Zone-3, Section VII. Simulation using Matlab and VIII. Result and Discussion

2.Distance Protection Relayand It's Demerits

Distance hand-off goes about as fundamental assurance for issues inside area 1 while for zone 2 and locale 3, it goes about as reinforcement security for abutting line. Zone 1 accomplish is ordinarily set best as much as eighty% - 90% of the covered line. It isn't set one hundred% of the covered line to evade hand-off from underneath came to or over came to because of current and voltage estimation botches, brief effect and incorrectness in transmission line boundaries. On the off chance that a shortcoming happened inside this region in which distance hand-off goes about as fundamental security, the hand-off will without a moment's delay transport ride sign to open the electrical switch. The resulting 10% assurance edge guarantees that need to cowl the excess 10% of the street. The territory 2 covers the leftover part of the line in addition to 20 reliable with penny of the following briefest line and activity time is going to about there is no danger of the Zone - 1 security over-achieving the included line as a result of mistakes in the present day and voltage transformers, errors in line impedance data accommodated setting capacities and blunders of transfer putting and estimation of the space assurance zero.2 to 0.Three seconds. The stumbling time for zone 2 ordinarily set at various hundred milliseconds. Reinforcement assurance for complete nearby line is incorporated through district 3 reach. It is commonly set in any event 1.2 cases the impedance of ensured abutting line. The set stumbling time for zone three reach is commonly various seconds.

Third zone covers the whole region ensured by the first and second zones in addition to 50 percent of the following long queue (third line) and postpone time is set between 0.5 to 1.0 seconds..

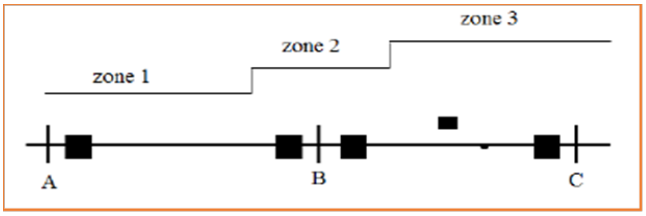


Fig 1. layout of three zones of Distance Relay operation

The relay whose working relies upon on the space between the impedance of the faulty segment and the position on which relay set up is known as the impedance relay or distance relay. It is a voltage controlled gadget. For lower fault resistance, the impedance is proportional to the space from the relay to the fault. A distance relay is designed to most effective function for faults happening between the relay location and the chosen reach point and stays solid (or inoperative) for all faults out of doors this vicinity or region. Each relay operates independently according to the 3 distinctive kind quarter of protection as shown in Fig.1

3. Wide Area Monitoring System (WAMS)

Wide region checking frameworks (WAMS) depend on the fresh out of the box new data procurement innovation of phasor estimate and permit the following transmission contraption circumstances over immense areas considering recognizing and moreover balancing lattice hazards. The WAMS framework obliges of the Phasor estimation unit (PMU) and Phasor insights concentrator (PDC). Current, voltage and recurrence estimations are taken via Phasor Measurement Units (PMUs) at settled on areas in the force machine and put away in a realities concentrator (PDC) every 100 milliseconds. The deliberate bits incorporate the two sizes and section points, and are time-synchronized through Global Positioning System (GPS) collectors with an exactness of 1 microsecond. A Phasor insights concentrator gets two or three PMU data streams , plays circulate statistics fee conversion in which required, time aligns the steam and repacks the streams into one or more output streams for transmission to other systems require phasor data.

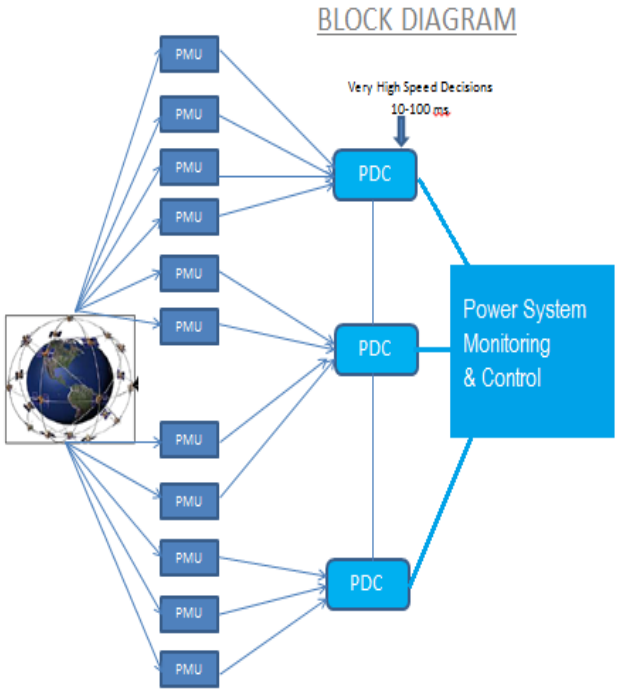


Fig2. Wide Area backup protection system

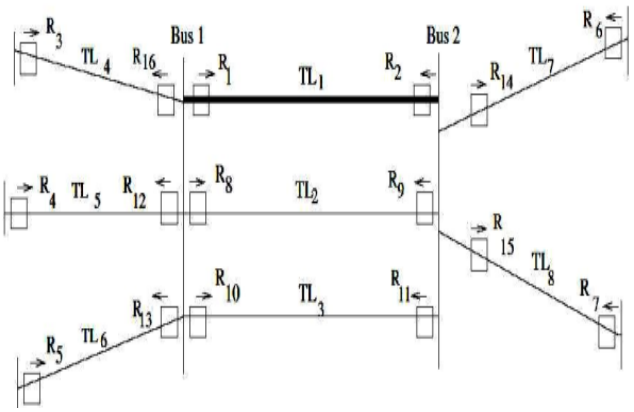
This system operates as backup protection system for WAMS and it is substation of conventional backup protection in power system.

4. The Proposed Supervised Zone-3 Distance Protection

The PMUs to measure 25 samples per sec makes them suitable for analysing the system under dynamic conditions. The PMUs transmit line current and bus/line voltage synchro phasor to PDC Centralised location. The PDC creates time snapshot for the system.

To avoid time delays in PMU for protection applications, it is preferable to use P-type PMUs as they are fast. Connect PMUs to protection core of CTs. They will not saturate on fault current. The supervisory analytic is centralized and located at the location of the PDC.

With PMUs placed at both ends of the transmission lines, differential currents can be computed. Once differential currents for all backed up lines are available, decision to block or not block Zone-3 of the backup relay can be taken. The whole procedure of obtaining synchrophasor from PMUs differential current computation communicating appropriate decision to relay should happen well within one second.



Primary relays for line TL1 = R1 & R2
Zone-3 back-up relays associated with R1 : B1 ={R3;R4;R5;R9;R11}
Zone 3 back relays associated with R2 : B2 = {R6;R7;R8;R10}

Zone-3 of R3 backs up following set of relays:
P3 = {R1;R8;R10;R12;R13}.

i.e., during fault (which is not yet cleared by primary
Protection) on any one of the lines TL1, TL2, TL3, TL5, TL6,
Then Z3 of R3 must operate.

5. Differential Protection Logic

A fault which has not been cleared by primary protection s systems can be detected by differential protection logic. This can be implemented by using positive(1), negative(2) and zero sequence(0)synchrophasor line currents. Since the Zone-3 time delay setting is of the order of a second, and PMU reporting time 40 milliseconds, the fault can be detected in multiple and successive PMU frames.

\

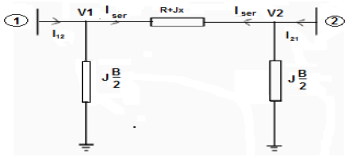


Fig 4. Differential protection Scheme for a Line

- ψ functions are defined as:

$$\psi(V_1, V_2) = j\frac{B}{2}(V_1 + V_2)$$

$$\underline{\psi}(V_1, V_2) = j\frac{B}{2}(V_2 - V_1)$$

- Fault detection logic using differential currents can be given to be:
- Zero sequence differential current

$$I^0_{diff}(k) = \left| \frac{\overrightarrow{I_{12}}^0(k) + \overrightarrow{I_{21}}^0(k) - \psi^0(V_1^0, V_2^0)}{\overrightarrow{I_{12}}^0(k) - \overrightarrow{I_{21}}^0(k) + \underline{\psi}^0(V_1^0, V_2^0)} \right| \times 100\%$$

- Positive sequence differential current

$$I^1_{diff}(k) = \left| \frac{\overrightarrow{I_{12}}^1(k) + \overrightarrow{I_{21}}^1(k) - \psi^1(V_1^1, V_2^1)}{\overrightarrow{I_{12}}^1(k) - \overrightarrow{I_{21}}^1(k) + \underline{\psi}^1(V_1^1, V_2^1)} \right| \times 100\%$$

- Negative sequence differential current

$$I^2_{diff}(k) = \left| \frac{\overrightarrow{I_{12}}^2(k) + \overrightarrow{I_{21}}^2(k) - \psi^2(V_1^2, V_2^2)}{\overrightarrow{I_{12}}^2(k) - \overrightarrow{I_{21}}^2(k) + \underline{\psi}^2(V_1^2, V_2^2)} \right| \times 100\%$$

- If $I_{diff}(k)^{012} \leq \varepsilon^{012}$ then no fault exists on the line k.
- The value of $\varepsilon^0, \varepsilon^1, \varepsilon^2$ can be between 1 - 10 %

The approach monitor the fault on the designated line
e.g., TL1.
Primary design attribute: Line
Secondary design attribute: Set of backup relays for the line. If differential logic indicates fault on the line, then PDC raise TRIP FLAG for set of back up relays (B1 and B2).

ASSERT TRIP decision for a relay is obtained by OR operation on ASSERT TRIP flags for the lines it is backing up (FOR R3 -> P3). If differential protection logic indicates a healthy line (e.g., TL1), raise BLOCK FLAG for the backup relays (B1 U B2).

For a given backup relay, (R3), perform AND operation on the BLOCK FLAGS of corresponding set of primary lines. (P3). If resulting decision is amative, ASSERT BLOCK is

issued for relay R3. If PMU data is unavailable and ASSERT TRIP is not obtained on any of the primary lines, system defaults to ENABLE TRIP (B1 and B2).

6. ACTUAL CASES OF SPOURIUS OPERATION IN ZONE3:

The Actual tripping events happened Southern region of our country for spurious fault of Zone -3 protection from Southern Region Protection Committee (SRPC), Government of India web site.

Table 1.Zone -3 Trip Cases

	Date & Time	Line Details
1	17-05-2019 at 14:10 Hrs.	APTRANSCO 400kV Kurnool-Srisailam line
2	18.05.19 12.13 Hrs.	220KV Ambewadi-Ponda line
3	14.06.19 14.00 Hrs.	220KV Sedam - RTPS line-1&2 (Generation loss)
4	07.02.19 11.49Hrs	KPTCL – 400KV Lingapuram-Guttur Line Tripped at ZONE-3
5	27.03.19 17.45 Hrs.	KPTCL – 220KV BTPS to Lingapuram Line Tripped at ZONE-3
6	08.04.19 16.11 Hrs.	APTRANSCO - 400KV Srisailum-Nanoor Tripped Indication of Zone-3

7. Simulation Using Matlab

The accompanying 5 transport network is taken for the contextual analysis. MATLAB/Simulink pack is utilized to mimic the organization and the proposed set of rules is done and researched. The PMU position is in like manner completed, 220 KV interconnected transmission line network, a hundred km transmission line. Producing station on one angle and on the other aspect is load each are connected through interconnected follows. Diverse flaw circumstances are reproduced on that line the utilization of MATLAB programming program. The qualities indicated are in as per unit on a hundred MVA (base).

The transmission line positive and zero succession Parameters are R1=0.10809Ω/km, R0=0.2188Ω/km,L1=0.00092H/km,L0=0.0032H/km,C1=1.25*10−8f/km,C0=7.85*10−9f/km. The allotted parameter model of transmission line is taken into consideration for evaluation. A sampling frequency of 20 KHz for a system working at a frequency of 50 Hz is used on this examine. To reveal the capability of the technique most effective few cases of fault occurrence are proven here. KHz for a system operating at a frequency of fifty Hz is used on this examine. To show the ability of the approach most effective.

Simulation version

The Three phase to ground fault are placed on

Transmission line (TL2) connecting vicinity"1" and place "three" as shown in fig.5. The output three section voltage waveforms, modern-day wave forms and TRIP & BLOCK Signal are shown below in fig. 6 & 7 respectively.

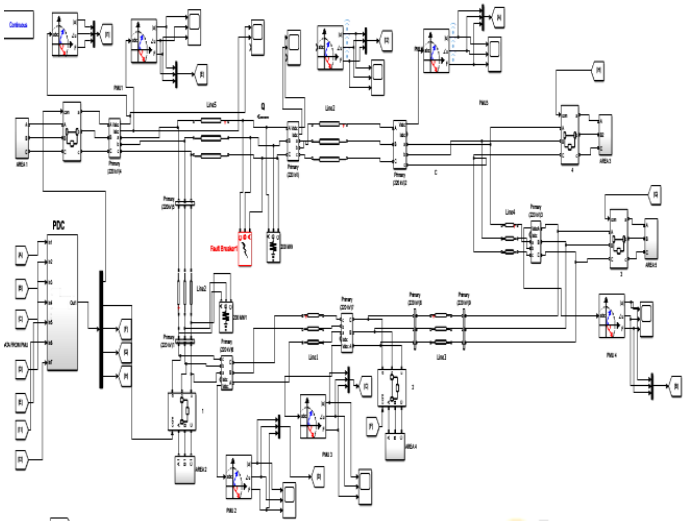


Fig 5. Simulation model

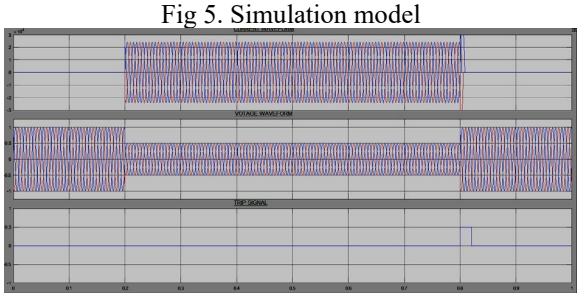


Fig 6. Voltage , Current & Trip Signal

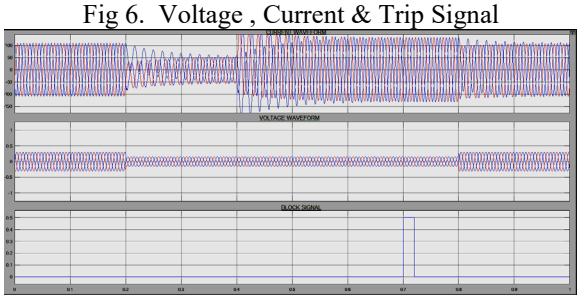


Fig 7. Voltage , Current & Block Signal

8. Result & Discusstion

In segment 5 we seen three distinctive Zone-3 shortcoming stumbling misleading instances of various area in southern force district of India year 2019. The proposed calculation structure is reasonable for evading such conditions and give powerful reinforcement insurance (zone-3) and furthermore distinguished the blamed line everywhere on the transmission interface framework. In contrast to the current procedures, it gives improvement of dependable security to the force framework and evade immense business misfortunes because of Blackouts , Generation misfortune.

9 Conclusion

A Wide Area Backup Protection plot for transmission follows in wide district framework utilizing PMUs is proposed in the paper. It utilizes time labeled realities of Wide Area Measurement System. Based at the high-caliber and zero succession flows entering the Backup Protection Zone is molded. Conventional back-up insurance plans are one-sided towards steadfastness. Be that as it may, the proposed plan can change its security/constancy predisposition to solid winning strength device situations. By doing this, the likelihood of fell blackouts due to hand-off mal-tasks can be kept away from. Since zone-3 is a relatively moderate security plot with working season of the request for a second, phasor data (PMU based) of a WAMS can be utilized to manage the zone-3 transfer. Consequently, the presentation of the zone-3 security plan can be improved.

References

[1] Shalini, Subhransu Ranjan Samantaray, Ankush Sharma “Transmission Line Back- up Protection with Unreliable PMU Data “ IEEE Proceedings of the National PowerSystems Conference (NPSC) - 2018, December 14-16, NIT Tiruchirappalli, India

[2] A.P.Vaidya, Prasad A. Venikar,” Distance Protection of Long Transmission Lines by Considering the Effect of Fault Resistance,” IEEE - International Conference On Advances In Engineering, Science And Management (ICAESM -2012) March 30, 31, 2012.

[3] Manas Kumar Jena, S.R.Samantaray , B.K Panigrahi “A New Wide Area Back-up Protection scheme for series – compensated Transmission system” IEEE- Systems Journal ,vol PP no.99 pp,1-11.

[4] G.Kavya, M.MeenakkshiDevi, Dr. M.Geethanjali “Wide Area Backup Protection Scheme using Optimal PMUs” IEEE- 2018 National Power Engineering Conference (NPEC) .

[5] M. M. Eissa, Senior, M. Elshahat Masoud, and M. Magdy Mohamed Elanwar, “A Novel Back up Wide Area Protection Technique for Power Transmission Grids Phasor Measurement Unit,” IEEE-TRANSACTIONS ON POWER DELIVERY, VOL. 25, NO. 1, JANUARY 2010.

[6] S.Karthick , K.Lakshmi “Wide Area Backup Protection Scheme for Power Transmission Lines using PMU” by International Research Journal of Engineering and Technology [IRJET] Vol- 02, Issue:09 Dec-2015.

[7] Shital Uttam Karpe, M N Kalgunde,”power system backup protection in smart grid using synchronised PMU”, IEEE conf, Jun. 2017.

[8] S Lakshmi, R Ramaprabha. “A Novel Multiphase Interleaved Quadrupler Circuit With Reduced Voltage Stress And Ripples For Photovoltaic Applications”. Int Trans Electr Energ Syst. 2020; e12317. https://doi.org/10. 1002/2050-7038.12317

[9] S Lakshmi, R Ramaprabha., “Stability Evaluation Of Four Phase High Gain Converter By Small Signal Modeling” Rev. Roum. Sci. Techn.– Électrotechn. et Énerg. Vol. 65, 1-2, pp. 75–80, October 2020.
[10] Lakshmi S, “Closed-Loop Control of a DC-DC Four-Phase Interleaved Quadrupler for Solar Photovoltaic Applications” IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE), November 2019.
[11] S. Lakshmi , R. Ramaprabha, “Design And Analysis Of An Improved High Gain Non Isolated Interleaved Boost Converter For Solar Photovoltaic Applications” Journal of Electrical Engineering, Politehnica publishing house. Volume 18 / 2018 - Edition: 4, pp: 1210- 131

Monitoring Energy Level of Smart Energy System for Home Appliances

M. Rupesh[1], Dr.N.Anbu Selvan[2],
{roopeshroop97@gmail.com[1], anbu.1324@gmail.com[2]}

UG Scholar[1], Department of Electrical and Electronics Engineering, Saveetha School of Engineering, Saveetha Institute of Medical And Technical Science, Chennai
Assistant Professor[2], Department of Electrical and Electronics Engineering, Saveetha School of Engineering, Saveetha Institute of Medical And Technical Science, Chennai

Abstract. There is a continues change and modification in communication technology. Earlier days customers know about their energy consumption only when a member for EB takes the readings. But now the technology has been changed. The method we have proposed here is based on IOT system. The smart meter is connected to the customer's phone number. When the usage of current is more the customer gets an alert message to the particular registered number. Their bill for the current consumption is send to the registered number. If the customer didn't pay the bill their supply of current will be blocked to the particular house. This technology reduces the man power and time. Earlier it is difficult to upload the customer's fee in the website, but this technology which has been implemented directly uploads the bill in the website and displayed to the user through SMS. These are the smart devices used to manage and record electricity of electronic devices. This device monitors the electric system in real time. It also has the ability to get lower electricity bills. When the user exceeds the limit, this proposed system automatically issues an alarm to the consumer. Smart meter is constructed by using Ardunio micro controller, current senor and voltage sensor.

Keywords: Energy Meter, IoT, Sensor, Current Sensor, Voltage Sensor.

1 Introduction

In current situation the entire world is facing energy problem. Electricity is the most important basic requirement of human beings. It is mainly used in houses, manufacturing organizations and farming industries. Electric meter is the important component to measure the amount of current used. Traditional meters are used to measure only the amount of units consumed by the user. This system does not provide any warning message to user when the user crosses the threshold level. The main problem in the traditional meter is to collect the reading from the users place. Using existing system the meter reading is collected by manually. It leads to various corruption activities and human error also occur. The main disadvantage of the existing system is to wastage of human energy. To avoid the above mentioned problems IoT based smart meter is used measure the usage of current. It also provides an alarm to the user when the users cross the maximum level. This meter generates a SMS and E-Mail when after generating bill. This new system also provides two way communication facilities.

The important features of this proposed smart meter are

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- Measure the current consumption level automatically with the help of various sensors
- Creates an alarm when the user cross the limit
- Entire system is controlled from remote location

The second section of this paper reviewed about various smart meters. Third section explains the proposed architecture of smart meter. Section four deals with sample output of proposed system. Finally fifth section concludes the system.

2 Literature Survey

Geetha.R M.E et al., says about the various problems in traditional electric meter. Measuring and monitoring electricity consumption is very difficult process in current situation. Now the people from EB comes and measures the energy consumption level and update the collected information into the server. Based upon the unit consumed the electric charge is collected from the user. Here the authors construct a new system to measure the current readings automatically with the help of internet. This proposed system is constructed by using Arduino controller. This system measures the consumed level and transfers the units via internet with the help of WiFi communication. By using this system the user can easily check the current usage with charge in online. The above details are displayed on the user's webpage itself. This system cost is less compared with other ordinary meters and this system also prevents the electrical equipments from repair. [1]

M. M. Mohamed Mufassirin et al., discussed about how to identify electrical theft. Many countries collect the information about the current usage and finding illegal electricity usage is very critical. It takes large amount of time and human resources. To overcome this issues the authors proposed a new system for reading current and monitory the meters by using IoT. This new system is very efficient and low cost way to send the data of current consumed to the authorized people. It also provides the service to find the illegal way to use the electricity. The main aim of this system is monitory the current consumption level in houses and crease a EB bill in automatic manner using current communication technology IoT. This system is also used to find the current theft and control it. Arduino microcontroller is control the entire system and to make the connection to wifi network, server. Infrared sensor is used to detect the illegal activities in the current meter. If the system found any illegal activities in the electric meter automatically the server disconnect the power supply. The automation facility decreases the human man power [2].

N M Yoeseph et al., discussed about the usage of energy meter. This device is an electrical instrument used to measure the current consumption level and to calculate the amount based upon usage of current. This paper presents a new system; it is used to measure current consumption reading using current sensor, voltage sensor and IoT server. The entire system is controlled by arduino microcontroller. The energy meter LCD display used energy units and EB bill. The alter message of current usage or EB amount can be created and displayed to the user [3].

M. Prathik ET AL., explained about the importance of electricity. In this digital world electricity is the important key factor of human life. Due to the growth of communication technology IoT based devices are created as a new revolution in communication world. The

important aim of this proposed project is to generate alertness about usage of energy and for save energy. In traditional electric billing system have lot of demerits. This new system provides current consumption level and generates a bill automatically. This system also issues an alarm sound when the user can cross the limit. Most of the human errors are reduced when using this proposed system. It is very helpful to the common people for conserve energy. If user does not pay the EB bill on time, this system automatically disconnect the power supply [4].

Amrita Singh et al., designed a new device for measure energy consumption rate without human intervention. Iot is the new communication concept; it creates a link between various physical devices such as sensors, controllers and software. This new automatic device is used to collect the data from the consumers and send the data to the server for billing purpose. This system is used to collect correct reading, generate the EB bill properly and immediately send the message to the consumers [5].

Mr. Samarth Pandit et al., explained about the disadvantages of existing energy meter. In this paper the authors proposed a new device to measure the energy level. This new system is helpful in various ways likes decrease energy consumption level and measure the number of units consumed by the user. This new system is designed by using Arduino device, sensors and IoT concepts. In case of any illegal activates are occurring in meter the power supply will removed automatically [6].

Syed Mustafa et al., describes about smart energy meter using sensors, micro controller with IoT concepts. This energy meter is reduced the human interventions during meter reading. The EB bill also generate automatically bill and send to the user immediately. The entire information will be displayed on the user web page for their reference. . WiFi module do the IoT operations by transfer energy data to the users web page. The web page is accessed by the specific IP address. To construct this system various hardware and software modules are used. Sensors and used to sense the surrounding values and send to the server immediately for further processing [7].

A.Subba Rao et al., proposed a new framework of measure and control the energy on current meters. The current consumption is also collected from remote locations. This proposed frame work send the current consumption value to the user automatically with the help of GSM concept. The SMS alert message is also receive from the administrator to the consumers automatically. Frame work is developed based on ARM controller and it is utilized various sensor values [8].

ManasaNagesh et al., discussed about the current scenario of measuring electricity. Now a person come to the users house and measure the current usage level manually. Based upon the usage level the consumers pay the EB bill. The main disadvantage of this traditional system is the EB peoples go to the specific area directly, measure the current usage, generate the bill and transfer to the user. During this process various human errors will occur. To overcome these issues the authors proposed a new smart device using Arduino controller. This proposed device is embedded with the existing meter. GSM module is used to send the SMS to the user [9].

3 Proposed Method

Electricity is playing a major role in every human life. Using traditional meters the people directly come to the consumers place and take the readings. Based upon the consumed level the bill is generated. The proposed device is used to monitor the current usage level and send the consumed level to the users immediately. This smart system is constructed with the help of Arduino controller with WiFi module. Using this system user can get the sms message and check the usage of the current level from anywhere in the country with the help of WiFi module. Smart meter is constructed by using various sensors. Current sensor (**ACS712 Current Sensor**) is used to observe the energy usage level. The important usage of the current sensor is it measures AC and DC current. The following figure 1 shows the block diagram of our proposed system.

Fig1 Block Diagram of Proposed System

The traditional meter needs number of labors for measuring current consumption. But this device is used to measure the current usage level automatically, calculate the bill based upon usage level and send to the user immediately with the help of various sensors. This smart meter save our home from bad current condition and provides the alert message to the consumer when the current consumption level exceeds the threshold value. Ardunio based controller is used to develop the real time projects. The connection is cut off when the voltage level exceeds the limit. So electrical appliances are saved from being damage due to high voltage.

4 Results And Discussions

This proposed smart meter is used to measure the current consumption level automatically with the help of current communication technologies. IoT plays a major role in all areas. Smart meter is also constructed with the help of various sensors and controller. The controller controls the entire functions of the system. Smart energy meter provides an alert message to the consumers when the usage level crosses the limited level. The following message is displayed when the user exceeds the limited level.

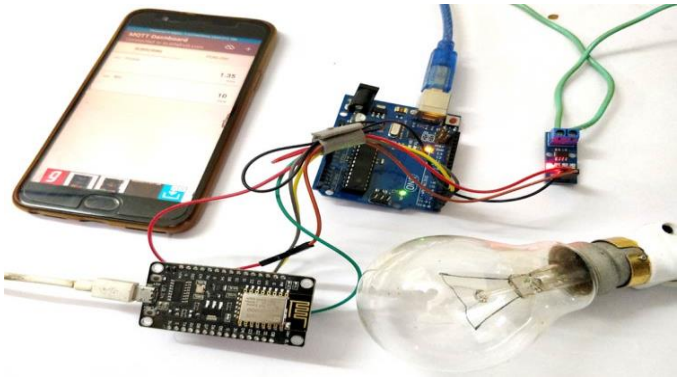

Fig 2: Hardware setup of smart meter

The usage level is measured automatically and generates the bill. The generated bill sends to the user's mobile phone and their websites. The users can see their bill amount and the usage of the current level from anywhere at any time. The following message is to be send to the user after measuring the consumption level.

5 Conclusion

Energy meter is one of the important components in our day today life. In traditional meter all the activities are done manually. Due to this reason various types of errors are occurred. To avoid such kind of problem smart meter is introduced. This smart energy meter is used to measure the energy level regularly. It is assist to decrease the energy consumption level by compare with daily usage level. The major benefit of this proposed system is to reduce the human energy to measure the current reading monthly. The alarm will help the consumers to develop a consciousness to the people regarding current usage level. It also reduces the energy wastage level and the websites display the details in regular basis. The user can able to check the details from anywhere in the world. Sensors are used to measure the current and send to the server for billing purpose. The whole system is controlled with the help of microcontroller.

References

[1] S. K. Shukla (2014), "2014 Real-Time Monitoring System for Landslide Prediction Using Wireless Sensor Networks ", International Journal of Modern Communication Technologies & Research (IJMCTR) ISSN: 2321-0850, Vol. 2, No. 12, pp. 14-19.

[2] Niraj Prasad Bhatta &Dr.Thangadurai.N(2017), "A Review on Environmental Sensors Used For Landslide Prediction And Detection ", Journal of Environmental Engineering and Studies, Vol. 2 , No. 2, pp. 1-8.

[3] K Sundaraganapathy, S. Nirmala SugirthaRajini& S Ramamoorthy(2017), "Embedded lockets for multipurpose tracking system using GPS GPRS and GSM", Indian J. Science and Technology 10 (3), pp.1-5.

[4] Govind Singh Bhardwaj, MayankMetha, Md. Yeasin Ahmed, Mohammod&Aktarul Islam Chowdhury(2014), "Landslide monitoring by using sensor and wireless technique: a review "International Journal Of Geomatics And Geosciences, Vol. 5, No 1, ISSN 0976 – 4380 , pp. 1-7.
[5] Anitha K & Ravi S(2016), " An Overview of Landslide Forecasting Using Wireless Sensor Network and Geographical Information System", Journal of Engineering Research and Applications, ISSN: 2248-9622, Vol. 6, Issue 4, pp.70-75.
[6] Kim &Hyoung Woo(2016), " Development of Wireless Sensor Node for Landslide Detection", Proceedings of the APAN – Research Workshop, pp. 56-60.
[7] Gang Qiao , Ping Lu , Marco Scaioni , Shuying Xu , Xiaohua Tong , Tiantian Feng , Hangbin Wu , Wen Chen , Yixiang Tian , Weian Wang &Rongxing Li (2013), "Landslide Investigation with Remote Sensing and Sensor Network: From Susceptibility Mapping and Scaled-down Simulation towards in situ Sensor Network Design", Remote Sensing, ISSN 2072-4292, pp.4319-4346.
[8] N. Dixon, A. Smith, J. A. Flint, R. Khanna, B. Clark & M. Andjelkovic(2018), "An acoustic emission landslide early warning system for communities in low-income and middle-income countries", pp. 1631–1644, Springer.
[9] Th.Nanao&RomeshLaishram(2019), "Integrated Earthquake and Landslide Monitoring Over Wireless Sensor Network", International Journal of Recent Technology and Engineering (IJRTE), ISSN: 2277-3878, Vol.8 No. 4, pp. 9594 – 9599.
[10] Meryem El Moulata, Olivier Debaucheb,c, Sa¨ıdMahmoudib, LahcenA¨ıtBrahima& Pierre Mannebackb(2018), "Monitoring System Using Internet of Things For Potential Landslides Monitoring System Using Internet of Things For Potential Landslides", The 15th International Conference on Mobile Systems and Pervasive Computing Procedia Computer Science 134, pp. 26–34.
[11] Maneesha& V. Ramesh(2009)," Real-time Wireless Sensor Network for Landslide Detection", Third International Conference on Sensor Technologies and Applications, pp 505-409.

An Analytical Validation of the National Statistics Authority Consumer Satisfaction Survey: Towards Improving Public Service Assessment Construct

Rosita G. Santos[1]*
{rosita.santos@lpu.edu.ph[1]}

[1]Lyceum of the Philippines (LPU), Manila Campus,
Muralla St, Intramuros, Manila, 1002 Metro Manila, Philippines

Abstract. Consumer satisfaction research has risen in the private sector. Public sector agencies have also adopted consumer satisfaction feedback on consumer needs, values and satisfaction. The National Statistics Authority's documents registry program has equally adopted consumer surveys to determine consumer satisfaction index that guides its operations.Through a qualitative descriptive, the study validated NSA's consumer survey by analyzing survey results and validating these through ocular observation and walk-on interviews in three outlets. The study confirmed the satisfactory consumer index, but took cognizance of the NSA survey use of the single variable of queuing time improvement in methodical steps to deliver services.Proposal to improve the survey construct through more variables (technical, social, physical) was suggested for determining total consumer satisfaction. Full computerization was recommended for automation was registry services that reach out to Filipinos abroad and far-flung places in the archipelago.

Keywords: Consumer Satisfaction; Consumer Satisfaction Index; Index Variables; Full-Computerization; Ocular Observation; Registry Documents; Queuing Improvement; Walk-On Interviews.

1 Introduction

in the private sector [1, 2]. This is in the interest of private firms to boost up economic value and profitability through useful feedback on consumer needs, value and satisfaction of services and product [3]. The public sector including the National Statistics Authority (NSA) has rightfully used consumer satisfaction research, among which is a consumer satisfaction index on NSA's computerized registry documents delivery so vital for public needs in securing permits, for travel, employment clearance, marriage, etc. The NSA's adoption of a computerized system has certainly boosted up NSA registry operations by shortening queuing time, processing and release of registry documents namely birth, death, and marriage certificates. With the country's population growth which has today reached more than a 100 million, official registry has also increased tremendously both at the local and the national levels. To date, the NSA has six Metro Manila outlets in Quezon, Pasay, Caloocan, Makati, Muntinlupa and Pasig cities. Bulk of registry document applicants each day number into thousands, if not tens of thousands in these outlets most especially in the main NSA at East Avenue, Quezon City. Computerization has served to imbue speed, efficiency and integrity

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into NSA's registry services, as its regular monthly consumer service surveys attest to this. As the NSA functions as the central statistical authority of the Philippine government on primary data collection, analysis and administration of civil registry function,avalidation study of its consumer satisfaction feedback deserves consideration.

Research studies on consumer satisfaction have been on the rise the past decade,further accelerated by concepts accrued from the use of computer systems.Computerized operations greatly enhanced consumer satisfaction in many fields in the commercial and public sectors [4, 5].The advantages and disadvantages of computerized systems are considered along experiential aspects of computerized operations.Use of the system determines whether it is beneficial or detrimental to operations, while there is the opposite perspective on whether benefits outweigh losses or the other way around. Advantages identified are greater efficiency in performing specific tasks, larger storage capacity for documents and data, as well as enlivening operations [6].

Advantages in the workplace point to streamlining of operations that require less staff or employees. While there is feat that computerization can endanger job securitythere is also the resultant creation of challenging new jobs, as well as the opening of new professional fields.Among new extensions credited computerization are in civil service, drafting services, electronic accounting, information services, portfolio management services.[7]. Public registry services have benefitted from computerization in contributing to diversity in registry operations, public safety and crime records filing, care provider registry referral, etc. Data access on national health-and death is exemplified by the National Center for Health Situation and its centralized database on health and death records [8].

The call for simplified revenue generation resulted in the adoption of an effective semi-automated tax mapping system by the Quezon City Assessor's Office. The transition from a labor intensive paper-based to a semi-operated operation was realized throughdigitization of tax maps and launching of a proprietary client-server technology.A fully automated Geographic Information System (GIS) is foreseen as the nest step toinstitute enhancement of tax mapping and improve delivery of services [9, 10].

As provided for in Act No. 3753, the National Statistics Authority is assigned the function to "Carry out, enforce and administer civil registration functions in the country" [11]. It collaborates with other departments on the national government including Government-Owned-Corporate-Companies and Local Government units in the collection, computation, maintenance and publication of statistical information, including statistical data derived from these departments and their subsidiaries.NSA has therefore developed and maintained appropriate framework and standards for collecting, processing, analysis and dissemination of data including registry documents which are of vital interest to the general public. For the past decade, the NSA has also embarked on a computerized system particular in providing applicant-consumers who need official certificates of birth, death and marriage required for travel, employment, marriage, etc.

The main problem is to determine the validity of the NSA consumer satisfaction survey by way of analysis of survey results most recently posted online by the NSA website.The study is important for continuing efforts to give value to consumer satisfaction particularly inpublic services. Gaining consumer intelligence will certainly boost public support for government and its officialdom, while serving to respond topublic need and welfare. In particular, the study can benefit NSA by upgrading its continuing consumer satisfaction survey.Registry public consumers can benefit through services that incorporate human variable along technical, social and physical parameters.Model consumer satisfaction construct can be applied and be advantages to all agencies of government other than the

NSA.Prospects for full computerization of NSA registry services shall benefit Filipinos all over the archipelago and abroad.

2 Conceptual Framework

Figure 1 illustrates the paradigm for comparison analysis of NSA consumer satisfaction on registry service to public consumers. The National Statistics Authority conducts a consumer survey in all NSA registry outlets to determine the level of consumer satisfaction of applicants who request official registry documents (birth, death and marriage).One determining variable is used and this is on queuing time that is being facilitated by a computerized system to search, retrieve and copy/print registry documents. The study conducted what can be a model consumer satisfaction survey construct by amplifying variables to include the technical, social and physical facets of consumer satisfaction, resulting in a total consumer index.Queuing time variable has also been validated by ocular visit for visible observation of actual operations in three NSA outlet sites, namely Quezon, Pasay and Caloocan cities coupled with random casualinterviews to draw the more meaningful perceptions on how NSA registry operations are satisfactory, less or not satisfactory in terms ofpublic service.

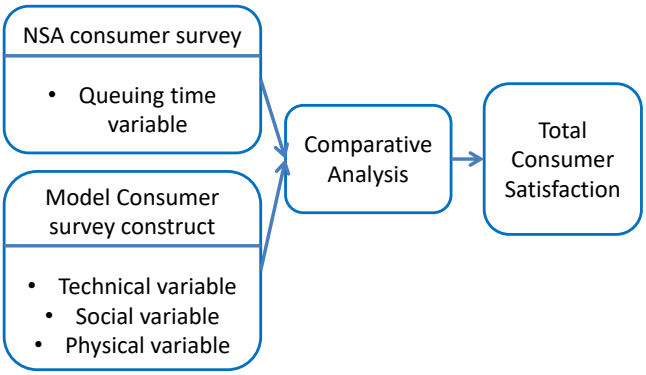

Figure 1. Paradigm for comparison analysis of NSA consumer satisfaction on registry service to public consumers

3 Methodology

The study utilized the descriptive method of research qualitatively and quantitatively.It analyzed data results from an official NSA survey on consumer satisfaction which retrieved from September 2016. Then, data were subsequently validated by observation of registry operations and consumer perception of registry services at three NSA outlets.This method thus described the visible situation as they existed at the time of the conducted visit-interviews with participants.

Research participants

Validation analysis through random interviews involved thirty (30 participants), ten (10) from each outlet. A common interview template with three variables (technical, social and physical) was used to arrive at a total consumer satisfaction index.Interview profile reflected

NSA's survey profile, namely 60 percent female, two of every five or 40 percent within the 20-29 age groups. Majority or 60 percent had at lease college education. More than half of interviewed clients or 70 percent resided in Metro Manila, while only 25 percent of one-of-four came from areas outside Metro Manila.

Research Instrument

While the NSA consumer satisfaction survey focused singly on the variable of queuing and the shortened time for delivery of service to clients, visit-interviews required adoption of more extensive variables to consumer satisfaction.

The technical to include methodical and efficient processing steps consisting of various steps, namely

Step 1. A application forms distribution section either for birth, death, marriage or CENOMAR or No-marriage certificate.

Step 2. Applicant filling-up of forms

Step 3. Correction checking of filled up forms by NSA first-line staff.

Step 4. Queue for submission and payment in submission and payment booths. In Caloocan, Muntinlupa and Makati city outlets, payment is received by the City Hall Cashier rather than NSA booth.

Step 5. Second queue for release of registry documents.

4 Result And Discussion

Demographic profile of NSA survey participants

Table 1 tabulates the distribution of NSO clients by demographic profile: December 2012. From Table 1, on participant's age, clients from ages 15-34 composed more than half of daily registry applicants. Clients from ages 35-49 compose one-fourth of applicants. Only 5.5 percent and 6.7 percent compose applicants in the 15-19 and 55-60 age groups. Next on education, those who reached college or higher education composed the majority of clients compared with only 2.9 percent and 32.3 percent of those in the elementary and high school grades respectively. Besides that, on work, there were more than half were unemployed and understandably need registry documents for employment. The employed composed a little less than half and would understandably need documents for other purposes such as travel, marriage, business, etc. Lastly is about residence, majority were from the National Capital Region, while a fourth segment were from outside the Metropolis. Data on residence do not reveal the need of those who leave more remote provinces in the northern parts of Luzon and in the Visayas and Mindanao. The need for the NSA to establish NSA outlets in these areas is apparent.

Table 1. Distribution of NSO Clients by Demographic Profile: December 2012

Criteria	Categories	Percentage (%)
Gender	Male	39.6
	Female	60.4
Age Group	15 to 19	5.5
	20 to 24	19.6
	25 to 29	20.9
	30 to 34	16.8
	35 to 39	9.7
	40 to 44	10.3

	45 to 49	6.6
	50 to 54	4.3
	55 to 59	3.8
	60 and above	2.7
Education	Elementary	2.9
	High school	32.3
	College or higher	64.8
Work	Employed	46.6
	Unemployed	53.4
Residence	NCR	75.6
	Outside NCR	24.4

Purposes and types of for securing registry documents

Table 2 shows the distribution of client's purpose for requesting civil registry documents: December 2012. There are varied reasons why registry documents are needed by the public. Official documents serve to ascertain name, birthdays, death, or marriage. These documents forestall fraudulent or criminal intent among persons who apply for jobs, travel abroad and transact business or other engagements. Table 2 shows that majority or almost half of requests for registry documents are for travel, namely for getting a passport and Embassy requirements. Other needs follow namely for local employment (17.1%). school (12.1%) and others.

Table 2. Distribution of Clients purpose for requesting civil registry documents: December 2012

Purpose	**Percentage (%)**
Passport	30.9
Embassy	14.9
School	12.1
Local employment	17.1
GSIS/SSS	10.1
BIR	1.5
Baptism	3.2
Exam/PRC	2.1
Marriage	4.9
Others	7.5

Table 3 demonstrates the distribution of type of document requested in December 2012. Most documents needed were for birth certificate which is basically needed for many travel, employment, education, etc. There is lesser demand for marriage documents consisting of marriage certificates and CENOMAR or non-marriage certificates.

Table 3. Distribution of Type of Document Requested: December 2012

Type	**Percentage (%)**
Birth	68.2
Marriage	17.8
Death	4.5
CENOMAR	9.2
Prewar	1.2
Authentication	1.6

NSA satisfaction survey

Figure 2 illustrates a graph shows a satisfactory net satisfaction rating (average +75.80 for 2009-2012). Single variable of reduced time for queuing was used for the NSA continuing survey. From the documentary report of the survey, a total of 642 thousand processed transactions were reported in 2012, providing estimate of consumers from year-to-year.

The East Avenue Main Outlet had the biggest proportion (70%) or clients followed by recorded clients in Muntinlupa (36%). Comparatively, there were more clients (84.3%) in civil registry services in East Avenue than in other outlets.

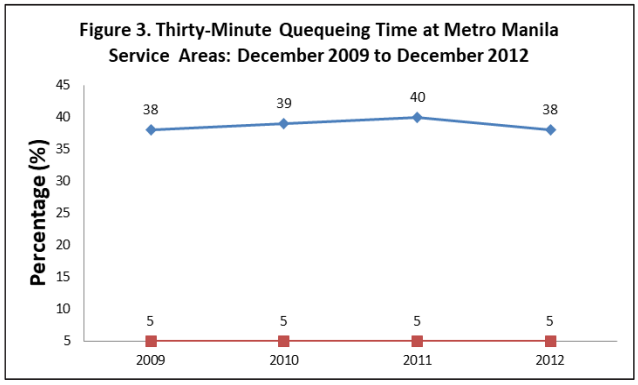

Figure 2. The consumer satisfaction survey of the NSA revealed satisfactory rating by consumers on NSA registry services.

Data from Ocular Observation and Interviews

Random interview did not differ by way of demographic profile, purpose and kinds of documents and other data from the NSA consumer satisfaction survey. However interviews provided the following observed facts and data:

On technical variable:

The process of registry document filing adopted a methodical and efficient process of steps facilitated by security personnel.

Step 1. Application forms were made available by Security and staff personnel.

Step 2. Clients fill up forms in available writing desks, and forms submitted for checking and correction by the NSA staff.Clients are advised to present required authorization papers, if needed such as by applicants not in direct line of parentage to names/persons requiring documents.Children and grandchildren are allowed to request documents for parents, and parents in turn for their children. Brothers, cousins and other persons need to present certificates of authorization to secure requested documents.

Step 3. Clients queue for submission of forms in submission booth together with payments. In NSA outlets in Caloocan, Makati and Muntinlupa, payments are made at the city cashier's office.

Step 4. Clients wait for one to two hours (depending on volume of applicants during the day)to queue for document release in another booth or section of the NSA outlet.

It became apparent that while queuing time was shortened to 30 minutes for application and payment procedures, the whole process of securing or finally receiving registry documents takes about two-three hours, or half of a working day.

There was observed greater convenience and satisfaction in the Pasay City outlet owing to more modern, spacious and air-conditioned facilities. The whole NSA building was divided

into two portions, the processing section in the front side of the edifice and the release section at back of the edifice.Chairs were provided for waiting in addition to a television set to ease hours of waiting time.

On social variable

Observation and interview evoked the need to improve the congenial atmosphere in the NSA outlets.NSA staff and security personnel were focused on order and discipline, rather than the need to demonstrate caring and friendly service to clients. There were none or only a few smiling security and staff members in the processing stages. While security personnel wore uniforms, NSA staffers were not uniformed and wore casual attire. In the crowded East Avenue Main Outlet which received tens of thousands clients in a day, the atmosphere was tense, as there can be jostling in the queues.

Clients were mainly from the working and middle and lower-middle economic bracket of society. This createda market-like atmosphere in the NSA outlets, especially in the Main East Avenue Main Outlet.

In the Caloocan outlet, there was observed the presence of fixers who offered facilitation of document issuance in exchange for a fee. Observably, there was connivance with NSA office computer processing staff, as applicants who paid fixers were allowed to enter inside the computer section office to secure their documents.

On physical environment

The East Avenue Main Outlet delivered services under a large covered court site, which can be hot during the day or cold and windy during heavy rains. The Main outlet has closed beginning September 2016 as construction of a more spacious and modern edifice has commenced and to be completed in three years' time. In the meantime, frontline service in the main outlet has been transferred to Solicarel Building I and II in Sta. Mesa Manila While computer-supported procedures are in place in the new outlet, lack of space in the Solicarel Building creates the problem of congestion in NSA operations.

Metro Manila subsidiary outlets are open to serve residents of the NCR and nearby provinces. This point to the need forNSAservices in other parts of the country.

Presently, online communication has enabled the NSA to receive registry documents from abroad, e.g. U.S., Japan, European cities, etc. Online registry services can therefore be explored so that Filipinos here and abroad can secure needed registry documents without having to course their request through relatives in the NCR.

In summary, the study validated satisfactory consumer index for NSA's registry services in outlets in the National Capital Region. The single variable of shortened queuing time served as the basis for determining satisfaction index among consumers. Ocular visit and interviews confirmed satisfactory consumer index, with some apprehensions. Apart from 2-3 hours process, there is grave evidence of service fixing in NSA's Caloocan outlet. The prospects for further improvement surfaced through the use of more variables (technical, social and physical) for determining total consumer satisfaction on services. Computer online transmission can pave the way for online transactions to serve applicants abroad, as well as those in far-flung provinces of the country.

Conclusion

This study confirmed the satisfactory and efficient service NSA operations in the NCR with the following specific conclusions. The NCR consumer satisfaction surveys adopt a

single variable consumer satisfaction construct in its survey. Total consumer satisfaction is yet to be determined through varied variable in survey. NSA staff and security personnel need orientation of social communication for friendly services to clients. There are not enough safeguards to secure the integrity of registry service. A fully computerized registry operation is yet to be planned and implemented to be aligned with a technological society in a borderless world.

Acknowledgments

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References

[1] Karim, R.and Chowdhury, T. 2014. Customer Satisfaction on Service Quality in Private Commercial Banking Sector in Bangladesh. *British Journal of Marketing Studies*. 2. 1-11.

[2] Suchánek, P.andKrálová, M. 2018. Customer satisfaction and different evaluation of it by companies.*Economic Research-EkonomskaIstraživanja*. 31, 1, 1330-1350.

[3] Ray, J. 2018. Customer Satisfaction: A Comparative Study of Public and Private Sector Banks in Bangladesh. *IOSR Journal of Business and Management (IOSR-JBM)*. 20, 1, 15-21.

[4] Mittal, A.and Srivastav, G. 2016. Impact of service quality on customer satisfaction in private and public sector banks. *International Journal of Bank Marketing*. 34. 606-622.

[5] Hennayake, Y. 2017. Impact of Service Quality on Customer Satisfaction of Public Sector Commercial Banks: A Study on Rural Economic Context. *International Journal of Scientific & Research Publications*. 07. 156.

[6] Advantages & Disadvantages of Computerized Systems. [Internet]. *techwalla.com*[cited 22 March 2020]. Available from:https://www.techwalla.com/articles/advantages-disadvantages-of-computerized-systems

[7] Shane, D. Chapter 1 Accounting Information Systems: An Overview Suggested Answers to Discussion Questions. [Internet]. [cited 22 March 2020]. Available from:https://www.academia.edu/23733910/CHAPTER_1_ACCOUNTING_INFORMATION_SYSTEMS_AN_OVERVIEW_SUGGESTED_ANSWERS_TO_DISCUSSION_QUESTIONS

[8] National Death Index. 2017. [Internet]. *Centers for Disease Control and Prevention.* [cited 22 March 2020]. Available from:https://www.cdc.gov/nchs/ndi/index.htm

[9] Cabildo III, A. 2012. Effectiveness of Semi-Automated Tax Mapping System at Quezon City Assessor's Office: Basis for Adaption of a Fully-Automated System. *Lyceum of the Philippines Graduate School Journal*. 71-83.

[10] Hussain, A., Mkpojiogu, E.O.C., Yusof, M.M. (2016). Perceived usefulness, perceived ease of use, and perceived enjoyment as drivers for the user acceptance of interactive mobile maps. AIP Conference Proceedings, 1761, art. no. 020051.

[11] Republic of the Philippines, Philippine Statistics Authority, Davao Oriental. [Internet]. [cited 22 March 2020]. Available from:https://psadavaoor.wixsite.com/psadavaoor/about-us

Philippine Youth's Perceptions, Knowledge and Comprehension of Corruption in the Country

Raul A. Aquino[1]*
{raul.aquino@lpu.edu.ph[1]}

Lyceum of the Philippines (LPU), Manila Campus, Muralla St, Intramuros, Manila, 1002 Metro Manila, Philippines.[1]

Abstract. The moral education system can enable the younger generation to become responsible moral citizens in the future. An informed citizen who understands the moral importance in life will greatly help strengthen the democratic values of their country and reduce unethical behavior and corruption. Hence, this study determines the present perceptions, knowledge, and understanding of the Filipino youth on corruption in the country. This study utilized qualitative research approach to gather the primary data through questionnaire survey among the Filipino youth from sector of academic and police. The survey was participated by the Campus Integrity Crusades, Pamantasan ng Valenzuela, Office of the Ombudsman, Lyceum of the Philippines University, Manila, City of Malabon University, University of Caloocan, and Philippine National Police. The obtained qualitative data were analyzed through the content and textual analysis. The results obtained indicate that the respondents emphasized that corruption violates good behavior and has negative effects on society and country. The pervasiveness and extensiveness of corruption problem has led most people to believe that this is a norm in the country, with no response or resistance. The survey results also highlight that the current corruption situation in the Philippines is worrying..

Keywords: Philippine Youth; Corruption; Perceptions; Knowledge; Comprehension; Philippine.

1 Introduction

The United Nations described corruption as a complex social, political and economic phenomenon that affects all countries. Corruption undermines democratic institutions, slows economic development and contributes to governmental instability [1, 2]. It attacks the foundation of democratic institutions by distorting electoral processes, perverting the rule of law and creating bureaucratic quagmires whose only reason for existing is the soliciting of bribes. Economic development is stunted because foreign direct investment is discouraged and small businesses within the country often find it impossible to overcome the "start-up costs" required because of corruption.

Chugh[3] described corruption as a product of variety of actions or behaviors which make it very hard to establish a clear definition. Corruption is an inherently multi-level phenomenon. It can operate at individual, group, organization, and industry level. He defined corruption as a process which prevents the original nature of an individual or group from a purer state to a less pure state". He considered corruption as appropriate and what appropriate under the law and ethical and vice versa to standardize the motion of morality.

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El-Rayess[4], a faculty member in Columbian University, in her dissertation paper, investigated the students' behavior on corrupt practices acts in Bosnian public higher educational institutions using the Albert Hirschman's theory of voice, exit, and loyalty within higher education. Her findings revealed that the voice of Bosnian students supposedly as a powerful tool of the students in voicing out their concerns in educational issues affecting them become futile due to persisting systemic corruptions and fear from powerful faculty members who are not qualified but have strong influence in the corrupt environment. She also noted that students were dissatisfied the way their complaints were addressed due to lack of effective action.

Sika [5] found out that the Egyptian youth believed in democratic values but did not participate politically during the time of President Hosni Mubarak due to lack of understanding on the dynamics of authoritarian rule and corruption.

According toMansuri and Rao [6], corruption happens in some public sectors in India because of the general perception that a complaint creates a bad image on the institution; therefore it must be avoided or just simply ignores it.While there is a feedback mechanism design to address a certain complaint and improve the system, the said mechanism is not also responsive; thus, giving citizen participation to lose trust and confidence. He concluded therefore that the ability to address a certain complaint is a key factor in determining the kind of public perceptions on the issue of corruptions.

Transparency International Report 2013 [7] showed that the police (69% of the respondents), public officials, and civil servants (64% of the respondents) are perceived the most corrupt in the Philippines. In addition, Filipino respondents made the following perceptions in other institutions: Judiciary (56%), Political Parties (55%), legislatures (52%), military (43%), education and medical and health services (32%), and media and religious (15%).

Melgar, Rossi, and Smith [8] believed that the idea and understanding of corruption depends on the people and having a clear definition is a continuing challenge since the concept of corruption is influenced by society, culture, and country. For instance in Indonesia, the Supreme Court and Constitutional Court has a different interpretation of unlawful act of corruption which often lead to some Supreme Courts and prosecutors continue tocircumvent the Constitutional Court ruling [9]

Tavits[10] investigated the causes of corruption and focused her studies on the individual behavior and perceptions. She strongly believed that it is the people who are corrupt and not the country. She further added that corruption is more likely to happen if an individual is doing it voluntarily and not aware or no knowledge at all that what he/she is doing is morally or by situations it is wrong but believing it as an acceptable social behavior.

Heywood [11] posited that the level of corruption in an institution or organization is usually determined by the effectiveness of external auditing, level of administrative discipline, strength of internal policies and norms to preserve integrity and transparency, and the level of economic development. Therefore, this study aims to determine the Philippine youth's perceptions, knowledge and comprehension of corruption in the country.

2 Methodology

The methodology of this study is a qualitative data analysis method that describes how Filipino youth aged 18-30 from the National Capital Region assesses and understands corruption in the Philippines.

Research Design

This study gathers the primary data through questionnaire survey from the selected organizations and institutions and the participants are age between 18 to 30 years old. There are 144 participants from six different organizations and institutions.

Research Sample

In the qualitative data analysis, a total of 144 respondents answered the interview guide questionnaires. Table 1 tabulates fifteen (15) Filipino youth respondents came from the Campus Integrity Crusades (CIC) in Pamantasan ng Valenzuela, forty-seven (47) employees from the Office of the Ombudsman, twelve (12) employees from the National Youth Commission (NYC), twenty (25) students from Taguig City University, twenty (26) students from the City of Malabon University, and nineteen (19) police personnel from the Philippine National Police (PNP).

Table 1. Respondents by Institution/Organization

Organizations/Institutions	**Frequency**	**Percent**
Campus Integrity Crusades (CIC)	15	10.42
City of Malabon University (CMU)	26	18.06
National Youth Commission (NYC)	12	8.33
Office of the Ombudsman	47	32.64
Philippine National Police (PNP)	19	13.19
Taguig City University	25	17.36
Total	**144**	**100.00**

Research Instrument

The research tool used in this study to gather the primary data is a designed survey questionnaire. The survey questionnaire was distributed to the participants to determine the Filipino youth's views, knowledge and understanding of corruption in the country. In addition, the survey questionnaire was validated by certified researchers in the Research and Innovation Center of the Lyceum of the Philippines University, Manila.

Data Collection and Data Analysis

The study was conducted from August 2017 to March 31, 2018 for approximately 8 months. This study includes survey and investigations that strictly adhere to all standard protocols during the investigation, especially in terms of ethics. Prior to the survey and investigation, the study was approved and supported by the appropriate organizations and institutions.

The questionnaires have been distributed to participants and assistance has been provided to better understand the survey questions. The obtained qualitative data were treated using the content and textual analysis.

Besides that, this study ensures that the identities of the participants are kept confidential, and the survey data obtained will be used only for the purposes of this study.

3 Result And Discussion

This study used survey questionnaire to gather the primary data from 144 participants from six different organizations and institutions in order to determine the Philippine youth's perceptions, knowledge and comprehension of corruption in the country.

The views, knowledge and understanding of corruption among youth in the Philippines are:

Whether Corruption is a common practice in the Philippines

Table 2 presents the summary of the contents and context of the respondent's qualitative answers on whether corruption is a common practice in the Philippines. As seen above, 108 or 75% of the total 144 respondents said yes, corruption is a common practice in the country; 19 or 13.19% said no, it is not a common practice in the country; and the remaining 17 or 11.81% had no answer.

Accordingly, those respondents who said yes that corruption is a common practice in the Philippines, confirmed that corruption is common scenery, not lessening, and prevalent. They also observed that money is highly valued by many instead of honesty and integrity especially among politicians and high government officials.Palakasan and clannish culture are common which allow the propagation of corruption. On the other hand, thosewho answered no, that corruption is not a common practice in the country still believe that not all Filipinos are corrupt; that corruption is limited to some; and it was only perceptions that all Filipinos are corrupt. The respondent also believe that the present president is doing his best to solve and prevent corruption; that corruption is only done by selfish politicians and leaders who lack good values and manners; and blamed the past administration for its failure to address corruption; corruption is a personal choice and you cannot accused all of being corrupt; and no, it is not a common practice because many government agencies still preserve integrity and God-fearing.

Table 2. Summary of the Contents and Context of the Respondent's Qualitative answer on Whether Corruption is a common practice in the Philippines

Answers	**Students, NYC, & PNP**	**Office of the Ombudsman**	**CICC**	**Total**	**%**
Yes, it is a common practice in the country.	67	26	15	108	75.00
No, it is not a common practice in the country	11	8	0	19	13.19
No Answer	4	13	0	17	11.81
Total	**82**	**47**	**15**	**144**	**100.00**

Whether Corruption in the Philippines is an Acceptable Behavior

Table 3presents the summary of the contents and context of the respondent's qualitative answer on whether corruption is an acceptable behavior in the Philippines. As shown, 95 or 65.97% of the total respondents said no, corruption is not an acceptable behavior and 47 or

32.64% of the respondents said yes that corruption is now an acceptable behavior; and the remaining 2 or 1.39% had no answer.

For those who answers no, that corruption is not an acceptable behavior in the Philippines, some respondents provided the following explanation: they don't accept it as part of their moral principle; no but people are powerless to stop it because the leaders are the actors of corruption and tolerating it; no because they still believe that the President and some people are doing something to stop it; and no because there are people who has no knowledge that what they are doing is already an act of corruption. Two respondents from the Office of the Ombudsman tell that why people are very quiet and silent to discuss corruption because it is already a practiced and no one is interested to listen. Discussing the issue of corruption will only bring anxiety, fear, and hassle on your part.

Data implies that while it is true that corruption is a common knowledge and scenery in the country, it is not a generally accepted behavior. However, many of the respondents were convinced that majority of the Filipinos already accepted corruption as part of the cultural practices due to their passive and non-reactionary behaviors, concluding that it is a form of toleration. As said by former army Gen. Danilo Lim, "Dissent without action is consent". Also, the respondents have strongly observed that corruption is so widespread involving almost all institutions and sectors in society, particularly in the government wherein the actors and protectors of corruption are the most powerful, rich, and high officials of the country.

Corruption is a very sensitive issue to discuss in the workplace and in the community due to the present political environment of fear, lack of support and interest from the government, judicial system, and from the people itself, and the inconveniences that it will bring once you got involved and put interest into the issue.

Table 3. Summary of the Contents and Context of the Respondent's Qualitative answer on Whether Corruption in the Philippines is an Acceptable Behavior

Answers	**Students, NYC, & PNP**	**Office of the Ombudsman**	**CICC**	**Total**	**%**
No, it is not an acceptable behavior in the Philippines	58	31	6	95	65.97
Yes, corruption is now an acceptable behavior in the Philippines	24	14	9	47	32.64
No Answer	0	2	0	2	1.39
Total	**82**	**47**	**15**	**144**	**100.00**

The definition, description, or understanding of corruption

Table 4 presents the summary of the contents and context of the respondent's qualitative answer on what is your definition, description, or understanding of corruption. In the analysis of qualitative data about how the Filipino youth defined, described, and understand the word "corruption", 44 or 30.56 % of the 144 respondents opined that corruption is any act that is unethical, evil, illegal, and harmful that destroys integrity [12]. Common examples are

cheating, lying, abuse or misuse of power from person in authority for personal gain (26.39 %), it is about stealing of money because people believe that money is power (22.92 %), it's about selfishness or greediness (8.33 %); 6.25 % of the respondents believe that corruption is harmful to society; two (2) or 1.39 % of the respondents thinks that it is a crime; and six (6) or 4.16 % have no answer.

Table4. Summary of the Contents and Context of the Respondent's Qualitative answer on What is your definition, description, or understanding of corruption

Answers	**NYC, Students, PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**%**
Stealing	28	4	1	33	22.92
Illegal behavior of people	18	17	9	44	30.56
Misuse of power	16	18	4	38	26.39
Greediness	8	4	0	12	8.33
Harmful and dangerous to society	5	3	1	9	6.25
Crime	2	0	0	2	1.39
No answer	5	1	0	6	4.16
Total	**82**	**47**	**15**	**144**	**100.00**

Corruption is persistent in the Philippines despite the consequences and penalty

Table 5 presents the summary of the respondent's qualitative answers on why corruption persists despite its consequences and penalty. As revealed, 40 or 27.28% believed it is because of bad leadership and governance serving as the orchestrator and protector; 14.58% claims for non-contentment in life, greediness/love of money; 11.81% because of the poor laws and justice system; 5.56% said it has become a culture; 2 or 1.39% said because of poverty and lack of education; 1 or .69% said because of low salary; 3 or 2.08% answered others; and 48 or 35.22% did not answer.

The data suggest that bad leadership and governance is the main cause why corruption persist and rampant in the country. These bad leaders were effective in creating an environment of fear that conditions the minds of the Filipinos to become submissive, cooperative, and accept corruption as a process or culture in the country [13].

Table5. Summary of the Contents and Context of the Qualitative answers of the Filipino Youth Respondent's Qualitative answer on Why Corruption is persistent in the Philippines despite the consequences and penalty

Reasons	**Students, NYC, & PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**%**
Bad leadership and governance	27	3	5	40	27.28

Non contentment in life, greediness/love of money	15	1	5	21	14.58
Poor laws and justice	10	3	4	17	11.81
Culture	8	0	0	8	5.56
Poverty	2	0	0	2	1.39
Lack of education	1	1	0	2	1.39
Low salary	0	0	1	1	.69
Others	3	0	0	3	2.08
No answer	9	39	0	48	35.22
Total	**82**	**47**	**15**	**144**	**100.00**

The motivates of a person to do corruption

The result in Table 6 shows that love of money, power, prestige, and non-contentment in life leading to selfishness and greediness are the main reasons why a person is motivated to do corruption with 39.58%. Other reasons cited were poverty 13.89%; environmental influence in the workplace and community 5.56%; personal needs 4.17 %; culture and weak value system of the person 3.47%; other comments 2.77% and 30.56 % of the total 144 respondents did not give any answer.

Looking at both results, it shows that money and power are the main reasons why a person/s are magnetized to commit corruption. Respondents also identified that those people involve are rich and have positions in government and in society who use their power and influence to dictate the tempo and create an atmosphere of fear and intimidation to others, forcing them to cooperate and not to question, and/ or to remain silent about corruption issues.

Table 6. Summary of the Contents and Context of the Respondent's Qualitative answer on What motivates a person/s to do corruption?

What motivates a person to do corruption?	**NYC, Students, PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**%**
Greediness due to love money, power, prestige, non-contentment in life	50	5	2	57	39.58
Poverty	14	1	5	20	13.89
Culture and weak value system	4	0	1	5	3.47
Personal needs	4	1	1	6	4.17
Environmental influence	2	0	6	8	5.56

Comments	3	1	0	4	2.77
No answer	5	39	0	44	30.56
Total	**82**	**47**	**15**	**144**	**100.00**

People who are primarily involved in abuse and corruption

Table 7 demonstrates the summary of the contents and context of the respondent's qualitative answer on people mostly involved in corruption and abuses. As regard to who are the people mostly involved in corruption and abuses, the politicians ranked number one which was identified 80 times; followed by the government employees mentioned 45 times; next were the police which was mentioned 44 times; then government officials mentioned 36 times; businessmen mentioned 22 times; and lastly the education sector which was mentioned 17 times.

Table7. Summary of the Contents and Context of the Respondent's Qualitative answer on people mostly involved in corruption and abuses

Mostly involved in Corruption	**NYC, Students, & PNP**	**Office of the Ombudsman**	**CIC**	**Total mentioned**
Politicians	43	25	12	80
Government employees	16	17	12	45
Police	12	25	7	44
Government officials	16	17	12	36
Businessmen	18	3	1	22
Education	13	3	1	17

Institutions/Sectors who are primarily involved in abuse and corruption

Table 8 illustrates the list of institutions/sectors considered as the most corrupt in the country by the respondents. Ranked from highest to lowest, Bureau of Custom is on top of the list with a total of 73 mentioning from the different group of respondents. It is followed by the BIR with 52; PNP with 40; DPWH with 38; LGU and LTO with 37 each respectively; then Congress with 33; and Education with 29. The results explain that corruption is so widespread in the Philippines whether in government or in private sectors.

As observed by Hutchcroft[14], "There is collusion among public and private enterprises in the Philippines resulting to the weakening of state institutions to perform its mandate honestly and justly".

Table8. Summary of the Contents of the Respondent's Answer whom they considered as the most Corrupt Institutions/Sectors in the Philippines

Institutions	**NYC, Students,& PNP**	**Office of the Ombudsman**	**CIC**	**Total mentioned**
Bureau of Customs	31	28	14	73
BIR	21	20	11	52
PNP	11	17	12	40
DPWH	12	20	6	38
LGU	17	15	5	37

LTO	10	19	8	37
Congress	15	11	7	33
Education	22	7	0	29

Reasons why people are not reporting wrongdoings/corruption acts

Based on Table 9, people are very hesitant or not filing a complaint against corruption and wrongdoings in the country because of fear with 57 or 39.58% due to possible retaliation. 23 or 15.97 % noted that many Filipinos are not interested party against corruption on the belief that the government will not give them the necessary support and protection with 8 or 5.56%. However, it was noted that 56 or 38.89 of the respondents did not answer nor give any comment on this question.

Table9. Summary of the Contents and Context of the Qualitative answers of the Filipino Youth Respondents why people are hesitant or not filing a complaint against wrongdoings or corruption acts

Reasons why people are not reporting wrongdoings/ corruption acts	**NYC, Students, & PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**%**
Fear	47	2	8	57	39.58
Not interested	20	0	3	23	15.97
Lack of Trust to the Government	4	0	4	8	5.56
No answer	11	45	0	56	38.89
Total	**82**	**47**	**15**	**144**	**100.00**

The Culture of Vindictiveness of Filipinos

Table 10 presents the summary of the contents and context of the respondent's qualitative answers on the culture of vindictiveness of Filipinos. As seen, 59 or 40.97% of the respondents answered yes, I do believe that Filipinos are vindictive in nature; 5 or 3.47% answered no, I don't believe Filipinos are vindictive in nature; 77 or the highest percentage of 53.47 did not any indicate answer; 1 or .69% said that there is a chance to take revenge; and the remaining 2 or 1.40 said they don't know.

Table10. Summary of the Contents and Context of the Respondent's Qualitative answers on the Culture of Vindictiveness of Filipinos

Answers	**Students, NYC, & PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**%**
Yes, I do believe that Filipinos are vindictive in nature	45	1	13	59	40.97
No, I don't believe	4	0	1	5	3.47

Filipinos are vindictive in nature					
No Answer	32	46	0	77	53.47
There is a chance to take revenge	1	0	0	1	.69
Don't know	1	0	1	2	1.40
Total	**82**	**47**	**15**	**144**	**100.00**

Consequences of complainant / whistleblower corruption or any misconduct

Table 11 demonstrates what usually happens to the complainant or whistleblower of corruption and wrongdoings. Respondents said that they are threatened/intimidate/isolated which was mentioned 51 times equivalent to 35.42%; complainant get killed mentioned 9 times or 6.25%; supported and protected with 8 or 5.56%; bribed with 6 or 4.17%; other answers with 8 or 5.56%; and no answer dominated with 62 or 43.04%.

Majority of the respondents from National Youth Commission, Philippine National, Police and students who answered the interview guide questionnaire were strongly convinced that complaint against corruption and wrongdoings usually failed, rejected, or end to nothing due to long processes, biases, threats, and other forms of intimidation against the complainant, giving the latter no other choice but to withdraw, not to file a case anymore, to keep quiet, or have opted to accept payment in exchange of personal benefits, safety, and peacefulness.

In addition, most of the qualitative respondents strongly believed that the complainant/s on corruption are usually killed, suffers tremendous fear, psychological, and emotional pain due to all forms of harassment and intimidation such as threat to his life, family and relatives, work isolation, and counter false charges forcing the complainant to withdraw the complaint. Others opted to accept bribe in exchange of safety, silence, and benefits. Only few complainants get full support and protection once they filed the case.

All these instances or situations are highly visible in Philippine setting knowing our culture of close-knitted relationship, palakasan system, culture of impunity, tolerance, culture of vindictiveness and fear, inconsistent and complicated policies, weak and dysfunctional government institutions that failed to provide the necessary support and protection to the whistleblowers or complainant resulting to withdrawal, rejection or dismissal of cases.

With these data and information, it can be deduced that pursuing to go against corruption in the country is very dangerous and difficult due to strong political environment, tedious and toxic legal processes forcing the complainant to withdraw, to cooperate with the corrupt, or to think many times before deciding to file a complaint.

Table 11. Summary of contents and context of the Respondent's Qualitative answers on what usually happens to the complainant/whistleblower of corruption or any wrongdoings

What Usually happened to the complainant?	**NYC, Students, & PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**%**
Threatened/Intimidated/isolated	39	2	10	51	35.42
Complainant Get killed	9	0	0	9	6.25

Supported and Protected	3	0	5	8	5.56
Bribed	6	0	0	6	4.17
Other answers	8	0	0	8	5.56
No answer	17	45	0	62	43.04
Total	**82**	**47**	**15**	**144**	**100.00**

Consequences of a reported corruption complaint

Table 12 presents the summary of the contents and context of the respondents answer on what usually happens to the reported complaints about corruption. As seen, 72 or 50% of the total respondents said that the complaint undergoes a very tedious process ending to nothing; 13 or 9.03% said that complaint is automatically rejected and ignored; 12 or 8.33% said it is accepted, investigated with optimism to prosper; and the rest which is 47 or 32.64% had no answer. The analyses suggest that getting real and truthful justice system in the Philippines is very difficult and an elusive dream for many.

As pointed out by legal luminaries and by the Filipino people, Philippine justice system is such problematic that it cannot be trusted especially for those who are victims, oppressed, and in less in life.

Table 12. Summary of the Contents & Context of the Respondent's Qualitative answer on the question What usually happens to the reported complaints on corruption

What usually happened to the complaints on corruption and wrongdoings?	**NYC, Students& PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**%**
Undergoes a tedious process ending to nothing	59	2	11	72	50.00
Automatically rejected and ignored	13		0	13	9.03
Accepted, investigated with optimism to prosper	8	0	4	12	8.33
No answer	2	45	0	47	32.64
Total	**82**	**47**	**15**	**144**	**100.00**

Filipino behavior and response and its role in preventing corruption

Table 13 shows the summary of the contents and context of the Filipino behaviors and reactions and its effects in preventing corruption. As revealed, 67 or 46.53% answered no, the present reactions and behaviors of the Filipinos against corruption seems to have no effect at all; 66 or 45.83% answered yes, the present reaction and behaviors of the Filipinos show positive effect in preventing corruption; 2 or 1.39% with mixed answer; and 9 or 6.25% with no answer at all.

Table 13. Summary of the Contents and Context of Respondent's Qualitative answers on Filipino Behaviors and Reactions and its Effect of Preventing Corruptions

Present reactions and behaviors of Filipino and its Effect in Preventing Corruption	**NYC, Student, and PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**%**
No, the present reactions and behaviors of the Filipinos against corruption seem to have no effect at all.	37	21	9	67	46.53
Yes, the present reactions and behaviors of the Filipinos against corruption show positive effect.	39	21	6	66	45.83
Mixed Answers	0	2	0	2	1.39
No Answer	6	3	0	9	6.25
Total	**82**	**47**	**15**	**144**	**100.00**

Current corruption status in the Philippines

Table 14 presents the summary of contents and context of the present corruption situation as described by the Filipino youth. Out of the total 144 respondents, 124 or 86.11% described it as worst and the remaining 20 or 13.89% described it as improved.

Table 14. Summary of Contents and Context of the Respondent's Qualitative answers on Present Corruption Situation of the Philippines

Corruption Situation	**NYC, Students, and PNP**	**Ombudsman**	**CIC**	**Total**	**%**
Worst	70	41	13	124	86.11
Improved	4	4	12	20	13.89
Total	**82**	**47**	**15**	**144**	**100.00**

Because of the qualitative disappointing assessment on the present corruption situation of the country, it can be said that the present corruption situation of the country did not improve and even worsen due to weak reactions of the Filipino people to go against corruption encouraging some Filipino youth respondents to suggest a more radical solution by saying to kill them all or imposed death penalty for corrupt officials. Other respondents encouraged to impose and practice integrity and honesty, particularly on powerful people, have the political will and be more concern with the poor and country, all aspiring government officials must undergo strict background check and to put limits on their power, and increase the penalty on corruption with strict implementation of the law.

4 Conclusion

In conclusion, the obtained result from the survey indicated majority of the participants agree that corruption is a common practice in the country. Next, majority of the respondents claim that corruption is not an acceptable behavior.Most of the Filipino youth defined, described, and understand the word “corruption”, is any act that is unethical, evil, illegal, and harmful that destroys integrity

Besides that, many respondents knowing that corruption is persistent in the Philippines despite the consequences and penaltybecause of bad leadership and governance serving as the orchestrator and protector as well as the non-contentment in life, greediness and love of money. The obtained survey result also indicates that love of money, power, prestige, and non-contentment in life leading to selfishness and greediness are the main reasons why a person is motivated to do corruption.

As regard to who are the people mostly involved in corruption and abuses, the politicians ranked number one followed by the government employees. Correspondingly, Bureau of Custom is on top of the list of institutions/sectors considered as the most corrupt in the country by the respondents

People are very hesitant or do not complain about corruption and wrongdoing in the country because of fear of possible retaliation. Also, majority of the respondents do believe that Filipinos are vindictive in nature. Most respondent claims they will be threatened, intimidate, and isolated to the complainant or whistleblower of corruption and wrongdoings. In addition, most respondents believe that the complaint undergoes a very tedious process ending to nothing.

About half of the respondents the present reactions and behaviors of the Filipinos against corruption seems to have no effect at all, while the remaining half of the respondents agree that the present reaction and behaviors of the Filipinos show positive effect in preventing corruption.Lastly, most respondents agree that of the present corruption situation in the country is worst.

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References

[1] Corruption undermines democracy and contributes to instability, warns senior UN anti-crime official. 2019. [Internet]. United Nations News. [Cited 2 April 2020]. Available from: https://news.un.org/en/story/2019/08/1045081

[2] International Anti-Corruption Day 9 December. [Internet]. United Nations. [Cited 2 April 2020]. Available from: https://www.un.org/en/observances/anti-corruption-day/background

[3] Chugh, D. 2012. Psychology of Corruption. Journal: The Learning Curve, Lady Shri Ram College for Women Finalist, Young Psychologist 2012. [Internet]. [Cited 2 April 2020]. Available from: https://ssrn.com/abstract=2117247

[4] Sabic-El-Rayess, A. 2014. Acting and Reacting: Youth's Behavior in Corrupt Educational Settings. Peabody Journal of Education. 89. 70-85. DOI=10.1080/0161956X.2014.862473.

[5] Sika, N. 2012. Youth Political Engagement in Egypt. From Abstention to Uprising. [Internet]. [Cited 2 April 2020]. Available from: https://www.tandfonline.com/doi/abs/10.1080/13530194.2012.709700 on March 17, 2019
[6] Mansuri, G.; Rao, V. Localizing Development: Does Participation Work? Washington, DC: World Bank. 2013.
[7] Transparency International Report 2013. [Internet]. Transparency International. [Cited 2 April 2020]. Available from: https://www.transparency.org/gcb2013/country?country=philippines
[8] Melgar, N., Rossi, M. and Smith, T.W. 2010. The perception of corruption. International Journal of Public Opinion Research. 22, 1, 120-31.
[9] Wibowo, R. A. 2018. When anti-corruption norms lead to undesirable results: learning from the Indonesian experience. Crime, Law and Social Change, 70(3), 383-396.
[10] Tavits, M. 2005. Causes of Corruption: Testing Competing Hypotheses. Nuffield College, University of Oxford [Internet]. [Cited 2 April 2020]. Available from: http://www.nuffield.ox.ac.uk/politics/papers/2005/Tavits%20Nuffield%20WP.pdf on January 29, 2016
[11] Heywood, A. 2007. Politics 3rd Edition. Palgrave Macmillan. 175 Fifth Avenue, New York, NY 10010, USA
[12] Graaf, G. D., and Huberts, L. 2018. Integrity Violations and Corruption in Western Public Administration: Empirical Evidence and Reflection from Netherlands. Public Integrity, American Society of Public Administration, Washington DC, USA. 131-149.
[13] Keegan, S. M.2015. The Psychology of Fear in Organizations, Kogan Page Limited, Great Britain and United States of America.
[14] Hutchcroft, P. D. 1998. Booty Capitalism: The Politics of Banking in the Philippines. Ithaca: Cornell University Press

The Ethnolinguistic Vitality of the Dumagat Communities in Three Philippine Provinces

1st Romualdo A. Mabuan[1]*
{romualdo.mabuan@lpu.edu.ph[1]}

Lyceum of the Philippines (LPU), Manila Campus, Muralla St, Intramuros, Manila, 1002 Metro Manila, Philippines[1]

Abstract. This paper presents the findings of sociolinguistic research conducted between 2013 and 2015 among the Dumagat indigenous communities in Aurora, Bulacan, and Quezon Province. The primary goal of the study is to investigate the factors that account for the ethnolinguistic vitality of these communities. Employing qualitative techniques, data were gathered using interviews, participant observation, and focus group discussions (FGDs). Interview data were analysed using the nine criteria of language vitality and endangerment outlined in the UNESCO Expert Meeting in March, 2003 and were triangulated by the data gathered from participant observation and FGDs. Results reveal varying levels of language vitality among these Dumagat communities as influenced by factors that include social factors (social stigma, exogamy or external marriage, and migration patterns), institutional factors (governmental policies, support, and reforms), and linguistic factors (language contact, linguistic attitude, and language use). These findings situate these indigenous communities in the continuum of language reinvigoration and revitalization and implicate inter-level agencies to design feasible framework to document, cultivate, and protect this indigenous language for future generations of these IP communities.

Keywords: Ethnolinguistic Vitality; Language Vitality; Ethnolinguistic Vitality of Dumagat; Language Vitality of Dumagat Communities.

1 Introduction

Today, around 30 of over 150 Proto-Malayo-Polynesian (PMP) languages are spoken by negrito populations in the Philippines [1]. Many of these are severely endangered languages or have become extinct within recent historic times [2]. Apparently, when look at Reid's [3], Revised subgrouping of Cordilleran languages, notice that he did not specifically account for this variety; thus, the closest subgroup can identify it is the DumagatUmiray which is spoken by the negrito groups in the north eastern Luzon under the Northern Cordilleran language sub-group.

The Dumaget language is one of the five languages in the North Eastern Luzon Group of Northern Cordilleran languages [4]. The other languages include Palanan Dumagat, Paranan, Casiguran Dumagat and East Cagayan Dumagat. Genetically related, these languages may be morphologically and phonologically different from one another, but they are semantically related. BayaniAzcarraga states (Dumagat leader): "*Magkakaiba man ang ibangsalita at pagbikasnamin, nagkakaintindihan pa rin kami dahil halos pareholangnaman ang*

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aminglenggwahe."(Some of our words and pronunciation may be different, but we still understand one another because our language is almost similar.)

The traditional economy in Sitio Pinag-anakan, Barangay Cabog, and Sitio Masla has been, and still remains, hunter-gathering and swidden ('kaingin') farming, and this is reflected on their practices, though some may take on seasonal jobs being fishermen, cottage industry and construction workers. Some do not have any particular jobs at all and may take on any casual jobs available.

The traditional religion of the Dumagats in these areas is the consecration of their God "Makedepat" and the observance was high. However, it has gradually changed with the introduction of Christianity in their communities by some religious groups during l980s and 1990s. Nowadays, they identify themselves as Christians, Iglesia Ni Cristo, Mennonites and Seventh Day Adventist, while some remain to embrace their traditional belief.

Pinag-anakan Elementary School is the only public elementary school located in Sitio Pinag-anakan, Barangay Kabayunan, Norzagaray, Bulacan. It offers Grades 1 to 6 and is under the administration of the Department of Education. Currently there are two teachers conducting multi-grade classes with 46 Dumagat schoolchildren, who live within the Angat Dam watershed areas. Barangay Cabog in Dingalan, Aurora has one public elementary school, Cabog Elementary School, and one public high school, Cabog High School, which are just a stone's throw from the Dumagat community. Both Dumagat and Tagalog schoolchildren attend classes.

Currently, there are two public elementary schools in Barangay Sablang, General Nakar, Quezon: Sablang Elementary School, which is a mainstream school, and KatutubongPaaralang Jose P. Laurel (KPJPL), a school built primarily for the Dumagat schoolchildren, and is donated by the PUGAHAN Project (Pamana'yUgatin, Hasain at Arugain) with the collaboration of Lyceum of the Philippines University (LPU), National Commission on Indigenous Peoples (NCIP), and AusAID (Australian Agency for International Development). There is one teacher handling multi-grade classes from Grades 1 to 3, and there is a community teacher conducting Dumaget mother tongue classes for an hour every day.

Like any political units in the Philippines, Barangay Kabayuna, Barangay Cabog, and Barangay Sablang are governed by their respective barangay captains and barangay councillors who are duly elected during the local elections. These barangay officials are responsible for maintaining peace and order in their communities as well as implementing government projects. As mandated by the Philippine Constitution, all community members who are eligible voters can participate in the election of these local officials.

However, aside from the barangay officials, the Dumagats have another political structure, the Tribal Council, which is headed by their Chieftain and his council members. This political sub-unit operates within the context of barangay, and its main duty is to oversee its own people. In short, the Barangay and the Tribal Council work hand-in-hand to maintain a peaceful and orderly community for the benefit of all.

This study aims to investigate the ethnolinguistic vitality of some selected Dumagat communities (Sitio Cabog, Barangay Matawe, Dingalan, Aurora; Sitio Pinag-anakan, Barangay Kabayunan, Angat,Bulacan; and Sitio Masla, Barangay Sablang, General Nakar, Quezon) along the Sierra Mountain range. Also, identify the the factors contributing to the ethnolinguistic vitality situation of the Dumaget language in these communities.

2 Methodology

The Concept of Ethnolinguistic Vitality

In order to place social identity (and other social psychological) processes underlying ethnolinguistic behaviour in their appropriate sociostructural contexts, Giles, Bourhis, and Harwood [5] introduced the notion of Ethnolinguistic Vitality. It was defined as "that which makes a group likely to behave as a distinctive and active collective entity in intergroup situations". Giles et al. [5] proposed that group's strengths and weaknesses on dimensions of institutional support and control as well its social status and demographic strength may be assessed "objectively" to provide a rough overall classification of ethnolinguistic groups as having low, medium or high vitality. It was argued that the more vitality an ethnolinguistic group has the more likely it would be to survive as a distinctive linguistic collectivity in intergroup settings. Conversely, groups that have little or no group vitality were expected to assimilate linguistically or cease to exist as distinctive groups.

John Edwards [6], working under the framework of Ethnolinguistic Vitality, constructed his 'typology of language endangerment' which he specifically designed to research minority language situations. Edwards set eleven areas of factors that can influence a group's ethnolinguistic vitality at three different levels. The eleven areas are demography, sociology, linguistics, psychology, history, politics (including law and government), geography, education, religion, economics, and the media. The three levels are 'speaker', which does not mean the individual speaker but the minority speech community; then 'language', which signifies the relationship between the minority language as an object and the area of influence in question; and finally 'setting', which situates the minority community within the majority community.

Grenoble and Whaley [7] present and refine a scheme laid out by Edwards [6], which seeks to give an overview of all those factors that have a bearing on ethnolinguistic vitality. The factors in their refined scheme are demography, sociology, linguistics, psychology, history, politics, geography, education, religion, economics, technology, and literacy. Each of these factors can be analysed on the micro-level (that is, with respect to the language itself, or its speakers) or macro-level (that is, the broader setting within which the language and its speakers exist).

In March 2003, the UNESCO Expert Meeting defined nine criteria for ascertaining the vitality of a language [8, 9]; these factors were used to provide partial assessment of the vitality of the Dumaget language among the three communities in the current study:

Factor 1: Intergenerational language transmission,
Factor 2: Absolute number of speakers,
Factor 3: Proportion of speakers within the total population,
Factor 4: Trends in existing language domains,
Factor 5: Response to new domains and media,
Factor 6: Materials for language education and literacy,
Factor 7: Language attitudes and policies,
Factor 8: Community member's attitudes toward their own language
Factor 9: Amount and quality of documentation

Research Locales

The current study focuses on the three Dumagat communities in Sitio Cabog, Barangay Matawe, Dingalan, Aurora; Sitio Pinag-anakan, Barangay Kabayunan, Angat, Bulacan; and Sitio Masla, Barangay Sablang, General Nakar, Quezon. The researchers visited Barangay Cabog on March 29-31, 2015 and on April 16-17, 2015. The first visit aimed at presenting the

rationale of the research and being acquainted with the members of the community, though it has to be noted that LPU-COSeL has already been engaging with the community since 2010 for the PUGAHAN Project, which is a community-building initiative geared towards cultural revitalization of indigenous groups. The second visit is to conduct transect walk with the community to Kailogan, a vast land area which serves as their primary source of livelihood and their original abode before they moved to Bahay Kalinga resettlement project in Barangay Cabog. Kailogan can be reached on foot for approximately three hours by crossing rivers and climbing mountains. Some Dumagats reach some areas going to Kailogan by using habal-habal, a local term for a motorcycle designed to carry at least five passengers including the driver. The population in the area is homogenous and concentrated, but it had high contact with visitors or outsiders because of the national road accessed by buses and other vehicles.

The researchers visited the Dumagat community in Sitio Pinag-anakan in Bulacan on April 9-10, 2015. The area is one of the indigenous communities covered with the expansion of the Culturally Adaptive Basic Education and Health (CABEH) Program, which is a collaboration among National Commission on Indigenous Peoples (NCIP), Department of Education (DepEd), and Lyceum of the Philippines University (LPU). CABEH shares mission and vision with PUGAHAN, and the two programs work together in implementing LPU-COSeL's community extension initiatives. Sitio Pinag-anakan can be reached by van from Manila to Barangay Hilltop, and by motorboat going to Angat Dam watershed areas, which serve both as the source of livelihood of the Dumagats as well as their shelter. By virtue of local government policy, only Dumagats are allowed to dwell in the watershed areas, whereas outsiders or non-Dumagats are prohibited to enter and settle in those locations. The population is homogenous but dispersed; some dwell near the school and some live in the mountains nearby. There is a very low contact with visitors and outsiders.

The researchers visited Sitio Masla in General Nakar, Quezon on April 22-23, 2015. In the visits, the researchers have participated in community building and development activities such as tree planting, English language tutorials, and community immersion. The researchers have witnessed its physical transformation from a rustic community to a place built with a school, library, water system, toilet facility, and multi-purpose halls. The population is concentrated with houses built near the school.

Research validation was conducted on January 9-10, 2016 at the Matawe Bay Farm, Sitio Cabog, Barangay Matawe, Dingalan, Aurora, where the key informants from the three ethnolinguistic groups gathered to discuss the results of the research findings.

Research Instruments

The data in this study was drawn from structured, semi-structured and unstructured interviews; focus group discussion (FGD); and participant observation. The interview questionnaire aimed to determine the research participants' demographic profiles, educational background, livelihood, ethnic identity, and the Dumaget language use in the following domains: home and family; relatives, friends, and neighbours; school or education; religion; work; business or market; religion; social and cultural community activities; and agriculture. Thirty questions were developed to correspond to these domains. The survey was conducted personally, with the aid of the community members. Data from the FGDs and participant observation was used to complement and validate the data obtained from the interviews.

Research Participants

Due to physical, spatial, and temporal limitations, comprehensive sampling was not possible to gather data for the current study. Another concern includes inapplicability of western approach of soliciting information from participants individually. With their social solidarity, Dumagats prefer to be interviewed within a group context and within the frame of

reference of their own community. Hence, 'informed sampling' was employed[10] by identifying key informants from each locale with a view of drawing a sample that could represent their communities. Reliability was derived from selecting participants, particularly the senior members of the group, who are considered the 'keepers' of their cultural heritage, systems, and practices. Validity was assured from gathering their responses, keeping records and interpretations of them, and arriving at conclusions with their consensus and agreement through research validation.

Data Analysis

The data from the interviews was analysed using the nine criteria of language vitality, as outlined in the UNESCO Expert Meeting in March 2003 [8, 9], and was complemented by the outputs of the FGDs and participant observation that were carried out in the study.

3 Result And Discussion

Intergenerational Language Transmission, Absolute Number of Speakers and Proportion of Speakers within the Total Population

Based on the August 2013 LPU-DepEd-NCIP PUGAHAN Progress Report, Sitio Cabog had a total population of 440, Sitio Pinag-anakan had 108, and Sitio Masla had 241. Although the report lists the spoken languages of all the residents including the parents and their children, it was not easy to identify the exact number of Dumaget speakers. Table 1 shows the estimated number of Dumaget speakers in the three communities.

Table 1. Estimated Number of Dumaget Speakers in the Three Communities

Dumagat Communities		**Sitio Cabog (Aurora)**	**Sitio Pinag-anakan (Bulacan)**	**Sitio Masla (Quezon)**
Spoken Languages	Dumaget only	25	42	14
	Tagalog only	11	2	104
	Dumaget& Tagalog	395	60	112
	Others (Dumaget&Bikol/ Igorot/ Ilokano)	3	-	5
	Incapable of articulation/ undetermined	6	4	6
Total		440	108	241

The three communities vary according to the number of Dumaget; Tagalog; Dumaget and Tagalog; and Dumaget and other language speakers, with Sitio Cabog and Sitio Pinag-anakan having more Dumaget language speakers compared to Sitio Masla in terms of ratio to the total population. Even though the UNESCO criteria state that the total number of language speakers does not necessarily mean that the language vitality is endangered, "ceteris paribus, a smaller group is likely to be under greater pressure than a larger group" [8]. This idea is supported by

Brenzinger et al. [9]:A small population is much more vulnerable to decimation (e.g. by disease, warfare, or natural disaster) than a larger one. A small group may also merge with a neighbouring group, losing its own language and culture.

Referring to UNESCO criteria in Table 2, approximate the linguistic vitality of the Dumagat communities based on the ratio of speakers to the total population. However, it should be noted that this is only an estimate as actual language proficiency assessments have still to be conducted to ascertain the linguistic proficiency self-report from the study participants and key informants as presented in Table 1.

The UNESCO Intergenerational Language Transmission criteria suggest that the Dumaget language in Sitio Cabog (Aurora) and Sitio Pinag-anakan (Bulacan) is likely situated at Grade 5 of the language endangerment scale, while the Dumaget language in Sitio Masla (Quezon) is likely situated at Grade 3. In the UNESCO criteria, Grade 5 refers to the status of a language that is still secured because all speakers from children and up are still using it, while Grade 3 refers to a language status that is not secured because the language is no longer being learned as the mother tongue at home, and although parents may still speak their language to their children, the children do not typically respond in the language.

Table 2. Intergenerational language transmission [9]

Degree of Endangerment	**Grade**	**Speaker Population**
Safe	5	The language is used by all ages, from children up.
Unsafe	4	The language is used by some children in all domains; it is used by all children in limited domains.
Definitely endangered	3	The language is used mostly by the parental generation and up.
Severely endangered	2	The language is used mostly by the grandparental generation and up.
Critically endangered	1	The language is used mostly by very few speakers of the great-grandparental generation.
Extinct	0	There exists no speaker.

Unbroken language transmission from parents to children across generations is a strong indicator of linguistic vitality of a community. In the case of Sitio Cabog and Sitio Pinag-anakan, it is still evident, as all of the children are Dumaget language speakers. On the other hand, Sitio Masla's linguistic situation proves otherwise, as many children no longer speak the language. Nevertheless, the interview data suggests that all of the participants in the three communities believe in the importance of language transmission to their children and agree that the Dumaget language should be taught at home to the younger generation. The parents believe that the Dumaget language is their identity; hence, it should be learned by their children. As one parent comments:

"*Bali-baliktadin man yungpagkataomo, yungwikamo'yyun pa rin ang nakatataksapagkatao mo*."

'Even if your identity is turned upside-down, your language will still be your identity marker.' (SMQ-F-1)

This is supported by another parent's sharing on how her own parents reminded her of keeping the Dumaget language with her, urging her to do the same to her own children:

"*'Pag ang salitaninyoanak ay nilayoninyosasarilininyo, kayo narin ang pumutolna parang hindina kayo tunaynakatutubo.*"

'If you keep your own language away from you my child, it is like you cut [your lineage] as if you were no longer a true indigenous person.' (SCA-F-1)

Still following Brenzinger et al.'s perspective [9], the Dumaget language in Sitio Cabog (Aurora) and Sitio Pinag-anakan (Bulacan) is likely "stable yet threatened (5-)". "Stable yet threatened" indicates that a language is spoken in most contexts by all generations with unbroken intergenerational transmission from grandparents to parents and to children. However, multilingualism among the native language speakers and one or more dominant language(s) have started penetrating important communication spheres in the community. In this context, the dominant language refers to the language of the majority and the language of power, prestige and influence. In this case, the dominant language is Tagalog or Filipino. This linguistic situation of multilingualism among the Dumagat communities is shown in the parents' statements below:

"*'Pag nasapaaralan po ang mgaanak ko, siyempre, nag-ta-Tagalog sila para maunawaansila ng kanilangmgaguro at mgakaklase, pero 'pagsila-silangnalang ang nag-uusap, pa-Dumagatna.*"

'When my children are at school, of course, they speak Tagalog so that their teachers and their classmates can understand them, but if they talk among themselves, they use Dumaget.'(SCA-F-2)

"*Kumporme kung sino ang kausap… halimbawa 'pagbibilisa bayan, natural Tagalog ang gamitkasipapano ka namanmauunawaan ng tindera kung pa-Dumagat ka. Pero kung ang kasama ko ay Dumagat, sasalitangDumagat kami mag-uusap.*"

'It depends on who we are talking to…for example, if we buy something in town, of course we use Tagalog because how can a vendor understand you if you speak Dumaget. But if I am with a Dumagat, we converse in Dumaget. (SPB-M-1)

The following section explores the multilingual/bilingual situation of these speech communities, the position of the Dumaget language, the bilingual factor among the Dumagat speakers, and the role of the dominant language in specific communicative contexts or settings.

Trends in Existing Language Domains

Domain refers to the connection between the choice of language and the sphere and general activities of a particular society [11]. Specifically, domains are defined in terms of institutional contexts or socio-ecological co-occurrences [12]. They show the communication spheres and clusters as well as the language/s used by speakers when performing communicative acts in these settings. Domains can reveal prioritized and privileged languages that are utilized in various socio-cultural contexts. They can also show minorities and less preferred languages in realizing communicative goals in different situations.

As every particular society has different aspects and needs, the domains for language use also vary. For instance, a community that is situated in the "remotest of the remote" place will definitely have different domains than a community located in an urban area, as the life-ways and lifestyles of the people in these situations also vary. This study explores eight domains for language use among the three Dumagat communities: (1) home and family; (2) relatives, friends, and neighbours; (3) school or education; (4) work; (5) business or market; (6) religion;

(7) social and cultural community activities; and (8) agriculture. Table 3 demonstrates the general language distribution in selected domains among the Dumagat communities.

Table 3. General Language Distribution in Selected Domains among the Dumagat Communities

Domains	**Sitio Cabog (Aurora)**			**Sitio Pinag-anakan (Bulacan)**			**Sitio Masla (Quezon)**		
	Dumaget	**Tagalog**	**English**	**Dumaget**	**Tagalog**	**English**	**Dumaget**	**Tagalog**	**English**
Home and family	x	x		x	x		x	x	
Correspondence with relatives, friends, and neighbours	x	x		x	x		x	x	
School or education		x	x		x	x	x	x	x
Social and cultural community activities	x	x		x	x			x	
Religion	x	x		x	x			x	
Work		x			x			x	
Mass Media		x	x		x	x		x	x
Business or market	x	x	x	x	x	x		x	x
Agriculture	x			x				x	

A general picture of the language distribution across domains in Sitio Cabog (Aurora), Sitio Pinag-anakan (Bulacan), and Sitio Masla (Quezon) is given in Table 3. This shows the bilingual status in the home and family domains among the communities, with both Dumaget and Tagalog being spoken among family members. However, it should be noted that the extent and stretch of use of these two languages vary geographically. For instance, Sitio Cabog and Sitio Pinag-anakan have reported consistent use of Dumaget in their households, although some children are starting to use Tagalog when communicating with their parents and siblings. On the other hand, only few families use Dumaget at home in Sitio Masla, as majority of the population use Tagalog, particularly those families whose parents are non-Dumagats. Although the use of Dumaget in the home and family domain in Sitio Cabog and Sitio Pinag-anakan is maintained and still minimally practiced in the case of Sitio Masla, if look at all the social strata of society, Tagalog is gradually penetrating this domain. The same language behaviour holds true for community activities and contact with relatives, friends, and neighbours. The following respondent's avowal from Sitio Cabog (Aurora) illustrates this situation:

"*'Pag nasabahay po kami, Sir, e talagang pa-Dumagat ang amingimikan…ganunnarinsamgakapitbahaynamin. Naiibalangkapag Tagalog na ang kaharapnamin…*"

'When at home, Sir, we really speak in Dumaget…as when we converse with our neighbours. It only changes when we face Tagalog speakers…' (SCA-F-2)

In the same manner, the Dumagats in Sitio Pinag-anakan (Bulacan) also use their language at home, as stated below:

"*Ditosa amin, halos lahat kami dito ay Dumagat kaya walangnagta-Tagalog samgabahay-bahay…patiyungmgaasawa ng DumagatnahindiDumagat ay natututonarinmagsalitanang pa-Dumagat…iyonkasi ang naririnignilaaraw-araw…*"

'Here in our place, almost all of us here are Dumagats, that's why nobody speaks Tagalog at home…even the husbands or wives of the Dumagats who are not Dumagats are learning how to speak Dumaget…because that is what they hear every day…'(SPB-M-1)

In contrast, the linguistic situation in Masla is slowly changing even in the home domain:

"*Aaminin ko po sainyo, Sir…e talagangmadalangnalang ang nagsasalita ng pa-Dumagatditosa amin…peromarurunongsila…perohindilangsila nag-iimikan ng pa-Dumagat…una, dahil ang asawa ng iba ay hindiDumagat…at pangalawa parang ayawlangnilagamitin ang ganoongsalita…hindi ko alam…*"

'I'll admit to you, Sir…there are really few who speak Dumaget here in our place…but they know [Dumaget]…but they just don't converse in Dumaget…first, because the wives or husbands of others are non-Dumagats…and second, it seems that they just don't want to use the language…I don't know…' (SMQ-M-1)

The first change is noticeable when looking at the school domain where both Tagalog and English are in use in all of the three communities. Being the Philippine official national language, Filipino is used as the required medium of instruction (MOI), with English being taught as a second language and used as an MOI throughout higher grades. However, with the passing of Republic Act 10523, otherwise known as the Enhanced Basic Education Act of 2013 that implements the K to 12 Basic Education Program in the Philippines, the Mother Tongue – Based Multilingual Education (MTB-MLE) was institutionalized. MTB-MLE mandates the use of students' mother tongue (L1) as MOI beginning grade 1 through grade 3 as well as the integration of local cultures into the teaching and learning process in the classroom through localization and indigenization of curriculum, as it aims to develop multilingual, multi-literate and multicultural citizens of the society. It is with this educational policy that primary schools have started to restructure their Basic Education Curriculum in order to integrate students' mother tongue in the classroom, and put premium on the importance of learning concepts through students' first language to facilitate literacy, to promote cognitive development, and to capitalize on students' prior knowledge for lesson bridging and scaffolding. This is what is now being done in Sitio Masla, which conducts mother tongue classes to its pupils from kindergarten to grade four through a community paraprofessional teacher. Still, full implementation of this program is not realized due to the emergence of some concerns such as lack of mother tongue teachers, lack of instructional materials, and lack of teacher training. While educational institutions are addressing these issues, majority of the teachers continue to use Filipino as the MOI in their classroom instruction.

Table 3 also suggests that the domain of mass media is bilingual, with Filipino and English being used as the language of radio, television, and news and broadcast. In addition, small business and official transaction on the local level take place in Tagalog, while big business, management discussions and government decisions on the higher level are communicated mostly in English. Dumaget is used only if the transaction is done by the Dumagat speakers among themselves, which usually takes within local communication contexts. This positions Dumaget as the language mainly for personal, social, and non-formal functions.

A similar case of changing pattern in the use of Dumaget in the religious domain can be observed. Although this domain is regarded as the strongest domain in which to preserve the use of a native language, this is not the case in all of the three Dumagat communities. Both Sitio Cabog and Sitio Pinag-anakan have bilingual language status in the religious sphere, as they use both Dumaget and Tagalog in church functions, although they use Tagalog in general in order to adapt to the different linguistic orientations of the churchgoers. Dumaget is used only when all of the mass attendants are Dumagats. Although there are few religious reading materials that are translated to Dumaget from Tagalog or English by American missionaries, the Bible that they use in the church is written in Tagalog. This is partly because the mass celebrant is usually an outsider who speaks Tagalog in preaching sermons and conducting prayers.

The change in the pattern of language use in the religious domain is closely connected to the changes that take place in the Dumagat communities. Traditionally, Dumagats would use the Dumaget language in worshiping their god "Makedepat", in praying, and in performing healing rituals. This is no longer the case at present. Interview results revealed that majority of the informants have embraced Christianity. The Bible that they use in the church has been translated from English to Tagalog, and the language of preaching is Tagalog, which inevitably changes the linguistic landscape of the Dumagats' religion in general. The Tagalog's position in the religious domain of the Dumagats can be considered a dominant status, similar to the Arabic language, which is considered a superposed H (High) language among the Muslims in Malaysia and Singapore [13].

This study reveals that the life patterns among the Dumagats in these areas have slowly changed over time. The inevitable change in the social milieu of the Dumagats has gradually shifted the landscape of their practices. In terms of religion, the embrace of Christianity by most Dumagats has replaced their customs and traditions that they upheld for so long, as most of these are considered to be in conflict with the teachings of Christianity, and hence, they do not practice them anymore. In the case of work, it was observed that Dumagats do not work in the government or private offices; they have work on their own such as fishing, farming, and hunting. Some take on casual work, and some may even do not have any work at all. When they have an important transaction, they visit these offices, which are commonly run and occupied by the speakers of the dominant language. This interaction exposes them to the dominant language and may gradually contribute to a significant change in their patterns of language use. In terms of agriculture, Dumaget is still strongly used within the community, particularly in Sitio Cabog and Sitio Pinag-anakan, whereas Tagalog is more commonly used in Sitio Masla.

There is also an observable interaction of communication spheres when look into the language contact among these Dumagat communities and the other communities. In the case of Sitio Cabog in Aurora, it is geographically situated along the national highway, which exposes this group to other groups of people such as local tourists and the neighbourhoods. In short, the Dumagats in Sitio Cabog are positioned in the crossroads of cultures, and hence, may expose them easily to the other groups. In a similar situation, Sitio Masla in Quezon is also situated along the community road, even though it is considerably far from the municipality. This position exposes the Dumagats in Sitio Masla to the others groups, as it allows language contact and interaction between them and the Tagalog speakers. This continuous contact with each other will be necessary for them to communicate with each other, and so some speakers will gradually acquire (elements of) the other group's language; and while this may happen in both ways, typically the lower-status group (Dumagat) will adjust to the politically dominant one (Tagalog). If this situation persists over time, this may

lead to what Schneider [14] refers to as emergent bilingualism, where more and more speakers of the indigenous language (in this case, Dumaget) will acquire Tagalog for practical reasons, which, in some extreme cases, may lead to complete language shift. On the other hand, Sitio Pinag-anakan in Bulacan is located in a secluded area within the Angat Dam watershed system, making it less accessible to other groups, as entry to the community is regulated by the government. The Dumagats in this area are less exposed to the other groups; the interethnic interaction only occurs when the other groups such as religious and educational institutions visit the place for some programs. Thus, the language exposure to the dominant language is reduced, and the use of the native language is maintained within the community.

Sitio Cabog in Aurora has public elementary and secondary schools, Cabog Elementary School and Cabog High School, which are located across the Dumagat community and are attended by a mixture of Dumagat and Tagalog students.Sitio Pinag-anakan in Bulacan has an elementary school, Pinag-anakan Elementary School, which contains one classroom that conducts multi-grade classes from grades 1 to 6. Dumagat pupils who wish to continue their education in the secondary level beginning grade 7 have to go out of the area and stay in the town proper, where the municipal high school is located. Sitio Masla in Quezon has a newly-built elementary school in 2013, KatutubongPaaralang Jose P. Laurel (KPJPL), which was founded through the initiative of the Community Outreach and Service Learning (COSeL), Lyceum of the Philippines University's center for community extension programs and services. It has three classrooms that primarily serve Dumagat schoolchildren from kindergarten to grade 4 levels. Before the establishment of KPJPL, Dumagat children attended at Sablang Elementary School, a barangay public elementary school located around 30 to 40 minutes on foot from Sitio Masla. The MOI in all of these schools is Filipino, and English is taught as a subject, although English is also used as MOI in higher levels particularly in content areas such as Science and Mathematics. At present, it is only Sitio Masla in Quezon that offers Dumaget mother tongue classes to all of its students through a community paraprofessional teacher who is a Dumaget mother tongue speaker. The mother tongue classes are conducted in conjunction with the regular classes delivered by the teachers of the Department of Education. The classes are held every Monday morning and Friday afternoon, totalling four hours weekly for each group of learners: group 1 (composed of kindergarten, grade 1 and grade 2 pupils) and group 2 (composed of grade 3 and grade 4 pupils). Sitio Cabog in Aurora had Dumaget mother tongue classes that were also conducted by a Dumaget mother tongue speaker two years ago but the program had stopped, although recently the Dumagat community as well as the school officials are planning to re-open the program. Sitio Pinag-anakan in Bulacan did not have mother tongue classes yet, but they expressed interest in the possibility of including them in the school curriculum. The main concern among these communities is the availability of the Dumaget mother tongue speakers who will serve as Dumagat community teachers and conduct classes on a regular basis.

The use of the two national languages (Filipino and English) in the school domain as MOIs in these IP communities require students to learn to read and write and master the curriculum in both Filipino and English while at the same time acquiring these languages. This may result in low comprehension and poor intake of the subject matter particularly to those students who are not proficient in these languages. To address this concern, Gonzalez [15] suggests that a language that students understand, i.e., their mother tongue, must be used transitionally until a new MOI can be used with comprehension in the classroom.

This data shows that the patterns of language use across domains in the three Dumagat communities vary. At the institutional level, it suggests that the choice of languages for active use in situational contexts is not free, but often prescribed by the government or official bodies

as in the case of the use of a dominant language in the educational system. This is socially conditioned diglossia[16, 17], where two languages are used in the community, with the other being utilized in the high domains and the other in the low domains. At the individual level, there is indeed a personal choice to use one of the two languages in their active use (individual bilingualism) among the Dumagats, yet this choice is always directed to the dominant language [18], which is Tagalog or Filipino in the higher domains and Dumaget in the lower domains.

The data also reveals that most of the Dumagats in Sitio Cabog and Sitio Pinag-anakan and few in Sitio Masla are stable bilinguals, who are proficient in their mother tongue and shift only to Tagalog for instrumental purposes. This stable bilingualism [12] among the Dumagat speakers enables them to switch to Dumaget or Tagalog whenever the communicative situation calls for it, without any difficulty of communicating. This suggests that the use of Tagalog among Dumaget speakers is 'incentivized', primarily motivated for purposes of educational and economic access, but not necessarily affect their ethnolinguistic identity. Table 4 demonstrates the loss of existing language use domains

Table 4. Loss of existing language use domains [9]

Degree of Endangerment	**Grade**	**Domains and Functions**
Universal use	5	The language is used in all domains and for all functions.
Multilingual parity	4	Two or more languages may be used in most social domains and for most functions.
Dwindling Domains	3	The language is used in home domains and for many functions, but the dominant language begins to penetrate even home domains.
Limited of Formal Domains	2	The language is used in limited social domains and for several functions.
Highly limited Domains	1	The language is used only in very restricted domains and for a very few functions.
Extinct	0	The language is not used in any domain or for any function.

Based on Table 4, it is suggested that the Dumaget language in Sitio Cabog and Sitio Pinag-anakan falls into Grade 3 of the language endangerment scale, that is, the dwindling domains, which corresponds to language use in home domains and for many functions, but the dominant language begins to penetrate even home domains. In other words, the Dumaget language is still the language being used by Dumaget speakers at home and for my functions in the community, but the dominant language, i.e., Tagalog, has begun to penetrate these spheres. On the other hand, the data suggests that the Dumaget language in Sitio Masla falls into Grade 1 category, that is, the highly limited domains, which means that Dumaget is used only in very restricted domains and for a very few functions such as the use of the language at home of few speakers.

Governmental and Institutional Language Attitudes and Policies

Language policy is the law that is related to the construction, implementation and maintenance of language use in a particular speech community [11]. In the Philippines, the language policy is outlined in the Philippine Constitution. The 1974 and 1987 Bilingual Education policies determined the language of instruction in the Philippine educational system to be Filipino and English, despite the fact that about 80% of the population does not speak either of these languages as their first language (L1) or mother tongue. Recently, the implementation of DepEd Order No. 60, s. 2008 and DepEd Order No. 74, s. 2009 caused a significant change in the current national educational landscape. The latter recognizes that the mother tongue, when used as a language of instruction (LOI), can facilitate student learning more effectively. Even more recently,the passing of Republic Act 10523, otherwise known as the "Enhanced Basic Education Act of 2013", institutionalized the Mother Tongue-Based Multilingual Education (MTB-MLE) language policy, which is regarded as the government's banner program for education as a salient part of the implementation of the K to 12 Basic Education Program (Department of Education, 2013). MTB-MLE requires instruction, teaching materials, and assessments to be in the "regional or native language of the learners" from kindergarten through grade three with a "mother tongue transition program" from grades four through six. Gradual implementation had already started with grade one students in 2012 and had been followed by grades two and three in 2013 and 2014, respectively.

Before the institutionalization of MTB-MLE, Filipino and English have been used as LOIs in the Philippine education system. These are also the languages mostly used in the public and private sectors of the government, as well as in formal business transactions. This resulted in the deterioration of functional load of the non-dominant or minority languages in the public domain. The minority languages were not taught as subjects in the school curriculum, and are used only as vernaculars in limited domains, which fail to strengthen their functional transparency, that is the degree of autonomy and control that is owned by the language in specific domains [11]. This indicates that they do not have power and prestige in the society.

However, with the integration of Philippine local and indigenous languages into the Philippine basic education curriculum through MTB-MLE, the minority languages are starting to gain support and momentum.The so-called localization or indigenization in the classroom breathes a new life in the national educational landscape and revitalizes the language situation in the Philippines.Thus, with this recent language policy, Factor 7 of the UNESCO criteria, Governmental and Institutional Language Attitudes and Policies [9], likely positions the Dumaget language in the context of threatened language vitality. Table 5 shows the governmental and institutional language attitudes and policies

Table 5. Governmental and institutional language attitudes and policies [9]

Degree of Support	**Grade**	**Official Attitudes toward Language**
Equal support	5	All languages are protected.
Differentiated support	4	Minority languages are protected primarily as the language of the private domains. The use of the language is prestigious.
Passive assimilation	3	No explicit policy exists for minority languages; the dominant language prevails in the public domain.

Active assimilation	2	Government encourages assimilation of the dominant language. There is no protection for minority languages.
Forced assimilation	1	The dominant language is the sole official language, but non-dominant languages are neither recognized nor protected.
Prohibition	0	Minority languages are prohibited.

Based on Table 5, the Dumaget language is likely situated between Grade 5 and Grade 4. In this case, it is true that all languages including the majority, minority and indigenous languages are protected by the government with the recent national educational language policy; however, at the same time, the dominant language, Filipino, still prevails in the public domain. This means that there is some degree of support from the government to the minority and indigenous languages, yet; still, there is passive assimilation that occurs because the standard Filipino language is the language of the public domain.

Community Members' Attitudes towards Their Own Language

Obiols [19] defines attitude as a "mental disposition towards something", it acts as a bridge between opinion and behaviour. Ryan and Giles [20] define language attitudes as "any affective, cognitive or behavioural index of evaluative reactions toward different language varieties or speakers." Language attitude of the members of a speech community may vary from person to person. They may see it as essential to their community and identity and promote it; they may use it without promoting it; they may be ashamed of it, and therefore, not promote it; or they may see it as a nuisance and actively avoid using it.

Interview and focus group discussion data among the three IP communities under study reveal some perspectives on community members' attitudes towards the Dumaget language. In general, all members agreed that they value their language and they wish to see it promoted for the following reasons: (1) it is their identity marker; (2) it is their legacy from their ancestors that they have to pass on to the young generation; (3) it is the bearer of their culture. These reasons are supported by the following participants' avowals:

"*Eh kasi 'yun ang kinagisnan naming salita…di pwedengmawalasaamingsarili ang salitanamin…*"

'That's the language we've born with…it's not possible to detach our language from ourselves…'(SCA-F-3)

"…Balibaliktadin man, yungpagkataomo at yungwikamo'yyun pa rinnakatataksapagkataomo…."

'Whether your identity is turned upside down and reverted, your language remains etched in your identity…'(SPB-M-2)

However, even though all of the Dumagats support their language, they admit that there are also challenges that may affect in promoting and advancing their own language. These include the following: (1) social stigma associated with using the language; (2) exogamy or interethnic marriage; (3) modern technological advancements; (4) out-migration; and (4) practical reasons. One common factor cited is the social stigma that is associated in speaking the language. Speaking Dumaget in the presence of non-Dumaget speakers particularly in school usually ends up in bullying and discrimination. Several stories that have been shared regarding this issue can be traced back to the previous negative experiences of their grandparental and parental generations. It has left them deep and open wounds that would soon prevent them from using the language, particularly when they are in public places. This

stigmatized and 'dis-incentivized' use of Dumaget even led some parents not to teach the language to their children deliberately:

"*Dahil nga po sapanunukso ng mgaunat, di na kami tinuruan pang magsalita ng awing wika ng amingmgamagulang…*"

'Because of the constant bullying of the non-Dumagats, our parents did not teach us how to speak our language deliberately…'(SMQ-F-3)

Interethnic marriage or exogamy is also seen as a contributory factor in the decline of use of Dumaget. The participants believe that if a Dumagat marries a non-Dumagat such as a Tagalog, this will consequently result in the changing patterns of language use at home among the parents and the children in order to accommodate one another in communication. They also concurred that if the non-Dumagat is the mother, the language of the children will likely be the language of the mother as they have longer contact hours and interaction than with the father who traditionally is the one who leaves home for work.

"*Sa amin po ditosaMasla ay maraminangnakapag-asawa ng mga di tuladnamin kaya pag nag-uusapsilasabahay Tagalog na ang gamit para magkaintindihansila…*"

'Here in our place in Masla, many have already married with non-Dumagats; that's why when they converse in their homes they use Tagalog so they can understand each other…'(SMQ-M-2)

It is also believed that the advent of modern technology that is slowly affecting the lifestyles of the Dumagats is another intervening factor in the promotion of Dumaget among these communities. In particular, the communities in Sitio Cabog - Aurora and Sitio Masla – Quezon already have access to electricity, and some households now own television sets, video players, and mobile phones. This exposes them to languages such as Filipino, English, and even Korean by watching TV programs and movies in DVD formats. In contrast, these technological innovations have a lesser effect in Sitio Pinag-anakan – Bulacan, which is still has no access to electricity, although some households already own some mobile phones for communication with their family members who are working and studying in the town proper. However, despite this perceived effect of modern technology towards their Dumaget language use, others maintained that it has a very little impact on them:

"*Meron din, kumbaganababawasanyungpagsasalita ng pa-Dumaget, pero di namanganunkatindi ang epektokasi di namannilanakakalimutan ang salitanamin…*"

'There is (an effect), it seems that their (children) speaking in Dumaget is reduced, but the effect is not that alarming because they don't forget our language…'(SCA-F-3)

Out-migration is also seen as a factor in the promotion and maintenance of the Dumaget language. The participants believe that when any member of their family leaves their community for work or study and goes to another community where their language is not spoken, it can affect their language use, as they have to adapt to their present environment. The significant change in language proficiency, they believe, is especially apparent to young children who live in the town proper with non-Dumagats for years. Some of them, although proficient in speaking Dumaget, deliberately switch to Tagalog when speaking in their community to suggest that they have been to the city, which they believe is a good social class marker among them. However, majority still believe that in the case of the adult members of the community who have already established their proficiency in Dumaget, this is not a major concern, as they speak only Tagalog for instrumental reasons, and not as a sign of language shift.

"*Yung ibangmgakabataanditonalumuwas ng lungsod para magtrabaho, pagbalik Tagalog na kung magsalita…peroalamnamannila mag-Dumagetpinipilitlangnila…para masabilangnagalingsasyudad…*"

'Some of the youth here who went to the city to work, when they come back they speak in Tagalog…but they do know how to speak Dumaget…they deliberately speak in Tagalog so others will know that they have been to the city…'(SCA-M-2)

Finally, Dumagats believe that a pervasive factor affecting the promotion and maintenance of Dumaget is the social reality of learning and using the dominant language (in this case, Tagalog) for more pragmatic reasons: educational, economic, and social access. Since Tagalog is the language of school, commerce, business, work, and government transactions, they regard using it as an advantage for their welfare. This could be the reason why some parents even encourage their children to learn Tagalog so that they can easily assimilate to the outside environment and mainstream society. The use of Tagalog is associated with social mobility, which will provide them better and bigger chances of achieving their life goals.

"*Maramingmgamagulangdito Sir Tagalog natalaga ang tinuturosamgamagulangkasikailangan po sapaaralan at pag-nagtrabahona…*"

"Many parents here Sir teach Tagalog to their children because it is needed in school and in their future work…'(SMQ-F-4)

Speakers' attitudes towards their own language are an essential factor in strengthening its language vitality. Based on Table 6, the three Dumagat communities under study are likely positioned between Grade 5 and Grade 4 in the UNESCO language vitality and endangerment scale, as the interview and focus group discussion data suggest that although all members of these communities support their language, some may not feel strongly about this due to the reasons outlined above. However, it should be noted that these initial findings are exploratory in nature, and hence more in-depth studies are suggested to validate these results. Furthermore, assessing language attitude is complex in nature, and can only glean from the information shared by the participants. It is also possible that their language attitude may vary across trajectory in space and time, and as linguistic reconfigurations occur to suit their life goals and everyday needs. After all, language attitude is fluid in nature and it changes dynamically with time and social changes [21].

Table 6. Community members' attitudes towards their own language [9]

Grade	Community Members' Attitudes toward Language
5	All members value their language and wish to see it promoted.
4	Most members support language maintenance.
3	Many members support language maintenance; others are indifferent or may even support language loss.
2	Some members support language maintenance; others are indifferent or may even support language loss.
1	Only a few members support language maintenance; others are indifferent or may even support language loss.
0	No one cares if the language is lost; all prefer to use a dominant language.

Other Factors

The Dumaget language in Sitio Cabog – Aurora and Sitio Pinag-anakan – Bulacan does not fulfil the criteria of Factors 6 and 9 on the UNESCO scale. Factor 6 refers to Material for Language Education and Literacy, and both of these communities are observed to have very limited materials written (some folklores and translated Biblical teachings) in Dumaget, which situates the language in the scale of Grade 1 (A practical orthography is known to the

community, and some material is being written). It should also be noted that even though there some materials written in the language, it does not necessarily mean that they are taught to the children through classroom integration.On the other hand, the Dumaget language in Sitio Masla – Quezon is situated in the UNESCO scale at Grade 4, as there are already materials written in the language that are used in developing children's literacy through Dumaget mother tongue classes. Even so, these materials still have to be developed through language documentation and planning.

Considering Factor 9 (Amount and Quality of Documentation), the Dumaget language in Sitio Cabog – Aurora and Sitio Pinag-anakan – Bulacan is likely situated at Grade 1 (Inadequate) of the UNESCO scale, as only fragmentary texts written in the language exist, and there are no audio and video recordings of usable quality. In Sitio Masla – Quezon, the language has some existing documentations such as basic word-lists, basic communication phrasal expressions, some local stories, and a localized alphabet, which situates Dumaget at Grade 2 (Fragmentary) of the UNESCO scale.

The Dumaget language in Sitio Cabog – Aurora and Sitio Pinag-anakan – Bulacan does not fulfil Factor 5 (Response to New Domains) at it is at Grade 0 (Inactive), which means that it is not used in new domains such as school, radio, and television. The use of Dumaget usually occurs in more private domains such as the home, or in private communications such as text messaging and phone calls. The language in Sitio Masla – Quezon, however, is likely situated at Grade 1 (Minimal), as the language is used as the language of instruction in mother tongue classes at school. In general, the dominant languages, Filipino and English, are still being used in new domains. Table 7 summarizes the findings of this study. The present data suggests that the Dumagat communities in Sitio Cabog – Aurora and Sitio Pinag-anakan – Bulacan have similar linguistic situations, although they may vary to some extent, while Sitio Masla (Quezon) differ from the two in certain aspects.

Table 7. Summary of the Factors on Ethnolinguistic Vitality among the Three Dumagat Communities

Factors	**Dumagat Indigenous Communities**		
	Sitio Cabog (Aurora)	**Sitio Pinag-anakan (Bulacan)**	**Sitio Masla (Quezon)**
Intergenerational Language Transmission	5	5	3
Absolute Number of Speakers	423/440	102/108	131/241
Proportion of Speakers within the Total Population	5	5	2
Shifts in Domains of Language Use	3	3	1
Response to New Domains and Media	0	0	1
Materials for Language Education and Literacy	1	1	4
Governmental & Institutional Language Attitudes & Policies including Official Status & Use	5	5	5
Community Members' Attitudes toward Their Own Language	5	5	4
Amount & Quality of Documentation	1	1	2

Conclusion

This exploratory study presents a sociolinguistic perspective on the ethnolinguistic vitality of the three Dumagat indigenous communities in Sitio Cabog, Barangay Matawe, Dingalan, Aurora; Sitio Pinag-anakan, Barangay Kabayunan, Angat, Bulacan; and Sitio Masla, Barangay Sablang, General Naka, Quezon Province. Using the Language Vitality and Endangerment Scale of UNESCO [9] in analysing the data drawn from the interview, focus group discussions and participant observation, the findings reveal that the Dumaget language in these communities are under threat and are likely to deteriorate because the nine factors proposed by UNESCO have not been fulfilled. However, while this may be the general case, the degree of threat and the extent of deterioration may vary from community to community.

With the present data, the functional load and functional transparency of the Dumaget language vary among the three communities. Both the Dumagat communities in Sitio Cabog – Aurora and Sitio Pinag-anakan – Bulacan still have strong intergenerational language transmission and language use in the home domain is still intact. These are still strong signs of vitality as language endangerment experts regard these factors as the most important in the UNESCO language vitality assessment scale (author here). The governmental support through Mother Tongue-Based Multilingual Education (MTB-MLE) may also help in promoting the language. However, the low ratings in other factors may gradually affect the language maintenance, as the functional load in the public domains is generally occupied by the dominant languages, i.e., Filipino and English. Sitio Pinag-anakan's geographical position may help lessen the effects of these factors across time, but it is still not a guarantee since the globalization forces and urbanization efforts are in place and gaining momentum. Sitio Cabog faces a stronger threat as it is susceptible to language contact with Tagalog due to its geographical location, and hence, multilingualism is inevitable, which can soon lead to the decline in the use of Dumaget.

The Dumagat community in Sitio Masla – Quezon faces the strongest threat of language deterioration as it does not fulfil satisfactorily the nine criteria set forth by UNESCO. With very limited functional load even at the home domain, weak intergenerational language transmission, and mixed attitudes of community members towards the language, it is likely to decline fastest among the three communities.

Because of the growing awareness among the members of these IP communities about the advantages of learning Tagalog for their economic and educational access, it is seen that the trend in learning more of the majority language and less of their indigenous language may increase as years go by. It may even extend to learning another majority language such as English as they struggle to exist and survive in an increasingly challenging, marginalizing and demanding knowledge-based economy. And as they strive for social and economic inclusion, education and literacy will serve as their key for their rights and self-determination [22,23].

As multilingualism and plurilingualism come with the advent of modern technology that penetrates into the different domains of the society, as well as the seemingly borderless and seamless flow of information, goods and services across various contexts, the modern Dumagat has to adapt with these changes and adopt feasible mechanisms in order to keep up and to continuously build contacts at all levels: regional, community, individual [24]. These changes seem to come in two-fold: while these communities may be facing language endangerment and cultural loss, their political empowerment is also coming underway. It is then our hope that the concerted efforts of those in "power" work in to contribute to the revitalization, reinvigoration and preservation [25] of the Dumagat communities' language and culture, as help them become "self-determined rather than outwardly imposed" [23].

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References

[1] Lewis, M., Simons, G., and Fennig, C. eds. 2013. Ethnologue: Languages of the World, 17th ed. Dallas, TX: SIL International.
[2] Headland, T. 2010. Why the Philippine negrito languages are endangered. Endangered Languages of Austronesia, M. Florey, ed. Oxford University Press. 110-118.
[3] Reid, L. 2013. Who are the Philippine Negritos?: Evidence from language. Human Biology.85, 1, 1-32.
[4] Reid, L. 1989. Arta, another Philippine negrito language. Oceanic Linguist. 28, 47-74.
[5] Giles, H., Bourhis, R. and Taylor, D. 1977. Towards a theory of language in ethnic group relations. In H. Giles (Ed.), Language, Ethnicity and Intergroup Relations.London: Academic Press. 307-348.
[6] Edwards, J. 1992. Sociopolitical aspects of language maintenance and loss: Towards a typology of minority language situations. Maintenance and loss of minority languages, Fase, J. and Kroon, ed. Philadelpha: J Benjamins, 37-54.
[7] Grenoble, L. and Whaley, L. 1998. Toward a typology of language endangerment. Endangered languages, ed. Grenoble and Whaley. Cambridge: Cambridge University Press.22-54.
[8] Lewis, M. P. 2006. SIL Electronic Working Papers SILEWP 2006-002. [Internet]. [cited 16 March 2020]. Available from: http://www.sil.org/silewp/abstract.asp?fef=2006-002
[9] Brenzinger, M., Y. Akira, A, Noriko, K. Dimitri, M. Anahit, D. Arienne, G. Colette, K. Michael, M. Osahito; S. Osamu, S. Rieks, and Z. Ofelia, 2003, Language vitality and endangerment: Paris: UNESCO Ad Hoc Expert Group Meeting on Endangered Languages. [Internet]. [cited 16 March 2020]. Available from: http://unesdoc.unesco.org/images/0018/001836/183699E.pdf
[10] Tiessen, C. 2003. Positive orientation towards the vernacular among the Talysh of Sumgayit. MA Thesis: University of North Dakota.
[11] Mohamed, N. and Hashim, N. H. 2012. Language Vitality of the Sihan Community in Sarawak, Malaysia. Kemanusiaan. 19, 1, 59-86.
[12] Fishman, J. 1972. The relationship between micro- and macro-sociolinguistics in the study of who speaks what language to whom and when. Sociolinguistics. eds. J. B. Pride and Janet Holmes. Harmondsworth: Penguin Books Ltd., 15-32.
[13] Noriah, M., Hashim, H. and Lah, Y.C. 2009. Factors that influence the sustainability usage of three endangered indigenous languages in Malaysia. The International Journal of the Humanities. 7, 6, 169-193.
[14] Schneider, E. 2007. Post-colonial English: Varieties around the World, Cambridge: Cambridge University Press.
[15] Gonzalez, A. 1996. Using Two/Three Languages in Philippine Classrooms: Implications for Policies, Strategies and Practices. Journal of Multilingual and Multicultural Development. 17:2-4, 210-219.
[16] Ferguson, C. 1959. Diglossia. Word. 15, 325-340.
[17] Fishman, J. 1967. Bilingualism with and without diglossia; diglossia with and without bilingualism. Journal of Social Issues. 23, 29-38.
[18] Dirven, R., and Pütz, M. 1993. Intercultural communication. Language Teaching. 26, 03, 144.
[19] Obiols, M.S. 2002. The Matched Guise Technique: A Critical Approcimation to a Classic Test for Formal Measurement of Language Attitudes. [Internet]. [cited 16 March 2020]. Available from: http://www.cultura.gencat.net/llengcat.noves
[20] Ryan, E.B. and Giles, H. 1982. Attitudes towards Language Variation. Edward Arnold: London.
[21] Mee-ling, L. 2009. 'I love Cantonese but I want English' – A Qualitative Account of Hong Kong Students' Language Attitudes. The Asia-Pacific Education Researcher. 18, 1, 79-92.

[22] López L.E., and Sichra I. 2008. Intercultural Bilingual Education Among Indigenous Peoples in Latin America. In: Hornberger N.H. (eds) Encyclopedia of Language and Education. Springer, Boston, MA

[23] Hussain, A., Abdullah, A., Husni, H., Mkpojiogu, E.O.C. (2016). Interaction design principles for edutainment systems: Enhancing the communication skills of children with autism spectrum disorders.RevistaTecnica de la Facultad de Ingenieria Universidad del Zulia, 39 (8), pp. 45-50.

[24] Stenzel, K. 2006. Multilingualism in the Northwest Amazon, Revisited. [Internet]. The Archive of the Indigenous Languages of Latin America [cited 16 March 2020]. Available from: http://www.ailla.utexas.org/site/cilla2/Stenzel_CILLA2_vaupes.pdf

[25] Zuckermann, G. and Walsh, M. 2011. Stop, Revive, Survive: Lessons from theHebrew Revival Applicable to the Reclamation, Maintenance and Empowerment ofAboriginal Languages and Cultures. Australian Journal of Linguistics. 31, 1, 111-127.

Philippine Youth from Academic and Police Sectors Views, Knowledge and Understanding of Philippine Corruption

Raul A. Aquino[1]*
{raul.aquino@lpu.edu.ph[1]}

Lyceum of the Philippines (LPU), Manila Campus, Muralla St, Intramuros, Manila, 1002 Metro Manila, Philippines.[1]

Abstract. Corruption has several negative effects on society, especially in developing countries such as the Philippines. Effective civic education is a key weapon against corruption in a country. Therefore, this study determines the present perceptions, knowledge, and understanding of the Filipino Youth on corruption. Quantitative research method was used to gather the primary data of this study. The questionnaire survey was conducted among the Filipino Youth from academic and police sectors age between 18-30 years old. The questionnaire survey was conducted in selected institutions in the National Capital Region and participated by the Philippine National Police, City of Malabon University, Lyceum of the Philippines University, Manila, Taguig City University, and University of Caloocan for the quantitative survey. The collected quantitative data were interpreted using the four-point Likert scale and SPSS analysis. The obtained result shows corruption is common sense in the country, but most knowledge and criticism are highly limited to governance, power, money, greed and powerful people. Bad leaders have been pinpointed in this study as the main culprit of corruption and they are expert in creating an environmental condition of submission and tolerance from the population with the use of violence and other unethical acts. Due to the pervasiveness and extensiveness of corruption problem, majority of the population considered it as a normal process showing no reactions or resistance..

Keywords: Sectors Views; Knowledge; Understanding; Philippine Youth; Philippine; Corruption; Academic Sector; Police Sector.

1 Introduction

This

Corruption is considered as the most hated and shameful act. It is commonly identified to any wrongdoing or evil act that is harmful to humanity. It is about the continuing practice and enjoyment of a rotting culture and morality due to personal benefits. For the Greeks, they defined it as destructive behavior. Aristotle and Cicero defined it as an abandonment of good habits that injures other's rights [1-3].

The World Bank [4] defined corruption as the misuse of public office for public gain. With regards to grave abuse of authority, such has been defined as a misdemeanor committed by a public officer, who under color of his office, wrongfully inflicts upon any person any bodily harm, imprisonment or other injury; it is an act of cruelty, severity, or excessive use of

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authority. On the other hand, dishonesty has been defined as the disposition to lie, cheat, deceive, or defraud; untrustworthiness; lack of integrity; lack of honesty, probity or integrity in principle; lack of fairness and straightforwardness; disposition to defraud, deceive or betray [5].

The study of about integrity and corruption in Indonesian context found out that the word "integrity" seems foreign to more than half of his Indonesian youth respondents ages 16-21 years old when these Indonesian youth cannot provide a good definition on the word integrity which is very vital in combatting corruption in Indonesia [6]. Sihombing[6] concluded that the lack of knowledge and understanding about the word integrity was due to limited exposures and practices in their social environment such as family, community, and social media. He further added that if honesty and integrity will only be learned and valued by the Indonesian youth, they will become effective agents of social change in Indonesia.

Weiten, Dunn, and Hammer [7] noted that positive institutions like families, schools, government, and organizations with positive virtues focus on purpose, fairness, humanity, safety, and dignity greatly helps people to become good and productive citizen by cultivating civic cultures that will promote common good. In addition, they also found out that individuals who graduated from good schools tend to have good work ethics in the workplace.

Taft and Gordon [8] found out that the programs for youth political participation offered in North and Latin America is negatively accepted by the youth activists for their understanding and position is different from the youth advisory councils as representatives of youth political power in governance. The youth activists also perceived that the youth council as more on elitist and used as a means of social control that tame and channel youth dissent rather than promoting youth political power.

Balanon et al [9] found out that SK Officials and representatives are most worried about corruption at the barangay and municipal levels. They are concerned about abusive politicians who engaged in nepotism and narco-politics and meddle in election results via vote buying. Some participants complained local government authorities use SK officials as 'tools' in advancing their political agenda. They are dismayed over the lack of existing programs for the youth, and lack of support in terms of funding and implementation of existing youth programs that limit their projects to sports activities and street-cleaning initiatives.

Heather [10] concluded that an effective citizenship education is the key weapon in fighting against corruption in Hongkong not an anti-corruption campaign. In her analysis, the government and academic institutions should focus more on educating and training the young people of Hongkong on how to be a good citizen and remind them of their duties and responsibilities to the state.

The Philippine political system is still controlled and dominated by strong traditional political families, which are generally considered highly corrupt [11-13].Therefore, this study aims to determine the Philippine youth from academic and police sectors views, knowledge and understanding of Philippine corruption.

METHODOLOGY

This study utilized quantitative research method to gather the primary data through questionnaire survey in order to determine the Philippine youth from academic and police sectors views, knowledge and understanding the issue of corruption in the Philippines.

Research Target

The primary source of quantitative data obtainedthrough survey from academic sector and police sector. The Lyceum of the Philippines University, Manila, City of Malabon University, Taguig City University, and University of Caloocan representing the academic sector. The

Philippine National Police (PNP) from various districts/units in Metro Manila representing the police sector.

As indicated in Table 1, quantitative respondents are represented by the two sectors of the Filipino youth namely the academic and the police sector. Of the total quantitative respondents, 519 or 61.20 % belongs to the academic sector, 313 or 36.91 % of the respondents were from the Police sector and the remaining 16 or 1.89 % respondents had no answer on this item.

Table 1. Quantitative Respondents by Sector

Respondents' Sector	**Frequency**	**Percent**
Academe	519	61.20
PNP	313	36.91
No indicators	16	1.89
Total	**848**	**100.00**

Research Instrument

In this study, the structural survey questionnaire was the research instrument used to gather the primary data, which prepared and validated by certified researchers in the Research and Innovation Center of the Lyceum of the Philippines University, Manila.

Data Collection

The study was conducted for approximately eight months from August 2017 to March 31, 2018. This research strictly adheres to all standard protocols in the research process, especially in terms of ethics. The identities of the participants remain confidential and the survey data obtained was used for this research purpose only. This study was approved and supported by the appropriate agencies and institutions before the investigation was conducted. The survey questionnaire was distributed to the participants manually. Participants were assisted in providing a clearer understanding of the survey questions. The completed survey questionnaire was collected and analyses.

Data Analysis

The data collected was quantitative and interpreted using the four-point Likert scale and SPSS analysis at the Office of Research and Innovation Center, Lyceum of the Philippines University, Manila.

RESULT AND DISCUSSION

Questionnaires were conducted on selected agencies and institutions to identify Filipino youth from the academic, police sector perspectives, knowledge and knowledge of Philippine corruption.

What are the present perceptions, knowledge, and understanding of the Filipino Youth on corruption as regard to:

Preliminary statements about Corruption

Table 2 shows the present preliminary knowledge and understanding of Filipino youth about corruption in the country. As indicated, most of the Filipino youth respondents strongly agreed that they are familiar with word corruption (3.62); know the meaning of corruption (3.57); believed that leaders can prevent corruption if they wanted to (3.56); convince that most Filipinos are not sincere in fighting corruption because of personal interest (3.41); corruption is not a common practice (3.37); and refusing to do the right thing is a form of corruption (3.32). They also believe that corruption happens because it is allowed by leaders (3.20, agree); convince that everybody is doing corruption (3.15, agree); and corruption is not a generally accepted behavior in the Philippines (2.92, agree).

Statistical test results in Table 2 shows no significant difference on the present perceptions and knowledge of the Filipino youth respondents on the nine (9) preliminary statements about corruption except on the statement that corruption is a generally accepted behavior with Asymp. Sig, 2 tailed result of .683.

Table 2. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on the Preliminary Statements about Corruption

Preliminary statements about Corruption	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**Police**	**Average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**Asymp.Sig. (2 Tailed)**	**Result**
I am familiar with the word corruption.	3.72	3.46	3.62	Strongly agree	59188.500	106774.500	-7.172	.000	NSD
I know the meaning and understand the word "corruption"	3.65	3.44	3.57	Strongly agree	63356.000	110942.000	-5.517	.000	NSD
I am also convinced that leaders can prevent and minimize corruption if they wanted to.	3.64	3.43	3.56	Strongly agree	63391.500	110669.500	-5.165	.000	NSD
I am highly convinced that most Filipinos are not sincere in fighting corruption because of personal benefits.	3.54	3.19	3.41	Strongly agree	57555.500	105141.500	-7.199	.000	NSD
I believe that corruption is not a common practice in the country.	3.44	3.23	3.37	Strongly Agree	65722.500	112693.500	-4.147	.000	NSD
I believe that refusing to do the right thing is a form of corruption.	3.39	3.19	3.32	Strongly Agree	66254.000	112614.000	-3.644	.000	NSD
I believed that corruption happen because it was allowed by leaders.	3.31	3.00	3.20	Agree	62342.000	108702.000	-5.081	.000	NSD
I am convinced that everybody is doing corruption in their own ways.	3.29	2.89	3.15	Agree	59108.000	106386.000	-6.405	.000	NSD
Corruption is not a generally accepted behavior in the Philippines.	2.94	2.89	2.92	Agree	76919.500	123693.500	-.408	.683	S

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Meaning, definition, and understanding of the word "corruption"

Table 3 shows the meaning, definition, and understanding of corruption by the present Filipino youth. Based from the data gathered, it is a common knowledge that corruption is about the use of government funds for personal interest (3.73, strongly agree); stealing money, awards, and cheating (3.71, strongly agree); unethical use of power and position (3.64, strongly agree); dishonesty and unethical acts (3.61, strongly agree); illegal and any improper behavior (3.61, strongly agree), any wrongdoing that injures other's rights (3.58, strongly agree); and it's about deceit and false information (3.45, strongly agree). The above data indicates that the word "corruption" is best understand by the respondents as a word identified to evil or bad behaviors that is harmful to man and society.

Statistical test in Table 3 reveals no significant difference of assessment of the two sectors of respondents as regard on the meaning, definition, and understanding on the word corruption. Corruption is the use of government funds for personal interest (.000); it is stealing money (.000), awards, and cheating (.000); its unethical use of power and position (.000); it is about dishonesty and unethical acts (.000); it is any act that is improper, illegal, and unethical (.000); it is any wrongdoing or unethical act that injures other's right (.000); and it's all about deceit and false information.

This implies that both sectors of Filipino youth respondents supplied the meaning, definition, and understanding of the word "corruption" in the Philippines which support the common definition provided by United Nations, World, Bank, Transparency International, and scholars.

Table 3. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on the Meaning, Definition, and Understanding of Corruption

Meaning, definition, and understanding of the word "corruption"	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**Police**	**Average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**Asymp. Sig. (2 Tailed)**	**Result**
use of government funds for personal interest	3.81	3.60	3.73	Strongly Agree	62894.000	110789.000	-6.409	.000	NSD
stealing money, awards, and cheating	3.80	3.54	3.71	Strongly Agree	58584.000	105555.000	-7.494	.000	NSD
unethical use of power and position	3.73	3.50	3.64	Strongly Agree	62208.000	110103.000	-5.976	.000	NSD
dishonesty and unethical acts	3.67	3.51	3.61	Strongly Agree	62681.000	110267.000	-5772	.000	NSD
any act that is improper, illegal, and unethical.	3.69	3.48	3.61	Strongly Agree	66958.000	114236.500	-4.089	.000	NSD
any wrongdoing or unethical act that injures other's right	3.64	3.48	3.58	Strongly Agree	67116.000	113781.000	-3.811	.000	NSD
deceit and false information	3.51	3.35	3.45	Strongly Agree	67464.000	115050.000	-3.677	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Considered a form of corruption

Table 4 presents how the two sectors of Filipino youth respondents assessed the above listed common political acts in the Philippines whether they considered it as a form of corruption.

As indicated by statistical results, most of the Filipino youth respondents from the two sectors agree that all the listed common political acts are considered a form of corruption. Topping the list with high group average median with strongly agree interpretations, were testifying and protecting in favor of relatives/friends who commit corruption and wrong doings in society (3.42); use of organizational supplies and materials for personal use (3.39); "palakasan system" in hiring, promoting, and giving of awards in the organization (3.37); resisting change and innovation to protect personal interest (3.36); leaders/administrators who always use prerogatives in decision-making despite its unethical and non-conformity to rules and regulation (3.31); and allowing hospital arrest for high profile personalities (3.30). The respondents also gave an agree assessment on nepotism or appointing families, relatives, and friends (3.27);staging people power to prevent arrest/suspension of public officials involve in corruption and abuses (3.26); no action/response to your official complaints (3.24); Congress non-approval of freedom of information bill (3.20); Congress non- approval of anti-political dynasty bill; gossiping/spread of rumors and fake news in society (3.17); politicians putting their names & pictures in government projects (3.13); teacher giving low grades to an intelligent student who is very critical to his/her teaching and school policies and standards (3.12); religious endorsement of politicians in times of election (3.12); political ads prior to election campaign period; voting and supporting political dynasties (3.08); voting and supporting political dynasties (3.04); habitual absenteeism and tardiness of employees in the workplace resulting to inefficiency and ineffectiveness (3.03); tarpaulin greetings of politicians on occasions such as fiesta, holidays, religious anniversaries, etc (2.96); teacher requiring students to buy his/her own book (2.93); taxi driver refusing to convey passenger during bad weather (2.93); selling raffle tickets/bingo cards during Christmas & holiday season (2.86); and no or delayed suspension of classes during bad weather/heavy rains causing flood and tremendous traffic and inconveniences (2.73).

Results only means that the present values and attitudes of the Filipinos in most of its activities are infected by the virus of corruption that is very hard to challenge, in most cases not usually challenged, enjoyed, and tolerated due to strong family relationship and personal interest involved.

Table 4. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on the Common Political Acts as a Form of Corruption

Considered a form of corruption	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**PNP**	**Average**	**Interpretation**	**Mann - Whitney U**	**Wilcoxon**	**Z**	**Asymp. Sig. (2 Tailed)**	**Result**
testifying and protecting in favor of relatives/friends who commit corruption and wrong doings in society	3.48	3.32	3.42	Strongly agree	67541.00	113901.00	-3.641	.000	NSD
organizational supplies and equipment are used for personal purposes	3.45	3.30	3.39	Strongly agree	68145.000	114201.000	-3.168	.002	NSD
"palakasan" system in hiring, promoting, and giving of awards in the	3.41	3.32	3.37	Strongly agree	73097.000	119457.000	-1.686	.092	S

organization									
resisting change and innovation to protect personal interest	3.44	3.24	3.36	Strongly agree	65750.000	111503.000	-4.018	.000	NSD
leaders/administrators who always use prerogative in decision-making despite its unethical and violative of laws and human rights	3.38	3.20	3.31	Strongly agree	66715.500	112468.500	-3.608	.000	NSD
allowing house and hospital arrest for high profile personalities	3.36	3.20	3.30	Strongly agree	68664.500	114417.500	-2.948	.003	NSD
appointing families, relatives, and close friends in jobs and contracts	3.29	3.25	3.27	Agree	75387.500	121443.500	-.780	.436	S
Staging people power to prevent arrest/suspension of corrupt public officials	3.31	3.17	3.26	Agree	69318.500	115374.500	-2.766	.006	NSD
No action/response to your official complaints	3.27	3.18	3.24	Agree	71243.500	117299.500	-1.611	.107	S
Congress non-approval of freedom of information bill	3.25	3.11	3.20	Agree	70168.500	115921.500	-2.541	.011	NSD
Congress non- approval of anti-political dynasty bill	3.21	3.10	3.17	Agree	72305.000	118058.000	-1.837	.066	S
gossiping/spread of rumors and fake news in society	3.20	3.11	3.16	Agree	73556.500	119007.500	-1.318	.187	S
politicians putting their names & pictures in government projects	3.11	3.17	3.13	Agree	74117.500	206472.500	-1.178	.239	S
teacher giving low grades to an intelligent student who is very critical to his/her teaching and school policies and standards	3.13	3.09	3.12	Agree	76342.000	122398.000	-.503	.615	S
religious endorsement of politicians in times of election	3.10	3.14	3.12	Agree	75836.000	209222.00	-.683	.495	S
political ads prior to election campaign period	3.09	3.05	3.08	Agree	75942.500	121998.000	-.542	.588	S
voting and supporting political dynasties	2.95	3.15	3.04	Agree	69151.000	202021.000	-3.094	.002	NSD
habitual absenteeism and	2.95	3.14	3.03	Agree	68155	19846	-	.003	NSD

tardiness of employees in the workplace resulting to inefficiency and ineffectiveness					.000	0.000	2.938		
tarpaulin greetings of politicians on occasions such as fiesta, holidays, religious anniversaries, etc.	2.92	3.04	2.96	Agree	71616.500	20397 1.500	-1.915	.055	S
Teacher requiring students to buy his/her own book	2.85	3.03	2.93	Agree	69741.000	20312 7.000	-2.577	.010	NSD
taxi driver refusing to convey passenger during bad weather	2.89	3.00	2.93	Agree	72750.500	20459 1.500	-1.459	.144	S
selling raffle tickets/bingo cards during Christmas & holiday season	2.78	2.99	2.86	Agree	68787.000	20114 2.000	-2.952	.003	NSD
no or delayed suspension of classes during bad weather/heavy rains causing flood and tremendous traffic and inconveniences	2.66	2.84	2.73	Agree	69239.000	20108 0.000	-2.675	.007	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree
Legend: S-Significant; NS- Not Significant at .05 level of significance

Contributory factors that allows the persistence of corruption in society

Table 5 demonstrates theassessment on the contributory factors that allow the persistence of corruption. The two Filipino youth sector-respondents strongly identified that tolerating corruption due to personal benefits (3.55); the culture of "palakasan system" (3.54); most of our political leaders arecorrupt (3.46); many Filipinos are afraid to question corruption due to fear of retaliation (3.44); lack of proper education and knowledge about the bad effects of corruption (3.37); laws are too complicated, not strictly, and fairly implemented (3.36); and the police and military are too weak and afraid to implement the laws especially to the rich and powerful families (3.33) are the main contributory factors why corruption continues to persist and proliferate in the Philippines.

In addition, a few quantitative respondents pointed some observation concerning corruption issues. They said that:*they are not afraid of the rich, they are controlled;and even though there are Filipinos who wants to fight corruption some government officials will use their power to get rid of this people.*

In Table 5, the statistical test shows no difference of assessment between the two sectors of Filipino youth respondents as to the contributory factors that allows corruption to persist in the Philippines. These are corruption is a tolerated activity in the society due to personal benefits (.000); the "palakasan" system is highly imbedded in Philippine culture (.000); most political leaders are corrupt (.000); many Filipinos are afraid to question corruption due to fear of retaliation (.000); lack of proper education and knowledge about the bad effects of corruption (.000); laws are too complicated, not strictly, and fairly implemented (.014); and police and

military are too weak and afraid to implement the laws especially to the rich and powerful families (.000).Above data implies confirmation of the present condition of the country in relation to corruption acts.

Table 5. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on the Contributory Factors that allow the persistence of Corruption

Contributory factors that allows the persistence of corruption in society	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**Police**	**Average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon**	**Z**	**Asymp. Sig. (2 tailed)**	**Results**
Corruption is a tolerated activity in the society due to personal benefits.	3.61	3.46	3.55	Strongly Agree	66944.500	114222.500	-3.799	.000	NSD
The "palakasan" system is highly imbedded in Philippine culture.	3.60	3.45	3.54	Strongly Agree	65859.500	112524.500	-3.816	.000	NSD
Most of political leaders are corrupt.	3.55	3.32	3.46	Strongly Agree	62181.500	108846.500	-5.247	.000	NSD
Many Filipinos are afraid to question corruption due to fear of retaliation.	3.52	3.31	3.44	Strongly Agree	62982.000	109953.000	-4.937	.000	NSD
The lack of proper education and knowledge about the bad effects of corruption.	3.43	3.27	3.37	Strongly Agree	67611.500	114582.500	-3.487	.000	NSD
The laws are too complicated, not strictly, and fairly implemented.	3.41	3.29	3.36	Strongly Agree	69882.000	116242.000	-2.459	.014	NSD
The police and military are too weak and afraid to implement the laws especially to the rich and powerful families.	3.46	3.08	3.33	Strongly Agree	57577.500	103633.500	-6.468	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Motivates a person/people to engage in corruption

Table 6 tabulates the median and interpretation of assessment on the question what motivates a person to engage in corruption. Majority of the two sectors of Filipino youth respondents strongly agree that power and position (3.78); love of money (3.74); prestige (3.57); poverty (3.53); low salary (3.51); and maintaining personal relationship to sustain influence (3.44) are the main reasons why many people are encouraged to engage in corruption activities in the country.

The statistical test in Table 6reveals that there is no significant difference on the assessments of the two sectors of Filipino youth respondents on the two motivational factors that induces an individual to engage in corruption practices, these are power and position

(.000) and love of money (.000). On the other hand, respondents have significant difference in their answers as regard to prestige (.156), escape poverty (.242), low salary (.634), and maintain relationship and influence (.547) as encouraging factors to commit corruption.

Table 6. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on the Question what motivates a person/people to engage in corruption

Motivates a person/people to engage in corruption	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**Police**	**Average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**Asymp. (2-tailed)**	**Result**
power and position	3.84	3.69	3.78	Strongly agree	67235.500	114206.500	-4.709	.000	NSD
the love of money	3.82	3.61	3.74	Strongly agree	62590.500	109868.500	-6.412	.000	NSD
prestige	3.59	3.54	3.57	Strongly agree	73785.000	120450.000	-1.420	.156	S
escape poverty	3.55	3.51	3.53	Strongly agree	74437.000	121102.000	-1.170	.242	S
Low salary	3.50	3.52	3.51	Strongly agree	76906.000	207211.000	-.476	.634	S
Maintain relationships and influence	3.43	3.46	3.44	Strongly agree	76622.500	206417.500	-.602	.547	S

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

People who are primarily involved in abuse and corruption

Table 7 presents the list of individuals identified by the respondents as the most involved in abuses and corruption in society. Rank number one are the politicians with 722 or 85.14%, followed by businessmen with 29 or 3.41%. The teachers and drivers tied in third place with 12 or 1.42% respectively. Others who were also considered are the PNP, lawyers, traffic enforces for kotong activities, school officials for many questionable academic practices, judges for unfair judgement, religious leaders for sexual abuses and money matters collection. Results is an indication that corruption knows no boundaries regardless of profession and status in life, each one of us are prone or can commit corruption acts in various ways.

Table 7. Individual/s identified as mostly involved in abuses and corruption

Mostly involved in abuses and corruption in society	**Rank**	**Frequency**	**%**
Politicians	1	722	85.14
Businessmen	2	29	3.4

			1
Teachers	3	12	1.42
Drivers	3	12	1.42
PNP	4	7	.82
Lawyers	5	5	.56
Traffic Enforcers	6	3	.35
School Officials	7	1	.12
Justices	7	1	.12
Religious leaders	7	1	.12
No answer		55	6.52
Total		**848**	**100.00**

Institutions/Sectors who are primarily involved in abuse and corruption

Table 8 illustrates the institutions or sectors identified as highly involved in corruption and abuses in the country. As regard to sectors/institutions highly involved in corruption and abuses, most of the two sectors of Filipino youth respondents regarded the business group as the most highly involve sector in corruption with 27.12 % knowing that many businessmen are involved in smuggling, hoarding, over-pricing, and selling of sub-standard services and products as well as they are involve in many arbitrary practices in labor management. Second are the local government units (12.02%); then education sector with 11.44%; law enforcement with 8.25%; religion with 6.72%; politicians with 5.42%; judiciary with 5.42%; the transport sector with 4.83%; and 18.78% have no answers.

Meanwhile, some quantitative respondents made additional remarks saying: *the people who are greedy and not contented in what they have in life; anyone because man by nature is a political animal; and sometimes it's not their education that made them corruptions but their personality*.

Table 8. Institutions/Sectors identified as highly involved in corruption and abuses in the country

Institutions/sectors highly involved in corruption and abuses	**Rank**	**Frequency**	**%**
Business Group	1	230	27.12
Local Governments	2	102	12.02
Education	3	97	11.44
Law enforcement	4	70	8.25
Religious	5	57	6.72
Politicians	6	46	5.42

Judiciary	6	46	5.42
Transport	7	41	4.83
No answer		159	18.78
Total		**848**	**100.00**

A person is involved in corruption

Table 9 demonstrates the median and interpretation of assessment on who are involved in corruption. Based from the survey, the two sectors of Filipino Youth respondents strongly agree that a person is involved in corruption if he is dishonest and not transparent (3.51); if he has wealth and properties beyond his means (3.44); gaining credit at the expense ofothers (3.43); if his actions are beyond his official functions (3.43); always identify himself to powerful people (3.41); and only agree on if his actions are contrary to my personal values (3.23).

Other respondents made some comments such as:*Always disagree in change for the good of country; Bad influence on leadership; and my personal value are not the values of the people.*

Table 9presents the test of significant difference on the assessment of the two Filipino youth respondents on who is/are involved in corruption. As seen, there is no significant difference on the assessment of the respondents on the following: if he is dishonest/non-transparent (.000); his wealth and properties are beyond his means (.001); gaining credit at the expense of others (.000); if his actions are beyond his official duty/functions (.002); and always identify himself to persons in power (.000). However, the assessment if his actions are contrary to my personal values and morality shows significant difference (.708).

Analyses only show that dishonesty and not transparent, unexplained property and wealth, credit grabber, abusing official duties and functions and always siding to people with power are the signs that a person is involve in corruption acts.

Table 9. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sector on who is/are involved in Corruption

A person is involved in corruption	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**Police**	**Average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**Asymp. Sig. (2 tailed)**	**Result**
if he is dishonest / non-transparent	3.58	3.40	3.51	Strongly agree	64431.500	109581.500	-4.499	.000	NSD
gaining wealth and properties beyond his means	3.48	3.34	3.44	Strongly agree	67659.500	113110.500	-3.334	.001	NSD
gaining credit at the expense of others	3.48	3.34	3.43	Agree	63014.000	108465.000	-4.842	.000	NSD
if his actions are beyond his official duty/functions	3.51	3.30	3.43	Strongly agree	68339.500	113790.500	-3.107	.002	NSD

always identify himself to persons in power	3.31	3.47	3.41	Strongly agree	66448.500	111899.500	-3.714	.000	NSD
If his actions are contrary to my personal values and morality	3.22	3.24	3.23	Agree	75691.500	207019.500	-.374	.708	S

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Instances/situation a person most likely to commit corruption

Table 10 illustrates the median and interpretation of assessment on instances/situations why a person induced himself to corruption. Accordingly, the two sectors of Filipino Youth respondents strongly agree that a person who will most likely to commit corruption if they know that they are being protected (3.53); if they know that no one will question them (3.47); if the person is given the opportunity (3.46); if the person sees that everyone in his surrounding is doing it (3.42); and if there are no clear polices or rules governing the behavior (3.42).

In addition to these instances, some respondents have expressed their opinions:*If he chose to do what is wrong because the decision is in that person; if the person knows that the Filipino is not knowledgeable about the country funds/money; and these statements are not applicable to all situations/people.*

Statistical test in Table 10 shows no significant difference on the assessment on the two Filipino youth sectors when it comes to the various instances and situations that a person might induce himself to corruption activities. It is shown as: if he knows that he is being protected (.000); if he believes that no one will question him (.000); if he is given the opportunity (.000); if he sees that everyone is doing it (.000); and if there are no clear policies or rules.

This only implies that corruption will happen if the person knows that he is being protected, that no one will question the said act, if there is an opportunity, that is the scenery of his environment, and if there are no clear rules or policies to follow. Because of the Filipino culture of "palakasan system", violence, impunity, and personal relationship, the above situations or instances are very common in Philippine setting resulting to the widespread and in-dept practices of abuses and many questionable behaviors.

Table 10. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sector on Instances/Situations a person may induce himself to Corruption

Instances/situation a person most likely to commit corruption	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**Police**	**Average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon**	**Z**	**Asymp. Sig. 2 tailed**	**Result**
if he knows that he is being protected	3.62	3.37	3.53	Strongly agree	63172.500	112313.500	-6.134	.000	NSD
if he believes that no one will question him	3.56	3.34	3.47	Strongly agree	65926.500	115067.500	-5.112	.000	NSD
If he is given the opportunity	3.53	3.34	3.46	Strongly	67221.500	116362.500	-4.6	.000	NSD

				agree			90		
if he sees that everyone is doing it	3.51	3.28	3.42	Strongly agree	65601.000	114742.000	-5.158	.000	NSD
If there are no clear policies or rules	3.50	3.30	3.42	Strongly agree	67744.500	116885.500	-4.448	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Instances a person may allow corruption to happen

Table 11 indicates the following instances that an individual may allow corruption to happen with his full knowledge. These are the following: if the person/s involve are powerful and influential (3.59 strongly agree); if he benefits from it (3.46 strongly agree); if no one sees it or it was kept secret (3.44 strongly agree); if the doer is a relative/s (3.35 strongly agree); if the person is a friend/s (3.29 strongly agree); if it is generally accepted in his environment (3.29 strongly agree); and only agree if his life is in danger (3.24).Some comments were also extracted from the survey questionnaire that is related to the above assessment:*It depends to the person's virtue and values, all in the above maybe yes or no. For me, if I am that person, I will not allow it in any instance; and sometimes other powerful in position "lantaranangpag-abusosapera ng bayan", not only in politicians but also in.... I can't say so.*

Statistical test in Table 11shows no significant difference on the assessment of the two sectors of Filipino Youth respondents when it comes to all possible indicated instances and situations that a person might allow corruption. This has been presented as: if the person/s involve are powerful and influential (.000); if he will be given benefits (.000); if no one sees it or it was kept secret (.000); if the person/s doing it are his/her relatives (.000); if the person/s doing it are his/her friends (.001); if it is generally accepted in his environment (.001); and if he believes that his life is being threaten (.001).

Table 11. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sector on Instances/Situations a person may allow Corruption to happen

Instances a person may allow corruption to happen	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**Police**	**average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**Asymp. Sig. 2 tailed**	**Result**
if the person/s involve are powerful and influential	3.69	3.42	3.59	Strongly agree	61336.500	110477.500	-6.913	.000	NSD
if he will be given benefits	3.55	3.32	3.46	Strongly agree	65099.000	114240.000	-5.327	.000	NSD
if no one sees it or it was kept secret	3.53	3.31	3.44	Strongly agree	66148.500	115289.500	-4.998	.000	NSD
if the person/s doing it are his/her relatives	3.42	3.22	3.35	Strongly agree	68036.000	117177.000	-4.34	.000	NSD

							7		
if the person/s doing it are his/her friends	3.35	3.19	3.29	Strongly agree	71337.000	12047 8.00	-3.226	.001	NSD
if it is generally accepted in his environment	3.35	3.17	3.29	Strongly Agree	70257.000	11908 5.000	-3.428	.001	NSD
if he believes that his life is being threaten	3.31	3.13	3.24	Agree	71169.000	12031 0.000	-3.231	.001	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

People are very hesitant to report or file a complaint against corruption

Table 12 tabulates the median and interpretation of assessment of the two Filipino youth sectors on why people are very hesitant to report or file a complaint of corruption. In Table 12, majority of the two sectors of Filipino Youth respondents strongly agree that people are very hesitant to report or file a complaint of corruption due to fear of losing work and life (3.53); lack of government support and protection (3.46); if he is part of the crime (3.44); lack of trust and support from superiors (3.42); lack of financial capability (3.39); and agree on lack of trust and support from relatives and friends (3.27); and avoiding broken relationship (3.23).

In addition, comments were taken from the survey questionnaire:*Never fear when you are on the right side. Often, it is because people are fearful; some Filipinos are willing to fix this problem but since government has the power to control things, they can't do it; and if he knows his/her kapartido is getting caught and he will save himself first.*

Statistical test in Table 12 shows no significant difference on the assessment on the two Filipino youth sectors on the seven reasons provided on why people are very hesitant or refuse to file a case of corruption. It is presented as: afraid of losing work and one's life (.000); lack of government support and protection (.000); if he is involved in it (.000); lack of trust and support from superiors (.000); lack of financial capability (.000); lack of trust and support from relatives and friends (.000); and avoiding broken relationship (.003).

Table 12.Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on why people are very hesitant to report or file a complaint against corruption

People are very hesitant to report or file a complaint against corruption	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**Police**	**Average**	**Interpretation**	**Mann-Whitney**	**Wilcoxon**	**Z**	**Asymp. Sig. 2 tailed**	**Result**
afraid of losing life and work	3.62	3.36	3.53	Strongly agree	62884.500	112025.500	-6.203	.000	NSD
lack of government support and protection	3.58	3.23	3.46	Strongly agree	58128.000	106956.000	-7.592	.000	NSD
if he is part of it	3.52	3.29	3.44	Strongly agree	65850.000	114991.000	-5.100	.000	NSD

lack of trust and support from superiors	3.25	3.52	3.42	Strongly Agree	62596.500	111737.500	-6.195	.000	NSD
lack of financial capability	3.46	3.26	3.39	Strongly agree	68031.500	117172.500	-4.293	.000	NSD
lack of trust and support from relatives and friends	3.35	3.12	3.27	Agree	66842.500	115983.500	-4.754	.000	NSD
to avoid broken relationships	3.28	3.13	3.23	Agree	71896.000	121037.000	-3.010	.003	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Usually happens to a person/s who exposed corruption or any unethical acts in the organization/society

Table 13 shows the median and interpretation of assessment of the two Filipino youth sector on what usually happens to a person exposing corruption and unethical acts. For the two sectors of the Filipino Youth respondents, these what usually happens to a person or people who exposes corruption or any unethical acts in the organization and in society. Harassment and isolation are the most likely to be experienced by a complainant or whistleblower of corruption with 2.97 and 2.95 agree assessment respectively. The admiration, respect, support, and promotion with 2.85 agree assessment. Awards can also be given but is the least to be expected (2.77).

Other answers from survey questionnaire are:*Imprisonment; Failed justice system is the other reason why were so fearful denounce iniquities; and many ordinary people who help to decrease the corruption here are become threatened since they report bad crimes.*

Statistical test in Table10 reveals no significant difference on the assessment of the two sectors of respondents on what usually happen to a complainant or whistleblower when it comes to subjected to harassment (.006); isolated (.019); and admired, respected, and supported (.044). However, there is a significant difference of assessment on the issue of being promoted and awarded (.108).

This only means that even if is true that there are some individuals who exposed corruption and wrongdoings in society were given positive compliments resulting to adifference of assessment, generally as expected, people who usually exposed corruption and wrongdoings are subjected to harassment and isolation rather than to be admired, respected, supported, promoted, and awarded.

Because of these situational factors, most Filipinos prefer to be passive, quiet with high tolerance, and do nothing about corruption problem. Others become co-actors for the corruption activities due to fear of retaliation, being alone, and thus, keeping to themselves the secrets, and later taking justice into their own hands due to poor justice system and lack of government and leaders' support for the cause of good governance and society.

Table 13. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on What usually happens to a person who exposed corruption or any unethical acts in the organization/society

Usually happens to a person/s who	**Median and Interpretation**				**Test of Significant Difference**				
	Aca	**Poli**	**Ave**	**Inter**	**Mann-**	**Wilcoxon**	**Z**	**Asymp.**	**Resul**

exposed corruption or any unethical acts in the organization/society	deme	ce	rage	pretation	Whitney U	W		Sig. 2 tailed	t
subjected to harassment	3.05	2.86	2.97	Agree	72671.000	121812.000	-2.727	.006	NSD
Isolated	3.01	2.84	2.95	Agree	73821.500	122962.500	-2.343	.019	NSD
Admired, respected, and supported	2.91	2.76	2.85	Agree	74828.500	123969.000	-2.011	.044	NSD
Promoted and awarded	2.82	2.69	2.77	Agree	76063.500	125204.500	-1.609	.108	S

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Usual response and actions on the exposed corruption and unethical acts in the organization/society

Table 14 shows how the Filipino youth describe the usual response and actions of the government on the exposed corruption or unethical practices in the country. Survey revealed the following assessment of the Filipino youth respondents: unresponsive and favors the rich and powerful with group median average of 3.18 (agree); slow, unclear, confusing, and unfair with group median average of 3.16 (agree). However, many Filipino respondents saw it somewhat responsive and respectful with group median average of 2.68 (agree) and fast, clear, and just with 2.56 (agree) group median average, with the academe giving a disagree assessment of 2.46 group median average.

Statistical test in Table 14 reveals no significant difference on the assessment of the two Filipino youth sector respondents when it comes to the usual response and actions on your exposed corruption and unethical acts in the organization and in the country. It is shown as: unresponsive and favors the rich and powerful (.000); slow, unclear, confusing, and unfair (.000); responsive and respectful (.000); and fast, clear, and just (.000).It is a common knowledge for Filipinos that justice in the Philippines is delayed and eventually denied.

Table 14. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on the usual response and actions on your exposed corruption and unethical acts in the organization in the Philippines

Usual response and actions on the exposed corruption and unethical acts in the organization/society	Median and Interpretation				Test of Significant Difference				
	Academe Median	PNP Median	Grouped Median Average	Interpretation	Mann – Whitney U	Wilcoxon W	Z	Asymp. Sig. 2 tailed	Result
unresponsive and favors the rich and	3.29	2.97	3.18	Agree	64680.000	113821.	-5.34	.000	NSD

powerful						000	7		
slow, unclear, confusing, and unfair	3.24	3.01	3.16	Agree	69415.000	118556.000	-3.799	.000	NSD
Responsive and respectful	2.61	2.81	2.68	Agree	728010.000	207750.000	-2.660	.000	NSD
Fast, clear, and just	2.46	2.71	2.56	Agree	71291.000	206231.500	-3.101	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Situation when a person be ready to report or file a complaint against corruption

Table 15 shows median and interpretation of assessment of the two Filipino youth sector on when a person is ready to report or file a complaint against corruption. In Table 15, both the academe and police respondents have assessed strongly agree on the situation that they ready to report or file a complaint against corruption if they have the support and protection from the authorities (3.48); theyhave enough solid evidence (3.48); they have the full support and protection from their superior (3.45); if the people involve are his/her enemies or competitors (3.39); they have the full support and protection from their families (3.39); they are not part of the wrongdoings (3.37); they have the full support from their colleagues (3.37); and if the people involve are not powerful (3.28). In the same manner that the academe and the police respondents also assessed agree that a person or individual is willing to report or file a complaint if the people involve are not his/her relative (3.25) and if the people involve are not his/her friends (3.24).

Statistical test in Table 15 shows no significant difference on the assessment between two Filipino youth sectors when it comes to issue on when to report or file a complaint of corruption or wrongdoings. A person is ready to report a case of corruption or wrongdoings if they believed that the government will provide them the protection and support (.000), if they have solid evidence to prove their claim (.000), if the people involved are his enemies or competitors (.000), if their families will support and protect them (.000), if they are also being supported by their colleagues (.000), if the people involve are not powerful (.000), if the people involved has no personal relationship with them (.001).

Result indicates that full government support and protection, strong evidence, family support and personal relationships involved, and positions/status in life of the personalities involved in the case are the usual consideration of the prospective complainant before going to a legal battle to ensure his safety and winning of the case.

Table 15. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sector on When people are ready to report or file a complaint against corruption

Situation when a person be ready to report or file a complaint against corruption	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**Police**	**Average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**Asymp. Sig. 2 tailed**	**Result**

if they have the support and protection from the authorities	3.58	3.30	3.48	Strongly agree	59006.000	107834.000	-7.384	.000	NSD
if they have enough solid evidence	3.59	3.28	3.48	Strongly Agree	60954.000	110095.000	-6.760	.000	NSD
if they have the full support and protection from their superiors	3.55	3.26	3.45	Strongly Agree	61073.500	110214.500	-6.713	.000	NSD
if the people involve are his/her enemies or competitors	3.48	3.22	3.39	Strongly agree	66463.500	115604.500	-4.858	.000	NSD
if they have the full support and protection from their families	3.47	3.25	3.39	Strongly agree	63747.000	112888.000	-5.808	.000	NSD
if they are not part of the wrongdoings	3.48	3.18	3.37	Strongly agree	61752.000	110893.000	-6.407	.000	NSD
if they have the full support from their colleagues	3.46	3.21	3.37	Strongly agree	64185.500	113326.500	-5.552	.000	NSD
if the people involve are not powerful	3.35	3.16	3.28	Strongly agree	69277.500	118418.500	-3.893	.000	NSD
if the people involve are not his/her relatives	3.33	3.12	3.25	Agree	67965.500	117106.500	-4.386	.000	NSD
if the people involve are not his/her friends	3.30	3.13	3.24	Agree	70905.500	120046.500	-3.392	.001	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Common issues and problems encountered in the campaign against corruption

Table 16 indicates themedian and interpretation of assessment of the two Filipino youth sector on the common issues and problems encountered in the campaign against corruption. Most of the Filipino youth respondents from the two sectors of Filipino Youth respondents strongly agree that the lack of government sincerity (3.47); most of the political leaders are involved in corruption (3.46); laws are poor and not properly enforced (3.37); most of the Filipino people are also involved in corruption (3.36); and people are not interested to deal corruption (3.28) are the common issues and problems encountered in the campaign against corruption.

Statistical test in Table 16 reveals no significant difference on the assessment of the two Filipino youth sector respondents when it comes to the usual response and actions on your exposed corruption and unethical acts in the organization and in the country. It is presented as: lack of government sincerity (.000); most of the leaders are involved in corruption (.000); laws are poor and not properly implemented (.000); most of the people are also involved in corruption (.000); and people are not interested to deal corruption (.000).

This only means that corruption in the country is very hard to address and becomes pervasive for so many years due to lack of political will on the part of the government wherein many government officials are involved and protectors resulting to the weak and not proper implementation of the laws. The involvement of the many people in corruption and lack of interest to deal with it has been viewed by many as an acceptance and toleration behavior.

Table 16. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sector On the common Issues and Problems encountered in the campaign against Corruption

Common issues and problems encountered in the campaign against corruption	**Median and Interpretation**				**Test of Significant Difference**				
	Academe Median	**PNP Median**	**Grouped Median Average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**Asymp. Sig. 2 tailed**	**Result**
lack of government sincerity	3.60	3.21	3.47	Strongly Agree	54572.000	103713.000	-8.895	.000	NSD
most of the leaders are involved in corruption	3.58	3.23	3.46	Strongly Agree	58356.000	107497.000	-7.588	.000	NSD
laws are poor and not properly implemented	3.50	3.10	3.37	Strongly Agree	56852.000	105993.000	-7.963	.000	NSD
most of the Filipino people are also involved in corruption	3.48	3.15	3.36	Strongly Agree	60511.500	109652.500	-6.804	.000	NSD
people are not interested to deal corruption	3.38	3.10	3.28	Strongly Agree	64271.000	113412.000	-5.523	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

3.1.16 Over-all corruption situation of the Philippines

Table 17 illustrates themedian and interpretation of assessment of the two Filipino youth sector on the over-all corruption situation of the Philippines. Data reveals that corruption situation in the Philippines has improved with an assessment of 2.60 (agree). As clearly seen from the above table, only the police sector made the agree assessment of 2.76 contrary to the academic sector with 2.49 disagree assessment.

Statistical test results show no significant difference of assessment of the two Filipino youth sectors respondents on the over-all situation of the Philippines when it comes to corruption.

This only means that for the Filipino youth, there is no significant improvement on the corruption situation in the Philippines due to lack of government sincerity, political leaders, and even the people themselves when they are also guilty of doing corruption and unethical acts in his day to day political life.

Table 17. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors On the Over-all Corruption situation of the Philippines

Over-all corruption situation of the Philippines	Median and Interpretation				Test of Significant Difference				
	Academe	PNP	Average	Interpretation	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. 2 Tailed	Result
Improve	2.49	2.76	2.60	Agree	66298.500	201238.500	-4.810	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

The present environment and working condition of the Respondents

Table 18 shows themedian and interpretation of assessment of the two Filipino youth sector on their present working environment and condition. In describing their respective work environment and conditions, the two sectors of Filipino Youth respondents gave the following answers: highly motivated and confident to work (3.06 agree); can work freely and honestly (3.05 agree); confident that their colleague will support them in case their exposed wrongdoings (2.81 agree); immediate superiors do not intervene with my official functions (2.74 agree); confident that my immediate superior will take sides on me in case I expose unethical acts and corruption (2.73, agree); confident that the government will support and protect me in case I reveal unethical and corruption (2.65, agree); and experienced certain degree of work-harassment (2.51 disagree) when academic sector respondents provided a disagreeing assessment of 2.44 group median.

Statistical test in Table 18reveals no significant difference on the assessment of the two Filipino youth sector respondents on their present environment and working conditions as regard to motivation and confident to work such as I can work freely and honestly with .000; I am confident that my colleagues will support me if in case I reveal any wrong doings with .005; my immediate superiors do not intervene with my official functions with .010; I am confident that my immediate superior will take sides on me in case I expose unethical acts and corruption with .000; I am confident that the government will support and protect me in case I reveal unethical acts and corruption with .000; and I experienced a certain degree of work-harassment with .013.

Results from Tables 15 imply that both respondents show optimism in their present working environment when it comes to the issue of corruption. However, it was noted that academic respondents do not trust government when it comes to support and protection if they will reveal corruption and wrongdoings in the workplace. Majority of academic respondents also admitted that they experienced a certain degree of harassment in the workplace knowing that all the respondents in the academic sectors are students and are subject to many forms of control and policies by teachers and academic officials.

This revelation of respondents should be given proper attention by the government, parents, and academic officials as school is expected to be safe and secure for the students to get better education to learn good values and character that is why parents have entrusted their children to such institution.

However, many studies confirmed that school is one of the most corrupt institutions in our society becoming a haven of many questionable practices and abuses mostly committed by teachers and academic officials [14].

Table 18. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Sectors of Filipino Youth Respondents on their present working environment and condition

The present environment and working condition of the Respondents	Median and Interpretation				Test of Significant Difference				
	Academe	PNP	Average	Interpretation	Mann-Whitney U	Wilcoxon	Z	Asymp. Sig. 2 tailed	Result
I am highly motivated and confident to work.	2.88	3.27	3.06	Agree	621170.500	197110.500	-6.164	.000	NSD
I can work freely and honestly.	2.98	3.15	3.05	Agree	72614.500	207554.500	-2.840	.005	NSD
I am confident that my colleagues will support me if in case I reveal any wrong doings.	2.74	2.91	2.81	Agree	72787.000	207727.000	-2.572	.010	NSD
My immediate superiors do not intervene with my official functions.	2.65	2.89	2.74	Agree	69627.000	204567.000	-3.726	.000	NSD
I am confident that my immediate superior will take sides on me in case I expose unethical acts and corruption.	2.62	2.92	2.73	Agree	66941.500	201881.500	-4.581	.000	NSD
I am confident that the government will support and protect me in case I reveal unethical acts and corruption.	2.42	2.99	2.65	Agree	56698.500	191638.500	-7.730	.000	NSD
I experienced a certain degree of work-harassment.	2.44	2.61	2.51	Disagree	73291.500	208231.500	-2.479	.013	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree
Legend: S-Significant; NS- Not Significant at .05 level of significance

Respondents' personal conviction/principle when it comes to corruption and wrongdoings

Table 19 presents the personal position/conviction/principle of the Filipino youth when it comes to the issue of corruption and wrongdoings. Most of the Filipino youth strongly said that they prefer the truth even if it hurts with 3.42(strongly agree); integrity without richness over richness without integrity with 3.39 (strongly agree); prefer good leaders with 3.39 (strongly agree);will not accept an award or promotion if they don't deserve with 3.37 (strongly agree);will make objective decisions and not based on personal relationships with 3.36 (strongly agree); and will reject all forms of corruption regardless of consequences with 3.31 (strongly agree). They also agree that they will not accept favor at the expense of personal advantage and friendship (3.27); willing to tell the truth with or without protection

for the sake of truth and justice (3.27); and will not go beyond official work or abuse his work despite pressures from superiors (3.25).

Statistical test in Table 19 shows no significant difference on the assessment of the two Filipino youth sector respondents on their present convictions and principle when it comes to the issue of corruptions and wrongdoings except on the issue that they will not go beyond on their official duties and functions in their respective organizations despite pressures from superiors (.064) due to the fact Filipinos usually apply or prerogatives or judgement call in their work.

Data shows positivity among young people when they answered the question academically. This only means that idealism is still present and strong in their hearts which is usually expected from young people and besides their thinking that it was safe to answer this question since the question is hypothetical that requires ideal answers.

Table 19. Median and Interpretation as well as Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on their present personal convictions and principles on the issue of corruption and wrongdoings

Respondents' personal conviction/principle when it comes to corruption and wrongdoings	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**PNP**	**Average**	**Interpretation**	**Mann - Whitney U**	**Wilcoxon**	**Z**	**Asymp. Sig. 2 tailed**	**Result**
I always prefer truth even it hurts.	3.49	3.29	3.42	Strongly agree	66982.500	116123.500	-4.741	.000	NSD
I prefer integrity without richness over richness without integrity.	3.47	3.27	3.39	Strongly agree	68239.500	117380.500	-4.303	.000	NSD
I prefer good leaders	3.46	3,27	3.39	Strongly agree	67736.500	116877.500	-4.468	.000	NSD
I will not accept an award/promotion if I don't deserve it.	3.44	3.26	3.37	Strongly agree	68528.000	117356.000	-4.055	.000	NSD
I always make decisions objectively and not based on personal relationships.	3.43	3.25	3.36	Strongly agree	68977.500	118118.500	-4.043	.000	NSD
I strongly reject all forms of corruption regardless of consequences.	3.40	3.23	3.34	Strongly agree	69763.500	118591.500	-3.715	.000	NSD
I will not accept any favor for the sake of personal advantage and friendship.	3.36	3.23	3.31	Strongly agree	72751.500	121892.500	-2.795	.005	NSD
I am willing to tell the truth even if it is against my families, relatives, and organization.	3.33	3.17	3.27	Agree	71248.500	120389.500	-3.234	.001	NSD
I am willing to testify against any corrupt or unethical acts for the sake	3.33	3.17	3.27	Agree	71219.500	120360.500	-3.293	.001	NSD

of truth and justice with or without protection.									
I will not go beyond my official function despite pressures from my superiors.	3.28	3.20	3.25	Agree	75518.500	124659.500	-1.852	.064	S

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

CONCLUSION

The obtained results indicated that most of the Filipino youth respondents strongly agreed that they are familiar with word corruption; know the meaning of corruption; believed that leaders can prevent corruption if they wanted to; convince that most Filipinos are not sincere in fighting corruptions because of personal interest; corruption is not a common practice; and refusing to do the right this is a form of corruption. As regard to the meaning, definition, and understanding of the word "corruption" corruption most of the Filipino youth respondents strongly agreed that is about the use of government funds for personal interest; stealing money, awards, and cheating; unethical use of power and position; dishonesty and unethical acts; illegal and any improper behavior, any wrongdoing that injures other's rights; and it's about deceit and false information.

All identified political acts of Filipino culture from small to big are considered as a form of corruption. The politicians top the list as the most highly involve in corruption activities in the Philippines according to the majority to the survey result. As regard to sectors/institutions highly involved in corruption and abuses, most of the two sectors of Filipino youth respondents regarded the business group as the most highly involve sector in corruption. As regard who are the people most likely to commit corruption in society. Accordingly, a person/s will most likely to commit corruption if they know that they are being protected.

On the issue why many people are very hesitant to report or file a complaint of corruption, the survey result reveals that due to fear of losing work and life as well as lack of government support and protection.On what usually happens to a person who exposes corruption or any unethical acts in the organization and in society. Obtained result shows harassment and isolation are the most likely to be experienced by a whistleblower/s of corruption.

Survey reveals the usual response to complaint of corruption and wrongdoings. People are ready to report or file a complaint against corruption if they have the support and protection from the authorities and they have enough solid evidence. In the same manner, academe and police respondents also agree that a person or individual is willing to report or file a complaint if the people involve are not his/her relative and if the people involve are not his/her friends.

Besides that, majority of the two sectors of Filipino Youth respondents strongly agree that power and position and love of money are the main reasons why many people are encouraged to engage in corruption activities in the country.Majority of respondents strongly identified that tolerating corruption due to personal benefits and the culture of "palakasan system". The common issues and problems encountered in the campaign against corruption are the lack of government sincerity, and most of political leaders are involved in corruption.

Data reveals that over-all corruption situations of Philippines have improved. Majority of the respondents agree that their present environment and working condition are highly motivated and confident to work and can work freely and honestly. In terms of their personal

conviction on corruption issues, most of the Filipino youth strongly agree that they prefer the truth even if it hurts with; integrity without richness over richness without integrity; prefer good leaders; will not accept an award or promotion if they don't deserve; will make objective decisions and not based on personal relationships; will reject all forms of corruption regardless of consequences 3.31. They also agree that they will not accept favor at the expense of personal advantage and friendship; willing to tell the truth with or without protection for the sake of truth and justice; and will not go beyond official work or abuse his work despite pressures from superiors.

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References

[1] Vergara, C. 2019. Corruption as systemic political decay. Philosophy & Social Criticism. 1-25. DOI=https://doi.org/10.1177/0191453719868265

[2] Ancient Political Philosophy. 2010. [Internet]. Stanford Encyclopedia of Philosophy. [Cited 2 April 2020]. Available from: https://plato.stanford.edu/entries/ancient-political/

[3] Hill, L. Conceptions of Political Corruption in Ancient Athens and Rome. [Internet]. [Cited 2 April 2020]. Available from: https://www.auspsa.org.au/sites/default/files/conceptions_of_political_corruption_lisa_hill.pdf

[4] Kaufmann, D. 1997. Corruption: The Facts. [Internet]. [Cited 2 April 2020]. Available from: http://www1.worldbank.org/publicsector/anticorrupt/fp_summer97.pdf

[5] Administrative Law. 2017. [Internet]. Supreme Court of Philippines. [Cited 2 April 2020]. Available from: http://sc.judiciary.gov.ph/case-index/2017/january-2017-june-2017/administrative-law-2/

[6] Sihombing, Sabrina O. 2018. Youth Perceptions Toward Corruption and Integrity: Indonesian context. [Internet]. [Cited 2 April 2020]. Available from: https://reader.elsevier.com/reader/sd/pii/S245231511830153X?token=4DB6F92C0101552746B38F6B64361C19F0776470BA5B6DAE72F4559A314CB8A83D408D7ECEBBFCDDD020D5CEFA9C326E on April 13, 2019

[7] Weiten, W., Dunn, D. S., and Hammer, E. Y. 2015. Psychology applied to modern life: adjustment in the 21st century. Eleventh Edition. Boston: Cengage Learning.

[8] Taft, J. K., and Gordon, H. R. 2013. Youth activists, youth councils, and constrained democracy. Education, Citizenship and Social Justice. 8, 1, 87-100. DOI=https://doi.org/10.1177/1746197913475765

[9] Balanon, F., Ong, M., Torre, B., Puzon, M., Granada, J., and Trinidad, A. 2007. The Impact of Youth Participation in the Local Government Process. The United Nations Children's Fund (UNICEF).

[10] Marquette, Heather. 2007. Civic education for combating corruption: Lessons from Hong Kong and the US for donor-funded programmes in poor countries. Public Administration and Development. 27. 239-249.

[11] Purdey, J. Tadem, J.S.E. and Tadem, E. C. 2016. Political dynasties in the Philippines. South East Asia Research. 24, 3, 328-340. DOI=10.1177/0967828X16659730

[12] Teehanke, J. 2002. Electoral Politics in the Philippines. Electoral Politics in Southeast & East Asia. Publisher: Friedrich Ebert Stiftung. [Internet]. [Cited 2 April 2020]. Available from: https://library.fes.de/pdf-files/iez/01361006.pdf

[13] Transparency International, 2018. Corruption Perceptions Index 2006. [Internet]. [Cited 2 April 2020]. Available from: https://www.transparency.org/research/cpi/cpi_2006/0

[14] Chapman, D. 2013. Abusing Power for Private Gain: Corruption in Academe. [Internet]. [Cited 2 April 2020]. Available from: http://www.universityworldnews.com/article.php?story=20131001104015 44Ausgust 6, 2016

The Impact of Corruption on Filipino Youth from Academia and Police Background and Anti-Corruption Methods

Raul A. Aquino[1]*
{raul.aquino@lpu.edu.ph[1]}

Lyceum of the Philippines (LPU), Manila Campus, Muralla St, Intramuros, Manila, 1002 Metro Manila, Philippines.[1]

Abstract. Huge corruption has caused major national institutions such as the judiciary, military, police, schools and other public service providers to fail to perform their functions effectively, fail to perform their duties, and fail to best serve the interests of the people, resulting in many serious societies Issues such as poverty, broken discipline, failure of the judicial system, a culture of distrust and impunity. This study aims to determine the impact of corruption on Filipino youth and identify some anti-corruption methods. Both qualitative and quantitative research approaches were used to gather the research data. This study gathered the primary data through a survey of Filipino youths from the academic and police backgrounds of the National Capital Region. The prepared questionnaires focused on the perceived effects of corruption to the Filipino youth and the solutions in fighting corruption. Specifically, the survey identifies the perceived effects of corruption to the respondents and the society in general, the present assessment on government's actions and performance in fighting corruption as well as, the solutions to address the problem of corruption in the Philippine. The results obtained indicate that most respondents are anti-corruption. They are also aware of the negative effects of corruption on them and society. The government must fully support anti-corruption. Some proposed anti-corruption solution is to educate individuals on moral values and political cleansing..

Keywords: Impact of Corruption; Filipino Youth; Academia Background; Police Background; Anti-Corruption Methods.

1 Introduction

Corruption has a great impact on society and youth in a country. National Anti-poverty Commission confirmed that poverty remains a very serious challenge in governance. It was estimated that 21. 8 million Filipinos are poor when it comes to income and around 50 to 60 million are considered poor citing various dimensions of poverty [1].

Besides that, corruption also has a significant degree of influence in the academic field. Keegan [2] identified some effects on psychology of fear in the organization created by evil leaders. These are good people are leaving the organization and afraid to speak or no freedom of expressions for a healthy debate due to possible retaliation (losing jobs, non-promotion, isolation from work, losing credibility or a special project, losing face) or to remain silent as a sign of protest. But the most common reason why people remain silent so as not to be

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perceived as oppositionist or labeled is negative. This prevents the free flow of ideas towards a healthy conversation to thresh out vital issues and to encourage new ideas in the organizations.Nealaga[3] believes that many teachers in the Philippines are suffering from the delusion, dissatisfaction, and estrangement due to lack of opportunity to shift their work. He called this situation as burnout syndrome teachers which greatly affect the quality of instructions.

Goetsch and Davis [4] noted that internal politics in organization is counter-productive leading to loss of morale, questionable decisions, loss of the best and brightest employees, perpetuation of outdated process, procedures, and technologies, constant work conflict among employees, and loss of quality, competitiveness, and customers.Caillier[5] found out that employees with high commitment to the organization are willing to report wrongdoings or illegal acts in the organization without fear if they believe that they are being supported by their superiors and no retaliation will be taken against them by their organization.

Knox [6] noted that corruption hit the most underprivileged in Bangladesh and only a strong political leadership commitment is needed to make anti-corruption effective. Secretary-General, Ban Ki-moon said at the occasion of International Anti-Corruption Day on 9 December 2009 [7] that it is the world's vulnerable who suffer "first and worst" by corruption such as the theft of public money or foreign aid for private gain. The result, he said, is fewer resources to fund the building of infrastructure such as schools, hospitals and roads. Mr. Ban noted, however, that corruption "is not some vast impersonal force" but "the result of personal decisions, most often motivated by greed." Pointing out that "the UN Convention against Corruption is the world's strongest legal instrument to build integrity and fight corruption", he also called on businesses to adopt anti-corruption measures in line with the Convention.

Uslaner and Rothstein [8] posited that corruption is deeply rooted to social and political structure of the state. Countries that provide universal and mass education to their citizens earned trust and confidence leading to loyalty to the state. They also added that countries that are highly involved in corruptions are less likely to spend bigger budget in education.

Resurreccion[9] focused her study on the contributory factors on the prevalence of academic dishonesty committed by the students in selected state higher education institutions in Southern Philippines during the First Semester of Academic Year 2012-2013. Her study showed that trust, one of the values of academic integrity culture as well as faculty and peers exhibit significant influence on students' likelihood of committing academic misconduct providing initial empirical evidence on the determinants to students' likelihood to commit academic misconduct in the Philippines.

Therefore, this study conducts a survey on the Filipino Youth from several selected organizations and institutions in order to determine the impact of corruption on Filipino youth from academia and police background and also identify the possible anti-corruption methods.

2 Methodology

This study utilized a descriptive mix-method through quantitative and qualitative data analysis to determine the impact of corruption on Filipino youth from academia and police background, also identify the anti-corruption methods. The mix-method allows for a more comprehensive finding for better empirical analyses and understanding [10].

Research Design

This study gathers the primary data from both research methods namely quantitative and qualitative. The survey questionnaire is the research instrument that used to gather the primary data in this study with the aim to determine the impact of corruption on Filipino youth from academia and police background and identify the anti-corruption methods.

The study was conducted in selected institutions in the National Capital Region and participated by the Philippine National Police (PNP), City of Malabon University, Lyceum of the Philippines University, Manila, Taguig City University, and University of Caloocan for the quantitative survey.

For qualitative data, it was participated by the Campus Integrity Crusades (CIC), Pamantasan ng Valenzuela, Office of the Ombudsman, Lyceum of the Philippines University, Manila, City of Malabon University, University of Caloocan, and Philippine National Police (PNP).

The academic sector consists of Lyceum of the Philippines University, Manila, City of Malabon University, Taguig City University, and University of Caloocan. For the police sector, it was represented by the Philippine National Police from various districts/units in Metro Manila.

The participants of this study are age between 18-30years old. Table 1 tabulates the total number of participant in both research methods. From total of 992 participants, there are 85.48% of the participant are involved in quantitative survey question and the remaining 14.52% are involved in qualitative research question.

Table 1. Quantitative and Qualitative Data

Mix-Method	Frequency	Percent
Quantitative	848	85.48
Qualitative	144	14.52
Total	**992**	**100.00**

Data Collection

This study was conducted from August 2017 until March 31, 2018 and strictly observed all the standard protocols in research undertaking particularly on the ethical aspect. The designed questionnaires were internal checked and validated by three certified researchers in the Research and Innovation Center of the Lyceum of the Philippines University, Manila. The research has also been endorsed and supported by relevant agencies and institutions.

Data Analysis

This study used four-point Likert's scale to interpret the quantitative data were subjected to SPSS analysis at the Office of Research and Innovation Center, Lyceum of the Philippines University, Manila while the qualitative data were treated using the content and textual analysis.

RESULT AND DISCUSSION

This study aim to determine the impact of corruption on Filipino youth from academia and police background, also identify the anti-corruption methods. The surveys were conducted in two difference approaches to gather the primary data.

What are the perceived effects of corruption to the Filipino Youth respondent-groups and to the society in general?

Effects of Corruption to Respondents

Table 2 described how the Filipino youth respondents were affected by the continuing corruption practices in the country. According to them, they have lost their trust and confidence with the government (3.17, agree), they do not accept corruption but it is already part of the system (3.02, agree), they are already used to it (2.64, agree), and they are ashamed

of being a Filipino (2.60, agree). However, despite of the negative effects of corruption to the Philippines, presently most of the respondents have no plans of migrating to other countries with a group median of 2.32 disagree.Apart from this statistical result, some respondents made the following comments: The person that implementing the lawis also part of the corruption; and corruption is everywhere in this country.

Statistical test in Table 2indicates no significant difference on the assessment of the respondents on the effects of corruption to them. It showed with: I have lost my trust and confidence to the government and system (.000); I don't accept corruption, but it is part of the system (.000); I am ashamed of being a Filipino (.000); and I plan to migrate to other countries for good (.000).

Effects of corruption to the country

Next, the median and interpretation of assessment of the two Filipino youth sectors on the effects of corruption to the Philippines is shown in Table 3. The Filipino youth respondents strongly identified tremendous poverty and abuses (3.35 strongly agree), loss of integrity and national pride (3.31, strongly agree), culture of impunity (3.30, strongly agree), little trust to the government and proliferation of poor ideas and sub-standard services and products with both having a group average median of 3.28 (strongly agree) as the bad effects of corruption practices in the country. Respondents were also convinced that many Filipinos are already used and have accepted corruption as part of the process (3.23, agree) that prevent new ideas and innovation to pursue (3.22, agree). Aside from this data, two respondents made different comments by saying: He/They are willing to fight corruptions/drugs specially the president.

In Table 3, the statistical test has revealed no significant difference on the assessment of the two sectors of Filipino Youth respondents in all identified effects of corruption in the Philippines such astremendous poverty and abuses in society (.000); loss of integrity and national pride (.000); many Filipinos are doing things with impunity (.000); people have little trust with the government (.000); proliferation of poor ideas and substandard products and services (.000); most Filipinos have accepted it as part of the process (.000); andno new ideas and prevents innovation to prosper (.000).

The obtained results analyses suggest that corruption in the country is a very serious threat to country's national security and development and has greatly damaged the national pride having been labeled as one of the most corrupt countries in the world.

What is the present assessment of the respondents on government's actions and performance in fighting corruption?

Rating of government actions and performance in fighting corruption

Accordingly to Table 4, majority of the respondents from the academe and police agreed that the present government actions is not effective and efficient (2.80); not honest and tolerating corruption (2.78); but also agreed that that is effective and efficient (2.71); and honest and determine (2.62).Checking the answers of the two sectors of Filipino youth respondents, it was found out that the higher positive assessment came from the PNP sector while the lower assessment came from the academic sector.The assessment of the PNP sector only implies of their defense mechanism being one of the institutions of government and indicative of strong support to the present administration who is under strong criticisms from various sectors of society locally and internationally.

In Table 4, the statistical test on the significant difference of assessment of the two sectors of Filipino youth shows no significant difference on the rating with the current government actions and performance in fighting corruption in the country.

Table 2. Median and Interpretation with Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on the Effects of Corruption to the Respondents

	Median and Interpretation				Test of Significant Difference				
Effects of Corruption to Respondents	**Academe**	**PNP**	**Average**	**Interpretation**	**Mann Whitney U**	**Wilcoxon**	**Z**	**Asymp. Sig. 2 tailed**	**Result**
I have lost my trust and confidence to the government and system	3.35	2.77	3.17	Agree	54797.500	103938.500	-8.389	.000	NSD
I don't accept corruption, but it is part of the system.	3.13	2.81	3.02	Agree	66121.500	115262.500	-4.842	.000	NSD
I am used to it.	2.77	2.45	2.64	Agree	65840.500	114981.500	-4.820	.000	NSD
I am ashamed of being a Filipino.	2.72	2.41	2.60	Agree	67858.000	116999.000	-4.129	.000	NSD
I plan to migrate to other countries for good.	2.43	2.14	2.32	Disagree	68665.000	117806.000	-3.875	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree
Legend: S-Significant; NS- Not Significant at .05 level of significance

Table 3. Median and Interpretation with Test of Significant Difference on Assessment of the Two Filipino Youth Sectors on the Effects of Corruption to the Philippines

	Median and Interpretation				Test of Significant Difference				
Effects of corruption to the country	**Academe**	**PNP**	**Average**	**Interpretation**	**Mann Whitney U**	**Wilcoxon**	**Z**	**Asymp. Sig. 2 tailed**	**Result**
tremendous poverty and abuses in society	3.49	3.09	3.35	Strongly Agree	55632.500	104773.500	-8.331	.000	NSD
loss of integrity and national pride	3.46	3.04	3.31	Strongly Agree	55805.500	104946.500	-8.297	.000	NSD
many Filipinos are doing things with impunity	3.39	3.12	3.30	Strongly Agree	64365.000	117806.000	-3.875	.000	NSD
people have little trust with the government	3.40	3.06	3.28	Strongly Agree	59636.000	108464.000	-7.061	.000	NSD
proliferation of poor ideas and substandard products and services	3.41	3.02	3.28	Strongly Agree	57684.500	106578.500	-7.679	.000	NSD
most Filipinos are accepting it as part of the process	3.33	3.05	3.23	Agree	64060.000	113201.000	-5.677	.000	NSD
no new ideas and prevents innovation	3.36	2.94	3.22	Agree	57437.500	106578.500	-7.778	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree
Legend: S-Significant; NS- Not Significant at .05 level of significance

Table 4. Median and Interpretation with Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on Government Actions and Performance against Corruption

	Median and Interpretation				Test of Significant Difference				
Rating of government actions and performance in fighting corruption	**Academe**	**PNP**	**Average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon**	**Z**	**Asymp. Sig. 2 tailed**	**Result**
not effective and not efficient	2.94	2.59	2.80	Agree	65530.500	114671.500	-4.945	.000	NS
not honest and tolerating it	2.95	2.54	2.78	Agree	62704.000	111220.000	-5.676	.000	NS
Effective and efficient	2.56	2.98	2.71	Agree	63490.00	198430.000	-5.531	.000	NS
Honest and determine	2.47	2.89	2.62	Agree	62734.500	197674.500	-5.832	.000	NS

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Table 5 shows the respondents' qualitative answer on the effectiveness of the government's anti-corruption programs. As seen, 48 or 33.33% of the respondents said that it is effective; 10 or 6.94% said it is just somewhat effective; 55 or 38.19% said it is not effective; 1 or .71% has other answer; and 30 or 20.83% did not put any answer.

Table 5. Summary of the Contents and Context of the Respondent's Qualitative answers On the Effectiveness of Government's Anti-Corruption Programs

Answers	**Students/ NYC, & PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**Percent**
Effective	24	16	8	48	33.33
Somewhat Effective	3	7	0	10	6.94
Not Effective	32	16	7	55	38.19
Other answers	1	0	0	1	.71
No answers	22	8	0	30	20.83
Total	82	47	15	144	100.00

Table 6 presents the summary of contents and context of the respondent's answer on why corruption is persistent in the country despite various efforts and programs of the government to stop it. As shown, 40 or 27.77% of the total 144 respondents believed it is because of bad leadership and governance and poor justice system; 31 or 21.53% said because it has become a culture; 16 or 11.11% said because of non-contentment in life and/or love of money; 5 or 3.47% said because it's their personal choice; 7 or 4.86% said because of lack of education; 4 or 2.77% with other answers; and 41 or 28.47% with no answer.

The obtained results only confirmed that the present actions and performance of the government against corruption is not enough resulting to their dissatisfaction and no significant changes in the corruption situation since many of our leaders are protectors and involved in corruption.

Table 6. Summary of the Contents and Context of the Qualitative answers of the Filipino Youth Respondents on why Corruption is so persistent in the Philippines despite various efforts and programs of the government to stop it

Causes	Students, NYC, & PNP	Office of the Ombudsman	CIC	Total	Percent
Bad leadership and governance, and poor justice system	19	13	8	40	27.77
Culture	11	13	7	31	21.53
Non contentment in life/love of money	10	6	0	16	11.11
Personal choice	2	3	0	5	3.47
Lack of education	3	4	0	7	4.86
Others	4	0	0	4	2.77
No answer	33	8	0	41	28.47
Total	82	47	15	144	100.00

What are the suggestions given by the respondents to effectively and efficiently address the problem of corruption in the Philippines?

Summarizing the suggestions and comments of the quantitative respondents to effectively and efficiently address the problem of corruption in the Philippines, data shows that most of the suggestions and comments pointed to the following answers arrange in ranking order:

First, respondents believe that change starts within us. Self-analyses with self-rectification are the first step to become a good person and a citizen of the country. This can be done through better education, practice self-discipline, being honest, and have integrity by not tolerating corruption and wrongdoings, avoiding bad habits such as crab mentality, be a responsible and intelligent voter to elect the right people on the right position.

Second, good leadership and governance that can be best expressed in the form of honesty and transparency in government actions, strict and fair implementation of the law, crafting better laws specifically on anti-political dynasty, election law, and anti-corruption laws, conduct investigations on all government officials and employees and those found involve in abuses and corruption be immediately removed and meted with high penalty as a way of reforming the bureaucracy, increase the salary of government employees, and have sustainable programs on poverty alleviation. All of these are needed by the government to set a good example to the people in order to earn trust and confidence.

Third is political cleansing such as killing all corrupt politicians and changing the government system which is more radical way.

And lastly, people must support the present administration's action and programs to address the problem of corruption.

Table 7 presents the summary of the contents and context of the qualitative answers of the respondents on the suggestions to effectively and efficiently fight corruption. Education, observe honesty, and have integrity got a total of 34 or 23.61% from the total respondents; political will on the part of the leaders to implement the laws and improve the justice system got 19 or 13.19%; vote wisely with 7 or 4.86%; speak up and have the freedom of information approve with 8 or 5.56%; death penalty with 9 or 6.25%; create more jobs with 3 or 2.08%; support the president with 1 or 0.69%; e-governance, close monitoring and checking of every government offices with 13 or 9.03%; firing of corrupt officials and employees and increase

the penalty with 12 or 8.33%; create an specialize anti-corruption agency with 3 or 2.08%; and no answer with 36 or 25%.

Table 7. Summary of the Contents and Context of Respondent's Qualitative answers on the Suggestions/Recommendations to effectively and efficiently address the issue of corruption in the country

Answers	**Students/ NYC, & PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**Percent**
Education, observe honesty, and integrity	10	17	7	34	23.61
Political will on the part of leaders to implement the laws and improve Justice	9	8	2	19	13.19
Vote wisely	5	1	1	7	4.86
Speak up & Freedom of Information	6	2	0	8	5.56
Death penalty	6	2	1	9	6.25
Create more jobs	1	2	0	3	2.08
Support the President	1	0	0	1	0.69
E-Governance, close monitoring & checking	4	6	3	13	9.03
firing of corrupt and increase penalty	10	2	0	12	8.33
Create a separate anti-corruption agency	1	1	1	3	2.08
No answer	29	7	0	36	25
Total	82	47	15	144	100.00

Conclusion

The obtained survey result concluded that most interviewees believe that Filipinos have lost their trust and confidence in the government. They do not accept corruption, but corruption has become a part of the system. They are used to corruption and are ashamed to become Filipinos. However, despite the negative impact of corruption on the Philippines, most respondents currently have no plans to migrate to other countries.

Regarding the impact on Philippine society, most respondents firmly agreed with the immense poverty and abuse, the loss of integrity and national pride, the culture of impunity, the distrust of the government, and the proliferation of bad ideas and unqualified services and products. It is the adverse effect of corruption in the country. Respondents also firmly believe that many Filipinos are already being used and that they accept corruption as part of the process, thereby preventing new ideas and the pursuit of innovation.

Because of bad leadership and passive culture of most Filipinos, weak state institutions, and poor government support and protection, the campaign against corruption in the country were assessed not effective and efficient resulting to a no significant improvement or a status quo situation is sustained or even worsens the corruption situation in the country.

Lastly, most of the suggestions provided by interviewees involved becoming a good person, good leadership and governance, political cleansing and killing of all corrupt leaders, and seeking support for the current government.

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References

[1] NAPC Secretariat. 2017. Reforming Philippine Anti-Poverty Policy. [Internet]. [Cited 2 April 2020]. Available from: http://www.napc.gov.ph/sites/default/files/documents/articles/Reforming%20Philippine%20Anti-Poverty%20Policy.pdf

[2] Keegan, Sheila M. 2015. The Psychology of Fear in Organizations, Kogan Page Limited, Great Britain and United States of America.

[3] Nealaga, A. 2013. Predictors of Burnout Syndrome of Secondary School Science Teachers in Camarines Sur. Sed Vitae. Research Journal of Nueva Caceres City of Naga. 2.

[4] Goetsch, D. L., and Davis, S. 2013. Quality Management for Organizational Excellence: Introduction to Total Quality, 7th Edition.

[5] Caillier, J. G. 2013. Agency Retaliation against Whistleblowers: Factors Affecting Employee Perceptions. Public Integrity. A Journal of the American Society for Public Administration. 15, 1.

[6] Knox, C. 2009. Dealing with Sectoral Corruption in Bangladesh: Developing Citizens' involvement. University of Ulster, Northern Ireland, Public administration and Development published online in Wiley Inter Science.

[7] Fight corruption, save development. 2009. [Internet]. United Nations Office on Drugs and Crime. [Cited 2 April 2020]. Available from: http://www.unodc.org/unodc/en/frontpage/2009/December/fight-corruption-save-development.html?ref=enews111209

[8] Uslaner, E. and Rothstein, B. 2016. The Historical Roots of Corruption. State Building, Economic Inequality, and Mass Education. Comparative Politics, published quarterly by The City University of New York. 48, 2, 227-241.

[9] Resurreccion, P. 2012. The Impact of Faculty, Peers and Integrity Culture in the Academe on Academic Misconduct among Filipino Students: An Empirical Study Based on Social Cognitive Theory. [Internet]. [Cited 2 April 2020]. Available from: https://iit.edu.ph/faculty-staff/article-detail.php?no=122&s=aebbf9f0225e806d167f710220b7b582 March 17, 2016

[10] Brians, C. L., Willnat, L., Manheim, J. B., and Rich, R. C. 2011. Empirical Political Analysis: Quantitative and Qualitative Research Methods 8th Edition, Pearson Education Incorporated. USA.

Philippine Youth from Academia and Police Sector Views on the State Of Corruption in the Philippines

Raul A. Aquino[1*]
{raul.aquino@lpu.edu.ph[1]}

Lyceum of the Philippines (LPU), Manila Campus,
Muralla St, Intramuros, Manila, 1002 Metro Manila, Philippines.[1]

Abstract. The Greed and getting rich quickly are the main motivations for individuals to engage in corruption. Corruption violates good practices and has many harmful effects on individuals, society and a country. Thus, this study aims to determine the Philippine youth views on the state of corruption in the Philippines especially from academia and police sectors. This research method used ni this study is a descriptive hybrid method, consisting of quantitative and qualitative methods. The main data for this study was collected through a survey of Filipino young people aged 18 to 30 in the National Capital Region. The questions investigated focused on the leadership attributes, present values and attitudes of the Filipinos when it comes to corruption and wrongdoings, typical Filipino behaviors/reactions on corruptions, Philippine justice system, present issues and problems of the Philippines as well as the main cause of poverty in the Philippines. The survey results obtained show that the present Filipino leadership is accepted in terms of competencies and capabilities of a leader but questionable when it comes to ethical dimensions and rule of law. The Philippines 'youth from both sectors are understood the meaning and impact of corruption and the corruption situation in the Philippines.

Keywords: Philippine Youth; Academia Sector; Police Sector; Corruption in Philippines; National Capital Region.

1 Introduction

Filipinos are highly regarded and perceived as good people by other nationalities on attribute good qualities such as beauty, hospitable, friendly, and highly religious only if corruption is not an issue of humanity [1]. However, such perceptions cannot be transformed into concrete moral and legal practices. Corruption and unethical practices have become a normal way of life for many Filipinos.

In a famous work "Damaged Culture" in 1987, James Fallows viewed Filipinos as people with no sense of nationalism and lacks national pride whom the national hero Jose Rizal mentioned during his campaign for reforms against the Spaniards [2]. Worse, James Fallows described Filipinos as a very dangerous creature when he noticed that most Filipinos treat countrymen worse than enemy. He concluded that the ingrained cultural defect of the Filipinos is inherent that allows corruption to persist in the country. Although his theory has been rejected and challenged by other scholars, particularly Filipinos of different point of views, the truth on the issue of corruption is loud and clear and has become a joke and colorful.

Meanwhile, Fr. Anton, a known Catholic priest and one of the spiritual advisers of El Shaddai religious group, in his homily during the baccalaureate mass at the Lyceum of the Philippines University Manila grounds on April 2012 said that corruption in the Philippines is

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one and only in the world. He described Philippine corruption as under the table, over the table, and including the table.

While the Philippines slightly improved on the 2018 Transparency International Global Corruption Perception Index ranking 99 out of 180 countries [3] and the strong resistance against corruption in the 2018 SWS survey seems to be not enough and convincing because corruption and wrongdoings are rampant and are glaring in numbers.

The Philippine political system are still controlled and dominated by powerful traditional political families [4, 5], who are generally perceived as highly corrupt [6], many of them having formal cases of corruption at the Office of the Ombudsman and Sandiganbayan [7, 8]. These political families are also known for various abuses such as coercion, fraud, patronage and known with culture of impunity [9, 10].

It is estimated that billions of pesos are lost annually on corruption which has a very detrimental effects to the country's development. It deprives many people of quality living, opportunities, and fair justice hitting mostly the poor, the weak and oppressed, and the young people who are the usual and unseen victims such as the case of anti-dengue vaccination, human trafficking, and corruption in education yet they are not given enough attention or has no participation in policy formulation.

Moreover, big or petty corruption has a long-term effect in every institution or organization whether public or private entity. Because of corruption, incompetent people are promoted in different working organizations applying their repressive and irrational policies to pursue personal interest. It has also displaced millions of people to work and live abroad, displaced good and best employees in a company, poor government facilities and services, poor transportation and communication system, and poor justice system leading to the propagation the culture of corruption.

However, the issue of corruption in society has been the subject of debate and studies by scholars due to various cultural differences and conflicting understanding about corruption. Understanding corruption is still limited and vague when it comes to its definition, nature, causes, forms, responsibility and accountability, how it is done, and its solutions [11].

To better understand what corruption is in Philippines' experience, as the shapers of next generation of this country, this study focuses on the present perceptions and knowledge of the Filipino youth 18 -30 years old on how they view and understand the issue of corruption in terms of nature, definition, and forms. The Filipino youth must be given an opportunity to voice their concerns and must be heard with great concern not only of the government but also by the society. Their active participation as an effective catalyst of social change cannot be denied. The history has replete of accounts of their active participation and sacrifices in social change applying different methodologies from peaceful to violent means, up to extent of giving their lives. It is with great hope that the result of this study may become one of the steps and a contribution to the continuing search of solution to counter the evil effects of corruption in the society and country.

2 Methodology

This study is a descriptive mix-method using both quantitative and qualitative data analysis on how the Filipino youth 18-30 years old from the National Capital Region assessed and understand the issue of corruption in the Philippines. The mix method was applied in

order to come up with a more comprehensive finding for better empirical analyses and understanding [12].

Population and Sample

The study was conducted in selected institutions in the National Capital Region and participated by the Philippine National Police (PNP), City of Malabon University, Lyceum of the Philippines University, Manila, Taguig City University, and University of Caloocan for the quantitative survey. The primary source of quantitative data came from the Lyceum of the Philippines University, Manila, City of Malabon University, Taguig City University, and University of Caloocan representing the academic sector. For the police sector, it was represented by the Philippine National Police from various districts/units in Metro Manila.

For qualitative data, it was participated by the Campus Integrity Crusades (CIC), Pamantasan ng Valenzuela, Office of the Ombudsman, Lyceum of the Philippines University, Manila, City of Malabon University, University of Caloocan, and Philippine National Police.

Of the total population of 23,748 30 years old and below, the study has gathered 848 quantitative respondents, twice the number of the required samples of randomly selected 400 respondents using the Slovin's formula at +/-5 % margin of error.

Table 1 presents the two types of data. It is interpreted and analyzed using the mix-method approach. Out from the total nine hundred ninety-two (992) respondents, 848 or 85.48 % of the respondents were for the quantitative approach and 144 or 14.52% respondents were for the qualitative data analysis.

Table 1. Quantitative and Qualitative Data

Mix-Method	Frequency	Percent
Quantitative	848	85.48
Qualitative	144	14.52
Total	**992**	**100.00**

Research Instrument

In assessing the current state of corruption in the Philippines, survey questions in quantitative and qualitative instruments were directed on the present leadership.

Data Collection

In gathering the data, the researcher strictly observed all the standard protocols in research undertaking particularly on the ethical aspect. These are the following:

Upon approval of this proposed research from the Research and Innovation Center of the Lyceum of the Philippines University, Manila, the researcher consulted three certified researchers in the university for internal checking and validation process of questionnaires. After the said internal process validation and checking, a pre-test was conducted in a location which was not part of the study. Then it was followed by a series of checking and revision of questionnaires in consultation with internal and external validators to ensure the validity and reliability of the instruments before the formal data gathering.

After the finalization of the instruments, the researcher sent formal letters of request to conduct the study to the selected intended institutions that will serve as the sources of respondents and information. Upon approval and support on the letters of request to conduct the study by the concern institutions, the researcher immediately made the necessary communication, ethics, and protocols for the smooth conduct of the data gathering.

A regular report in both oral and written was undertaken by the researcher for proper monitoring of the research project. The report includes the progress, the issues and problems encountered, and the solutions applied. The study was conducted from August 2017 until March 31, 2018.

Data Analysis

The four-point Likert's scale interpretation of the quantitative data were subjected to SPSS analysis at the Office of Research and Innovation Center, Lyceum of the Philippines University, Manila while the qualitative data were treated using the content and textual analysis.

3 Result And Discussion

This section presents the results and discussion on how the Filipino youth 18 to 30 years old view and understands the present issues and problems of corruption in the Philippines as regard to the following questions answered.

How do the two sectors of Filipino youth respondents describe the present condition of the Philippines in relation to corruption

Leadership attributes

Table 2 presents how the Filipino youth assessed the present Filipino leadership. Survey shows that respondents from academic group and from the PNP both provided positive assessment when it comes to the important attributes of the present Filipino leadership. The results are as follows: honest, transparent, and determine 2.97 (agree)with academic group median of 2.81 and PNP group median of 3.20 (agree) and with an over-all group median average of 2.97 (agree); realistic and innovative both agree, academic group median of 2.95 and police group median of 3.19 with an over-all group median average of 3.04; caring and sensitivity to the needs of the needy wherein both respondents agreed with an academic group median of 2.85 and PNP group median of 3.15 having a general average of group median positive assessment of 2.96 (agree); open-minded and accepts criticisms positively alsowith both positive assessment, academic group median of 2.82 and PNP group median of 3.15 group median average of 2.95 (agree); professional and objective; and not vindictive with academic respondents providing agree assessment of 2.79 group median and PNP agree positively with 3.18 and having a total group median average of 2.94 (agree); intelligent and competent, both respondent groups agree with academic group median of 3.15 and PNP group median of 3.28 with an over-all total group median of 3.20 (agree); and as regard to value ethical and compliant to rules and regulations; both respondent groups have agree having an academic group median of 2.78 and PNP of 3.19 respectively with a total group median average of 2.94 (agree).

Table 2 also tabulates the test of significant difference on the assessment on the present Filipino leadership. Testing the significant difference of assessment at .05 level of significance between the two group of respondents, it revealed that there is no significant difference of assessment when it comes to intelligence and competency (.000) knowing the president as a lawyer, former prosecutor, and government official; realistic and innovative (.000); and honest, transparent, and determine (.000). On the contrary, there is a significant difference of assessment when it comes to caring and sensitive (.316); open minded and accepts criticisms positively (.150); professional and objective, and not vindictive (.715); and highly valued ethics, morality, and respectful to rule of law (.469) which are the three important aspects of good leadership.

Table 2. Survey Result and Test of Significant Difference of Assessment of the Two Filipino Youth Sectors on the Present Filipino Leadership

Leadership	Median and Interpretation	Test of Significant Difference

attributes	Academe	Police	Average	Interpretation	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. 2 tailed	Result
Intelligent and competent	3.15	3.28	3.20	Agree	59214.500	192600.500	-7.166	.000	NSD
Realistic and innovative	2.95	3.19	3.04	Agree	59671.500	189976.500	-6.450	.000	NSD
Honest, transparent, and determine	2.81	3.20	2.97	Agree	62352.000	194707.000	-5.381	.000	NSD
Caring and sensitive to the needs	2.85	3.15	2.96	Agree	75657.500	123243.500	-1.003	.316	S
Open minded & accepts criticisms positively	2.82	3.15	2.95	Agree	75073.500	122968.500	-1.441	.150	S
Professional, objective, and not vindictive	2.79	3.18	2.94	Agree	77529.500	124807.500	-.365	.715	S
Valued ethics and compliant to rule of law	2.78	3.19	2.94	Agree	76600.500	124186.500	-.725	.469	S

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Aside from the survey answers, some respondents made comments on the issue of the present leadership such as:

It is not directly to the person or position, but some politician may have the characteristic of being good and not upon governance;

Leadership needs to focus on the youth, the generation is continuously changing, and the Filipino youth is not supervised;

I don't see these characteristics describe how politicians lead our country, I am not stereotyping all of "them", but from what I have observed Philippines is getting worst because of their inhumane practices!!!;

I'm not sure if the president alone is the one who will be judged here, so that those answers are nuts!!!; and

I'm highly positive about Duterte's leadership and his innovative Build, Build, Build plan. I'm not just sure about others under him.

Prior and after he was elected in 2016, the present Filipino leadership has demonstrated and projected the strong character of leadership as manifested by filing formal charges to the officials of the former administration, impromptu and vulgar speeches, strong anti-drug campaign, new foreign policy shifting to China and Russia instead of United States of

America, government revamps by removing government officials known for corruption and incompetency. These greatly convinced many people that the present leadership is doing his job right as a strong leader for the benefit of the masses and poor, wherein many become diehard supporters and are very active in the proliferation of propaganda journalism in social media in support to the present leadership. These observations seem to have influenced majority of the Filipino youth respondents to provide agree assessment in most areas of needed attributes of leadership in the Philippines as also manifested in trust survey results conducted by SWS and Pulse Asia.

Checking how the respondents assessed this question, it was found out that PNP-respondents were consistent in giving positive assessment in all leadership attributes. On the contrary, the academic sector respondents gave a low approval assessment in the areas of caring and sensitivity, open minded and accepts criticisms positively, professional and objective, and not vindictive, and highly value ethics, morality, and respectful to rule of law which are very important traits of a good leader towards good governance.

Explaining the two sector-respondents' assessment on the present Filipino leadership, the PNP and the AFP have been the most favorite institutions of the president since he assumed leadership. Increasing the salary of PNP and AFP, giving concerns to their well-being by even allowing the presidential chopper/plane to transport wounded police and soldiers for immediate medical treatment, visiting police and military headquarters, going to the wake of dead soldiers and police and even attending funeral services personally, appointing many retired police and military officers in sensitive government positions, and very vocal of moral and legal support in strong peace and order campaign are the bases of consistent positive assessment of the PNP-respondents. In addition, it is also an expression of loyalty to the chain-of- command and support to the duly constituted authority having been voted by majority of the Filipino people. It can also be said that the culture of "pagtanaw ng utang naloob" and "pakikisama" are well-observed by the PNP respondents.

Meanwhile, the low agree assessment from the academic sector is attributed to the president's vulgar words about the Roman Catholic Church, joke on rape of women, and lack of conviction on the issue of political dynasty as one of those considered form of corrupt practices. His selective justice approach particularly on his strong political critics led by Sen. Laila De Lima, the deposed Chief Justice Lourdes Sereno, and his executive order revoking the amnesty of Sen. Trillanes were seen as a character of a dictator that is highly whimsical and vindictive, who usually ignores legality procedures and morality which sectors from the legal profession, academic, and religious strongly dislikes and considered thesetraits of a bad leader. Moreover, his sudden shift of foreign policy, specifically with China dealings has been earlier viewed as an innovation and realistic but is also seen as a soft, coward, treacherous approach, and may result to many questions of Constitutionality and legality in the future [13], and his controversial strong anti-drug campaign associated with extra-judicial methods got a strong opposition both from local and international community.

Meanwhile, Table 3 shows that of the total 144 qualitative respondents, 34.03% of the respondents are not happy and disappointed on the present leadership; 20.83% of the respondents are happy and satisfied with the present leadership in addressing corruption; and 10.42% of respondents are on average optimism. On the contrary, 29.16% of the respondents did not give any answer or no comment at all, and 5.56% of the respondents have mixed comments such as blaming that the corrupt environment composed of families, relatives, and people benefiting from corrupt practices that have dragged good leaders to systemic corruption which is why many said that nothing has changed and the situation has even worsen.

With these quantitative and qualitative analyses, it can be deduced that the present Filipino leadership seems to be not enough and not effective to address the problem of corruption. President Duterte himself admitted candidly in many of his presidential speeches that he is tired, done, and has surrendered with corruption. He even straight forwardly admitted that he can do nothing on the issue of political dynasty wherein he himself failed to discourage and prevent his children from dominating the local politics in Davao City.

Table 3. Summary of the Contents and Context of the Respondent's Qualitative answer on the way Filipino Leadership & Management Address the Problem of Corruption

Answers	**Students/ NYC, & PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**Percent**
Not happy and not satisfied	24	16	9	49	34.03
Happy and satisfied	11	16	3	30	20.83
Average optimism	10	2	3	15	10.42
Other answers	8	0	0	8	5.56
No answers	29	13	0	42	29.16
Total	**82**	**47**	**15**	**144**	**100.00**

Present values and attitudes of the Filipinos when it comes to corruption and wrongdoings

Table 4 indicates the present values and attitudes of the Filipinos on corruption and wrongdoings as described by the Filipino youth respondents. Presented in ranking order, many respondents saw that Filipinos used to talk rather than to act (3.18, agree); more concerns with personal issues instead of national issues for the good of the country (3.11, agree); always prefer to do things in the easy way rather than going through the process (3.03, agree); more on personal relationship and pagtanaw ng utang naloob instead of truth and merit system (2.99, agree); open to unethical acts for personal gains (2.92, agree); quiet but full of bitterness (2.89, agree); objective and not vindictive (2.72, agree); very considerate and forgiving (2.70); and respectful to rules and regulations (2.58, agree).

In addition, some quantitative respondents made comments concerning Filipino values and behaviors on corruption and wrongdoings:

The Filipinos have different status in life, depends on what status, because their values are based on their status;

People do not consider the benefits of others, corrupt politicians are more talkative, they are very defensive that makes them more looks that they guilty for doing;

The people are easily swayed by words and empty promises;and

Corruptions are everywhere.

Table 4 indicates there is a significant difference of assessment on the six indicators of the present Filipino values and attitudes when it comes to corruption. Based from the result, it showed no significant difference when it comes to more on talking but lack of action (.000);

very considerate and forgiving (.000); and respectful to rules and regulations (.000). The other remaining factors showed significant difference as enumerated: more concern on personal issues rather than national issues (.150), prefer to do things in the easy way (.316), prefers relationship and debt of gratitude instead of truth and professionalism (.469), willing to accept unethical situation due to personal benefits (.715), very quiet but full of bitterness (.053), and objective and not vindictive (.316).

Table 4. Assessment and Test of Significant Difference of Assessment of the Two Filipino Youth Sectors on the Present Values and Attitudes of Filipinos on Corruption & Wrongdoings

Present values and attitudes of the Filipinos when it comes to corruption and wrongdoings	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**PNP**	**Average**	**Interpretation**	**Mann - Whitney U**	**Wilcoxon W**	**Z**	**Asymp. Sig. 2-Tailed**	**Result**
More on talking but lack of action	3.30	2.96	3.18	Agree	62494.000	110389.000	-5.517	.000	NSD
More concern with personal issues rather on issues that will do good for the country.	3.15	3.06	3.11	Agree	75073.500	122968.500	-1.441	.150	S
Prefer to do things in the easy way rather than going through the process.	3.05	2.99	3.03	Agree	75657.500	123243.500	-1.003	.316	S
prefers relationship and debt of gratitude instead of truth and merit system	3.01	2.96	2.99	Agree	76600.500	124186.500	-.725	.469	S
Willing to accept unethical situation due to personal benefits.	2.93	2.91	2.92	Agree	77529.500	124807.500	-.365	.715	S
very quiet but full of bitterness	2.94	.82	2.89	Agree	73112.000	120698.000	-1.938	.053	S
objective and not vindictive	2.61	2.91	2.72	Agree	75657.500	123243.500	-1.003	.316	S
very considerate and forgiving	2.60	2.87	2.70	Agree	62353.000	194707.000	-5.381	.000	NSD
respectful to rules and regulations	2.42	2.85	2.58	Agree	59671.500	189976.500	-6.450	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Typical Filipino behaviors/reactions on Corruptions

In Table 5, summary of the content and context of the answers on the question "How will you describe the present behaviors/reactions of the Filipinos on the issue of corruption?", qualitative respondents provided the following various observations on the typical behaviors and reactions of the Filipinos: 42 or 29.17% of the total respondents believed that corruption is being accepted and just letting it to happen; 40 or 27.78% of the respondents reject corruption but do nothing about the problem; another 18 or 12.5% of the respondents reject and hate corruption and are doing something about the problem; 11 or 7.64% have mixed reactions; 7

or 5.56% are still optimistic to solve the problem; another 7 or 5.56% are afraid to discuss the issue; 2 or 1.39% are blaming the government; and the remaining 15 or 11.10% have no answer.

Table 5. Summary of Contents and Context of Filipino Reactions/Behaviors on the Issue of Corruption in the Philippines

Typical Filipino behaviors/reactions on Corruptions	**NYC, Students, & PNP**	**Office of the Ombudsman**	**CIC**	**Total**	**Percent**
Accepting and letting it go to happen	19	16	7	42	29.17
Rejecting and hating corruption but without action	25	11	4	40	27.78
Rejecting and hating corruption with actions	8	7	3	18	12.5
Mix Reactions	6	5	0	11	7.64
Still optimistic to solve corruption	5	3	0	7	5.56
Afraid to discuss the issue of corruption	4	3	0	7	5.56
Blaming the government	2	0	0	2	1.39
No answer	13	2	0	15	11.10
Total	**82**	**47**	**15**	**144**	**100.00**

Explaining their answers, Filipinos are not enraged with corruption and simply embracing it because they believe that they are also guilty of doing it daily by simple bribing to fasten their transaction with the government and doing nothing to change; some Filipinos prefer not to get involved in the discussion of corruption because on the personal assumption that they are powerless and fearing for their lives; and corruption is so widespread that it is very hard to deal with and it requires radical solution.

On the other hand, Filipinos dislike, angry, and still optimistic in fighting corruptions with the help of social media; doing protest and demonstrations; vote wisely; and a number have filed formal cases, optimistic and believes that the present President and some people are doing something to the problem. Meanwhile, respondents also noted that some Filipinos reacted negatively but others simply ignored corruption as nothing happens and go with the flow and are shallow, stupid and hypocrite when it comes to corruption issues; Filipinos always make so many commentaries against corruption in specifically in social media; but not officially filing a formal complaint to the authorities and comes election day they still voted the candidates who are involved in corruption; doing nothing; doing corruption daily although sometimes unaware already of committing it but doing nothing to change for the better; Filipino reactions depend on the situation and weighing the possible outcomes by knowing first who the personalities are involved on corruption and the possible gains, a wait and see attitude of many Filipinos commonly known as “segurista culture”; Filipinos always blame the government; and Filipinos are very sensitive to discuss the issue of corruption and does not want to get involved.

On August 2, 2017, two personnel of the Office of the Special Prosecutor, Office of the Ombudsman were personally interviewed by the researcher. According to a female employee, 23 years old, people don't usually complain if they are not directly affected. They have also the notion that their complain is useless against powerful people doing corruption; and people usually consider the position and status in life and possible consequences before making any move. The other respondent, male, 23 years old said, "Corruption cannot be prevented, but it can be minimized. It prevails partly because leaders collaborate or tolerate their subordinate in doing corruption."

Analysis only implies that the present values and attitudes of the Filipinos are non-resistant, attractive, and even tolerating the culture of corruption.

Philippine Justice System

Table 6 shows how the Filipino youth describe the present justice system of the country. Most of the Filipino youth respondents described the Philippine Justice System as generally unclear, confusing, and unfair (2.80, agree); responsive and respectful to the needs of the people (2.60 agree); and can be trusted and reliable with a very low affirmation of 2.52 (agree). In the same manner that most of the respondents disagreed when it comes to speed, clearness, and just with an average group median of 2.36 (disagree). This disagree assessment supports their description that justice system in the Philippines is unclear, confusing, and unfair resulting to a low affirmation on its responsiveness and respectfulness to the needs of the people that put doubts on its reliability and honesty.

Also, some respondents made some comments about the Philippine Justice System.They have observed that:

Connections are the best policy in the Justice System;

Bias;

We all know that justice here in the Philippines sucks!!! It does not prevail;

The Philippine Justice System is only fair and just for those who have money who can afford to hire their own lawyers;

Responsive and respectful only to those who have power; but partially trusted and reliable; and

The justice system is negative, but it could be improved (male, 3rd year, LPU Manila).

With these observations, the Philippine Justice System has been generally perceived as not fair, not responsive to the needs of the people, unreliable and cannot be trusted if justice and fairness will be the bases [14, 15, 16].

Test of significant difference in Table 6shows that there is no significant difference the way the academic and police respondents described the Philippine justice system today. This only means that the present justice system in the country is unclear, confusing, and unfair due to the strong political interventions that usually promote favoritism and corruption that is why in most cases, the result is not responsive to the needs of the people that declines trust and confidence in governance.Similar condition is perceived in Indonesia to which Wibowo [17] deduced that the anti-corruption laws loosely defined the elements needed to prove guilt.

In the qualitative results on why many complainants are very hesitant to report or file a formal complaints against corruption and why corruption is so persistent in the country, most of the respondents have pinpointed the tedious, slow, and bias justice system as one of the causes that allows corruption and why many complainants are not interested to pursue a case.

Based on the two analyses, it only implies that the present justice system of the Philippines is not responsive and respectful to the needs of the people due to unclear and confusing policies that slows down the process affecting the later the decisions that is usually

perceived as unfair, thus giving the impression for the people to doubt and not to trust the government and authorities [18].

Table 6. Assessment and Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on the Present Philippine Justice System

Philippine Justice System	Median and Interpretation				Test of Significant Difference				
	Academe	PNP	Average	Interpretation	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-Tailed)	Result
unclear, confusing, and unfair	2.87	2.69	2.80	Agree	68642.500	115307.500	-3.126	.002	NSD
responsive and respectful to the needs of the people	2.49	2.79	2.60	Agree	60040.00	189326.000	-5.914	.000	NSD
trusted and reliable	2.36	2.79	2.52	Agree	52159.000	180937.000	-8.360	.000	NSD
fast, clear, and just	2.19	2.63	2.36	Disagree	54659.500	183437.500	-7.483	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Present issues and problems of the Philippines

Table 7 presents the assessment of the Filipino youth respondents on the present major issues and problems of the Philippines that beset its development. The Filipino youth strongly agree that the following are the major issues and problems of the country that needs to be addressed: over population (3.60); poor transportation system (3.55); criminality, drugs, and extra-judicial killings (3.53); low salary (3.50); lack of employment opportunities (3.50); poor health services (3.46); lack of discipline (3.43); Mindanao and insurgency problem (3.39);inflation (3.38); and bad leadership and corruption (3.32) and poor educational services with an agree assessment (3.23).

Results on the test of significant difference on the assessment between two sectors in Table 7showed that there is no significant difference in all identified major issues and problems of the Philippines except on the Mindanao and insurgency problem (.097 level of significance) which was temporarily silenced by the newly approved Bangsamoro Basic Law and other peace process initiatives by the government.

The statistical results implied that the two sectors of Filipino youth respondents confirmed that these issues and problems do exist besetting the country's development that needs to be addressed in the soonest possible time.

Meanwhile the qualitative data has also revealed many social issues as a result of the persisting corruption in the country such as tremendous poverty, poor government services, and abuses.

Table 7. Assessment and Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on the Present Issues and Problems of the Philippines

Present issues and problems of the Philippines listed below	Median and Interpretation				Test of Significant Difference				
	Academe	Police	Average	Interpretation	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-Tailed)	Result
over population	3.65	3.53	3.60	Strongly agree	69718.500	116689.500	-3.053	.002	NSD
Poor transportation system	3.66	3.37	3.55	Strongly agree	59596.000	106261.000	-6.373	.000	NSD
criminality, drugs, extra-judicial killings	3.68	3.24	3.53	Strongly agree	50446.00	97111.000	-9.577	.000	NSD
Low salary	3.57	3.39	3.50	Strongly agree	66184.500	112544.500	-3.937	.000	NSD
Lack of employment opportunities	3.55	3.41	3.50	Strongly Agree	68366.500	115031.500	-3.211	.001	NSD
Poor health services	3.54	3.31	3.46	Strongly agree	63358.000	109718.000	-4.894	.000	NSD
Lack of discipline	3.59	3.12	3.43	Strongly agree	49696.500	95752.500	-9.419	.000	NSD
Mindanao and insurgency problem	3.42	3.34	3.39	Strongly agree	71748.500	117199.500	-1.659	.097	S
High prices of basic commodities	3.48	3.20	3.38	Strongly agree	61462.500	108127.500	-5.506	.000	NSD
Bad leadership, corruption, abuses	3.46	3.04	3.32	Strongly agree	56804.500	103164.500	-6.714	.000	NSD
Poor educational services	3.33	3.04	3.23	Agree	59596.000	106261.000	-6.373	.000	NSD

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree

Legend: S-Significant; NS- Not Significant at .05 level of significance

Main cause of poverty in the Philippines

In Table 8, Filipino youth respondents strongly agree that the following are the major causes of poverty in the Philippines: over population (3.57); low salary and lack of employment opportunities (3.53); lack of discipline (3.47); bad leadership, corruption, and abuses (3.45); lack of basic services (3.44); inflation (3.44); criminality, drugs, and extra-

judicial killings (3.39); and Mindanao and insurgency problem with an agree assessment (3.06).

Table 8 shows no significant difference on the assessment of the two groups of Filipino youth respondents on the main causes of poverty in the Philippines, Lack of discipline (.000); bad leadership abuses, and corruption (.000); lack of basic services (.000); high prices of basic commodities (.000); and criminality, drug, and anti- drug campaign (.000). On the other hand, perceptions and knowledge of the Filipino youth significantly differ in overpopulation (.059 level of significance); low salary and lack of opportunity (.358 level of significance); and Mindanao and insurgency problem (.102).

The significant of assessment on the issue of overpopulation, low salary and lack of opportunity, and Mindanao and insurgency problem is because majority of the respondents are members of the Roman Catholic faith, who are strongly against death penalty artificial family planning, and divorce. In addition, majority of the respondents belong to the poor and average sector and strongly believe that despite poverty, they still value honor and dignity, thus are against doing corruption and wrongdoings.

Table 8. Assessment and Test of Significant Difference on the Assessment of the Two Filipino Youth Sectors on the Main Causes of Poverty in the Philippines

Main cause of poverty in the Philippines	**Median and Interpretation**				**Test of Significant Difference**				
	Academe	**Police**	**Average**	**Interpretation**	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**Asymp. Sig. (2 Tailed)**	**Result**
over population	3.60	3.52	3.57	Strongly agree	70893.500	116646.500	-1.887	.059	S
low salary and lack of employment opportunities	3.55	3.51	3.53	Strongly agree	74507.500	120563.500	-.920	.358	S
lack of discipline	3.55	3.33	3.47	Strongly agree	61991.000	107744.00	-5.086	.000	NSD
Bad leadership, corruption, and abuses	3.55	3.27	3.45	Strongly agree	61304.500	107664.500	-5.441	.000	NSD
lack of basic services (education, health, justice, transportation,	3.50	3.34	3.44	Strongly agree	66247.500	112000.500	-3.571	.000	NSD
High prices of basic commodities	3.52	3.32	3.44	Agree	64511.000	110871.000	-4.374	.000	NSD
Criminality, drugs, and EJK	3.48	3.23	3.39	Strongly agree	62601.000	108052.000	-4.628	.000	NSD
Mindanao and insurgency problem	3.02	3.12	3.06	Agree	72301.500	201587.500	-1.637	.102	S

Legend: 3.28- 4:00- Strongly agree; 2.52- 3.27- Agree; 1.76- 2.51- Disagree; 1:00- 1.75- Strongly disagree
Legend: S-Significant; NS- Not Significant at .05 level of significance

Conclusion

The present Filipino leadership received a positive assessment on the identified attributes of leadership. However, the confirmation is not too strong because of many doubts especially on the issue on open to criticisms, professionalism, morality and ethics and respectful to rule of laws when he demonstrated despotic character in many of his decisions and actions in governing the Philippines. The present values and attitudes of the Filipinos when it comes to the issue of corruption are not sincere and passive in going against corruption but rather are encouraging and open for its proliferation. The present Justice system of the Philippines is not responsive, respectful to the needs of the people that has low trust and reliability and identified as one of the contributory factors why corruption persist and proliferates in the country. Because of tremendous corruption in the Philippines, it breeds many conflicting social problems that led to poverty, bad behaviors and culture of impunity for many Filipinos, poor basic services of government, and weak national pride. Bad leadership and governance has been identified by most of the respondents as the main cause of corruption in the Philippines when politicians and business sectors are the top identified corruptors and abusers. The Philippine political environment has been known as a very ideal for corruption and unethical practices because of weak state institutions particularly the major institutions such as the military, the police, and the judiciary whose main function is to protect the Filipino people from all forms of injustices and abuses as stated in the Constitution.

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References

[1] Wong, A. C. 2012. What Filipinos can be proud of. [Internet]. Inquirer.Net.[Cited 2 April 2020]. Available from: https://globalnation.inquirer.net/45875/what-filipinos-can-be-proud-of
[2] Fallows, J. 1987. A Damaged Culture. [Internet]. [Cited 2 April 2020]. Available from: https://www.theatlantic.com/magazine/archive/1987/11/a-damaged-culture/505178/
[3] Bueza, M. 2019. Philippines slightly improves in 2018 global corruption index. [Internet]. [Cited 2 April 2020]. Available from: https://www.rappler.com/nation/222177-philippines-ranking-corruption-perceptions-index-2018
[4] Purdey, J. Tadem, J.S.E. and Tadem, E. C. 2016. Political dynasties in the Philippines. South East Asia Research. 24, 3, 328-340. DOI=10.1177/0967828X16659730
[5] Teehanke, J. 2002. Electoral Politics in the Philippines. Electoral Politics in Southeast & East Asia. Publisher: Friedrich Ebert Stiftung. [Internet]. [Cited 2 April 2020]. Available from: https://library.fes.de/pdf-files/iez/01361006.pdf
[6] Transparency International, 2018. Corruption Perceptions Index 2006. [Internet]. [Cited 2 April 2020]. Available from: https://www.transparency.org/research/cpi/cpi_2006/0

[7] Stephenson, M. 2016. Specialised anti-corruption courts: Philippines. [Internet]. U4 BRIEF.[Cited 2 April 2020]. Available from: https://www.u4.no/publications/specialised-anti-corruption-courts-philippines.pdf
[8] Bueza, M. 2017. What are the Sandiganbayan's oldest pending cases? [Internet]. [Cited 2 April 2020]. Available from: https://www.rappler.com/move-ph/issues/corruption/164524-oldest-pending-cases-sandiganbayan-justice
[9] Hassan, Seid. 2019. Corruption, state capture, and the effectiveness of anticorruption agency in post-communist Ethiopia. Economic and Political Studies. 6. DOI=10.1080/20954816.2018.1535757.
[10] Snaith, E. 2018. 'Culture of impunity' among MPs over hospitality from corrupt regimes. [Internet]. [Cited 2 April 2020]. Available from: https://www.theguardian.com/uk-news/2018/jul/30/transparency-international-uk-hospitality-corrupt-regimes-azerbaijan
[11] Navot, D. 2014. The Concept of Political Corruption Lessons from a Lost Epoch. Public Integrity. 16, 4, 357-373.
[12] Craig Leonard, B., Lars, W., Jarol B. M., and Richard C. R. 2011. Empirical Political Analysis: Quantitative and Qualitative Research Methods 8th Edition, Pearson Education Incorporated. USA.
[13] SWS Survey on the Campaign on Illegal drugs 2018. [Internet]. [Cited 2 April 2020]. Available from:www.sws.org.ph
[14] Buan, L. 2019. Diokno on PH justice system: Too many vacancies in judiciary, lacks transparency. [Internet]. [Cited 2 April 2020]. Available from:https://www.rappler.com/nation/politics/elections/2019/230089-diokno-says-too-many-unfilled-vacancy-lacks-transparency-justice-system-philippines
[15] Hussain, A., Mkpojiogu, E.O.C., Kamal, F.M. (2016). The role of requirements in the success or failure of software projects. International Review of Management and Marketing, 6 (7Special Issue), pp. 305-310.
[16] Narag, Raymond E. 2017. Failure of the Legal System: A challenge to Filipino Lawyers. [Internet]. [Cited 2 April 2020]. Available from:https://www.rappler.com/thought-leaders/177893-failure-legal-system-challenge-Filipino-lawyers.
[17] Wibowo, R. A. 2018. When anti-corruption norms lead to undesirable results: learning from the Indonesian experience. Crime, Law and Social Change, 70(3), 383-396.
[18] Carmello, M. 2011. Basic Cause of Government Corruption. [Internet]. [Cited 2 April 2020]. Available from:http://www.the-filipino-people.com/Basic-Cause.htmlAugust 24,2016

Restricted Decentralization: A Review of Supreme Court Decisions on Philippine Local Autonomy

Glenn Niño M. Sartillo[1]*
{glenn.sartillo@lpu.edu.ph[1]}

Lyceum of the Philippines (LPU), Manila Campus, Muralla St, Intramuros, Manila, 1002 Metro Manila, Philippines.[1]

Abstract. This paper attempts to review how the Supreme Court interpreted local autonomy in the Philippines through the decisions it rendered from 1991 to 2016, in the hope of outlining and summarizing the meaning and extent of local autonomy within the framework of the 1987 Constitution, the Local Government Code of 1991 and other laws. More particularly, the paper examines the interplay between local autonomy, on the one hand, and executive and legislative powers on the other.

Keywords: Restricted Decentralization; Supreme Court Decisions; Philippine Local Autonomy.

1 Introduction

In 1991, Congress enacted into law Republic Act 7160, otherwise known as the Local Government Code of 1991, which is described as "by far the most radical and far-reaching policy" aimed at addressing a politico-administrative system that is over centralized in Manila [1]. By devolving to local government units certain responsibilities, such as the enforcement of certain regulatory powers, as well as by increasing financial resources available to local government units, the Code is said to have further enhanced local autonomy in the Philippines.

Not everyone, however, found comfort in such reform. At one side, there were those who wanted to retain as much power as possible, but acknowledge that they bit-off more than they could chew. While recognizing the potential rewards from the new setup, the national government would reasonably have to firmly hold its grip in the rope of power and influence in the political tug-of-war, if only to remain as relevant as before. At the other extreme side, the enactment was considered a lukewarm response to the centuries-old deprivation of power from the countryside. Such consolation prize would not be acceptable for those who deem federalism as a, if not the solution, to the state's backwardness. If the republican design of the Philppine government were to give the cue, the election to the presidency in 2016 of Rodrigo R. Duterete, a former city mayor of Davao, would be an indication of the electorate's desire to shift to a federal government. True to its promise during the electoral campaigns, the Duterte administration has been actively and seriously advocating for federalism to be pursued through constitutional reforms.

2016 marks the 25th anniversary of the enactment of the Code. It has already been a while that the political makeup of the Philippines featured a degree of local autonomy, the RA 7160 style. The journey is not completely smooth, but one interspersed with actual controversies in the application and operation of local autonomy. As the highest court in the judicial

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department, the Supreme Court has let the hammer fall to settle the legal controversies on local autonomy that reached its bench, promulgating the authoritative interpretation of relevant constitutional and legal provision. The jurisprudence laid down by the Supreme Court provides guidance on how different actors and institutions should sway the sword of local autonomy within the parameters of the constitution and other laws.

2 Local Autonomy, Decentralization, And Local Governments

Local autonomy is defined by Tapales as "the degree of self-determination exercised by a local government unit vis-à-vis the central government." She further argues that "(t)o attain local autonomy, a necessary prerequisite is decentralization" [2].

Raul P. De Guzman defines decentralization as the "systematic and rational dispersal of power, authority and responsibility from the center to the periphery, from top to lower levels, or from the national to local government" [3]. And one of the strongest arguments for decentralization is that it works towards development. Particularly referring to decentralization efforts in Third World Countries, Cheema and Rondinelliargue that decentralization policies are more likely to achieve development because they can overcome the severe limitations of centrally controlled national planning, cut through massive amounts of red tape, increase government sensitivity to local interests and challenges, and provide greater representation for different groups in development decision-making, potentially leading to greater equity in the allocation of government resources. [4].

The responsiveness of local governments remains to be a most powerful underpinning of decentralization. Local governments enjoy a relatively higher level of sensitivity to the specific needs of the people at the local level as compared to the national government. Through local governments, decisions are made according to needs of the locality and are located closer to the scene of action. Moreover, decision making processes can be hastened and made relatively easier making development goals easier to achieve. As such, decentralization improves efficiency of government response to the needs of the people, and is capable of addressing poverty, improving healthcare and education, among others [5, 6]. Decentralization is also often intended as a positive policyinstrument for accommodating a region′s unique culture and history, apart from predominantly to protect minorities andmanage conflict [7].

Decentralization varies across political systems, depending largely on the degree of autonomy local governments enjoy. Under the Code, Brillantes lists devolution as among the three major forms of decentralization, and has always been associated with the local autonomy. As compared to the other two forms, deconcentration and debureaucratization, devolution is political in nature, involving "transfer of powers and authorities to lower level political or local government units."

Said Tapales: *An autonomous local government is one which has attained a measure of decentralization, or devolution. This involves greater taxing powers, as well as greater prerogative to determine priorities in the administration of certain services or the earmarking of resources.*[2]

3 Brief Historical Account Of Local Autonomy In The Philippines

Local autonomy is relatively not new in the Philippines. Prior to the 1987 Constitution and the Code, there have been policies that are supportive of giving more powers to the local government. In 1983, the Maura Law enacted by the colonial government established *tribunales, municipales* and *justasprovinciales*. In 1899, under the short-lived First Philippine Republic, the Malolos Constitution mentioned "decentralization" and "administrative autonomy," and instituted municipal and provincial assemblies. Even the colonial government that administered the Philippines during the American occupation promulgated policies that are pro-local autonomy such as those that organized municipal and provincial councils based on general suffrage, and Act 1396 that organized provincial governments [2].

The 1935 Constitution, which governed the Commonwealth period (1935-1946), provided for the status of local governments vis-à-vis the President:

The President is in charge of all federal branches, bureaus, and agencies, as well as exercising general supervision over all municipal bodies as required by law, and ensuring that the laws are diligently carried out.

What is clear is that the constitution provided for a limited power of the President over the local governments, in contrast to what he could exercise over the executive branch. Citing Ocampo and Panganiban, Brillantes notes that this "was a compromise measure substituted for the stronger guarantee of local autonomy that was proposed during the constitutional convention." [2]

Pursuant to the constitutional fiat, the Congress in 1959 passed RA 2264, "An Act Amending the Law Governing Local Governments by Increasing Their Autonomy and Reorganizing Local Governments." In the same year, RA 2370, otherwise known as the Barrio Charter Act, was also passed. It granted autonomy to barrios in the Philippines, which were regarded under the law as quasi-municipal corporations. In 1967, another landmark legislation was passed, RA 5185 or the Decentralization Act of 1967, which aimed to:

... grant municipal councils more flexibility and ability to adapt to their people's demands and foster their prosperity and welfare, as well as a more equal and systematic distribution of governmental powers and wealth. At that end, municipal councils will be entrusted with carrying out certain tasks that are better administered at the local level, and they will be given as much autonomy and financial capacity as is necessary to carry out these duties more effectively.

Local autonomy was given more importance in the 1973 Constitution, if the space it apportioned to local government is indicative of such intent. For the first time, an entire article was devoted to Local Government, aside from the basic principle of government under Section 10, Article II that:

The state must guarantee and promote the independence of local government units, especially barangays, in order for them to fully develop as self-sufficient communities.

The 1973 Constitution mandated the *BatasangPambansa*to enact a local government code that defines "a more responsive and accountable local government structure with an effective system of recall, allocating among the different local government units their powers, responsibilities, and resources,..." Local governments were likewise granted "power to create its own sources of revenue and to levy taxes, subject to limitations as may be provided by law." In response, the legislature enacted *Batas Pambansa*337 or the Local Government Code of 1983, which reemphasized the policy of the state to "guarantee and promote the autonomy of local government units." However, "(f)ull autonomy could not be realistically implemented under the authoritarian regime."

4 Constitutional And Legal Framework Of Local Autonomy In The Philippines

This section discusses the current framework of local autonomy in the Philippines, which is primarily provided for by the 1987 Philippine Constitution, and the Local Government Code of 1991.

Constitutional Policy on Local Autonomy

More pronounced legal provisions supportive of local autonomy can be found under the 1987 Constitution. Article II, Section 25 declares as one of the state policies that "(t)he State shall ensure the autonomy of local government."

The entire Article X is dedicated to Local Government. Section 2 states that "(t)he territorial and political subdivisions shall enjoy local autonomy." Meanwhile, Section 3 provides:

The Congress shall implement a local government framework that addresses a more responsive and accountable local government model through a decentralization program that implements effective recall, initiative, and referendum systems, distributes powers, responsibilities, and resources among the various local government units, and establishes qualifications, election, and appointment procedures for local government officials.

The Local Government Code of 1991

Pursuant to the constitutional mandate, Congress enacted RA 7160 or the Local Government Code of 1991, which became effective on 01 January 1992. The following are some of the Code's key features, as defined by Brillantes:

1. It delegated to local government units responsibility for a number of social services that were previously handled by the federal government.
   x xx
2. It further transfers responsibilities for the regulation of such administrative authorities to municipal governments.
   x xx
3. The Code further establishes the legislative and administrative framework for civil society involvement in local government.
   x xx
4. The Code boosts the amount of money allocated to municipal governments (LGUs). The Code specifically: (a) expands their taxation powers; and (b) provides them with a specific share of the national resources exploited in their region.,… ; and (c) increases their share of national income, from a low of 11% to as high as 40% of internal revenue allotments (IRA). The Code also gives municipal governments more flexibility in terms of generating revenue from city fees and charges.
   x xx
5. Finally, the Code provided the basis for more entrepreneurial city councils to emerge and flourish.

5 Interpreting Local Autonomy

The following discussion hinges on the jurisprudence on local autonomy laid down by the Supreme Court from 1991, the year RA 7160 was enacted, to 2016, essentially covering 25 years. The cases were identified through the help of *LexLibris*, which generated results on the

topic "local autonomy" appearing on the syllabus of cases. As the latest update of *LexLibris* only allows the listing of cases as per syllabus until 2006, the cases from 2007 until 2014 were identified through the Supreme Court Reports Annotated Quick Index-Digest. Cases decided in 2015 and 2016 were again identified through the use of *LexLibris*, by searching not through the syllabus but the text of the cases.

Jurisprudence on the Constitutional Policy of Local Autonomy Prior to the Enactment of RA 7160

Interestingly, the Supreme Court promulgated rulings in 1991 that made use of the rather motherhood constitutional provision on local autonomy, without waiting for Congress to enact the enabling law. As cited in the landmark case of *Manila Prince Hotel v. GSIS* [8], "unless it is expressly provided that a legislative act is necessary to enforce a constitutional mandate, the presumption now is that all provisions of the constitution are self-executing." It is clear that the 1987 Constitution requires the enactment of the local government code, and by inference, the state policy on state autonomy may not be considered self-executing.

In *San Juan v. CSC*, the Court took a different path. Resolving the issue on the validity of the appointment of a Provincial Budget Officer made in 1988 by the Undersecretary of the Department of Budget and Management (DBM), the Court upheld the imperative to secure first the recommendation made by the Provincial Governor. Making reference to the constitutional policy of local autonomy, the Court articulated:

The validity of one Provincial Budget Officer's position isn't the only issue before the Court. The dispute between the Secretary of Budget and Management and the Governor of Rizal, the Philippines' most populous province, revolves around the implementation of a core constitutional strategy and principle: local autonomy. It is necessary to adhere to the specific directive on local autonomy. When a law is seen from two perspectives, one that favoursMalacaang'scentralised control and the other that favours territorial sovereignty, the scales tip in favour of democracy.

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The Civil Service Commission went against the letter and intent of the constitutional provisions on local autonomy when it treated the Provincial Governor's advising authority as solely advisory. The task of genuine regional democracy is blocked and put back if the DBM Secretary jealously hoards all discretionary authority and lacks the ability of local councils to develop self-reliance and resoluteness in the management of their ownfunds.

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Our national authorities must respect not only the fundamental guarantees of local sovereignty, but also the spirit of liberty that these laws are founded on [9].

Meanwhile, the Court had the occasion in *Basco v. PAGCOR* to clarify the meaning of the principle of local autonomy. Holding that "the matter of regulating, taxing or otherwise dealing with gambling is a State concern and hence, it is the sole prerogative of the State to retain it or delegate it to local governments," the court cited that "the principle of local autonomy under the 1987 Constitution simply means 'decentralization.' … It does not make local governments sovereign within the state or an 'imperium in imperio.'" [10]

Challenged in *Ganzon v. CA* was the power of the President to suspend and/or remove local officials. The petitioners argued that the President is no longer entitled to wield the power of suspension and/or dismissal over local authorities under the 1987 Constitution, which was intended to "strengthen self-rule by local authority units" and to rid the President of the power of control over local councils by repealing the word "as may be provided by law," a proviso present in the 1935 Constitution. They contend that such deletion is significant "since

(1) the power of the President is 'provided by law' and (2) hence, no law may provide for it any longer." The Court disagreed:

Despite the alteration in the constitutional language, the Court believes that the charter does not mean to strip the legislature of its power or the President of her prerogative to impose regulatory penalties on elected authorities, as provided by existing law. The omission (of "as may be granted by law"), in our view, serves only to emphasise local councils' autonomy from Congress and to minimize Congress' "control" over local government matters.The Constitution, on the other hand, did not wish to deprive the legislature of any jurisdiction over municipal corporations, especially in matters of discipline, for the sake of local autonomy.

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The petitioners believe the Constitution has given the President only supervisory rights, without the power of prosecution, and has refused her jurisdiction, which includes disciplinary authority. It's a misunderstanding, since "supervision" is not incompatible with regulatory power under the law.… [11]

The Court went on to explain the concept of local autonomy, an articulation that was made reference in a number of subsequent cases:

Local autonomy, as defined by the Constitution, means establishing a more open and transparent local government mechanism in a decentralised framework. As we have seen, the Constitution serves only to break the national government's monopoly on local government affairs, and to free local councils from Manila's imperialism, as put by political supporters.Autonomy, on the other hand, does not plan to break the partnership and interdependence between the central government and local government units, nor does it intend to usher in a federalist system. That is not where the Charter can go. Local governments are governed by the Constitution, but only to a certain extent, and for no other reason than to improve self-government, despite the confusion.

Decentralization, as we saw in one scenario, includes devolution of national administration but not authority to local levels. As such:

Decentralization of administration or decentralization of authority is now synonymous with autonomy. Decentralization of administration happens as the federal government delegate governmental responsibilities to political subdivisions in order to expand the reach of government authority, make local councils more open and responsible, ensure their complete growth as self-sufficient societies, and make them more productive participants in national development.Simultaneously, it relieves the central government of the responsibility of managing local politics, allowing it to focus on national issues. They are supervised by the President in general, but only to maintain that municipal issues are conducted in accordance with the constitution. He doesn't have much influence on their actions in the way that he can't make their decisions for them.

Decentralization of power, on the other hand, entails the handing over of state power to local governments. The autonomous government is free to chart its own course and shape its own direction in this case, with limited intervention from the central government. According to one constitutional analyst, decentralization of power is equivalent to self-immolation since provincial governments are held accountable to their citizens rather than central authorities.

These decisions brought to fore that the constitutional policy on local autonomy, while more aggressive, remain circumscribed. Equally important, the rulings may have set the tone for future interpretations with respect to the power of the President and the legislature. We now turn to these issues.

Local Autonomy and the Executive

Preliminarily, instructive to dynamics between executive power and local autonomy is a review of the relevant provisions in previous constitutions. As quoted above, the 1935 Constitution effectively distinguished the kind of executive power the President could exercise over local government units, i.e. supervision. Citing *Tecson v. Alas*, the Court in *San Juan v. CSC* further clarified that such supervision is "both general and circumscribed by statute":

... The presidential integrity does not even extend to general oversight, but to general supervision as defined by statute. As a result, he was unable to go beyond the relevant constitutional provisions, which bind and restrict his discretion in the matter. Furthermore, as Justice Padilla had previously ruled in Mondano V. Silvosa (97 Phil. 143 [1955]), which the current Chief Justice alluded to in his decision in the Hebron case, oversight should not extend beyond that "overseeing or the power or authority of an officer to see that subordinate officers perform their duties. If the latter fail or neglect to fulfill them the former may take such action or step as prescribed by law to make them perform their duties." (Ibid, pp. 147-148) Control, on the other hand, "means the power of an officer to alter or modify or nullify or set aside what a subordinate had done in the performance of their duties and to substitute the judgment of the former for that of the latter."

Clearly, the President, even under the 1935 Constitution, does not have control over local government units.

While there was no expressed mention regarding the relationship between the executive and local government units in the 1973 Constitution, it nevertheless affirmed local autonomy under Article II, Section 10. A case noted that similar to the 1935 Constitution, the 1973 Constitution likewise limited the President's power over local government units to supervision and excluded the power of control [12].

Explicitly resurrected in the 1987 Constitution, through a separate provision, is the President's power of general supervision over local governments. Article X, Section 4 states: "The President of the Philippines shall exercise general supervision over local governments," which must be read alongside Article II, Section 25: "The State shall ensure the autonomy of local governments."

In a line of cases, the Supreme Court interpreted the constitutional provisions in favour of local government, construing certain acts of the President and his agents as running afoul the constitutional policy of local autonomy. As noted above, one of the earliest cases that sustained local autonomy vis-à-vis the power of the Executive over the appointment of a local official is *San Juan v. CSC*. Meanwhile, dealing with a controversy that revolved around the authority of the Local Government Secretary over the *katipunanngmga* barangay, the Court held that he does not have the authority to "pass upon the validity or regularity of the election of the officers of the *katipunan*," as it is tantamount to control over local government units permitting him to "interfere in a purely democratic and non-partisan activity aimed at strengthening the barangay as the basic component of local governments so that the ultimate goal of fullest autonomy may be achieved." [13]

In The National Ligangmga Barangay v. Paredes, the Supreme Court ruled that the Secretary of the Department of the Interior and Local Government (DILG) as the President's alter ego would not have the authority to name a temporary caretaker of the Ligangmga Barangay. The act of the DILG in electing the respondent as president of the Liga's Caloocan Chapter prior to the newly-scheduled elections, when the petitioner was already president, was found to be in excess of oversight and an exercise of power [14].

The withholding of a portion of the Internal Revenue Allotment (IRA) cannot be validly ordered by the President even in the pretext of solving economic difficulties. In *Pimentel v. Aguirre*, President Ramos issued Administrative Order No. 372, Section 4 of which ordered

the withholding of 10% of the IRA of LGUs. It was struck down by the Court for encroaching fiscal autonomy of local governments, saying that "purposes must be carried out by legal methods." [15]

Local fiscal autonomy was again discussed and upheld in a more recent case of The Province of Batangas v. Romulo, wherein a program known as Local Government Service Equalization Fund (LGSEF) aimed at facilitating "the process of enhancing the capacities of local government units in the discharge of the functions and services devolved to them…" as contained in the General Appropriations Acts of 1999, 2000 and 2001 was declared violative of the constitutional precept on local autonomy. More particularly, it contradicted Article X, Section 6 of the Constitution, which provides that LGUs shall have just share in national taxes that must be determined by law and be automatically released to LGUs. However, the LGSEF could not be released without the approval of an Oversight Committee. For the Court, to subject to conditions imposed by the Oversight Committee the distribution and release of the LGSEF, which is part of the IRA, is constitutionally impermissible, as the same makes the release not automatic [16].

The Court likewise declared null and void a Local Budget Circular of the DBM, which limited additional honorarium that local governments can give to national government officials and employees assigned in their localities to rates not exceeding P 1,000 in the provinces and cities, and P 700 in municipalities. Aside from failing to comply with the publication requirements, the issuance was declared to have gone beyond the law it seeks to implement, emphasizing that interference of the President or any of his alter egos can be justified if the affairs and activities of local governments are contrary to law. Said the Court:

The law that supposedly acts as the legislative foundation for LBC 55, Section 458, art. (a)(1)(xi), of RA 7160, requires judges to be given extra allowances whether the city government's resources enable it. The clause in question would not provide for a specific upper limitation on the extra allowances given to judges. Thus, we do not need to focus on the fact that a city government's finances can permit the award of additional allowances greater than P1,000 if the city government's revenues exceed its annual expenses. [17]

The preceding cases should not necessarily create an impression that Court always favors local autonomy in relation to the power of the executive. A case in point is *Ganzon v. CA*, as already discussed. To reiterate, the Court articulated that despite the change in constitutional language, the 1987 Constitution "did not intend to divest the … President of her prerogative as conferred by existing legislation to provide administrative sanctions against local officials." There, the Court held that the power of the Secretary of Local Government to suspend local government officials is within the contemplation of the meaning of supervision. Importantly, the court stipulated the following rules insofar as the constitutional principle of local autonomy is concerned:

1. Local autonomy, as defined by the Constitution, entails a decentralization of administration rather than authority, with local authorities remaining responsible to the central government in accordance with the law;

2. The new Constitution does not prescribe federalism;

3. The change in constitutional language (in relation to the supervision clause) was intended only to deny legislative authority of municipal governments; it did not exclude them from legislative legislation as long as such regulations were compatible with the basic principle of autonomy;

4. Since local councils are still responsible to the national government, the latter can take disciplinary measures against local officials in accordance with the legislation and the procedures set out therein.

5. "Supervision" and "investigation" are not inconsistent terms; "investigation" does not signify "control" (which the President does not have)…

While a local government unit can regulate the conduct of business, it cannot regulate practice of profession, like optometry, as the latter function is "within the exclusive domain of the administrative agency specifically empowered by law to supervise the profession…" This was the ruling in *Acebedo v. CA*, where the Court held as invalid the conditions imposed by the Office of the City Mayor of Iligan as the same pertains to the practice of optometry [18]

In a fairly recent case of *Mangune v. Ermita*, the Court upheld the authority of the President to devolve the Taguig-Pateros District Hospital from the Department of Health to the City of Taguig. This was considered part of the authority of the President to reorganize offices under the executive department [19].

Local Autonomy and the Legislature

By strengthening local autonomy, never did the 1987 Constitution intend to setup a federal regime of centre-periphery relations, but one that is unitary. In contrast with the federal government where sovereignty and not just power is shared between governments, say central government and local government, within a single state, the unitary form exclusively concentrates sovereignty with the central government. Subnational levels may implement, and even make policy, but with leave of the central government [20].

Working within the parameters of the constitutional principle of local autonomy, Congress is clearly empowered by the 1987 Constitution to exercise control over local government units. Article X, Section 3 states:

The Congress must pass a local government code that provides a more sensitive and responsible local government system by decentralization and efficient recall, petition, and referendum processes, distributes rights, duties, and services among the various local government entities, and determines local officials' credentials, election, and appointment..

As earlier pointed out, such local autonomy means decentralization. The Court in *Lina v. Paño* elucidated:

The most recent articles in the Constitution strengthening local autonomy policy have not weakened the basic relationship between the national legislature and local government units. Without wishing to belittle the approach, we should say confidently that Congress maintains jurisdiction of local government units, although to a far lesser extent than under previous Constitutions. The ability to build also requires the ability to kill. The ability to give requires the ability to withhold or recall.True, the Constitution contains several noteworthy innovations, such as the direct grant of taxing authority to local government bodies (citing Art. X, Sec. 5, Constitution), which cannot yet be revoked by statute. The national legislature, on the other hand, remains the principal of local government units, which cannot defy, alter, or breach its will (citing Magtajas v. Pryce Properties Corp. 234 SCRA 255) [21]

At issue in said case is the validity of a local legislation enacted by the *SangguniangPanlalawigan* of Laguna, which vehemently objected to the operation of lotto in the province, and became basis of the denial by the Mayor of San Pedro of an application for permit to operate lotto filed by the private respondent. The petitioners alleged that such legislation is a valid exercise of police power under the General Welfare Clause of RA 7160. The Court declared such position untenable, explaining that lotto is a game of chance duly authorized by Congress in RA 1169, as amended by Batas PambansaBlg. 42 and that local ordinances cannot go against laws passed by Congress, since "the power of local government units to legislate and enact ordinances and resolutions is merely a delegated power coming from Congress." It stressed further that:

Municipal councils are nothing more than servants of the federal government. Local governments only have constitutional authority that has been assigned to them by Congress, the nation's legislative body. The delegate cannot be more powerful than the principal or have more authority than the others. It is heresy to say that local government units would revoke Congress's actions, from which they derived their authority in the first place, and eliminate the statute's provision with a simple ordinance.

Municipal companies owe their existence to the government, which therefore grants them all of their privileges and privileges. It gives them life, which they wouldn't have if it weren't for it. It can ruin what it makes. It has the ability to abridge and manipulate as well as kill. Unless there is some procedural restriction on the right, the government could, in a single act, and if we can imagine it worthy of such stupidity and wrongdoing, wipe out all of the state's local companies, and the corporations will be unable to stop it.In terms of the company itself, we are unaware of any restrictions on the right. They are, to put it another way, the legislature's mere tenants at will (citing Clinton vs. Ceder Rapids, etc. Railroad Co., 24 Iowa 455).

The same conclusion was reached by the Court *in Basco v. PAGCOR*, which similarly deals with gambling, as noted above.

The Davao City *SangguniangPanlungsod* passed an ordinance prohibiting all agricultural institutions in the city from using aerial spraying as a farming activity. The ordinance was forced by the respondents because it disregarded certain Fertilizer and Pesticide Authority laws. Sustaining the contention of the respondents, the Court explained:

Despite the fact that the Local Government Code gives municipal corporations enough autonomy to regulate themselves and administer their affairs and operations, they have no authority to pass regulations that contradict state laws and policies. The aim of the Local Government Code was to describe the general parameters and restrictions that each local government unit would obey when exercising its delegated powers, with the goal of converting the local government unit into a fully functioning subdivision of the state while staying within statutory and legislative constraints.175 The Local Government Code does not grant a local government agency blanket power to legislate on any matter it deems appropriate in the name of promoting the public interest.

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Certainly, Congress is the only source of regulatory power for each local government entity. The local government entity will never be more powerful than the source of its power. As a result, the ordinance cannot conflict with or violate established statutes, precisely because its jurisdiction is derived solely from Congress's valid delegation. [22]

And whenever LGUs exercise powers delegated to it by Congress, the former must strictly comply with the statutory requirements. In exercising the power of eminent domain, the *SangguniangPanlungsod* of Mandaluyong City issued a resolution authorizing the City Mayor to institute expropriation proceedings over a private property. After differentiating "resolution" as a mere declaration of sentiment of opinion of a *sangguniano*n a matter, from "ordinance" which is a law, the Court annulled the expropriation proceedings, because the Local Government Code of 1991 clearly and specifically requires an ordinance, and not a resolution, for purposes of exercising the power of eminent domain. The Court said:

(W)hileWe can't give judicial permission to a municipal government agency exercising its delegated right of eminent domain in violation of the statute that gave it that power. [23]

Tested in *Ferrer vs. Bautista* was the exercise of taxation and police power of a city. The Quezon City Council passed an ordinance requiring the collection of garbage fees from residential properties, which must be collected entirely and entirely in a separate fund

designated for garbage collection. The Court struck down such provision of the ordinance for being inconsistent with Section 10 of RA 9003, which limits the responsibility of a city to the collection of non-recyclable materials and special wastes. The ordinance imposed garbage fee based on the volume of waste generated by each person in Quezon City, without regard for the specific types of wastes [24].

Congress, however, will not be upheld in the exercise of control over LGUs when it already transgresses the constitutional policy of local autonomy. In the case of *Film Development Council v. Colon Heritage Realty Corporation*, the Court was asked to resolve a dispute between the inherent taxing power of Congress and the power to tax delegated to local governments. In 1993, the City of Cebu enacted amusement taxes of thirty percent (30%) of total admission fee receipts on owners, lessees, or managers of theatres, cinemas, concert halls, circuses, boxing stadia, and other amusement venues. The Film Development Council of the Philippines (FDCP)was established by RA 9167, passed by Congress in 2002. It also stated that income from the graded film amusement tax, which would otherwise go to cities and towns, would be withdrawn and remitted to the Council by the proprietors, owners, or lessees of theatres or cinemas. While admitting that the power of taxation is purely legislative, it can be validly delegated to municipal corporations. Quite interestingly, the Court said:

... It is important that Congress, rather than the taxing body, earmarked, if not completely confiscated, the money received by the LGU from people in favour of and for transfer to FDCP. This, in our view, is in gross breach of the constitutional provision that taxes levied by LGUs accrue exclusively to that LGU, which is incompatible with the right of LGUs to distribute funds according to their own desires.

The natural legislative powers of Congress are constrained and preserved within the four walls of the Constitution, which is a foundational principle.As a result, if the government uses the authority to pass, modify, or repeal statutes, it shall do so within the bounds set out by organic statute. [25]

6 Conclusion

How Philippine local governments behave vis-à-vis the executive and legislative branches of the national government within the legal framework changed in recent politico-administrative history. With the constitutional policy of local autonomy and the enactment by Congress of the enabling law, the Local Government Code of 1991, local governments were obviously given more powers, functions and responsibilities that were formerly concentrated at, if not monopolized, by the national government. This does not mean, though, that local governments are completely autonomous, absolutely free from any interference, especially that coming from the executive and legislative branches.

This paper unveiled that the Supreme Court, in applying and interpreting the law, is not ready to accept the view that local autonomy means creating empires within an empire, but that of restricted decentralization, where local governments enjoy autonomy, but remain under the general supervision of the President and an attenuated control by Congress. The Constitution and the law remains the “North Star” of the Supreme Court in interpreting the concept of local autonomy.Among the objectives of Filipino-type of decentralization are to break the narrative of a highly centralized governmental design, and create sublevel units that are more responsive to the needs of the immediate locality, but still within the context of national development. As elucidated by the eminent Justice Isagani Cruz, as cited in a case,

"(a)utonomy does not, after all, contemplate making mini-states out of local government units." The case further elaborated:

... In the fact that the legislature's legislative responsibility—as the "supervision clause" itself suggests—is to wean local government bodies from over-reliance on the central government, autonomy, in the constitutional sense, is subject to the legislature's guiding light, but not control.

The foregoing findings are suggestive of the need for constitutional revision, not merely amendment, if the direction is to introduce substantive reforms to weaken or deepen local autonomy. The decisions promulgated thus far by the Supreme Court underscore a limited form of decentralization, such that any attempt to break away from the current setup will necessarily entail meaningful changes on the relations between the local governments on the one hand, and the executive and legislative branches, on the other. If these reforms would amount to a shift from the unitary to a federal setup, constitutional amendment is not enough, much less a mere amendment of the Local Government Code 1991. The proper manner or method of institutionalizing any reform, from mere statutory amendment to the more arduous constitutional revision, would depend on the extent and degree of the desired changes.

Whither the centre-periphery relations should proceed is a political issue left to the discretion of the political agencies and ultimately the sovereign, and is beyond the competence of the Supreme Court to resolve.

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References

[1] Alex B. Brillantes, Jr. 2003.Innovations and Excellence: Understanding Local Governments in the Philippines. 8.
[2] Proserpina Domingo Tapales. 2003. The Nature and State of Local Government.Public Administration in the Philippines: A Reader. 315-316.
[3] Brillantes, A.B. 2003. Decentralized Democratic Governance Under the Local Government Code: A Governmental Perspective. Public Administration In The Philippines: A Reader.324.
[4] ShabbirCheema, A. and Rondinelli, Dennis A. 1983. Decentralization and Development: Policy Implementation in Developing Countries. 16.
[5] Einsiedel, N. 2002. Overcoming the Obstacles to Decentralization in Asia, Philippine Journal of Public Administration. 25-38.
[6] Cariño, L. 1998. Governance in Local Communities: Towards Development and Democracy. The Local Government In The Philippines: A Book Of Readings. 7.
[7] Haryanto, Lay, C., &Purwoko, B. (2017). Asymmetrical Decentralization, Representation, and Legitimacy in Indonesia. Asian Journal of Political Science, 25(1), 130-50.
[8] Manila Prince Hotel v. GSIS, G.R. No. 122156, February 3, 1997.
[9] San Juan v. CSC, G.R. No. 9229, April 19, 1991.
[10] Basco v. Philippine Amusement and Gaming Corp., G.R. No. 91649, May 14, 1991.
[11] Ganzon v. Court of Appeals, G.R. Nos. 93252, 93746 & 95245, August 5, 1991
[12] National Ligangmga Barangay v. Paredes, G.R. Nos. 130775 & 131939, September 27, 2004.
[13] Taule v. Santos, G.R. No. 90336, August 12, 1991.
[14] G.R. Nos. 130775 & 131939, September 27, 2004.

[15] G.R. No. 132988, July 19, 2000.
[16] The Province of Batangas v. Romulo, G.R. No. 152774, May 27, 2004.
[17] Dadole v. Commission on Audit, G.R. No. 125350, December 3, 2002.
[18] G.R. No. 100152, March 31, 2000.
[19] G.R. No. 182604, September 27, 2016.
[20] Hague, R. and Harrop, M. 2004. Comparative Government And Politics: An Introduction. 229 and 236.
[21] G.R. No. 129093, August 30, 2001.
[22] Mosqueda v. 2016. Pilipino Banana Growers an Exporters Association, Inc., G.R. Nos. 189185 & 189305, August 16, 2016.
[23] Heirs of Suguitan v. City of Mandaluyong, G.R. No. 135087, March 14, 2000.
[24] G.R. No. 210551, June 30, 2015.
[25] G.R. Nos. 203754 & 204418, June 16, 2015.

Effectiveness of Human Resource Information System (HRIS) in Banking Industry in India

Dr. N. Srinivas Kumar[1]
{drsrinivaskumar23@gmail.com[1]}

Professor & Assistant, School of Management Studies, Guru Nanak Institutions Technical Campus, Telangana[1]

Abstract. Human Resource Information Systems (HRIS) plays an important part in banking industry. Due to this, the main objective of this study is to examine the effectiveness of determining factors across HRIS effectiveness in chosen commercial banks in India. In five dimensions HRIS was measured (Human Resource, Environmental, Technological, Organizational, and Security Factors). Likert scale which has five points of 28 statements is used by the whole HR department. The data was evaluated and analyzed with the help of package of statistical data analysis, SPSS (Statistical Package for the Social Sciences version 23.0) along with the single variant and bi-variant methods. The investigations of the survey declares that 91.7% of HRM (Human Resource Management) effectiveness variance is explained by HRIS and investigated the significant difference between determining factors acrossHRIS of the bank employees concluded that human resource, technological, organizational, environmental and security factors significantly difference with HIRS of bank employees.

Keywords: HRIS, Human Resource, Environmental, Technological, Organizational, Security Factors and Banking Industry.

1 Introduction

The HRIS is described as an "incorporated framework which is used to break down, assemble, and store data in correspond to an association's HR's involving PC applications, information bases, programming important to convey, oversee, gather, store, record , introduce and control information to employee of HR (Hendrickson, 2003). This may play out different capacities from the basic correspondence and stockpiling data, to more mind boggling exchanges. As the progress of innovation increases, the scope of capacities that a HRIS can embrace increments. In order to get vital accomplices along with top management the HRIS utilization has been considered as an open door for human asset experts. The thought has been that HRIS would take into account the HR capacity to turn out to be more proficient and to give better data to dynamic. The inquiry remains whether HRIS has satisfied its guarantee (Beadles, Lowery and Johns, 2005).

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2 Literature Review

A few authors have recommended that HRIS utilization it will moderate the costs of HR through computerizing data and minimizing the need of huge quantities of employees in HR department, by helping representatives to manage very own data; and by permitting chiefs to get to significant data and information, direct examination, decide, and speak with others without speaking with a HR professional (Awazu and Desouza, 2003; Ball, 2001) [1]. Preferably, with a proper utilization of HRIS, fewer individuals ought to be expected to perform managerial errands, for example, record keeping and additional time would be made accessible for HR managers to help by giving information on a vital level. A considerable lot of these creators accept the future to be brilliant for HRIS as it makes new ways for HR and for the organizations that adequately use HRIS. One study even ventures to recommend that there is proof that HRIS can improve investor esteem (Brown, 2002) [2].

Human Resource Management (HRM) issues have been significant concern for managers at all levels, since they all meet their objectives through the endeavors of others, which require the viable and productive administration of people (Dessler, 1999) [3]. The open cluster of HRM exercises for instance, arranging, enrolling, determination, and preparing just to specify yet scarcely any spot tremendous requirements on chiefs and managers alike. These grasp dissecting occupations, arranging work needs, choosing representatives, situating and preparing representatives, overseeing pay, imparting (which incorporates guiding and restraining), and keeping up worker duty. As a matter of fact, HRIS is coordinated towards the HR division itself (Ruël, Bondarouk and Looise, 2004) [4], yet the utilization of HRIS can give various advantages not exclusively to the HR work, yet in addition line managers, and the more extensive organization. Parry (2009) [5].

The utilization of HRIS has been advocated as an open door for human resource professional to become vital accomplices with top management. HRIS permit HR function to turn out to be more effective and to give better data to dynamic (Beadles, Lowery and Johns, 2005) [6]. Obeidat (2012) reasoned that Human Resource information framework capacities were found to have a relationship with HRM functionalities. All the more explicitly, it was discovered that vital incorporation, anticipating and arranging, HR examination, and correspondence and coordination have no relationship with human asset functionalities. While, it was discovered that presentation improvement, information the executives, and records and consistence as measurements of HR data frameworks have a relationship with HR functionalities [7]. Kovach et al. (2002) [8] recorded a few managerial and key focal points to utilizing HRIS.

HRIS can improve organizational performance, facilitate strategic value generation practices and ensure contribution of human assets to achieve business objectives Boateng(2007) [9]. The usage of HRIS into organization significantly increase to gather, store, analyze, retrieve human resource data all over the world from last two decades HRIS ensure integration, cost efficiency, accessibility and user friendliness to an organization to ameliorate human capability of an organization Troshani, I., Jerram, C., & Hill, S. R. (2011) [10]. HRIS assured dynamic speed on administrative tasks with a minimum number of worker for any organization to achieve competitive advantages Karim, Z., & Rahman, M. H. A. (2018) [11].

Bhuiyan, Chowdhuri&ferdous (2014) uncovered historical development pattern of HRIS from personnel management to evolution of HRM, HRIS and Tech era and SHRM to nourish HRM practices in business world [12]. Gupta (2013) also supported this development period of HIRS and depicted opportunities and threats of HRIS [13]. They also stated most frequently used software from vendors for both service and manufacturing industries. Such as- Abra Suite, Oracle, People Soft, Vantage etc. Shiri (2012) investigated that adoption of HRIS will enhance the productivity of an organization [14]. Troshani et al. (2010) [15] demonstrated the adoption of HRIS in the public sector depends on environmental, organizational and technological factors in three ways as such demonstrated benefits and usefulness of HRIS, management commitment and regulatory guidance as well as succession rate of HRIS adoption by using TOE framework as analytical tools.

3 Research Problem

The major critical HR challenges are retaining talent, hiring right staff, staff development, cutting salary of staff, external threats, etc. The some other tasks or challenges are re-skilling, compensation and Changing working conditions, etc. Coping with the massive technology adoption programme – change management from employees' as well as customers' perspectives. Some concerns over management are: Human assets, Marketing HR services, Talent management, Man-power planning, a novel approach for the performance management, How HR can act as the 'organizational conscience' or 'corporate glue' and Making the capital of human.

3.1 Research Objectives

1. To identify the determining factors of HRIS in Banking industry.
2. To measure the effectiveness of determining factors on HRIS in Banking industry.
3. To explore the differences in the determining factors across the HRIS in Banking industry.

3.2 Research Hypotheses

H01: There is no specific relationship in between determining HRIS and factors in Banking Industry.

H02: No specific variations in determining factors correspond to HRIS in Banking Industry.

- **$H0_{2.1}$:** There are no major variations in human resources factor with respect to HRIS in Banking Industry.
- **$H0_{2.2}$:** There are no major differences in technological factor correspond to HRIS in Banking Industry.
- **$H0_{2.3}$:** There are no important differences in organizational factors correspond to HRIS in Banking Industry.
- **$H0_{2.4}$:** There are no major differences in environmental factor correspond to HRIS in Banking Industry.
- **$H0_{2.5}$:** There are no major differences in security factor correspod to HRIS in Banking Industry.

3.3 Research Tools

- Reliability Test
- Exploratory Factor Analysis (EFA)
- ANOVA (Analysis of variance)

4 Research Methodology

4.1 Sample Size

The Sample size which plays important part in result accuracy and in appropriateness of selected statistical technique. SPSS version 20 (Statistical Packages for Social Sciences) conducts this study.

Samples are taken by researchers from different stages. At initial stage 5 cities are identified in India (Bangalore, Kochi, Mysore Hyderabad and Chennai) to this purpose, with the help of Judgmental sampling. In this 3 cities are selected randomly out of five cities, via Lottery Method (Simple Random Technique).

In the next stage i.e., second, by convenience sampling every bank in 3 cities were selected, were approached to data collection for permission. The data collected for this study was from the permitted banks only. A standardized and well-framed questionnaire prepared only after bank permitted.

In the last stage i.e., third 330 questionnaires distributed among respondents (110 from each city by convenience) total of 228 were returned.

4.2 Research Limitations

- Employees not really have free time to give response in their schedule.
- Employees feels timid to respond on the top management
- Subject under study is nor familiar and comprehensible to some of the Employees.

5 Data Analysis & Results

Table 1. Case Processing Summary

		N	%
Cases	Valid	228	100
	Excluded[a]	0	0
	Total	228	100

a. List wise deletion based on all variables in procedure.

Table 2. Reliability Statistics

Cronbach's Alpha	N of Items
.917	24

The internal consistency of the questionnaire of 24 questions with a value of the Cronbach's Alpha is .930, which shows that data is 91.7 % reliable.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.871
Bartlett's Test of Sphericity	Approx. Chi-Square	2277.453
	Df	171
	Sig.	.000

A test is conducted using KMO- Bartlett‘s in order to find the eligibility of data before going to the factor analysis. This normality of multivariate and sampling adequacy is measured by this test among variables. The value of KMO in the present study is 0.71> 0.5 that indicates the taken sample is adequate. The normality of multivariate among the variables indicated by Bartlett's Test on Sphericity value is 0.000 < 0.05. So the analysis on factors is considered as appropriate method for further data analysis.

Table 4. Total Variance Explained

Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	7.231	38.060	38.060	7.231	38.060	38.060	3.582	18.853	18.853
2	2.337	12.298	50.359	2.337	12.298	50.359	3.327	17.509	36.363
3	1.354	7.128	57.487	1.354	7.128	57.487	2.397	12.618	48.980
4	1.218	6.413	63.900	1.218	6.413	63.900	1.990	10.472	59.452
5	1.042	5.484	69.384	1.042	5.484	69.384	1.887	9.932	69.384
6	.798	4.203	73.587						
7	.768	4.040	77.627						
8	.580	3.053	80.680						
9	.517	2.722	83.402						
10	.464	2.443	85.845						
11	.456	2.402	88.248						
12	.389	2.049	90.297						
13	.350	1.845	92.142						
14	.318	1.674	93.816						
15	.297	1.564	95.380						
16	.279	1.471	96.851						
17	.230	1.213	98.064						
18	.197	1.035	99.099						

19	.171	.901	100.000						

Extraction Method: Principal Component Analysis.

As per the Varimax Rotation along with Kaiser Normalization, there are 8 factors extracted. Every factor is contains of all variables that may have factor loadings higher than 0.5. Five factors are clubbed by 19 variables. These factors which are clubbed are useful in study. These factors explain 69.384 % of variability.

Table 5. Rotated Component Matrix of employees' opinion on Determinants factors of HRIS

Factor No	Variable Covered	Factor Loading Value	Name of the Factor
1	Top Management is enthusiastic to experiment a newinformation system.	.833	Human Resources Factor
	There must need of minimum one computer operator in the department of human resources.	.781	
	Senior executives often risk doing things differently.	.779	
	Senior executives are enthusiastic to testing a newinformation system.	.744	
	The organization has sufficient software and databaseresources to support HRIS.	.593	
2	HRIS application Adoption is compatible with existing practices.	.853	Technological Factor
	HRIS applications are consistent with our organization'svalues and belief.	.790	
	The organization must have a strong plan for backup for network failure.	.756	
	HRIS development is a complex process.	.642	
3	Costs cut are allowed by HRIS in operations.	.879	Organizational Factor
	Top management willingly supports the adoptionof HRIS.	.817	
	It also allows enhancing the productivity.	.566	
4	The overall practices in the pressure of industry to adopt HRIS.	.869	Environmental Factor
	Vendors should provide the HRIS Training.	.709	
	The HRIS benefits are known by Top management.	.635	
5	Adequacy of technical support during and after HRISimplementation.	.798	Security Factor
	The government security of availability and protection influence us to use HRIS.	.765	

5.1 One-Way ANOVA

H02: There are no major difference in determining factors in correspond to HRIS in Banking Industry.

- **$H0_{2.1}$**: There are no major difference in human resources factor in correspond with HRIS in Banking Industry

Table 6. Descriptive Statistics of Human Resource Factor across HRIS

Scale	N	Mean	Standard Deviation	Standard Error
Disagree	86	3.17	.689	.074
Neither Disagree nor Agree	38	3.11	.894	.145
Agree	56	4.16	.733	.098
Strongly Agree	48	4.25	.668	.096
Total	**228**	**3.63**	**.898**	**.059**

Table 7. Analysis of variance of Human Resource Factor across HRIS

	Sum of Squares	Df	Mean Square	F	Sig. (P value)
Between Groups	62.536	3	20.845	38.745	.000
Groups	120.516	224	.538		
Total	183.053	227			

In order to analyze some differences in an average value of human resource factor as a dimension of HRIS, One-way ANOVA is used. It was strongly pointed maximum average value is obtained in the dimension of human resource factor is 4.25. Though, other employees shown results are not satisfactory (mean=3.11) i.e., neither agree nor disagree. The test result of One-way ANOVA indicates value of F= 38.745 and significance=0.000 that is less than 0.05 (at 95% confidence level), this shows that there was a particular difference. (See in Table 7) So, null hypothesis

- **$H0_{2.1}$**: There are no major difference in human resources factor in corresponds with HRIS in Banking Industry is rejected. This specifies that there was a major difference in human resource factor in corresponds with HRIS.
- **$H0_{2.2}$**: There was no major difference in technological factor in correspond with HRIS in Banking Industry.

Table 8. Descriptive Statistics of Technological Factor across HRIS

Scale	N	Mean	Standard Deviation	Standard Error
Disagree	45	3.00	.640	.095
Neither Disagree nor Agree	58	3.22	.727	.095
Agree	47	3.70	.931	.136
Strongly Agree	78	4.26	.692	.078
Total	**228**	**3.63**	**.898**	**.059**

Table 9. Analysis of variance of Technological Factor across HRIS

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig. (P value)**
Between Groups	58.265	3	19.422	34.863	.000
Groups	124.788	224	.557		
Total	183.053	227			

In order to analyze some differences in an average value of human resource factor as a dimension of HRIS, One-way ANOVA is used. It was strongly pointed maximum average value is obtained in the dimension of technical factor is 4.25. Though, other employees shown results are not satisfactory (mean=3.00) as disagree. The test result of One-way ANOVA indicates value of F= 38.863 and significance=0.000 that is less than 0.05 (at 95% confidence level), this shows that there was a particular difference. (See in Table 9) So, null hypothesis

- **$H0_{2.2}$**: There are no major difference in technical factor in corresponds with HRIS in Banking Industry is rejected. This specifies that there was a major difference in technical factor in corresponds with HRIS.
- **$H0_{2.3}$**: There was no major difference in inorganizational factor in correspond with HRIS in Banking Industry.

Table 10. Descriptive Statistics of Organizational Factor across HRIS

Scale	**N**	**Mean**	**Standard Deviation**	**Standard Error**
Strongly Disagree	3	3.67	.577	.333
Disagree	63	3.22	.706	.089
Neither Disagree nor Agree	61	3.13	.718	.092
Agree	53	3.89	.824	.113
Strongly Agree	48	4.52	.618	.089
Total	**228**	**3.63**	**.898**	**.059**

Table 11. Analysis of variance of Organizational Factor across HRIS

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig. (P value)**
Between Groups	67.246	4	16.812	32.373	.000
Groups	115.806	223	.519		
Total	183.053	227			

In order to analyze some differences in an average value of organizational factor as a dimension of HRIS, One-way ANOVA is used. It was strongly pointed maximum average value is obtained in the dimension of organizational factor is 4.25. Though, other employees shown results are not satisfactory (mean=3.33) as disagree. The test result of One-way ANOVA indicates value of F= 32.373 and significance=0.000 that is less than 0.05 (at 95%

confidence level), this shows that there was a particular difference. (See in Table 11) So, null hypothesis

- **$H0_{2.3}$:** There are no major difference in environmental factor in corresponds with HRIS in Banking Industry is rejected. This specifies that there was a major difference in environmental factor in corresponds with HRIS.

$H0_{2.4}$: There was no major difference in environmental factor in correspond with HRIS in Banking Industry.

Table 12. Descriptive Statistics of Environmental Factor across HRIS

Scale	N	Mean	Standard Deviation	Standard Error
Strongly Disagree	5	3.80	.837	.374
Disagree	56	3.07	.628	.084
Neither Disagree nor Agree	47	3.40	.901	.131
Agree	60	3.70	.766	.099
Strongly Agree	60	4.25	.856	.111
Total	**228**	**3.63**	**.898**	**.059**

Table 13. Analysis of variance of Environmental Factor across HRIS

	Sum of Squares	Df	Mean Square	F	Sig. (P value)
Between Groups	43.369	4	10.842	17.309	.000
Groups	139.683	223	.626		
Total	183.053	227			

In order to analyze some differences in an average value of organizational factor as a dimension of HRIS, One-way ANOVA is used. It was strongly pointed maximum average value is obtained in the dimension of organizational factor is 4.25. Though, other employees shown results are not satisfactory (mean=3.07) as disagree. The test result of One-way ANOVA indicates value of F= 17.309 and significance=0.000 that is less than 0.05 (at 95% confidence level), this shows that there was a particular difference. (See in Table 13) So, null hypothesis

- **$H0_{2.4}$:** There are no major difference in security factor in corresponds with HRIS in Banking Industry is rejected. This specifies that there was a major difference insecurity factor in corresponds with HRIS..
- **$H0_{2.5}$:** There was no major difference in security factor in correspond with HRIS in Banking Industry.

Table 14. Descriptive Statistics of Security Factor across HRIS

Scale	N	Mean	Standard Deviation	Standard Error
Strongly Disagree	3	4.00	.000	.000

Disagree	56	3.11	.779	.104
Neither Disagree nor Agree	54	3.41	.790	.107
Agree	60	3.82	.873	.113
Strongly Agree	55	4.16	.811	.109
Total	**228**	**3.63**	**.898**	**.059**

Table 15. Analysis of variance of Security Factor across HRIS

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig. (P value)**
Between Groups	36.148	4	9.037	13.718	.000
Groups	146.905	223	.659		
Total	183.053	227			

In order to analyze some differences in an average value of organizational factor as a dimension of HRIS, One-way ANOVA is used. It was strongly pointed maximum average value is obtained in the dimension of organizational factor is 4.25. Though, other employees shown results are not satisfactory (mean=3.11) as disagree. The test result of One-way ANOVA indicates value of F= 13.718 and significance=0.000 that is less than 0.05 (at 95% confidence level), this shows that there was a particular difference. (See in Table 15) So, null hypothesis

$H0_{2.5}$: There are no major difference in security factor in corresponds with HRIS in Banking Industry is rejected. This specifies that there was a major difference in security factor in corresponds with HRIS.

6 Conclusion

The study investigated the significant difference between determining factors across HRIS of the bank employees concluded that human resource, technological, organizational, and environmental and security factors significantly difference with HIRS of bank employees.

References

[1] Awazu, Y. & Desouza, K. C. (2003). Knowledge Management. HR Magazine, 48(11), 107. Ball, K. S. (2001). The Use of Human Resource Information Systems: a Survey. Personnel Review, 30(6), 667- 693

[2] Brown, D. (2002). EHR – Victim of Unrealistic Expectations. Canadian HR Reporter, 15(16), 1-6.

[3] Dessler, G. (1999). How to earn employee's commitment. Academy of management executive, 13(2), pp. 58–66.

[4] Ruel, H. J. M., Bondarouk, T., & Looise, J. C. (2004). E-HRM: Innovation or irritation. An explorative empirical study in five large companies on web-based HRM. Management revue, 15(3), 364-380.
[5] Parry, M.L., Lowe, J.A. and Hanson, C. (2009). 'Overshoot, Adapt and Recover', Nature 258(7242), pp1102–1103.
[6] Beadles, N., Lowery, C. M., & Johns, K. (2005). The impact of human resource information systems: An exploratory study in the public sector. Communications of Indian Institute of Management. 5(4), 39-46.
[7] Obeidat, "The relationship between Human Resource Information System Functions and Human resource management Functionalities", Journal of Management Research, ISSN 1941-899X, 2012, Vol. 4, No. 4, ISSN 1941-899X , 2012, Vol. 4, No. 4
[8] Kovach, K. A., A. A. Hughes, P. Fagan, & P. G. Maggitti (2002). Administrative & strategic advantages of HRIS, Employment Relations Today, Summer, 43-48 http://dx.doi.org/10.1002/ert.10039
[9] Boateng, A., Qian, W., & Tianle, Y. (2007). Cross-border M&As by Chinese firms: An analysis of strategic motives and performance. Thunderbird international business review, 50, 259-270.
[10] Troshani, I., Jerram, C., & Rao, S. (2011). Exploring the public sector adoption of HRIS. Industrial Management and Data Systems, 111(3), 470-488.
[11] Karim, Z. and Rahman, Md. H A. (2018). Practices of Human Resource Information Systems: A Study on Some Private Business Enterprises in Bangladesh. Global Journal of Management and Business Research. Vol. 18, Issue 11.
[12] Bhuiyan, F., Rahman, M. M., & Gani, M. O. (2014). Impact of Human Resource Information Systems on Firms Financial Performance. International Journal of Business and Management, 10(10), 171-185. https://doi.org/10.5539/ijbm.v10n10p171
[13] Reference: Gupta A, et al. (2013) Telomere length homeostasis responds to changes in intracellular dNTP pools. Genetics 193(4):1095-105
[14] Shammy, Shiri (2012) Effectiveness of Human Resource Information System on HR Functions of the Organization:A Cross Sectional Study. US - China Education Review . 830 -839. ISSN 1548 – 6613
[15] Troshani, I., C.Jerram and S. Rao Hill, 2010, "EDxploring the public sector adaption of HRIS", Ind. Manage. Data. Syst., 111:470-488.

Best Practices for Employees' Workplace Health and Safety: Mediating Role of Organizational Culture

Shadrach OMOFOWA[1], Rita Omon AKHIDUE-OGOGO [2], Chijioke NWACHUKWU[3], Trung Minh LAM [4]
{shadrachomofowa@gmail.com[1], ritaomon2002@yahoo.com[2], cesogwa.nwachukwu@huparis.eu[3], trung.lm@vlu.edu.vn[4]}

[1] Global Business School, [2]University of Benin, Nigeria. [3]Horizons University Paris and Department of Financial Technologies, South Ural State University Chelyabinsk, Russia. [4] Corresponding Author. Lecturer, Faculty of Business Administration, Van Lang University, Vietnam

Abstract. To sustain the competitive edge, competent Human Force are required both at present and in the future and to achieve that, best practices are in reconciling the need of the employees in terms of health, and safety in workplaces in an organization. This study examines best practices, employee's occupational health and safety and the mediating role of organisational culture in a glass manufacturing company. The study uses responses from 350 employees of BETA Glass Company in Nigeria relying on regression analysis techniques and PLS structural equation modelling to test four hypotheses. This study validates the assumptions that training and development dimension of best practices positively impacts employee's health and safety in the workplace. This study affirms that leadership quality dimension of best practices fosters employee's health and safety in the workplace. Further, safe work procedures a dimension of best practices promote employee's health and safety in the workplace. Similarly, the result suggests that organisation culture mediates the relationship between best practices and employee's health and safety in the workplace. We, therefore, conclude that the relationship between best practices and employee's health and safety in the workplace is both linear and indirect..

Keywords: leadership quality, organisational culture, safe work procedures, training and development. **JEL:**M0, M10, M53

1 Introduction

Organisations that aspire to sustain their competitive edge, both at present and in the future require competent Human Force (Employees). More so, 21st-century challenges call for employees that are well equipped with recent techniques and technologies. Despite the application of technology in the modern business organisations, human resources are still relevant and most adaptive resources of the organisation (Hoang, Vu & Ngo, 2020). Today's organisation is faced with several demands such as recruitment, and selection criteria (e.g. Ekwaoba, Ikeije & Infoma, 2015), managing unethical behaviour (e.g. Cremer & Vandekerckhove, 2017), sustaining employee commitment to strategy implementation (e.g. Nwachukwu, Žufan & Chládková, 2020), job environment, ensuring customers satisfaction (Nwachukwu, Žufan & Chládková, 2020), achieving superior organisational performance (e.g. Salau, Adeniji & Oyewunmi, 2014), investigating favouritism, (Alwerthan, 2016), technical

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and behavioural competence and performance evaluation (Albino, 2018), nepotism, cronyism and favouritism (Shabbir & Siddique, 2017), inclusive leadership, workplace spirituality organisational commitment and organisation citizenship behaviour (Utami, Sapta, Verawati & Astakoni, 2021; Tran & Choi, 2019), strategic leadership and business sustainability (Vu &Nwachukwu, 2020), role ambiguity, competency and person-job fit (June & Mahmood, 2011) and individual and social factors affecting occupational Accidents (Barkhordari, Malmif & Malakontikhah, 2019). The strategic value of best practice application stems from the fact that managers are endowed with discretionary decision-making power which can be exercised in health upliftment of the employees. The whole essences of best practices in an organisation are in reconciling the need of the employees in terms of health, and safety in workplaces. Although management focus towards best practices has increased of late, management literature reveals a relatively limited study on best practices and employee's health and safety at the workplace. Yet, there is more to understand in terms of how contextual factors such as organisational culture empowers or restrict the relationship between best practices and employee's health and safety in the workplace. Few efforts examining its implementation on employees health and safety measures in workplace focused on the general characteristics and the impact of occupational health and safety measures on employees' performance (e.g. Gbadago, Amedone & Honyenuga, 2017, Gaceri, 2005, Lorincova, 2015), analysis of individual, leadership and supervisor support as social factors affecting employee faith and safety at the workplace (Barkhordari, Malmir, & Malakoutikhah, 2019, Molnar et al., 2019, Yanar, Lay & Smith, 2019) and organisational culture in leadership (Xue, 2019). Other scholars examined integrated Best practices with other extrinsic cues (e.g., Corporate governance, ethical leadership, employees' creativity, corporate social responsibility, ethical organisational culture, the business judgment rule and Human rights) and employees safety measure and management policies (Ozuomba, Onyemaechi & Ikpeazu, 2016, Elqassaby, 2018, Selcuk, 2019, Debode, Avmenakis, Field & Walker, 2013, Wilson, 2013). Other Best practices – related research includes studies measuring best practices for workplace safety, health and wellbeing (Jonathan & Mbogo, 2016, Sorensen et al., 2019), organisational ethical culture and whistleblowing (FArooqi, Abid & Ahmed, 2017), ethical leadership and injury management (Taufek, Zuikifle & Abdulkadiri, 2015, Oketunji, 2014, Khan & Javed, 2018, Alshammari, Almutairi & Thuwalnl, 2015). Despite several studies on the subject, both conceptual and contextual gap exists. The understanding and application of best practices, leadership, training and development of employee's and safe work procedures vary across nations, continents, and regions. The present study attempt to narrow this knowledge gap. The objective of this paper is to contribute to the management literature by examining the impact of the implementation of Best practices (leadership, training and development for newly employed staff, safe work procedures) on employees' health and safety. Second, ascertain whether organisational culture mediates the relationship between Best practices and employee's occupational health and safety measures.

2 LiteratureReview

2.1 Theoretical Perspective

Beer's concept of human resource management and the integration of agency and system concept of safe lifestyle are included in this research. Beer's human resource management

framework suggests that the job system has long-term implications for employers' or employees' health, in addition to affecting loyalty, competency, cost-effectiveness, and congruence. There is proof that the way people function has an effect on their physical and emotional health, as well as the length of their lives. Employees and their dependents struggle and lose money as a result of ill-health and accidents sustained by the work system or working conditions.Managers and supervisors must serve as role models (ensure best practices measures) for the safety programs. The convergence of agency and structure theory of healthy lifestyle was established by William Cockerham in 2005. This theory incorporates the concepts of agency and structure to show that in today's society, not everybody has the same opportunity to be well. It uses the term agency to correspond to a person's right to choose their behaviour and to emphasise that there may be other choices that the person does not choose. The Cockerham agency structure theory of healthy lifestyles shows that merely wanting to be healthy isn't always enough; personal improvements will, without a doubt, make an individual healthier. These theories are appropriate to explain that day-day activities, jobs and behaviors are empowered or constrained by social-physical environment factors. It reveals that the actions or behaviors of employees determines their health status which can as well affect their productivity at the workplace.

2.2 An Overview of Employees' Workplace Health and Safety Measures

The concern for health and safety has been there in history. Early researchers were concerned about the theoretical insight into employees' health and safety. Surveys which have been done later focused on the importance of legislation. According to Linhard (2005), firms focus their attention on occupational health and safety performance because of its potential for influencing productivity and workplace health and safety. Indeed, employee's health and safety awareness call for implementing best practices to address the problems of economic cost, performance, training and development, leadership qualities and safe working procedures in an organization. Employees are protected from hazards in the workplace by company healthcare and regulations on occupational health and safety practises. This requires adherence to safety guidelines, responsiveness to health and safety concerns, safety communication procedures, hazard detection and prevention, and reimbursement to workers in the event of permanent disability.The effectiveness of an occupational health and safety management system is influenced by employee engagement. This system is made up of a number of processes and mechanisms that encourage workers to participate in decision-making in both direct and indirect ways (Pavolowska, 2013). The active involvement of workers is emphasized as a crucial element in enhancing safety efficiency in the occupational health and safety management system model (Walters & Frick, 2000). Employee involvement in an occupational health and safety management system is intended to eliminate workplace accidents and increase employee health.The active involvement of workers is emphasised as a crucial element in enhancing safety efficiency in the occupational health and safety management system model (Walters & Frick, 2000). Enforcement of regulations is very vital in ensuring the efficacy of regulations. Idubor and Osiamoje (2013) opine that regulation without proper enforcement is tantamount to no laws. They go on to say that a lack of strict implementation of workplace safety and health laws encourages non-compliance. Occupants in factories are normally required to register their workplaces. Workplace safety and health laws and bills have been in place in Nigeria since the 1974 Labor Act and the passing of the labour, defence, health, and welfare bill in 2012.The factories Act of 1987 (now identified as the factory Act of 1990), which Kalejaiye (2013) defines as a significant updating of the

factory Act of 1958, the workman's compensation Act of 1987, the labour Act of 1990, the workman's compensation Act of 2004, and the workers' compensation Act of 2011 (which repeals the workman's compensation Act of 2004) were all passed around this period.The factory Act of 1987, for example, excludes the building industry from the scope of its premises (Idoro 2008, 2011, Diugwu, Baba, & Egila 2012), leaving the industry unregulated. According to Idubor and Osiamoje (2013) and Okojie (2010), the severity of penalties stipulated by Nigerian workplace safety and health laws are negligible since criminals are not detained. Thankfully, the new bill (the labour, safety, health, and welfare law of 2011), which stipulates strict penalties for violations, fixes all of the above concerns. It includes both Nigeria's formal and informal manufacturing sectors.The proposed bill aims to repeal the Factory Act and replace it with robust worker safety and health regulations.

2.3 Training and Development

Managers play a critical role in assisting workers in their learning and development within a company. To achieve this, managers must coach, guide and support employees. Training and development as well as a conducive work environment promote employee satisfaction and productivity in the workplace (Nwachukwu, Žufan & Chládková, 2020). Employee preparation, it is argued, would enable them to be more efficient and provide a better working atmosphere. To do so, workers must go through orientation training, which introduces them to workplace specifications and how to complete delegated tasks. According to Ali, Abdullah, and Subramaniam (2009), the ineffectiveness of safety preparation would lead to a rise in workplace accidents and injuries. Safety preparation is intended to protect both staff and company property from physical injury. This require physical precautions like how to keep factories, computers, appliance machinery, and houses in good working order.Torrington, Hall and Taylor, (2005) opine that safety training should inform employees about the nature of the hazard at the workplace, the safety rules and procedures in case of emergency and the need to enforce compliance to these rules. Safety training needs to be done during induction, on the job and in refresher courses. Lectures, discussions, films, role-playing, and slides are some of the teaching methods that can be used. Posters, safety advertising programs and correspondence, and corrective procedures for violations of safety codes should be used to complement these approaches. Employees, it is arguable, should be educated on essential safety precautions that could help reduce the effects of threat exposure or accident risk. Workplace protocols and practices, as well as occupational health and safety training and encouragement, are examples of these preventive interventions. Occupational health and safety programs and protocols are implemented at the workplace level to shield workers from hazard exposure and workplace harm.

2.4 Leadership Quality

The method of motivating workers to do their best in order to accomplish the desired outcome is known as leadership. It's also known as the power to convince people to change their minds. The defence, wellness, and well-being of workers was clearly prioritised by leadership around the board. Leadership encourages prosocial behaviour and helps businesses succeed (Salim & Rajput, 2021). Managers have the tools and atmosphere required to foster a positive working environment. To ensure workers' safety, fitness, and well-being, leaders must have the tools required to enforce best practises.Establishing responsibility for the execution of appropriate policies and practises, as well as efficiently communicating these goals through

formal and informal networks. Leaders that lead by example and demonstrate commitment to maintaining health and safety measures perform higher (O'Brien, 2001). Via coordination with labour or workplace councils, management/leadership can include employees in health and safety issues. Employees will be aware of the rules that extend to them and will be able to respond to policy violations as a result of this (Kaplan, 2009).Where labour unions are recognised, leaders can meet with them together on health and safety issues, regardless of whether the unions are recognised.

2.5 Safe Work Procedures

A warning about the possible effects of deviation is included in safe job procedures. They are designed to outline the actions to take in order to complete a mission without risking injuries or sickness. Safe work procedure provides important and consistent information to employees of what is expected of them from a safety perspective. Implementing workplace safety and health at work effectively will increase working conditions. Occupational health and safety prevention is one of the management's practises for preventing workplace accidents and injury. Employees must perform an occupational hazard report to assess whether certain risks necessitate the use of PPE (PPE). Employees are more motivated to perform activities in a hostile environment while they are wearing personal protective gear, which leads to better results and efficiency.Furthermore, failing to use personal safety devices is a risky procedure that can result in injury. According to Fernandez Monies, Montes-peon, and Vazquez (2009), procedures, strategies, and interventions will help employees and businesses avoid injuries. According to Gopang, Nebhwan, Khatri, and Marri (2017), the availability of a written safety policy document may have an effect on an organization's efficiency. With procedures and activities that include working environments, the organization improves workforce safety, fitness, and well-being.To reduce the number of accidents in the industrial industry, employers should adopt and follow both occupational safety and health standards and procedures. Human errors can sometimes cause accidents and injuries to the employees, but this can be effectively managed with the implementation of robust safety measures by management. Griffins and Nean (2000) contend that injuries or accidents in the workplace may happen when employees ignore safety procedures.

2.6 Organisational Culture as a Mediating Variable

It is important to ensure that best practices measures are incorporated in a structure of the business process and it transformed into the organisational culture. Culture is the ideas, emotions and behaviour that express the social structure of groups of employees and are express by symbols that are created and transmitted (Cram et al., 2017). Organizational culture is related to how employees understand the cultural characteristics of an organisation. Organisational culture represents a common perception of employees of the organisation in otherwise; culture is a system of shared meaning. Culture believes that the collective learns through "external adaptation" and "internal integration" problem-solving (Nurkholis et al., 2020). We reason that the relationship between best practice (leadership, training and development for newly employed staff, safe work procedures) and employees health and safety is not straight forward. Organisational culture interacts with different factors to influence organisational outcomes. Arguably, organisations will need a robust culture to enjoy the benefit of implementing best practices.

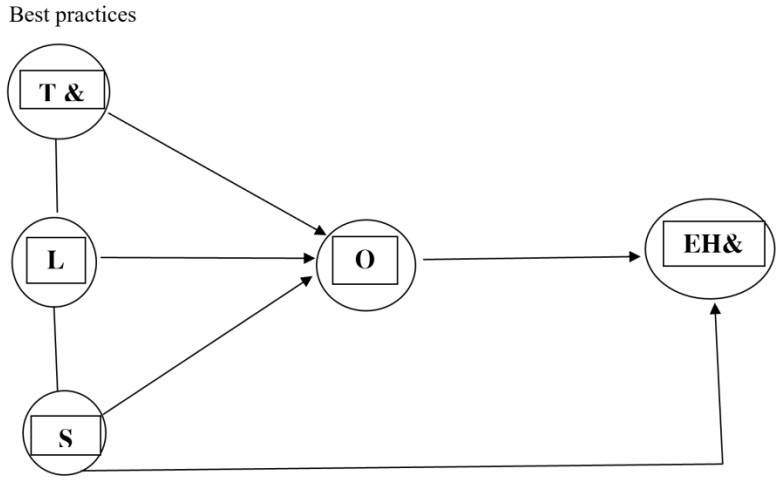
2.7 Empirical Studies

Dwomoh, Owusu and Addo (2013) examine the impact of health and safety policies on employee's performance and safe work procedures in the Ghana timber industry. The study has been employed interviews and questionnaires to collect data from participants. Pearson correlation has been used to assess the relationship between investment in health and safety and employee's performance in safe work procedure. The results suggest that health and safety is positively correlated with employee's performance and safe work procedures. It has been concluded that an organisation needs to pay attention to health and safety measures to enhance employee performance. Jan (2012) submits adherence to health and safety rules and procedures promote employee effectiveness and efficiency resulting in better performance of employees. Chikono (2017) observes that business leaders created a safe work environment, trains and empowers employee with relevant skills. Mashi, Johanim and Subramaniam (2016) examine the relationship between safety training and workers involvement and health care workers safety behaviour. A survey of 229 nurses from Abuja Secondary Health facilities in Nigeria suggests that safety training is positively related to compliance and safety participation. Also, workers involvement positively relates to safety compliance and participation. Extant literature in occupational safety supports the view that safety training is a key factor in maintaining and changing workers attitude towards safety (e.g. Ali, Abdullah & Subramaniam, 2009, Boughaba, Hassane & Ronkia, 2014, Keffane, 2014). Petita, Probst and Barbaranelli (2017) report that bureaucratic safety culture is connected to moral disengagement whereas technocratic safety culture was associated with moral disengagement.

2.8 Conceptual Framework

This study examines the relationship between best practices as a predictor variable (the independent variable) and employees' health and safety measures as then criterion variable (the dependent variable) as shown in the figure (1). The dimensions of best practices in the framework are training and development, leadership quality, and safe work procedures. Organisational culture is playing a mediator role in the model.

Figure 1. Research model showing the relationship between the variables.



Where:T & D = training and development, LQ= leadership quality, SWP= safe work procedures, EH &S= employees' health and safety, OC = organisational culture.

2.9 Research Hypothesis

The following research hypotheses were stated in the Null form, and they are to determine if there is any significant relationship between each dimension of best practices and employees' health and safety measures in the workplace.

$H0_1$: There is no significant relationship between training and development and employees' health and safety measures in workplace.

$H0_2$: There is no significant relationship between leadership quality and employees' health and safety measures in workplace.

$H0_3$: there is no significant relationship between safe work procedure and employees' health and safety measures in workplace.

$H0_4$: Organisational culture does not significantly mediate the relationship between Best practice and employee's occupational health and safety.

3 Methodology

This section outlines the methodology employed in the study. It went through the target population, sample size, data collection processes, and then a rundown of data processing and presentation techniques. The study's key goal is to look at the impact of best practises policies on employee health and safety in the workplace, as well as the mediating influence of organisational culture, in a manufacturing firm in Ughelli, Delta State (Beta Glass Company Plc, Ughelli).

3.1. Research Questions

The following analysis questions directed the investigation.

- To what extent do training and development affect employees' health and safety measures in a manufacturing company?
- To what extent does leadership quality affect employees' health and safety measures in a manufacturing company?
- To what extent do safe work procedures influence employees' health and safety measures in a manufacturing company?
- Does organisational culture mediate the relationship between best practice and employee occupational health and safety measures in a manufacturing company?

3.2. Research Design

The authors used case study survey research approach. The target population is all employees of BETA GLASS company in Ughelli in Delta State of Nigeria. The Glass company was of interest because it is considered as one of the biggest employers of labour in the industry. The total population of the study is 2850 staffs of Beta Glass Company, Ughelli.

3.3. Sample Size and Sampling Technique

The sample size of study was determined by the use of TARO YAMANE formula

$$n = \frac{N}{1+N(e)^2}$$

Where: n= sample size, N = population of study and e = error margin (5%)

$$n = \frac{2850}{1+2850(0.05)^2}$$

$$n = \frac{2850}{1+2850(0.0025)}$$

$$n = \frac{2850}{1+7.125}$$

$$n = \frac{2850}{8.125}$$

$$n = 350$$

The sample size is 350. Hence, 350 copies of questionnaire were administered to employees of the various departments. The questionnaires were randomly distributed to participants.

3.4. Research Instrument/ Questionnaires Design

The respondents were asked to evaluate the impact of best practises on employee wellbeing and safety at work.We used structured questionnaires to elicit information from respondents. Primary data was obtained through self-administered Questionnaires. The structured questionnaires were divided into three sections; section A sought information on demographic variables, B asked questions relating to Best practices, while C elicits information about employees' health and safety. A five (5) point Likert scale was employed ranging from ''strongly agree 5 to strongly disagree 1''.

3.5. Validity and Reliability of the Instrument

To ensure the validity of the questionnaires, we developed it following the literature review. A draft of the questionnaires was sent to senior academics in the field of management to evaluate how well the questions asked affirms the review of the related literature. The term "reliability" refers to calculations of how free a measurement is from random or unsuitable error (Cooper & Schindler, 2003). We conducted a pilot test using 20 copies of the questionnaires. Data analysis method employed involved quantitative procedures. Data were analysed using both descriptive and inferential statistical methods. Ordinary least square (OLS) regression and canonical correlation analysis were done PLS structural equation modelling was used to evaluate the mediating role of organisational culture. The study used STATA version 13.0 software for data analysis.

3.6. Model Specification

Employees' health and safety measures in workplace = f (Best Practices)

$EHW = f(BESP)$ …… Equation 1

$BESP = (TDEV, LQLT, SWPR)$ ……..…….…. Equation 2

Equation (1) and (2) is expanded as follows:

Model: EOHW = α0 + β1TDEV+ β2LQLT+ β3SWPR+ Ui ……..Equation 3
Where:
BESP = Best Practices
TDEV = Training and Development
LQLT = Leadership Qualities
SWPR = Safe Work Procedure
ORGC = Organisational Culture
EOHW = Employees' health and safety measures in workplace
Ui = Stochastic Variables
B1 – βn = Coefficients of Regression
α0 = The Intercept

4 Results

4.1. Results.

Table 1 indicates that the structures have a maximal value of 5, showing that all of the questions were answered with clear agreement at some stage. The average response is 4 (Agree), indicating that the respondent agrees with the questions.

Table 1. Descriptive statistics

stats	tdev	lqlt	swpr	orgc	eohw
mean	4.277143	4.285714	4.345714	4.311429	4.291429
p50	4	4	4	4	4
max	5	5	5	5	5
min	3	3	3	3	3
N	350	350	350	350	350

Source: Authors 2020

The result in table 2 suggests that training and development (r = 0.630), leadership quality (r = 0.669), safe work procedures (r = 0.587), and organisational culture (r = 0.433) are positively correlated with employees' occupational health and safety. This implies that both the dependent and independent variable move in the same direction. Thus, as the company implement best practices employees' health and safety in the workplace will improve.

Table 2. Correlation Result

	tdev	lqlt	swpr	orgc	eohw
tdev	1.0000				
lqlt	0.6564	1.0000			
swpr	0.5181	0.5282	1.0000		
orgc	0.4616	0.4554	0.4636	1.0000	
eohw	0.6301	0.6693	0.5875	0.4334	1.0000

Source: Authors 2020

Table 3. Multiple Regression

Source	SS	df	MS		
Model	67.1607545	3	22.3869182	Number of obs	350
Residual	53.1135313	346	.153507316	F(3, 346)	145.84
Total	120.274286	349	.34462546	Prob > F	0.0000
				R-squared	0.5584
				Adj R-squared	0.5546
				Root MSE	.3918

eohw	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
tdev	.2559609	.0491772	5.20	0.000	.159237	.3526849
lqlt	.3696317	.0505323	7.31	0.000	.2702425	.4690208
swpr	.2671226	.0442412	6.04	0.000	.1801072	.354138
_cons	.4516727	.1860604	2.43	0.016	.0857208	.8176246

Source: Authors 2020

Table 4. PLS-SEM

(1) [tdev]BESP = 1

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
orgc <-						
BESP	.7888979	.0764375	10.32	0.000	.6390831	.9387126
_cons	4.311429	.0332037	129.85	0.000	4.246351	4.376507
eohw <-						
orgc	.4089784	.0454595	9.00	0.000	.3198794	.4980774
_cons	2.528147	.1980194	12.77	0.000	2.140037	2.916258
Measurement						
tdev <-						
BESP	1	(constrained)				
_cons	4.277143	.0313137	136.59	0.000	4.215769	4.338517
lqlt <-						
BESP	.9854927	.0708515	13.91	0.000	.8466264	1.124359
_cons	4.285714	.0306965	139.62	0.000	4.22555	4.345878
swpr <-						
BESP	.8280794	.0713672	11.60	0.000	.6882022	.9679565
_cons	4.345714	.030927	140.52	0.000	4.285099	4.40633
var(e.tdev)	.1241111	.0151839			.0976504	.1577421
var(e.lqlt)	.1170257	.0145688			.0916882	.149365
var(e.swpr)	.1845403	.0170341			.154	.2211373
var(e.orgc)	.2495224	.0214303			.2108647	.2952671
var(e.eohw)	.279099	.0210979			.2406653	.3236705
var(BESP)	.2190807	.026973			.1721096	.2788708

LR test of model vs. saturated: chi2(5) = 220.47, Prob > chi2 = 0.0000

Source: Authors 2020

4.2. Discussion.

The modified R-squared value of 0.55 in the multiple regression findings in table 3 indicates that best practises clarified 55 percent of the systemic differences in workers' health and safety policies in the workplace. The multiple regression analysis is statistically important on the whole, with an F-statistic of 145.8 and a P-value of 0.000. Furthermore, the regression findings in Table 3 indicate that preparation and growth (B = 0.2559, P = 0.000) has a significant association with occupational health and safety in the workplace (B = 0.2559, P =

0.000). The null hypothesis was shown to be false, while the alternative hypothesis was found to be true (H1).This supports the works of (Mashi, Johanim & Subramaniam, 2016; Ali et al., 2009; Boughaba et al., 2014; Keffane, 2014). In their submission that training is usually used as a key requirement for compliance and participation to achieve optimal safe working environment and to improve employee competence.There is a significant association between leadership efficiency and workers' health and safety policies in the workplace (= 0.3696, p = 0.011). As a result, the null hypothesis (Ho) was dismissed, while the alternative hypothesis (H2) was adopted, meaning that there is a substantial connection between leadership efficiency and workplace occupational health and safety policies. This is in line with Chikono (2017), who claims that corporate leaders should promote a healthy work atmosphere by preparing the work to be done, how the mission will be completed, and when it will be completed.Preventing social and environmental damage in the workplace improves employees' wellbeing and standard of living (Ho, Vu & Vu, 2020). Training empowers and equips employee with relevant skills. Safe work procedure ($\beta = 0.2671$, $p = 0.000$) indicates that there exists a significant relationship between safe work procedure and employees' health and safety measures in the workplace. As a result, the null hypothesis (Ho) was dismissed and the alternative hypothesis (H3) was adopted, suggesting that there is a substantial connection between healthy work procedures and occupational health and safety policies.This backs up the claims made by Dwomoh, Owusu, and Addo (2013) and Jan (2012) that if employees understand the health and safety laws, procedures, and equipment used in operations, they can function more efficiently, resulting in improved results. Additionally, as workers are kept safe at work, they feel respected. This allows workers to achieve corporate excellence by doing very well on the job.The mediating impact of organizational culture was investigated using PLS Structure equation modeling (PLS-SEM). The route analysis results in figure 2 and table 4 reveal that organizational culture mediates the relationship between best practices and workers' health and safety policies at work. As a result, the null hypothesis (Ho) was dismissed, while the alternative hypothesis (H4) was adopted, meaning that organizational culture mediates the interaction between best practices and workers' occupational health and safety policies.This backs up Petitta, Probst, and Barbaranelli's (2017) claim that a positive safety culture is linked to better safety results. This link is optimistic, indicating that a more positive safety atmosphere is linked to better safety results. These findings suggest that there is a direct and indirect connection between best practices and workplace occupational health and safety.

5 Conclusion

The aim of this research was to determine the effect of best practices on employee health and safety in the workplace. It's fascinating to learn that in Nigeria, best practices foster employee health and safety at work. The implications of adopting Best practices in terms of their positive effect on protecting and fostering workplace protection, welfare, and wellness are becoming increasingly clear. For employee health and safety in the workplace, best practices such as preparation and growth, healthy job processes, and leadership efficiency in terms of supervising positions of managers are critical.This highlights the importance of emphasizing Best practices in healthy and safety in the workplace. Organizations must implement innovative plans and strategies to achieve competitive edge (Nwachukwu, Žufan & Chládková, 2020). In this context, companies can accomplish their strategic objectives by

adopting innovative ideas to ensure health and safety of employees. The study concluded that Best practices protect, preserve the health and safety of employees of Beta Glass Industry, a manufacturing company in Delta State to a large extent. Training and development, safe work procedure and leadership quality can result in an improvement in health and safety measures at the workplace. Managers need to share information, skills with employees, create an individualised relationship with employees in health and safety. It is believed that providing greater autonomy to employees on health and safety matters will add value to the company.

In terms of the recommendation, given the stated findings and conclusions, the authors propose the following suggestions that could assist managers to implement Best practices that will enhance employee's health and safety measures in the workplace:

- Employees training and development activity should be used to identify knowledge, skills and competency deficit in an organisation to improve and comply with regulations guiding employees at work.
- Manufacturing firms should give attention to health and safety issues.
- Manufacturing firms must ensure financial and non-financial reward packages in employees who might be disabled due to accident or fire outbreak in their line of duty.
- Manufacturing firm must ensure that organisational culture must be binding on all employees, both contract and permanent staffs in hospitality, treating and dispensing of drugs and protective equipment to workers.

As for the managerial implications, the outcome of the present study will be useful for manufacturing industry managers as they search for ways to improve best practice measures and minimise the occurrence of hazards and mishap in organisations. The study informs employees, managers, governmental agencies, human right activist and the society in general. Knowledge of such information will facilitate a better understanding of best practices that promote employee health and safety and implement them accordingly. Indeed, this study defines how best practice flows in the manufacturing sector in Nigeria. The study contributes to the management literature by highlighting how the implementation of Best practices foster employee's health and safety in the workplace. Finally, the study suggests that the relationship between best practices and employees' health and safety in the workplace is both straight forward and indirect.

Also, there are some limitations and suggestions for future study. While our findings may be limited to the context examined, that is a single case study. Nevertheless, the present study enriches scholarship on management and employee wellbeing. Further study should examine the subject by using data from more companies in different geographical contexts. Scholars can introduce other contextual factors or organisational characteristics to determine if the result will be different from the present study.

References

[1] Albino. G. (2018). Technical and Behavioural competencies on performance evaluation: Petrek leaders perspectives. Sage open, April-June, 1-12

[2] Ali, H., Abdullah, N. A & Subramaniam, C. (2009) Management Practices in Safety Culture and its Influence on Workplace Injury an Industry in Malaysia. Disaster Prevention and Management, 18(5), 470-477.

[3] Alshammari, A., Almutairi, N. &Thuwaini, S. (2015). Ethical leadership the effect on employees International Journal of Business and Management, 10(3), 108-116.

[4] AlwerThan, T. A. (2016). Investigating favouritism from a psychological lens. The Journal of Values-Based leadership, 9(2), 1-10.

[5] Barkhordari, A., Malmir, B.& Malakoutikhah, M. (2019). An Analysis of individual and social factors affecting occupational Accidents. Safety and health at work, 10(2), 205-212.

[6] Boughaba, A, Hassane, C, & Roukia, O. (2014). Safety culture assessment in petrochemical industry: a comparative study of two algebraic plants. Safety and Health at Work, 5(2), 60-65.
[7] Chikono, N. N. (2017). Leadership practices that improve the workplace safety environment. Walden university scholars works. Walden dissertation and doctoral studies collections.
[8] Cockerham, W. C. (2005). Health lifestyle theory and the convergence of agency and structure. Journal of Health and Social Behaviour, 461(6), 46-105.
[9] Cooper, D. R. & Schindler, P. S. (2003). Business Research Methods (8th eds). USA: McGraw-Hill.
[10] Cram, W. A., Proudfoot, J. G., & D'arcy, J. (2017). Organizational information security policies: a review and research framework. European Journal of Information Systems, 26(6), 605–641.
[11] Cremer, D. D.& Van Dekerckhove, W. (2017) managing unethical behaviour in organizational the need for a behavioral business ethics approach. Journal of Management and Organisational, 23(3), 437-455.
[12] Debode, N. D., Armenakis, A. A., Field, H.& Walker, A. G. (2013). Assessing ethical organizational culture: refinement of scale. This Journal of Applied Behaviour Science, 49(4), 460 – 484.
[13] Diugwu, I. A., Baba, D. L.& Egila, A. E. (2012). Effective Regulation and Level of Awareness and Expose of the Nigerian Construction Industry, Open Journal of Safety Science and Technology2, 140-146
[14] Dwomoh, G, Owusu, E. E.& Addo, M. (2013). Impact of occupational health and safety policies on employees' performance in the Ghana Timber industry. Evidence from Lumber and Logs limited. International Journal of Education and Research, 1(12), 1-14.
[15] Ekwoaba, J. O., Ikeije, U. U.& Ufoma, N. (2015). The impact of recruitment and selection criteria on organisational performance. Global Journal of human resources management, 3(2), 22-33.
[16] Elqassaby, H. K. (2018) The effect of ethical leadership on employees' creativity. International Journal of Economics and Management Science, 7(5), 1-13.
[17] Farooqii, S., Abid, G.& Ahmed, A. (2017). How bad it is to be good: impact of organizational ethical culture on whistleblowing (the ethical partners). Arab Economics and Business Journal, 12(2), 69-80
[18] Fernandex-Miniz, B., Montes-Peon, J. M. & Vazquez-Ordas, C. J. (2014). Safety leadership, risk management and safety performance in Spanish firms. Safety Science70, 295-307.
[19] Gaceri, K. A. (2015). Factor affecting the implementation of health and safety in supermarkets in Kenya. International Journal of Human Resource Studies, 5(2), 223-281.
[20] Gbadago, P., Amedome, S. N.& Honyenuga, B. Q. (2017). The impact of occupational health and safety measures on employees' performance at the South Tongu District hospital. Global Journal of medical research: K Interdisciplinary, 17(5), 13-19.
[21] Gopang, M. A., Nebhwani, M., Khatri, A & Mairi, H. R. (2017). An Assessment of Occupational Health and Safety Measures and Performance of SMEs: An Empirical Investigation. Safety Science93, 127-133.
[22] Griffin, M. A & Neal, A. (2000). Perception of safety at work: a framework for linking safety climate in safety performance, knowledge and motivation. Journal of Occupational Health Psychology, 5(3), 347-58.
[23] Ho, T. T. H., Vu, T. N. P. & Vu, H. M. (2020). Determinants Influencing Consumers Purchasing Intention for Sustainable Fashion: Evidence from Ho Chi Minh City. Journal of Asian Finance, Economics and Business, 7(11), 977–986.
[24] Hoang, L. V., Vu, H. M.& Ngo, V. M (2020). Corporate Social Responsibility and Job Pursuit Intention of Employees in Vietnam. Journal of Asian Finance, Economics and Business, 7(12), 345–353.
[25] Idoro, G. I. (2008). Health and safety management effort as correlate of performance in the Nigeria construction industry. Journal of Civil Engineering and Management, 114(4), 277-285

[26] Idoro, G. I.(2011). Comparing Occupations Health and Safety (OH8) Management Efforts and Performances of Nigeria Construction Contractors. Journal for Construction in Developing Countries, 16(92), 151-173
[27] Idubor E. E. & Osiamoje, M. D. (2013). An exploration of health and safety management issues in Nigeria's Effort to Industrialize. European Scientific Journal, 9(12), 154-169.
[28] Jan, R. (2012). Cost and Benefits of Implementing an Occupational Safety and Health Management System (OSH MS) in Enterprises in Poland. International Journal of Occupational Safety and Ergonomics, 18(2), 181-193.
[29] Jonathan, G. K. & Mobogo, R. W. (2016). Maintaining health and safety at workplace. Journal of Education and Practice, 17(29), 1-7.
[30] June, S. & Mahmood, R. (2011) The relationship between role ambiguity, competency and person-Job fit with the job performance of employees in the service sector SMEs in Malaysia. Business Management Dynamic, I(2), 79-98.
[31] Kalejaiye, P. O. (2013). Occupational health and safety: issues, challenges, and compensation in Nigeria. Peak Journal of Public Health and Management, 1(2), 16-23.
[32] Kaplan, N. (2009). Understanding People ManagementKaplan Business Books, London: Kaplan
[33] Keffane, S. (2014). Communization role in safety management and performances for road safety practices. International Journal of Transportation Science and Technology, 3(1), 79-94
[34] Khan, S. R. & Javed, U. (2018). Revision of ethical leadership scale. Journal of research and reflections in education, 12(2), 121- 135.
[35] Linhard, J. B. (2005). Understanding the return on health safety and environmental Investment. Journal of Safety Research, 36(3), 257-260.
[36] Lorincova, S. (2015). The improvement of the effectiveness in the recruitment process in the Slovak public administration. Procedia Economics and Finance34, 382-389.
[37] Mashi, S, Johanim, J. & Subramaniam, C. (2016). The effects of safety training and workers involvement on healthcare workers safety behaviours: the moderating role of consideration of future safety consequences. International Journal of Business Management, 1(2), 46-81
[38] Molnar, M. M., Schwartz, U.V.T., Hellgrem, J., Hasson, H & Tafuelin, S. (2019). Leading four safety: a question of leadership focus. Safety and Health at Work,10(2) 180-187.
[39] Nurkholis, N., Dularif, M., & Rustiarini, N. W. (2020). Tax evasion and service-trust paradigm: A meta-analysis. Cogent Business & Management, 7(1), 1–20.
[40] Nwachukwu, C., Žufan, P & Chládková, H. (2020). Employee commitment to strategy implementation and strategic performance: organisational policy as moderator. International Journal of Business Excellence, 20(3), 398-418.
[41] O'brien, P. D. (2001). The Safety Officer Concise Desk Reference, London: Lewis Publishers.
[42] Oketunji, S. F. (2014). Influence of occupational health and safety (OHS) information availability and use on job performance of library personal in public universities in South-West Nigeria. European Scientific Journal10, 337 – 350.
[43] Okojie, O. (2010). System for reporting occupational disease in Nigeria: African Newsletter on Occupational Health and Safety, 20(93) 51-53.
[44] Ozuomba, N., Onyemachi, U. & Ikpeazu, N. (2016). Effects of corporate governance on organisational performance: A case study of Nigeria Breweries Plc, Enugu State. International Journal of Management Science and Business Research, 5(11), 1-21.
[45] Petitta L., Probst, T. M. & Barbaranelli, C. (2017). Safety Culture, Moral Disengagement, and Accident Underreporting. Journal of Business Ethics 141, 489–504.
[46] Salau, A. A.& Oyewunmi, A. (2014). Relationship between element of job enrichment and organizational performance among the non-academic staff in Nigeria public universities. Management and Marketing, 11(2), 173-189.
[47] Salim, A. & Rajput, N. A. R. (2021). The Relationship Between Transformational Leadership, Prosocial Behavioral Intentions, and Organizational Performance. Journal of Asian Finance, Economics and Business, 8(1), 487–493.

[48] Shabbir, B. & Siddique, H. (2017). Impact of nepotism, cronyism and favouritism on organisational performance with a strong moderator of Religiosity. International Journal of Scientific and Engineering Research, 8(4), 29-309.
[49] Sorensen, G., Sparer, E., Williams, J. A. R., Gundersen, D., Boden, L. L., Dennerlein, J. T., Hashimoto, D., Kafz, J. N., Mclellani, D., Okechukwu, C. A., Pronk, N. P., Revette, A & Wagner, G. R. (2019). Measuring best practices for workplace safety health and wellbeing: the workplace integrated safety and health assessment. Journal of Occupational and Environmental Medicine, 60(5), 430 – 439.
[50] Taufek, J. H. B. M., Zulkifle, Z. B.& Aldul Kadir, S. Z. B. (2016). Safety and health practice and injury management in manufacturing industry. Procedia Economics and Industry35, 705 – 712.
[51] Torrington, D., Hall, L. & Taylor, S. (2005). Human Resource Management (6th Edition). Financial Times: Prentice Hall – Harlow.
[52] Tran, T. B. H. & Choi, S. B. (2019). Effects of inclusive leadership on organisational citizenship behaviours: the mediating roles of organisational justice and learning culture. Journal of Pacific Rim Psychology, 13(17), 1-11.
[53] Utami, N. M. S., Sapta, K. S., Verawati, Y & Astakoni, M. P. (2021). Relationship between Workplace Spirituality, Organizational Commitment and Organizational Citizenship Behavior. Journal of Asian Finance, Economics and Business, 8(1), 507–517.
[54] Vu, H. M. & Nwachukwu, C. (2020). Human resources, financial resources and strategic performance: Organisational policy as moderator. Quality-Access to Success Journal, 21(175), 18-24.
[55] Walters, D. R & Frick, K. (2000). Workers participation on the management of occupational health and safety reinforcing or conflicting strategies? In K, Frick, L, P, Jesen, M, Quinlan and with Agen Eds, Systematic Occupational Health and Safety Management – Perspectives on an International Development, Pp 43-65, Pergamon Press, Oxfords, Uk.
[56] Wilson, N. (2013) Corporate social responsibility the business judgment rule and human right in Australia- warm inner glow or warming the globe. Monash University Law Review, 38(3), 148-167.
[57] Xue, Y. (2019). The influence of organisational culture on leadership: a case studies of Baidu Corporation, China. Asian Journal of Social Science, 4(4), 86 – 106.
[58] Yanar, B., Lay, M. & Smith, P. M. (2019). The interplay between supervisor safety support and occupational health and safety vulnerability on work injury. Science Direct Oshri, Safety and Health at Work 10, 172-179.

Assessing Supplier-Customer Relationship Management Practice and Business Performance

Chijioke Nwachukwu1, Vu Minh Hieu2*
{cesogwa@yahoo.com[1], hieu.vm@vlu.edu.vn[2]}

[1]Business School, Horizons University Paris, France
[1]Department of Financial Technologies, South Ural State University Chelyabinsk, Russia
[2]*(Corresponding author) Faculty of Business Administration, Van Lang University, Vietnam

Abstract. The To remain competitive firms must develop and implement strategies to attract and retain key suppliers and customers. Drawing on transaction cost economics (TCE) and social exchange theory (SET), this study shed light on the link between supplier relationship management (SRM) practices, customer relationship management (CRM) practices and business performance. The paper uses surveys conducted on microfinance banks operating in Nigeria. This study used correlation and regression to analyse the direct influence of SRM practices and CRM practices on business performance. Data from 307 respondents affirm that supplier relationship management practices and customer relationship management practices increase business performance. Furthermore, supplier relationship management practices and customer relationship management are significantly correlated with financial health, market and sales performance and operational performance. We conclude that implementing strong collaboration with suppliers and customers can foster superior business performance.

Keywords: SRM, CRM, microfinance banks, business performance, financial health.

1 Introduction

In today's highly competitive environment, securing a competitive edge is crucial for business expansion and survival. To manage business complexities and improve performance, organisations need to execute strategies and policies that focus on service delivery. In this context, customer relationship management (Eisingerich and Bell, 2006) and supplier relationship management are such strategies. Strategic management of supplier-customer relationships has emerged as a key consideration for producing superior market outcomes in scholarly and practitioner literature. As a result, businesses must evaluate their investment decisions around the supply chain to optimise supplier-customer processes (Hananiah, Miller, Richards and Cavusgil, 2003; Silva, Bradley and Sousa, 2012). More so, inadequate resources are exposing firms to production and distribution risks which are impacting negatively on their business performance. Thus, optimising all available resources has become a challenge for firms (Modi and Mabert, 2007). Nonetheless, this challenge also presents opportunities for building supplier-customer relationships. Indeed, these relationships can enable firms to effectively use their resources in managing successful transactions as well as encourage joint performance and long-term exchange (Kremic et al., 2006).

By value co-creation, supplier-customer partnerships have the power to promote mutual profitability (Lusch and Vargo, 2006; Enz and Lambert, 2012). Managers must do this by

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establishing long-term strategic relationships with suppliers and customers by proactive supplier-customer relationship management.Supplier relationship management (SRM) focuses on the preparation, execution, development, and tracking of a company's existing and future supplier relationships (Akamp and Müller, 2013). Arguably, creating a relationship with the best suppliers can facilitate the timely delivery of products and services and improve product quality. Links between operations and suppliers have been shown to improve firm efficiency (Swink et al., 2007; Singh and Power, 2009; Flynn et al., 2010) and the potential to co-create value (Enz and Lambert, 2012). According to research, supplier partnership management has become a challenge (Muhia and Afande, 2015), and company maturity is limited (Klemettinen, 2018). Several scholars (e.g. Gatobu and Moronge, 2018; Njagi and Shalle, 2016; Kähkönen and Lintukangas, 2012) have called for further research on supplier relationship management in different contexts. Customer relationship management (CRM), on the other hand, is concerned with the direct relationship between consumers and advertisers, as well as the retention of new customers and the development of long-term partnerships with them (Sanzo and Vasquez, 2011). The opportunity for customer relationship management has arisen as a result of the changing market climate (Soltani and Navimipour, 2016). Customer relationship management (CRM) aims to boost customer loyalty by providing goods and services that match or surpass their expectations.CRM has been shown to have an effect on corporate success (Day and Van den Bulte, 2002; Reinartz, Krafft, and Hoyer, 2004), business performance (Palmatier, et al, 2006), and consumer performance (Day and Van den Bulte, 2002). (e.g. Mithas, Krishnan and Fornell, 2005). Nevertheless, there is limited studies on CRM process and firm performance in under-developed economies (Ngambi and Ndifor, 2015).

Intense competition has forced microfinance banks in Nigeria to seek a long-term profitable relationship with suppliers and customers to deliver superior business performance. Nwachukwu et al. (2017) opined that managers of microfinance banks need to execute effective strategies and policies to improve performance and create value for their stakeholders. Considering the dynamic nature of the Nigerian microfinance banking sector, and the paucity of research on the subject (supplier-customer relationship management practices), this paper intends to investigate the effects of SRM-CRM practices on the performance of microfinance banks. The aim of this paper is to investigate the connection between SRM-CRM activities and business results (financial health, market and sales performance and operational performance). This paper makes the following important contributions: First, the paper adds to the existing literature on supplier-customer relationship management practices in microfinance banks in the emerging market contexts. As a result, this paper adds to the discourse about how to build and maintain client relationships by offering methodological observations into the effect of mixed supplier and customer relationship management approaches on business success.By shedding light on how SRM practices and CRM practice affect the performance of microfinance banks, this study enhances the understanding of what drives the performance of microfinance banks. Furthermore, relating SRM-CRM practices to operational performance extends the SRM-CRM literature (Arawati, 2011; Hamid and Hamid, 2014). Empirical studies on the impact of SRM practices, CRM practices on operational performance is scanty, in establishing a positive connection between SRM practices, CRM practices and operational performance, this study adds to empirical findings on the relationship between SRM practices, CRM practices in operational performance contexts (e.g. Shobayo, 2017). The below is the outline of the document.Theoretical foundation, an overview of the literature on SRM practice-business performance link, CRM practice-business performance link, and the research hypotheses.

Next, is the methodology used and the presentation of the research results. Finally, the theoretical and practical implications of the results are discussed.

2 Theoretical foundation

The costs of creating, maintaining, and controlling a firm's commercial operation in a market are known as transaction costs. Relationship interaction should be based on economic considerations which organise and constrain a firm's behaviour and promote cooperation, minimising partners' incentives for opportunism, disputes, and transaction costs, according to transaction cost economics (TCE) (e.g. Luo et al., 2015).TCE can be used to explain how various types of investments within firms can create long-term capabilities and foster performance (Grover and Malhotra, 2003). Indeed, the ability of a firm to collaborate with a strategic partner to provide them with services and maintain the relationship is a source of competitive advantage. TCE can enrich our understanding of whether it is beneficial for firms to maintain robust supplier relationship management practices. Besides, TCE can be used to evaluate the quality and richness of the relationships as well as the value of creating partnership between different firms. Social exchange theory (SET) is considered as an appropriate theoretical lens to explain customer-supplier relationships because it offers social ways to manage a relationship and enhance cooperation (Liu et al., 2009; Hawkins et al., 2008; Li et al., 2010). SET is widely used to explain customer-supplier relationships (e.g. Granovetter, 2005; Luo, 2002). SET suggest that actions of individuals are motivated by what they get from others (Blau, 1964). The key drivers of relationship sharing are confidence and loyalty, and SET focuses on reciprocating benefits between relationship partners (Blau, 1964; Palmatier, 2008). TCE and SET have been used by academics to clarify how governance considerations affect inter-firm results (e.g. Ferguson et al., 2005).As a result of research on inter-firm relationship governance, the impact of relationships on business success has been identified (Poppo and Zenger, 2002; Terpend, Tyler, Krause and Handfield, 2008; Dyer and Chu, 2011; Liu, Luo and Liu, 2009; Luo, Liu, Yang, Maksimov and Hou, 2015; Liu et al., 2017). Arguably, firms can use successful cooperation/collaboration (supplier-customer relationship management practice) to reduce transaction costs and conflicts and improve the performance of relationship exchange. In the context of this study, optimising SRM-CRM practices can enable firms to reduce cost and enhance business performance.

Link between supplier relationship management and performance

Organisations are striving to create long-term strategic partnerships with innovative suppliers and cooperate with them in providing solutions and responding to changing business needs. Strategic supplier relationship management creates value to organisations through creativity among suppliers (Tarafdar and Qrunfleh, 2013). Supplier relationship management enables firms to optimize their supply base to achieve competitive advantage (Schuh et al., 2014). Indeed, strategic partnerships with suppliers can enable firms to develop new and efficient products and enhance their performance. Arguably, firms can reduce costs, create new products and value by optimising long-term collaboration with key suppliers. Researchers have reported that suppliers play a major role in driving firms' operational performance (e.g., Wagner and Krause, 2009; Modi and Mabert, 2007). Tangus et al. (2015) found that supplier relationship management activities were linked to manufacturing company success in Kenya. Supplier partnership management affects procurement efficiency in fast-moving consumer goods manufacturing companies, according to Gatobu and Moronge (2018). According to the

report, strong supplier coordination frees up managerial time, lowers job costs, and increases organisational stability.Al-Abdallah et al. (2014) investigated the impact of supplier relationship management activities on competitive success in Japan, Korea, the United States, and Italy.They observed that firms cannot rely only on their internal resources and capabilities but must strategically manage the relationship with their suppliers to achieve competitive performance. Krause, Handfield, and Tyler (2007) found that firms' loyalty to long-term partnerships with main suppliers, common priorities and principles with suppliers, and participation in supplier growth programmes have a major impact on purchasing company competitive success in the US automotive and electronics industries. In light of the above, the following theories were suggested in this study:

H1. Supplier relationship management practice significantly influences business performance.

H1a. Supplier relationship management practice is positively correlated to financial health.

H1b. Supplier relationship management practice is positively associated with market and sales performance.

H1c.Supplier relationship management practice is positively correlated with operational performance.

Link between customer relationship management and performance

Customer Relationship Management (CRM) is built on the ideals of Relationship Marketing (RM) (Rahimi and Kozak, 2017). Customer relationship management focuses on creating and improving the portfolio of customer relationships (Zablah et al., 2004). Customer relationship management aims at creating and maintaining individual relationships with key customers using the right information and communication technologies (Nguyen, Sherif and Newby, 2007; Bose 2002). Customer relationship management emphasizes developing and maintaining relationships with customers in every position to leverage relationship value (Richards and Jones, 2008). CRM focuses on building and maintaining long-term relationships with consumers (Josiassen, Assaf, and Cvelbar, 2014) and relies on data gathered prior to making decisions (Khosravifar, Bentahar, Gomrokchi, and Alam, 2012). According to Giannakis-Bompolis and Boutsouki (2014) CRM is “a comprehensive strategy and process of acquiring, retaining, and partnering with selective customers to create superior value for the company and the customer”. Arguably, CRM is a managerial activity that focuses on optimising relationships with customers to maximize relationship value. Lambert (2010) opines that the customer relationship management process is successful when there is a positive impact on the profitability of specific customer or segment of customers over time. Customer relationship management practices can enhance product and service quality through feedback from customers. Ramani and Kumar (2008) assert that customer relationship management is effective and efficient in building innovation capabilities which help firms achieve competitive advantage. Reinartz (2004) submitted that CRM activities lead to superior business performance. Anuforo et al. (2015) investigated the interaction between customer relationship management and commercial bank success in two cities in Nigeria's Abia State. Customer relationship management (CRM) has a significant impact on customer satisfaction, sales value, and market share, according to the researchers. To achieve their business goals, commercial banks in Nigeria should sustain close cooperation with their customers, according to the study.Simonet, Kamdem, and Nguefack (2012) reported that customer relationship management is connected to the commercial performance of Microfinance institutions in Cameroon. Contrarily, Ngambi and Ndifor (2015) found that CRM does not have a positive effect on the performance of Microfinance Institutions in Cameroon. Customer relationship

management strategies, we conclude, would have a substantial and constructive effect on company success.

H2. Customer relationship management practice significantly influences business performance.

H2a. Customer relationship management practice is positively correlated to financial health.

H2b. Customer relationship management practice is positively associated with market and sales performance.

H2c. Customer relationship management practice is positively correlated with operational performance.

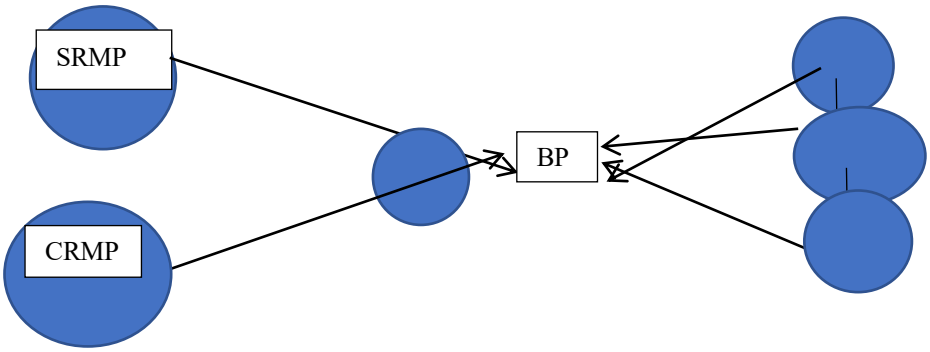

Figure 1. Conceptual model showing the relationship between the research variables

Source: Authors elaboration

Note: SRMP= supplier relationship management practices, CRMP= customer relationship management practices, BP= business performance, FH= financial health, MSP= market and sales performance, OP= operational performance.

3 Methodology

3.1. Research questions

The aim of this research is to provide answers to the following questions;

- Does supplier relationship management practice influence business performance dimensions (financial health, market and sales performance operational performance)?
- Is customer relationship management practice related to business performance dimensions (financial health, market and sales performance operational performance)?

3.2. Sample data and demographics

The study used data obtained from microfinance banks operating in Nigeria. The survey took place between the months of July and September 2018 covering MFBs located in 3 geopolitical zones in the country). Microfinance banks are well-represented in these geographical areas. The existing state of microfinance in Nigeria, as well as potential

challenges, can be mitigated by developing novel skills (Nwachukwu et al., 2018). Nigeria has one of Africa's biggest markets, with crude oil revenues being a main source of income.Authors sent online survey to 450 respondents who were randomly selected. We sent the survey connect to the respondents' e-mail addresses to ensure that only specific individuals participated in the online survey.Completed responses from managers saddled with the responsibility of managing suppliers and customers relationships of this MFBs were used in this analysis.In the end, 307 completed responses from these firms were analyzed. The sample size is appropriate and within the recommended sample size (Bryman, 2004). Patel et al., 2015; Parida and rtqvist, 2015) found that a single industry analysis reduces the possible noise that comes from many industry studies. This represents a 68% response rate which is appropriate analysing the resultant data and for drawing conclusion (Bryman and Bell, 2015).

3.3. Measures and analytical approach

To address the needs of this report, the European Foundation for Quality Management (EFQM, 2013) scale was adapted and updated. Part A of the questionnaire sought information on supplier relationship management practises, customer relationship management practises, and business performance. Part B of the questionnaire sought information on supplier relationship management practises, customer relationship management practises, and business performance. Part B gathered information on the firm's profile. Three questions were used to assess supplier partnership management activities. Three items were used to evaluate customer relationship management practices. Three questions were used to access supplier relationship management practices, which includes: (i) We chose our suppliers based on our strategy and manage our relationship with them accordingly, (ii) Our relationship with our suppliers is based on mutual trust respect, and openness, (iii) Our cooperation with our supplier is based on sustainable benefits. To evaluate customer relationship management practices, three questions were used to collect information from respondents; (i)We handle and improve customer relationships by understanding the needs and expectations of our various customer groups; (ii) we establish and sustain a dialogue with all of our customers based on accountability, honesty, and trust; and (iii) we conduct daily customer surveys with metrics that track consumer satisfaction.Performance is a construct which has many definitions. It is independent from the purpose and is something achieved by an individual or organisation (Dugguh and Ayaga, 2014). Customer-related results of company success have been recorded in the literature (e.g, Kaplan and Norton, 1996). To measure business performance, single questions each was used to assess financial health, market and sales performance and operational performance. As with multiple-item scales, single-item tests have a high statistical validity (Bergkvist and Rossiter, 2007, 2009). A 5-point Likert scale ranging from 1 = strongly accept to 5 = strongly disagree was used to evaluate supplier relationship management activities, customer relationship practises, and company results. The subjective measure was used to operationalised business performance because of lack of access to financial data. Cronbach's alpha for customer relationship management practices (0.71), supplier relationship management practices (0.67), business performance (0.76) and the overall scale (0.80) suggests that the questionnaire effectively measures the variables in this study (Zikmund et al., 2013). The KMO and Bartlett's measure of sampling adequacy were both important (KMO: 0.776, P = 0.000 <0.05), and the sample size was greater than 0.5. (Hair et al., 2010). Experts have checked the measurement scale's face truth, comprehensiveness, and coherency. For data analysis, descriptive and inferential statistics were used. The relationship between SRM practises, CRM practises, and financial stability, business and revenue efficiency, and operating performance was investigated using correlation analysis.The role of supplier relationship management (SRM) and customer relationship management (CRM) activities on

company success is determined using regression analysis. The data was analysed using the Statistical Kit for Social Sciences (SPSS 25) programme.

3.4. Handling common method bias

Managers responsible for managing suppliers-customers collaboration can give reliable information about the subject. Evaluation apprehension was minimized by assuring respondents anonymity (Conway and Lance, 2010; Podsakoff et al., 2003). We used a cover letter to keep it apparent that the independent variable measurements are unrelated to the dependent variable measurements. To ensure comprehensiveness and coherency, a group of six academic and non-academic experts carefully constructed and checked scale pieces. Furthermore, correlations of more than 0.9 between the variables suggest typical process bias (Bagozzi et al., 1991). The structures with the highest correlation (supplier relationship management practise and customer relationship management practise) had a correlation of 0.494, indicating that there was no traditional process bias problem (see table 2).

4 Empirical Findings

In terms of employee numbers, 46 (15%) of MFBs have between 1 and 10 workers, 206 (67%) have between 11 and 20 employees, 49 (16%) have between 21 and 30 employees, and 6 (2%) have between 31 and 40 employees. Just 3 (1%) respondents said their companies had been in the market for 11 years or more, while 15 (5%) said they had been in the market for 0 to 5 years, 289 (94%) said they had been in the market for 6 to 10 years, and 15 (5%) said they had been in the market for 11 years or more.

Table 1. Descriptive Statistics on supplier-customer relationship management practice/ business performance

	SA		A		U		DA		SD	
	F	%	F	%	F	%	F	%	F	%
1. We chose our suppliers based on our strategy and manage our relationship with them accordingly	93	30.3	158	51.5	-	-	45	14.7	11	3.6
2. Our relationship with our suppliers is based on mutual trust respect, and openness	94	30.6	147	47.9	-	-	54	17.6	12	3.9
3. Our cooperation with our supplier is based on sustainable benefits	80	26.1	162	52.8	-	-	56	18.2	9	2.9
4.We manage and enhance customer relationship by knowing the needs and expectation of our different customer groups	114	37.1	146	47.6	-	-	39	12.7	8	2.6
5.We build and maintain a dialogue with all our customers based on openness, transparency and trust	130	42.3	147	47.9	-	-	24	7.8	6	2
6.We hold regular customer survey, with indicators that monitor the satisfaction of customers	110	35.9	151	49.3	17	5.6	23	7.5	5	1.6
7.We have positive trends over the past three years for the indicators measuring our financial health	88	28.7	146	47.6	11	3.6	55	17.9	7	2.3
8.We have positive trends over the past three years for the indicators measuring our market and sales performance.	63	20.5	136	44.3	9	2.9	76	24.8	23	7.5
9.We have positive trends over the past three years	45	14.7	168	54.9	9	2.9	69	22.5	15	4.9

for the indicators measuring our operational performance

Source: Own, 2019

Table 1 indicates the respondents' responses to the following comments about supplier partnership management practice: We choose our vendors in accordance with our plan, and we maintain our relationships with them accordingly(30.3 %) strongly agree, (51.5%) agree, (14.7 %) disagreed and (3.6 %) strongly disagreed, our relationship with our suppliers is based on mutual trust,respect, and openness (30.6%) strongly agree, (47.9 %) agree, (17.6 %) disagreed and (3.9 %) strongly disagreed, our cooperation with our supplier is based on sustainable benefits (26.1 %) strongly agree, (52.8%) agree, (18.2 %) disagreed and (2.9 %) strongly disagreed. With respect to customer relationship management practice: Knowing the interests and expectations of our various client classes helps us handle and improve customer relationships(37.1 %) strongly agree, (47.6%) agree, (12.7 %) disagreed and (2.6 %) strongly disagreed, we establish and handle a dialogue with all our customers based on openness, transparency and trust (42.3 %) strongly agree, (47.9%) agree, (7.8 %) disagreed and (2 %) strongly disagreed, We hold regular customer survey, with indicators that monitor the satisfaction of customers (35.9 %) strongly agree, (49.3%) agree, (5.6 %) undecided, (7.5 %) disagreed and (1.6 %) strongly disagreed. In terms of business performance: We have positive trends over the past three years for theindicators measuring our financial health (28.7 %) strongly agree, (47.6%) agree, (3.6%) undecided, (17.9 %) disagreed and (2.3 %) strongly disagreed, we have positive trends over the past three years for theindicators measuring our market and sales performance (20.5 %) strongly agree, (44.3 %) agree, (2.9 %) undecided, (24.8 %) disagreed and (7.5 %) strongly disagreed, we have positive trends over the past three years for the indicators measuring our operational performance (14.7 %) strongly agree, (54.9 %) agree, (2.9 %) undecided, (22.5 %) disagreed and (4.9%) strongly disagreed.

Table 2. Correlation results

SRM	CRM	
Financial health		
Pearson Correlation	0.418**	0.425**
Sig. (2-tailed).	0.000	0.000
Market/sales performance		
Pearson Correlation	0.271**	0.233**
Sig. (2-tailed).0.000	0.000	
Operational performance		
Pearson Correlation	0.280**	0.214**
Sig. (2-tailed).0.000	0.000	
Supplier relationship management		
Pearson Correlation	1	0.494**
Sig. (2-tailed).		0.000
Customer relationship management		
Pearson Correlation	0.494**	1
Sig. (2-tailed).	0.000	

N= 307, **. Correlation is significant at the 0.01 level (2-tailed).

Table 3. Regression results

SRM/CRM/Bus.Pef	SRM practice/Business performance	CRM practice/Business performance

β		0.287	0.205
t		4.797	3.423
P-value	0.000	0.000	0.001
VIF		1.323	1.323
R	0.427		
R^2	0.183		
F	33.712		
Durbin Watson	2.060		

N= 307, **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Source: Authors, 2019

Presented in Table 2 is the results testing hypotheses 1a, 1b, 1c, 2a, 2b and 2c. The result (R= 0.418**, P = 0.000 < 0.05) support ***H1a*** that supplier relationship management practices is positively correlated to financial health. (R= 0.271**, P = 0.000 < 0.05) suggest that supplier relationship management practice is positively associated with market and sales performance (***H1b***). The (R= 0.280**, P = 0.000 < 0.05) support ***H1c***, supplier relationship management practice is positively correlated with operational performance. The R-value for customer relationship management practice on financial health (***H2a***), is positive 0.425** with a p-value of 0.000, suggesting that the relationship is statistically significant. Furthermore, the R-value for customer relationship management practices on market and sales performance has a positive value of 0.233** and a p-value of 0.000 (***H2b***), indicating that customer relationship management practice is positively associated with market and sales performance. Similarly, the R-value for customer relationship management practices on operational performance (***H2c***) is 0.214** with a p-value of 0.000, which shows that customer relationship management practice is positively correlated with operational performance. Presented in Table 3 is the results testing hypotheses 1 and 2. The coefficient value (β) for supplier relationship management practices on business performance (***H1***) is 0.287** with a p-value of 0.000, indicates that supplier relationship management practices influence the performanceof microfinance banks. The coefficient value (β) for customer relationship management on business performance (***H2***) is 0.205** with a p-value of 0.001, suggesting that customer relationship management practices influence the performance of microfinance banks. The result (R^2 = 0.183) further shows that supplier relationship management practice and customer relationship management practice jointly explain 18.3% variation in microfinance bank performance.The variance inflation factor 1.323 is less than 5, indicating that there is no multicollinearity problem (Ringle et al., 2015). These findings show that the method has strong calculation properties. The lack of autocorrelation in the method is shown by the Durbin-Watson test value of 2.060.

Table 4. Hypotheses test results/ decision

Hypotheses	P-value	Remark/decision
H1	0.000	Accept
H1a	0.000	Accept
H1b	0.000	Accept
H1c	0.000	Accept
H20.001	Accept	
H2a	0.000	Accept

H2b	0.000	Accept
H2c	0.000	Accept

Source: Author, 2019

5 Discussions and conclusions

5.1. Key findings and implications

The objective of this study is to look at the connection between supplier and consumer relationship management in terms of business performance. Survey data from 307 microfinance banks suggest an overall positive influence of SRM-CRM practices on business performance. Given that this relationship has been a source of contention in the marketing/supply chain management literature,(e.g., Muhia and Afande, 2015; Klemettinen, 2018; Gatobu and Moronge, 2018; Njagi and Shalle, 2016), the current findings contribute to theoretical claims and limited observational research on the topic in the context of growing markets.This research relates to the field of transaction cost economics (TCE) (e.g. Luo et al., 2015) and social exchange theory (SET) (e.g. Liu et al., 2009; Hawkins et al., 2008) by establishing that successful cooperation/collaboration (supplier-customer relationship management) have positive effect on business performance. It was insightful to find that SRM practices, CRM practices shows a positive and significant correlation with financial health, market and sales performance and operational performance. This study reveals that SRM-CRM practices are important for the performance of microfinance banks. Therefore, SRM-CRM practices are key areas that should be considered in future studies in marketing/supply chain management. The findings of the research support previous studies on the importance of supplier relationship management in enhancing performance. For instance, Gatobu and Moronge, (2018) who observed that that supplier relationship management foster procurement performance in fast-moving consumer goods manufacturing firms, Tangus et al., (2015) who reported that supplier relationship management practices impact performance of manufacturing firms in Kenya, Al-Abdallah et al. (2014) who found that supplier relationship management practices foster competitive performance selected manufacturing firms in Japan, Korea, USA, and Italy and Krause, Handfield and Tyler (2007) who observed that supplier relationship management practices are linked to firm competitive performance. This results also support past empirical studies that reported a positive link between customer relationship management and performance (e.g. Simonet et al., 2012; Anuforo et al., 2015; Reinartz, 2004). Indeed, improving the relationship with customers can lead to profitable and sustainable performance. However, this finding deviates from the submission of Ngambi and Ndifor (2015) who concluded that CRM does not have a positive effect on performance. The paper also contributes to empirical research on microfinance banks, especially in Nigeria. Microfinance banks provide services that support the growth and development of small businesses as well as the Nigeria economy (Nwachukwu, 2018). However, MFBs are faced with challenges that emanate from intense competition, sophistication in technology and market uncertainties. Consequently, developing, executing and maintaining robust supplier-customer relationship management practices can enable them to adapt to these challenges and improve their performance.

5.2. Managerial Implications

The results have several implications for managers and executives of microfinance banks. The important role of suppliers and customers need special attention from managers and

executives in delivering superior performance. In this context, microfinance banks in Nigeria can take strategic decisions on how to develop a robust relationship/collaboration with their suppliers and customers to achieve better performance. The future of firms depends on creating and managing supplier-customer relationships that will meet current and future business needs. Implementing strong collaboration can improve their ability to attract and retain suppliers and customers. Firms should implement strong SRM practices as this directly influences performance (financial health, market and sales performance, operational performance). To achieve this, they should choose suppliers based on their strategy and manage the relationship with them accordingly. It is important to build and manage the relationship with suppliers' base on mutual trust, respect, and openness. Trust, respect and openness can foster a strong relationship with key suppliers, enhance value creation and sustainable benefits. The supplier network contributes positively to the performance of firms by making available quality products and services in a short time and at the lowest cost. Thus, firms that aspire to be market leaders must adopt a strategic approach to managing the relationships with suppliers. Strategically managing relationships with suppliers can lead to product innovations that would make firms to achieve better performance. Indeed, firms with robust supplier relationship management practices outwit their peers in term of performance. To remain in business, MFBs need to create tactics to retain their customers, minimise the cost of attracting new ones and reposition themselves towards the customer-focused business philosophy. One way of doing this is for executives and managers to implement strong customer relationship management practices. Creating and implementing effective and efficient practices that focus on the customer relationship can lead to microfinance bank's success They need to manage and improve customer relationship by anticipating the needs and expectation of different customer groups. To cope with rapidly changing customer expectations, firms must develop collaborative relationships with customers. This relationship with customers should be based on openness, transparency and trust. Furthermore, it is important to hold regular customer survey and monitor the level of customer satisfaction. In so doing, the firms will be able to attract and retain their customers. Thus, reducing customer attrition and improve business performance. Finally, failure to implement SRM-CRM practices may lead to loss of important customers and suppliers which can be costly, both directly and indirectly. Consequently, firms may fail to achieve their strategic objectives.

5.3. Limitations and outlook

This study has some shortcomings. First, subjective data on business performance (financial health, market and sales performance, operational performance) was used. Future studies can use objective data where available and additional indicators of business performance using multiple scales. The use of larger sample sizes to examine the subject in various contexts (industries and countries) might provide new insights. Future studies can consider the use of longitudinal data sets to examine potential changes over time. Future researchers should continue to search for moderating and mediating variables as this might enhance our understanding of the SRM-CRM practice – performance relationship, particularly firm-specific factors (e.g size, age). Despite these drawbacks, this section reviews the literature by highlighting the important impact of SRM and CRM methods on successful organization in a developing industry.

References

[1] Akamp, M. and Müller, M. (2013).Supplier management in developing countries. Sustain. Manag. Corp. Boundaries 56, pp. 54–62.
[2] Al-Abdallah, G. M., Abdallah, A. B and Hamdan, K. B. (2014).The Impact of Supplier Relationship Management on Competitive Performance of Manufacturing Firms. International Journal of Business and Management, 9(2), pp. 192-202.
[3] Anuforo, R., Ogungbangbe, B. M. and Edeoga, G. (2015). A Study of the Impact of Customer Relationship Management on Bank Growth in Nigeria, Journal of Social Economics, 2(4), pp. 177-187.
[4] Arawati, A. (2011). Supply chain management, supply chain flexibility and business performance. Journal of Global Strategic Management, 5(1), 134-145.
[5] Bagozzi, R. P., Yi, Y. and Phillips, L. W. (1991).Assessing construct validity in organizational research. Adm. Sci. Q. 36, 421–458.
[6] Bergkvist, L. and Rossiter, J. R. (2007). The predictive validity of multiple-item versus single-item measures of the same constructs. Journal of Marketing Research, 44(2), 175–184.
[7] Bergkvist, L. and Rossiter, J. R. (2009). Tailor-made single-item measures of doubly concrete constructs. International Journal of Advertising, 28(4), 607–621.
[8] Blau, P. M. (1964). Exchange and Power in Social Life, New York: Wiley.
[9] Bose, R. (2002). Customer relationship management: Key components for IT success. Industrial Management & Data Systems, 102(2) pp. 89-97.
[10] Bryman, A. (2004). Social Research Methods, 2nd ed., Oxford: Oxford University Press
[11] Conway, J. M. and Lance, C. E. (2010). What reviewers should expect from authors regarding common method bias in organizational research. Journal of Business and Psychology, 25(3), pp. 325-334.
[12] Day, G. S. and Van den Bulte, C. (2002). Superiority in customer relationship management: consequences for competitive advantage and performance. working paper, Wharton School, University of Pennsylvania.
[13] Dugguh, S. I. and Ayaga, D. (2014). Job satisfaction theories: Traceability to employee performance in organizations. Journal of Business and Management, 16(5), pp. 11–18.
[14] Dyer, J. H. and Chu, W. (2011).The determinants of trust in supplier-automaker relationships in the US, Japan, and Korea. Journal of International Business Studies, 42(1), pp. 10-27.
[15] EFQM (2013).The EFQM Excellence Model.Retrieved from: www.efqm.org.
[16] Eisingerich, A. B. and Bell, S. J. (2006). Relationship marketing in the financial services industry: the importance of customer education, participation and problem management for customer loyalty. Journal of Financial Services Marketing, 10, pp. 486–97.
[17] Enz, M. G and Lambert, D. M. (2012).Using cross-functional, cross-firm teams to co-create value: The role of financial measures. Industrial Marketing Management, 41(3), pp. 495–507.
[18] Ferguson, R. J., Paulin, M. and Bergeron, J. (2005). Contractual governance, relational governance, and the performance of interfirm service exchanges: the influence of boundary-spanner closeness. Journal of the Academy of Marketing Science, 33(2), pp. 217-234.
[19] Flynn, B. B., Huo, B. and Zhao, X. (2010). The impact of supply chain integration on performance: a contingency and configuration approach. Journal of Operations Management, 28(1), pp. 58-71.
[20] Gatobu, J. G. and Moronge, M. (2018). Influence of supplier relationship management on procurement performance in fast moving consumer goods manufacturing firms in Nairobi City County, Kenya. The Strategic Journal of Business & Change Management, 5(1), pp. 745- 768.
[21] Giannakis-Bompolis, C and Boutsouki, C. (2014). Customer Relationship Management in the Era of Social Web and Social Customer: An Investigation of Customer Engagement in the Greek Retail Banking Sector. Procedia-Social and Behavioral Sciences, 148, pp. 67-78.
[22] Granovetter, M. (2005).The impact of social structure on economic outcomes.The Journal of economic perspectives, 19(1), pp. 33-50.
[23] Grover, V. and Malhotra, M. K. (2003). Transaction cost framework in operations and supply chain management research: theory and measurement. Journal of Operations Management, 21(4), pp. 457-473.

[24] Hair, J., Black, W., Babin, B. and Anderson, R. (2010) Multivariate data analysis, 7th ed., Englewood Cliffs: Prentice Hall
[25] Hamid, K. and Hamid, R. A. (2014). Study of performance measurement practices in supply chain management. Proceedings of the 2014 International Conference on Industrial Engineering and Operations Management Bali, Indonesia, January 7 – 9, pp. 273-285.
[26] Hanvanich, S., Miller, S. R., Richards, M. and Cavusgil, S. T. (2003).An event study of the effects of partner and location cultural differences in joint ventures. International Business Review, 12(1), pp. 1-16.
[27] Hawkins, T. G. Wittmann, C. M. and Beyerlein, M. M. (2008). Antecedents and consequences of opportunism in buyer-supplier relations: Research synthesis and new frontiers. Ind. Mark.Manag. 37, pp. 895–909.
[28] Josiassen, A., Assaf, A. G. and Cvelbar, L. K. (2014). CRM and the bottom line: Do all CRM dimensions affect firm performance? International Journal of Hospitality Management, 36, pp. 130-136.
[29] Kähkönen, A. K. and Lintukangas, K. (2012).The underlying potential of supply management in value creation. Journal of Purchasing & Supply Management,18(2), pp. 68-75.
[30] Kaplan, R. S., & Norton, D. P. (1996). The balanced scorecard: Translating strategy into action. Harvard Business Press.
[31] Khosravifar, B., Bentahar, J., Gomrokchi, M. and Alam, R. (2012). CRM: An efficient trust and reputation model for agent computing. Knowledge-Based Systems, 30, pp. 1–16.
[32] Klemettinen, J. (2018). Supplier Relationship Management: influence of effective relationship management on competitive advantage. Lappeenranta University of technology published master thesis.
[33] Krause, D., Handfield, R. and Tyler, B. (2007).The relationships between supplier development, commitment, social capital accumulation and performance improvement. Journal of Operations Management, 25(2), pp. 528–545.
[34] Kremic, T., IcmeliTukel, O. and Rom, W. O. (2006).Outsourcing decision support: a survey of benefits, risks, and decision factors.Supply Chain Management: An International Journal, 11(6), pp. 467-482.
[35] Li, Y., Xie, E., Teo, H. and Peng, M. W. (2010).Formal control and social control in domestic and international buyer-supplier relationships.Journal of Operations Management, 28(4), pp. 333-344.
[36] Liu, Y., Luo, Y. and Liu, T. (2009). Governing buyer-supplier relationships through transactional and relational mechanisms: Evidence from China. Journal of Operations Management, 27(4), pp. 294-309.
[37] Liu, Y., Luo, Y., Huang, Y. and Yang, Q. (2017).A diagnostic model of private control and collective control in buyer-supplier relationships.Industrial Marketing Management, 63, pp. 116-128.
[38] Luo, Y. (2002). Contract, cooperation, and performance in international joint ventures.Strategic Management Journal, 23(10), pp. 903-919.
[39] Luo, Y. (2005). Transactional characteristics, institutional environment and joint venture contracts. Journal of International Business Studies, 36(2), pp. 209-230.
[40] Luo, Y., Liu, Y., Yang, Q., Maksimov, V and Hou, J. (2015). Improving performance and reducing cost in buyer-supplier relationships: the role of justice in curtailing opportunism. Journal of Business Research, 68(3), pp. 607-615.
[41] Lusch, R. F. and Vargo, S. L. (2006). The service-dominant logic of marketing, Armonk, NY: M.E. Sharpe.
[42] Mithas, S., Krishnan, M. S. and Fornell, C. (2005). Why do customer relationship management applications affect customer satisfaction? Journal of Marketing, 69(4), pp. 201–209.
[43] Modi, S. B. and Mabert, V. A. (2007). Supplier development: Improving supplier performance through knowledge transfer. Journal of Operations Management, 25(1), pp. 42-64.

[44] Muhia, D. W. and Afande, F. O. (2015). Adoption of e-procurement strategy and procurement performance in State Corporations in Kenya: A Case of Kenya Revenue Authority. Industrial Engineering Letters, 5(6), pp. 1-24.
[45] Ngambi, M. T. and Ndifor, P. S. (2015). Customer Relationship Management and Firm Performance: revisiting the case Of the Camccul Microfinance Institutions. International Journal of Information Technology and Business Management, 38(1), pp. 12-21.
[46] Nguyen, T. H., Sherif, J. S. and Newby, M. (2007).Strategies for successful CRM implementation. Information Management & Computer Security, 15(2), pp. 102-115.
[47] Njagi, M. M. and Shalle, N. (2016). Role of supplier relationship management on procurement performance in manufacturing sector in Kenya: A case of East African Breweries. International Academic Journal of Procurement and Supply Chain Management, 2(1), pp. 1-20.
[48] Nwachukwu, C. (2018). The impact of different types of innovations on customer satisfaction in microfinance bank in Nigeria.Published MBA Thesis, Jamk University of Applied Sciences, Jyvaskyla, Finland.
[49] Nwachukwu, C., Chladkova, and Olatunji, F. (2018).Strategy Formulation Process and Innovation Performance Nexus. International Journal for Quality Research, 12(1), pp. 147-164.
[50] Nwachukwu, C., Chladkova, H., Zufan, P. and Olatunji, F. (2017).Visionary Leadership and Its Relationship to Corporate Social Performance. Imperial Journal of Interdisciplinary Research, 3(4), pp. 1302-1311.
[51] Palmatier, R. W. (2008). Interfirm relational drivers of customer value. Journal of Marketing, 72(4), 76-89.
[52] Palmatier, R. W., Dant, R. P., Grewal, D. and Evans, K. R. (2006). Factors influencing the effectiveness of relationship marketing: a meta-analysis. Journal of marketing, 70(4), pp. 136-153.
[53] Parida, V. and Örtqvist, D. (2015). Interactive effects of network capability: ICT capability, and financial slack on technology-based small firm innovation performance. Journal of Small Business Management, 53, pp. 278–298.
[54] Patel, P. C., Kohtamäki, M., Parida, V. and Wincent, J. (2015). Entrepreneurial orientation as-experimentation and firm performance: The enabling role of absorptive capacity. Strategic Management Journal, 36(11), pp. 1739–1749.
[55] Podsakoff, P., MacKenzie, S., Lee, J. and Podsakoff, N. (2003). Common method biases in behavioural research: A critical review of the literature and recommended remedies. Journal of Applied Psychology, 88, pp. 879-903.
[56] Poppo, L. and Zenger, T. (2002). Do Formal Contracts and Relational Governance Function as Substitutes or Complements? Strategic Management Journal, 23(8), pp. 707–725.
[57] Rahimi, R. and Kozak, M. (2017). Impact of customer relationship management on customer satisfaction: The case of a Budget Hotel Chain. Journal of Travel & Tourism Marketing, 34(1), pp. 40–51.
[58] Reinartz, W. Krafft, M. and Hoyer, W. D. (2004). The customer relationship management process: Its measurement and impact on performance. Journal of marketing research, 41(3), pp. 293-305.
[59] Ringle, C. M., Wende, S. and Becker, J-M. (2015). SmartPLS 3.Bönningstedt: SmartPLS. Retrieved from http://www.smartpls.com
[60] Sanzo, M. J & Vasquez, R. (2011). The Influence of Customer Relationship Marketing Strategies on Supply Chain Relationships: The Moderating Effects of Environmental Uncertainty and Competitive Rivalry. Journal of Business-to-Business Marketing, 18, pp. 50–82.
[61] Schuh, C., Strohmer, M. F., Easton, S., Hales, M. and Triplat, A. (2014) Supplier Relationship Management –How to maximize supplier value. A press. [online] Available at: https://link-springer-com.ezproxy.cc.lut.fi/content/pdf/10.1007%2F978-1-4302-6260-2.pdf
[62] Shobayo, P. B. (2017). Supply chain management and operational performance in Nigeria: a panel regression model approach. International Journal of Entrepreneurial Knowledge, 5(2), pp.66-77.

[63] Silva, S. C., Bradley, F. and Sousa, C. M. P. (2012).Empirical test of the trust performance link in an international alliance's context.International Business Review, 21(2), pp. 293–306.
[64] Simonet, M. A., Kamdem, D. and Nguefack, C. (2012). Impact of the Customer relationship management on the performance of the Institutions of Microfinance in Cameroon: The case of the Camccul network. International Journal of Management & Information technology, 1(3), pp. 37-53.
[65] Singh, P. and Power, D. (2009). The nature and effectiveness of collaboration between firms, their customers and suppliers: a supply chain perspective. Supply Chain Management: An International Journal, 14(3), pp. 189-200.
[66] Soltani, Z. and Navimipour, N. J. (2016). Customer relationship management mechanisms: A systematic review of the state-of-the-art literature and recommendations for future research. Computers in Human Behavior, 61, pp. 667–688.
[67] Swink, M., Narasimhan, R. and Wang, C. (2007).Managing beyond the factory walls: effects of four types of strategic integration on manufacturing plant performance. Journal of Operations Management, 25(1), pp. 148-64.
[68] Tangus, C., Oyugi, L. A. and Rambo, C. (2015).Effect of supplier relationship management practices on performance of manufacturing firms in Kisumu County, Kenya.International Journal of Economics, Commerce and Management, 3(2), pp. 499-512.
[69] Tarafdar, M. and Qrunfleh, S. (2013). Lean and agile supply chain strategies and supply chain responsiveness: the role of strategic. Supply Chain Management: An International Journal, 18(6), pp. 571 -582.
[70] Terpend, R., Tyler, B. B., Krause, D. R. and Handfield, R. B. (2008). Buyer-supplier relationships: Derived value over two decades. Journal of Supply Chain Management, 44(2), pp. 28-55.
[71] Wagner, S. M. and Krause, D. R. (2009). Supplier development: communication approaches, activities and goals. International Journal of Production Research, 47(12), pp. 3161-3177.
[72] Zablah, A. R., Bellenger, D. N. and Johnston, W. J. (2004). An evaluation of divergent perspectives on customer relationship management: Towards a common understanding of an emerging phenomenon. Industrial Marketing Management, 33(6), pp. 475-489.
[73] Zikmund, W. G., Babin, B. J., Carr, J. C. and Griffin, M. (2013).Business research methods. 9th ed., USA: South-Western, Cengage Learning.

Relationship Between Business Ethics and Corporate Social Responsibility of Listed Manufacturing Companies in Nigeria

Mary Shadrach OMOFOWA[1], Shadrach OMOFOWA[2], Chijioke NWACHUKWU[3], XuyenThi My NGUYEN [4]
{maryshadrach7@gmail.com[1], shadrachomofowa@gmail.com[2], cesogwa@yahoo.com[3], xuyen.ntm@vlu.edu.vn[4]}

[1]Department of Business Administration, University of Benin, Nigeria., [2]Global Business School, Nigeria., [3]Horizons University Paris and Department of Financial Technologies, South Ural State University Chelyabinsk, Russia., [4] Corresponding Author. Lecturer, Faculty of Business Administration, Van Lang University, Vietnam

Abstract. This study examines the impact of business ethics on corporate social responsibility. We has employed surveys conducted on 50 manufacturing companies listed on the Nigerian Stock Exchange. 236 employees participated in the study. The regression results suggest that ethical code, corporate image, ethical leadership and brand equity influences corporate social responsibility of sample manufacturing firms. Our results lend support to the role business ethics play in fostering corporate social responsibility in the emerging country context. Drawing on the stakeholder perspective, the study addresses business ethics and corporate social responsibility, thus adding to strategic management literature, especially in Nigeria. This study informs managers and stakeholders in the manufacturing sector on the importance of creating an enabling environment that encourages corporate social responsibility.

Keywords: brand equity, corporate image, corporate social responsibility, ethical code, ethical leadership. JEL:M0, M10, M14

1 Introduction

The efficient utilisation of resources, the creation of human capital, and the implementation of appropriate management strategies are all factors in modern businesses' development and growth. Economic advantage is achieved by aggressive behaviour and the effective use of financial tools available to businesses (Nwachukwu, Žufan&Chládková, 2020). As such, business ethics and corporate social responsibility can foster competitive edge and sustainability of the corporation and as well add value to society. Society has questioned the existence of corporations because of the negative corporate behaviours of some of them (Davis, 1999). Besides, the notion that corporate activity is all about profit-making has become a major concern to stakeholders (Friedman, 1970, Jensen 2001). In developing countries, corporations have paid less attention to the ethical and social expectation of society. Business ethics focus on ethical principles and the moral conduct of corporations. It is a code of values and principles that governs corporate actions towards what is regarded as right or wrong. Firms need guidelines, rules, and procedures to support their strategic initiatives

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(Wanner, 2014). Business ethics provide a guideline on how a business should act in the face of ethical dilemmas and controversial situation. Corporate social responsibility suggests balancing social, environmental and economic practices by acting ethically to sustain stakeholder satisfaction (Agyemang&Ansong, 2017; Feng, Wang &Kreuze, 2017; Pinto &Allui, 2020). Firms can use CSR strategy to enhance their reputation, brand, customer loyalty and improve business performance (Soewarno, Tjahjadi&Fitriyah, 2021; Zahari et al., 2020). The 2002 awful event on corporate scandals involving Enron, Tyco, Worldcom, and their accounting firm Authur Anderson received global concern. Unethical practice, manipulations and malpractices led to the death of these companies. These scandals impelled business and stakeholder to scrutinize company ethics and operation, making the ordinary investors to understand the very essence of ethical behaviour in organization framework. Unethical behaviour or a lack of corporate social responsibility will destroy a company's image and make it less attractive to relevant stakeholders (Daft, 2001). While recent research has focused on business ethics and corporate social responsibility (e.g., Falola et al., 2018; Feng, Wang &Kreuze, 2017; Hebe, 2018), a study of the business literature shows that there are very few studies in the field of business ethics and corporate social responsibility in terms of their importance to business operations and stakeholders. Prior studies examined ethical leadership and employees' creativity (Hebe, 2018), ethics in corporate social responsibility (Singh & Singh 2013), corporate standard and corporation moral responsibility (Abun, 2015), corporate image and customers behavioural outcome (Falola et al., 2018; Adda, Azigwe&Awuni, 2016; Milenkovska, Petrovsja&Stoikovsk, 2019) and performance (Agyemang&Ansong, 2017; Lee, 2020; Porter & Kramer, 2007; Miller, Eden & Li, 2017). Most of these studies were not done in developing economies contexts such as Nigeria. In Nigeria, very few indigenous companies have a life span of 50 years due to very weak institutions which hardly carry out reforms. There is a gap in the literature in terms of understanding how ethical norms, values code of conduct and ethical practice influence corporate social responsibility. This study attempt to narrow this knowledge gap. The aim of this paper is to investigate the relationship between business ethics aspects (ethical code, corporate reputation, ethical leadership, and brand equity) and manufacturing firms' corporate social responsibility initiatives in Nigeria. We contribute to the theoretical understanding of ethical norms, values, code of conduct and ethical practice in organisations, by examining the effect of major components of business ethics on corporate social responsibility of manufacturing firms. Since ethical norms, values practices of ethical principles in developing nations differ from the developed world, the present study is relevant.

2 Literature review

The stakeholder theory encompasses the study. Stakeholders continue with the presumption that principles are clearly a part of doing business, according to Freeman, Wicks, and Parmar (2004). Stakeholder theory suggests that companies are obligated to show concern for the environment and social problems of stakeholders (Famiyeh, 2017; Freeman & Reed, 1983; Mahrani&Soewarno, 2018). The stakeholder principle of corporate social responsibility is based on economic principles and asserts that, rather than its stockholders, a company is socially liable to look after the interests of a broader number of stakeholders, including owners, vendors' workers, and the environment (Rodin, 2005). We argue that the means of meeting the expectations and needs of stakeholders is by implementing ethical behaviour. A

socially responsible corporation must consider the impact of its decision on a wider range of stakeholders. Innovative strategies can enable organizations to meet and surpass the expectations of divergent stakeholder and enhance competitive advantages (Vu, 2020). A corporation business ethics goes beyond trust and complying with the laws but include several other important stakeholders whose lives can be affected by the corporation decisions. Ebitu and Beredugo (2015) study the role of codes of ethics in leading the service industry's corporate success and enforcement in Calabar, Nigeria. The produced data revealed that successful organisational success was built on a code of ethics, and the degree of enforcement was strong, according to the Chi-square review. Ethical behaviour contributes to employees' performance and improves social and corporate performance (Saeed, Shekeel&Lodhi, 2013) and Adda, Azigwe and Awuni (2016) observe that ethical code is important for customer and employee relations as well as business growth. Razaq et al. (2013) examine the effect of ethical principles and codes on corporate social responsibility in Pakistan's public sector. The findings suggest that ethical principles and codes have a positive impact on corporate social responsibility. In other commercial affairs, good corporate ethics act on data ethically. In the minds of the public, a company's reputation is described as an overall appraisal of the company (Aydin&Ozer, 2005). Customers' thoughts, emotions, and perceptions shape a company's image. Al Mubarak, Ben Hamed, and Al Mubarak (2019) investigate the effect of corporate social responsibility on company profile.Customers saw corporate social responsibility as the most important factor when dealing with businesses, according to the findings. When businesses engage in those practises, their public profile improves. In the banking sector, Vazifehdust, Mojoudi, and Jalalian (2014) examine the impact of corporate social responsibility on business reputation, customer retention, and loyalty. They discovered that corporate social responsibility improves a company's reputation.Ethical leadership entails modelling normatively appropriate behaviour through personal decisions and interpersonal relationships, as well as promoting it through two-way contact, encouragement, and decision-making (Trevino, Brown & Hartman, 2003). Externalities synonymous with ethical leadership include trust and loyalty (Berrone, Sureroca&Tribo, 2007).In corporate social responsibility, ethical leadership refers to how ethical leaders, or workers, perceive their responsibility or obligation to make choices that protect and encourage the health and well-being of stakeholders and community. Financial crises, economic poverty, climatic change, societal insensitivity, workforce ethnic and sexual harassment, and periods of corporate financial irregularities all need ethically sensitive officials (Bello, 2012). Training on ethical leadership conduct, according to Walumbwa et al. (2011), encourages organizational business practices and relationships.Piccolo et al. (2010) examine the importance of mission autonomy and task relevance in the relationship between ethical leadership and organizational success. The findings show that ethical leadership increases mission significance, which improves organizational efficiency. Corporate social responsibility has a direct effect on a company's brand equity and profitability. (Lai, Chiu, Yang & Pai, 2015). Tuan (2014) observes that ethical leadership and brand equity are important predictors of legal, economic and moral responsibility in Vietnam. Based on the literature review the following research hypotheses are formulated.

H1. *There is significant relationship between the ethical code and corporate social responsibility.*

H2. *There is significant relationship between corporate image and corporate social responsibility.*

H3*. There is significant relationship between ethical leadership and corporate social responsibility.*

H4. *There is significant relationship between brand equity and corporate social responsibility.*

3 Methodology

The study applied a cross-sectional research approach. Primary data has been obtained from fifty (50) listed manufacturing companies that have been in operation in Nigeria since 1980 in (5) subsectors. Food-beverage-tobacco, breweries, chemical and paint, consumer and domestic goods, conglomerates-building materials, and pharmaceuticals are among these subsectors. The facts that these are the most environmentally visible and responsive subsectors of the manufacturing industry influenced the selection of these subsectors. Moreover, the manufacturing industry was selected because they are known to engage in corporate social responsibility in their locality. We selected employees who had more work experience for at least 15yrs to ensure that participants had been exposed to a considerable period of corporate social responsibility and had observed the model of business operation of these companies to ascertain their compliance with ethical and best practices. The total population of the study is 576 comprising of top management employees who have spent 15yrs and above in these various manufacturing companies. The sample size of the study was determined by the use of the TARO Yamane formula.

$$n = N / 1 + N (e)^2$$

Where: n = sample size, N = population of study and e = error margin 5%. Thus, $n = 576 / (1 + 576(0.05)^2$ and the sample size of the study is 236.

236 questionnaires were sent to workers at different industrial firms who had worked for 15 years or more. The distribution of the copies of the questionnaires was done on equal representation of these manufacturing companies to be able to capture all the various dimension of business ethics and corporate social responsibility. Only 200 questionnaires were found suitable for our analysis. Questions were developed using the five-point Likert scale ranging from “strongly disagree” to “strongly agree”. The Ethics Position questionnaires (EPQ) was developed by Forsyth to measure ethical ideologies, codes and morals conduct held by employees. However, the ethics position Questionnaires was re-modified for appropriateness of the independent variable. It has a high degree of internal accuracy (Forsyth, 1980; Schlenker& Forsyth) and has been included in a number of trials, including Singhapakdi and Vitell (1994) and Rawwas, Patzer, and Klasseh (1994). (1995). The 5-item leadership at work (ELW) questionnaire created by Kalshoven, Den Hartog, and De Hough was used to test ethical leadership (2011). Fairness, honesty, legal advice, task clarity, and respect for sustainability are among the factors measured in the questionnaires.A five-item corporate social responsibility scale was used to test attitudes about stakeholders' support and beneficial management activities (Valentine & Fleischman, 2008; Valentine &Godkin, 2009).Data were analyzed using OLS regression, canonical correlation analysis techniques and descriptive statistic. To certify the regression analysis fit before generalisation, the Jacque Bera normality test, correlation, and OLS regression analysis, as well as the post regression diagnostic test (PRDT) were used. The VIF test, a test for heteroskedasticity, and the Ramsey regression specification-error test for omitted variables are among the tests (Ramsey Reset). The mathematical package for data processing in this thesis was STATA version 13.0.

Thus, the model Specification is established as follows:

$$CSRA = \alpha 0 + \beta 1ECOD + \beta 2COPI + \beta 3\ ELSH + \beta 4BREQ + Ui$$

Where:
ECOD = Ethical Code,
COPI = Corporate Image,
ELSH = Ethical Leadership
BREQ = Brand Equity
CSRA = corporate social responsibility, activities
$\alpha 0$= Constant
$\beta 1 - \beta n$ = Regression coefficient.

4 Results

The Cronbach alpha statistic index test was used to determine reliability, and a pilot test was conducted with 20 copies of the questionnaires distributed at random to workers of the manufacturing firms. The pilot test reveals that the questionnaire is relevant and reliable because the Cronbach's alpha for business ethics (0.78) and CSR (0.87) is higher than the minimum threshold of 0.70. Using STATA version 13.0 programme, data was obtained and the questionnaire's reliability was calculated. Participants' answers were handled with anonymity to avoid traditional process prejudice (Conway & Lance, 2010; Podsakoffet al., 2003), which minimized apprehension. Further respondents were informed that the independent variable (ethical codes, corporate image, ethical leadership and brand equity) is not linked to the dependent variable (corporate social responsibility). Since there is no heteroscedasticity problem, the heteroscedasticity test (table 3) assumes that the difference between the dependent and independent variables is homoscedastic. The model is free of unequal variance at 1.27(0.2631), implying that the regression findings are sufficient to evaluate the hypotheses. The mean VIF value in the variance inflation factor test is 2.67, which is smaller than the reference value of 5. (Ringle et al., 2015). This means that multi-collinearity is not present. The probability value of 0.3479 derived from the Ramsey regression equation definition error test indicates that there are no omitted variables in the formula.

Table 1. Descriptive statistics

variable	mean	p50	max	min	N
ecod	4.205	4	5	2	200
copI	4.245	4	5	2	200
elsh	4.325	4	5	2	200
breq	4.265	4	5	2	200
csra	4.24	4	5	2	200

Table 2. Correlation results

	ecod	copi	elsh	breq	csra
ecod	1.0000				
copi	0.7549	1.0000			
elsh	0.7089	0.7242	1.0000		
breq	0.7206	0.4894	0.5716	1.0000	
csra	0.7313	0.7368	0.8041	0.5258	1.0000

The following hypotheses were tested using OLS Multiple Regression n the Table 1 below

Table 3: OLS Regression result of business ethics and corporate social responsibility

Variables	**B**	**T**	**P>/t/**
Ethical Code	0.2858952	3.86	0.000
Corporate Image	0.1360846	1.98	0.029
Ethical Leadership	0.4813349	7.92	0.000
Brand Equity	0.1099185	1.98	0.031
Cons.	0.0959061	0.49	0.628
R-squared	0.7330		
Adj. R-squared:	0.7261		
F	106.52		
Prob.>F.	0.0000		
Post Regression test:			
Heteroskedasticity	1.25(0.2631)		
Ramson RESET test	0.3479		
Mean VIF	2.67		

Source: Own (2020)

The descriptive features of the data collection used in the study as seen in Table 1. The constructs have a higher value of 5, meaning that the respondents are strongly in agreement with all of the questions posed at some point, while the constructs have a lower limit of 2, indicating that the respondent disagrees with some query. The sample size is 200 respondents, according to the descriptive statistics. Based on the average findings, we can deduce that participants agree with the following statements: ethical code (4.21), corporate reputation (4.25), ethical leadership (4.33), and market equity (4.33). (4.26).Regression result in table 3 reveals that ethical code, corporate image, ethical leadership and brand equity R^2 = (.733) jointly accounts for 73.3% variation in corporate social responsibility in manufacturing companies in south-south Nigeria. Other variables not included in the present study explain 26.7%. variation in corporate social responsibility in manufacturing companies. The standard coefficients (beta) were used to evaluate the strength of ethical code corporate image, ethical leadership and brand equity. The regression results in table 3, ($t = 3.86$, $\beta=0.286$, $p < .05$) supports ***H1***there is a significant relationship between ethical codes and corporate social responsibility. This result is consistent with other related studies (e.g., Ebitu&Beredugo, 2015;

Razaq et al., 2013; Obara&Paelttie, 2017; Preuss & Brown, 2012) that concluded ethical codes fosters positive behaviour, integrity, and resourcefulness. The mission statements communicate the strategic posture of firms to their stakeholders (Nimwegen, Bollen, Hassink&Thijssens, 2008). Strategically, a mission statement must communicate a firm's ethical codes and values. The removal of ethical code and values can lead to failure and collapse of firms. We infer that organization that is committed to implementing ethical codes and values tends to engage more in corporate social responsibility. ***H2***(t =1.98. β = 0.136, $p<$ .05) there is a significant relationship between corporate image and corporate social responsibility is affirmed. This result provides support to the notion that corporate image influences corporate social responsibility (Al Mubarak, Ben Hamed&Al Mubarak, 2019; Vazifehdust, Mojoudi&Jalalian, 2014). ***H3***(t = 7.92, β= .481 $p < .05$) there is a significant relationship between ethical leadership and corporate social responsibility is supported. This result aligns with related studies that ethical leadership strengthen moral responsibility and corporate social responsibility (e.g. Tuan, 2014; Walumbwa et al., 2011, Piccolo et al., 2010). Strategic leaders need to conduct business ethically to ensure business sustainability (Nwachukwu & Vu, 2020). Arguably, ethical leaders that are committed to their job may experience a high quality of relationship with various stakeholders. Our result also supports ***H4*** (t= 1.98, β =.109, $p < .05$) there is a significant relationship between brand equity and corporate social responsibility. This finding agrees with extant literature (e.g., Lai, Chiu, Yang &Pai, 2015; Saeednia&Sohani, 2013; Ebitu&Beredugo, 2015) that implementing brand equity helps to identify and deal with ethical misconduct, an initiative to support quality corporate social responsibility. All the predicted hypotheses are supported. Given the scarcity of study on management practises in Nigeria's manufacturing industry, (Nwagu, 2019), particularly business ethics and corporate social responsibility, the present study contributes to strategic management and business policy literature. By recognizing the positive impact of ethical codes, corporate image, ethical leadership and brand equity, organizations can gain legitimacy. Developing and executing robust policies (e.g. human resources) can promote positive organisational outcome, strategic performance (Vu & Nwachukwu, 2020). In this context, strengthening, elaborating, and constantly improving policies framework in the sphere of ethical codes, leadership quality, brand equity and corporate image can foster corporate social responsibility.

Conclusion

Firms' resources and managerial processes can foster an ethical business environment. This study enriches our understanding of ethical code, ethical leadership, corporate image, brand equity and corporate social responsibility of manufacturing companies, in south-south Nigeria. Our result suggests that corporate social responsibility is influenced by ethical codes, corporate image, ethical leadership and brand equity. We observed that ethical leadership has the greatest effect on CSR compare to ethical codes, brand equity and company image. It becomes imperative for companies to set their priorities rights and give attention to host community stakeholders in terms of their corporate social responsibility activities. These findings are highly critical for the competitiveness and efficiency of Nigerian manufacturing companies. Improving and engaging in corporate social responsibility will lead to positive organizational outcomes. This study informs managers and stakeholders in the manufacturing sector on the importance of creating an enabling environment that encourages corporate social

responsibility. Doing this would promote a harmonious relationship between the companies and their stakeholders. Given the stated discussion, finding and conclusion, the author proposes the following suggestions that could assist managers to implement business ethics and enhance corporate social responsibilities activities of organizations.

- Ethical code should be used to foster positive behaviour, attitude and preservation of corporate culture. This could help to prevent failures and collapse of intended or established social responsibility activities.
- Manufacturing companies should give attention to their corporate image it helps to speak on their behalf.
- Manufacturing companies must ensure that managers in the helm of affairs possess ethical leadership skills this would help in strengthening moral responsibility, commitment and loyalty of managers in executing corporate social responsibility activities.
- Manufacturing companies should pay attention to their brand equity since they serve as a non-paid form of advertisement.

The current thesis has some flaws that should be addressed in future research. Our research centred on Nigeria's manufacturing industry. Then, to some extent, restrict the study's generalizability outside this sense. Patel, Kohtamäki, Parida, &Wincent, 2015; Parida&Ortquist, 2015) found that a single market analysis decreases the difficulty of multiple business surveys. More studies can be conducted in various sectors, with a large sample size, and across countries to get a better understanding of the phenomena.

References

[1] Abun, D. (2015). Moral standard and corporation moral responsibility. South American Journal of Management, 1(2), 1-15.

[2] Adda, G., Azigwe, J. B. &Awuni, A. R. (2016). Business ethics and corporate social responsibility for business success and growth. European Journal of Business and Innovation Research, 4(6), 26-42.

[3] Agyemang, O. S., &Ansong, A. (2017). Corporate social responsibility and firm performance of Ghanaian SMEs: Mediating Role of Access to Capital and Firm Reputation. Journal of Global Responsibility, 8(1), 47–62.

[4] Al Mubarak, Z., Ben Hamed, A.&Al Mubarak, M. (2019). Impact of corporate social responsibility on bank's corporate image. Social Responsibility Journal, 15(5), 710-722.

[5] Aydin S & Ozer, G. (2005). The analysis of antecedents of customers loyalty in the Turkish mobile telecommunication market. Europe Journal of marketing, 39(7), 910-925.

[6] Bello, S. M. (2012). Impact of ethical leadership on employees' job performance. International Journal of Business and Social Science, 3(11) 228-236.

[7] Berrone, P., Sureroca, J. &Tribo, J. A. (2007). Corporate ethical identity as a determinant of firm performance. A test of the mediating role of stakeholder satisfaction. Journal of business ethics, 76(1), 35-53.

[8] Conway, J. M. & Lance, C. E. (2010). What reviewers should expect from authors regarding common method bias in organizational research. Journal of Business and Psychology, 25(3), 325–334.

[9] Daft, R. (2001). Organization theory and design. Cincinnati, Ohio: South Western.

[10] Ebitu, E. T. &Beredutgo, S. B. (2015). Business ethics and the performance of service firms in Calabar, Cross River, Nigeria. European Journal of Hospitality and Tourism Research, 3(2), 28-38.

[11] Falola, H. O, Adeniji, A. A, Adeyeye, J. O., Osibanjo, A. O, Igbinoba, E. E &Salau, O. P. (2018) Corporate image and customers behavioral outcomes in the ICT inclined hospitality

industry in Nigeria. Intentional Journal of Mechanical Engineering and Technology, 9(13), 854-864.
[12] Famiyeh, S. (2017). Corporate social responsibility and firm's performance: empirical evidence. Social Responsibility Journal, 13(2), 390-406.
[13] Feng, M., Wang, X., &Kreuze, J. G. (2017). Corporate social responsibility and firm financial performance Comparison analyses across industries and CSR categories. American Journal of Business,32(3/4), 106-133.
[14] Forsyth, D. R. (1980). A Taxonomy of ethical ideologies. Journal of Personality and Social Psychology, 39(1), 175-184.
[15] Freeman, R. E. & Reed, D. L. (1983). Stockholders and stakeholders: a new perspective on corporate governance. California Management Review, 25(3), 88-106.
[16] Freeman, R. E., Wicks, A. C. & Parmar, B. (2004). Stakeholder Theory and The Corporate Objective Revisited. Organization Science,15(3), 364-369.
[17] Friedman, M. (1970). The social responsibility of business is to increase its profits. The New York Times Magazine 32, 122-126.
[18] Hebe, K. E. (2018). The effect of ethical leadership on employees creativity. International Journal of Economics and Management Science, 7(5), 1-13.
[19] Jensen, M. C. (2001). Value maximization, stakeholder theory, and the corporate objective function. Journal of Applied Corporate Finance, 14(3), 8-21.
[20] Kalshoven, K., Den Hartog, D. N. & De Hough, A. H. (2011). Ethical leadership at work questionnaire (ELW); development and validation of multidimensional measures. The Leadership Quarterly, 22(1), 51-69.
[21] Lai, C. S., Chiu, C. J., Yang, C. F. & Pai, D. C. (2015). The effects of corporate social responsibility on brand performance. The mediating effect of industrial brand equity and corporate reputation. Journal of Business Ethics, 14(4), 457-469.
[22] Lee, J. W. (2020). CSR Impact on the Firm Market Value: Evidence from Tour and Travel Companies Listed on Chinese Stock Market. Journal of Asian Finance, Economics and Business, 7(7), 159-167.
[23] Mahrani, M., &Soewarno, N. (2018). The effect of good corporate governance mechanism and corporate social responsibility on financial performance with earnings management as mediating variable. Asian Journal of Accounting Research, 3(1), 41-60.
[24] Milenkovska, V., Petrovsja, J. &Stoikovsk, A. (2019). Positive attitude towards business ethics and social responsibility for improving corporate image. UTMSJournal of economics, 10(1), 97 – 107.
[25] Miller, S. R., Eden, L. & Li, D. (2017). Corporate social responsibility and firm performance - A dynamic approach. Journal of Business Ethics, 163(3), 619-636.
[26] Nimwegen, V. G., Bollen, H. L., Hassink, H. &Thijssens, T. (2008). A stakeholder perspective on mission statements: An international empirical study. International Journal of Organizational Analysis, 16(1/2), 61-82.
[27] Nwachukwu, C. & Vu, M. H. (2020). Strategic flexibility, strategic leadership and business sustainability nexus. International Journal of Business Environment, 11(2), 125-143.
[28] Nwachukwu, C., Žufan, P. &Chládková, H. (2020). Employee commitment to strategy implementation and strategic performance: organisational policy as moderator. International Journal of Business Excellence, 20(3), 398-418.
[29] Nwagu, K. (2019). Impact of practices of corporate social responsibilities on the performance of Business in the context of contemporary Nigeria society. Texila International Journal of Management,Special edition, 1-15.
[30] Obara, L. J. & Peattie, K. (2017). Bridging the great divide? making sense of the human right – CSR, Relationship in UK multinational companies, Journals of World Business, 53(6), 781-793
[31] Parida, V. &Örtqvist, D. (2015). Interactive effects of network capability: ICT capability, and financial slack on technology-based small firm innovation performance. Journal of Small Business Management,53(S1), 278–298.

[32] Patel, P. C., Kohtamäki, M., Parida, V. &Wincent, J. (2015). Entrepreneurial orientation as-experimentation and firm performance: the enabling role of absorptive capacity. Strategic Management Journal, 36(11), 1739–1749.
[33] Piccolo, R. F., Greenaum, R., DenHartog, D. N. & Folger, R. (2010). The relationship between ethical leadership and core job characteristics. Journal of Organizational Behaviour 31, 259-278.
[34] Pinto, L. &Allui, A. (2020). Critical Drivers and Barriers of Corporate Social Responsibility in Saudi Arabia Organizations. Journal of Asian Finance, Economics and Business, 7(11), 259–268.
[35] Podsakoff, P., MacKenzie, S., Lee, J. & Podsakoff, N. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of Applied Psychology, 88(5), 879–903.
[36] Porter, M. E., & Kramer, M. R. (2007). Strategy and Society: The Link Between Competitive Advantage and Corporate Social Responsibility. Harvard Business Review84, 78–92.
[37] Preuss, L & Brown, D (2012). Business, policies on human rights. an analysis of their content and prevalence among FTST 100 firms. Journals of business ethics, 109(3), 2789-299.
[38] Rawwas, M. Y. A. & Patzer, G. L. (1995). Consumer ethics in cross- cultural settings entrepreneurial implications. European Journal of marketing, 29(7), 62 -78.
[39] Razaq, S., Ahmad, M., Zahid, S., Razaq, W., Gul, R. & Naeem, N. (2013). The impact of ethical values on the corporate social responsibility in public sector of Pakistan. European Journal of Business and Management,5(1), 44-50.
[40] Saeed, R., Shekeel, M. & Lodhi, R. N. (2013). Ethical behaviour and employee performance in education section of Pakistan. Middle East Journal of Scientific Research, 18(4), 524-529.
[41] Saeednia, H. R. &Sohani, Z. (2013). Investigation of effects of advertising on social responsibility reputation and value of brand equity of companies. Management Science Letters, 3(4), 1139-1144.
[42] Schlenker, B. R. & Forsyth, D. R. (1977). On ethical of psychological research. Journal of Experimental Social Psychology, 13(4), 369-396.
[43] Singh, K. H. T. & Singh, M. S. (2013). Ethic in corporate social responsibility. IOSR Journal of Business and Management, 9(2), 16-21.
[44] Singhapakdi, A. & Vitell, S. J. (1994). A cross cultural study of moral philosophies ethical perception and judgments – a comparison of American and Thai marketer. International Marketing Review, 11(6), 65-78.
[45] Soewarno, N., Tjahjadi, B. &Fitriyah, M. (2021). The Role of Corporate Social Responsibility on the Relationship of Competitive Pressure and Business Performance of Batik Industry in Central Java, Indonesia. Journal of Asian Finance, Economics and Business,8(1), 863-871.
[46] Trevino, L. K., Brown, M. & Hartman, L. P. (2003). A qualitative investigation of perceived executive ethical leadership perception form inside and outside the executive suit. Human relations, 55(1), 5-37.
[47] Tuan, K. (2014). Corporate social responsibility leadership and brand equity in health care service. Social Responsibility Journal, 8(3), 347-362.
[48] Valentine, S &Godkin, L. (2009). Ethics, social responsibility, and ethical reasoning in an education-based health science center: When doing good results in good employees. Journal of Leadership, Accountability and Ethics, 7(3), 1-17
[49] Valentine, S. & Fleischman, H. (2008). Ethics programs, perceived corporate social responsibility and Job Satisfaction. Journal of Business Ethics, 77(2), 159-172.
[50] Vazifehdust, H., Mojoudi, A &Jalalian, S (2014). The effect of corporate social responsibility on corporate image, customers satisfaction and loyalty in the banking industry (case study: Tehran Melli Bank). Paper presented at Conference of Development and innovation management in management empowerment, pp. 1-23.
[51] Vu, H. M. & Nwachukwu, C. (2020). Human resources, financial resources and strategic performance: Organisational policy as moderator. Quality-Access to Success Journal, 21(175), 18-24.

[52] Vu, H. M. (2020). A review of dynamic capabilities, innovation capabilities, entrepreneurial capabilities and their consequences. Journal of Asian Finance, Economics and Business, 7(8), 485-494

[53] Walumbwa, F. O., Mayer, M. D., Wang, P., Wang, H., Workman, K., & Christensen, A. L. (2011) Linking ethical leadership to employee performance. The role of leader-member exchange, self-efficacy, and organizational identification. Organizational Behavior and Human Decision Process, 155(2), 204-213

[54] Wanner, M. F. (2014). Implement strategy by strategic initiatives with effective program and change management. Paper presented at PMI® Global Congress 2014—EMEA, Dubai, United Arab Emirates. Newtown Square, PA: Project Management Institute.

[55] Zahari, A.R., Esa, E., Rajadurai, J., Azizan, N. A. &MuhamasTmayez, P. A. (2020). The Effect of Corporate Social Responsibility Practices on Board Equity: An Examination of Malaysia's Top 100 Brands. Journal of Asian Finance, Economics and Business, 7(2), 271-280

Women Entrepreneurship In Nigeria: Drivers, Barriers And Coping Strategies

Chijioke NWACHUKWU[1], Olatunji FADEYI[2], Njoku PAUL[3], Hieu Minh VU[4]
{cesogwa@yahoo.com[1], fadeyiolatunji@yahoo.com[2], a08036002952@gmail.com[3], hieu.vm@vlu.edu.vn[4]}

Business School, Horizons University Paris, France
Department of Financial Technologies, South Ural State University Chelyabinsk, Russia[1], College of Insurance and Financial Management Lagos Nigeria[2], Lead City University Ibadan Nigeria[3], (Corresponding author) Faculty of Business Administration, Van Lang University, Vietnam.[4]

Abstract. Entrepreneurship is often considered a male-gendered concept and carries masculine connotations. However, the importance of women entrepreneurs and their contribution to the economy has recently been realized. Over the years women are seen in Nigeria business ecosystem as an unequal gender coupled with the cultural heritage of Nigeria where each woman is expected to be submissive. Women entrepreneurs struggle with gender discrimination, financial constraints, work-family conflict, lack of infrastructural support, unfavourable business and political environments, lack of entrepreneurship education, and personality-related barriers. These obstacles negatively impact the profitability, growth and survival of women-owned businesses. Our paper provides insights into the drivers, barriers and strategies women entrepreneurs adapt to survive and grow their businesses. To achieve this goal, an unstructured questionnaire was employed to elicit information from participants. This study informs entrepreneurs, policymakers and the research community of the survival strategies adopted by women entrepreneurs in Nigeria to deal with the challenges they are facing.

Keywords: Entrepreneurship education, financial constraints, gender discrimination, Women entrepreneurs, work-family conflict.

1 Introduction

Entrepreneurial activities support the survival and growth of business ventures (Nwachukwu, Chládková & Zufan, 2017). Entrepreneurship is the process of creating, organising and running a business enterprise for profit or non-profit reason. Entrepreneurship is an instrument for improving the quality of life for families and communities and for achieving economic and environmental sustainability. Entrepreneurship involves thinking of new ways to solve problems and create value. It is characterised by innovation, proactiveness and risk-taking (Covin & Slevin, 1989; Miller, 1983). Women entrepreneurship is a growing phenomenon (Martinez & Marlow, 2017; Zahra & Wright, 2016), which promote economic growth, creates jobs (Global Entrepreneurship Monitor Report, 2017) and improve quality of life (Orhan & Scott, 2001; McMullan & Warnice, 2016). Yet, the literature on women entrepreneurship and institutions is still fragmented (Giménez & Calabrò, 2018; Jennings & Brush, 2013). Their talents and potential have not been fully explored in developing countries due to economic and socio-cultural complexities (Jamali, 2009). Nonetheless, understanding

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the role of the institutional environment and gender is fast emerging in the literature (Yunis et al., 2019) which offers a strong theoretical foundation for examining women-owned enterprises. The literature on the contextual environment for entrepreneurship is not fully established (De Bruin et al., 2007; Dvouletý et al., 2018), which limits the understanding of the phenomenon. (Paul et al., 2017). Women entrepreneurs are successful in creating and managing small business ventures (e.g., Stevenson & St-Onge 2011). Prior studies have examined the challenges encountered by women entrepreneurs in Africa (e.g., Aladejebi, 2020) and elsewhere (e.g., Terjesen & Elam, 2012; Thébaud, 2015). These studies demonstrated that limited access to finance, human capital development opportunities, discrimination and social constraints, restrictions in decision making, conflicts between work and family life, handling patriarchal societies and gender discrimination hinders women entrepreneurship. It is important to understand gender in the context of entrepreneurship, particularly to identify the constraints, drivers and coping strategies employed by women micro-entrepreneurs. The economic participation of women is crucial in achieving a competitive environment to enable shared prosperity. We argue that it is important to explore the social constructions of gender in entrepreneurship, yielding new insights into the theory and perspectives of entrepreneurship. This is necessary to understand women entrepreneurial behaviour and their struggle to survive, such as how they respond to entrepreneurial constraints. The dynamic business environment in the West African region in general and Nigeria in particular, is pushing entrepreneurs especially women to search for how to remain competitive and survive in the marketplace. The competitive strategies are essential for all visionary women entrepreneurs of the twenty-first century. This paper offers insights into how various women entrepreneurs managed to adapt to the Nigerian business environment. Specifically, we contribute to gender and entrepreneurship literature by providing evidence on the obstacles, enablers and survival strategies of women micro-entrepreneurs in the emerging market context.

2 Literature review

Theoretical framework

Entrepreneurs act within a context determined by formal and informal rules. These rules can either enable or hinder entrepreneurship (Yunis et al., 2019). The feminist theory describes the "position" role of women in society. This theory is appropriate to understand the gendering of social entrepreneurship. We emphasize how gendering is perceived, and how it affects entrepreneurial behaviour. Institutional theory has been used to explain how entrepreneurs are hindered and enabled by the environment in which they live and work (Scott, 2008; Bruton & Ahlstrom, 2010). Feminism suggests that gender is not limited to women or femaleness (Hanson, 1992), but how gender is institutionalised. Arguably, the understanding of gender provides important insights into entrepreneurship research and practice (Henry et al., 2016; Stead, 2017).

Women entrepreneurship in Nigeria

Women in traditional Nigerian culture are considered homemakers and custodians of family honour. The societal norms and conservative practices are widespread. The social setting is often affected by tribal trends that promote patriarchal culture, thus ensuring women are structurally under men. These cultural norms give men control of women's lives, so that

gender forms an organising principle for society. The fact that women's social environment has a significant influence on their entrepreneurial activities present additional barriers for women entrepreneurs. Fielden and Davidson (2005) contend that family issues may hinder women entrepreneur's success. This remains the greatest challenge, particularly for women in a patriarchal society like Nigeria. The presence of women entrepreneur continues to be felt in every sector in Nigeria. Mahadeo, Dusoye and Aujayeb-Rogbeer (2015) observed that the case of disparity between men and women entrepreneurship was pronounced. Challenges faced by women entrepreneurs depend on sector, location and business model. It has been argued that women tend to be more in a disadvantaged position due to discriminatory sociocultural norm which sees them as wives and mothers (Adesua-Lincoln, 2012). Women entrepreneurs tend to have lower levels of financial capital than men entrepreneurs, raise smaller amounts of capital in both debt and equity, and rely on the internal source of financing (family, friend and personal savings) (Adesua-Lincoln, 2012). In Nigeria, women-owned businesses are not economically developed compared to that of men (Ekpe, Alabo & Egbe, 2014). This is due to institutional barriers which do not allow women to fully take part in economic empowerment programmes (Ekpe et al., 2014). Women are considered to have strongly connected to the family, and most work of maintaining the house is assigned to them (Motilewa, Onakoya & Oke, 2015). The generalisation of 'gender' in Nigerian suggest that women are not supposed to engage in stressful and high risk-taking ventures. This has discouraged many Nigerian women from developing, running, and growing successful business ventures. Aladejebi (2020) observes that widespread bias about social discrimination is not the main barriers women entrepreneurs encounter in South-West Nigeria. She concluded that lack of adequate training, access to start-up capital, and poor family support (including spousal support) hampers the growth of women entrepreneurship.

3 Method

This study employs a "*Mixed Method Research* (MMR)" approach (a combination of qualitative and quantitative approaches) (Schoonenboom & Johnson, 2017) in the identification of obstacles, enablers and coping strategies of women micro-entrepreneurs in Oyo State South-West Nigeria. For this study, the qualitative technique was adopted as the main method and is complemented by the quantitative method.

3.1. Design and instrument

This study utilises a phenomenological technique for qualitative analysis and a descriptive method for quantitative analysis. The choice of the phenomenological method is due to the intention of the researchers to draw out the experiences of women micro-entrepreneurs within the Nigerian business environment. Phenomenological qualitative research design is characterised by an expression of live experiences by subjects within a survey (Neubauer et al., 2019). The challenges of women entrepreneurs have been a continuous occurrence, hence, its adoption within the current study. Within the framework of phenomenological qualitative research design, the current study adopts qualitative content analysis which involved coding of spoken words. It is a research technique based on the interpretation of written data content and personal influences using the specified classification procedure of coding and style recognition (Hsieh & Shannon, 2005). As a research instrument, an open-ended interview form comprising of comprised 16 questions was used. The form is divided into two sections, A and

B. Section A contains 7 questions that sought demographic information of participants, while section B contains questions on the entrepreneurial experiences of the women.

3.2. Sample and data collection

Data colle

ction took between September to December 2020 employing the purposive sampling technique. A Purposive sampling method allows a researcher to select respondents who can provide reliable information on the phenomenon under study (Silverman & Marvasti, 2008). Our sample consists of 15 women who are small scale, micro-entrepreneurs. Data collection per participant lasted for 20 minutes and commenced with an introduction of the participant. Participants were informed about the confidentiality clause that comes with the provision of relevant information. This was necessary for the ethical considerations of the research.

4 Results

4.1. Quantitative aspects: descriptive statistics

In this section, we analyse field data using bar charts and simple frequency tables showing percentages, where necessary. Figure 1 shows the descriptive analysis of women entrepreneurs by age based on data gathered for the current study. The figure shows that women between ages 30-39 contribute to approximately 53% of surveyed participants, representing the largest part of the sample.

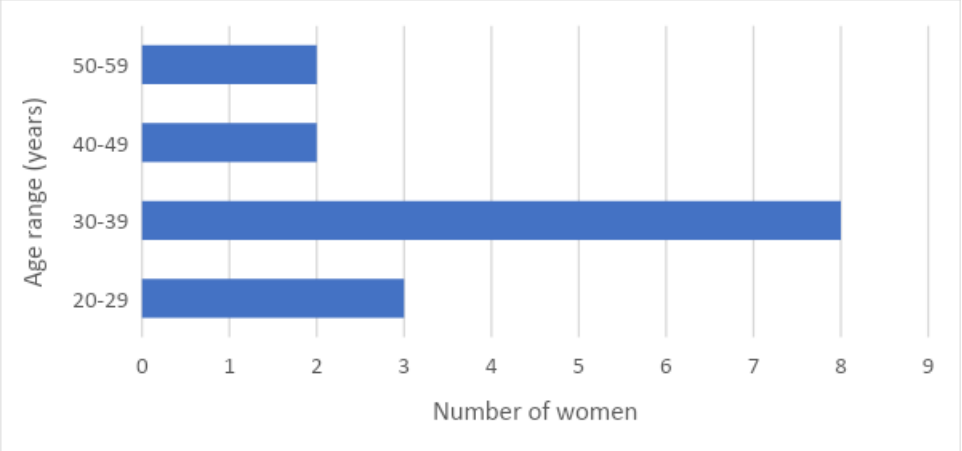

Figure 1. Descriptive statistics of female entrepreneurs by age

With regards to marital status, 60% of participants are married women who have ventured into entrepreneurship business to provide additional support for themselves and their homes. The horizontal bar chart in Figure 2 shows this information as well as the percentage of unmarried ladies (33.3%) who also manage micro-enterprises.

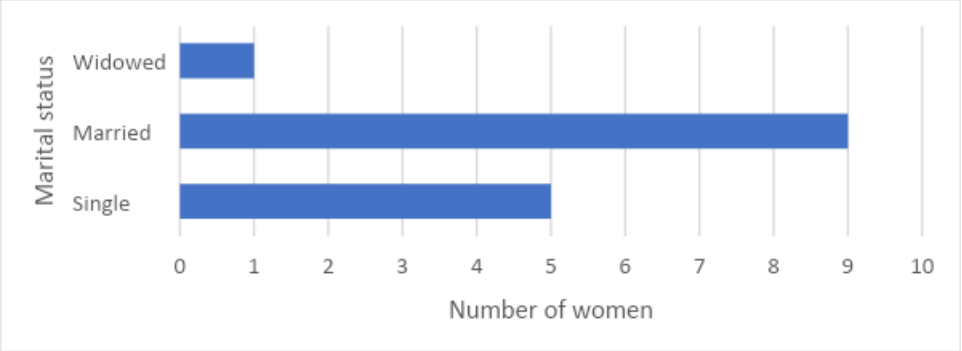

Figure 2. Descriptive statistics of female entrepreneurs by marital status

Data analysis for the current study as shown in table 1 reveals that the average women entrepreneur is educated for up to first grade. More than 35% have received national diplomas in comparison to 33.3% who have first degrees. In the same vein, one respondent was found to have a master's degree in business administration. This result suggests that women entrepreneurs are educated and knowledgeable.

Table 1. Educational level of female entrepreneurs

Level	**Frequency**	**Percentage (%)**
Primary	1	6.7
Secondary	2	13.3
NCE/OND	6	40
Bachelor/HND	5	33.3
Masters	1	6.7
Total	**15**	**100**

Figure 3 shows that women mostly use their personal savings as capital for entrepreneurship business. In the same vein, support from friends and family as well as a few bank loans are also reported.

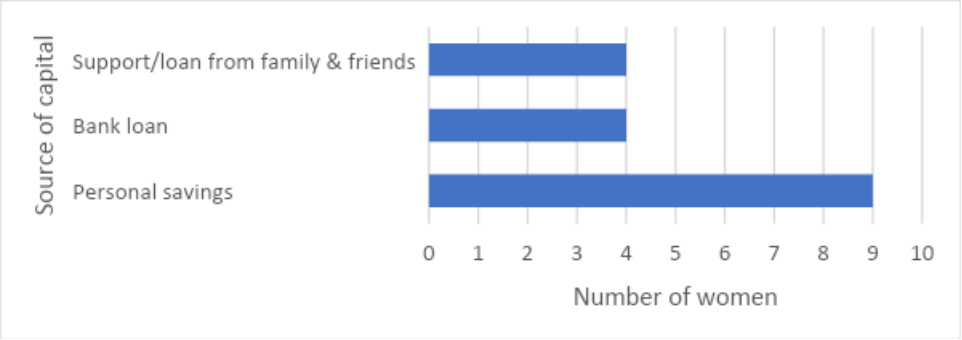

Figure 3. Source of capital of female entrepreneurs

With regards to the type of business amongst the women, it was observed that provision stores and supermarkets were the most common. Women who sold foodstuffs and frozen foods were also well represented. Other business areas include piggery (agriculture), hairdressing, sales of shoes and clothes, electronics and building materials, as well as small restaurants.

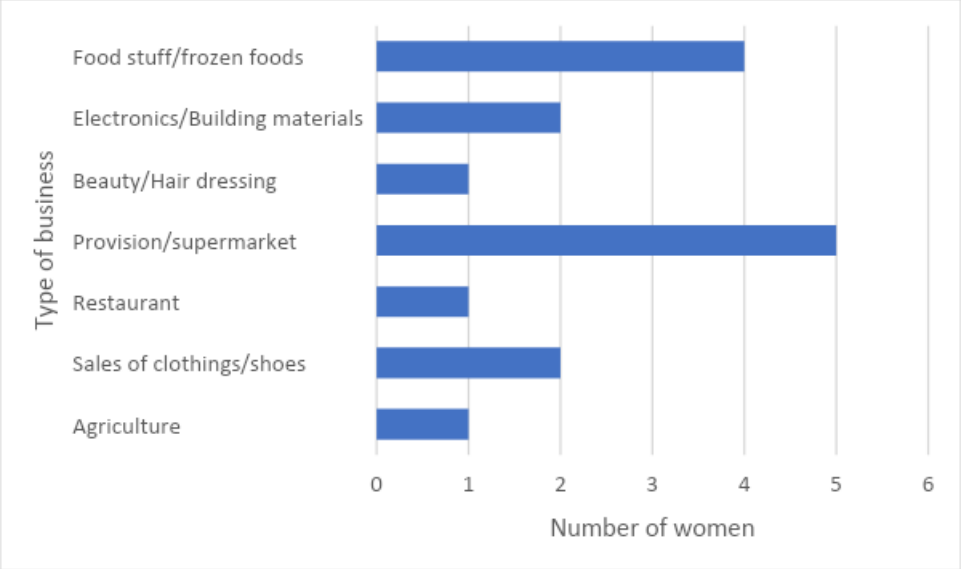

Figure 4: Types of business amongst surveyed female entrepreneurs.

With regards to whether or not women entrepreneurial businesses have been registered with Nigeria's Corporate Affairs Commission (CAC). Table 2 shows that only 40% of participants are yet to get their business registered.

Table 2. Entrepreneurship business registration

Registration	**Frequency**	**Percentage (%)**
Registered	9	60
Unregistered	6	40
Total	**15**	**100**

Table 3 shows how long surveyed women entrepreneurs have been in business. More than half have only been in business a few years. Whereas at least 20% have been in business for over a decade.

Table 3. Years of existence of business

Period of operation (years)	**Frequency**	**Percentage (%)**
< 1- 5	8	53.3
6-10	4	26.7
11-15	1	6.7
16-20	-	-
Above 20	2	13.3
Total	**15**	**100**

4.2. Qualitative Aspects: Content Analysis

Table 4 is the coded transcript for the current study. First, the researchers tried to look through the responses provided by participants to each of the questions. Responses were then grouped logically to provide a first impression of the overall idea of the questions/answers. Next, researchers followed a careful re-reading of the responses as transcribed from the recording device, this preceded the design of a code book. The codes were written out depending on the relationship existing between responses provided to each question by the

participants. When asked about the concept of entrepreneurship, many women entrepreneurs seem to demonstrate a clear understanding of its meaning without mincing words. Furthermore, it was observed many of the women entrepreneurs have mostly attained entrepreneurial skills from family businesses or apprenticeship programs. A few respondents also attended business schools where the knowledge of entrepreneurship was imbibed. Entrepreneurs need skills and knowledge to achieve success. As such, financial and economic knowhow are important competencies that can enable entrepreneurs, especially women micro-entrepreneurs to improve profitability (Vu & Nwachukwu, 2021).

Table 4. Coding of responses provided by female entrepreneurs

S/N	Question	Responses	Code
1.	Meaning of entrepreneurship	Personal business ownership	Basic understanding
2.	Mode of entrepreneurial skill acquisition	Learning via apprenticeship, family businesses, and business schools	Training avenues
3.	Motivation for entrepreneurship	Ability to meet personal needs	Financial security and Independence
4.	Entrepreneurial challenges	Running capital and irregular power supply	Paucity of Funds and infrastructural deficit
5.	Reason(s) for entrepreneurial challenges	Inaccessibility to bank loans; economic challenges exacerbated by pandemic; laissez faire attitude by government	Lack of opportunities for business growth
6.	Strategy(ies) to surpass challenges	Sourcing for alternative loan routes Customer service Credit sales	Resilience
7.	Impact of adopted strategy(ies) on business	Mostly negative, clumsy process by microfinance banks for little amount of money	Frustration funding processes
8.	Common barriers of female entrepreneurs	Spouse unwillingness to help in chores and care of children	Family structure
9.	Impact of barriers on entrepreneurial abilities	Hindering business growth and expansion	Inability to fulfil business potentials

All these training avenues ensured that participants are sufficiently skilled to succeed as entrepreneurs. It was important for many women to embrace entrepreneurship to gain financial freedom and some level of independence from spouses. This seemed like the most common motivation amongst the women for starting their businesses. Concerning the challenges faced, the paucity of funds was the main problem, and many women entrepreneurs hold the opinion that the availability of funds would have a positive impact on how much their businesses could grow. Furthermore, some of the participants who are into sales of frozen foods stressed the need for constant power supply. This is where the role of government is crucial, as infrastructural deficits would imply that there are little or no opportunities to grow. Notwithstanding the regular negative responses when they apply for loans, many of the women entrepreneurs continue to demonstrate resilience by seeking alternative routes to

securing loans. Some of the women explained that micro-finance banks are sometimes helpful, but that the process to secure very little amounts of money can be frustrating. There were also discussions around very high-interest rates charged by some of these banks. Overall, women entrepreneurs face competition for sales from their male counterparts and are mostly disadvantaged as some spouses do not support the businesses of their wives. All of these challenges hinder women entrepreneurs from fulfilling their business potentials.

5 Discussion of Results

Coded results in table 4 show several discouraging situations faced by women who have taken up entrepreneurial roles. Notwithstanding there are few positives that can be derived from opinions provided by women entrepreneurs. When asked about the challenges faced by women entrepreneurship, and the steps so far taken to surpass these challenges, one respondent stated that:

"I don't have adequate funds to support expansion, however, I'm being creative/innovative with the small funds I have so that my business can grow".

This implies that although finances remain a major barrier to the success of women entrepreneurship, innovativeness in business can help women grow as it can be adopted as a survival strategy. A typical way for a small business to innovate is for entrepreneurs to learn from the experiences, successes, and failures of other businesses (Akinwale et al., 2017). This is related to the adoption of outside knowledge to grow and is commonly referred to as "open innovation" (Akinwale, 2018). Organisations need to create and renew their capabilities (Nwachukwu & Vu, 2020) and find new ways to deliver their products and services to remain competitive (Nwachukwu, Zufan & Chládková, 2020). Another woman, a frozen food seller, lamented that:

"Lack of regular *power supply is the main problem for my business, even if I get a loan today, will I use all to buy fuel to power generator? ''Buying fuel to power generator will have a negative impact on my business".*

The above response shows another barrier to the sustainability of women entrepreneurial businesses. The impact of infrastructural deficit on entrepreneurship businesses (e.g., Obokoh & Goldman, 2016) is well documented in the Nigerian business literature. This affects all businesses, whether controlled by a woman or not. The government's attitude towards the funding of small-scale business in Nigeria, especially those run by women has not been encouraging. Similar to the provision of infrastructure, many of the women noted that the government is not doing enough to help them. Although there are quite a few structures in place to help SMEs, their effect has not been felt (Oboh & Nwachukwu, 2018). In many cases, the loans available are insignificant compared to the number of people that apply for them. As such, the government's negligence of entrepreneurial funding issue was greatly criticized by many participants.

Another identified barrier is the issue of family structure and how men support the businesses of their wives. One woman stated that:

"*My inability to travel far away to buy goods is affecting my business''. My husband will not allow me to, because there'll be no one to take care of the children if I travel".*

Women entrepreneurs are finding ways of coping with the barriers they are facing. One woman, a building materials seller stated that:

"I offer good customer service and sell on credit to encourage customers to buy from me" "Though selling on credit has its disadvantages; it is the method am using to survive".

Organisations need a robust strategy to deal with challenges posed by environmental dynamism and competition (Nwachukwu, Chládková & Olatunji, 2018). Customer satisfaction is essential to sustain customer loyalty (Deng et al., 2009; Nwachukwu & Zufan, 2017; Sabir et al., 2014) to survive in the marketplace. Given that, a satisfied customer will make repeated purchases and inform other customers about a firm's product/service. It is important to note that a poorly managed customer experience may lead to loss of patronage and revenue. From the forgone responses by some entrepreneurial businesswomen in Nigeria, this study developed themes that address the research objectives. Figure 5 shows the grouping of enablers, barriers, and coping strategies employed by women-owned micro entreprises. The figure reveals that there are more barriers than enablers to the success of women-owned micro entreprises in Nigeria.

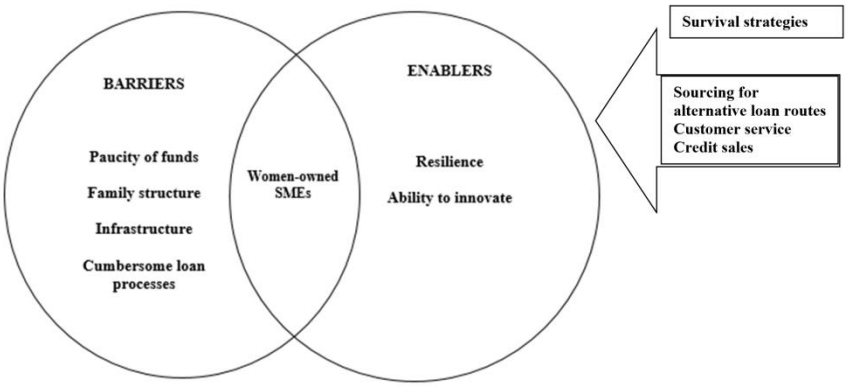

Figure 5. Themes derived for the study.

Conclusions

The survival of women-owned businesses has important implications for sustaining efforts made in advancing women's economic empowerment and gender equality across the world. This study has presented insight into gender and the gendering of women's entrepreneurship in the emerging market context. We capture the interpretive accounts of the challenges, enablers and coping strategies adopted by women micro-entrepreneurs. The findings suggest that paucity of funds was the main problem, and many women entrepreneurs hold the opinion that availability of funds would have a positive impact on how much their businesses could grow. Family structure, inadequate infrastructure and cumbersome loan processes present some challenges for women micro-entrepreneurs. Women entrepreneurs

tend to be more concerned with balancing work and family, thus, deliberately choosing to keep their businesses small and easily controllable. Resilience and the ability to innovate is are important enablers for women entrepreneurs, even when they do not have access to enough funding opportunities. Creative education and training can foster women entrepreneurs' creativity (Vu & Nwachukwu, 2020). Further, sourcing for alternative loan routes, customer service and credit sales are survival strategies employed by women micro-entrepreneurs. This study shed light on the experiences of women entrepreneur in Oyo State Nigeria, their constraints, motivations and survival strategies, contributing to gender and entrepreneurship literature in the developing country context. We, therefore, recommend that.

1. Government must provide adequate infrastructure to support women micro-entrepreneurs
2. Lending institutions should make it easy for women micro-entrepreneurs to assess loans for their businesses
3. Government agencies for example Small and Medium Enterprises Development Agency (SMEDAN) must ensure that loans are granted according to laid down rules.
4. Women micro-entrepreneurs should register their businesses with the Corporate Affairs Commission and other relevant government agencies as this can facilitate easy access to funding and support.

The present study has some shortcoming. This research uses a qualitative and descriptive approach, with a non-probability sample which somewhat limits its generalisability beyond this context. Nonetheless, this study adds to the debate on gender and entrepreneurship in the developing economies setting.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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References:

[1] Adesua-Lincoln, A. (2012). Prospects and Challenges of Women Entrepreneurs in Nigeria (November 28, 2012). Available at SSRN: https://ssrn.com/abstract=2181943 or http://dx.doi.org/10.2139/ssrn.2181943

[2] Akinwale, Y.O. (2018). Empirical analysis of inbound open innovation and small and medium-sized enterprises' performance: Evidence from oil and gas industry. South African Journal of Economic and Management Sciences, 21(1),1-9.

[3] Akinwale, Y., Adepoju, A & Olomu, M., (2017). The impact of technological innovation on SMEs profitability in Nigeria. International Journal of Research, Innovation and Commercialization, 1(1), 74–92.

[4] Aladejebi, O. (2020). 21st Century Challenges Confronting Women Entrepreneurs in Southwest Nigeria. Archives of Business Research, 8(3), 261-280.

[5] Bokoh, L.O. & Goldman, G. (2016). Infrastructure deficiency and the performance of small- and medium-sized enterprises in Nigeria's Liberalised Economy. Acta Commer., 16(1), 1-10.

[6] Bruton, G.D., Ahlstrom, D & Li, H.L. (2010). Institutional theory and entrepreneurship: Where are we now and where do we need to move in the future? Entrep. Theory Pract. 34, 421–440.

[7] Covin, J.G. & Slevin, D.P. (1989). Strategic management of small firms in hostile and benign environments. Strategic Management Journal 10, 75–87.

[8] De Bruin, A., Brush, C.G. and Welter, F. (2007). Advancing a framework for coherent research on women's entrepreneurship. Entrep. Theory Pract. 31, 323–339.
[9] Deng, Z., Lu, Y., Wei, K.K & Zhang, J. (2009). Understanding customer satisfaction and loyalty: An empirical study of mobile instant messages in China. International Journal of Information Management, 30(4), 289 – 300.
[10] Dvouletý, O., Gordievskaya, A. & Procházka, D.A. (2018). Investigating the relationship between entrepreneurship and regional development: Case of developing countries. J. Glob. Entrep. Res., 8-16. https://doi.org/10.1186/s40497-018-0103-9
[11] Ekpe, D.E., Alabo, E & Egbe, I.J. (2014). Women, gender equality in Nigeria: A critical analysis of socioeconomic and political (gender issues). Journal Research in Peace Gender and Development, 4(1), 15–20.
[12] Ekpe, D.E., Alabo, E & Egbe, I.J. (2014). Women, gender equality in Nigeria: A critical analysis of socioeconomic and political (gender issues). Journal Research in Peace Gender and Development, 4(1), 15–20.
[13] Fielden, S.L & Davidson, J.M. (2005). The way forward for women small business owners', in Fielden, S. L. and Davidson, J. M. (Eds.): International Handbook of Women and Small Business Entrepreneurship. Cheltenham: Edward Elgar Publishing Limited.
[14] Giménez, D. & Calabrò, A. (2018). The salient role of institutions in Women's entrepreneurship: A critical review and agenda for future research. Int. Entrep. Manag. J. 14, 857–882.
[15] Global Entrepreneurship Research Association (GERAI. 12017). Global entrepreneurship monitor Global report 2016/17. Available from https://www.gemconsortium.org/report.
[16] Hanson, S. (1992). Geography and feminism: Worlds in collision? Ann. Assoc. Am. Geogr. 82, 569–586.
[17] Henry, C., Foss, L & Ahl, H. (2016). Gender and entrepreneurship research: A review of methodological approaches. Int. Small Bus. J., 34, 217–241.
[18] Hsieh, H.F. & Shannon S.E. (2005). Three approaches to qualitative content analysis. Qual Health Res., 15(9), 1277-88.
[19] Jamali, D. (2009). Constraints and opportunities facing women entrepreneurs in developing countries: A relational perspective. Gend. Manag. Int. J., 24, 232–251.
[20] Jennings, J.E. & Brush, C.G. (2013). Research on women entrepreneurs: Challenges to (and from) the broader entrepreneurship literature? Acad. Manag. Ann., 7, 663–715.
[21] Mahadeo, J.D., Dusoye, I.C. & Aujayeb-Rogbeer, A. (2015). Women and entrepreneurship: an alluring or luring option. Int. J. Entrepreneurship and Small Business, 25(3), 351–374.
[22] Martinez Dy, A. & Marlow, S. (2017). Women Entrepreneurs and Their Ventures: Complicating Categories and Contextualising Gender. London, UK: Routledge
[23] McMullen, J.S. & Warnick, B.J. (2016). Should we require every new venture to be a hybrid organization? J. Manag. Stud. 53, 630–662.
[24] Miller, D. (1983). The correlates of entrepreneurship in three types of firms. Management Science 29, 770–791.
[25] Motilewa, B.D., Onakoya, O. & Oke, A.D. (2015). ICT and gender specific challenges faced by female entrepreneurs in Nigeria. International Journal of Business and Social Science, 6(3), 97-105.
[26] Neubauer, B.E., Witkop, C.T. & Varpio, L. (2019). How phenomenology can help us learn from the experiences of others. Perspect Med Educ. 8, 90–97.
[27] Nwachukwu, C & Vu, M.H. (2020). Strategic flexibility, strategic leadership and business sustainability nexus. International Journal of Business Environment, 11(2), 125-143.
[28] Nwachukwu, C & Žufan, P. (2017). Influence of Customer focused Mission statement on Customer Satisfaction. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 65(3), 1031-1038.
[29] Nwachukwu, C., Chládková, H. & Olatunji, F. (2018). Strategy formulation process and innovation performance nexus. International Journal for Quality Research, 12(1), 147–164.

[30] Nwachukwu, C., Chládková, H., & Žufan, P. (2017). The relationship between entrepreneurial orientation, entrepreneurial competencies, entrepreneurial leadership and firm performance: A proposed model. Business Trends, 7(1), 3-16
[31] Nwachukwu, C., Žufan, P. & Chládková, H. (2020). Employee commitment to strategy implementation and strategic performance: organisational policy as moderator. International Journal of Business Excellence, 20(3), 398-418
[32] Oboh, I. & Nwachukwu, C.E. (2018). Entrepreneurial support in Nigeria: A review paper. Management Strategies, 2(40), 45-51.
[33] Orhan, M. & Scott, D. (2001). Why women enter into entrepreneurship: An explanatory model. Women Manag. Rev. 16, 232–247.
[34] Paul, J.; Hermel, P. & Srivatava, A. (2017). Entrepreneurial intentions—Theory and evidence from Asia, America, and Europe. J. Int. Entrep. 15, 324–351.
[35] Sabir, R., Ghafoor, O., Hafeez, I., Akhtar, N. & Rehman, A. (2014). Factors affecting Customer Satisfaction in Restaurants industry in Pakistan. International review of Management and Business Research, 3(2), 869 – 876.
[36] Schaupp, L.C. & Belanger, F. (2016). Social commerce benefits for small businesses: An organizational level study. Journal of Organizational and End User Computing (JOEUC), 28(3), 49-66.
[37] Schoonenboom, J. & R. Burke J. (2017). How to Construct a Mixed Methods. Research Design. Köln Z Soziol (Suppl 2)69, 107–131.
[38] Scott, W. (2008). Approaching Adulthood: The Maturing of Institutional Theory. Theory and Society, 37(5), 427-442.
[39] Silverman, D & Marvasti, A. (2008). Doing Qualitative Research: A Comprehensive Guide. Thousand Oaks, CA, USA: Sage.
[40] Stead, V. (2017). Belonging and women entrepreneurs: Women's navigation of gendered assumptions in entrepreneurial practice. Int. Small Bus. J. 35, 61–77.
[41] Terjesen, S., & Elam. A. (2012). Women Entrepreneurship: A Force for Growth. International Trade Forum. 2, 16–18.
[42] Thébaud, S. (2015). Business as plan B: institutional foundations of gender inequality in entrepreneurship across 24 industrialized countries. Administrative Science Quarterly, 60(4),671–711.
[43] Vu, H.M. & Nwachukwu, C. (2020). Constraints and enablers to growth of female-owned businesses: empirical review. Proceedings of the 36th International Business Information Association (IBIMA), 5701-5708, 4-5 November 2020, Granada Spain.
[44] Vu, H.M. & Nwachukwu, C. (2021). Influence of entrepreneur competencies on profitability and employee satisfaction. International Journal of Management and Enterprise Development, 20(1), 1-16.
[45] Yunis, M.S., Hashim, H. & Anderson, A.R. (2019). Enablers and constraints of female entrepreneurship in Khyber Pukhtunkhawa, Pakistan: Institutional and Feminist Perspectives, Sustainability, 11(27), 1-20.
[46] Zahra, S.A. & Wright, M. (2016). Understanding the social role of entrepreneurship. J. Manag. Stud. 53, 610–629.

Work Life Balance of Airhostess at Airlines Sector

Asima Aziz[1], Dr. Y. Vinodhini[2]
{ruhiasima@gmail.com[1], adithyasiddartha13@gmail.com[2]}

Associate Professor, Dept of management studies
Deccan School of Management[1], Professor, Dept of management studies
Anwarul Uloom College of Business Management, Hyderabad

Abstract. Work-life balance is particularly crucial when an organization must handle highly technical professionals because their strong dedication and loyalty are required for the organization's success. Aviation is a strategically important sector of any economy. People working in the aviation industry, particularly the flight attendants/ Air hostess. It is an interesting place to be for people who love to travel, see new sights and experience the ultimate adrenaline rush. Many issues throw into Air hostess not understanding sufficient work life balance including uneven and extended working hours, travelling, spending a lot of time absent from home and the inflexibility of time schedules. This paper empirically analyzes the factors influencing social and emotional factors of airhostess in aviation sector..

Keywords: Work Life Balance, organization, commitment, women, airhostess, factors.

1 Introduction

Work life balance usually pleased with their functioning arrangements (Eikhof D. R., 2007). Work/life balance has become a principal issue in the workplace. Marital status, working hours, necessity of flexibility, added working hours and over time distort the work life balance (Fleetwood S., 2007). Basically the main purpose of work life balance is to have a growth in both in professional and personal growth or satisfaction (Yadav R.K., & Dabhade N., 2014).

Air Hostess

An air hostess, also called as a flight attendant or stewardess, are employees of airline company (Williams C., 2003). They are authorized by federal law to observe public security and guarantee the fulfillment of customers with airline safety systems. They hold the in-flight requirements of clients, administer first aid to those who become unwell, and provide food and beverages (Barry K., 2007). They typically work long hours during which they must do diverse responsibilities.

Job satisfaction

Job satisfaction mostly appears at the level to which employees have optimistic or unenthusiastic manner towards their employment (Ahmad M. B., Wasay E., & Jhandir S. U., 2012). An attitude is an individual employee's feeling (satisfaction, indifference or dissatisfaction) towards a precise condition, object or person. Job satisfaction is the net effect of the superior or poor approach held by an individual employee at a given phase of time

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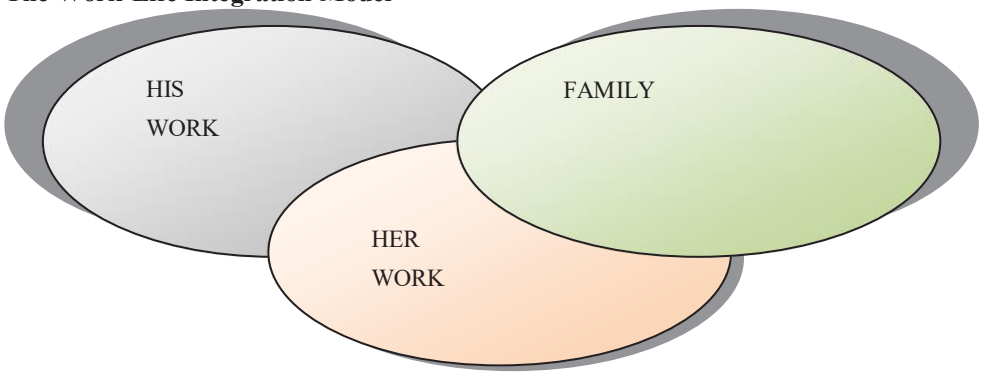
(Maeran R., Pitarelli F., & Cangiano F., 2013). It is subject to swings from one extreme to the other but typically reverts to a quite even stage that can be good or poor.

The Work-Life Integration Model



Source: (Barnett R. , A New Work-Life Model for the Twenty-First Century, 1999)

The above model expresses an understanding for employees and their lives outside of work. This model takes into consideration the needs of its employee's partners or spouses (Fan W., et al., 2015). This is to ensure employers can retain the best employees as well as ensuring optimum working productivity from its employees. Although this model has come about no new formal work-life policies have resulted which recognize men and women as multi-dimensional beings who participate in several roles through their lives (Barnett R., 1999).

2 Review of Literature

Work-life harmony is a crucial principle. All has to strike a balance between their work and family lives in order to live a happy life. This is why employers now choose businesses that have exclusive and appealing work-life balance plans. As a result, many companies implemented Work-Life Balance practices to recruit more workers and minimize work-life tension among current staff in order to improve organizational success (Beauregard T. A., & Henry L. C., 2009).

Work Life balance

1. **Lockwood (2003)** defined work- life balance is a method of balancing work and personal obligations. Senior management would promote work-life activities. An organizational culture that allows workers to look at business in a completely different manner and respects and embraces employees as people with interests outside of the workplace is beneficial for work-life opportunities in the workplace. Employee motivation and morale was increased by work-life balance systems.

Work life balance at Aviation sector

1. **Liang and Hsieh (2007)**, the airline industry's turnover rate remains high due to the difficulty of the job and the delay challenge to strike a balance between home and work life.

2. **Chung and Chung (2009, p. 217)** state "flight attendants have demonstrated abnormally high degrees of fatigue." Therefore, health remains an important part of a flight attendants ability to do his or her job effectively

Social and emotional factors of work life balance

3. **Karasek and Theorell, (1990, p. 6)**Numerous terms are used to describe social support; the most common of which is the beneficial social interactions between managers and colleagues in the organization

4. **Brown, Prashantham and Abbott (2003)** contend about the burnout of employees that social support provided from managers and colleagues have more influence on buffering employees' burnout.

Objectives of the study:

1. To study the conceptual framework of work life balance
2. To analyze social and emotional factors of airhostess in aviation sector.

Hypothesis

H_0: There is no significant impact of work life balance aspects and Work life balance at aviation sector

H_0: Age of respondents has no significant impact on work life balance aspects

3 Research Methodology

Type of study: Descriptive

Primary Data: Primary data has been collected with data collection instrument (Questionnaire) administered to the respondents

Sources of data: Secondary data has been sourced for the present study surf engines, journals, and magazines.

Limitations of the study

- Small sample has been selected for the study
- The information gathered may be biased
- Time is one of the limiting factors

3. Data analysis and interpretation

Table-1: Age

Age	Respondents	%
17-25years	102	68
25-35	48	32

Total	**150**	**100%**

Source: Based on Primary Data

Analysis: From the above table it is clear that 68 percent respondents are in the age group of 17-25 years and remaining 32 percent respondents are in the age group of 25-35 years.

Table-2: Marital Status

Marital Status	Respondents	%
Married	**25**	**17**
Unmarried	**125**	**83**
Total	**150**	**100**

Source: Based on Primary Data

Analysis: It is depicted from the table above pertaining to marital status of sample respondents, that out of 150 sample size of respondents (airhostess) 83 percent respondents are unmarried and remaining 17 percent respondents are married.

Table-3: Qualities of airhostess

Qualities of airhostess	Highly important	Important	Neither/ nor	Not important	Highly unimportant	Total
Multi-tasking	**5**	**8**	**2**	**2**	**1**	**18**
empathy	**4**	**11**	**1**	**1**	**1**	**18**
Situation awareness	**4**	**4**	**2**	**1**	**1**	**12**
learning potential	**3**	**8**	**2**	**1**	**1**	**15**
Tolerant and flexible	**3**	**5**	**2**	**1**	**1**	**12**
Patience	**3**	**8**	**1**	**1**	**1**	**14**
discipline	**3**	**6**	**1**	**1**	**1**	**12**
style and glamorous	**3**	**12**	**2**	**1**	**1**	**19**
kindness	**4**	**8**	**2**	**1**	**1**	**16**
Work in team	**6**	**4**	**2**	**1**	**1**	**14**
Total	**38**	**74**	**17**	**11**	**10**	**150**

Source: Based on Primary Data

Analysis: From the above table it is found that with regards to the qualities of airhostess on **Multi tasking** 5 respondents mentioned as Highly important 8 respondents mentioned as important, 2 respondents mentioned as neither or nor, 2 respondents mentioned as unimportant and only 1 respondent mentioned as highly unimportant, **with regards to empathy**, 4 respondents mentioned as Highly important 11 respondents mentioned as important, 1

respondent mentioned as neither or nor, 1 respondent mentioned as unimportant and 1 respondent mentioned as highly unimportant, **with regards to the qualities of airhostess on Situation awareness** 4 respondents mentioned as Highly important 4 respondents mentioned as important, 2 respondents mentioned as neither or nor, 1 respondent mentioned as unimportant and 1 respondent mentioned as highly unimportant, **with regards learning potential,** 3 respondents mentioned as Highly important 8 respondents mentioned as important, 2 respondents mentioned as neither or nor, 1 respondent mentioned as unimportant and 1 respondent mentioned as highly unimportant. **with regards to Tolerant and flexible,** 3 respondents mentioned as Highly important 5 respondents mentioned as important, 2 respondents mentioned as neither or nor, 1 respondent mentioned as unimportant and 1 respondent mentioned as highly unimportant, **with regards to Patience level of respondents/airhostess** 3 respondents mentioned as Highly important 8 respondents mentioned as important, 1 respondent mentioned as neither or nor, 1 respondent mentioned as unimportant and 1 respondent mentioned as highly unimportant, **with regards to** Discipline, 3 respondents mentioned as Highly important 6 respondents mentioned as important, 1 respondent mentioned as neither or nor, 1 respondent mentioned as unimportant and 1 respondent mentioned as highly unimportant, **with regards to style and** Glamour, 3 respondents mentioned as Highly important 12 respondents mentioned as important, 2 respondents mentioned as neither or nor, 1 respondent mentioned as unimportant and 1 respondent mentioned as highly unimportant, **with regards to kindness,** 4 respondents mentioned as Highly important 8 respondents mentioned as important, 2 respondents mentioned as neither or nor, 1 respondent mentioned as unimportant, 1 respondent mentioned as highly unimportant, and **with regards to work in team** 6 respondents mentioned as Highly important 4 respondents mentioned as important, 2 respondents mentioned as neither or nor, 1 respondents mentioned as unimportant 1 respondent mentioned as highly unimportant

Table-3: Work life balance at aviation sector

	Strongly Agree	**Agree**	**Neither/nor**	**Disagree**	**Strongly Disagree**	**total**
Very good experience	**5**	**8**	**6**	**1**	**1**	**21**
Multi cultural working environment	**5**	**12**	**4**	**2**	**2**	**25**
Every day brings new challenges	**3**	**3**	**2**	**2**	**2**	**12**
Physically challenging	**1**	**2**	**2**	**1**	**2**	**8**
Away from home	**9**	**3**	**1**	**1**	**1**	**15**
Long working hours	**3**	**8**	**2**	**1**	**1**	**15**
Lonely feeling	**2**	**3**	**1**	**2**	**2**	**10**
Fatigue	**3**	**3**	**4**	**1**	**1**	**12**
Constant progress and training	**7**	**10**	**3**	**1**	**1**	**22**
Job security	**1**	**2**	**1**	**3**	**3**	**10**
Total	**39**	**54**	**26**	**15**	**16**	**150**

Source: Based on Primary Data

Analysis: Out of total 150 respondents 21 respondents said very good experience, 25 respondents mentioned as multicultural working environment, 12 respondents every day brings new challenges, 8 respondents physically challenging, 15 respondents away from home, 15 respondents said long working hours, 10 respondents mentioned as lonely feeling, 12 respondents mentioned as fatigue, 22 respondents mentioned as constant progress and training and remaining 10 respondents mentioned as job security.

Table-5: Work life balance aspects

	Strongly Agree	**Agree**	**Neither/nor**	**Disagree**	**Total**
Commitment	**8**	**11**	**2**	**1**	**22**
Adequate and fair compensation	**8**	**5**	**1**	**1**	**15**
Job satisfaction	**6**	**11**	**6**	**2**	**25**
Training and development	**4**	**12**	**2**	**1**	**19**
Safe and healthy working conditions	**3**	**14**	**2**	**2**	**21**
Skill utilization and growth	**5**	**9**	**3**	**2**	**19**
Social Integration	**12**	**5**	**2**	**1**	**20**
Work environment	**6**	**4**	**3**	**2**	**15**
Total	**46**	**71**	**21**	**12**	**150**

Source: Based on Primary Data

Analysis: Out of total 150 respondents 22 respondents mentioned as **commitment**, out of this 8 respondents mentioned as strongly agree 11 respondents as agree, 2 respondents mentioned as neither/nor, and only 1 respondent mentioned as disagree **with regards to adequate and fair compensation(15)** 8 respondents mentioned as strongly agree, 5 respondents mentioned as agree, 1 respondent mentioned as neither or nor and 1 respondent mentioned as disagree, with regards **job satisfaction** 6 respondents mentioned as strongly, 11 respondents mentioned as agree, 6 respondents mentioned as neither or nor, 2 respondents mentioned as disagree. **with regards to training and development(19)** 4 respondents mentioned as strongly agree, 12 respondents mentioned as agree, 2 respondents mentioned as neither or nor and 1 respondent mentioned as disagree, **with regards to Safe and healthy working conditions(21) respondents** 3 respondents mentioned as strongly agree, 14 respondents mentioned as agree, 2 respondents mentioned as neither or nor and 2 respondent mentioned as disagree, **with regards to skill utilization and growth(19)** 5 respondents mentioned as strongly agree, 9 respondents mentioned as agree, 3 respondents mentioned as neither or nor and 2 respondents mentioned as disagree, **with regards to social integration(20 respondents),** 12 respondents mentioned as strongly agree, 5 respondents mentioned as agree, 2 respondents mentioned as neither or nor and 1 respondent mentioned as disagree, **with regards to work environment(15 respondents)** 6 respondents mentioned as strongly agree, 4 respondents mentioned as agree, 3 respondents mentioned as neither or nor and 2 respondents mentioned as disagree

Table: 6 Crosstab of Work life balance at aviation sector and work life balance aspects

Work life balance at aviation sector/work life balance aspects	Commitment	Adequate and fair compensation	Job satisfaction	Training and development	Safe and healthy working conditions	Skill utilization and growth	Social Integration	Work environment	**Total**
Very good experience	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**21**
Multi cultural working environment	**4**	**2**	**3**	**5**	**3**	**3**	**3**	**2**	**25**
Every day brings new challenges	**1**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**12**
Physically challenging	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**8**
Away from home	**1**	**2**	**2**	**2**	**1**	**3**	**2**	**2**	**15**
Long working hours	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**15**
Lonely feeling	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**10**
Fatigue	**1**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**12**
Constant progress and training	**2**	**3**	**3**	**3**	**4**	**2**	**2**	**3**	**22**
Job security	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**1**	**10**
Total	**22**	**15**	**25**	**19**	**21**	**19**	**20**	**15**	**150**

ANOVA

Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Rows	**28.31746**	**8**	**3.539683**	**10.83401**	**1.47E-08**	**2.138229**
Columns	**2.31746**	**6**	**0.386243**	**1.182186**	**0.331675**	**2.294601**
Error	**15.68254**	**48**	**0.32672**			
Total	**46.31746**	**62**				

The **ANOVA** Two-way to find whether there is any significant impact of work life balance aspects and Work life balance of women at aviation sector

α = 0.05 **Reject H_0**

Between Rows:

F calculated value = 10.83401 at (Degree of Freedom 8, 48)
Table Value: 2.138229
Since F cal value is > than F table value Reject H_0

Between Columns:
F calculated value=1.182186 at (Degree of Freedom 6, 48)
Table Value 2.294601

Since F cal Value < Table Value Accept H_0

Hence, null hypothesis has been failed to be accepted, as such the results indicate that there is a significant impact of work life balance aspects on work life balance of women at aviation sector

Table 8: Crosstab of Work life balance at aviation sector and work life balance aspects

Age/worklife balnce aspects	Commitment	Adequate and fair compensation	Job satisfaction	Training and development	Safe and healthy working conditions	Skill utilization and growth	Social Integration	Work environment	**Total**
17-25years	**15**	**10**	**18**	**`15**	**13**	**12**	**16**	**12**	**68**
25-35	**7**	**5**	**7**	**4**	**8**	**7**	**4**	**3**	**32**
Total	**22**	**15**	**25**	**19**	**21**	**19**	**20**	**15**	**150**

ANOVA

Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Rows	**272.25**	**1**	**272.25**	**61.97561**	**0.000101**	**5.591448**
Columns	**40**	**7**	**5.714286**	**1.300813**	**0.36871**	**3.787044**
Error	**30.75**	**7**	**4.392857**			
Total	**343**	**15**				

2. The ANOVA to find out the impact of Age of respondents on work life balance aspects

$\alpha = 0.05$ Reject H_0

Between Rows:
F calculated value = 61.97561 at (Degree of Freedom 1, 7)
Table Value: 5.591448
Since F cal value is > than F table value Reject H_0

Between Columns:
F calculated value= 1.300813 at (Degree of Freedom 7, 7)
Table Value 3.787044

Since F cal Value < Table Value Accept H_0

Hence, null hypothesis has been failed to be accepted, as such the results indicate that there is a significant impact of Age of respondents on work life balance aspects

Conclusions

1. It is concluded that most of the sample respondents (airhostess) of aviation sector are teenagers and youth.
2. It is clear from the sample respondents of airhostess majority are unmarried and chose to select airhostess profession as their choice of career.
3. Childcare, time stress, long working hours shift system are some of the
4. With regards to qualities of airhostess majority of respondents gave priority to style and glamorous, followed by multitasking, empathy and learning potential and kindness
5. With regards to **Work life balance at aviation sector** most of the respondents mentioned that it provides them multi cultural working environment, continuous progress and training, greater experience to work in aviation sector.
6. Some of the respondents felt fatigue and long working hours, such areas have to be looked at to minimize such aspects in order to balance work and life and gain greater support from organizational perspective.
7. Coming to the point of work life balance aspects job satisfaction is more among the airhostess, their commitment level, safe and healthy working conditions, and skill utilization and growth are positive aspects if aviation sector creates a healthy working culture, greater training and development with adequate and fair compensation, this sector would be very attractive for the airhostess to work for and make a sustainable work life balance.
8. Null hypothesis has been failed to be accepted, as such the results indicate that there is a significant impact of work life balance aspects on work life balance of women at aviation sector

Null hypothesis has been failed to be accepted, as such the results indicate that there is a significant impact of Age of respondents on work life balance aspects

References

[1] Barnett, R. (1999). A New Work-Life Model for the Twenty-First Century. Annals of the American Academy of Political and Social Science, 56(2), 143-158.

[2] R.lockwood, N. (2003). Work life balance; challenges and solutions. 1-12

[3] Liang, S., & Hsieh, A. (2007). Burnout and workplace deviance among flight attendants in Taiwan. Psychological Reports, 101(202), 457-468.

[4] Chung, C., & Chung, U. (2009). An exploration of quality of life and related factors amongst female flight attendants. Journal of Nursing Research, 17, 212-219.

[5] Karasek, R. A., & Theorell, T. (1990). Health work. Basic Book, New York.

[6] Brown, N. C., Prashantham, B. J., & Abbott, M. (2003). Personality, social support and burnout among human service professionals in India. Journal of Community & Applied Social Psychology, 13(4), 320-324.

[7] Fleetwood, S. (2007). Why work–life balance now?. The international journal of human resource management, 18(3), 387-400.

[8] Yadav, R. K., & Dabhade, N. (2014). Work life balance and job satisfaction among the working women of banking and education sector-A comparative study. International Letters of Social and Humanistic Sciences, 21, 181-201.

[9] Williams, C. (2003). Sky service: The demands of emotional labour in the airline industry. Gender, Work & Organization, 10(5), 513-550.

[10] Maeran, R., Pitarelli, F., & Cangiano, F. (2013). Work-life balance and job satisfaction among teachers. Interdisciplinary Journal of Family Studies, 18(1).

[11] Beauregard, T. A., & Henry, L. C. (2009). Making the link between work-life balance practices and organizational performance. Human resource management review, 19(1), 9-22.

[12] Barry, K. (2007). Femininity in flight: A history of flight attendants. Duke University Press.

[13] Ahmad, M. B., Wasay, E., & Jhandir, S. U. (2012). Impact of employee motivation on customer satisfaction: Study of airline industry in Pakistan. Interdisciplinary Journal of Contemporary Research in Business, 4(6), 531-539.

[14] Eikhof, D. R. (2007). Introduction: what work? What life? What balance?. Employee relations.

[15] Fan, W., Lam, J., Moen, P., Kelly, E., King, R., & McHale, S. (2015). Constrained choices? Linking employees' and spouses' work time to health behaviors. Social Science & Medicine, 126, 99-109.

Relationships of Marketing, Customer Satisfaction and Customer Loyalty – A Case Of Vietnamese Dairy Retail Stores in Ho Chi Minh City, Vietnam

Trung Minh LAM[1], Bach Tuan LE[2], Tuan Hoang Anh DINH[3], Hieu Minh VU[4]
{trung.lm@vlu.edu.vn[1], bachstep1008@gmail.com[2], dhatuan@upt.edu.vn[3], hieu.vm@vlu.edu.vn[4]

Faculty of Business Administration, Van Lang University, Vietnam[1,] Foreign Trade University, Ho Chi Minh City Campus, Vietnam[2,] Department of Post Graduate – Phan Thiet University, Vietnam[3,] Faculty of Business Administration, Van Lang University, Vietnam[4]

Abstract. With the current high market competition, all businesses must have a suitable approaches and strategies to develop more and more customers and achieve their customer satisfaction and loyalty. This work aspires to inspect the relationships of the marketing, customer satisfaction and customer loyalty in Vietnamese dairy retail stores in Ho Chi Minh City, Vietnam. The study employs to methods of qualitative and quantitative. The qualitative technique is gone with the related literature and theories, consultations with 6 academic researchers, 27 business owners, and 15 managers, group discussions and 3 in-depths planned interviews with 30 random customers. The quantitative tool is done with 200 surveyed questionnaires with the customers in milk product retail stores in Ho Chi Minh city. The findings show 4 important factors affecting customer satisfaction: Product, Price, Promotion, Place (Distribution channel) and 2 crucial other factors: Satisfaction and reference group have linear relationships with customer loyalty. The findings are expected to add to the accessible literature to both theoretical and managerial approaches for a superior understanding of the activities of the marketing mix, customer satisfaction, and customer loyalty, particularly in the research trade setting..

Keywords: Customer loyalty, Customer satisfaction, Dairy retail stores, Ho Chi Minh city, Marketing (relationship marketing).

1 Introduction

At present, many new entrants providing similar products/ services and product substitutes are available in the market and the industry (Alden, 2012; Purnamasari, 2013). Besides, as known, the world has suffered from the Covid-19 pandemic and it causes business markets to become more and more competitive and constant change. Businesses need to compete and search for suitable approaches to strengthen their competitive advantages to survive in the industry.

Quelch and Jocz (2009) and Wixcey (2014) depict that customers get smarter, more selective, more demanding, more sensitive to price, more familiar with products/ services but they are less loyal to businesses. More of that, Kuusik (2007) affirms customers own relatively limited time and they must find out the highest value for themselves. Also, the long-term success of the businesses is upon various determinants, not only for the optimized product

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price and the qualities as well (Kuusik, 2007). According to Parekh (2019) and Solnet and Kandampully (2008), customers are the cornerstone and the main determinant of the businesses' existence. In this 21st century, customers are of major significance for any business, specially in the framework of retail sales. Also, Nwakanma, Jackson and Burkhalter (2007) confirm that customers must be at the center of a businesses' operations and businesses must have the right strategy to serve better customers' needs. Businesses should make their achievement and development on a enduring customer relationship (Kuusik, 2007) and both of the satisfaction and the loyalty of the customers are always seen as the goal of the marketing activities (Nwakanma, Jackson & Burkhalter, 2007). Besides, Kaur and Sharma (2009) point out customer satisfaction are the crucial element of the strategic decision process in various marketing activities. Many findings of the recent studies show customer satisfaction and loyalty own an extremely crucial role in the businesses' success and development (Dubrovski, 2001; Nwakanma, Jackson & Burkhalter, 2007; Kaur & Sharma, 2009). Customer satisfaction is seen as a prerequisite or sufficient condition for customer loyalty, and a tool to create the businesses' profits (Hill, Roche, & Allen, 2007).

As seen, the overall business strategy must be towards to the customers significantly concentrating on the generation of customer satisfaction and loyalty throughout the strong and good relationships with customers, and as such, marketing activities are placed as one of the most crucial issues and a useful weapon to maintain and develop customer satisfaction and loyalty for businesses. Keeping a positive interaction with consmers is the key to success in business operations (Lund, 2021). Ndubisi (2007) states that customer loyalty will be increased by increasing the relationship marketing concentrating on the customer.

As an emerging country, due to the extensive economic integration and influence of the COVID-19 pandemic in the world and Vietnam, growth reduced but remained in optimistic territory in 2020 with 1.6%. As per the rationalized IMF forecasts from January 2021, GDP development in Vietnam is probable to bounce back to 6.7% this year and 7.4% in 2022 (Chung, 2021). As for Vietnam's dairy industry, according to the Vietnam Dairy Association report in 2019, there are over 70 dairy producers and traders with more than 300 domestic and foreign brands. In terms of the revenues, the dairy industry has been making a positive contribution to the country's economy by its rapid growth, the revenues of the following year are always higher than the previous year at the average from 15-17% per annual. As known, milk is an essential consumer commodity, and household require for dairy products is not mainly affected by Covid-19. The demand for dairy products in the Vietnamese market is growing at a high rate, dairy enterprises have had many opportunities to approach market development and pursue different product marketing strategies. In particular, it reduced by only 4% in rate while Fast Moving Consumer Goods (FMCG) consumption development reduced by 7.3%. At present, the milk sector accounts for 12% of total FMCG sales in Vietnam, which is identical to that in 2019 (Chung, 2021). One of the marketing activities done to meet the demand requirements of the customers is to develop the retail stores (Hang, 2019, Nguyet, 2020) because the current big challenges and competition in the dairy industry. As a result, businesses must create outstanding customer relationships to develop customer satisfaction which leads to their customer loyalty and gain the business targets and profits consistently. However, in marketing activities, businesses must pay attention to influencers (called reference groups) rather than the entire target market, because influencers can alter customer behavior. The reference group is an important factor influencing users' purchases by its informative influence and normative influence because, in different purchases, customers gain different product information, experience, and attitudes. Customer satisfaction with businesses' products or services will lead customers to willingly recommend to the publicity

positively and to their relatives (Brunner, Stöcklin & Opwis 2008.) Customer satisfaction will create and lead to customer loyalty due to their good experience with businesses' products or services. Currently, many works conversing the relationship between client fulfillment and reliability are available with different results.

Therefore, this study is to find the consequence of marketing mix comprising product, price, promotion, and place on loyalty through the arbitrating role of customer pleasure of the Vietnamese Dairy retail outlets in Ho Chi Minh city. The findings are expected to contribute to the accessible literature to both theoretical and managerial approaches for a enhanced understanding of the activities of the marketing mix, customer satisfaction, and customer loyalty, mainly in the research industry setting.

2 Literature Review

Concepts of Customer satisfaction

In the marketing discipline, the word "satisfaction" is significantly relative to customer needs and desires. Oliver (1997) has determined customer satisfaction as: "... Satisfaction is the response to consumer performance. It is a judgment that a product or service provided (or is being provided) has some degree of attraction to customers ... " (Oliver, 1997). Additionally, Hill, Roche and Allen (2007) state customer satisfaction is seen as "the feeling that the customer has about the degree of their experience with the organization that has met their needs". Also, Kotler and Keller (2006) affirm satisfaction is the emotional or emotional state gaining from perception and expectation comparison of a product/service they use. Customer satisfaction becomes a crucial and key goal in the enhancement of product/service quality, loyalty maintenance, and improvement the business competitiveness (Khan & Fasih, 2014). It is a vital determinant to impress clients to keep the accomplishment of businesses in the long run (Zeithaml, Berry & Parasuraman, 1996). Besides, Barnes (2003) states customer satisfaction is the reaction to the need fulfillment, and Kotler (2005) points out that customer fulfillment is the point of one's after comparing the apparent performance with his/her prospect.

Understanding of customer loyalty

Customer loyalty is placed as the central to marketing discipline (Toufaily, Ricard & Perrien, 2013). From a practitioner's perception, customer loyalty is one of the main substantial properties of the businesses. In the literature, various definitions of loyalty are existing. Leverin and Liljander (2006) define reliability as a active commitment to re-buy or re-subscribe products/services that have been constantly chosen in the future. The term "loyalty" can be known as something that customers express to a certain brand, product, service and/or activity (Balbanis, Reynolds & Simintiras, 2006) which is comprising three different elements (Balbanis, Reynolds & Simintiras, 2006) as behavioral, attitudinal, and situational loyalty. Behavioral loyalty means the business products will be continued to purchase when finding their usage benefit (Zeithaml, 2000). Attitudinal loyalty is the customers' belongingness feeling towards a product or brand (Zeithaml, 2000) or the constant relationship between a customer and a brand which are strongly influenced by family and friends (Mascarenhas, Kesavan & Bernacchi, 2006). And for situational loyalty, this is the loyalty type depending on the relationship to the brand and determined by the customers' purchasing and shopping status. Three of them are crucial, even though both types of

behavioral and attitudinal loyalty are more emphasized when market share and long-term relationships are being developed.

Customer loyalty owns a vital role in the customer strategy of all businesses (Keiningham et al., 2007). How to enhance customer loyalty has always become the key research topic among managers, consultants, and academicians (Keiningham et al., 2007). Also, in the existing theory, there are many extensive models as Macintosh and Lockshin's model (1997), models of Flavian, Martinez and Polo (2001), Srinivasan, Anderson and Ponnavolu (2002) and Allender and Richards (2012).

For the contribution of the customer loyalty to the business operation, customer loyalty is as a pivotal issue for enhancement of profitability and maintenance of the businesses' position in the market (Haghighi et al., 2012), achievement of a major competitive advantage (Aksu, 2006; Aksoy, 2013), retention of the long-term, equally helpful relations with clients (Pan, Sheng & Xie, 2012); occupation of attachment and commitment toward businesses, willingness to pay more, expression of superior purchasing purposes and switching resistance (Evanschitzky et al., 2012).

Aspects of reference group

Consumer behaviour is heavily influenced by the reference community. As a result, a reference group is any person or group that is used as a point of contrast (reference) when establishing general or special values or behaving. In marketing terms, a reference group is a group of people who are used as a benchmark for making buying or consuming decisions. As stated above, attitudinal loyalty is the customers' belongingness feeling towards a product or brand (Zeithaml, 2000) or the constant relationship between a customer and a brand which are strongly influenced by family and friends (Mascarenhas, Kesavan & Bernacchi, 2006). Completely, most people have groups in their lives and these groups influence each of product purchasing decision. In terms of the influence of reference groups on the consumption process, it is crucial to adjust the consumption process with reference groups (Turčínková and Moisidis, 2011). More of that, reference groups consisting of family, friends or colleagues have the strong and great influence to consumer behavior in purchase decision (Chaudhary, 2018) by their advice and input factor for purchasing decision (Heung, 2012; Hussain et al., 2012; Rena, 2013 and Handoko et al.,2017)

As for the definitions of reference groups, many of them are available in the theory. It is considered as a group which an individual references during the process of decision making, judgment, cognition, and behavior (Hawkins & Mothersbaugh, 2013; Schiffman & Wisenblit, 2015). In the study of Schiffman, Kanuk, & Hansen (2012), reference group is a person or group serving as a point of comparison (or reference) for an individual in the formation of either general or specific values, attitudes or behaviour (Schiffman, Kanuk, & Hansen, 2012). According to Kotler (2012), the reference group is a group influencing directly or indirectly on a person's attitude and behavior. According to Zia (2011), a reference group (preference group) is an individual or group of people that significantly affects someone. According to Dhurup et al. (2013), the reference group is defined as a person or group of people who significantly has the effect on an individual's behavior. Sumarwan (2011) affirms reference group has the close relation to the consumers' behavior in their purchasing decisions. This is agreed by Bearden and Michael (2011) that reference groups as family / friends / partner can strengthen consumers' desire to repurchase products. Mantasari (2013) affirms groups include friends, family, friendship groups, shopping groups, work groups, virtual groups or communities and celebrities and these groups differ in behavior depending on the age, geographical surroundings, level of education, social and marital status regarding purchasing

behavior. Hawkins et al. (2007) and Hsiung et al. (2013) point out several reference groups have their influences in the form of informational, utilitarian, and value expression.

Armstrong and Kotler (2011) define Marketing as a set of steps delivering value which customer can remember, create a relationship with customers and deliver benefits to the organization. Besides, Kotler and Keller (2016) affirm marketing mix comprising of 4Ps as product, price, place, and promotion is the distribution and communication of the customer value to the market of which 4Ps (also called as marketing mix) are the controllable medium reflecting customer's satisfaction (Shankar & Chin, 2011). Also, American Marketing Association - AMA in 2017 states "Marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large" (AMA, 2017).

However, many marketing scholars have criticized the 4Ps of the marketing mix from different perspectives (Akroush, 2010) and many marketing models as 7Ps (product, price, place, promotion, people, process, and physical evidence) or Relational/ Relationship marketing have been developed and existed in the literature. Some scholars agree 4Ps marketing mix is traditional marketing, and others are modern marketing. In terms of the contribution of Marketing to the businesses, Bay, Petrizzi and Gill (2008) confirm marketing mix will make businesses increase the sales and profits level.

As stated by Smith (2020), the traditional marketing mix (4Ps Marketing) is concentrating on the whole addressable market and relationship marketing is targeting individual customers in the market. Moreover, in modern marketing, relationship marketing is seen as the cornerstone of modern marketing literature (Gronroos, 2004). The relationship marketing concept has emerged within the fields of service marketing and industrial marketing (Gronroos, 2004; Akroush, 2010). Relationship marketing is considered as an alternative model to replace the traditional marketing mix theory (transactional marketing). Relationship marketing aims to improve the acquisition and retention of profitable customers efficiently and effectively by selective initiation, development, and maintenance of the appropriate relationships with customers (Payne & Frow, 2005; Osarenkhoe & Bennani, 2007). relationship marketing is "to identify, establish, maintain and enhance relationships with customers and other stakeholders, at a profit, hence, the objectives of all other related parties are achieved; this is done by a mutual exchange and fulfillment of promises" Gronroos (2004). Relationship marketing encompasses skills of creating and building long-term relationships with customers (Gronroos, 2004, Payne & Frow, 2005), enhancing and maintaining high-quality relationships with customers (Roberts, Varki & Brodie, 2003; Ventetis & Ghauri, 2004); building and keeping detailed customers database (Payne & Frow, 2005).

In addition, Kotler (2005) affirms relationship marketing is a procedure of generating, preserving, and reinforcing relationship that is full of worth with the clients and other believers. It is not for development of a short-term transaction but for creation of a long-term relationship with the clients which regularly exploit a equally helpful relationship with customers and other related stakeholders. This concept is also agreed by Wibowo (2006). He states that relationship marketing as a progression in which businesses develop a long-term agreement and relations with their existing clients or potential customers and cooperate for achievement of the established goals (Wibowo, 2006) by accepting the customers' needs, treating the customers as partners, meeting the customers' satisfaction, and providing quality products throughout the employees' commitment. The key relationship marketing goal is to enhance the customer satisfaction which directs to customer loyalty (Tjiptono, 2000).

Relations of marketing mix, customer satisfaction and customer loyalty

Facing the highly competitive environment, the importance of the development of strong relationships with their customers has been recognized in all businesses (Morgan & Rego, 2006). In most of the businesses' development, the supports of two extremely crucial factors customer satisfaction and customer loyalty are recognized (Caruana, 2002; Chigora & Zvavahera, 2015) because both impact the profitability revenues of the businesses (Rosenberg & Czepiel, 1984)

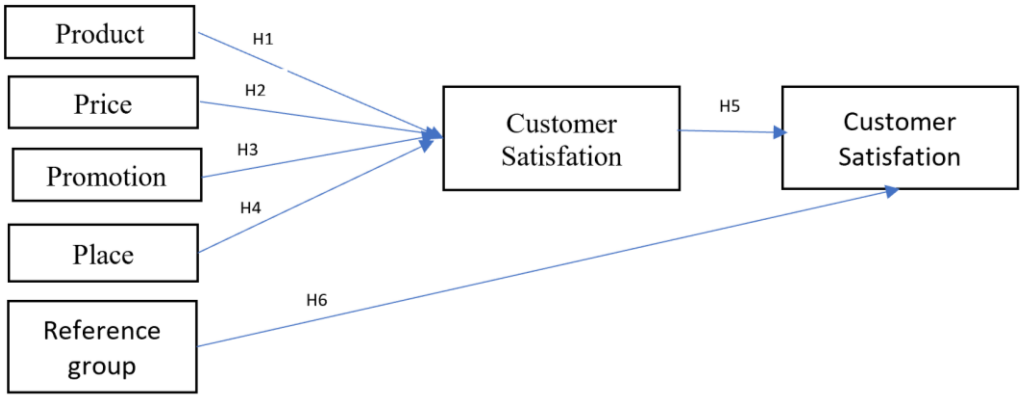
According to Nuseir and Madanat (2015), traditional Marketing (mix of 4Ps) is to face the environmental challenges seriously to achieve greater market share and is considered as a key contributor to develop and increase customer loyalty and customer satisfaction in terms of businesses' products (Nuseir & Madanat, 2015). In the contrast, modern/ relationship marketing is a business philosophy and a strategic orientation concentrating on the development of a good long-term relationship among stakeholders, suppliers, and customers of which will strengthen customer loyalty (Payne, David & Christopher, 2005). Because customer satisfaction will establish and raise customer loyalty being the key capital to achieve and to survive in the competition and customers are willing to recommend the businesses to their relativeness (Chigora & Zvavahera, 2015; Nuseir & Madanat, 2015). Hence, loyalty is significant to build a long-term relationship between businesses and customers. As in the theory, there are many studies relating to the effect and relations among reference groups, customer satisfaction, and customer loyalty with various results (e.g Homburg & Giering, 2001; Leverin & Liljander, 2006; Caruana, 2002; Lau & Phau, 2007; Ndubisi, 2007; Walsh, Heiner & Maren, 2008; Karatepe, 2011; Rubio, Oubina & Villasenor, 2014; Risa, 2016). In the previous studies, customer satisfaction is considered as the former of the loyalty in service (e.g Lam et al., 2004; Coelho & Henseler, 2012; Belás & Gabčová, 2016)

In terms of the Marketing sector, including marketing mix and relationship marketing, there are many studies on its effect on customer satisfaction and customer loyalty with different results (Marshall & Rossman, 2011; Suthar, Lathangi, & Pradhan, 2014). According to Rust, Zeithaml and Lemon (2000), the businesses own a high quantity of satisfied customers, and completely, product/ service structure and quality will be improved further because they put believes and trusts, pay more, and contribute to the profitability and the development of the businesses and, customer loyal will definitely come and develop. Significantly, businesses' brand loyalty from customers makes businesses reduce the product costs, attract new customers, enhance the organization's reputation (Bontis, Booker & Serenko, 2007). Relating to customer loyalty process of businesses. There are numerous studies on the compositions of the marketing impacting to client fulfillment and customer loyalty such as the contribution of the supply chain to customers' loyalty towards businesses and its brands, the involvement of stakeholders as suppliers, manufacturers, distributors, and end customers to businesses' capability to do superior to gratify a customer (Poirier, 1990), on time products delivery (Cravens & Piercy, 2007). Product pricing (Collins & Parsa, 2006), customers' response (Cravens & Piercy, 2007), promotion techniques (Mills, 2003; Jensen & Jepsen, 2006; Hollensen, 2007), Productive management (Jerenz, 2008). And in other studies, customer satisfaction, customer loyalty, and organization initiatives of quality standards (Cravens & Piercy, 2007; Li & Green, 2010), and product quality (Bei & Chiao, 2001; Caruana, 2002; Fullerton & Taylor, 2002; Dimyati & Subagio, 2016) have been proved on their relationships.

Research model and hypothesis

As above statements, the research model for the study is developed as follows

Figure of Proposed research model



Hypotheses are established as follows

- H1: There is a positive correlation between products and customer satisfaction.
- H2: There is a positive correlation between price and satisfaction.
- H3: There is a positive correlation between promotion and customer satisfaction.
- H4: There is a positive correlation between place and customer satisfaction.
- H5: A relationship exists between customer satisfaction and customer loyalty.
- H6: A relationship exists between reference groups and customer loyalty.

3 Research Methodology

The study employs 2 kinds of data - the secondary information and primary information with qualitative and quantitative study techniques through 2 phrases.

The first phase is done with qualitative research techniques with the secondary and primary data. Firstly, the related literature and theories have been explored in the published journals, books, and other sources like websites, businesses' reports, etc. Secondly, consultations with 6 academic researchers, 27 business owners, and 15 managers for exploration of the overview and current market/ business status, hidden issues, and measurement scales for the study have been done through the 5 interviews. In addition, group discussions and 3 in-depths planned interviews have been done with 30 random customers to increase a deep considerate of the measurement scales (observed variables) as a crosscheck for better outcomes.

The second phase is done with the quantitative research tool after achieving results from the qualitative method and the questionnaire is the key tool to collect data. The questionnaire content is adapted from previous studies as Poirier (1990); Rust, Zeithaml and Lemon (2000); Homburg and Giering (2001); Bei and Chiao (2001); Caruana (2002); Fullerton and Taylor (2002); Mills (2003); Lam et al. (2004); Leverin and Liljander (2006); Collins and Parsa (2006); Jensen and Jepsen (2006); Lau and Phau (2007); Ndubisi (2007); Bontis, Booker and Serenko (2007); Cravens and Piercy (2007); Hollensen (2007); Walsh (Heiner and Maren (2008); Jerenz (2008); Li and Green (2010); Karatepe (2011); Marshall and Rossman (2011); Coelho and Henseler (2012); Rubio, Oubina and Villasenor (2014); Suthar, Lathangi and Pradhan (2014); Belás and Gabčová (2016) Risa (2016); Dimyati and Subagio (2016). After establishing the questionnaire, before initiating out for the definite survey, the authors have

completed pilot tests with 10 random customers to ensure directness and send response to progress the simplicity of the survey. As known, this study is the post-positivism rigor and Hair et al. (2010) defines the sample size should be as N = 5*item (where item means observed variables) and Tabachnick & Fidell (2001, 2007) confirms the sample size should be as N = 8*var + 50 (where var means independence variables using in the regression model). Therefore, the study uses 200 surveyed questionnaires with the customers in milk product retail stores in Ho Chi Minh city. Also, it should be explained that the sampling technique in this study is the convenient technique. After all, the information is progressed with statistical methods as Cronbach's Alpha, EFA, T-Test, ANOVA, etc.

4 Findings And Discussions

Results of demographic

The table shows the ratio of male customers are at 38% and female customers at 62%. This is consistent with the market and purchasing behavior and culture in Vietnam. As known, males often do not pay attention to the market service. Also, the age range is wide, however, most of the customers are over 50, accounting for 32%. As for the employment, the respondents are mainly the pupils and students at a ratio of 40,5%. Besides their income is mostly under 6 million at 64,5%

Table 1: Result of demographic analysis

	Frequency	**Ratio (%)**
Gender		
Male	76	38.0
Nữ	124	62.0
Age range		
Under 18	44	22.0
18 - 35	57	28.5
36 - 50	35	17.5
Above 50	64	32.0
Employment		
Governmental officer	22	11.0
Business officer	17	8.5
Self-employed	25	12.5
Blue collared workers	7	3.5
Housewives	20	10.0
Retirement	23	11.5
Pupils / students	81	40.5
Others		5
Income		
Under VND 6 million/ month	123	61.5
6 - 8 million/ month	49	24.5
8 - 12 million/ month	19	9.5
Above 12 million/ month	9	4.5

Source: Own (2021)

The process to test the model will be gone with 2 key tools of Cronbach's Alpha and Exploratory Factor Analysis test. As analyzed, table 2 presents the descriptive statistics and the reliability coefficients of the studied variables the reliability of all the constructs used in this study are found acceptable to process and analyze in the next step.

Table 2: Reliability Coefficient and Descriptive Statistics

	Cronbach's Alpha	Mean	Std deviation
Product (PDC)	0.867	3.62	.764
Price (PRI)	0.811	3.72	.694
Promotion (PRO)	0.813	3.88	.647
Place (PLA)	0.804	3.84	.764
Satisfaction (STF)	0.609	3.88	.640
Reference Groups (REF)	0.804	3.60	.838
Loyalty (LYT)	0.798	3.85	.603

Source: Own (2021)

The results of EFA analysis show all variables are appropriate and satisfactory as follows:

Table 3: Results of EFA analysis

	Component			
	1	2	3	4
PDC1	.864			
PDC2	.862			
PDC3	.863			
PDC4	.760			
PRI1		.674		
PRI2		.796		
PRI3		.829		
PRI4		.794		
PRO1			.692	
PRO2			.811	
PRO3			.809	
PRO4			.840	
PLA1				.752
PLA2				.836
PLA3				.822
PLA4				.757

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Source: Own (2021)

As for the EFA results with factors affecting customer loyalty, The results of EFA analysis showed that 2 factors extracted at the eigenvalue at 1,559 and the variance extracted is 60.525% and the PRO is 0.717. Therefore, they are appropriate, and the variance is satisfactory> 50%.

Table 3: EFA results with factors affecting customer loyalty

	Components	
	1	2
REF3	.809	

REF2	.808	
REF4	.732	
REF1	.707	
STF1		.745
STF3		.648
STF2		.626

Source: Own (2021)

Regarding the EFA result of variables affecting customer satisfaction, it shows that the observed variables of this scale are satisfactory for the next analysis.

Table 4: EFA results with factors affecting customer satisfaction.

	Factors
	1
STF1	.779
STF3	.761
STF2	.711

Source: Own (2021)

And for the EFA analysis results of the variables of customer loyalty, all of them are high, the lowest is variable LYT2 = 0.621. Thus, the observed variables of this scale are satisfactory for the next analysis.

Table 5: EFA results with factors affecting customer loyalty.

	Factors
	1
LYT5	.790
LYT6	.787
LYT4	.731
LYT1	.701
LYT3	.638
LYT2	.621

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Source: Own (2021)

With the result of regression analysis, the table depicts the model has R^2 = 0.613 and adjusted R^2 = 0.605 and adjusted R^2 is smaller than R^2. Adjusted R^2 = 0.605 indicates the appropriateness of the model is 60.5%. Also, the ANOVA analysis points out that F has a significance level (sig.) = .000b, which proves that the research regression representation is consistent with the gathered data set, and the included variables are significant statistically significant with a 5% consequence level. Thus, the independent variables in the model are related to the dependent variable "Satisfaction". The regression results show that 4 important factors as Product, Product Price, Promotion, Place (Distribution channel) affecting customer satisfaction have linear relationships with customer satisfaction (Sig <0.05). Therefore, these 4 factors will be retained in the regression model.

Table 5: Results of regression analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.112	.231		.482	.630		
	PDC	.115	.035	.156	3.308	.001	.890	1.123
	PRO	.304	.043	.329	7.012	.000	.903	1.108
	PLA	.163	.036	.208	4.525	.000	.939	1.065
	PRI	.415	.043	.480	9.647	.000	.802	1.247

Dependent Variable: STF

Source: Own (2021)

Model Summary^{b}

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Durbin - Watson
1	.783^{a}	.613	.605	.301	2.093

Source: Own (2021)

Table 6 states the results of multiple linear regression analysis of the model have R^2 = 0.433 and adjusted R^2 = 0.427 and adjusted R^2 is smaller than R^2. Also, ANOVA analysis shows F has a significance level (sig.) = .000b, which proves that the built-in regression model is consistent with the collected data, and the variables have statistically significant at a 5% significance level. Thus, all factors and variables are correlated. More of that, the regression results show that 2 crucial factors: Satisfaction, and reference groups have linear relationships with customer loyalty (Sig <0.05). Thus, these two factors will be retained in the regression model.

Table 6: Analysis linear regression models (loyalty)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.364	.208		6.545	.000		
	REF	.113	.035	.176	3.218	.002	.968	1.033
	STF	.538	.049	.603	11.066	.000	.968	1.033

Model Summary^{b}

Mode	R	R^2	Adjusted R^2	Std. Error of the Estimate	Durbin - Watson
1	.783^{a}	.433	.427	.323	1.892

Conclusions

First, the regression results show that there are 4 important factors affecting customer satisfaction: Product, Price, Promotion, Place (Distribution channel) have linear relationships with customer satisfaction (Sig <0.05). Also, 2 crucial other factors: Satisfaction and reference group have linear relationships with customer loyalty (Sig <0.05). Throughout this study, the results recommend businesses in the dairy market should have concrete measurement scales to measure concepts relating to the development of customer satisfaction and customer loyalty.

Secondly, the Board of Management or Directors of the related businesses as dairy corporations, retail shops' owners, and researchers gain deep understandings of factors affecting customer satisfaction and loyalty. Consequently, businesses will have suitable approaches to develop, achieve and measure customer satisfaction and customer loyalty by focusing on the relational marketing tools and strategies.

References

[1] Akroush, N. M. (2010). Transactional marketing and relationship marketing paradigms: A structural equation modelling approach. Int. J. Electronic Customer Relationship Management, 4(2), 125 – 160.

[2] Aksoy, L. (2013). How do you measure what you can't define? The current state of loyalty measurement and management. Journal of Service Management, 24(4), 356-381.

[3] Aksu, A. (2006). Gap analysis in customer loyalty: A research in 5-star hotels in the Antalya region of Turkey. Qual. Quant., 40(2), 187-205.

[4] Alden, M. (2012). Dividend growth businesses with high switching costs. Dividend Monk. Available at http://dividendmonk.com/5-dividend-growth-businesses-with-high-switching-costs/

[5] Allender, W. J. & Richards, T. J. (2012). Brand loyalty and price promotion strategies: An empirical analysis. Journal of Retailing, 88(3), 323-342.

[6] American Marketing Association – AMA (2017). Definitions of Marketing. Available at https://www.ama.org/the-definition-of-marketing-what-is-marketing/

[7] Armstrong, G. & Kotler, P. (2011). Marketing: An Introduction (10th Eds). Pearson Publishing.

[8] Balbanis, G., Reynolds, N., & Simintiras, A. (2006). Bases of e-store loyalty: Perceived switching barriers and satisfaction. Journal of Business Research, 59(2), 214-224.

[9] Bandara, S.S.U. & Wanninayake, W.M.C.B. (2012). The Impact of Closeness and the Profession of Reference Groups towards Brand Loyalty of Beer Products: A Study on Sri Lankan PerPDCective. Paper presented at the ICBI2012- Management and Marketing conference, pp. 78-88.

[10] Barnes, J. G. (2003). Establishing Meaningful Customer Relationships: Why some Companies and Brands Mean More to Their Customers. Managing Service Quality,13(3), 178-186.

[11] Bay, S., Petrizzi, R. & Gill, P. (2008). The why of the buy: Consumer behavior and fashion marketing. New York: Fairchild Books.

[12] Bearden, W.O., Etzel, M.J., 1982. Reference group influence on product and brand purchase decisions. Journal of Consumer Research. 9(2), 183-194.

[13] Bei, L. T. & Chiao,Y-C. (2001). An Integrated Model for The Effects of Perceived Product, Perceived Service Quality, and Perceived Price Fairness on Consumer Satisfaction and Loyalty. Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior 14, 125-140.

[14] Belas, J. & Gabčová, L. (2016). The relationship among customer satisfaction, loyalty and financial performance of commercial banks. E+M Ekonomie a Management, 19(1), 132-147.

[15] Bontis, N., Booker, L. & Serenko, A. (2007). The Mediating Effect of Organizational Reputation on Customer Loyalty and Service Recommendation in the Banking Industry. Management Decision, 45(9), 1426-1445.

[16] Brunner, T., Stöcklin, M. & Opwis, K. (2008). Satisfaction, image and loyalty: New versus experienced customers. European Journal of Marketing 42, 1095-1105.

[17] Caruana, A. (2002). Service loyalty: The effects of service quality and the mediating role of customer satisfaction. European Journal of Marketing, 36(7/8), 811-828.

[18] Chang, C. H. & Tu, C.Y. (2005). Exploring Store Image, Customer Satisfaction and Customer Loyalty Relationship: Evidence from Taiwanese Hypermarket Industry. Journal of American Academy of Business 7, 197-202.
[19] Chen-Yu, J. & Hong, K-H. (2002). Antecedents and consequences of consumer satisfaction/dissatisfaction with the performance of apparel products at purchase and after consumption: A comparison of male and female South Korean consumers. International Journal of Consumer Studies 26, 117 - 127.
[20] Chigora, F. & Zvavahera, P. (2015). Awareness completes brand loyalty: Reality of Zimbabwe Tourism Destination. Business and Management Horizons, 3(2), 60-69.
[21] Chung, M. (2021). In what scenario will the dairy industry grow in 2021? Available at https://vneconomy.vn/nganh-sua-nam-2021-se-tang-truong-theo-kich-ban-nao-20210201141922071.htm
[22] Coelho, P. & Henseler, J. (2012). Creating Customer Loyalty through Service Customization. European Journal of Marketing, 46(3/4), 331-356.
[23] Collins, M., & Parsa, H. G. (2006). Pricing strategies to maximize revenues in the lodging industry. *International Journal of HoPDCitality Management, 25*(1), 91–107.
[24] Cravens, W. D. & Piercy, N. (2007). Marketing Estratégico. Mcgraw Hill – Artmed.
[25] Dick, A. S. & Basu, K. (1994), 'Customer loyalty: toward an integrated conceptual framework', Journal of the Academy of Marketing Science, 22(2), 99-113.
[26] Dimyati, M. & Subagio, N. A. (2016). Impact of Service Quality, Price, and Brand on Loyalty with the mediation of Customer Satisfaction on Pos EkPDCres in East Java. Mediterranean Journal of Social Sciences, 7(4), 74-86.
[27] Dubrovski, D. (2001). The role of customer satisfaction in achieving business excellence. Total Quality Management, 12(7), 920–925.
[28] Flavian, C., Martinez, E. & Polo, Y. (2001). Loyalty to grocery stores in the PDCanish market of the 1990s. Journal of Retailing and Consumer Services, 8(2), 85-93.

Inspecting the Impact of Various Factors Influencing Employee Attrition in Hotel Industry

R. George Leslie Davidson[1], Dr. G. Brindha[2]
{georgelesliephd@gmail.com[1], bkk28@yahoo.co.in[2]}

Research Scholar, Bharath Institute of Higher Education and research, Chennai.[1],
Professor & Head, Faculty of Management studies, Dr. M.G.R Educational and Research Institute, Chennai.[2]

Abstract. The study aims to investigate the important reason behind the employee attrition in Star Category Hotels within Tamilnadu with respect to gender and job designation. The current study adopted descriptive research design. The data was collected from 419 samples using structured questionnaire online. For the study, 12 Star category hotels were considered, from which samples were taken through a convenience sampling technique. From the analysis performed, it can be well understood that there no significant difference in opinion among respondents with respect to gender and various Job positions. But using the rank analysis using mean score it can be clearly understood that salary, incentive and benefits are an important reason for the male employee attrition while Work-life balance is the important reason behind the female employee attrition. With respect to job position top-level employees, it is the work-life balance that is causing employee attrition, while for lower-level employees it is salary, incentives and benefits. But for the middle-level employees, it is better employment opportunities in other Star category hotels.

Keywords: Employee Attrition, Monetary Benefits, Work-Life Balance, Nature of Work and Better Employment Opportunity.

1 Introduction

Hospitality industry leaders can better implement policies and strategies that increase organizational competitiveness and profitability if they understand the factors that significantly affect revenue ratios among employees. To mention a few of these factors include inadequate employee compensation, layoffs, low motivation, job dissatisfaction, and unfavourable work environment.Human resources are the most important and valuable asset of a company. Nevertheless, it is seen as a cost hub by most companies. Employees play an important role in the industry because of everyone. Resources are lost when workers are not used properly and efficiently. A tradition can be created by creating and breaking a system. The success of a company today depends on the efficiency and reliability of human resources to compete in a highly competitive and diverse business world. Recruiting and retaining existing employees is a very difficult issue for every company. Management employees leave a company, it leads to serious problems for the company. Attrition generally increases as a result of business dissatisfaction, low pay, poor working conditions, lack of motivation, poor relationships with colleagues and supervisors, employee dissatisfaction and many more. The

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income ratio reveals that something is wrong with a company's health and the environment in terms of salary, working conditions, industrial relationships, and workplace health services.

Retaining employees is an issue in the business world. This has a huge impact on a company's competitiveness. The arrival of workers in a company causes chronic problems. Workers have recognized the effects of employee income over the past few years. While a company's productivity is not good for growth and development, high commitment ratios indicate instability and workflow inconsistency. Many companies are facing unpredictable costs, manufacturing and job disruptions, recruitment costs, hiring costs, learning and growth. Such issues raise the question of why the car industry is characteristic.

Attrition rate (%) = Number of employees who resigned per month / (Total number of employees at the beginning of the month + Number of employees who resigned during the month-Number of employees who resigned) x 100. The industry has become quieter. Are coming. Employee earnings or employee attrition are identified as the rate of change of employees in a company over some time. In its broadest sense, the rating ratio estimates the number of people or items leaving a group at a given time. This is one of the two primary factors determining the consistent position of customers who support a business."

2 Review of Literature

Milind&Peshave in this paper explored the details of increasing rates with employee attrition. Reactions are graphically described and analyzed using simple percentages. The results of his research indicate that the main factors affecting the level of inflation in hotels are long working hours and low wages that greatly affect the satisfaction and reputation of hotel customers. Although the hotel industry is concerned about the growing rate and various policies have been formulated to control it, this issue has not been adequately addressed this is inturn leading to employee attrition (Milind A. Peshave, 2015). In these challenging and uncertain times, businesses, executives and leaders face a serious challenge to retain talented employees and reduce revenue. HR managers are eager to hear that workers are leaving their company during this period of cut-throat competition. The demand for hours is to have employees who want to change constantly. This research aims to study the history of Indian wage rates and the factors contributing to the rise in the wage rates of Indian companies. This work attracts secondary information collected from magazines, journals and the Internet (Farkiya, 2016). Of all the workplace challenges, changing external conditions is one of the major issues in the current situation of employee income. With the resignations, deaths and pensions, there is said to be a gradual decline in the number of workers. If for any reason a company is left with a well-trained and well-adjusted worker, there is a vacuum in a company that creates a clear position. It is very difficult to fill the gap for an employee member in human resources. Research helps to understand how turnover occurs. It helps to find explanations for retaining employees and why managers are confronted with retaining employees (Guru Vignesh. S, 2018).

3 Objectives of the Study

The study aims to investigate the important reason behind the employee attrition in Star Category Hotels within Tamilnadu with respect to gender and job designation.

4 Research Methodology

For the study,the descriptive research design was adopted. The data was collected from 419 samples using structured questionnaire online. For the study, 12 Star category hotels were considered, from which samples were taken through a convenience sampling technique.

5 Analysis & Interpretation

Causes for Employee attrition with respect to Gender

As the dependent data type [Causes for Employee Attrition] is metric and independent data type [Gender] being categorical with two option, therefore,Independent Sample T-test was used to identify the whether there is a significant difference in opinion.

Null Hypothesis: There is no significant difference in opinion between male and female for the cause of Employee attrition.

Table No. 1:Causes for Employee attrition with respect to Gender

Independent Samples Test						
		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Salary, Incentives & Benefits	Equal variances assumed	.0827	.7738	.5906	418.0000	.5551
	Equal variances not assumed			.5914	415.5233	.5546
Work-Life Balance	Equal variances assumed	1.1677	.2805	-1.5203	418.0000	.1292
	Equal variances not assumed			-1.5225	415.4719	.1286
Nature of Work	Equal variances assumed	.0015	.9691	-.7902	418.0000	.4299
	Equal variances not assumed			-.7904	413.9888	.4297

Better Employment Opportunity	Equal variances assumed	.7847	.3762	.0435	418.0000	.9653
	Equal variances not assumed			.0436	416.7767	.9653

Source: (Primary data)

The estimated significance value is greater than 0.05 for all the variables. Meaning the Null hypothesis is accepted i.e. there is no significant difference in opinion for the causes for employee attrition between male and female respondents.

The researcher had found no significant difference in opinion. Hereby to have better insight rank analysis was carried out using the mean score.

Table No. 2:Rank Analysis -Causes for Employee attrition with respect to Gender

	Male		Female	
	Mean	Rank	Mean	Rank
Salary, Incentives & Benefits	2.8371	1	2.7638	4
Work Life Balance	2.7330	4	2.9246	1
Nature of Work	2.7466	3	2.8442	2
Better Employment Opportunity	2.8145	2	2.8090	3

Source: (Primary data)

From the rank analysis carried using the mean score, it can be interpreted that, the important reason for male employee attrition are; 1. Salary, incentive & benefits, 2. Better Employment Opportunity and 3. Nature of Work. Similarly, the important reason for female employee attrition is; 1. Work-Life Balance, 2.Nature of Work and 3. Better Employment Opportunity.

Causes for Employee attrition with respect to Job Position

As the dependent data type [Causes for Employee Attrition] is metric and independent data type [Job Position] being categorical with three option, therefore, ANOVA test was used to identify the whether there is a significant difference in opinion.

Null Hypothesis: There is no significant difference in opinion among employees from top, middle and lower level for the cause of Employee attrition.

Table No. 3:Causes for Employee attrition with respect to Job Position

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Salary, Incentives & Benefits	Between Groups	1.9913	3	0.6638	0.4105	0.7455
	Within Groups	672.6063	416	1.6168		
	Total	674.5976	419			
Work-Life Balance	Between Groups	9.1633	3	3.0544	1.8420	0.1389
	Within Groups	689.7986	416	1.6582		
	Total	698.9619	419			

Nature of Work	Between Groups	10.3748	3	3.4583	2.1844	0.0893
	Within Groups	658.6038	416	1.5832		
	Total	668.9786	419			
Better EmploymentOpportunity	Between Groups	1.7509	3	0.5836	0.3558	0.7850
	Within Groups	682.3896	416	1.6404		
	Total	684.1405	419			

Source: (Primary data)

The estimated significance value is greater than 0.05 for all the variables. Meaning the Null hypothesis is accepted i.e. there is no significant difference in opinion for the causes for employee attrition among respondents belonging to the top level, middle level and lower-level position.

The researcher had found no significant difference in opinion. Hereby to have better insight rank analysis was carried out using the mean score.

Table No. 2:Rank Analysis -Causes for Employee attrition with respect to Job Position

	Top Level		Middle Level		Lowe Level	
	Mean	Rank	Mean	Rank	Mean	Rank
Salary, Incentives & Benefits	2.7656	3	2.7293	4	2.8963	1
Work Life Balance	3.1719	1	2.7669	2	2.7630	4
Nature of Work	3.0938	2	2.7444	3	2.8370	2
Better Employment Opportunity	2.7031	4	2.8872	1	2.8222	3

Source: (Primary data)

From the rank analysis carried using the mean score, it can be interpreted that, the important reason for Top-level employee attrition are; 1. Work-Life Balance, 2.Nature of Work and 3.Salary, Incentives & Benefits. Similarly, the important reason for middle-level employee attrition is; 1. Better Employment Opportunity, 2. Work-Life Balance and 3.Nature of Work. Similarly, the important reason for lower-level employee attrition is; 1. Salary, Incentives & Benefits, 2.Nature of Work and 3. Better Employment Opportunity.

6 Findings & Discussion

From the analysis performed with 419 samples, it can be well understood that there no significant difference in opinion among respondents with respect to gender and various Job positions. But using the rank analysis using mean score it can be clearly understood that salary, incentive and benefits are an important reason for the male employee attrition while Work-life balance is the important reason behind the female employee attrition. Therefore, it is suggested to star category hotels in Tamilnadu to provide fixed and convenient for female employees. Also, frame suitable HR policies for the welfare for female employee family to reduce employee attrition. While for the male employees it is advised to provide better career options along with increased salary, incentive and benefits to reduce employee attrition. With respect to job position top-level employees, it is the work-life balance that is causing employee attrition, while for lower-level employees it is salary, incentives and benefits. But

for the middle-level employees, it is better employment opportunities in other Star category hotels, hereby it is suggested to hotels to have suitable policies and contract terms to a certain period to reduce employee attrition rate.

7 Conclusion

The current study adopted descriptive research design. The data was collected from 419 samples using structured questionnaire online. For the study, 12 Star category hotels were considered, from which samples were taken through a convenience sampling technique. From the analysis performed, it can be well understood that there no significant difference in opinion among respondents concerning gender and various Job positions. But using the rank analysis using mean score it can be clearly understood that salary, incentive and benefits are an important reason for the male employee attrition while Work-life balance is the important reason behind the female employee attrition. With respect to job position top-level employees, it is the work-life balance that is causing employee attrition, while for lower-level employees it is salary, incentives and benefits. But for the middle-level employees, it is better employment opportunities in other Star category hotels.

References

[1] Farkiya, R. (2016). A Study on Overview of Employee Attrition Rate in India. Indian Journal of Management, 1-15.

[2] Guru Vignesh. S, S. V. (2018). Employee Attrition and Employee Retention-Challenges & Suggestions. Conference: International Conference On Economic Transformation with Inclusive Growth, 1-22.

[3] Milind A. Peshave, R. G. (2015). Study Of Factors Influencing Increasing Attrition Rate In Hotels Of Pune, Its Impact On The Organization And Measures Undertaken By The Hotels To Curb The Attrition Rate. JOHAR -- Journal of Hospitality Application & Research, 1-10.

[4] Abdulla, J. D. (2015). Determinants of Job Satisfaction In The UAE: A Case Study of The Dubai Police. Personnel Review, 126-146.

[5] Ahmad, A. R. (2014). Higher Dissatisfaction Higher Turnover in the Hospitality Industry. International Journal of Academic Research in Business and Social Sciences, 45-52.

[6] Bhattacharya, S. a. (2006). Stress and Coping: A Study on Lady Criminal Lawyers of Kolkata City. Indian Psychological Review, 227-234.

[7] Bilgic, R. (1998). The Relationship Between Job Satisfaction And Personal Characteristics of Turkish Workers. The Journal of Psychology, 549-561.

[8] Hashemi, S. J. (2015). Determinant of Employee Job Satisfaction and Role of Male and Female Differences: An Empirical Study at Hotel Industry in Iran. Journal of Hospitality Application and Research, 15-36.

Contemporary Concerns Impacting Higher Technical Education

G.Rathidevi[1], Dr. G. Brindha[2]
{rathiharini85@gmail.com[1], bkk28@yahoo.co.in[2]}

Research Scholar, Department of Management studies, Bharath Institute of Higher Education and Research, Chennai[1], Professor and Head, Department of Management studies, Dr. M.G.R. Educational and Research Institute, Chennai[2]

Abstract. The current buzz with regard to knowledge explosion is globally experienced and its repercussions are felt throughout the length and breadth of higher education. Knowledge is the collection of information, education, research, experience and intelligence that is mainly harnessed in educational institutions. Precisely, systems and procedures articulated within the context of liberalization, privatization and globalization (LPG), made the governments across the world to come up with various agenda to revamp higher education. Governance reforms like enhanced autonomy, process reengineering, Human Resource (HR) policy, accountability, transparency processes, academic reforms and such other frameworks, influenced the higher education sector to develop a vision for an overall learning experience.

Keywords: Contemporary concern, Impact, Human Resource, Technical Education.

1 Introduction

Despite differences in the size and status of higher education sectors, many countries have acknowledged that the closed higher education systems are incompatible to the changing political-social-economic-cultural-technological contexts. As a resultant effect, pressures are felt by the higher education institutions from different stake holders in the policy processes viz. industries, higher education commissions, reports from various committees etc. to deliver desirable outcomes in tune with the societal demands such as institutional accountability, benchmarking performance standards, employability and alike. According to a major study conducted by the U.S. National Academy of Engineering titled 'The Engineers of 2020 – Visions of Engineering in the New Century' (U.S.NAE, 2004) a detailed analysis was carried out to identify the myriad challenges that are likely to be faced by the engineers in future both at the macro and micro levels. Besides providing backup solutions in the form of rapid recovery, reconstruction and deployment the study highlighted the scope of engineers to create solutions for qualitative problems like predicting 2 potential biological disasters, water and food contamination and damage to physical and technological infrastructure. Interestingly, this aspect is crucial for developing countries like India which is celebrated as one among the largest higher education systems in the world. However, in terms of quality the situation is drastic in the case of India as there are only few institutions like Indian Institute of Managements (IIM), National Institute of Technologies (NIT), Indian Institute of Technologies (IIT) and Jawaharlal Nehru University (JNU) that have been globally acclaimed

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for their standard of education. The Indian Technical Education (TE) being one of the largest higher educational systems in the world seems to be extremely complex for sustaining at the global level. Hence, there is a need to create mass human capital in this sector. In the age of knowledge explosion, the scope of knowledge society seems to be very crucial for engineering education in particular, as India possesses more than 3495 Engineering Institutions in the country as of 2010-11 with a total intake capacity of 17,61,976 students. To be reinforces his view on the need to frame a strategy to nurture engineering graduates as highly intelligent postsecondary students. It is in this regard that the quality of engineering education emerges as the issue of paramount importance. Having mentioned the relevance of engineering graduates in sustaining the economy, he focuses on training the mind and developing the analytical abilities. In fact, to accomplish such outcomes it is good to review the faculty of Technical Educational Institutes (TEI). At a conference on International Engineering Education organized by IIT-Madras, 2017, experts from different educational domains acknowledged the fact that despite a fivefold increase in the growth of technical education institutions in India during 1995-2005, there has been a serious shortfall in quality teaching faculty. To illustrate, with a dictum, 'As you sow so shall you reap', the need for fundamental change can be addressed in the context of developing the faculties of the faculty. To study this aspect in engineering faculty, the researcher has empirically examined existing HR practices in three engineering institutes/universities.

Further, Natarajan (2009) while reviewing the current issues in Indian technical education has highlighted the need to dismantle the existing systems to suit the contemporary needs, viz. access, affordability, diversity, globalization, innovation, 4 outcomes based performance, relevance, quality etc. With the discussion and debate in higher education research oriented towards striking a balance between quantity and quality, the current chapter makes an effort to explore the concept of quality in scientificlearning from the human resources perspective.

2 Recommendations of Important Committees and Policy Documents for Higher and Technical Education

There were several commissions and policies on higher and technical education since independence all of which focussed on improving the standards of education. The first of its kind was the Scientific Manpower Committee set up in the year 1947, to assess the growing demand for scientific and technical personnel in government departments. In 1948-49, the University Education Commission was formed to study the problems in higher education. It also critically assessed the engineering and technological education in the country. It strongly recommends the strengthening of scientific and technical base of the educational system. NPE (National Policy on Education - 1986, modified in 1992) an important policy document of Government of India (GOI) has given the following steps for promoting cost – effectiveness and excellence in technical and management education which includes modernisation and removal of obsolescence, generate resources to provide services to community and industries, adequate hostel and other facilities, effect procedure for recruitment of faculty and their promotion, adequate staff development programmes for the multiple roles the teachers have to perform, curricular revisions, promotion of climate conducive of excellence and innovation with full involvement of the faculty, autonomy at academic, administrative and financial levels and the networking of systems between technical education and others. NPE has stressed the need for National Manpower Information System at all stages of technical

education in order to provide a more balanced technical education system. Other significant recommendations include flexible modular pattern based on credits for multipoint entry for technical and management education. NPE has reiterated the fact that of all the factors that determine the quality of education the teaching faculty is the most important and they should be given enough academic freedom to pursue and publish their research. The Programme of Action, 1992 has given detailed strategies for implementing the various recommendations of the NPE. It is projected that through TEQIP, about 100-120 well performing organizations will be extended into outstandingorganizations of world class. In order to make the academic profession more attractive the University Grants Commission (UGC) decided to revise the pay scales by appointing a pay review committees (PRC) headed by Rastogi in 1996, but the recommendations were rejected by the UGC due to various reasons. Later another PRC for higher education headed by Prof G K Chaddha in 2007 was appointed by the UGC. The Chadda committee had suggested over 70 per cent pay hike with additional allowances like academic allowance in addition to transport, house rent, special duty, medical and travelling allowances. It also suggested 65 years as the retirement age, which can be changed up to 70 years. An annual increment of 3-4% of the basic pay depending on the teacher's performance was also recommended by the committee. The committee recommended new positions to academics in the higher education sector viz. an assistant professor at an entry level (instead of a lecturer), Associate Professor and Professor. The committee suggested introduction of new ranks like professor of eminence, senior professor and senior associate professor. Professors are experts in their field and their package will be at par with that of the vice-chancellors. The National Knowledge Commission, formed in 2015, had analysed the Indian higher and technical education in detail and suggested issues related to expansion, excellence and inclusion. The Report of the working group on engineering education (NKC, 2019) viewed that lack of well qualified faculty and the issue of attracting and retaining motivated faculty as a serious challenge to engineering education. According to the report some of the core values that an educational institution should nurture are autonomy, academic freedom, teaching, research and information dissemination. It suggested competition and collaboration among institutions for many creative and innovative educational methodologies.

3 Traces of Human Resource Management Practices in Promoting Institutional Quality: The Indian Context

In the wake of globalization and the knowledge revolution engineering as a profession is expected to sustain globally as well as locally for which quality of the institutions viz. the quality of the faculty is very important. Owlia and Aspinwall (1996) came up with a conceptual structure to depict the quality dimension in higher education. These are competence, tangibles, content, attitude, reliability and delivery. For instance, National Assessment and Accreditation Council's (NAAC) core values like contribution to national development, building a value system among students and such others indeed provides a framework to determine the quality of higher educational organizations. In a bid to improve the quality in Higher Education (HE), prior to 2012, NAAC had developed a criterion for Governance and Leadership. With respect to change in the way the Institutions are managed worldwide, NAAC has revised their manual in 2012 by adding 'Management' as a parameter along with it and the weightage (100 points) is given to the way these institutions are being professionally managed. (Kurup, 2012) Precisely, this implies a fundamental shift in the way

things were operating especially in the context of human capital. To illustrate, for the first time, NAAC has brought in a new key aspect to institutionalize quality endeavours in the institution with 30 points weightage to Internal Quality Assurance Cell (IQAC). It requires the detailed procedure of how the institution brings about quality in all its initiatives, including training of the IQAC staff, accreditation by other agencies if any, communication of Quality Assurance policy to the stake holders and finally to bring about the strengths, weakness, opportunities and challenges faced by the institution. AICTE (All India Council for Technical Education) - the apex body of technical and management educational institutes in the country established NBA (National Bureau of Accreditation) in 1994 to grade technical and Management education programmes.

Thus Program level grading make sure that students declared to a program undergo a suitable level of teaching – learning process and are transforming themselves to capable and competent engineers in the future. NBA has an elaborate criteria such as Governance and Organisation, Physical and Financial resources, human resources of staff, faculty and students, the teaching learning process, other supplementary processes and research and development initiatives of the technological universities. Human Resources category (which carries a total of 600 points) is very important for the university's progress as the faculty human resources in particular forms the core competence of a university.

The Ministry of Human Resources Development (MHRD) has proposed the idea of technology based intervention on faculty quality enhancement through the National mission on education through Information and Communication Technology (NME-ICT) which involves a collaborative development of digital teaching learning contents for all the teachers and students. As of now, through the various Quality Improvement Programmes, (QIP) only a percentage of the 1, 50,000 teachers are being trained but this NME-ICT programme can train thousands of faculty located in different geographical areas of the country. The conditions under which higher education have been working is changing faster than they usually changed in the past. It has become a major driver for economic competitiveness in this globalised world. HR can bring in effective management principles into the higher education system and bring in solutions for sustained growth as well as develop the institute at par with international quality standards using its many innovative ways of managing the institutional human capital. Regardless of the fact that higher education systems all over the world differs in its culture and commitment there are certain systems that are common to all the 9 cultures and traditions in higher education which includes appointment of teachers, inducting them into their institution, training them for quality, appraising their performance, motivating them and finally retaining them. Ackom (2011) reports that human resources that is handled through these broad HR practices can build practical variation in terms of three organisational outcomes; quality of work life, productivity and profit. Every institution has its own distinct institutional culture and environment and at the same time will share a definite relationship with the external macro environment. Simultaneously the micro institution takes resources from the macro environment and gives back the same to it. In these circumstances, the human resources involved in every aspect of the institutional quality should be professionally managed to achieve the desirable effects in the globalised world. Appropriate Human Resource Management (HRM) practices can frame SMART targets – Specific, Measurable, Agreed, Realistic, and Time-bound and achieve the same so as to promote the overall growth and sustained development of its unique human capital.

4 Conclusion

Educational institution requires effective HRM functions to recognize stated objectives and goals. Effective HRM ensures greater organizational effectiveness. The present higher educational scenario requires effective application of HRM functions to govern the educational institutions. The present study tried to find out the scope of HRM functions conceded out by the contemporary issues and the management. The present study reveals greater application of HRM functions in the technical higher education system, although the HRM functions differ on the basis of certain teacher and institutional related variables.

References

[1] Alwiya.A.,Jolly.S.(2016). Strategic Human Resource Management in Higher Education Institutions: Empirical Evidence from Saudi. Procedia Social and Behavioral Sciences. Elsevier

[2] Anderson.(2014). Compensation and Recruiting: Private University versus Private Corporations. Journal of Corporate Finance , ELSEVIER

[3] Armstrong, M. (2019). A Handbook of Human Resource Management Practice(11th ed.). UK: Kogan Page.

[4] BaiqRohiyatun,(2014). PengembanganSumberDayaManusia di Perguruan Tinggi Swasta (StudiKasus di Univ.MuhammadiyahMataram&InstitutKeguruandanIlmuPendidikanMataram. JurnalIlmiah IKIP Mataram.

[5] Boxall, P., Purcell, J., & Wright, P. (2017). The Oxford Handbook of Human Resource Management. UK: Oxford University Press.

[6] Bratton, J., & Gold, J. (2011). Human Resource Management, Theory and Practice(2nd ed.). New Jersey: Lawrence Erlbaum Associates, Inc.

Buying Behavior Towards E-Tailing In Rural Areas Of Kanyakumari District

S.Fenin Samuel[1], Dr. K. Asha[2], Dr. M.C.Shibin Tad[3]
{feninsml@gmail.com[1], kajanardhanan@yahoo.com[2], shibintad@gmail.com[3]}

Research Scholar, Faculty of Management Studies, Noorul Islam Centre for Higher Education, Kumaracoil[1],
Assistant professor, Faculty of Management Studies, Noorul Islam Centre for Higher Education, Kumaracoil[2,3]

Abstract. In the contemporary world, E-Shopping has become one of the most popular arrangements among compulsive shoppers. E-Shopping gives access to any user to purchase any sort of products or avail any kind of services which are listed online, within their comfort zone. It does not even compromise on the convenience of the customers, because anyone who purchases a product or service from the internet have the provision to get it delivered at their doorstep. Online vendors have been acquiring more volume of customers through creative and crafty marketing and hassle-free shopping experience with maximum satisfaction. Online vendors stay on top of the game by fulfilling their clients' requirements seamlessly. A detailed assessment of this buying pattern reveals that users shop online with the principle moto to save their time. Some of the crucial issue with an online purchase was identified as EMI issues and the modest nature of items. Although there are many issues occurred during e-commerce, but the well-layered administration of the online vendors has managed to rule out all the grievances to a considerable extend. This has motivated many users to depend on online vendors and thus Consumer buying behavior has significant involvement in online shopping.

Keywords: e-shopping, e-tailing, Buying Behavior of Consumers.

1 Introduction

The purchasing conduct varies from customer to customer. Tastes and Interests of customers differ globally based on their culture, job, inclination, age, salary level, and many other influential factors. Considering their buying behavior online vendors offer a vast array of merchandise and enterprises to choose from. Shoppers usually are found to settle for regular purchase choices, these purchases are mostly an empathetic influence of their social, mental and personal traits. E-retailing has quickly grown into an effective medium for advertisements. As highlighted by the inclination of online shoppers, they can choose their value run, shading determination, models, colors, brand choice, and much more from the options available on an e-commerce website. Hence E-tailing or E-Retailing is beneficial, simple and offers privacy for the users. Online advertising channels similarly provide access to similar data about the organizations, their items, competitiors, and administrations. Online shoppers can use such websites to raise a query, provide suggestions and recommendations and even communicate their criticisms to organizations. E-commerce is developing at a rapid pace as most of the users prefer online methods for shopping.

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2 STATEMENT OF THE PROBLEM

Purchasing the required items without even leaving our room is increasingly gaining an advantage to the online form of shopping. However, Users still experience one or another issue while shopping online sometimes. A share of such issues is listed below.

Users often receive items that are slightly or entirely different from the items that are displayed on the website, which is totally the responsibility of the vendor. Duration for delivering the product will take more time than what was promised during the time of purchase. Certain vendors do not even offer a discount on the products if they have failed with their assurance. Delivering the products to the wrong location will always create a bad impression for the vendors in the minds of online shoppers.

3 REVIEW OF LITERATURE

A. Factors impacting customers to lean toward a specific online site

Sinha (2012) characterize that accommodation chance, item chance, money related hazard, saw conduct control, merchandise exchange, emotional standard, frame of mind, innovation explicit ingenuity, conveyance of an arranged item and digital laws, shipping expenses, and after administration were a part of the variables that influence the shoppers to incline toward explicit online site. Though the comfort hazard appeared to be the key factor substantially influencing Indian shoppers' online purchases, when taking a quick peek at male and female discernments, there were various elements influencing male or female customer's practices.

B. E-business: customers purchasing conduct towards e-shopping

Bashir (2013) defines that E-business has made life basic and creative of people and gatherings; purchaser Behavior in e-shopping is not the same as the physical market. Price, efficiency, and accommodation were identified as important elements that lead to certain purchasing conduct. In e-shopping customers are hesitant to make web-based acquisitions, because at that point in time, the most well-known hindrance is the low degree of trust in online stores. Considering this fact, online vendors should adopt legitimate techniques to increase the buyer's degree of trust in them.

C. e-tailing: level of fulfillment of customers

Karim (2013) states that the customers use the internet to buy items through online stores considering the fact that they trust it is accommodation to them and the term advantageous incorporates components for example, efficient, data accessibility, opening time, usability, sites route, less shopping pressure, more affordable and shopping fun. Parallel to respondents' outlooks, online installment security, individual protection and trust, vague guarantees and returns arrangements and absence of individual client administration are the preeminent barriers of e-shopping.

4 OBJECTIVES OF THE STUDY

- To break down the factors influencing buyers to incline toward a specific e-shopping site.
- To assess the shopping conduct of online shoppers in rural areas of Kanyakumari district.
- To identify the degree of fulfillment of the clients towards web-based retailing.
- To provide recommendations based on the discoveries of the examination.

5 SCOPE OF THE STUDY

- The study has been conducted to discover the purchasing conduct of buyers towards online shopping or E-shopping. This analysis the analyst, online customers of rural Kanyakumari region and online retailers by examining purchasing conduct and inclinations of the buyers and distinguishing the purchasing choice of the online buyers that begins sometime before the real buy.
- To identify the extent of fulfillment of the clients towards web-based retailing.
- To make recommendations based on the analysis of the examination

6 RESEARCH METHODOLOGY AND DATA COLLECTION

A. Type of Research

Descriptive research is adopted for this study.

B. Sampling Method

From the aggregate of four panchayats, 80 tests have been taken through Stratified Random Sampling.

C. Sample Size

The respondents are clients of E-shopping. For the examination, 20 tests from Melpuram Panchayat, 20 tests from Munchirai Panchayat, 20 from Killiyoor Panchayat and 20 from Thiruvattar Panchayat have been taken through Random Sampling Method.

D. Data Collection Method

The information is gathered through Primary and Secondary Sources.

a) Primary Data:
Essential information is gathered through Structured Questionnaire. Information is gathered from the online buyers of rural areas of Kanyakumari District.

b) Secondary Data:
Auxiliary information is gathered through articles, diaries, magazines and e-tailing websites.

E. Tools Used for the Study:

- The instruments utilized are Correlation Analysis and Chi-square.

7 HYPOTHESIS OF THE STUDY

- Ho: There is no huge connection between the Income level of the shoppers and the Price of the item.
- There is a noteworthy connection between the Income level of the customers and the Price of the item.
- Ho: There is no huge connection between Gender and Shopping Behavior of the customers.
- There is a huge connection between Gender and Shopping Behavior of the customers.
- Ho: There is no huge connection between Age and Customer Satisfaction.
- There is a huge connection between Age and Customer Satisfaction.

8 ANALYSIS AND INTERPRETATIONS

1. To dissect the components impacting purchasers to favor a specific e-shopping site.

Individuals make online purchases by relying on their expectations for everyday comforts and other social variables repeatedly. Online retailers will be making use of such behavior of the customers and arrange products for their intended target group. For instance: Salary, everyday convenience, age group and much more.

Table No: 1 Correlation between the Income level of the online buyers and cost of the item.

X	dx	dx^2	y	dy	dy^2	dxdy
7	-9	81	5	-11	121	99
28	12	144	25	9	81	108
20	4	16	30	14	196	56
18	2	4	13	-3	9	-6
7	-9	81	7	-9	81	81
∑ x =80	**∑dx = 0**	**∑dx^2= 326**	**∑y = 80**	**∑dy = 0**	**∑dy^2 = 488**	**∑dxdy = 338**

Source: Primary data

r= 338/ 398.86

= 0.8474

In this way, the coefficient of the relationship between x and y is certain. Its seamlessly depicted that the elective speculation is acknowledged. It also reveals that there is a significant relationship between the income level of the buyers and the price of items. As such, the purchasing conduct of the client relies upon their income levels and the retailers arrange their items based on it.

2. To look at the shopping conduct of rural customers in Kanyakumari district

The shopping conduct of buyers can be based on gender. Frequently women have remarkable shopping tendency, thus an assessment is conducted to find out if there exists a relationship between Gender and Shopping behavior.

O	E	O – E	$(O – E)^2$	$(O – E)^2/E$
2	3.1	-1.1	1.21	0.390
6	4.9	1.1	1.21	0.247
0	0.775	-0.775	0.601	0.775
2	1.225	0.775	0.601	0.491
0	0	0	0	0
0	0	0	0	0
2	1.1625	0.8375	0.701	0.603
1	1.8375	-0.8375	0.701	0.381
3	2.7125	0.2875	0.083	0.031
4	4.2875	-0.2875	0.083	0.019
7	8.9125	-1.9125	3.658	0.410
16	14.0875	1.9125	3.658	0.260
3	5.8125	-2.8125	7.910	1.361
12	9.1875	2.8125	7.910	0.860
1	2.325	-1.325	1.756	0.755
5	3.675	1.325	1.756	0.478
4	2.325	1.675	2.806	1.207
2	3.675	-1.675	2.806	0.764
7	3.1	3.9	15.21	4.91
1	4.9	-3.9	15.21	3.104

2	0.775	1.225	1.501	1.94
0	1.225	-1.225	1.501	1.225
Total				20.2016

The calculated value of chi-square test = 20.2016
Critical value (0.05), 10 = 18.3
Calculated value >Table value, 20.2016 > 18.3

Hence the determined estimation of chi-square is more noteworthy than the table worth, so the elected theory is acknowledged. This shows that there exists a significant relationship between gender and shopping conduct of purchasers.

3. To distinguish the degree of fulfillment of the clients towards e-tailing

Presently e-shopping facility is availed by a massive number of users including all age groups. Finally, an assessment is being done in this study to uncover if there exists a relationship between the age of clients and their fulfillment towards e-shopping.

Table No 3: Application of Chi-square test between Age and Shopping Behavior

O	E	O – E	$(O – E)^2$	$(O – E)^2/E$
3	3.15	-0.15	0.023	0.0073
11	11.025	-0.025	0.00063	0.000057
4	4.4625	-0.4625	0.214	0.048
2	1.8375	0.1625	0.026	0.014
1	0.525	0.475	0.226	0.430
4	3.75	0.25	0.063	0.017
15	13.125	1.875	3.516	0.268
3	5.3125	-2.3125	5.348	1.007
2	2.1875	-0.1875	0.035	0.016
1	0.625	0.375	0.141	0.226
0	1.65	-1.65	2.723	1.650
7	5.775	1.225	1.501	0.260
3	2.3375	0.6625	0.439	0.188
1	0.9625	0.0375	0.0014	0.0015
0	0.275	-0.275	0.076	0.276
4	2.4	1.6	2.56	1.067
6	8.4	-2.4	5.76	0.686
4	3.4	0.6	0.36	0.106
2	1.4	0.6	0.36	0.257
0	0.4	-0.4	0.16	0.4
1	1.05	-0.05	0.0025	0.0024
3	3.675	-0.675	0.456	0.124
3	1.4875	1.5125	2.288	1.538
0	0.6125	-0.6125	0.375	0.612
0	0.175	-0.175	0.031	0.177
Total				9.385

The calculated value of chi-square test = 9.385
Critical value (0.10), 16 = 23.5
Calculated value < Table value, 9.385 < 23.5

Hence, the calculated value of chi-square is lesser than the value of table, the invalid theory is acknowledged. The invalid theory thus demonstrated that there is no critical connection among age and consumer loyalty towards web-based retailing. Thus this method is more practical and is favorite for a lot of people.

9 FINDINGS OF THE STUDY

- The majority of the clients revealed that they spend from Rs.1000 to 2999 for purchasing an item from the internet.
- Consumers usually buy garments and PC accessories online.
- The majority of buyers agree that they shop online to save time.
- Cash on Delivery is the most preferred mode of payment for the majority of clients when they shop online.
- The majority of the respondents research online about the product that they want to buy before they make the purchase from any e-retailing sites.
- Most of the purchasers revealed that it is safe to use charge cards while shopping online.
- Majority of customers have agreed that they face issues when shopping online, for example, they receive products with less quality and damaged products as well.
- Majority of the purchasers are satisfied and delighted with the delivery processes of online vendors.
- Majority of the responders agree that they acquired items through Blue Dart messenger services.
- Majority of the purchasers have not faced any issues with the courier services.
- Majority of the individuals have dispassionate understandings related to the discounts that are being finished by the retailers for damaged or harmed items.

Consumer Satisfaction towards Online Product:

- Minimal number of customers expressed that they are happy with the cost of items listed online.
- Majority of customers were unhappy with the nature of the item.
- Majority of the customers were significantly happy with the vast collection of online items.

Customer Satisfaction towards E-tailing:

- Majority of the customers are happy with the security given during payment exchanges.
- Most of the customers have nonpartisan thoughts about the security of personal data.
- Majority of the buyers have unbiased opinions regarding the after-sales administration offered by the e-retailers.
- Majority of the buyers have neutral thoughts about the special and commercial elements

- A small number of customers are very happy with the time taken for the transportation of the item.
- Most of the customers are satisfied with the data provided by the retailers on items.

Factors Influencing buyers concerning buy of merchandise through the Internet:

- Some of the customers are interested in reputed online sites as they feel that the popularity of the website is really important.
- Some of the purchasers assure that there is minimal significance to buy products from the internet.
- Majority of the respondents states that data privacy isn't remarkable when shopping online.
- Majority of the customers states that the cost of the items and security are significant factors for online shopping.

10 SUGGESTIONS OF THE STUDY

- As the majority of customers are inclined towards online shopping the online vendors must concentrate on providing the best quality products.
- Courier companies play a vital role in the transportation of products from retailers to shoppers. Courier companies should transfer the items in a sensible charge.
- People are more likely to buy online because of the simplicity in shipping and delivery of the products, so a faster pace in transportation will be highly commendable.
- Since the majority of the customers are satisfied with the vast collections of items online, the data associated with these items should be extended by e-tailing organizations.
- A large number of potential shoppers can be drawn in using advanced marketing advertisements in a shorter period of time.
- Privacy and security of the buyers' data are one of alarming concern for buyers in e-commerce practices. buyers are not confident in sharing their data without having the fear of being exposed. The e-retailing organizations must provide a more convincing privacy and security policy.
- E-tailing organizations can similarly improve their strategies and techniques to add more buyers to their list.

CONCLUSION

From the assessment, it is concluded that fulfillment towards E-tailing is fundamentally to save time and energy.

However, buyers from the rural area are prone to face issues in installment exchanges, delayed deliveries and accepting poor quality items, the result thus legitimizes the growth and progress of E-tailing.

This also has demonstrated the positive attitude of customers towards online shopping. This result can be used by E-retailing websites to cultivate superior consumer loyalty towards online shopping.

References

[1] Jayendra Sinha and Jiyeon Kim, "Factors affecting Indian consumers' online buying behavior", Innovative Marketing Review, Vol 8, Issue 2, 2012

[2] ChayapaKatawetawaraks and Cheng Lu Wang, "Online Shopper Behavior: Influences of Online Shopping Decision", Asian Journal of Business Research, Vol 1, No 2, 2011

[3] Steven Bellman, Gerald L. Lohse, and Eric J. Johnson, "Predictors of Online Buying Behaviour", Communications of ACM, Vol 42, No 12, Dec 1999.

[4] Philip Kotler, Gary Armstrong, Prafulla Y. Agnihotri and Ehsan ulHaque, " Principles of Marketing", Pearson Education, Inc, Fifth Edition, 2013, pp no: 426-437

[5] Donald R Cooper, Pamela S Schindler and J K Sharma, "Business Research Methods", Tata McGraw Hill Education Private Limited, 11th Edition, 2012, , pp no: 528-536

[6] Saad Akbar and Paul T J James, "Consumer's attitudes towards Online Shopping: Factors influencing employees of crazy domains to shop online", Journal of Management and Marketing Research

[7] Rashed Al Karim, "Customer satisfaction in Online Shopping: a study into the reasons for motivations and inhibitions", IOSR Journal of Business and Management, vol 11, Issue 6, Aug 2013, pp 13-20

[8] Rayed AlGhamdi, Jeremy Nguyen, "Factors Influencing E-commerce adoption by retailers in Saudi Arabia: A Quantitative Analysis", International Journal of Electronic Commerce Studies, 2012, vol 3, No:1, pp no: 83-100.

[9] Dr.GagandeepNagra, Dr. R. Gopal, "A study on Factors affecting Online Shopping Behaviour of Consumers", International Journal of Scientific and Research Publications, June 2013 ,vol 3, Issue 6.

Examining the Extent of Employee Attrition Due to Job Stress

R. George Leslie Davidson[1], Dr. G. Brindha[2]
{georgelesliephd@gmail.com[1], bkk28@yahoo.co.in[2]}

Research Scholar, Bharath Institute of Higher Education and research, Chennai.[1],
Professor & Head, Faculty of Management studies, Dr. M.G.R Educational and Research Institute, Chennai.[2]

Abstract. The objective of the study was to identify the extent of the impact of Job Stress on Employee attrition in the Hotel industry in Tamilnadu. The study adopted a descriptive research design. The data was collected from 500 samples using Simple random sampling method. The data was collected from a structured questionnaire. The analysis was carried using two study variable namely; Job stress and employee attrition. The findings illustrate that there is exists positive relationship between Job stress and employee attrition i.e. when job stress increases the employee attrition also increases. Also, the study indicates that job stress highly influences employee attrition. The model governing the job stress and employee attrition is given by Employee attrition = 131.53 + (0.930 × Job Stress).

Keywords: Employee Attrition, Job Stress, Hotel Industry..

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1 Introduction

Employees of some firms receive more attention from internal partners, such as owners and executives, than from external partners, such as customers. Employee satisfaction is an underlying assumption in these businesses. During peak business seasons, the hotel industry operates around the clock and hires casual or temporary staff. It is important to remember, however, that daily staff is in charge of key aspects such as customer service, room service, and food and beverages. In line with employers' performance demands, customers' expectations make their jobs more demanding and challenging. Employees' work-life balance can be impacted as a result of such strong customer attention. Such a strong customer emphasis may have a negative effect on employees' work-life balance, resulting in a subtle decline in individual and organisational efficiency. There isn't enough scientific research to shed enough light on the hotel staff's struggles with job stress and burnout. The results of previous studies are neither confirmed nor refuted in this report. The effect of job stress on employee turnover in the hospitality industry in Tamilnadu is investigated using a mixed method approach. Initially, a common technique was used to learn how hotel workers describe their daily lives, both on duty and at home. And there's the framework of the causal relationship. Then, using the equation model, the exclusion approach was used to evaluate the causal relationship structure between the study variables.

Review of Literature

Many previous studies claimed that statistical differences had an effect on employee job satisfaction. In the existing literature, there is no consensus on the relationship between population differences and other dependent variables such as job satisfaction and work stress. (Abdulla, 2015). Employees' age groups, gender, marital status, work experience, and job satisfaction levels were found to have no substantial differences in several studies. There is no clear trend in the relationship between demographic factors and job satisfaction among individuals in different occupations in different countries, including the hospitality sector, according to previous evidence. (Ahmad, 2014) says the author. The levels of job assessment are clearly dependent on various statistical variables, and the method still now adopted appears to be different in different industries or occupations. Do the methods described above resemble those used by hotel employees, especially those who work in five-star hotels? There is no significant evidence in the literature to support this claim, which necessitates further investigation (Bhattacharya, 2006).

Two studies of hotel industry experience from India, Germany, the United States, and the Middle East show that the variables that predict work satisfaction are diverse. Long working hours and low salaries were found to positively influence the job satisfaction of changing chief executives in one study conducted in the German hospitality industry. Similarly, emotional intelligence and guidance of managers have a huge effect on employee work satisfaction in the American hotel industry (Hashemi, 2015). There was a strong negative link between changing leadership and work tension and career burnout in Dubai's five-star hotels. The results presented above seem to be in conflict. The above results seem to be at odds with the literature's patterns. This may be attributed to concerns of cultural and diversity. Furthermore,

contact between "guest liaison staff" was found to be higher than communication between "non-guest liaison staff." Furthermore, three stock-related variables, stock uncertainty, stock dispute, and stock overload, were found to have a negative association with work performance in Kusadasi's four- and five-star hotels. Stock uncertainty, as opposed to stock dispute or higher loads, causes more tension. Job stress increased by rising company burnout, according to a study conducted by luxury hotels in China. In a separate study conducted in China, hotel employees were found to be frequently. Job stress increased by rising company burnout, according to a study conducted by luxury hotels in China. Another research in China found that hotel workers were often stressed at work as a result of workplace bullying or discrimination (Bilgic, 1998).

The objective of the Study

The objective of the study was to identify the extent of the impact of Job Stress on Employee attrition in the Hotel industry in Tamilnadu.

Research Methodology

For the study, the descriptive research design was adopted. Herein data was collected from 500 samples using Simple random sampling method. The data was collected from a structured questionnaire.

Analysis & Interpretation

Herein the independent data – Job stress is a metric data which is measured in Likert scale. Similarly, the dependent data – Employee attrition is metric data which is measured in the Likert scale. Therefore, to identify the relationship between job stress and employee attrition Pearson correlation analysis is employed.

Null Hypothesis: There is no significant relationship between job stress and employee attrition.

Table No. 1: Relationship between job stress and employee attrition

Correlations			
		Employee Attrition	Job Stress
Employee Attrition	Pearson Correlation	1	.789*
	Sig. (2-tailed)		.035
	N	7	7
Job Stress	Pearson Correlation	.789*	1
	Sig. (2-tailed)	.035	

	N	7	7

Source: (Primary data)

The estimated significance value is 0.035 which is less than 0.05. Thereby the null hypothesis is rejected meaning, there is a significant relationship between job stress and employee attrition. The Person Correlation value is estimated to by 0.789 which indicates there is a positive relationship between Job stress and employee attrition i.e. when job stress increases the employee attrition also increases.

From the above analysis, it is interpreted that there is a significant relationship between job stress and employee attrition. Hereby to make further insight influence of job stress on employee attrition is measured using the regression method.

Null Hypothesis: There is no significant influence of job stress on employee attrition.

Model Summary and Parameter Estimates

Dependent Variable: Employee Attrition

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	.625	8.263	1	5	.035	131.353	.930		
Logarithmic	.614	7.953	1	5	.037	-11736.037	1812.186		
Inverse	.592	7.254	1	5	.043	3771.091	-3377944.783		
Quadratic	.623	3.306	2	4	.142	18.615	1.048	-2.902E-05	
Cubic	.624	3.320	2	4	.141	-181.076	1.177	0.000	-1.964E-08
Compound	.616	8.011	1	5	.037	757.088	1.000		
Power	.603	7.601	1	5	.040	2.008	.906		
S	.578	6.860	1	5	.047	8.450	-1684.769		
Growth	.616	8.011	1	5	.037	6.629	.000		
Exponential	.616	8.011	1	5	.037	757.088	.000		
Logistic	.616	8.011	1	5	.037	.001	1.000		

The independent variable: Job Stress

Source: (Primary data)

Among the various regression model linear regression model has the highest R-square value of 0.625 meaning, there is 62.5% forecasting power. From the coefficient estimates, the regression model governing the job stress and employee attrition is given by:

Employee attrition = 131.53 + (0.930 × Job Stress)

Findings and Discussion

The study findings illustrate that there is exists positive relationship between Job stress and employee attrition i.e. when job stress increases the employee attrition also increases. Also, the study indicates that job stress highly influences employee attrition. Hereby it is suggested to the hotel industry in Tamilnadu to focus on framing suitable HR Policies and Practices to reduce Job Stress in the workplace, this, in turn, reduces the employee attrition to great extent. Further, it is advised to get an opinion based feedback from the employees to identify the stress associated factors and concentrate on decreasing it to reduce the employee attrition and increase employee retention.

Conclusion

The study adopted a descriptive research design. Herein data was collected from 500 samples using Simple random sampling method. The data was collected from a structured questionnaire. The analysis was carried using two factors namely Job stress and Employee attrition, each factor has 12 variables within it. The study findings illustrate that there is exists positive relationship between Job stress and employee attrition i.e. when job stress increases the employee attrition also increases. Also, the study indicates that job stress highly influences employee attrition. The model governing the job stress and employee attrition is given by Employee attrition = 131.53 + (0.930 × Job Stress)

References

[1] Abdulla, J. D. (2015). Determinants of Job Satisfaction In The UAE: A Case Study of The Dubai Police. Personnel Review, 126-146.

[2] Ahmad, A. R. (2014). Higher Dissatisfaction Higher Turnover in the Hospitality Industry. International Journal of Academic Research in Business and Social Sciences, 45-52.

[3] Bhattacharya, S. a. (2006). Stress and Coping: A Study on Lady Criminal Lawyers of Kolkata City. Indian Psychological Review, 227-234.

[4] Bilgic, R. (1998). The Relationship Between Job Satisfaction And Personal Characteristics of Turkish Workers. The Journal of Psychology, 549-561.

[5] Hashemi, S. J. (2015). Determinant of Employee Job Satisfaction and Role of Male and Female Differences: An Empirical Study at Hotel Industry in Iran. Journal of Hospitality Application and Research, 15-36.

Online Buying Behaviour: A Study With Reference To Nagercoil Town

D.Deekshith[1], Dr. M.J.Deepa[2], Dr. M.C.Shibin Tad
{dichi28@gmail.com[1], mjdeepa1@gmail.com[2], shibintad@gmail.com[3]}

Research Scholar, Faculty of Management Studies, Noorul Islam Centre for Higher Education, Kumaracoil[1],
Assistant professor, Department of Business Administration, S.T.Hindu College, Nagercoil[2]
Assistant professor, Faculty of Management Studies, Noorul Islam Centre for Higher Education, Kumaracoil[3]

Abstract. The Trading in the contemporary world involves the use of the internet to provide a virtual sphere where merchants and buyers can engage in selling and purchases of goods, without even leaving their comfort zones.

The buyers and sellers can engage in trade from different parts of the world, from different time zones and they need not even speak the same languages. Online trading has evolved limitlessly during this era of globalization. The customers and vendors of this era are highly influenced by modern technology and at the same time, they are highly creative as well. Eventually, the internet has provided a platform to showcase their commercial creativity and showcase e-commerce as one of its primary offering. E-commerce or online business offers services like -Bussiness, e-CRM, e-Supply chain, e-Marketplace, e-Payment, e-Entertainment, e-Ticketing, e-learning, to e-Citizen and e-governance which were only available in the physical world in the past. Online shopping is eventually gaining shape as a well-acknowledged approach to buy and sell different products and services such as PC accessory items, automobiles, automobile spare parts, travel items, venture items, garments, blossoms, books, music, homes, and even real estates. Information for this study is gathered by distributing an organized questionnaire. This study intends to uncover the customer's conduct in purchasing, factors influencing purchasing, issues concerning the purchasing, relevant discoveries and proposals.

Keywords: Consumer buying behavior, online shopping, online customers..

Keywords: Bussiness, e-CRM, e-Supply chain, e-Marketplace, e-Entertainment, e-learning.

1 Introduction

Online shopping is a developing technological advancement that offers vast varieties to buy and sell various products and services through the internet. It enables users to find the item for their requirements without even leaving their current location. This saves them a lot of time and effort. this practice can be executed by the users at any point of time during the day. E-commerce or Online shopping offered such a great convenience that this has become a part of everyday life for a normal person. In the beginning, the internet was just a model for

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correspondence and eventually, it has evolved into a medium that offers to learn, trade, enterprise and much more. Internet technologies have created another method of trade among purchasers and sellers and have created a customer-centric commercial center. Online shopping has become an alternative to the traditional form of trading. In comparison to conventional shopping, customers prefer web-based shopping primarily because of the convenience that it offers for its users. It provides its users with the option to be in their comfort zone and choose the required product by just entering the details of the products and choose from a wide collection of options and alternatives. Online shopping also provides really satisfying discounts which most of the users find it alluring. Also, some of the e-commerce giants are well known to offer seamless and punctual delivery procedures. Use of the internet for shopping has altered the shopping methods for many users. Online shoppers display a different buying behavior when compared to conventional forms of shopping.

2 Statement of the problem:

Internet-based purchases of products are considered as costly and inferior, are still common to a large extend presently. It is being accepted by the general public because of reconciliation, rapid exchanges, time sparing, attractive deals and offers and much more. online shopping is relatively a new concept and is in the developing phase, and there are no unshakable conventions presently.

3 Objectives of the study:

The objectives of the study are:

- To analyze the buying behavior of online shoppers
- To identify the problems faced by online buyers.
- To determine the internet usage profile of the respondents.

4 Methodology:

The following Methodology was used for conducting the present study.

Area of the study: The current study examines the online buying behavior of sample respondents selected from Nagercoil Town.

Data Source: The study is selected from among the internet users

Primary data: Obtained by distributing a well – structured questionnaire to respondents.

Sampling design: Non- random sampling for choosing the respondent.

Sampling size: A total of 25 respondents were used for the study, out of which 23 were internet shoppers.

Secondary data: Secondary data was collected from different from books, research papers, reports, journals, published research work on online consumer behavior and websites.

Limitations and Scope for the study: Few limitations were identified in the course of study. It focused only a few internet shoppers. Limited variables were used. Future researchers can use different variables.

Literature Review:

There have been many comprehensive studies on online shopping attitudes and behavior in the recent past. For instance, Case et al (2001) suggested that internet know-how, income level, and education are powerful predictors of internet purchases among university students. Bellman and colleagues (1999) disclosed that the internet population is relatively younger, more educated and wealthier. although the gaps are eventually blurring.

5 Analysis and Discussion:

Internet usage profile of the respondents:

The internet usage profile of the respondents is shown in the following table.

Table 1: Internet usage profile of the Respondents

Statements	Category	Number	percentage
No. of years since using a computer	Less than 1 yr	6	26.1
	1 -4yrs	8	34.7
	4 -6 yrs	6	26.2
	6yrs+	3	13.0
No of years since using the internet	Less than 1yr	4	17.4
	1 - 4 yrs	8	34.8
	4 – 6yrs	2	8.7
	4yrs+	9	39.1
Expertise in internet surfing	Beginner	3	13.0
	Intermediate	10	43.5
	Expert	10	43.5
Hours spent on internet surfing per week	Less than 5 hrs	9	39.1
	5 – 10 hrs	6	26.2
	More than 10hrs	8	34.7
Place of using the internet	Home	7	30.4
	Work place	6	26.2
	Cyber/internet café	5	21.7
		3	13.0
	Computer labs	2	8.7
	On mobile phone		

Concerned about internet security	Not at all	2	8.7
	Less concerned	5	21.7
	Neutral	3	13.0
	Concerned	7	30.4
	Quite concerned	6	26.2

Source: Primary data

Table 1 indicates that a higher portion of the respondents had been computer users for over six years.

Buying Behavior of online shoppers:

The buying behavior of the online shoppers is shown in the following table.

Table 2: Buying Behavior of Online Shoppers

Statements	Category	Numbers	Percentage (%)
Online shopping frequency	Frequent	18	78.3
	Infrequent	5	21.7
Information seeking	10 -30 mins	20	87.0
	30 – 60 mins	3	13.0
Decision making	Within a week	2	9.0
	After one week	21	91.9
Online shopping experience	Recent shoppers	6	26
	Medium shoppers	17	74
Amount spent	Low	5	21.7
	high	18	78.3

Source: Primary data

From Table 2 it can be understood that majority of the respondents are information seekers for 10-30mis (87%), Under the decision-making stage, A majority (91.9%) seeking information after one week, and 78.3% of the respondents spend amount.

Problems faced by online shoppers:

The following table reveals the problems of online shoppers.

Table 3: Problems of online shoppers

Statements	Numbers	Percentage
Fake Messages about a product	10	43.5
Low trust level of online stores	5	21.7
VAT/customs duty	4	17.4
No refund policy	4	17.4

Source: Primary data

Table 3 indicates that majority of the respondents stated fake messages about a product as a major problem.

6 Suggestions:

- The marketers should completely avoid misleading advertisements.

- The Government should adopt the necessary steps to provide high-speed internet access to the general public.
- To facilitate an opportunity to examine the product before the purchase.
- It is suggested that online vendors and e-commerce providers should adopt advanced technologies to maintain security for visitors online.
- Innovative services should be given to purchasers to contrasting the different items effectively and with making purchasing decisions.
- Excellent after-sales service should be provided to the buyers to offer them a fine experience.
- Majority of the Indian shoppers are used to conventional shopping methods. A majority of purchasers are used to buying temporary or seasonal products fro the internet. It is therefore suggested that the online vendor can focus on offering a large amount or wide variety of assured solid items.
- It is assumed that comfort and trust are the most important factors for customer satisfaction as well as decision making when shopping online, followed by the cost and nature of the products. These are considered as the most basic factors for any buyer to make a decision when shopping online.
- Online shopping seeks global parameters to ignore adjacent market standards. Concerning this statement, online vendors are required to acquire items conforming to the neighboring advertisement standards and become more viable for the local potential buyers. This will create better behavior for the buyers and help sellers to offer better deals for them.

7 Conclusion

E-commerce or E-retailing is probably one of the significant innovations that have influenced modern business to a large extent. It is contributing to a new economy, which has tremendous potential and in general sense, it is changing the future of many organizations. It is speculated that E-commerce will become a massive industry in the oncoming years and shopping is becoming an important aspect to meet their daily requirements of everyday lives effectively. Online shopping is evolving into a pattern of shopping methods. A number of buyers are enjoying the advantages that they have through online shopping. They cannot ignore the perks of online shopping like discounts, deals, 24x7 shopping, door to door delivery, choosing from a wide collection of products, having several alternatives to choose from, etc.

The principal reason which allure customers to online shopping is obviously the comfort and experience offered by the e-commerce vendors. Today, users can purchase railroads and air tickets, books, home appliances, electronic gadgets, movie tickets and much more by visiting a website. This study proposes that there is a rapid expansion in online shopping, and thus access to high-speed internet is very much required for the general public. Numerous purchasers and dealers across different socioeconomics are engaging in online shopping, as a result, it has impacted the lives of many people and bought unbiased changes. It is observed in the study that disregarding the immense potential outcomes available on the world wide web, it is still being used by people for surfing emailing and spending time. It is highly suggested to get the attention of such users as well so that internet commerce can be a dominant business model in the future.

References

[1] Jayendra Sinha and Jiyeon Kim, “Factors affecting Indian consumers’ online buying behavior”, Innovative Marketing Review, Vol 8, Issue 2, 2012

[2] ChayapaKatawetawaraks and Cheng Lu Wang, “Online Shopper Behavior: Influences of Online Shopping Decision”, Asian Journal of Business Research, Vol 1, No 2, 2011

[3] Steven Bellman, Gerald L. Lohse, and Eric J. Johnson, “Predictors of Online Buying Behaviour”, Communications of ACM, Vol 42, No 12, Dec 1999.

[4] Philip Kotler, Gary Armstrong, Prafulla Y. Agnihotri and Ehsan ulHaque, “ Principles of Marketing”, Pearson Education, Inc, Fifth Edition, 2013, pp no: 426-437

[5] Donald R Cooper, Pamela S Schindler and J K Sharma, “Business Research Methods”, Tata McGraw Hill Education Private Limited, 11th Edition, 2012, , pp no: 528-536

[6] Saad Akbar and Paul T J James, “Consumer’s attitudes towards Online Shopping: Factors influencing employees of crazy domains to shop online”, Journal of Management and Marketing Research

[7] Rashed Al Karim, “Customer satisfaction in Online Shopping: a study into the reasons for motivations and inhibitions”, IOSR Journal of Business and Management, vol 11, Issue 6, Aug 2013, pp 13-20

[8] Rayed AlGhamdi, Jeremy Nguyen, “Factors Influencing E-commerce adoption by retailers in Saudi Arabia: A Quantitative Analysis”, International Journal of Electronic Commerce Studies, 2012, vol 3, No:1, pp no: 83-100.

[9] Dr.GagandeepNagra, Dr. R. Gopal, “A study on Factors affecting Online Shopping Behaviour of Consumers”, International Journal of Scientific and Research Publications, June 2013 ,vol 3, Issue 6.

A Renaissance in the Management of HRM in Higher Technical Institutions

G.Rathidevi[1], Dr. G. Brindha[2]
{rathiharini85@gmail.com[1], bkk28@yahoo.co.in[2]}

Research Scholar, Department of Management studies, Bharath Institute of Higher Education and Research, Chennai[1], Professor and Head, Department of Management studies, Dr. M.G.R. Educational and Research Institute, Chennai[2]

Abstract. Human useful resource management in schooling is very significant and toy with it'd result in difficulty. This is because teaching personnel's are the main tool for attaining academic dreams and national development, consequently. Human assets are the key to speedy socio-economic improvement and green service shipping. That's why this paper harassed that without an adequate, professional and nicely-encouraged group of workers running inside a valid human aid management programme, improvement isn't feasible. Every instructional gadget at each degree relies upon heavily on the human resources for execution of its programme. The function of human useful resource management in schooling consists of group of workers maintenance, group of workers relations,group of workers improvement, procurement of team of workers and process performance praise. The challenges of human resource management consist of poor running circumstance, incessant transfer of teacher among others,trouble of staffing, funding. To cope with the diagnosed trials, the following endorsements have been made. Education should be made appealing by way of growing a conducive atmosphere for teachers. More government consideration is needed for training zone via improved feature as training retains the basis for the progress of all different sectors of the society. A united profits structure need to be made for all classifications of educators within the schooling sectors.

Keywords: Education Institutions, Human resource management in education, Renaissance.

1 Introduction

Education is vital to all of us in a country. It plays a essential position to alternate the state of the nation. No country can carry a revolution in it until it's human beings are knowledgeable sufficient to fulfill the experiments. Education makes a person comprehend approximately himself and his goals and to how to reap them. Basically, schooling is separated into 3 agencies. The training which clarifies a society is referred to as 'social education'. The education which develops a character inside a man himself is known as 'religious training'. The academic difficulty with the professionalism is called 'vocational education'. No nation could make the progression unless it promotes all these kinds of education. Learners want to be guided by human and social values, to mix with intelligent people, to unravel the unknown, to be in touch with the fast paced developments and to

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understand the essence of life. They seek quality education and prestigious qualifications leading to a secure and a comfortable career.

Education all over the world is still looked upon as a harbinger of all other changes - social, cultural, economic, scientific and technical. One of the changes that are envisaged is that knowledge will not only be a source of authority, but also the capital for further development. Efforts must, therefore, be directed to develop human resources in a manner that they become sources of strength and wealth to the country. It would be a challenge to harness modern technologies for an all-round development and simultaneously retain the socio-cultural identity which has survived for centuries and which has influenced countries of both northern and southern hemispheres in their thoughts and actions. The socio-economic improvement of any society relies upon on the increase of better instructional establishments and their involvement in dissemination of two understanding, academic innovative and excellence research and improvement programmes leading to encouraging indigenous generation and developing new products, inculcating entrepreneurship, patents and offerings. Education in India is seen as one of the ways to speed up social mobility. It currently represents a paradox as Indian specialists are taken into consideration many of the first-class inside the international.

2 Scope of the Study

Information spread, imagination and development are the existence blood of humanity. Higher instructive establishments assume an essential part in the way of life of people and in the budget of the nation. It's expansive capacity covers the board of advanced education, re-direction of advanced quality and education confirmation in advanced education. They include issues of private/public organization, administration and value just as strategy arranging, wellbeing cognizance, physical wellness, proficient morals, esteem instruction and assessment/appraisal framework and the most significant issue of supporting excellence. In creating nations like India, higher instructive establishments assume a fundamental part in the public improvement measure. The higher instructive organizations are encountering mounting understudies' desires each day. Rivalry is blossoming and the progression strategy is quickening at a remarkable rate. The new serious climate squeezes higher instructive foundations to increase the nature of training.

To give quality training, the higher instructive organizations need to endeavor to alter the learning and educating position. In the learning circumstance, the establishments ought to make friendly air by giving best foundation offices, for example, library, lab and so forth. In showing circumstance, the organizations should participate in building up the abilities, skills and capacities of the educators.

To bestow quality instruction, the foundations ought to build up a positive and favorable authoritative atmosphere. The pre-imperative for improving the hierarchical atmosphere is, rehearsing the compelling human asset the executives in higher instructive foundations. It is normal that the results of this investigation will give adequate criticism to improve the human asset the executives rehearses in higher instructive establishments.

3 A Renaissance in the Management of HRM in Higher Technical Institutions

Training is one of the possible components in the mankind. It is likely the fourth need after three essential needs viz. food, dress and safe house. It is a basic human ethicalness. Through hundreds of years, training has been an exceptionally powerful apparatus for mankind in confronting difficulties and encouraging advancement. Training is revamped as one of the basic modules of the public improvement endeavors and advanced education, exactly, is of crucial significant for the country, as it is an incredible asset to assemble information based society of the 21st century. In the public advancement measure, instruction framework has a significant task to carry out, uniquely the advanced education. After Independence, individuals needed to fabricate a cutting edge, solid, dynamic and independent India which could stand side by side with the created countries.

The Information Technology Revolution is the reformist withdrawal of state Governments from subsidizing advanced education. The private segment was permitted out of a major method to set up Deemed Universities, Professional and Quasi-proficient schools on self-financing premise. Favorable climate is additionally made for unfamiliar colleges to build up fixates on self-financing. Indeed, even presentation of new courses or projects in State Funded Universities and associated schools which are supported, is permitted distinctly on 'independent' premise, since the year 2000. The charges will be controlled by the 'market powers' and will be high far from the metropolitan and rustic poor. The monetarily and socially helpless youth will be denied of aptitude arranged self-financing courses. Individuals talk about 'consideration' boisterously, yet work on something very surprising. Banks are discovering it monetarily weak as majority of the instructive credits is turning out to be 'Non Performing Assets', making it eventually a backhanded weight on the citizens.

Coming up next are the significant pushes of advanced education in India:

a) To advance discussion and conversation on issues of worry in advanced education at different levels and effectively partake in their consultative systems as a support gathering.

b) To make groundbreaking musings and standards in zones identifying with advanced education including strategy, guideline, vital and operational and along these lines help in building up a fitting advanced education structure.

c) To encourage creation, advancement and development of higher instructive organizations of worldwide greatness by giving a wide range of help including staff improvement, encouraging other formative activities, making of collaboration among foundations and different partners, tending to quality and accreditation issues, among others.

d) To help build up a higher instructive framework that explicitly lines up with employability needs of corporate and different areas.

e) To advance exploration and distribution on contemporary and significant issues of advanced education.

f) To explicitly investigate, evaluate and assess World Trade Organization (WTO) and General Agreement on Trade and administration (GATS) arrangements and their suggestions on advancement of advanced education administrations in India and to make the Indian establishments arranged for the equivalent.

g) To be an autonomous voice of the advanced education network in India; be educated about the worldwide endeavors across countries for advanced education; be a piece of change

discoursed and contribute as a major aspect of World Trade Organization adjusts identifying with Indian advanced education issues in discussion with individuals from common society.

h) To participate in synergistic concurrences with comparable discussions/foundations/associations in different pieces of the world and advance "greatness in worldwide advanced education".

I) To attempt and do some other action auxiliary and legitimately or by implication identified with the abovementioned, which the gathering may jump at the chance to participate in every now and then in arrangement with its wide vision.

Conclusion

The socio-economic development of a country largely depends upon the effective organization and implementation of education. In India, education is seen as one of the ways to speed up social mobility and equality. The National Policy on Education visualizes that higher education should become dynamic in terms of consolidation and expansion of institutions, creation of more autonomous colleges and departments, redesigning the existing courses to cater to the needs of the learners, continuous training of teachers in the light of globalization of education, strengthening research and improvement in efficiency. The globalization of schooling at country wide and international tiers permits operative working of organizations giving room to quality development. The best development is the crux of the trouble in Indian higher education. To preserve nice bench mark, there may be a need for effective management between the working essentials in the learning device. The human assets within the company play a tremendous function in conducting the goals and goals of higher training. Possibly, dealing with the human assets is the high goal of an institution inside the context of globalization. The gift examine attempts to discover to what quantity the human resource sports are finished in higher schooling to satisfy the stated objectives and goals. The effects of the observe will be beneficial to the coverage planners to express suitable techniques in strengthening powerful management of manpower properties in better academic organizations.

References

[1] Dulebohn, J. H.. Ferris G. R &Stodd J. T. (2015). The history and evolution of human resource management. In Handbook of Human Management, Ferris, G. R. Rosen, S. D. and Barnum, D. T. Eds. Blackwell Publishers

[2] Ehrlich, C.J. (2017). Human resource management: A changing script for a changing world. Human Resource Management, 36 (1), 85-89.

[3] Green, K., Wu, C., Dwayne, W. &Medin, B. (2016). The impact of strategic human resource on firm performance and HR professional work attitudes and work performance. International Journal of Human Resource Management, 17(4), 559-579.

[4] Jamrog, J.J. &Overholt, M. H. (2014). Building a strategic HR function continuing the evolution. Human Resource Planning.27, (1), 51-62.

[5] Lee, D. (2005). Hiring the best teachers: Gaining a competitive edge in the teacher recruitment process.Public Personnel Management, 34(3), 263- 269.

[6] Noe, R., Hollenbeck, J., Gerhart, B. & Wright, P. (2014). Human resource management: Gaining a competitive advantage. Boston: Irwin McGraw Hill.

[7] Patrick, M. & Hartmann, L. (2019).Human resource management in Australia: Prospects for the twenty-first century," International Journal of Manpower, 22, (3), 198-206.

A Review on advancements in Nano memory devices

[1] V G Hamsaveni, [2] Kiran Agarwal
{[1]vghamsaveni@gmail.com, [2]drkirangupta15@gmail.com}

[1] Ph.D. Scholar, Department of Electronics and Communication DSCE, Visvesvaraya Technological University, Bangalore, MIEEE Professor Department of Electronics and Communication DSCE, Visvesvaraya Technological University, Bangalore[2]

Abstract. The In this era computing is one of the most prominent field and in the past 20 years the growth in the computers has improved with the combined growth in the field of electronics. Memory devices plays a major role in the most of the devices such as memory storage device and memory processing device which enables the fast computing and vast storage capacity. This paper reviews the history of the storage systems. Beginning with the mechanical calculators, magnetic tapes, magnetic disks, floppy disk, optical devices, Hard disk drive, solid state drive, SRAM, DRAM, graphene based memory with emerging technologies like Artificial intelligence, Bigdata, cloud computing, IoT, and blockchain, to the increasing demand in the in the computing high performing devices are a must and this includes and brief approach of the concept oriented research which involves with the Nano dot based memory devices which can enhance the future scope in memory devices, networking and cloud storage. This literature survey is an review for our work which we would like to present in our future projects and it gives a brief outcome of the research based on the synthesis of gold (Au) Nanodots α-Fe2O3.

Keywords: Nanomemory, Nanodots, Storage Device Evolution.

1 Introduction

In Today's world data is the most important thing and we are using lot of storage devices to store our day to day memory. The memory storage devices have improved when compared to the last decade it has shown a drastic improvement corresponding with Moore's law. The rapid development in the memory has shown an impact in the storage media and the large disk drives are turned into Nano devices that has enabled and shown new possibilities in the field of research which has an active possibility in the field of Nano memory.

In main goal in this article is we are discussing about the brief literature of existing technologies like the storage devices, 2d materials, rram, stt-mram, hdd, ssd and our contribution in making of the device which can improve the efficiency in terms of size and compatibility. It is observed that the research in the Nano materials field is restricted to the industry. Here we are using an process to improve data storage density, better performance and decreasing the size of the device. we use the synthesis of gold (Au) with Nanodots α-Fe2O3 using sol-gel method.

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2 Existing Technologies

1. STORAGE MEDIA (INCEPTION – PRESENT): Earliest computers used papers for the memory storage, after the pulp making process. In 1825 Paper was an primary material in the storage device. Later in 1880s it was replaced by the punch cards in the mechanical calculators that was invented to be used as a statistical tabulation. It was used to tabulate the census at that time based on the tabulations IBM was formed. Punching cards played a major role in mid 1980s. The usage of the materials has gradually increased year by year with opening a billion-dollar market. Introducing the magnetic tape which was manufactured using the ferric oxide powder coated this was used for sound and media. It was later used in manufacturing the phonograph records. Magnetic disks started revolutionizing it begun with IBM disk file developed which was controlled using servo motors it was built using the metal platters coated with magnetic materials and it stored around 3.75 MB of information and transfer rate of 8800 characters per second. It was reduced to smaller sized disks according to the market necessity. It has transformed from 14, 8, 5 inch platters. This has opened an wide market opportunity for the compact disks (CDs) and Digital versatile disc (DVDs). It had an option such as write once and read many (WORM) that had no option but to buy and store many disks. And the rewritable disks were found as an alternate to this model which disrupted the market with the 4.7GB, 8.5GB, 9.4GB, 17.8GB which is till date an alternate to the cost efficiency mode of memory transfer.
SCM – Storage Class Memory is the present and most efficient way of transferring the data from one system to other systems. Flash memory is the present and ongoing which is a sort of EEPROM electrically erasable programmable read only memory. Here the memory of the controller is capable of program or erase the information by putting or removing an electron to or from solid state cell made of a floating gate and read information by measuring voltage of the floating gate. This design particularly improvised the quality of the storage devices in the field of computers. Till date it is the dominant technology for the memory devices. Active research is being conducted in order to improvise the performance, reliability, and recording speed. Storage Networking is the latest and it is facing the new heights in terms performance, speed and reliability through the cloud computing storage technologies in the IT industry. Storage Area Network (SAN) and Network Attached Storage (NAS) are making an great access in the private networks where the data can be stored at home and accessed anywhere across the globe.

2. 2D MATERIALS CHARGE TRANSFER: 2D Materials has been a hot research topic from 2004. It is said that 2D materials has great diversity in bandgap, properties and this provided the platform for the electronic devices with high mechanical strength and allows materials without dangling bonds and it guarantees excellent electronic characteristics. Based on the Van der Walls forces it has a novel opportunity in the 2D materials and in the nanoscale devices. It has an potential solution to improve the memory performance and memory units. The fabrication done using carbon allotropes with a honey comb structure is used here in order to provide mechanical strength and high mobility. Carbon exhibits semi- metal behavior and now is a common parts of memory cells like electrodes or floating cells. Hexagonal boron nitride has a large bandgap and it performs as a insulator with ultra flat and zero defect interface. These honey comb structures can be manufactured in two ways dry transfer and wet transfer. In the first case the material is placed on the target substrate by the mechanical or Chemical Vapor Deposition (CVD) Technique. Then the bottom material is fixed by using the

specific polymer. The deionized water is used in the polymer dissolution by this method the transfer is achieved.

3. RRAM – CELLS & SYSTEM: In accordance with the fast program read speed and low power consumption and larger scalability the Resistive Random Access Memory is said to be an efficient option in the performance of the storage systems. It has attractive advantages to make a system faster in boosting the performance of the system which gives user rapid speed, performance and it is used for the high-density storage and accessible application in the modern computers. It is very complicated when compared with the previous generation memory it involves in accordance with electrode materials, switching materials, operation mode and temperature. It operates in the high resistance state to low resisting state determined by the SET status. It has two states unipolar and bipolar state when the SET and RESET are in same voltage this is said to be unipolar if they are in different voltage it is bipolar. If both are not applicable and if it is in the unipolar stage it is known as non-polar state. The Ag, Cu, Ni, Pt, Pd, Au following electrodes can be used for the performance in the electrochemical layer. The switching layer is of the ionic conductor is of oxidized metal ions. Under the electric field it transfers from active electrode to inert electrode with the influence of the chemical and electric potential field. Primary active electrodes or nano particles in the switching layer and the oxygen ions in the cells are composed of oxygen vacant which can extend from bottom to top electrode or top to bottom electrode based on and the migration towards bottom electode depending on the electrochemical oxidation of oxygen. These thermal effects are unavoidable because of the high electric field in the device operation. Phase-change memory (PRAM) is widely considered memory in the various devices which has high performance. These are used for the high density storage materials used in here CMOS compatibility is the main criteria which refers with the cost- effective and high storage and the device lifespan with performance. In the manufacturing Tantalum oxide (TaOx) and Hafnium oxide (HFOx) are most commonly used in materials. These have a potential to form a multi dimensional memory cell structure. Both the materials has given an positive outcome in the research conducted which could be manufactured within 40nm technology and this has shown positive performance including the operational characteristic outcome. In this paper we would like propose 9nm technology oriented with the fundamental mechanism which can be a result oriented outcome.

4. STT-MRAM - CELLS & SYSTEM: Spin transfer torque magneto-resistive random-access memory (STT-MRAM) has been developed 10 years ago which is based on the electrical approach through the magnetization which enables the MRAM with high density storage capability this opened the new opportunities in the very-large scale integrated circuits (VLSI). In the past few years this technology has been developed rapidly with improvements in the increasing storage and performance characteristics. It consists of magnetic tunnel junction diode and a select transistor. the tunnel diode is used to store the information when it is in parallel configuration between two ferromagnetic layers which responds to a low resistance and the series configuration refers to the high resistance state which is controlled selecting the transistor. the magnetization here is obtained by switching the ferromagnetic layer by a write current that is controlled by the select transistor. With the incubation time delay of 1 to 9 ns it always exists with the spin transfer torque by considering with the thermal effects the incubation time is proportional and inversely proportional to the damping cost of the layer the switching time must be lesser than the switching current. The magneto tunnel junction has a magnet tunnel resistance of 200% in

2005 with usage of tunnel resistance and then it has increased over 600% with usage of MgO in 2010. The MRAM has a wide range of practical applications which has performance characteristics which includes thermal stability, critical switching , switching speed and transmission which has been observed in the Figure 1 Transmission Electron Spectroscopy (TEM) image of MgO with STT-MRAM. This process has been widely used in the intel memory applications and the process has a good retention rate. The performance characteristics are shown in the Figure 2, The schematic sketch of single memory cell of STT-MRAM is in Figure 3. Usually STT-MRAM is known for its high performance characteristics and its volatile memory. The size and power required is simpler when compared with other technologies.

5. HARD DISK DRIVE (HDD) : This invention has given an tremendous changes in the storage devices where the storage space and it shown a real density in the performance and higher yield capacity in the devices which increased the storage space and it enabled desktop and laptop storage. It has unique storage capability which the previous generations lacked. It has given a tremendous changes in the storage system revolution. It usually consists of platter, spindle, actuator arm, axis and head, ide connector, jumper block and power connector. It usually starts with the platter a circular metallic disc which consists of one or more the platter is made of aluminum and coated with a magnetic later which allows the drive to store bits of memory consistently. The speed is around 200rpm that can go up to 15500 revolutions varying with the size and capacity of the device. The disk is then connected to the disk head with the actuator arm and axis. Magnetic disk drives has undergone changes which impacts in the todays size and capacity of the device. The invention of the higher storage has made the memory prices down with time it has drastically fallen and the performance has increased which todays servers use to store, write, and retrieve data. The HDDs has undergone vast changes with the significant capacity and it has become inexpensive the architecture has changed widely with the time. It is parallely used with the DRAM. To store the data in the system whereas the DRAM acts as a cache memory. These devices can be used to increase the performance and alternate in the portable drives, secondary memory device using caddy.etc..

6. SOLID STATE DEVICE (SSD): It operates on the NAND flash memory technique. The present generation the HDDs are being replaced by the SSDs as their speed is high. It uses IC assemblies to store the data there are few protocols such as Serial Advanced Technology Attachment (SATA) and Serial Attached Small Computer System Interface (SAS) which is comparatively costlier then the HDDs. These are used as a memory in the much smaller laptop computers where it can speedup the computers performance by 95%. It offers less storage and the secondary drive which can be used for the storing data. The SSDs are not cheap they are 2x more expensive than the HDDs. Its architecture is based on DRAM volatile memory which is based on NAND flash. The controller which is based on the embedded processor which controls flash chip it has higher latency and the cache acts as the memory of the previous user data and when powered off it shows exactly where we have stopped the work on restart. Internal RAM in the SSD is operated at high capacity and performance characteristics.

7. CLOUD STORAGE: The cloud industry is emerging with the several vendors with the storage service providers and they have owned data centers with the increasing network technologies from the customer point of view by a web application whole data can be uploaded or downloaded from the assigned data server with end to end encryption from the vendor. Where the storage management is often served as free initially and after certain limit

the subscription-based payments usually happen in this space. The top speed data with a huge bandwidth is provided with business overview.

3 Exisiting Methodologies

1. 3D STORAGE CLASS MEMORY: In this process Al2O3/TiO2 a hybrid device with memory which is low off current <1nA, low reset current <1nA, & high on/off ratio >104 with the outstanding observations in the read/write margins and ultra-low consumption are confirmed through array simulations.
Fabrication: A Mixture of Tio2 and Al203 of (2-6 nm) is taken and are sequentially deposited in the atomic layer deposition system and the Pt electrode which acts as a buffer layer by using sputtering technique from the Ag target and Te target.
Working: The operation principle of the hybrid memory device which initially exhibits a high threshold voltage because of the CF which is not formed in the memory layer. When
+Ve bias is applied it shows low threshold voltage is observed. The memory is obtained by read operation in low and high state. Ti buffer is introduced in order to improve the switching variability and Al2O3 layer with a higher operating voltage than the selector device is expected to obtain stable outcome.
Outcome: ultra thin dual oxide memory device using atomic layer deposition is done and optimized with low off current and high on/off ratio and it has a possibility in manufacture of 3D memory applications.
2. SIMULATION OF RRAM CIRCUITS: Two memory designs of RRAMs with conductive filaments are considered and the ohmic resistance, temperature, signals, voltage ramps & evolution are studied.
Observation: It has fast write and low voltage non volatile memories are main players in the semiconductors which are alternatives to flash cells. It has a scaling potential (<10nm) with low program, fast switching (<10ns), fast retention (>10 years), it supports CMOS processes. In this simulation of RRAM circuit it is reported that the device temperature, simulation time, shape and tunneling currents are efficient. It consists of a following options which includes SET and RESET which acts as bridge. The simulation results for I-V characteristics & signals are performed.
Simulation: The device and the conductive filament where the top and bottom electrodes which is linked with the electrochemical metallization cells. Each parameter from the I-V curves for the oxide and the thermal conductivity and heat are observed. The step response
in this model is responsive that it is exponential and considered to tunneling current model with max resistance of (~250 pΩ)
Outcome: Two models of RRAMs are analyzed in the simulation with the LT Spice Tool and it is observed ohmic resistance is linked to the conductive filament which gives an efficient outcome with the cylindrical filaments.
3. NANO FLOATING GATE MEMORY DEVICES: It is a kind of flash memory devices that uses Nano crystals as charge blocking element. That uses areas which are not extensively explored. This has a capability and application that can be organic, printed and flexible with advantages over other memory devices.
Operation: it is based upon the Metal oxide semiconductor transistor devices. In which the contrast, volatility, which have a constant charge it has a floating gate where the electrons can be stored. Electrons are deposited on tunneling oxide and the trap levels, trap sites can be

controlled by the Vth where it can be used for the erasing operations. Programmed state “0” and erased state “1”. In advanced flash memory technology it is capable of storing more than 1 bit in a memory cell so the memory stored can be doubled.
Outcome: In Nano floating gate memory it is observed that it has good properties such as particle size, density and distribution. It can be used in high density memory applications. They can also be used in the organic, printed and transparent materials. The programmable memory performance is excellent so it has a future scope in the manufacturing of the memory devices.

4. COAL BASED GRAPHENE STORAGE: Nano particles on a nickel substrate us used using electro deposition technique where the lithium performance of the composites using lithium ion battery is studied.
Synthesis: Graphene is extracted from the coal dust is pulverized and with nitric acid it is undergone a treatment process. Further oil bath is done at 140 °C for 24H. it is cooled and the nitrate is removed then the graphene structure is obtained.
Outcome: Graphene memory-based synthesis is performed using the vapor deposition and the acid oxidation using the anthracite powder. the electrodeposition method by adjusting the electrolyte solvent ratio it is prepared by two-step electrodeposition with the electrochemical test. It has shown an ideal rate performance. lithium storage performance and it exhibits the bridge effect that improves the porous spaces and efficiency.

5. HIGHLY REPEATABLE SWITCHING CHARECTERISTICS OF MEMORY DEVICE: In this paper Au/TiO2/Ti memory device is discussed. Comparing with the switching charecteristics and the thickness of the material. The application of device is usually used for RAM which has an extremely repeatable SET and RESET the multilevel switching is explained in different models.
Observation: high purity titanium is ultrasonically cleaned for 15 mins using de-ionized water. it is oxidized using Ti using a precisely temperature-controlled furnace. Ti foil is glued to a glass platform and it is formed into a structure with electrical characterization process. In high temperature it is thermally oxidized. The dispersion is observed using XRD and the TiO2 is found to be ~450nm which is carried out using a morphology instrument. The I-V charecteristics are measured using the semiconductor characteristic device which is used in the system sweeping.
Outcome: The characteristics are highly repeatable, multilevel of an Au/TiO2/Ti are thermally timed and used in the device which the study is of SET “1 or 2” and RESET “0”. The fabrication possibilities in RRAM with dimensions of 2*2 mm is possible. With the higher operating temperature upto 80 °C the temperature flow can be stabilized.

6. LOW TEMPERATURE FLASH MEMORY APPLICATION: This research discusses about the voltage to capacitance where the storage capacity is significantly increased with the hysteresis curves and capacitance-voltage (C-V). this relates to HfO2 based charge trap flash memory.
Observation: The samples are studied and the SiO2 film is thermally grown at 900 °C and with the atomic layer deposition process and the substrate is varied at different temperatures randomly with the 700 °C the structure is then annealed. With the Al gate the electrode is patterned with the spectroscope and it is measured at 100k Hz to extract the flat band voltage. The TEM images varies between 150 °C and 350 °C where the MHOS devices a distinct interface which can be observed between the SiO2 and HfO2. The device is fabricated using the specifications.
Outcome: This work relates to the thin film memory device which is manufactured through the Atomic Layer Deposition the capacitance-voltage, substrate temperature and the

parameters are observed. It is a significant that the storage capacity can be improvised by using this technique.

7. GRAPHENE QUANTUM DOTS: This study relates with the properties of the graphene in memory applications. this advancement has increased the biologically inert properties which is attracted by the academic and industry. This is a hydrothermal method is summarized. As the summary represents the doping of the energy in the Graphene is highly useful in biological imaging, batteries, memory devices, solar cells .etc.,

Method: The graphene can be manufactured using two methods namely top down and bottom up approach. Which is directing the bulk carbon materials into the nano sale with the lithography technique. It uses the poly cyclic hydrocarbons which are molecule in the graphene dots and external energy is provided for fabrication.

Synthesis: using liquid exfoliation method the preparation of graphene is from the graphite powder where it is performed using strong oxidizing agents. The synthesis of graphene quantum dots usually requires the acid which cuts the graphene. Bulk carbon materials will be obtained that has to be filtered in layers and graphene is formed. Usually coal or graphite is used to obtain the graphene.

Outcome: This review results with manufacturing of graphene with various materials fabrication of the graphene with memory devices has unique properties and the it is achieved that the layered graphene has an higher potential when compared with other materials such as lithium ion which is mostly used in day to day applications. this review discusses about the possibilities, developments and fabrication methods of the graphene.

8. NANO DOTS ON REDUCED GRAPHENE: This study relates to the Au nano dots on graphene oxide in this process the rapid reduction in the metallic nanodots on the surface is done. This has broader visible light absorption, lower generation in electrons, fast electron transfer. It has an potential application in the memory and storage applications.

Observation: Nanodot heterostructures are 2D graphene with metal oxides and it has an potential application in the memory and energy consumption. The nanostructures which is used are MoS_2, TiO_2, CdS, Mn doped α-Fe_2O_3, α-Fe_2O_3/3D graphene, α-Fe_2O_3/reduced graphene oxide and Au-supported with a low bandgap to absorb the photons. α-Fe_2O_3 is used with the carbon nanotubes and reduced graphene with the nanosheets.

Outcome: this review results with a green synthesis method of α-Fe_2O_3 under sunlight this generates the Au 3+ ions. it has large specific surface area, thermal conductivity, light transmission and good mechanical strength. This can be an active material in production of the memory devices, energy storage and conductors

9. NANO STRUCTURED HYDRODIXE SYNTHESIS: This work relates to the synthesis of iron oxides with various methods such as top-bottom method, chemical method, precipitation. iron oxides in the nanoscale has an great potential in various industry related applications one among is memory device manufacturing.

Synthesis: This iron oxides is an active research topic it has an unique features like concentration, temperature, mixing and oxidation. This depends on the desired shape and size. the synthesis follows slow, continuous and surface growth. The electrochemical synthesis of nano sized particles is non-aqueous medium in which 20 nm in the aqueous medium is taken and the stainless steel is used as a cathode and anode. 3-8 nm of maghemite

particles can be re-used in an aqueous solution in the cationic surface. This can be used in manufacturing of nano dots, nano wires.

Outcome: the iron oxide nano particles can be used in various industries such as memory devices, charge storage, medical applications, chemical industries and water purification. The size has been reduced when compared to other materials.

4 Conclusion

1. When compared to the above materials and processes the production using α-Fe2O3 and Au nanodots can improve the performance, speed, and size can be reduced.
2. The Nano particles can be synthesized by using precipitation, sol-gel, hydrothermal, dry vapor deposition, microemulsion, electro deposition.
3. The above mentioned comparisons are reviewed with the α-Fe2O3 green synthesis which can be environment friendly and which is bio degradable and can be used in various medical applications.
4. Green synthesis of α-Fe2O3 with Au can be most efficient when compared to other materials which are available today.
5. When compared to graphene the green synthesis is more viable as the cost of extraction of graphene is higher and difficult.

In conclusion this review has provided the developments, fabrication methods, it can be helpful in the green synthesis and it can be 30% more efficient when compared to the present methodologies as the process used in manufacturing of the α-Fe2O3 with Au nano dots can be a viable method.

References

[1] S.Y. Lim, W. Shen, Z. Gao, Carbon quantum dots and their applications. Chem. Soc. Rev. 44, 362–381 (2015).

[2] D. K. Bora, A. Braun, and E. C. Constable,Energy Environ. Sci.6, 407(2013).

[3] G. Bharath, et al, Sunlight-Induced photochemical synthesis of Au nanodots on α-Fe2O3@Reduced graphene oxide nanocomposite and their enhanced heterogeneous catalytic properties

[4] P. Tian et al, Graphene Quantum dots from chemistry to applications. Revise 221-258 (2018).

[5] G. Haider, et al, Electrical-polarization-induced ultrahigh responsivity of photo- detectors based on graphene alloys and graphene quantum dots, Advanced. Functional Mater. 4 (2016).

[6] P.C.Wu, et al. Efficient two photon luminescence for cellular imaging using biocompatible nitrogen doped graphene quantum dots conjugated with polymers, Nanoscale 1 (2018)

[7] H. Chen, Z. Wang, S. Zong, P. Chen, D. Zhu, L. Wu, Y. Cui, A graphene quantum dot- based FRET system for nuclear-targeted and real-time monitoring of drug delivery, Nanoscale 7 (2015)

[8] A. Dhand, S. Suresh, A. Jain, O.N. Varadan, M.A.K. Kerawalla, P. Goswami,Advances in materials for fuel cell technologies-a review, Int. J. Res. Appl. Sci.Eng. Technol. 5 (2017) 1672e1682.

[9] Q. Liu, Y. Yin, N. Hao, J. Qian, H. Mao, K. Wang, Self-templating synthesis ofnitrogen doped graphene quantum dots/3D bismuth oxyiodine hybrid hol-low microspheres with improved visible-light excited photocurrent gener-ation: simultaneous electron transfer acceleration and bandgap narrowing,J. Alloy. Comp. 729 (2017) 27e37

[10] Yating Zhang, et al. Preparation of coal based graphene quantum dots/α-Fe2O3 nano alloy composites and their li-ion storage prop. Rev 646-652 (2019)

[11] Wang Y, Roller J, Maric R. Novelflame synthesis of nanostructuredα-Fe2O3elec-trode as high-performance anode for lithium ion batteries. J Power Sources2018;378:511–5.

[12] Zenhan zhang, et al. Memory materials and devices: From concept to application. SEP 2019

[13] Chand U, Huang K-C, Huang C-Y, Tseng T-Y. Mechanism ofnonlinear switching in HfO2-based crossbar RRAM withinserting large bandgap tunneling barrier layer.IEEE TransElectron Devices.2015;62:3665-3670

[14] Woo J, Lee W, Park S, et al. Multi-layer tunnel barrier(Ta2O5/TaOx/TiO2) engineering for bipolar RRAM selectorapplications. Paper presented at: IEEE Symposium on VLSIT,2013:T168-T169

[15] Yu S, Wu Y, Jeyasingh R, Kuzum D, H-SP W. An electronicsynapse device based on metal oxide resistive switching mem-ory for neuromorphic computation.IEEE Trans ElectronDevices.2011;58:2729-2737
[16] Waser R, Dittmann R, Staikov G, Szot K. Redox-based resistive switching memories– nano ionic mechanism, prospect and challenges.Advanced Mater. 2010;21:2632-2663
[17] Yu S, Chen H-Y, Gao B, Kang J, H-SP W. HfOx-based verticalresistive switching random access memory suitable for bit-cost-effective three-dimensional cross-point architecture.ACSNano. 2013;7:2320-2325
[18] Tappertzhofen S, Waser R, Valov I. Impact of the counter-electrode material on redox processes in resistive switchingmemories.ChemElectroChem. 2014;1:1287-1292.
[19] Splendiani A, Sun L, Zhang Y, et al. Emerging photo-luminescence in monolayer MoS2.Nano Lett. 2010;10:1271-1275
[20] Liu C, Yan X, Song X, Ding S, Zhang DW, Zhou P. A semi-floating gate memory based on van der Waals hetero-structures for quasi-non-volatile applications.NatNanotechnol. 2018;13:404-410
[21] Fossum ER. CMOS image sensor aloy: electronic camera on a chip with memory dopant. Trans Electron Devices. 1997;44:1689-1698.
[22] Wu F, Si S, Cao P, et al. Interface engineering via MoS2inser-tion layer for improving resistive switching of conductive-bridging random access memory.Adv Electron Mater.2019;5:1800747.
[23] Park, S.G.; Köpe, B.M.; Nishi, Y. Theoretical study of the resistance switching mechanism in rutile TiO2−xforReRAM: The role of oxygen vacancies and hydrogen impurities. In Proceedings of the 2011 Symposium onVLSI Technology - Digest of Technical Papers, Honolulu, HI, USA, 14–16 June 2011.
[24] Ho, C.H.; Hsu, C.-L.; Chen, C.-C.; Liu, J.-T.; Wu, C.-S.; Huang, C.-C.; Hu, C.; Yang, F.-L. 9nm half-pitchfunctional resistive memory cell with<1μA programming current using thermally oxidized sub-stoichiometricWOx film. In Proceedings of the 2010 International Electron Devices Meeting, San Francisco, CA, USA, 6–8December 2010; pp. 436–439
[25] Kozicki, M.N.; West, W.C. “Programmable Metallization Cell Structure and Method of Making”. US PatentUS5761115A, 2 June 1998.
[26] G. González-Cordero, J.B. Roldán, F. Jiménez-Molinos, SPICE simulation of RRAMcircuits. Acompact modeling perspective. 2017
[27] X. Guan, S. Yu, and H.S.P.Wong, “A SPICE Compact Model of Metal Oxide Resistive Switching Memory with Variations”, IEEE Elec. Dev. Lett., vol. 33, pp. 1405-1407, 2012.
[28] P. Y. Chen and S. Yu, "Compact Modeling of RRAM Devices and Its Applications in 1T1R and 1S1R Array Design",in IEEE Transactions on Electron Devices, vol. 62, no. 12, pp. 4022-4028, Dec. 2015.
[29] S. Long, L. Perniola, C. Cagli, J. Buckley, X. Lian, E. Miranda, F. Pan, M. Liu and J. Suñé. “Voltage and power-controlled regimes in the progressive unipolar RESET transition of HfO2-based RRAM”,Scientific reports, 3, 2013.
[30] International Roadmap for Devices and Systems. “BeyondCMOS,”2017.
[31] N. Raghavan, R. Degraeve, A. Fantini, L. Goux, D. J.Wouters, G. Groeseneken, and M. Jurczak, “Stochasticvariability of vacancy filament configuration in ultra-thindielectric RRAM and its impact on OFF-state reliability,”in2013 IEEE International Electron Devices Meeting,Wash-ington, DC, Dec.2013, pp. 21.1.1–4.
[32] Victor Koledov, et al. 3D Nano-Manipulation and Nano-assembling by the smallest and the fastest shape memory alloy nano-tools. 2019
[33] V.S.Afonina, D.I. Zakharov, A.V.Irzhak, V.V.Koledov, P.V.Lega, A.V.Mashirov, et al. "Micromechanical device, the manufacturing method and system of manipulation of micro- and nanoobjects." Russian Patent No 2458002, 15.08.2010.
[34] Stefan Slesazeck, Nanoscale resistive switching memorydevices: a review. 2019.
[35] Changhyuck Sung, Jeonghwan Song, Donguk Lee, Seokjae Lim, Myounghun Kwakand Hyunsang Hwang, Ultra-thin (<10nm) Dual-oxide (Al2O3/TiO2) Hybrid Device (Memory/Selector) with Extremely Low Ioff (<1nA) and Ireset (<1nA) for 3D Storage Class Memory. 2019.

Pythagorean Fuzzy Cognitive Maps in Making Optimal Decisions on Feasible Strategies for Inhibiting Electronic Waste

F X Edwin Deepak[1], R Priya[2], W Lilly Merline[3], G Ramkumar[4], Nivetha Martin[5]*

{edwindeepak85@gmail.com[1], iampriyaravi@gmail.com[2], lilymerlinew@gmail.com[3], ramg.phd@gmail.com[4], nivetha.martin710@gmail.com[5]*}

[1]Department of Electrical and Electronics Engineering, PSNA College of Engineering and Technology, Dindigul, India
[2]Department of Mathematics, PKN Arts and Science College, Thirumangalam, India
[3]PG & Research Department of Mathematics, Periyar EVR College, Trichy, India
[4,5]Department of Mathematics, Arul Anandar College (Autonomous), Karumathur, India

Abstract. Electronic waste is an emerging cataclysm to the environment in recent times and the mounting industrial sectors are the constant contributors to it. Escalation of technology is being hailed but the environment impacts highly intrudes the resilience of the ecosystem. Refraining from technology is quite not possible in this digital epoch but reclamation of the milieu has high probability. Decision making on inhibiting electronic waste demands feasible strategies and it is the most challenging task for the industrial administrators. This paper proposes the new approach of Pythagorean fuzzy cognitive maps to find the viable strategies of electronic waste inhibition. The representation of the elements of the connection matrix as Pythagorean fuzzy sets is a distinctive feature of the research work. The strategies are subjected to the analysis of the experts to investigate their interrelational impacts. The resultant of the decision making model based on Pythagorean fuzzy cognitive maps is the score value of the strategies based on which they are ranked. This paper also presents the comparative analysis of Pythagorean fuzzy cognitive maps over fuzzy cognitive maps.

Keywords: Pythagorean Sets, Fuzzy Cognitive Maps, Decision Making, Electronic Waste.

1 Introduction

In this world of technology, the Electrical and Electronics Engineering industries are advancing by launching their new and innovative products. Manifold products are designed with the features of enhanced technology that makes the existing products turn obsolete. New product promotion is one of the default annual business targets of such kinds of industries and it is their nature to treat themselves as self-competitors and compete with themselves in terms of profit maximization. The ameliorating tendency of these industries has resulted in the generation of electronic waste and now it has become a great menace to environment sustainability of the nations worldwide. The disposal of electronic waste is nearly around 20 to 30 million tonnes every year universally and in India nearly 5.2 million tonnes is being

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generated annually. Industrial sectors, individual house hold and manufactures are the prime contributors to electronic waste. Nearly 10 states contribute to 70% and 65 cities contribute to 60% of total waste generated in our country [10]. In addition to it, the import of E waste by some companies are also propelling environmental catastrophe. If the electronic waste generation is not monitored and controlled, then India will emerge as one of the leading nation contributing to the electronic waste generation at global level.

Legislative measures are exclusively put forwarded to regulate and minimize the generation of electronic waste, but lack of strict enforcement of these laws is a setback [3]. Researchers are investigating on the optimal methods of mitigating waste generation and treating the waste generated. The electrical components are composed of toxic constituents such as lead, cadmium, mercury and other substances causing adversity to the mankind and environment. The electrical and electronic industrial sectors must devise feasible strategies to decrease waste generation and choose optimal methods of waste treatment. Special focus shall also be laid on product design, product production. If formulating strategies is a challenging task for these industries then selection of optimal strategy is yet another perplexing mission. The industrial sectors shall seek expert's opinion in framing and customizing the strategies that could meet the objectives of inhibiting waste generation. Scientific methods shall be used to make optimal decisions on feasible strategies as it is not possible to evaluate the effectiveness of all the strategies by implementing but rather it shall be stimulated to find the effectiveness of these strategies and their inter impacts. Fuzzy Cognitive Maps (FCM) [6] is a kind of scientific decision making model typically used in optimum decision making. FCM is a directed graph comprising of vertices and edges that represent the factors which are the elements of decision making. The strength of the relationship between the edges takes the values from [-1,1]. If the edge that connects the nodes representing the factors has weight 1, 0 and -1 then the factors has positive influence, no influence and negative influence over one another respectively. The connection matrix of FCM represents the edge weights between the factors. The FCM models are extended to intuitionistic and neutrosophic FCM with the intuitionistic [2,5] and neutrosophic connection matrix [12] respectively. FCM models with linguistic connection matrix was also developed in which the connection matrix consists of linguistic variables representing the inter associations between the factors [8]. These linguistic variables are quantified using fuzzy numbers, intuitionistic and neutrosophic fuzzy numbers. FCM models have wide spread applications in making decisions on pattern recognition, modeling of manufacturing systems, evaluating data interchange phenomenon, data mining, project management, investment analysis [1,4,9]. In this research work as a new initiative is made in developing Pythagorean FCM model in which the linguistic connection matrix is quantified using Pythagorean fuzzy sets. Yager [13] introduced Pythagorean fuzzy sets and it has also varied kind of applications in Multi-criteria decision making. Pythagorean fuzzy sets are also applied in the decision making methods such as DEMATEL, TOPSIS, VIKOR, PROMTHEE to make optimal decisions on various business management aspects such as supply chain management, product production and so on [7]. To the best of our knowledge, Pythagorean fuzzy sets are not used in FCM models and this paper initiates it. As many researchers are using Pythagorean fuzzy sets in different decision making techniques and based on their remarks on the efficiency of Pythagorean fuzzy sets, the authors are motivated to develop FCM model with Pythagorean fuzzy sets representations. In this paper a decision making model on determining the optimal strategies of E-waste generation is developed with the integration of the concepts of Pythagorean fuzzy sets. The scores of each strategy is determined and based on the score values the strategies are ranked and the optimal strategies are found.

The paper is organized as follows: section 2 presents the methodology; section 3 presents the application of the proposed model to the decision making scenario; section 4 discusses the results and the last section concludes the work.

2 Methodology

This section comprises of the steps contained in the proposed Pythagorean FCM model.

Step1. The strategies are formulated considering the nature of the company, principles of production, legislative demands and other influencing factors. The strategies are taken as the factors and represented as nodes or vertices of the directed graph.

Step 2. The connection matrix M is formulated using Pythagorean sets. A Pythagorean set P is of the form $\{(x,A(x),C(x)):x\in X\},A(x):X\rightarrow[0,1],C(x):X\rightarrow[0,1]$, where X is the universal set , A(x) & C(x) are the membership & non-membership degrees for each $x\in X$ satisfying the condition of $(A(x))^2+(C(x))^2 \leq 1$[13]. The Pythagorean fuzzy sets are the special case of intuitionistic fuzzy sets and it is defuzzified [11] by $\frac{A(x)}{A(x)+C(x)}$

Step 3. Consider an initial vector of the form X = (10000..0) and pass on to M, in this initial vector the value 1 represents that the first factor is kept in ON position and other factors in OFF position, threshold the resultant vector by assigning the value 1 to the factor in ON position and the greatest value, assign the value 0 to the remaining. The new vector is X1

Step 4 : Repeat Step 3 to the vector X1 and continue until two threshold vectors are alike. The state of attaining two like vectors indicates the presence of limit cycle.

Step 5: Repeat the Step 3 & 4 for other factors. The final vectors attained after each setting are tabulated (see Table 3.2) to determine the final score values of each factors.

Step 6: The optimal factors are determined based on the final score values.

3 Decision Making on the Strategies to Minimize Electronic Waste

This section presents the application of the proposed method in determining the optimal strategies. The proposed strategies from the outlook of experts are presented as follows,
ES1: Production of Eco - friendly electronic products
ES2: Designing of products embedded with eco-consciousness.
ES3: Selection of suitable electronic waste management method
ES4: Electronic products must possess features of recycling.
ES5: Product production with strict adherence to environmental regulations
ES6: Periodical review of the electronic waste stock
ES7: Choosing the optimal method of disposal
ES8: Selection of feasible electronic waste treatment methods to mitigate the environmental effects

ES9: Production of multi-faceted products to fulfill multiple needs
ES10: Innovation in creating secondary products from the generated electronic waste
The connection matrix M representing the linguistic inter impacts of the factors

	ES1	ES2	ES3	ES4	ES5	ES6	ES7	ES8	ES9	ES10
ES1	VL	VH	H	H	H	H	H	VH	M	H
ES2	VH	VL	VH	VH	VH	H	H	H	H	H
ES3	VH	H	VL	H	H	M	H	H	H	H
ES4	VH	H	H	VL	H	H	H	H	H	H
ES5	VH	VH	VH	VH	VL	VH	VH	VH	VH	VH
ES6	L	L	L	L	VH	M	M	M	L	L
ES7	M	M	M	VH	VH	VH	VL	VH	H	M
ES8	M	M	M	M	VH	VH	VH	VL	H	H
ES9	H	H	H	H	H	VH	H	H	VL	H
ES10	H	H	H	H	H	VH	M	M	M	VL

Table 3.1. Pythagorean Quantification of Linguistic Variable

Linguistic Variable	**Pythagorean Quantification**	**Crisp value**
Very High	(0.9,0.1)	0.9
High	(0.7,0.2)	0.78
Moderate	(0.6,0.5)	0.55
Low	(0.1,0.9)	0.1
Very Low	(0,0)	0

The quantified matrix is

	ES1	ES2	ES3	ES4	ES5	ES6	ES7	ES8	ES9	ES10
ES1	0	0.9	0.78	0.78	0.78	0.78	0.78	0.9	0.55	0.78
ES2	0.9	0	0.9	0.9	0.9	0.78	0.78	0.78	0.78	0.78
ES3	0.9	0.78	0	0.78	0.78	M	0.78	0.78	0.78	0.78
ES4	0.9	0.78	0.78	0	0.78	0.78	0.78	0.78	0.78	0.78
ES5	0.9	0.9	0.9	0.9	0	0.9	0.9	0.9	0.9	0.9
ES6	0.1	0.1	0.1	0.1	0.9	0	0.55	0.55	0.1	0.1
ES7	0.55	0.55	0.55	0.9	0.9	0.9	0	0.9	0.78	0.55
ES8	0.55	0.55	0.55	0.55	0.9	0.9	0.9	0	0.78	0.78
ES9	0.78	0.78	0.78	0.78	0.78	0.9	0.78	0.78	0	0.78
ES10	0.78	0.78	0.78	0.78	0.78	0.9	0.55	0.55	0.55	0

The first factor ES1 is kept in ON position
Let X1 = (1000000000)
X1*M = (0 0.9 0.78 0.78 0.78 0.78 0.78 0.9 0.55 0.78)
(1100000100) = X2

X2*M = (1.45 1.45 2.23 2.23 2.58 2.46 2.46 1.68 2.11 2.34)
(1000100000) = X3
X3*M = (0.9 1.8 1.68 1.68 0.78 1.68 1.68 1.8 1.45 1.68)
(1100000101) = X4
X4*M = (2.23 2.23 3.01 3.01 3.36 3.36 3.01 2.23 2.66 2.34)
(1000110000) = X5
X5*M = (1 1.9 1.78 1.78 1.68 1.68 2.23 2.35 1.55 1.78)
(1000000100) = X6
X6*M = (0.55 1.45 1.33 1.33 1.68 1.68 1.68 0.9 1.33 1.56)
(1000111000) = X7
X7*M = (1.55 2.45 2.33 2.68 2.58 2.58 2.23 3.25 2.33 2.33)
(1000000100) = X8
X6 = X8 the fixed point is obtained.
By repeating in the same mode, the following resultant vectors are obtained and presented in Table 3.2.

Table 3.2. Score values of the Factors

On position of the Strategies	**ES1**	**ES2**	**ES3**	**ES4**	**ES5**	**ES6**	**ES7**	**ES8**	**ES9**	**ES10**
(1000000000)	1.55	2.45	2.33	2.68	2.58	2.58	2.23	3.25	2.33	2.33
(0100000000)	1.55	0.65	1.55	1.9	2.7	1.68	1.33	2.23	1.66	1.43
(0010000000)	1.8	1.68	0.9	1.68	0.78	1.45	1.68	1.68	1.68	1.68
(0001000000)	1.45	1.33	1.33	0.55	1.68	1.68	1.68	0.78	1.56	1.56
(0000100000)	6.36	6.12	6.12	6.47	7.5	7.39	6.8	6.92	6	6.23
(0000010000)	1	1	1	1	0.9	0.9	1.45	1.45	1	1
(0000001000)	1.1	1.1	1.1	1.45	1.8	1.8	0.9	0.9	1.56	1.33
(0000000100)	1.1	1.1	1.1	1.45	1.8	1.8	0.9	0.9	1.56	1.33
(0000000010)	1.68	1.68	1.68	1.68	0.78	1.8	1.68	1.68	0.9	1.68
(0000000001)	0.88	0.88	0.88	0.88	1.68	0.9	1.1	1.1	0.65	0.1
Total Weight	18.47	17.99	17.99	19.74	22.2	21.98	19.75	20.89	18.9	18.67
Score Values	1.847	1.799	1.799	1.974	2.22	2.198	1.975	2.089	1.89	1.867
Rank	8	9	9	5	1	2	4	3	6	7

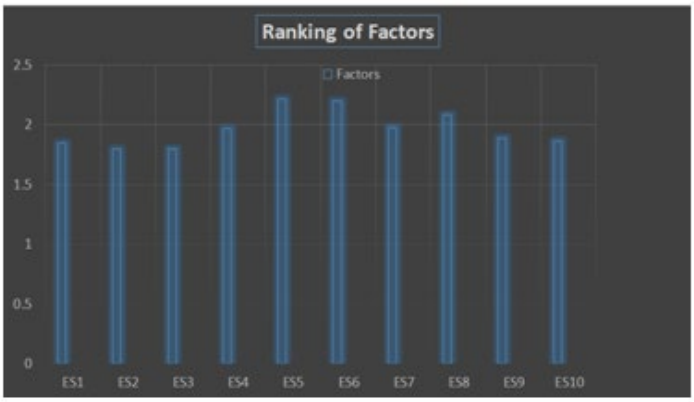

Fig. 3.1. Ranking of the Factors

4 Discussion

The score values obtained in Table 3.2.are ranked and the factors representing the strategies that has the maximum values are categorized as the optimal strategies. The factors are ranked and it is represented in Fig.3.1. The strategies ES5, ES6, ES8,ES7,ES4 are the most optimal strategies and also they possess the influencing characteristic features. The decision makers shall consider these optimal strategies in making decisions on inhibiting the electronic waste. The electrical and electronics industries shall take up feasible measures based on these strategies to maximize their profit with minimal waste generation rate.

5 Conclusion

In this research work a new kind of FCM decision making model integrated with Pythagorean fuzzy sets is developed. The efficiency of Pythagorean fuzzy sets in quantifying the linguistic representation of the expert's opinion is validated by applying to the decision making scenario of optimal strategies on inhibiting electronic waste. The proposed model can be extended with various extended representations of Pythagorean fuzzy sets. This research work has certain limitations, the comparative analysis with other FCM model are not done, substantiation of using Pythagorean fuzzy sets of representation is not highly stated.

References

[1] Abdollah Amirkhania., Elpiniki I.Papageorgioub., AkramMohsenia., Mohammad R.Mosavia., A review of fuzzy cognitive maps in medicine: Taxonomy, methods, and applications', Computer Methods and Programs in Biomedicine, Vol.142, pp – 129-145, 2017.

[2] Axelrod, R., Structure of Decision: The Cognitive Maps of Political Elites. Princeton, 1976.

[3] Bhaskar, K., & Turaga, R. M. R.India's e-waste rules and their impact on e-waste management practices: A case study. Journal of Industrial Ecology, 22(4), 930–942, 2018.

[4] Chrysostomos ,D.,StyliosPeter P.Groumpos, Application of Fuzzy Cognitive Maps in Large Manufacturing Systems, IFAC Proceedings Volumes, Vol. 31, pp-521-526, 1998.
[5] Hajek.P., Prochazka,O.,Interval-valued intuitionistic fuzzy cognitive maps for supplier selection, Intelligent Decision Technologies 2017: Proceedings of the 9th KES International Conference on Intelligent Decision Technologies (KES-IDT 2017) - Part I, pp. 207-217, 2018.
[6] Kosko, B., Fuzzy Cognitive Maps. Int. J. of Man-Machine Studies, V. 24, 1986, 65-75.
[7] Lazim Abdullah.,Pinxin Goh., Decision making method based on Pythagorean fuzzy sets and its application to solid waste management, Complex & Intelligent Systems.
[8] Nivetha Martin., Aleeswari.A., Lilly Merline,W., Risk Factors of Lifestyle Diseases – Analysis by Decagonal Linguistic Neutrosophic Fuzzy Cognitive Map, Materials Today: Proceedings, Vol. 24, pp-1939-1943, 2020.
[9] Papakostas, G. A. , Boutalis, Y. S., Koulouriotis, D. E. ,Mertzios, B. G., Fuzzy cognitive maps for pattern recognition applications, International Journal of Pattern Recognition and Artificial IntelligenceVol. 22, No. 08, pp. 1461-1486, 2008.
[10] Rama Mohana R. Turaga, Kalyan Bhaskar, Satish Sinha, Daniel Hinchliffe, Morton Hemkhaus, Rachna Arora, Sandip Chatterjee, Deepali Sinha Khetriwal, Verena Radulovic, Pranshu Singhal, Hitesh Sharma., E-Waste Management in India: Issues and Strategies, Vikalpa: The Journal for Decision Makers, Vol.44, Issue 3,pp 127-162, 2019.
[11] Solairaju and Shajahan, Transforming Neutrosophic Fuzzy Set into Fuzzy Set by Imprecision Method, Journal of Computer and Mathematical Sciences, Vol.9, No.10, pp-1392-1399, 2018.
[12] Vasantha Kandasamy,W. B. ,Florentin Smarandache, Fuzzy Cognitive Maps and Neutrosophic Cognitive Maps, Xiquan Publishers, Phoenix, 2003.
[13] Yager., "Pythagorean Fuzzy Subsets",In:Proc Joint IFSA World Congress and NAFIPS Annual Meeting, Edmonton,Canada, pp-57-61, 2013.
[14] Kiran Kumar, T.V.U., Karthik, B., Improving network life time using static cluster routing for wireless sensor networks, Indian Journal of Science and Technology, 2013, 6(SUPPL5), pp. 4642–4647
[15] Thamarai, P., Karthik, B., Kumaran, E.B., Optimizing 2:1 MUX for low power design using adiabatic logic, Middle - East Journal of Scientific Research, 2014, 20(10), pp. 1322–1326

Studies on Yttrium Incorporated Hydroxyapatite Nanocrystals Prepared by Sol Gel Method

Saranya S[1], Devi G[2], Kavitha V[3] ,Prema Rani M[4]
{saranyaashok122012@gmail.com[1], mailengr.devi@gmail.com[2], premaakumar91@gmail.com[3], kaviram06@gmail.com[4]}

[1] Department of Physics, S.V.N College, Madurai, Tamilnadu, India
[2] Department of EEE, PSNA College of Engineering and Technology, Dindigul, Tamilnadu, India
[3,4]Department of Physics, Madura College, Madurai, Tamilnadu, India

Abstract. Yttrium doped hydroxyapatite nanocrystals were synthesized by sol gel method for three different concentrations of yttrium (3%, 6% & 9%). XRD was used to examine structural parameters, SEM was used to examine surface morphology, and EDS was used to determine the elemental composition. XRD revealed that the crystallite size was 28 nm. When XRD data is compared to JCPDS data, the strength peaks from XRD data are found to be similar. Space group of the grown samples has been found to be P63/m. From the FTIR analysis the presence of HPO4 –was confirmed which reinforces that HAP was synthesized.

Keywords: Crystallite Size, Doping, FTIR, Hydroxyapatite, XRD.

1 Introduction

($Ca_5(PO4)_3OH$) is a biomaterial with a diverse set of uses. It's also known as bone mineral because it crystallises in a hexagonal system. It's filler that's used to patch amputated bone [1]. HAP is used to coat modern implants such as hip replacements, dental implants, and bone conduction implants [2, 3]. Porous HAP is a form of HAP that is used to deliver drugs to specific areas of the body, such as the bones [4, 5].

HAP has a low host reaction .When metal ions are doped in HAP, catalytic properties are observed [6, 7].Antibacterial activity is observed when yttrium is doped in HAP [8]. It slows bacterial growth in the mouth slightly. Human periodontal fibroblast development is accelerated by it [9]. It attracts water molecules with a high affinity. It boosts the performance of HaP-cultured cells [10]. It makes the proton environment more favourable.

2 Experimental Procedure

Solgel was used to make yttrium doped hydroxyapatite nanocrystals. In deionized water, diammonium hydrogen phosphate was dissolved and stirred at 90°C in a magnetic stirrer. Separately dissolved calcium nitrate tetrahydrate and Yttrium nitrate were added to deionized water. Drop by drop, the above two solutions were applied. Ammonium hydroxide was used

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to keep the P_H at 10. For six hours, the solution was held at 90°C. The precipitates were filtered and washed before being dried for 22 hours at 110°C and then calcined for 2 hours at 700°C.

3 Characterization

3.1 XRD

The phases of the samples were identified by powder X-Ray diffraction done at SAIF, Cochin with Cu Kα (λ = 1.5406 A0). The XRD data set was obtained using two ranges ranging from 100 to 1200 with a 0.020 phase scale. The obtained data was compared with JCPDS and crystal structure was confirmed as hexagonal with space group of p63/m. shows the XRD profiles of pure and doped hydroxyapatite samples. Table 1 shows the crystallite size as determined by XRD. The relationship between 2 and crystallite size is depicted in Figure 2.

Table 1. Crystallite size from XRD

S.No	Sample	2θ in degrees	Crystallite size in nm
1	Pure HAP	31.796	28.1205
2	3%Y doped HAP	31.807	28.1115
3	6%Y doped HAP	31.836	28.0864
4	9%Y doped HAP	31.858	28.0676

The size of crystallites was affected by yttrium doping. If the concentration of yttrium rises, the size of the crystallite shrinks. Because the ionic radius of yttrium (0.09nm) is smaller than that of calcium, this proves that Y^{3+} ions replace Ca^{3+} ions in the HAP. (0.1nm). Bragg's law states that as the interplanar distance decreases, the lattice parameter decreases. This also shows that as the concentration of Y increases, the crystallite size decreases.

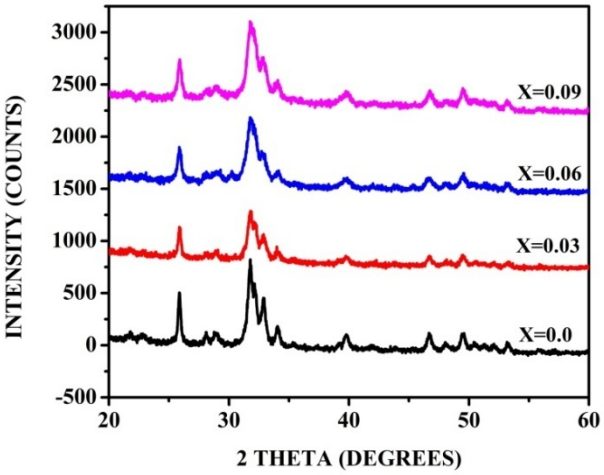

Fig. 1. XRD profiles for the pure and Yttrium doped Hydroxyapatite

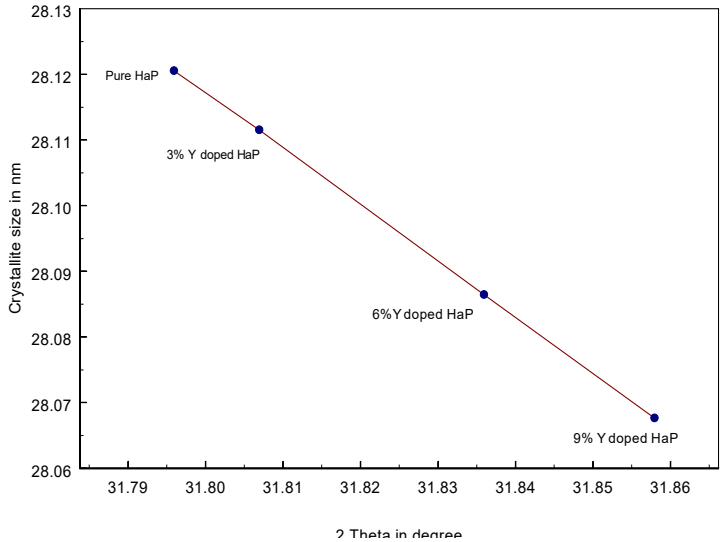

Fig. 2. Relation between 2θ and crystallite size of pure and Yttrium doped Hydroxyapatite

3.2 FTIR

Fourier transform infrared spectroscopy was used to validate the existence of functional groups. The spectrum was captured in the 4000-400cm-1 range. The spectrometer's resolution was 4cm-1. Many of HAP absorption peaks can be seen in FTIR spectra. Spectra were collected in the 472.56-3570.23 area. FTIR profiles of pure and doped Hydroxyapatite are shown in Figures 3a-3d. The FTIR peaks and their inferences are mentioned in Table 2.

Table 2. Peaks from FTIR and their corresponding inference

Sl. No.	Chemical group	pure hap	3%Y doped hap	6% Y doped hap	9%Y doped hap
1	OH^-	3423.65	3417.86	3514.93	-
2	CO_3^{2-}	1411.89	1413.82	1413.92	1415.75
3	Adsorbed water	-	2829.57	2833.43	2835.36
4	HPO_4^{2-}	-	877.61	876.61	875.68
5	PO_4^{3-}	601.79	603.72	603.72	603.72

Fourier transform-infrared spectroscopy is an analytical technique that uses the absorption or emission spectrum of materials to distinguish organic and inorganic materials. The existence of HAP is confirmed by FTIR performance. With a rise in yttrium concentration, we expect a decrease in the IR absorption bands of the phosphate groups of the samples.

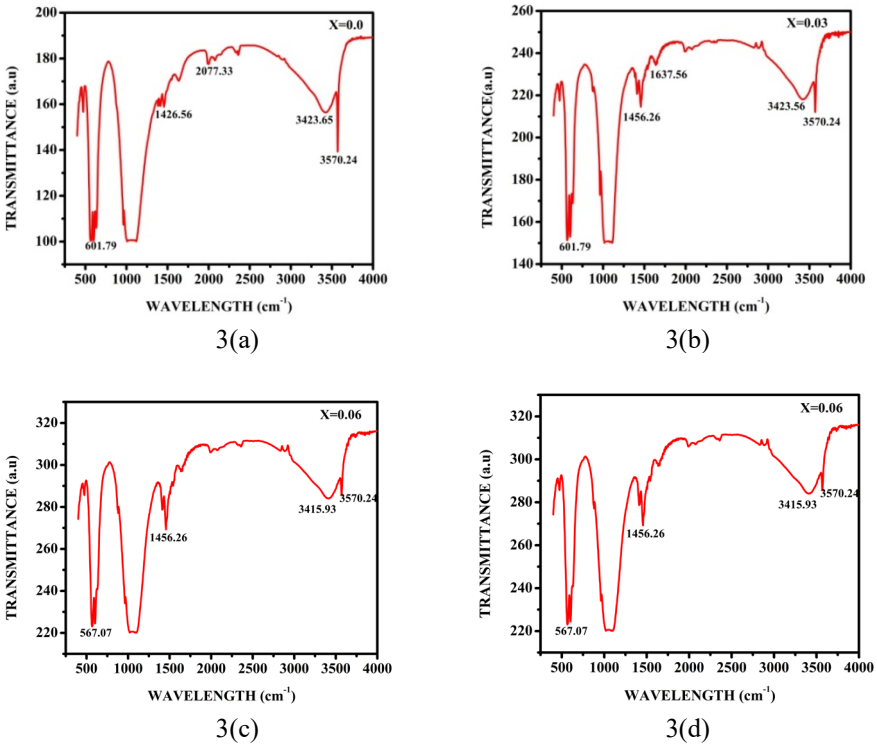

Fig. 3. FTIR profiles for the pure and doped Hydroxyapatite

3.3 SEM

SEM images of the samples were taken at International Research Centre, Kalasalingam University, Krishnan kovil. Figure 4 represents the SEM images of pure and doped hydroxyapatite.

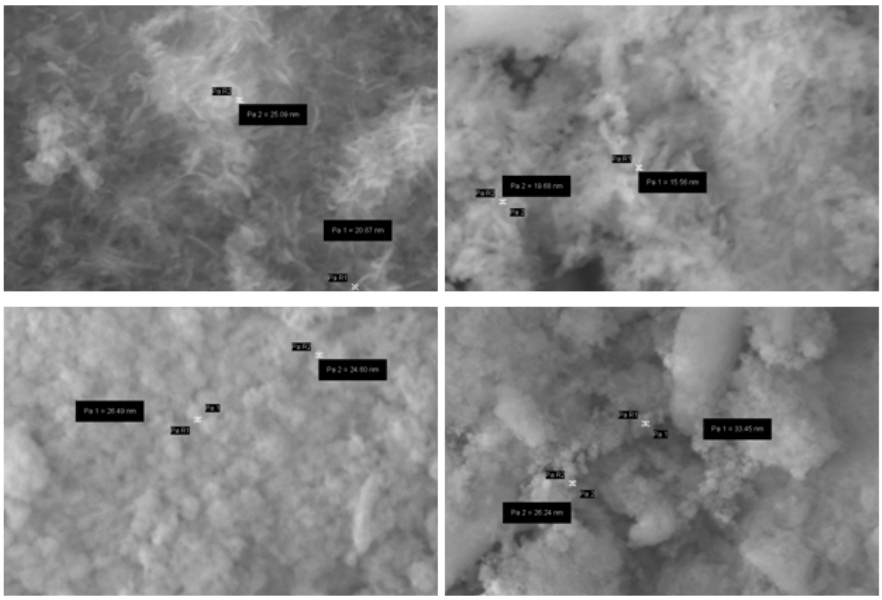

Fig. 4. SEM images of pure and doped Hydroxyapatite

3.4 EDS

Gandhigram Rural University performed the chemical characterizations of the samples. EDS representations of pure and doped hydroxyapatite are depicted in Figures 5a-5d. In pure and doped Hydroxyapatite, Table 3 shows the constituent elements.

Table 3. Constituent elements of pure and doped HAP

Sl. No.	Element	Pure HAP	3% doped HAP	6% doped HAP	9% doped HAP
1	O	38.81	62.05	42.24	14.94
2	C	-	14.76	15.23	24.68
3	Ca	42.26	20.12	18.27	2.67
4	P	16.32	10.03	9.57	5.55
5	Y	-	1.06	5.62	3.32

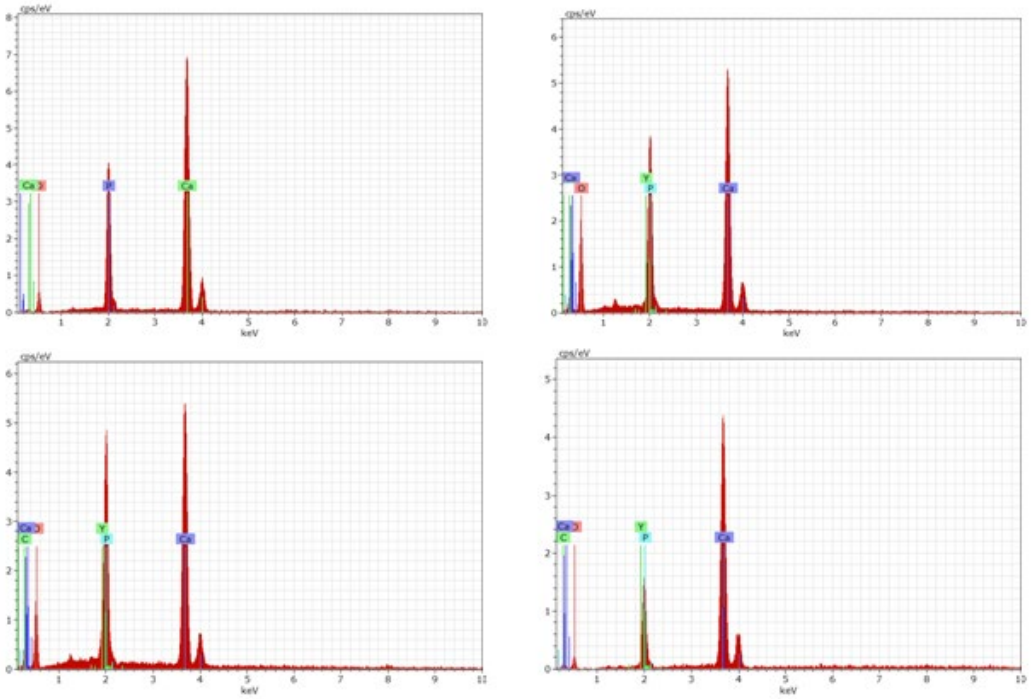

Fig. 5. EDS images of pure and doped Hydroxyapatite

4 Conclusion

The sol gel method was used to successfully synthesise yttrium doped hydroxyapatite nanocrystals in three different concentrations of yttrium (3 percent , 6 percent & 9 percent). The crystallite size was measured using XRD, and the crystallite size decreased as the Yttrium concentration increased. Using XRD data and JCPDS files as P63/m, the space category was calculated. The existence of an HPO4- group with a wavenumber in the order of 870cm-1 was confirmed by FTIR. SEM was used to examine the surface morphology, and EDS was used to determine the elemental composition.

References

[1] Setsuaki Murakami,Katsuya Kato, Yuki Enari, Masanobu Kamitakahara, Noriaki Watanabe, and KojiIoku,Hydrothermal synthesis of porous hydroxyapatite ceramics composed of rod-shaped particles and evaluation of their fracturebehavior, Ceramics international, 38(2), 2012, 1649-1654.

[2] Yan Li, Dandan Wang and Sierin Lim,Fabrication and Applications of Metal-Ion Doped Hydroxyapatite Nanoparticles, Juniper Online Journal Material Science, 1(2), 2017.

[3] Alek Sandra Sccze's, Lucyna Holysz and Emil Chibowski, Synthesis of HaP for biomedical applications, Advances in Colloid and Interface Science, Volume 249, November 2017, 321-330.

[4] Wei G, Ma PX, Structure and properties of nano-hydroxyapatite/polymer composite scaffolds for bone tissue engineering, Biomaterials 2004; 25(19):4749-4757.

[5] Kaili Lin, Na Zhang, Zhilan Yin, Weibin Zhang, Synthesis of water dispersible silicon containing hydroxyapatite nanoparticles with adjustable degradation rate and their application as pH-responsive drug carriers, China Chemical Engineering Journal, Volume 222, 2013, 49-59.
[6] Omer Kaygili, Sergey V. Dorozhkin, Tankut Ates, N. Canan Gursoy, Serhat Keseer, Fahrettin Yakuphanolgu, A. Birkan Selcuk, Structural and dielectric properties of yttrium- substituted hydroxyapatites, Material Science and Engineering C, 47(2015):333-338.
[7] Masseoud Othmania, Hassen Bachouaa, Yassin Ghandoura, Abdullah Aissaa, Mongi Debbabia, Characterization and catalytic properties of copper-substituted hydroxyapatite nanocrystals, Materials Research Bulletin, 97(2018):560-566.
[8] A.Mariappan, Pandi, N.Balasubramanian, Rajeshwara Palanichamy, K.Neyvasagam, Structural, Optical and Antimicrobial activity of copper and zinc doped Hydroxyapatite nano powders using SolGel method, Material Science & Engineering, April 2017, ISSN:2412-5954.
[9] Ming li, Pan Xiong, Feng Yan, Sijie Li, Changhong Ren, et al, An overview of graphene-based hydroxyapatite composites fororthopedic applications, Biomaterials, 3(2018):1-18.
[10] Burcin Bazar, Aysen Tezcaner, Dilek Keskin, Zafer Evis, Improvements in microstructural, mechanical and biocompatibility properties of nanosized hydroxyapatites doped with yttrium and fluroide, ceramics international , 36(5), 2010, 1633-1643.
[11] Xue Wei and Matthew Z.Yates, Yttrium doped Hydroxyapatite membranes with high proton conductivity, chemistry of materials, Volume 24, Issue 10, 1738-1743. Publication date (Web): April 27, 2012.
[12] Michiko Sato, Marisa A. Sambito, Arash Aslani, Nader M. Kalkhoran, Elliot B. Slamovich, Thomas Jay Webster, Increased osteoblast functions on undoped and yttrium doped nanocrystalline hydroxyapatite coatings on titanium, 27(11), 2006, 2358-2369.

Design and Implementation of AGU based FFT Pipeline Architecture

G. Prasanna Kumar [1], Maturi Sarath Chandra [2], K Shiva Prasanna[3], M Mahesh[4]
{prasanna4600@gmail.com[1], sarathchandra_ece@mvsrec.edu.in[2], shivaprasanna441@gmail.com[3], maheshm@sreenidhi.edu.in[4]}

Associate professor, ECE department, Malla Reddy Engineering College (Autonomous), Hyderabad, Telangana [1], Assistant Professor, ECE department, Maturi Venkata Subba Rao Engineering College, Hyderabad, Telangana [2], Assistant professor, ECE department, Teegala Krishna Reddy engineering College, Telangana [3], Assistant professor, ECE department, Sreenidhi institute of Science and technology, Telangana [4]

Abstract. Present it is most needful task to get various applications with parallel computations by using a Fast Fourier Transform (FFT) and the derived outputs should be in regular format. This can be achieved by using an advanced technique called Multipath delay commutator (MDC) Pipelining FFT processor and this processor will be capable to perform the computation of a different data streams at a time. In this paper the design and implementation of AGU based Pipelined FFT architecture is done. The proposed instructions calculate a butterfly within two cycles. The proposed architecture employs a Data Processing Unit (DPU) supporting the instructions and an FFT Address Generation Unit (FAGU) automatically calculating the butterfly input and output data addresses. The proposed DPU has a smaller area than commercial DSP chips. Moreover, the number of FFT computation cycles is reduced by the proposed FAGU. The design of FFT architecture will consists of real data paths. The FFT is mapped to pipelined architecture with different FFT sizes, different level of parallelism and various radixes. The most attractive feature of the pipelined FFT architecture is it consists of bit reversal operation so it requires little number of registers and better throughput.

Keywords: Fast Fourier transforms (FFT), parallel computation, pipelining, real data path, bit reversal, data stream and twiddle factor.

1 Introduction

FFT (Fast Fourier Transform) is utilized precisely as its name infers - to create indicative test designs ready to recognize fault types or issue areas. Its will likely recognize a greatest number of issues utilizing a negligible number of indicative test designs. Various FFT approaches have been proposed [1]. A large portion of these techniques depend on adjusted traditional FFT. At the point when the quantity of conceivable numerous issue competitors is enormous, it gets infeasible to unequivocally attempt all the potential mixes of various faults utilizing conventional methodologies.

Thus, existing FFT(Fast Fourier Transform) methods are basically utilized for single issue analysis. Another test to existing analytic test design age strategies is demonstrating unrecognized capacity.

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Issue analysis is a methodology to foresee the areas of imperfections in bombing chips. The data acquired through this strategy can be utilized to control the damaging Physical Failure Analysis (PFA) interaction to arrive at the genuine imperfection areas and discover the reasons for the deformities this is a basic technique for IC (Integrated Chip) assembling organizations to increase the yield of new cycle innovation. One significant advance of deficiency finding is to produce a reasonable arrangement of examples that can be applied to the chips through Automatic Test Equipment (ATE) [3-4] with the end goal that appropriate conclusion data of the chips can be gathered and broke down.

To improve the determination effectiveness of the volume conclusion strategies, a few example age methods have been proposed to create extra examples with high recognize capacity. In this paper this will call these extra examples as fourier transform while the first transformation. As a rule, a decent finding design age technique ought to accomplish three destinations: 1) high recognize capacity to recognize most nonequivalent deficiencies, 2) little analysis design volume, and 3) short conclusion design age time.

The essential thought of this methodology is to adjust the information circuit model by adding some analysis purposed logic into the first circuit with the end goal that the issue of recognizing two deficiency applicants is changed to the issue of distinguishing a solitary stuck to fault, consequently this doesn’t requires uncommon ATPG instruments. In this paper it additionally adds this methodology.

In a Circuit Under Test (CUT), when all the conceivable info blends are tried, more force will be naturally burned-through because of the flipping of the data sources. Along these lines, there is a requirement for decrease in the quantity of test designs that will be utilized on the CUT. There are numerous strategies that have conceived to decrease power scattering in the CUT. Vector filtering elemets out a portion of the successions that don't distinguish the issues in the circuit.

2 Multipath Delay Commutator (MDC) FFT

FFT calculations are for the most part worked in stages where in each stage information peruse and compose activities are performed by getting to memory . The memory based structures are ordered into single memory engineering and double memory design. In single memory engineering, the handling component is associated with a single memory unit of at any rate N words by a bidirectional transport as demonstrated. Information trades are occurred between the processor (Proc) and memory at each stage utilizing this bidirectional information transport. double memory engineering, where two recollections of size N each are associated with the preparing component with two separate bidirectional information transports. Information contributions from one memory are gone through the preparing component to another memory and the other way around till the change is finished.

Information rate may not be equivalent to the FFT processor recurrence, so the information data sources should go through three stages: input buffering, calculation and yield reordering. Information to be changed is first put away in the information cradle till the N tests

are gathered. At that point this memory is utilized as the computational memory, which is gotten to by the processor. Simultaneously another memory block turns into the info support to store another arrangement of information. The processor sets aside some effort to finish the calculations and stores the halfway information in computational memory. When the change is finished, the computational memory fills in as the yield cushion.

Memory based designs for processing a N point radix-r FFT require ((N/r) logr N) memory gets to where r words are perused from and kept in touch with memory at each entrance. The clock recurrence ought to be logr (N/r) times the recurrence of information inputs in light of the fact that just one preparing component is dealing with the calculations.

3 Radix-2 Pipelined FFT Architecture

Pipelined FFT models are quick and high throughput structures with parallelism and pipelining. Despite the fact that the equipment intricacy is high and less adaptable contrasted with different models, they offer high throughput and energy productive executions. Here we present some usually utilized pipelined structures, for example, Multi-way Delay Commutator (MDC) and Single-way Delay Feedback (SDF).

In this sort of designs, input succession is first isolated into different equal information streams by commutator and afterward, butterfly activity followed by fidget factor duplication is performed with legitimate deferrals to every information stream. In radix-2 MDC (R2MDC), input information stream is isolated into two equal ways as demonstrated in fig. 1 for N equivalent to 16. Absolutely, (log2N – 1) complex multipliers, log2N butterfly units and (3N/2 – 2) defer cradles are required.

All the butterfly units and multipliers can be used at 100% with legitimate information buffering. Fig. 6 shows the radix-4 MDC (R4MDC) engineering, in which four equal streams are prepared immediately. An aggregate of (3log4N – 1) complex multipliers, log 4N radix-4 butterfly units and (5N/2 – 4) expressions of memory is required.

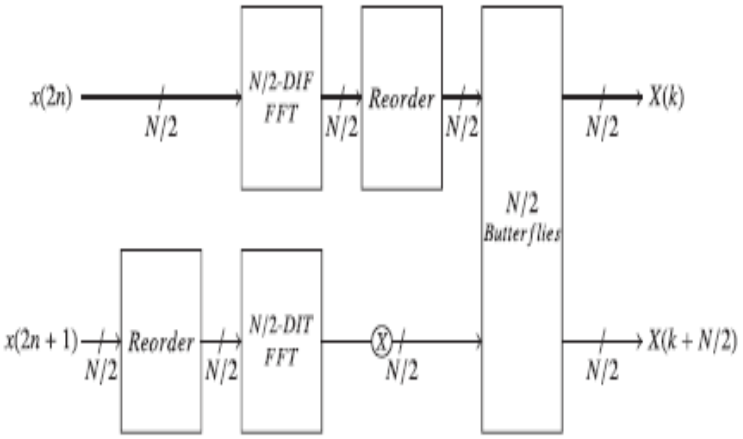

Fig. 1. Idea of the proposed method

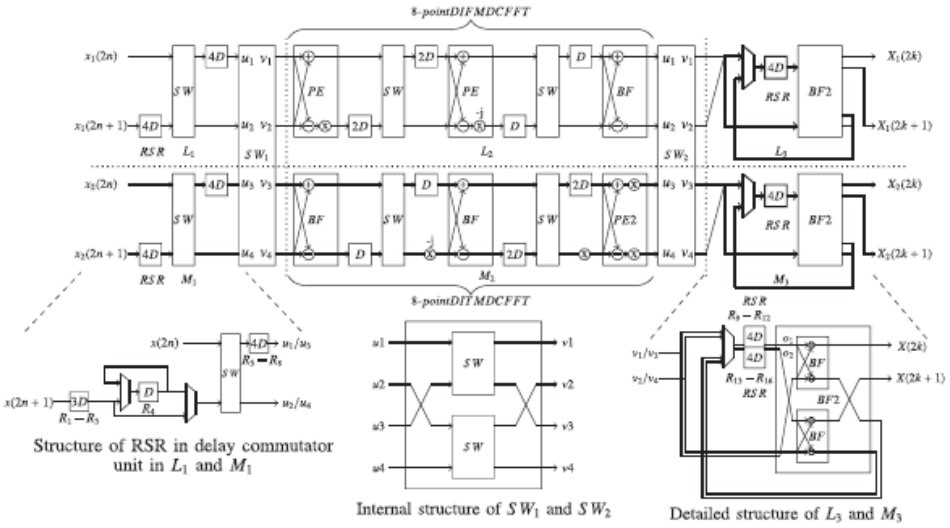

Fig. 2. Proposed 16-point radix-2 FFT architecture with outputs in natural order

In single way defer input models, a solitary information stream goes through multiplier in each stage. The defer units are more productively used by dividing a similar stockpiling among the sources of info and yields of the butterfly. Higher Radix MDC structures are not favored on the grounds that of their gigantic prerequisite of planning cushions though the higher radix SDF structures are favored on the grounds that the quantity of complex multipliers is decreased, equipment usage is upgraded furthermore, needs less memory. A cautious execution of higher radix preparing components is required on the grounds that the intricacy of adders may increment if not carried out by a few fell radix-2 butterfly units.

Among these structures, memory based designs and Pipelined structures are broadly embraced. Table 2 shows the examination between pipelined SDF design and memory based engineering for radix-r N point FFT execution. Both the structures have practically similar capacity necessities where in memory based design, principle memory is divided into r banks for concurrent access and in pipelined SDF, memory is appropriated into log2N banks. Force utilization can be diminished in pipelined SDF design with productive executions of consecutive cradles due to its successive access while in memory based engineering, to accomplish a contention free memory access, arbitrary tending to is important. Memory based design necessities to drive its clock logr (N/r) times the processor recurrence to accomplish a similar exhibition as pipelined SDF design.

Thus, pipelined designs are favored when execution and power are the primary sources than the intricacy. Then again memory based designs are acceptable decision where intricacy is of primary concern.

4 AGU Based Fft Pipelined

Any single FFT calculation itself isn't the best appropriate for all sorts of equipment stages. In this way, for better enhancement, a best reasonable calculation ought to be chosen for given equipment. Low power utilization, less territory, consistency in design and high execution are the primary worries of FFT enhancements. In the writing, diverse FFT calculations are received in various FFT structures for accomplishing required objectives in explicit applications. Here, we present the latest things in FFT engineering enhancement furthermore, best in class..

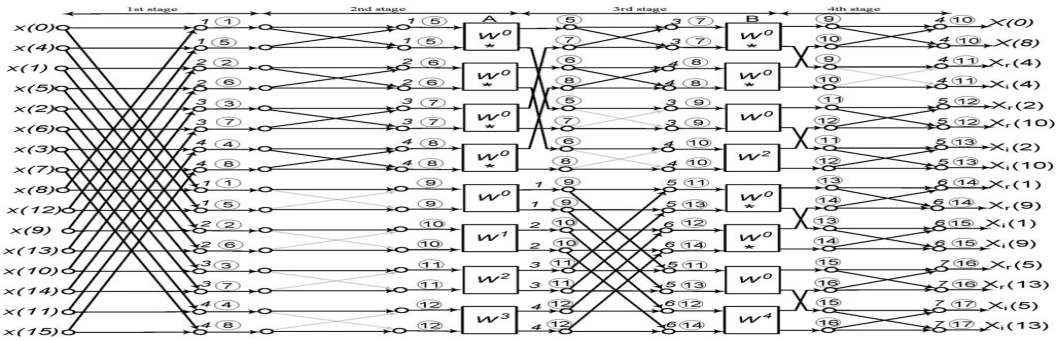

Fig. 3. Regular flow graph corresponding to Pipelined FFT

In this figure, genuine and nonexistent parts have been isolated Twiddle factors are moved to resulting stages depending on the situation, with the end goal that the changed stream chart contains one segment of BFs followed by one segment of Wk-blocks, and every segment in the stream diagram contains a sum of N genuine and fanciful examples. First and last stages needn't bother with Wk-blocks. Fig. 3 shows the standard design acquired after this change.

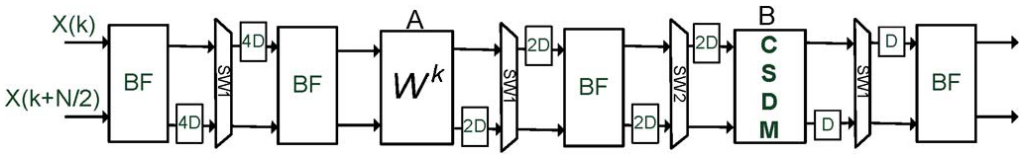

Fig. 4. Proposed two-parallel pipelined VLSI architecture for a 16-point DIF RFFT

Any single FFT calculation itself isn't the best appropriate for all sorts of equipment stages. Along these lines, for better streamlining, a best reasonable calculation ought to be chosen for given equipment. Low power utilization, less territory, consistency in construction and high execution are the primary sources of FFT advancements. In the writing, distinctive FFT calculations are embraced in various FFT models for accomplishing required objectives in explicit applications.

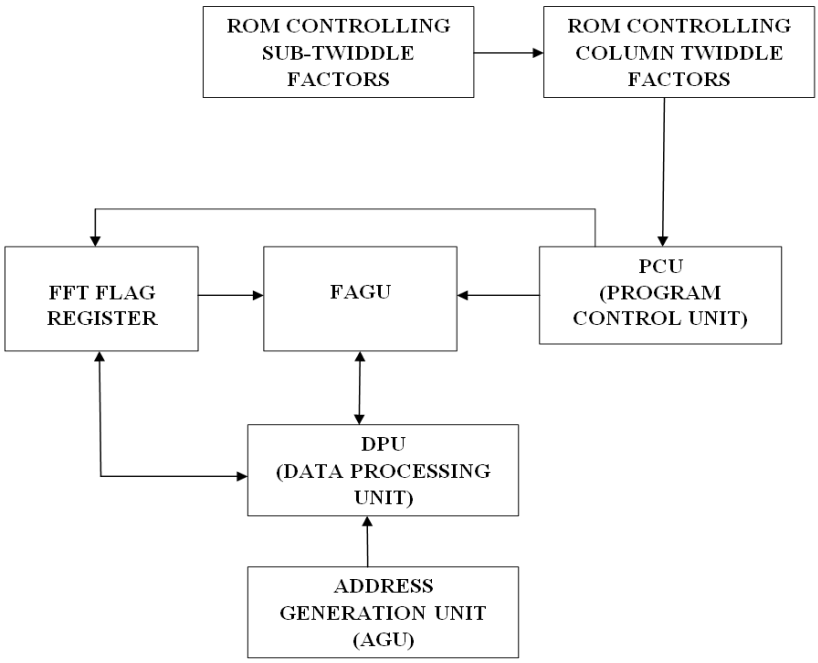

Fig. 5: Agu Based Fft Pipelined Architecture

The above figure (5) shows the block diagram of AGU based FFT pipelined architecture. The proposed FAGU consists of several counters, registers, etc. The yield locations of the FAGU are stacked into the balance address registers in the AGU. At that point the stacked addresses are utilized for counter balance locations of base locations. For instance, if a base location register is R0 and a counterbalance register is N0, the determined location which is the yield address of the AGU.

By utilizing set up FFT calculations and shared memory cradles, the memory utilization in memory based models can be incredibly diminished. A blended radix calculation is utilized with set up calculation system for struggle free memory access. The design comprises of just one butterfly unit prepared to do playing out a radix-4 activity or two radix-2 tasks. With this engineering, the region, computational clock recurrence and force utilizations are diminished. As of late, in the design introduced, the equivalent set up calculation system is utilized and an altered radix-2 calculation to stay away from excess tasks is received for genuine esteemed signs.

Scientists have proposed various changes to pattern designs for enhancing the handling components and postponement cradles to accomplish low force and high throughput. In memory based models, double port SRAMs are utilized for expanding the speed and decreasing the force utilization. To accomplish high throughput and decrease the increase intricacies in pipelined designs, FFT calculations with higher radices are received in light of radix-2k . With this methodology the routineness of construction is kept up without expanded intricacy.

5 Results

The below figure (6) shows the comparison of accuracy for FFT and AGU based FFT. The accuracy of AGU based FFT is very high.

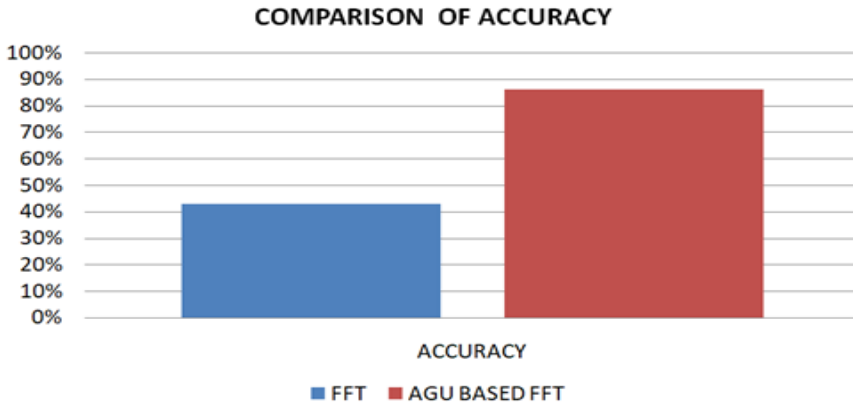

Fig. 6. Comparison of Accuracy

The below figure (7) shows the comparison of delay for FFT and AGU based FFT. The delay of AGU based FFT is reduced very effectively.

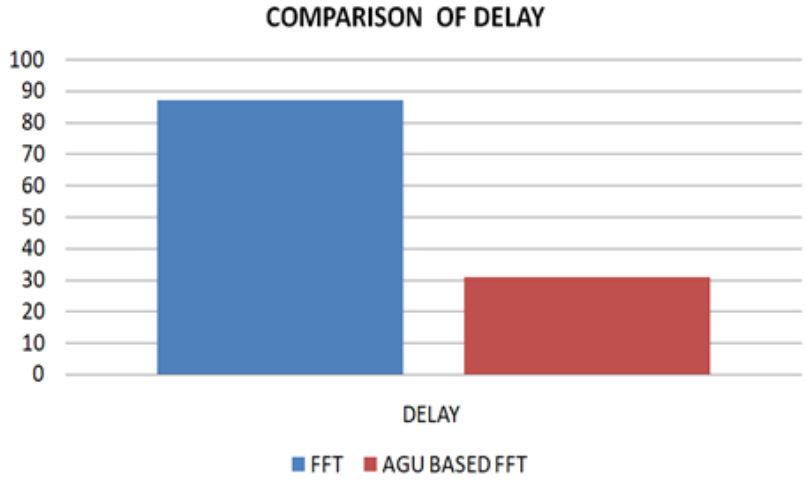

Fig. 7. Comparison of Delay

6 Conclusion

Hence in this paper the design and implementation of AGU based FFT pipelined architecture was implemented. This brief has presented a normal i/o order radix-2 multipath delay commutator fft pipelined architecture for real-valued fft for the computation of the fast Fourier transform (FFT) of real signals and inverse FFT of Hermitian-symmetric signals using

only real datapaths whose outputs are generated in the natural order. The bit reversal circuit present in prior designs is eliminated by integrating two FFT processors and the registers, which are present in the architecture, are reused for bit reversal. The real FFT structure is transformed by transferring twiddle factors to subsequent stages, such that each stage in the proposed flow graph contains one column of butterfly units and one column of twiddle factor blocks, and each column of the flow graph contains only *N* samples. These attributes make the proposed FFT processor superior in sense of hardware complexity and performance. Moreover, the proposed architecture provides throughput higher than the prior architectures.

References

[1] Z. Wang, X. Liu, B. He, and F. Yu, "A combined SDC-SDF architecture for normal I/O pipelined radix-2 FFT," IEEE Trans. Very Large Scale Integr. (VLSI) Syst., vol. 23, no. 5, pp. 973–977, May 2015.

[2] A. X. Glittas and G. Lakshminarayanan, "Pipelined FFT architectures for real-time signal processing and wireless communication applications," in Proc. 18th Int. Symp. VLSI Design Test, Jul. 2014, pp. 1–2.

[3] P. P. Boopal, M. Garrido, and O. Gustafsson, "A reconfigurable FFT architecture for variable-length and multi-streaming OFDM standards," in Proc. IEEE ISCAS, May 2013, pp. 2066–2070.

[4] K.-J. Yang, S.-H. Tsai, and G. C. H. Chuang, "MDC FFT/IFFT processor with variable length for MIMO-OFDM systems," IEEE Trans. Very Large Scale Integr. (VLSI) Syst., vol. 21, no. 4, pp. 720–731, Apr. 2013.

[5] M. Ayinala, M. Brown, and K. K. Parhi, "Pipelined parallel FFT architectures via folding transformation," IEEE Trans. Very Large Scale Integr. (VLSI) Syst., vol. 20, no. 6, pp. 1068–1081, Jun. 2012.

[6] S.-N. Tang, C.-H. Liao, and T.-Y. Chang, "An area- and energyefficient multimode FFT processor for WPAN/WLAN/WMAN systems," IEEE J. Solid-State Circuits, vol. 47, no. 6, pp. 1419–1435, Jul. 2012

[7] M. Garrido, J. Grajal, and O. Gustafsson, "Optimum circuits for bit reversal," IEEE Trans. Circuits Syst. II, Exp. Briefs, vol. 58, no. 10, pp. 657–661, Oct. 2011.

[8] Y. Voronenko and M. Püschel, "Algebraic signal processing theory: Cooley-Tukey type algorithms for real DFTs," IEEE Trans. Signal Process., vol. 57, no. 1, pp. 205–222, Jan. 2009.

[9] .Y. Chen, Y.-W. Lin, Y.-C. Tsao, and C.-Y. Lee, "A 2.4-Gsample/s DVFS FFT processor for MIMO OFDM communication systems," IEEE J. Solid-State Circuits, vol. 43, no. 5, pp. 1260–1273, May 2008.

[10] Y.-N. Chang, "An efficient VLSI architecture for normal I/O order pipeline FFT design," IEEE Trans. Circuits Syst. II, Exp. Briefs, vol. 55, no. 12, pp. 1234–1238, Dec. 2008.

[11] Y.-W. Lin and C.-Y. Lee, "Design of an FFT/IFFT processor for MIMO OFDM systems," IEEE Trans. Circuits Syst. I, Reg. Papers, vol. 54, no. 4, pp. 807–815, Apr. 2007.

[12] H. F. Chi and Z. H. Lai, "A cost-effective memory-based real-valued FFT and Hermitian symmetric IFFT processor for DMT-based wire-line transmission systems," in Proc. IEEE Int. Symp. Circuits Syst., May 2005, vol. 6, pp. 6006–6009.

[13] Y. W. Lin, H. Y. Liu, and C. Y. Lee, "A 1-GS/s FFT/IFFT processor for UWB applications," IEEE J. Solid-State Circuits, vol. 40, no. 8, pp. 1726–1735, Aug. 2005.

[14] A. V. Oppenheim, R. W. Schafer, and J. R. Buck, Discrete-Time Signal Processing., 2nd ed. Englewood Cliffs, NJ, USA: Prentice-Hall, 1998.

[15] S. He and M. Torkelson, "Design and implementation of a 1024-point pipeline FFT processor," in Proc. IEEE Custom Integr. Circuits Conf., Santa Clara, CA, USA, May 1998, pp. 131–134.

[16] S. He and M. Torkelson, "A new approach to pipeline FFT processor," in Proc. 10th Int. Parallel Process. Symp., 1996, pp. 766–770

Design of SOC Based SRAM Cluster for Reliability and Functional Safety Applications

Dr.A.Ranganayakulu[1], Dr.V.Surya Narayana[2], Dr.M.V.Nageswara Rao[3]
{ranganayak2005@gmail.com[1], s_vadhri@yahoo.co.in[2], nageswararao.mv@gmrit.edu.in[3]}

Professor and HOD, Department of ECE, NRRIT, Guntur, A.P, India[1]
Professor and HOD, Department of CSE, RCEE, Eluru, A.P, India[2]
Professor and HOD, Department of ECE, GMRIT, Rajam, A.P, India[3]

Abstract. In this paper the design of SOC based SRAM cluster is implemented for reliability and functional safety. The main objective of this research is to improve the accuracy and reduce the delay using SOC based design. The designed system initially generates the network using network generator. This network generator basically uses the strategies of both user's clusterization and hierarchy optimization. After the strategy of hierarchy structure the electronic design automation (EDA) generator will generate the test standards based on the access of tests. This generated components test will be extracted based on the standards. Next H-Array generator will generate the arrays of H-arrays for different cluster level sub networks. All these arrays will be cross compiled by mapping the cells. At last this will be saved in SRAM cluster. Hence the SOC based SRAM cluster will improve the accuracy and reduce the delay in effective way.

Keywords: System on chip (SOC), Electronic Design Automation (EDA), SRAM (Static Random Access Memory), H-Array generator, Network Generator.

1 Introduction

In the semiconductor technology, Electronic Design Automation (EDA) plays important role for the growth of tools that are used. In the pre defined design phase of chip, all chips are pre-verified. For the system reliability and functional safety, EDA tools are used in system on chips. Hence to reduce the delay and increase the accuracy of this design SRAM cluster is introduced. Basically in the domains of safety and critical mission, SOC is most widely used. By using SRAM cluster, the functional safety is provided to the design [1]. Earlier Built in self test technique is used to provide the safety for system on chip, but it doesn't give effective results. Hence SOC based SRAM cluster is introduced.

Generally, the system on chip requires only power to operate. In the field of effect, at certain point the delay is continuous. Chip area and delay are increased when it widely applied to the circuits. Hence, Two methods are commonly used to consume the power [2]. Based on the applied voltage circuits, speed limit of given chip is determined. By mixing the number of inverting and non inverting stages, chip of the system is provide with odd number of bits.

System on chip in complementary metal oxide semi conductor (CMOS) is composed of source- coupled differential resistively-loaded delay cells which are investigated. CMOS

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voltage-controlled System on chip with good phase-noise performance is presented. Chip and transmission line systems are specifically coupled to obtain the chip stabilization due to interaction of cell as at same time between the chip operation and a wave traveling in the transmission line systems [3].

In the System on chip (SoC) based on complementary metal oxide of semi conductor (CMOS), the on-chip inductors of the output chip is controlled. The system on chip(SoC) can be changed further by changing either voltage supply or number of stages. There is a low power in the cell phones and the computer of mobile chip is which is another important scaling factor.

Using the System on chip (SoC), the design is constructed on the Chip designs and they occupy the chip of less area and improving both the performance and cost. If delay cells of even numbers are used, it will generate both in the quadrature phase outputs and phase outputs. Because of their low quality factor the phase-noise performance of system on chip is poor. In the System on chip (SoC) basic element is a cell of a Dependability Manager. The complementary pairs of positive channel of metal oxide and negative channel of metal oxide obtained from the cell. The complex circuit behavior is estimated and determined by the results of obtained Dependability Manager (DM) [4].

Using the technology of complementary metal oxide of semi conductor (CMOS). all the digital and the designs of analog can be fabricated. In the gain stages a system on chip (SoC) is connected to a loop from the last of that output stage and it is given to the input of first stage. The system on chip (SoC) has been designed for different stages. Because of the various advantages, CMOS technology is widely used in commercial applications. Reliability is another important parameter which is also needed for designing of low power circuit [5].

In this most of the digital and electronic systems shows oscillatory behavior. Oscillators have now become the most important for all digital components, and the optical devices of a communication system. The electronic devices size is reduced greatly after the integrated circuits introduction of the technology. While designing any integrated technology and integrated chip, designers have to take care of some parameters. They are power consumption, speed, silicon area, delay and the System on chip is a closed loop.

The system on chip consists of different stages which has designed by using the technology of complementary metal oxide of semi conductor (CMOS) based on tanner tools. There are 5-stages of System on chip (SoC) and it is cascaded in to the output of the stage as one and it is fed into the next stage of input and finally it is feedback in to the output and the input of first stage. The voltage supply is also sufficient and it should be given and reset in to the voltage of input and it is applied at once to the circuit, so it spontaneously arise the oscillations. Where the positive channel of metal oxide of semi conductor which is also called as the network of pull-up and the negative channel of metal oxide of semi conductor also called as the network of pull-down. Hence, in this paper, the design of SOC based SRAM cluster is implemented for reliability and functional safety is implemented.

2 Background

The design of Modern complementary metal oxide of semi conductor is based on the consumption of reducing power and the circuit design which is stable. With respect to the time, it shows that the chip varying the voltage while performing simulation. The SRAM Power area is occupied by the consumption of current which is observed from the nearest chip which is wireless by maintaining 2.4 GHz frequency.

The output of amplifier rises slightly, when noise is reduced in the circuit. In this variation, voltage is presented from the output which will pass through the elements of delay. In this the amplifier, the negative gain will be always greater than 1. Input and output will be directly opposite to each other. The input value changes when the value is greater than 1.

The signal which is amplified and inverted will pass through the output block. Again this obtained value will be amplified and inverted for effectiveness. The given input value is sequential to the square wave and obtained output value is square wave. This output square wave consists of equal time period with less delay. Hence, the growth depends on the amplifier output voltage.

In the iJTAG network component, Segment Insertion Bit (SIB) plays important role. This will allow the network to organize the hierarchy. If the SIB is opened then 1 is updated and gives an active scan path. When the path is excluded then the SIB will update 0 and it will be closed.

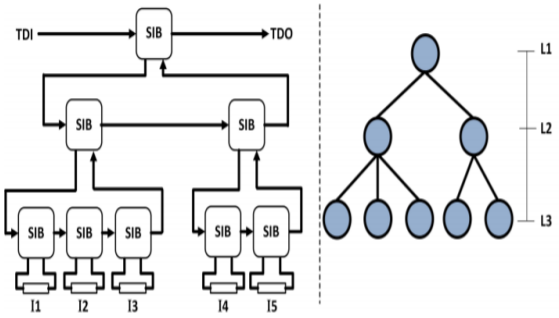

Fig. 1: An Example of a Hierarchical internal iJTAG Network

The above figure (1) shows the example hierarchical SIBs network. Segment Insertion Bit (SIB) consists of one parent and more than one child's. The parent will be at higher level and children will be at lower level. When the both upper and lower level is opened then SIB is selected. These are propagated from the parent SIB to children SIB. Based on the controller the roots of SIB are selected.

The wave grows from the noise of exact analysis and it will show that the initial and the square may not grow, square is formed when the limit of output is reaches the amplifier. Oscillator system is named as the version of the oscillator delay. The system oscillator uses the number of DM and the single amplifier effect of a DM greater than one. Hence the name

system on chip is having a delay rather than the single element, and it contributes the inverter of each and around the signal of the system which inverts the delay cells.

Adding the pair of the system oscillator is to increase the inverters of total delay cells and the chip decreases the delay. The changes in supply voltage of each delay inverter and the decrease in higher typical voltage and increase in the chip of the delay oscillator. Some methods have been described by the Bratislava of the chip stability which improves the consumption of power and the oscillator of system complementary metal oxide of semi conductor. The comprised system on chip has the number of delay stages, with the last stage and the output is fed back into the first input.

The sensitivity supply is the measure and the variation effect of the voltage supply on the response of circuits. According to the change the percentage which is defined by the chip, voltage supply varies. The sensitivity supply decreases the chip with increase in delay. At the frequencies of higher operating, the sensitivity falls below negative to a zero value. The design of Modern complementary metal oxide of semi conductor is based on the consumption of reducing delay and the stable circuit design.

3 SOC Based SRAM Cluster Architecture

The below figure (2) shows the architecture of SOC based SRAM cluster. The designed system initially generates the network using network generator. This network generator basically uses the strategies of both user's clusterization and hierarchy optimization. After the strategy of hierarchy structure the Electronic Design Automation (EDA) generator will generate the test standards based on the access of tests. This generated components test will be extracted based on the standards. Next H-Array generator will generate the arrays of H-arrays for different cluster level sub networks. All this arrays will be cross compiled by mapping the cells. At last this will be saved in SRAM cluster.

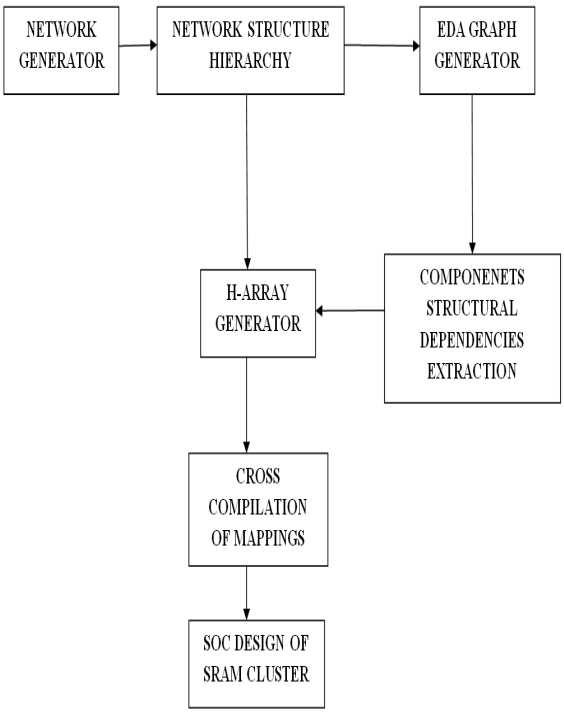

Fig. 2: SOC Based SRAM Cluster Architecture

By using both the user's clusterization and the hierarchy optimization strategy, network hierarchy is generated from network generator. EI clusters are controlled by the user and this is depending on the modules. This module will define the reliability and functionally of Cluster-DM by managing independently. In a modules, the group of EL clusters are represented as non-controlled EI cluster. Scanned signals perform the routing, when the clusters will be grouped together.

H-Arrays are generated by using H-Array generator. This H-Array generator is based on the cluster-level sub-networks which are correspondent to the Cluster-DMs. In system-DM, H-Array network is maintained. Cross compilation of mappings is done after arrays are generated from the H-arrays. Now this will be saved in the cluster of system on chip.

On-chip stores involve a larger division of the present superior microprocessors and handheld compact devices. Because of the expansion in off-state streams in every innovation era, reserves keep on accounting for a large measure of dissipation power in a microprocessor. Besides, as innovation scaling proceeds with, the cell turns out to be less steady because of lower supply voltage and expanded spillage. The soundness of SRAM cells is communicated by its static commotion edge. Consequently, the third piece of research is centered on the design of SRAM cells with low delay and high commotion edge without much corruption in performance.

4 Results

The below figure (3) shows the number of MOSFET's and independent nodes of SOC based SRAM cluster.

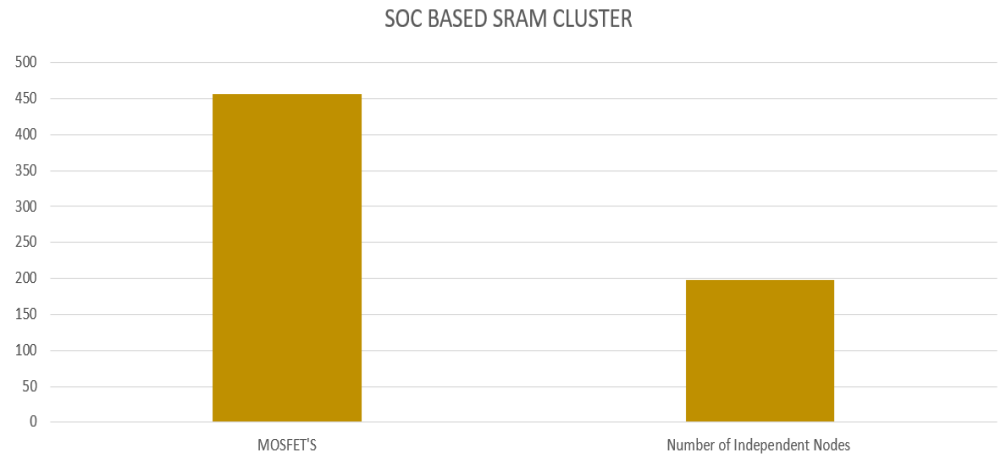

Fig. 3: Number Of MOSFET'S And Independent Nodes Of SoC Based SRAM Cluster

The below figure (4) shows the number of boundary nodes and total nodes of SOC based SRAM cluster.

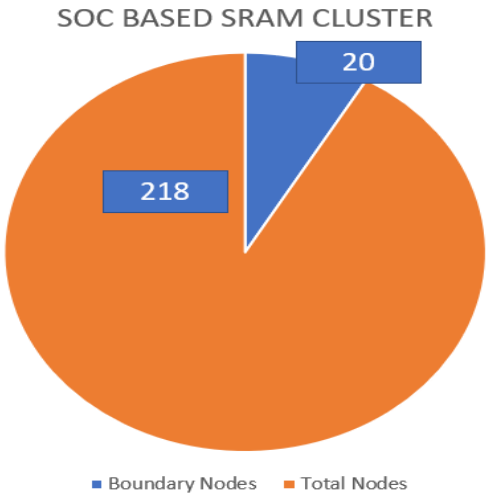

Fig. 4: Boundary Nodes And Total Nodes Of SoC Based SRAM Cluster

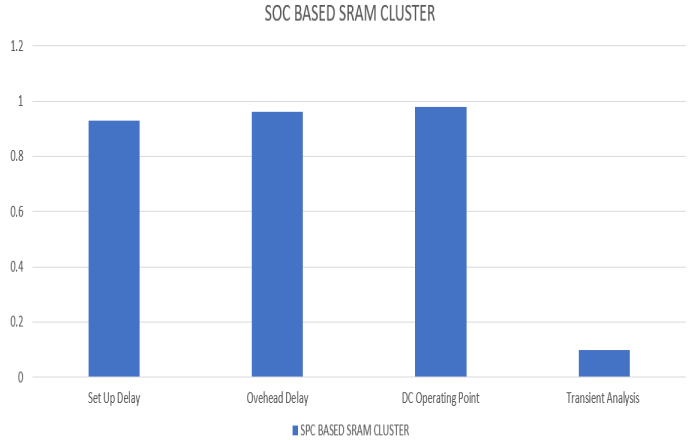

Fig. 5: Set Up Delay, Overhead Delay, Dc Operating Point And Transient Analysis Of SoC Based SRAM Cluster

5 Conclusion

Hence in this paper the design of SOC based SRAM cluster is implemented for reliability and functional safety. The designed system initially generates the network using network generator. After the strategy of hierarchy structure the electronic design automation (EDA) generator will generate the test standards based on the access of tests. Next H-Array generator will generate the arrays of H-arrays for different cluster level sub networks. All this arrays will be cross compiled by mapping the cells. At last this will be saved in SRAM cluster. Hence the SOC based SRAM cluster will improve the accuracy and reduce the delay in effective way.

References

[1] Ahmed M. Y. Ibrahim and Hans G. Kerkhoff, "An EDA Framework for Reliability and Functional Safety Management of System-on-Chips", 978-1-7281-4823-6/19/$31.00 c 2019 European Union.

[2] Ahmed M. Y. Ibrahim and Hans G. Kerkhoff, "An On-chip IEEE 1687 Network Controller for Reliability and Functional Safety Management of System-on-Chips", 978-1-7281-4718-5/19/$31.00 ©2019 European Union DOI 10.1109/ITC-Asia.2019.00032.

[3] PremachandranCS, Seungman Choi, Salvatore Cimino, ThuyTran-Quin, Lloyd Burrell,Patrick Justison , "Reliability Challenges for 2.5D/3D Integration: an Overview", 978-1-5386-5479-8/18/$31.00 ©2018 IEEE.

[4] Konstantin Shibin, Sergei Devadze , Artur Jutman, "On-line Fault Classification and Handling in IEEE1687 based Fault Management System for Complex SoCs ",978-1-5090-1331-9/16/$31.00 ©2016 IEEE.

[5] Poorani.P, Ms.Vijayashree.B M.E, "Implementation of AHB Bus Protocol For System On Chip Security", 978-1- 4788-7225 -8/15/$31.00©2015 IEEE.

[6] Buyoung Yun, Kang G. Shin, Shige Wang, "Thermal-Aware Scheduling of Critical Applications Using Job Migration and Power-Gating on Multi-Core Chips", 978-0-7695-4600-1/11 $26.00 © 2011 IEEE.

[7] L. Larcher, P. Pavan, " Flash Memories for SoC: an Overview on System Constraints and Technology Issues", Proceedings of the 9th International Database Engineering & Application Symposium (IDEAS'05) 1098-8068/05 $20.00 © 2005 IEEE.
[8] Haim Marom, "DF-RQA Practice for SoC", 0-7803.851 7-91041520.00 '2004 IEEE.
[9] J. L.Silva, R.M. Costa, G. H. R. Jorge, "RtrASSoc - An Adaptable Superscalar Reconfigurable System-On-Chip The Simulator", Proceedings of The 3rd IEEE International Workshop on System-on-Chip for Real-Time Applications ISBN 0-7695-1929-6/03 $17.00 © 2003 IEEE.
[10] Neil Bergmann, Peter Waldeck, John Williams , "A Catalog of Hardware Acceleration Techniques for Real-Time Reconfigurable System on Chip", Proceedings of The 3rd IEEE International Workshop on System-on-Chip for Real-Time Applications ISBN 0-7695-1929-6/03 $17.00 © 2003 IEEE.

Design of High Speed and Area efficient modified Kogge Stone Multiplier Using ZFL

S Baba Fariddin [1], Dr. Rahul Mishra [2]
{sbabafariddin@gmail.com[1], rahulmishra@aku.ac.in[2]}

Research Scholar, Dept of ECE, Dr. A.P.J. Abdul Kalam University, Arandia, Indore, M.P, INDIA[1]
Professor & H.O.D, Dept of ECE, Dr. A.P.J. Abdul Kalam University, Arandia, Indore, M.P, INDIA[2]

Abstract. In the applications of digital signal processing, multipliers plays important role. Basically, Finite field multiplier is the easiest of all operations in the finite field and most frequently used operation in arithmetic's. Hence in this paper the design of high speed and area efficient modified kogge stone multiplier is implemented. Multiplier and multiplicand are taken as input in this system. From both multiplier and multiplicand 1's and 0's are identified. Factoring technique is utilized to minimize switching energy and increase the speed of operation. Zeros finding logic will identify the zeros from obtained product. This product will be added using parallel prefix adder to minimize the area. Compared to ripple carry multiplier, kogge stone multiplier, the proposed kogge stone multiplier gives effective results.

Keywords: Kogge Stone Multiplier, Zero's Finding Logic, Factoring technique, Parallel Prefix adder.

1 Introduction

With the most recent upgrades in the zone of compact advanced applications and remote correspondence, power utilization investigation and techniques of reduction has become as noteworthy as speed, cost, and dependability in the circuit configuration level [1]. Energy utilization factors, which decide the measure of scattered devices, impact basic structure issues, for example, bundling and cooling necessities, power supply lines and limit, and the quantity of circuits that can be incorporated in a chip. The energy utilization in a computerized CMOS (Complex Metal Oxide Semiconductor) circuit comprises of dynamic power consumption, static power utilization, and short circuits power utilization. The prevailing power utilization is typically from the dynamic power, which is utilized in charging hub capacitances.

As this realizes that in the regions of system on chip and VLSI structures, the low power circuit plans is a significant issue. As the elements of transistors are contracted into the profound sub-micron area, the impact of static spillage flows turns out to be increasingly noteworthy. As the components of transistors are contracted into the profound sub-micron area, the impact of static spillage currents turns out to be progressively critical.

This part of intensity utilization can be controlled by novel plan, yet is transcendently taken care by process of technique. Two zones that has the focal point of dynamic research is

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dynamic logic. Hence, that the power diminishing properties of these systems could be joined, at that point where it should be Possible to deliver a logic structure procedure that is dynamic.

Scaling of transistor geometries have led to integration of millions of devices in a very small space, thus driving realization of complex applications on hardware and supporting high speed applications. This energy has revolutionized not only electronics, but also industry at large. In order to reduce power, many researchers, designers and engineers have come up with many innovative techniques and have given their ideas [2].

However, designers will need to budget and plan for power dissipation as a factor nearly as important as performance and perhaps more important than area. Low power techniques have been successfully adopted and implemented in designing complex VLSI circuits [3]. As the demand for faster, low cost and reliable products that operate on remote power source performing high end applications keep increasing, there is always a need for new low power design techniques for VLSI.

In digital signal processing applications, multiplier plays very important role in this present day generation. Not only in DSP (Digital Signal Processor) but also multiplier is used in various applications. With advancement in innovation, numerous scientists have attempted and are attempting to structure multipliers which offer both of the accompanying plan targets – rapid, low power utilization, less delay and subsequently occupancy of less area. Hence in this way making them reasonable for different fast, low power and smaller VLSI execution. The basic strategy of multiplication is "shift and add" calculation. In equal multipliers number of arithmetic operations to be included which is the primary parameter that decides the presentation of the multiplier.

Multiplication is a fundamental math activity for normal Digital Signal Processing (DSP) applications, for example, Fourier transform and Fast Fourier transform (FFT) [4]. To accomplish high execution speed, equal cluster multipliers are broadly utilized. Hence, these multipliers use more power. Power utilization has become a basic issue in the present VLSI framework plan. Subsequently the architects are expected to think power proficient multipliers for the plan of low-power DSP frameworks.

CMOS computerized gadget planners have a difficult prerequisite. They need to upgrade low engendering deferral and complex usefulness alongside low power circuits. The part of the arrangement is appropriate decision of working territories. The world is confronting amazing development of interest for vitality. One of the promising arrangements might be utilization of adiabatic logic guideline. The topic of adiabatic logic is utilized to increase the speed of operation. Voltage and current sources are utilized to power dissipation in parasitic opposition. In the gate capacitors the data is stored and power supply will be collected back.

This needs a network of oscillation for power supply. There are two essential issues or plan needs that must be tended to in any CMOS adiabatic circuit. The execution must bring about a vitality proficient plan of the consolidated power supply and clock. Addition, subtraction, multiplication and division are the essential operations of arithmetic system that are acted in any framework. The exhibition of numerous computational issues is regularly commanded by the speed at which an increase activity can be executed.

A multiplier is one of the key equipment which is most advanced signal processing frameworks. The significant activities in advanced sign preparing are shifting, convolution, and inward items. Generally, in DSP applications a multiplier assumes a significant role which is incorporated with advanced communication applications[5]. Among this all large number of gates are utilized to execute various activities in a regular circuit is irreversible. That is, each time a sensible activity is executed some data about the information which is evacuated or lost.

2 Review of Multipliers

The below figure (1) shows the structure of array multiplier. Array multiplier is circuit which uses array of AND gates and full adders to perform multiplication of binary operands is called as array multiplier. It is one of the widely used fundamental algorithms for multiplication. The array of AND gates present in the multiplier performs AND operation of multiplicand with each bit of the multiplier. These partial products produced by AND gates are shifted to left according to the position of multiplier bit.

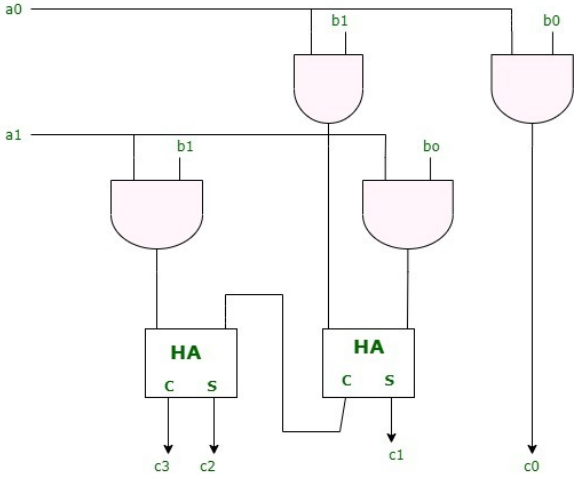

Fig. 1. Array Multiplier

The shifted partial products are summed up with a N-1 adders in parallel. However, addition performed in parallel there is large delay is introduced by ripple carry's. This is due to carry propagation in sequence of adders. The ripple carries are replaced with Carry Save Adder (CSA) to reduce the delay in array multiplication process. The CSAs compress the three number addition to one number addition so, that three operands are added at a time.

By using partial products in multiplication signals are generated based on shift and add techniques. The multiplier bit decides whether to shift the partial product or add the multiplicand to the product. Here this explains how conventional addition is performed. In order to fasten the multiplication procedure custom multiplication process divided into two sections. The first section focuses on producing partial products and the second section focuses on accumulation and addition of the partial products. Before adding of PPs (Partial Products) they need to be aligned in their corresponding positions by shifting.

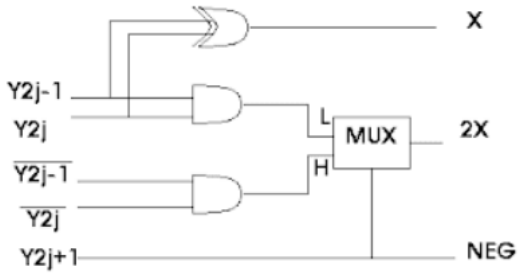

Fig. 2. Booth Multiplier

Booth technique is the most dominating method of multiplication for signed numbers. In this technique multiplication of both positive and negative operands are similarly performed. This technique is based on add-shift algorithm. In conventional multiplication procedures the number of partial products depends upon the operand size of the multiplier. If the size of the multiplier increases number of partial products also increases resulting in large delay when they get added to produce the end result. Since the delay of the multiplier is dominated by addition operation which is focused to reduce the number of additions occur in a multiplication task.

The multiplication of signed numbers must be observed through the operation to produce the appropriate sign of the result. Whereas in case of unsigned numbers there is no need to think about sign of the operands. If the multiplication of signed 2's complement numbers is performed in the way of positive number multiplication would results in incorrect output. Therefore, booth's algorithm introduced a technique to perform multiplication of signed numbers with the sign protection. In this technique the LSB (Least Significant Bit) of the multiplier are bi and bi-1 are tested at every clock cycle. If the two bits are zeros results shifting one bit position of the multiplier to the right. In case of sequence of 1's complemented, arithmetic operations like addition and subtraction are need to be performed at the edges of block of one's while changing from 1 to 0 and 0 to 1.

Booth's algorithm performs addition if last bits of multiplier encounters '0 1' and subtraction of multiplicand is needed if the LSB bits encounter '1 0'. This method efficiently works for signed numbers also. When multiplier consists of long blocks 1's this algorithm works well and effectively reduces number of additions performed. This algorithm clearly shown in above figure (2). In above figure (2) b, a, m represents multiplier, multiplicand and product respectively.

Almost every parallel multiplier performs multiplication function in three stages. Produces partial products using array of AND gates and applies different techniques to reduce the number of partial products. Then addition is performed to obtain end product. Baugh-wooley proposed a technique which is to be applied on the partial products to compress them. In order to reduce the number of partial products it arranges partial products in a triangular shape is called High Performance Multiplier (HPM) reduction tree. This arrangement results in a less wire length for connection of adders and propagates carry with less delay.

Braun multiplier is one type of parallel multiplier follows the fundamental procedure of multiplication, which is used manually. Its functioning is used in unsigned numbers only. It is also called as carry save multiplier. The structure of braun multiplier is shown in below figure. In this structure array of AND gates are used to produce partial products and full adders required for addition of partial products are reduced by column. This reduction in number of adders is achieved by using logic of carry save addition. It compresses the three number addition to two number addition. In Braun multiplier no shifting of partial products is performed.

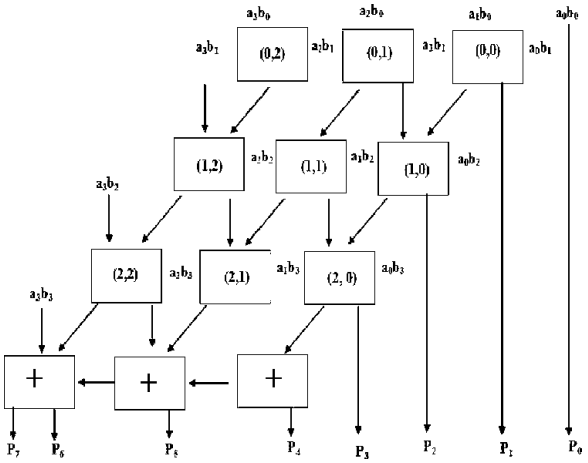

Fig. 3. Braun Multiplier

The high speed characteristics of column compression techniques have got the attractiveness of designers to implement multipliers with this technique. Dadda Multiplier was devised by a engineer Luigi Dadda. Dadda multiplier is based on the technique of column compression. This made some changes to the Wallace tree technique and implemented Dadda multiplier.

3 Modified Kogge Stone Multiplier Using ZFL

The below figure (4) shows the block diagram of modified kogge stone multiplier using ZFL. Multiplier and multiplicand are taken as input in this system. From both multiplier and multiplicand 1's and 0's are identified. Factoring technique is utilized to minimize switching energy and increase the speed of operation. Zeros finding logic will identify the zeros from obtained product. This product will be added using parallel prefix adder to minimize the area.

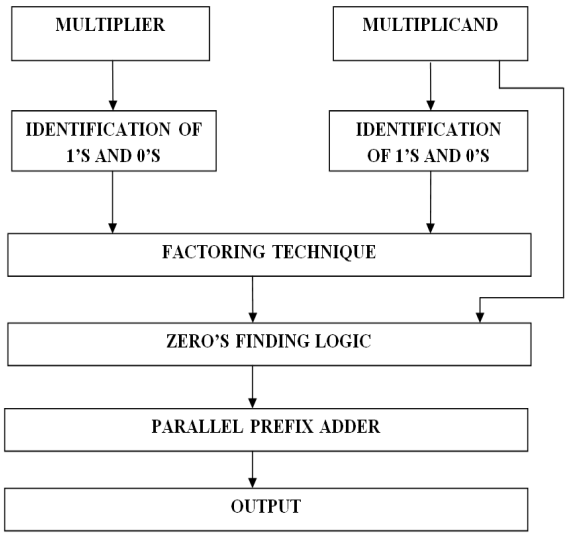

Fig. 4. Block Diagram Of Modified Kogge Stone Multiplier Using Zfl

Multiplication is one of the most critical arithmetic operations of the digital signal processor. Not only difficult but also consumes huge part of processors area and power. Therefore kogge stone multiplier is used to decrease the power and area consumption in highly essential processing units. Usually the result of multiplication of two operands of size n-bits requires 2n-bits for their result. In binary number representation MSB (Most Significant Bit) bits contains product value the lower order contains small values. Some multipliers are developed with fixed size calculates only bits of the multiplication function.

Multiplier circuits are model after the "shift and add" algorithm. In this algorithm, one partial product is created for each bit in the multiplier. Each input, partial product digit and result have been given a logical name and these same names are used as signal names in the circuit schematics. By comparing with various circuits, schematics, the behavior of the multiply circuit can be confirmed.

Partial products are the part of the multiplicand if the corresponding multiplier bit is '1', and all 0's when corresponding multiplier bit is '0'. Each successive partial product is shifted one bit position to the left. This generates all multiples of multiplicand with multiplier bits. The weights of the partial products vary according to the corresponding bit positions of the multiplier**.**

To the best of our knowledge, a factoring method has not been reported in the literature hence in the design of a finite field multiplier at an architectural level is implemented. A logic gate substitution technique is also used in our design to reduce the internal power consumption of the proposed digit-serial multiplier. The synthesis results show that new design has both the lowest logic and route delay consumption and the lowest total delay consumption among several similar existing works

In this parallel prefix adder operation is performed. The entire addition process is performed in three stages. The carry generation stage is controlled by the intermediate signals. At last the post processing stage gives output as sum and carry.

The below figure (5) shows the RTL (Register Transfer Level) schematic of modified kogge stone multiplier using ZFL. In this 'a' and 'b' are the 32 bit inputs and 'c' is the 64 bit output. Clock is used as input in this modified kogge stone multiplier using ZFL.

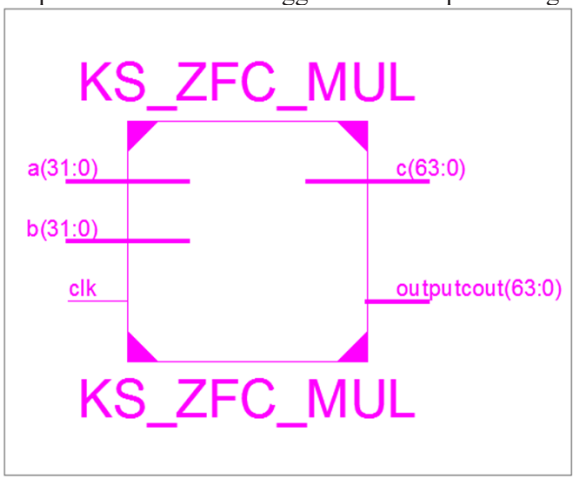

Fig. 5. RTL Schematic Of Modified Kogge Stone Multiplier Using ZFL

The below figure (6) shows the technology schematic of modified kogge stone multiplier using ZFL. Technology schematic is the combination of look up tables, truth tables, K-Map and equations.

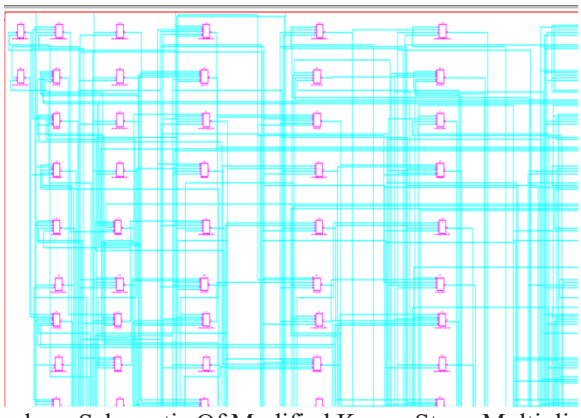

Fig. 6. Technology Schematic Of Modified Kogge Stone Multiplier Using ZFL

The below figure (7) shows the output waveform of modified kogge stone multiplier using ZFL.

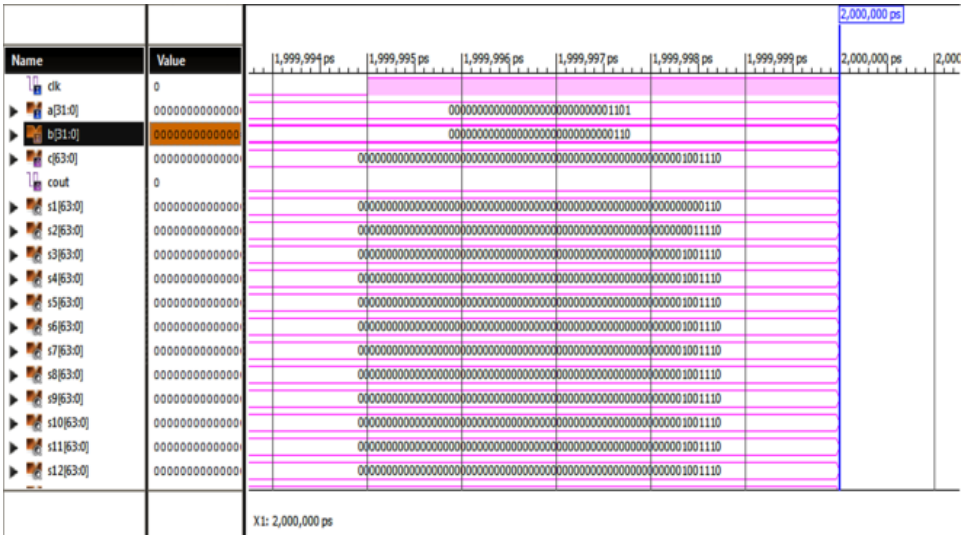

Fig. 7. Output Waveform Of Modified Kogge Stone Multiplier Using ZFL

4 Result analysis

The figure (8) shows the total delay comparison of modified kogge stone multiplier using ZFL and CLA multiplier. So, from this it can observe that total delay for modified kogge stone multiplier using ZFL is reduced very effectively.

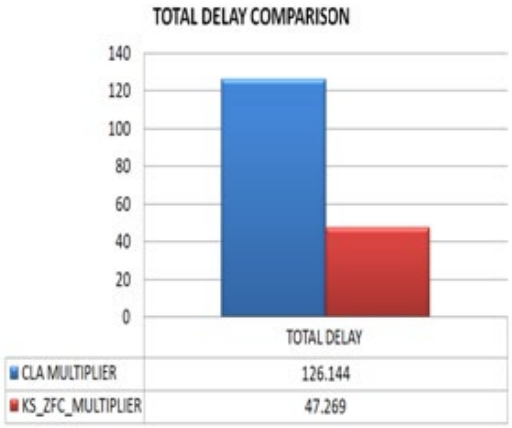

Fig. 8. Total Delay Comparison

The figure (9) shows the logic delay comparison of modified kogge stone multiplier using ZFL and CLA multiplier. So, from this it can observe that logic delay for modified kogge stone multiplier using ZFL is reduced up to 4.128ns and CLA multiplier up to 71.676ns. Hence, logic delay for modified kogge stone multiplier using ZFL is reduced very effectively.

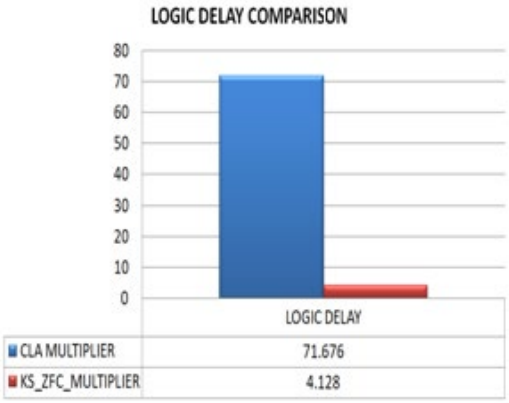

Fig. 9. Logic Delay Comparison

The figure (10) shows the route delay comparison of modified kogge stone multiplier using ZFL and CLA multiplier. So, from this it can observe that route delay for modified kogge stone multiplier using ZFL is reduced up to 43.141ns and CLA multiplier up to 54.468ns. Hence, route delay for modified kogge stone multiplier using ZFL is reduced very effectively.

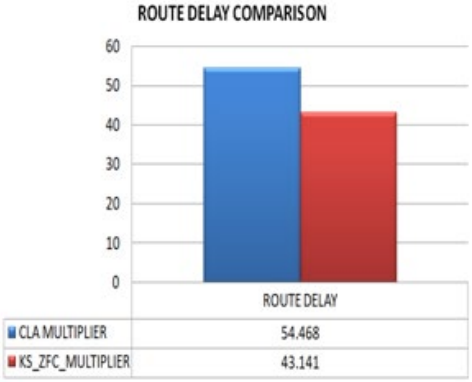

Fig. 10. Route Delay Comparison

5 Conclusion

Therefore in this paper the design of high speed and area efficient modified kogge stone multiplier is implemented. In this system, Multiplier and multiplicand are taken as input. 1's and 0's are identified from both multiplier and multiplicand. Factoring technique is utilized. To minimize switching energy and increase the speed of operation, zeros finding logic will identify the zeros from obtained product. Using parallel prefix adder this product will be added to minimize the area. Compared to CLA multiplier, the proposed kogge stone multiplier reduces the delay in effective way.

References

[1] Yamini devi Ykuntam, Katta Pavani, Krishna Saladi, "Design and analysis of High speed wallace tree multiplier using parallel prefix adders for VLSI circuit designs", from IEEE Xplore -49239, July 2020.

[2] Gunjan Jain, Meenal Jain, Gaurav Gupta, "Design of Radix-4,16,32 Approx Booth Multiplier Using Error Tolerant Application", 978-1-5090-3012-5/17/$31.00 ©2017 IEEE.

[3] "Design of area efficient and low power multipliers using multiplexer based full adder" S. Murugeswari , S. Kaja Mohideen, Second International Conference on Current Trends In Engineering and Technology - ICCTET 2014.

[4] H. Wu, "Bit-parallel finite field multiplier and squarer using polynomial basis," IEEE Trans. Comput., vol. 51, no. 7, pp. 750–758, Jul. 2012.

[5] H. Hinkelmann, P. Zipf, J. Li, G. Liu, and M. Glesner, "On the design of reconfigurable multipliers for integer and Galois field multiplication," Microprocessors Microsyst., vol. 33, no. 1, pp. 2–12, Feb. 2009.

[6] "Power-delay-area efficient design of vedic multiplier using adaptable manchester carry chain adder", Raghava Katreepalli , Themistoklis Haniotakis, 2007 International Conference on Communication and Signal Processing (ICCSP).

[7] P. K. Meher, "High-throughput hardware-efficient digit-serial architecture for field multiplication over GF(2m)," in Proc. 6th Int. Conf. Inf., Commun. Signal Process. (ICICS), Dec. 2007, pp. 1–5.

[8] "Design of area and delay efficient Vedic multiplier using Carry Select Adder", G. R. Gokhale , S. R. Gokhale, 2005 International Conference on Information Processing (ICIP).

[9] "Comparative study of performance vedic multiplier on the basis of adders used", Josmin Thomas , R. Pushpangadan , S Jinesh, 2005 IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE).

[10] "Design of high speed multiplier using modified booth algorithm with hybrid carry look-ahead adder" R Balakumaran , E Prabhu, 2004 International Conference on Circuit, Power and Computing Technologies (ICCPCT).

[11] "A vertical-MOSFET-based digital core circuit for high-speed low-power vector matching", Yitao Ma , Tetsuo Endoh , Tadashi Shibata, 2001 International SoC Design Conference.

[12] "Design of ultra low power multipliers using hybrid adders", Thottempudi Pardhu , N.Alekhya Reddy, 2001 International Conference on Communications and Signal Processing (ICCSP).

Smart Identification System on Internet of Things for User Authentication

Antonidoss A[1], Bhavani R[2], Prabha M[3], Manju S[4], Chinnadurai G[5]
{ aro.antoni@gmail.com[1], bhavaniramamurthi@gmail.com[2], prabha110292@gmail.com[3], smanju1102@gmail.com[4], china_durai@yahoo.co.in[5]}

Associate Professor, Department of Computer Science and Engineering, Hindustan Institute of Technology and Science, Chennai[1], Assistant Professor, Department of Information Technology, St.Joseph college of Engineering, Chennai[2], Assistant Professor, Department of Electronics and Communication Engineering, St.Joseph college of Engineering, Chennai[3], Assistant Professor, Department of Electronics and Communication Engineering, St.Joseph college of Engineering, Chennai[4], Assistant Professor, Department of Electronics and Communication Engineering, Rajiv Gandhi College of Engineering, Chennai[5].

Abstract. Regarding that, clients agreed on the value of reliable Internet access regardless of location, mode, or time. Individuals can now access a few top-tier administrations through the Internet of Things (IoT), which is a heterogeneous network characterized by machine-to-machine communication. Regardless of how the devices are used to set up the communications, the clients should be considered the true producers of data and purchasers of the yield data. As a result, clients should be viewed as a critical component of IoT; as a result, client distinguishing evidence, verification, and approval are required. In any case, the client Index measure is too perplexing, given the clients' apprehension about sharing their confidential and private information. However, some of their devices should be able to access this personal information. Appropriately, an unbiased method for understanding clients and coping with their personalities is important. Furthermore, the customer plays a minor but significant role in laying the groundwork for the character distinguishing proof and ensuring the consistency of open services. The main goal of this paper is to create a new identity management system (IdMS) for the Internet of Things. The main commitments of this paper are the suggestion of a gadget acknowledgment calculation for client identifiable evidence, the suggestion of a different identifier configuration, and a hypothetical IdMS framework.

Keywords: Authentication, identification algorithm, identity management, internet of things.

1 Introduction

The web is the solitary interlinked framework that permits worldwide correspondence between gadgets through a few standard conventions and associations of various kinds of organizations (government, business, scholarly, etc.,). In the first place, the web permitted correspondence through messages and addressed as static sites. Be that as it may, these days, there are numerous executions of the web, which is noticed anyplace in a few types of life as a bunch of gave applications and administrations by meeting clients' prerequisites paying little heed to the area and the time. This is an immediate result of the client and components digitalization [1].

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The web innovation request is reflected in every gadget of clients. It is getting convenient and drawing near to the client more than everything and like never before. These days, savvy gadgets give a consistent overall association, and this association gets necessary in ordinary lives. On account of the expanding number of associated gadgets, there is a need of an instrument permitting self-governing correspondence between gadgets [2]. The IoT is considered as an empowering arrangement. IoT is an organization permitting direct association between gadgets utilizing a novel identifier for looking for data. The yield of Machine-to-Machine (M2M) correspondence compares/created to/by clients [3]. Also, the clients are the owner of data; in this manner, client distinguishing proof and confirmation, secure correspondence foundation, and assets access are fundamental.

The clients address a fundamental part of the Internet of Things (IoT), and hence, they are viewed as shrewd things that make, assemble and oversee data utilizing individual or/and normal gadgets, and subsequently, clients ought to be recognized in the IoT likewise like different things (gadget, sensor, and actuator). Clients are firmly engaged with IoT since they influence the present ubiquitous web, and they make electronic gadgets and make more fitting UIs. Since the client is a vital part, his ID is obligatory. This addresses an alluring region for examination to discover answers for personality the board frameworks that save exertion and time.

Actually, the IoT is an arrangement of a limitless arrangement of connected things (like actuators, sensors, gadgets) that offer a few types of assistance through the web. Therefore, IoT addresses another chance for business, gadgets' execution, prompting administrations for clients. The presence of a few designs and conventions for sensors and gadgets connection in IoT and the absence of uniform arrangement, show the need for overseeing characters to guarantee the achievement of things association model [4]. As per various proposed models, client ID and verification are reliant on network geography, offices, and guidelines [5].

To resolve this problem, this paper proposes a new IdMS. By perceiving items in IoT, the proposed model means to separate clients and have client-focused administrations. Singular Thing Sign-On is a feature of the IdMS. The proposed model limits the scope of the inquiry to IoT and M2M.

It focuses in particular on the IdMS, which considers all aspects of IoT. (for instance, individuals, gadgets, and non-human interface gadgets like sensors and actuators). The distinguishing proof and evidence mechanisms, as well as its inquiries and recommendations, are depicted.

We also look at the client ID issues and suggest a new design for the Single Thing Sign-On Identity Management System (IdMS), which is focused on the end-user and is a client-arranged support framework. By distinguishing only one of the client's objects, the recommended design allows perceiving the client and his appointed administrations (gadget, sensor, etc.,). In addition, to differentiate the client, we suggest a calculation called Device Recognition (DR). To illustrate the concept, the DR measurement is hypothetically evaluated. The results support the relevance of the research issue.

The IdMS has finally been depicted. The IdMS requirements (client and framework requirements) are highlighted in particular. As a result, a new IdMS method is proposed that deals with the characteristics of items.

2 Analysis of Identity

2.1 Recognization

In today's world, personality is the window through which a client can communicate with his or her articles and harassment administrations. The personality definition is extended to things in the IoT's particular circumstance. Personality is regarded as an endpoint that allows concerned things to openly and effectively access endpoints [6]. Clients can use and change information through the well-known proof cycle, which also allows for customization of administrations and communications [7]. ID in IoT partners assigns an identifier to an address as appropriate. The quality of a thing, such as sensors with the name Radio Frequency Identifier, is an unmistakable property. The application space relies on the identifier, which distinguishes one thing from another. Since the identifier's sole purpose is to view items in a unique way, it should be strong. The frail identifier gives various items in the system its motivation [8]. The IdMS is in charge of creating, managing, and receiving personalities [9].

2.2 Authentication

Validation is known as the creation of a personality between related items (clients or gadgets). Because of the variety of items, there is a criterion for attack resistance and a minor response for verification. The client and gadget validation are each depicted in detail in the following sections.

Client Authentication: The testing period approves the client's displayed personality to see whether it is true or not by referencing accreditations. The word "certification" refers to confirmation device or identity verification. It is a test or validation measure stage that aids in the confirmation of the client's identity in relation to the system ID (for example, network address). The certification is crucial for validation since it displays a snippet of data (secret word) or specific properties (such as NFC and RFID labels or voice/face recognition). Confirmation can include one or more certifications, as well as accreditation [10]:

- Something is gained: the client hands over an unmistakable item containing the client's secret data, which is necessary for the confirmation contact. A USB stick, a brilliant card, or any unmistakable item may be used. Since the secret data is known for the secret word, there is no compelling reason to remember it. However, since clients can exchange articles and objects can be misplaced or stolen, how can you ensure that it gives the correct client ID [11].
- Possession of something:The client provides biometric data, which includes specific physical and social properties such as speech, advanced picture of the face, retina, unique mark, and so on. Despite the fact that biometric data is new and intended to be unaltered, there is a risk associated with its intentional or unintentional use (taken, duplicated, or misrepresented) [6].
- Something that is well known: The client provides confidential information (for example, username/secret key, designs, and graphical images). These techniques allow the client to remember private data, which is usually difficult to keep hidden from other clients [6].

2.3 Accounting and Authorization

The approval period point is to verify whether a specific client has the option to use a specific asset (information or gadget), while the verification interaction point is to validate client personality. The approval period is carried out in different locations depending on the security strategy (i.e., there is a comparison between the validated thing (for example, asset access) authorizations and the asset security strategy [12].

There can be four different types of user access techniques available.

- Quality Based Access Control: The character credits (rather than the actual personality) give the way to permitting admittance to a specific asset. Consequently, this method can't recognize a particular personality. To build the security viewpoint, all things, including clients, exercises are archived and saved. The methodology is named bookkeeping, and from a security point of view, it is compelling since it is executed paying little mind to the achievement or the disappointment of the confirmation interaction, and it is considered as evidence if there should arise an occurrence of a security examination.
- Discretionary and Obligatory Access Control: The consents provider is the point of convergence here. In most cases, an important executive determines the authorizations for each framework asset in mandatory access control. Regardless, in discretionary access control, the client establishes asset entry authorizations by contacting the asset's owner.
- Work Based Access Control: A new layer called the job layer is introduced to deal with the consents mission, and the jobs are considered authorization subsets. The permission to enter is linked to the work rather than a particular asset. As a result, the asset has a variety of jobs that allow it to operate based on a few authorization subsets.
- Access Control Lists: this strategy characterizes a rundown of consents doled out to an asset. This strategy figures out which clients are approved to admittance to assets, just as what activities are allowed on specific assets. By and large, an entrance control framework addresses a steady method to proclaim access authorizations in a network characterizing things-assets consents. The primary impediment of this methodology is the intricacy of dealing with a colossal number of assets and things.

3 Smart Identification System

This segment depicts the proposed Smart Identification System (SIS) for recognizing the client. It worth referencing that the proposed SIS calculation doesn't dispose of the most mainstream and notable ID strategy: the username and secret key, yet it very well may be seen as a strengthening technique to mechanize (without client intercession) the verification interaction, nonetheless, the manual validation is still alternatively utilized. Figure 1 presents the SIS calculation.

Before all else, the calculation appoints for every client a Smart Sheet (SA). SA is a rundown of distinguished gadgets of client A. Note that SA is novel. Every gadget D is put away in SA list with an extraordinary number inside [1,..,m] (to show there are m kinds of gadgets). Likewise, for every gadget type Dm there is a bunch of unmistakable identifiers types id, which is put away in SA list, with a one of a kind number inside [1,..,n]. Consequently, all gadget character sorts of the client (IdnDm) are recorded in SA list.

At whatever point a recognizable proof solicitation is gotten from one of the recorded gadgets in a particular space, a programmed search begins to distinguish other client gadgets and to check the quantity of accessible client gadgets in the neighborhood area. For this situation, the client can determine the security level by taking care of the quantity of gadgets needed as client character confirmation. For example, the client recommends the recognizable proof of 2 out of 4 individual gadgets all the while to be a standard for his programmed

personality ID. Since the client is a piece of IoT, he is considered as a guidelines chief in the framework, concerning his inclinations.

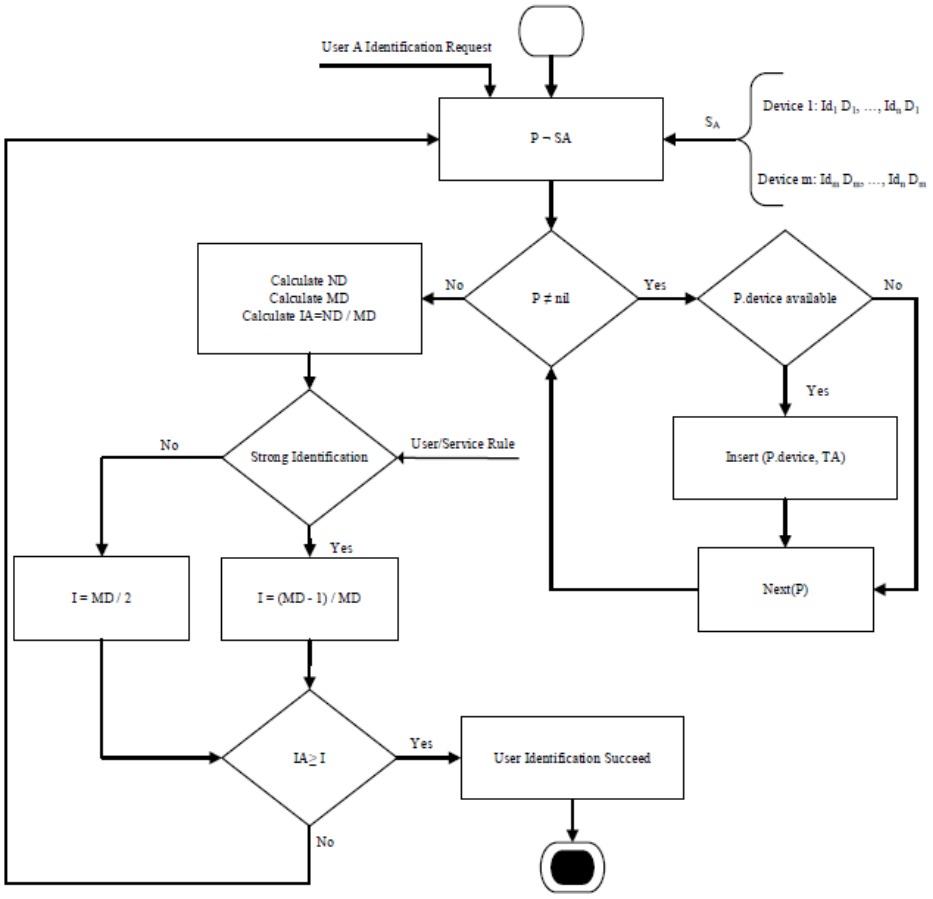

Fig.1. Smart Identification calculation

At that point, the calculation identifies and checks the quantity of accessible gadgets of client An and recorded in TA' sheet. From that point, the calculation ascertains the IA list addressing the proportion between the quantity of gadgets in SA sheet and the quantity of gadgets in TA sheet at a given time. At last, the calculation checks the required distinguishing proof level. In the present circumstance, there are two potential cases: solid and frail ID dependent on rules of client or administrations.

- Solid distinguishing proof: This record (addressing Index of Strong ID) asserts that all client gadgets ought to be accessible (identified and perceived) aside from one. In this way, the calculation analyzes the IDR list to IST record. In the event that I ≥ IST, the client recognizable proof succeeds. Something else, the calculation is executed iteratively until the assistance break ends.
- Powerless ID: The IWK file (addressing Index of Weak ID) asserts that at any rate half of the client gadgets ought to be accessible (identified and perceived). Hence, the calculation analyzes the IDR file to IWK list. Assuming I ≥ IWK, the client

recognizable proof succeeds. Something else, the calculation is executed iteratively until the assistance break ends.

Appropriately, the recognizable proof rate addressed by Equation (1) is utilized to evaluate the Smart Identification calculation.

IDR = NG/MG (1)

Where, IDR: characterizes the coefficient addressing the recognizable proof rate.

NG: characterizes the quantity of distinguished gadgets related with a particular client. Officially, NG is the quantity of gadgets in TA' sheet.

MG: characterizes the quantity of whole predefined gadgets needed for client ID. Officially, MG is the quantity of gadgets in SA' sheet.

Since the ID coefficient IDR of Smart Identification figuring depend on the quantity of perceived client gadgets, it is required that this coefficient should more like '1' to distinguish the client himself.

4 Smart Identification calculation Analysis

As referenced already, the Smart Identification computation doesn't reject the normal and mainstream login strategies. Nonetheless, the calculation is new, and it saves exertion and time since it presents a modernized technique for client distinguishing proof and validation. In addition, the shortfall of some client gadgets (lost or taken) permits the disappointment of the distinguishing proof and confirmation measures. Thusly, the admittance to the client's private data or administrations will be unapproved, on the other hand to the secret phrase saved money on the gadget. As an insurance against the non-accessibility of some client's gadgets at the confirmation time, the Smart Identification figuring permits an elective recognizable proof by entering the secret phrase (predefined by the client) physically secret word passage. In this way, the calculation permits the client's recognizable proof taking all things together cases. The recommended ID rate I see Equation (1) permits programmed client distinguishing proof and validation.

5 Heterogeneous IoT Networks Recognition Schema

The heterogeneous organizations and structures are talked about in this part. It begins by summing up the proposed ID plans in the writing by posting their benefits and weaknesses. In this manner, we recognize research difficulties. Along these lines, we acquaint another identifier design with meet the goal of a solid answer for personality the executives. At last, we assess the recommended identifier design.

5.1 Heterogeneous Internet of Things Networks

The Internet of Things (IoT) is a series of various interconnected things (mechanical or advanced), actuators, sensors, or only things that obey the trademark "all can be linked to the Web." The Internet of Things (IoT) provides an eco-system of services and smart programming that are used to improve and streamline human life and daily tasks. The Internet of Things (IoT) is a strongly linked development to M2M. IoT is placed as a framework of establishing and supporting M2M connections [13]. In [14], the nuances of M2M engineering are discussed.

5.2 Identification Format Formulated

A pre-owned identifier incorporates the total data of the personality for something specific. All in all, the identifier characterizes the space, client, his gadget, and non-UI gadget remarkably. This identifier doles out the owner to things as proposed in [15]. Thing in IoT addresses clients, data, or gadgets; in this manner, it is obligatory to realize the thing ascribes. Everything is related with a novel identifier and set of traits.

Our recommended identifier design, which consolidates halfway identifiers, is:

Gadgettype‖GDinterface‖LKinterface‖DomainGId‖GadgetId‖ClientId

where,

- Gadgettype: demonstrates a fractional identifier that characterizes the sort of the gadget (for instance, human client, PC gadget, actuator, sensor, etc.,).
- GDinterface: demonstrates a fractional identifier that characterizes the worldwide interface or possession, and it is vital because of gadget versatility.
- LKinterface: demonstrates a fractional identifier that characterizes the neighborhood interface or proprietorship, and it is fundamental because of gadget locatio
- DomainGId: shows a fractional identifier that characterizes the area of thing enrollment, and it is essential because of the presence of certain spaces having a similar identifier yet enlisted in various Identity Providers.
- GadgetId: demonstrates a fractional identifier that characterizes an interesting identifier for every gadget.
- ClientId: demonstrates a fractional identifier that characterizes a special identifier for every client (gadget proprietor) in light of a specific area.

The suggested identification design aims to improve the client experience by allowing for programmed assisting that would be less complex and time-consuming than all other methods of client identification and association currently available. Despite the fact that the relationship seems normal and simple, it conceals a perplexing acknowledgement and reconciliation. Such complications were concealed, and the client's perspective is ignored.

6 Framework for Managing Identity

Identity Management System is characterized as a bunch of programming parts and coordinated hand-worked exercises. The reason for IdMS is the distinguishing proof and observing of processing assets usage and the help of information trustworthiness and security. Besides, IdMS includes numerous exercises, for example, produce testament, oversee trait and job, validate and control access, and so on IdMS encases a bunch of conveyed programming segments and a huge number of systems administration conventions. In addition, since the IdMS interfaces with business segments, its administration methodology should adjust to business morals, HR, and laws guidelines. Hence, IdMS plan and organization ought to consider the refered to standards to carry out effective IdMS. The associations between the IdMS administrations layer and things layers ought to be secure, and the entrance ought to be controlled.

6.1 Architecture in IoT

The whole article suggests IdMS engineering, which includes a single layer. A list of IoT strategies is included in the IdMS engineering. Figure 2 illustrates the IdMS engineering. IdMS examines a person's personality by examining their character and characteristics. We present a domain identifier (DomId) that is dependent on the application area and supports climate data. The suggested engineering's main benchmarks were linked to both the board's

location, character affiliation and preparation, confirmation access and oversight, and, inevitably, deep rooted management using personalities and abilities as knowledge sources.

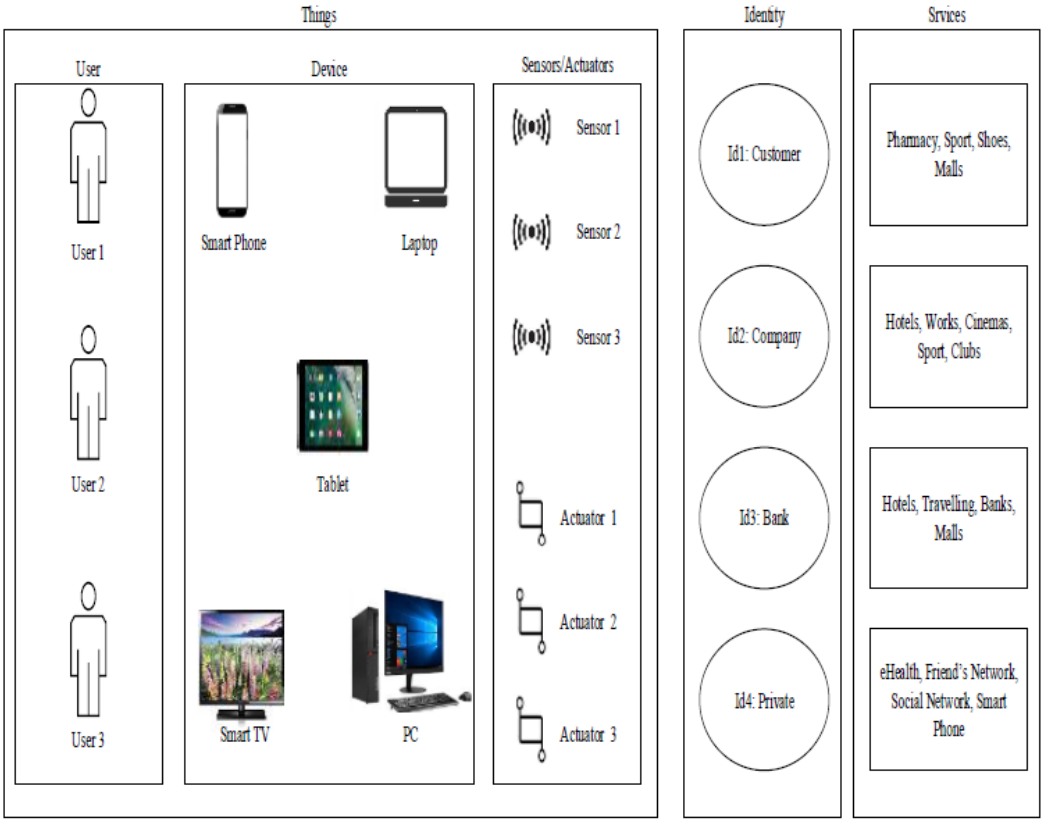

Fig. 2. IdMS architecture

In principle, the conceptual IdMS framework is yet another empowering engineering for handling characters in the Internet of Things. Nonetheless, for the assessment and review of IdMS proficiency, the execution of the IdMS model and its acceptance is critical. The proponents of the proposed IdMS lean on Information Communication Technologies to include storage space, operating procedures, clear model antiquities and administrations, and heterogeneous organization correspondence, among other things. As a result, a model for data connection and coordination among various members is important.

Conclusions

This paper defines the Internet of Things and describes the ID, validation, and acceptance cycles. It depicts the importance of smart IdMS implementation and suggests a fitting use case scenario to clarify and visualize the ID cycle's challenges. As a result, a Smart Identification System (SIS) calculation is proposed in order to identify gadgets in a timely and error-free manner. We suggested a factor that characterizes the gadget recognizable proof rate to test and examine the SIS estimate.

The report specifically portrays heterogeneous organizations and their engineering in the following section. Similarly, we differentiate the review problems by addressing the familiar proof plans and identifier designs suggested in the writing. Finally, we'll show you another identifier design that helps to personalize board perspectives. There is a conversation more about suggested identity design's evaluation in terms of gadget form, gadget versatility, and system adaptability.

The study presented a new and broader perspective for characterizing that panel in IoT in order to allow modernized communication between different items in IoT while saving clients' time and effort.

References

[1] Baker S.A., Nori A.S. (2021) Internet of Things Security: A Survey. In: Anbar M., Abdullah N., Manickam S. (eds) Advances in Cyber Security. ACeS 2020. Communications in Computer and Information Science, vol 1347. Springer, Singapore. https://doi.org/10.1007/978-981-33-6835-4_7

[2] Wang W., Tao X. (2018) A User Identification Algorithm for High-Speed Rail Network Based on Switching Link. In: Li K., Li W., Chen Z., Liu Y. (eds) Computational Intelligence and Intelligent Systems. ISICA 2017. Communications in Computer and Information Science, vol 874. Springer, Singapore. https://doi.org/10.1007/978-981-13-1651-7_48

[3] Mnasri, W., Azaouzi, M. & Romdhane, L.B. Parallel social behavior-based algorithm for identification of influential users in social network. Appl Intell (2021). https://doi.org/10.1007/s10489-021-02203-x

[4] H. Ning, Z. Zhen, F. Shi and M. Daneshmand, "A Survey of Identity Modeling and Identity Addressing in Internet of Things," in IEEE Internet of Things Journal, vol. 7, no. 6, pp. 4697-4710, June 2020, doi: 10.1109/JIOT.2020.2971773.

[5] D. Ghoshal, "A proposed technique of online face authentication to be used for the user identification," 2012 International Conference on Computer Communication and Informatics, Coimbatore, India, 2012, pp. 1-5, doi: 10.1109/ICCCI.2012.6158786.

[6] A. Theodouli, K. Moschou, K. Votis, D. Tzovaras, J. Lauinger and S. Steinhorst, "Towards a Blockchain-based Identity and Trust Management Framework for the IoV Ecosystem," 2020 Global Internet of Things Summit (GIoTS), Dublin, Ireland, 2020, pp. 1-6, doi: 10.1109/GIOTS49054.2020.9119623.

[7] Burmann C., Riley NM., Halaszovich T., Schade M. (2017) The Concept of Identity-Based Brand Management. In: Identity-Based Brand Management. Springer Gabler, Wiesbaden. https://doi.org/10.1007/978-3-658-13561-4_2

[8] G. Ben Ayed, "Digital Identity Metadata Scheme: A Technical Approach to Reduce Digital Identity Risks," 2011 IEEE Workshops of International Conference on Advanced Information Networking and Applications, Biopolis, Singapore, 2011, pp. 607-612, doi: 10.1109/WAINA.2011.118.

[9] H. Kim and E. A. Lee, "Authentication and Authorization for the Internet of Things," in IT Professional, vol. 19, no. 5, pp. 27-33, 2017, doi: 10.1109/MITP.2017.3680960.

[10] M. Shahzad and M. P. Singh, "Continuous Authentication and Authorization for the Internet of Things," in IEEE Internet Computing, vol. 21, no. 2, pp. 86-90, Mar.-Apr. 2017, doi: 10.1109/MIC.2017.33.

[11] "IEEE Standard for Authentication in Host Attachments of Transient Storage Devices," in IEEE Std 1667-2009 (Revision of IEEE Std 1667-2006) , vol., no., pp.1-125, 26 March 2010, doi: 10.1109/IEEESTD.2010.5438723.

[12] W. Lei and L. Xu, "Research and implementation of access control model of internet of things," 2016 5th International Conference on Computer Science and Network Technology (ICCSNT), Changchun, 2016, pp. 102-106, doi: 10.1109/ICCSNT.2016.8070128.

[13] Song, J., Kunz, A., Schmidt, M. et al. Connecting and Managing M2M Devices in the Future Internet. Mobile Netw Appl19, 4–17 (2014). https://doi.org/10.1007/s11036-013-0480-9

[14] R. Zheng, Y. Zhao and B. Chen, "Device-Free and Robust User Identification in Smart Environment Using WiFi Signal," 2017 IEEE International Symposium on Parallel and Distributed Processing with Applications and 2017 IEEE International Conference on Ubiquitous Computing and Communications (ISPA/IUCC), Guangzhou, China, 2017, pp. 1039-1046, doi: 10.1109/ISPA/IUCC.2017.00158.

[15] S. Pal, M. Hitchens and V. Varadharajan, "Towards the Design of a Trust Management Framework for the Internet of Things," 2019 13th International Conference on Sensing Technology (ICST), Sydney, NSW, Australia, 2019, pp. 1-7, doi: 10.1109/ICST46873.2019.9047734.

Automated Sierpinski Gasket Model using Mathematical Formulations for Ku and K Band Applications

Lakshmi bhavaniK[1] , Siddaiah P[2]
{konduribhavani@gmail.com[1], siddaiah_p@yahoo.com[2]}

Research Scholor,Department of ECE, ANU College of Engineering and Technology, Acharya Nagarjuna University, Guntur[1]
Professor & DEAN, Department of ECE , ANU College of Engineering and Technology, Acharya Nagarjuna University, Guntur[2]

Abstract: Fractal Antenna are embeds the different scenario of the antenna structures such M, C, O, Triangle, Step, star, and hexagonal etc. in practical application choice of interest. The design scenario improvised with frequency of operation of the different bands ensuring the correct size of the patch, and substrate with design criteria from the mathematical formulations. The proposed Antenna utilizes the Sierpiński gasket with the iteration varying from 0, 1, 2, 3 and 4. The design factor for the size of the antenna is calculated using the mathematical formulations with cut-off frequency at 15, and 17 GHz. This antenna improvised with two set of transmission line with the iteration from 0-1, 3-4 as step induced transmission line, and M shaped transmission line patch as generalist view. The novelty of design model utilizes the python as automated model for each set of iteration criteria and gaps from each subset of Sierpiński gasket. Each set of the antenna parametric values are observed with antenna design lying the Ku and Ka respectively

Keywords: Fractal Antenna (FA), Sierpinski gasket, Ku and K Band, Voltage Standing Wave Ratio (VSWR), Gain (G).

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1 Introduction

Long-range and adaptable interchanges provide wideband and conservative capabilities. Hand-scaled media are better suited for modern approaches. Fractals have the properties that obey all the preceding them, and appear in order to exhibit the new innovation. Utilizing pre-calculated geometrical shapes as radiators increases pre-utility. Analysts have been investigating and demonstrating how fractal wires can be applied in various applications over the years. A large percentage of the proceeds went into receiving wires with unique characteristics. Radiators with simpler settings and less pressure now appear to receive desired attributes two different methods have been suggested to attain the goal of wider band operation: This innovation can be applied to antenna apparatus with varying forms, as well as those having openings, in several different ways to help solve reception problems, including the shape of ground or antenna shapes. Mandal and Sarkar Pritam have developed a hi-band implementation using different ground structure and extruded base for the additional antennas [1]. A “U” shaped opening to the antenna with ground plane for multi-band operation have proposed an open-space transmission upgrade that keeps super wideband signal execution in pace with changing technology[2], [3]. For data capacity and wire scale reduction multiple fractal forms are utilized. To get high levels of transfer speed, the self-closeness and transferability of fractal geometry are essential [4], [5]. One may consider self-similitude to be a form that is divided into duplicate sections, as well as each of the parts representing the whole. Widespread and multiband reception is possible with this adapter. The capacity of the space used by objects diminishes as they have extended electrical duration, but is entirely filled and uses no additional space. Due to tangled and powerful data transmission, people are interacting with the fractal results, creating discontinuities in the process.

2 Literature Survey

The scenario for achieving wide band applications for an antenna with concentric circular structure and quad model is iterated with phase 2.The equilateral section is implemented with quad patch which has the size of 50*50 mm^2 with the FR4 substrate thickness of 1.2 mm and dielectric constant of 4.4. The bandwidth observed is more than 8GHz hence utilized with different applications such as 3G, 4G etc. [6].

The receptacle is created using the Fire-resistant evaluation 4 dielectric material (twelve by twenty-micron and with a thickness of one and sixteenth of a millimeter) on the Relative-permittivity 4.4 dielectric substrate. This substance, also known as fractal fixed side, incorporates multifractal formulas on its face, while single ring-meta surfcaster puts on the posterior surface. 2.45GHz and 3.17 GHz on S channel, 5.46 GHz on C band, 6.51 GHz on X band, 10.37 GHz on WLAN and other wireless systems. The functional characteristics are estimated with the features considered from the above bands of frequencies [7].

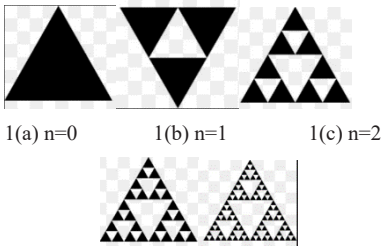
This paper shows how to design a smaller receiving wire that can be effective using any reception strategy and has three reverb frequencies in the S-band. One way to enhance the Minsky fractal system is to provide a DGS (deflected ground system) the receiving wire was built on Rogers RT/duroid ground with a 2.2mm dielectric. components of the last receiving wire has decreased by around 67% whereas square connector applications suffer by means of a reduction in 21X19mm to 67% 75-ohm input impedance on the S11 = 15.0 dB, 2.44 GHz influences the return [8].

Author describes about the fractal antenna design using quad band circular patch model which are operated at S and C band range of applications. With the current operated frequencies 2.86GHz, 4.76GHz, 6.50GHz and 7.42GHz and bandwidth observed of 110MHz and 90GHz for the performance parametric such as S11, VSWR and gain with four frequencies for the designed antenna to be acceptable level. With other factors considerations we have utilized an insert line feeding technique and other substrate parameters such as FR4 with designed dimensions calculated with frequencies of operations as 35X44.92X1.6 mm^2 and relative permittivity of 4.4[9].

Represents a novel model for the Murkowski and Meander curves based hybrid fractals which are utilized in current mobile applications for delay tolerant sensor networks and ADHOC networks. These curves contribute different frequencies of operations as mentioned as 1.98 GHz, 5.94 GHz, 10.61 GHz, 12.73 GHz, 14.85 GHz. These designs provide a better relational aspects on the performance for the parametric criteria as return loss, radiation pattern, current distribution, VSWR and gain are modelled and observed. The maximum bandwidth of the designed antenna are 2.83 GHz and 2.4 GHz at gain of 9dB. With current design of gain range of frequency at 2.4 GHz with 9dB would provide a different application scenario such as WI-MAX, WI-FI, WLAN 80211b/g [10].

3 Sierpinski Gasket Antenna Design

The proposed antenna design structures aims to follow the design consideration on sierpinski gasket where each triangle and its sub-triangles are estimated with the binomial equations as $(x+y)^{n-1}$ where n is the iterations for which triangles are generated at every stage. Assuming the triangle with n = 0 represents plain triangle and for n=1 it represents a triangle as shown in figure 1(a), for n=2 figure 1(b) and for n=3 figure 1(d).



1(a) n=0 1(b) n=1 1(c) n=2

1(d) n =3 1(e) n=4

Fig. 1. Representing the Sierpinski Gasket with iterations from n=0 to 4.

These sections of the triangular model is implemented using python code for specific values of gaps observed for each triangle on each iterations.

3.1 Algorithm for sierpinsiki gasket

- Create a triangle with the vertices and length of the each side as “a” since equilateral.
- For the iteration at each section value we need to choose the design model with angle of rotation at 60, 120 and 240 which will be iterated based on n=0, 1, 2, 3 and 4.

- *Mathematical fomulations are :*

$$Main_{SG} = ET_r(x, y, -r)$$

$$SubSG = ET_r(n, x, y, r)$$

$$ET_r(n, x, y, r) = ET_0\left(n-1, x - rcos\left(0 * \frac{pi}{3}\right), y - rsin\left(0 * \frac{pi}{3}\right), 0.39 * r\right) \quad (1)$$

$$ET_r(n, x, y, r) = ET_1\left(n-1, x - rcos\left(0 * \frac{2pi}{3}\right), y - rsin\left(0 * \frac{2pi}{3}\right), 0.39 * r\right) \quad (2)$$

$$ET_r(n, x, y, r) = ET_2\left(n-1, x - rcos\left(0 * \frac{4pi}{3}\right), y - rsin\left(0 * \frac{4pi}{3}\right), 0.39 * r\right) \quad (3)$$

- *Calling functions:*

$$ET_r(0,0,-r)$$

$$ET_r(n, 0,0, -0.45 * r)$$

To maintain certain gap with value of 0.39 radius and 0.45 as whole number which either contracts or increase the size.

4 Antenna Design Parametric Formulations

4.1 Antenna Design

1. For each set of iteration phase we need to calculate the side of the equilateral triangle and its substrate size.
2. We initiate the design cut off frequency at 17 and 15 GHz and calculate the side and substrate length and width.

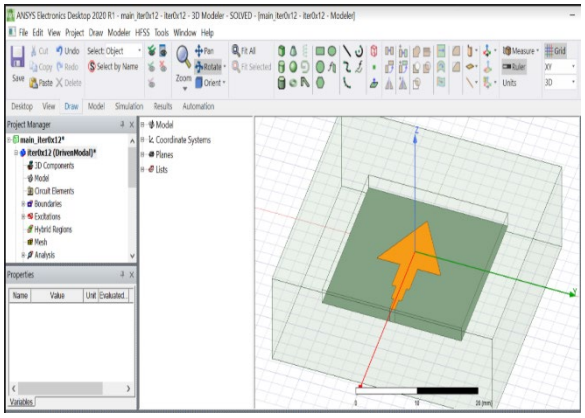


Fig.2.Representing the Structure of Stepped Triangular antenna.

Formulations for Equilateral Triangle:

1. *Side of equilateral* = $2 * \frac{c}{3 * f_r * \sqrt{\varepsilon_r}}$
2. $L = 4 * (a)$
3. $W = 4 * (a)$
4. *H = 1.6 for FR4_epoxy (consideration for this antenna).*
5. *Radiation box size :* $6 * (a)$

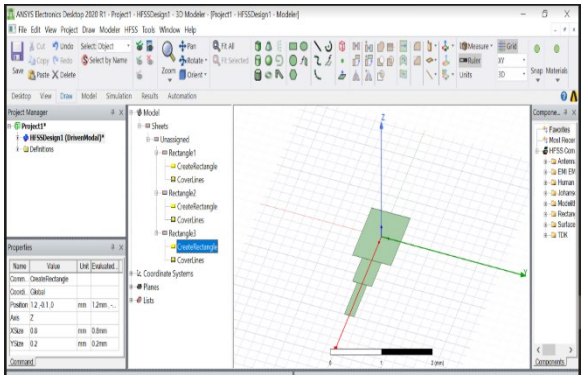


Fig. 3. Represents the design of the step induced line based on rectangular elements.

The values 4 and 6 are observed from the figure 2 representing the antenna structure where its dimensions with ¼ quarter of the substrate is estimated using the area formula. Assuming the dimensions of the substrate be s as for the square the area becomes s^2 and for equilateral becomes$\approx \frac{1}{4} * s^2$. Hence the length would be 2*a and width would 2*a. With factor of transmission line L = 2*a. we have the total lengths would be 4*a, and 4*a.

4.2Transmission Line Design

The size of the transmission line is calculated with the rectangular model and its equivalent reduction with powers of 2. As the rectangular size for the step assumed to 12mm, for step1 the length is 6mm and step2 the length of 4mm as a rectangular cut is positioned with the origin as mentioned figure 3 and 4.

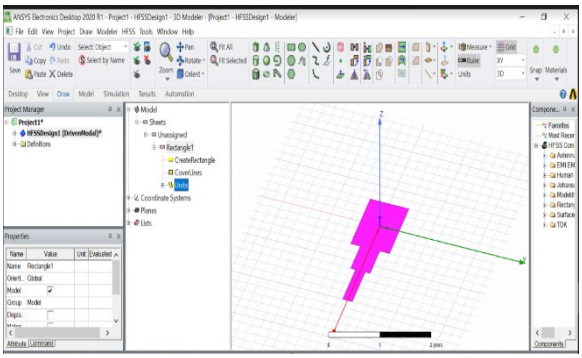


Fig. 4. Represents the design of the united step induced line based on rectangular elements.

5 Results andDiscussion

ITER 0:

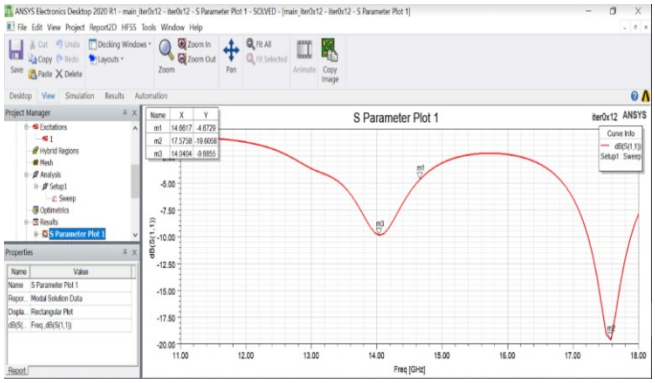


Fig. 5. Representing the reflection coefficient S_{11} value of -19.6056 with the frequency value at 17.578GHz.

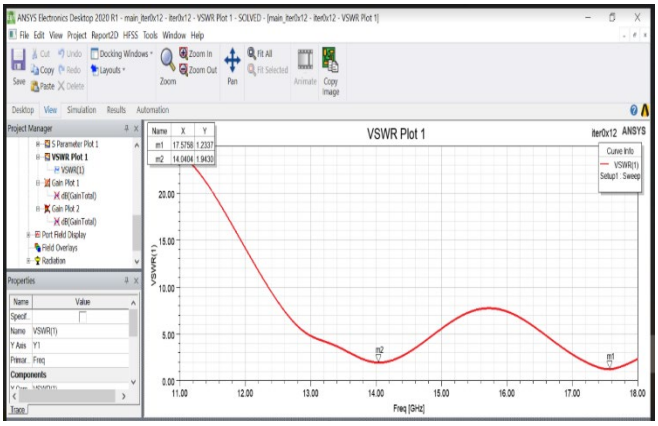


Fig. 6. Representing the VSWR value at 17.56GHz as 1.207.

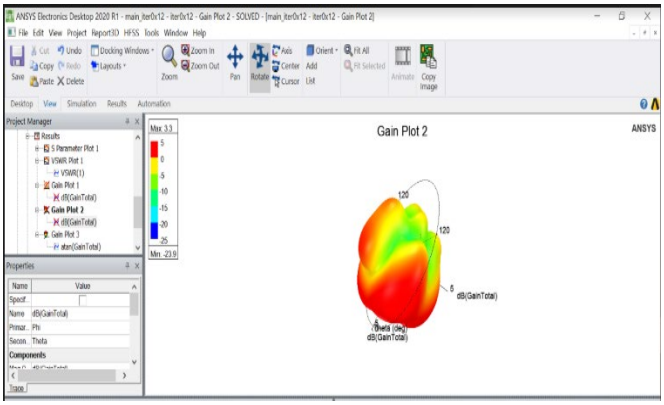


Fig. 7. Representing the GAIN 3-D plot for each frequency sweep.

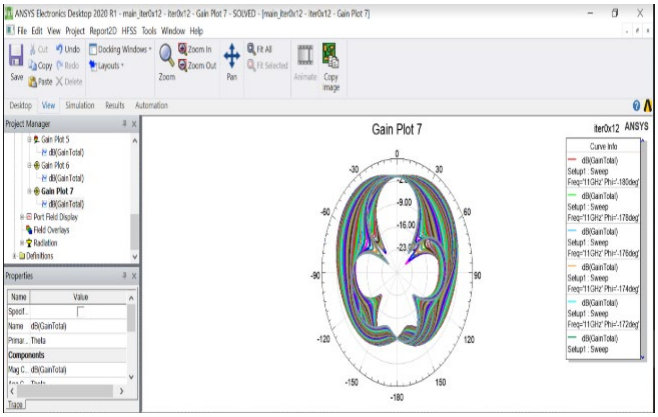


Fig. 8. Representing the Gain 2-D plot for each frequency sweep.

ITER 1:

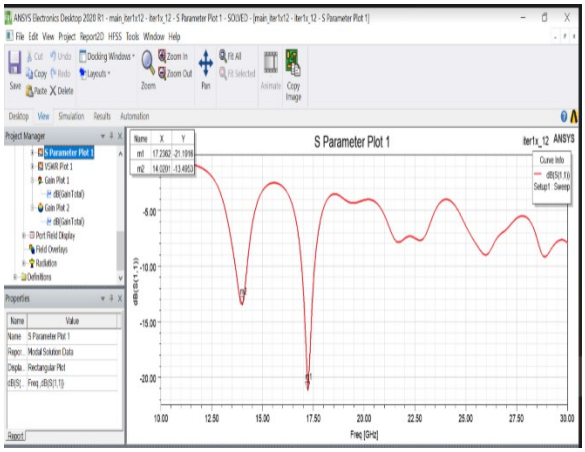


Fig. 9. Representing the reflection coefficient S_{11} value of -21.1916 with the frequency value at 17.206GHz.

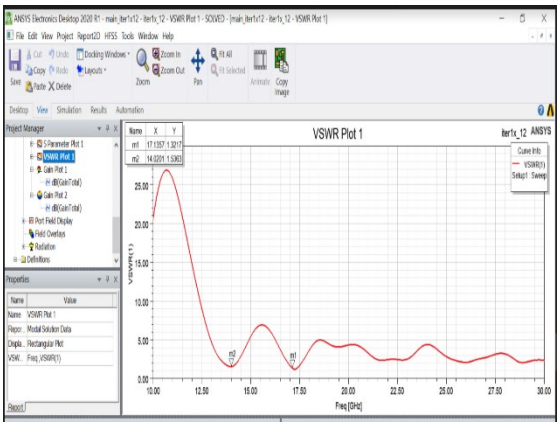


Fig. 10. Representing the VSWR value at 17.206GHz as 1.327.

This design model for the antenna at size of 6.358 mm for equilateral triangle at n=1 iteration. The variation of 0.2362GHz and 1GHz is observed from the fractal antenna for a value of -21.1916 dB and -13.4953 dB with the frequency sweep of 100 iterations. The overall gain of the antenna is observed with 26.7 dB in total as (max-(-min)). Maximum gain with 4.5dB is observed from the figure 8-11.

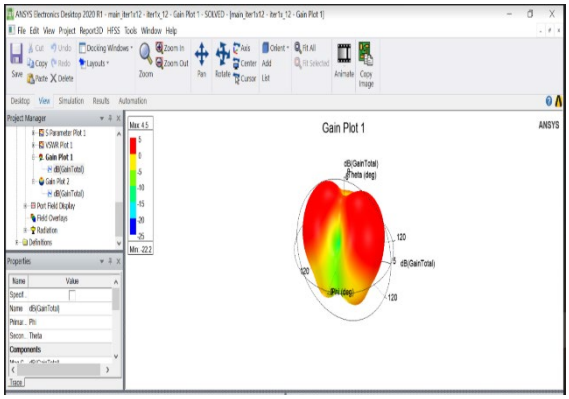


Fig. 11. Representing the Gain 3-D plot for each frequency sweep.

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ITER 2:

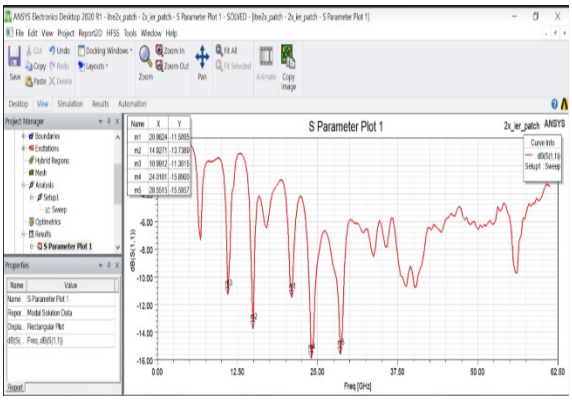

Fig. 12. Representing the reflection coefficient S_{11} value of -13.7389 with the frequency value at 14.9271 GHz and 24.0101 GHz S_{11} value is -15.89 dB.

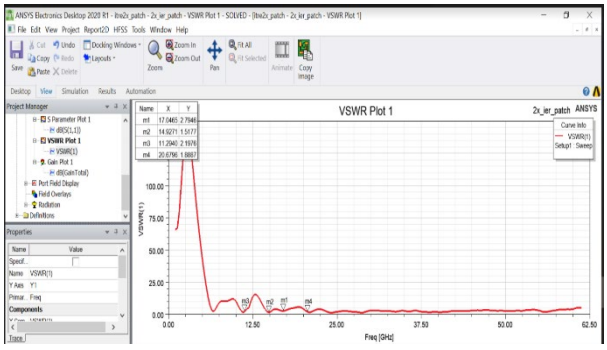

Fig. 13. Representing the VSWR value at 14.9271 GHz as 1.517.

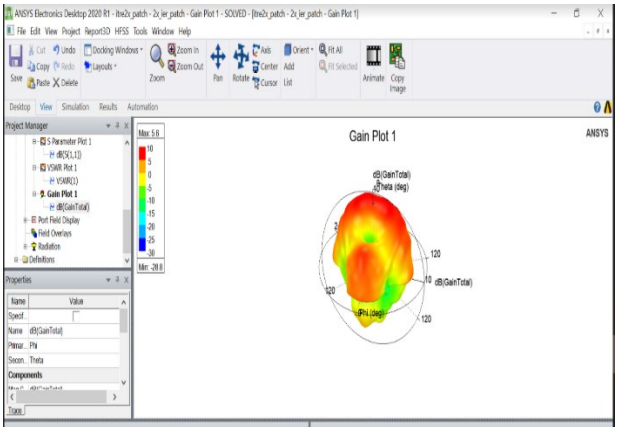

Fig. 14. Representing the Gain 3-D plot for each frequency sweep.

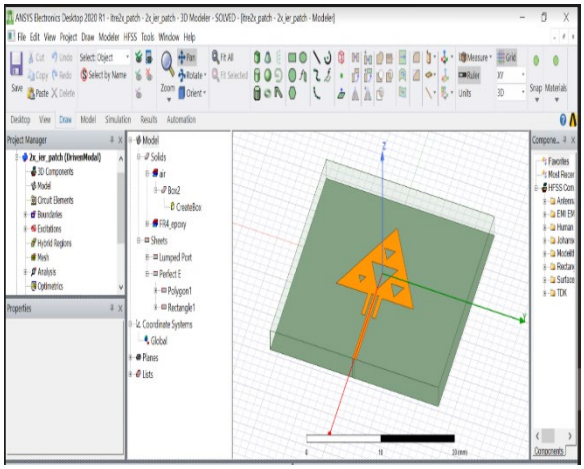

Fig. 15. Representing the M shaped transmission line designed for iteration 2.

This design model for the antenna at size of 6.358 mm for equilateral triangle at n=2 iteration. The variation of 0.0729 GHz from 15GHz, at 20.9824 GHz, 10.9912 GHz is observed from the fractal antenna for a value of -13.739 dB, 11.3015, and -11.5095 with the frequency sweep of 300 iterations. The overall gain of the antenna is observed with 34.4 dB in total as (max-(-min)). Maximum gain with 5.6dB is observed from the figure 12-14.Only for the iteration two a step induced has been changes from the M shaped transmission line as depicted in figure 15.

ITER 3:

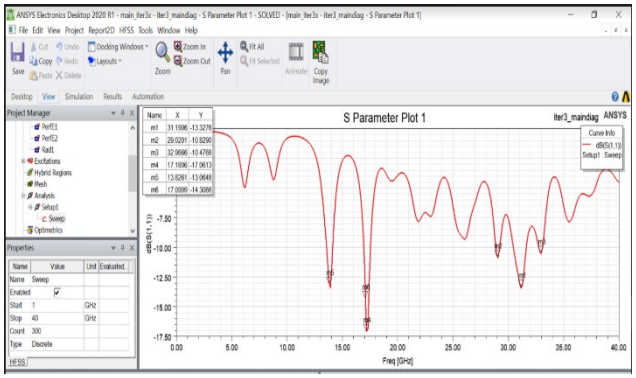

Fig. 16. Representing the reflection coefficient S_{11} value of -17.06 with the frequency value at 17.1806 GHz.

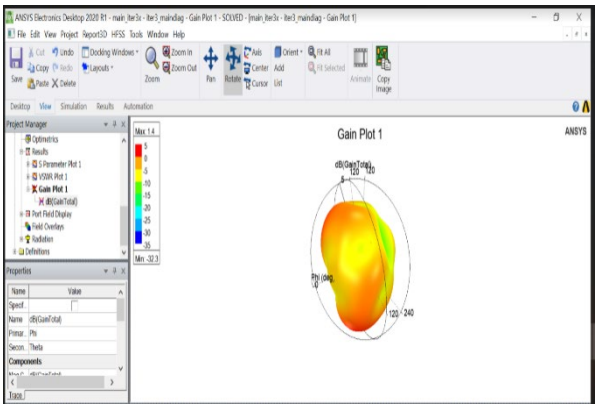

Fig. 17. Representing the Gain 3-D plot for each frequency sweep.

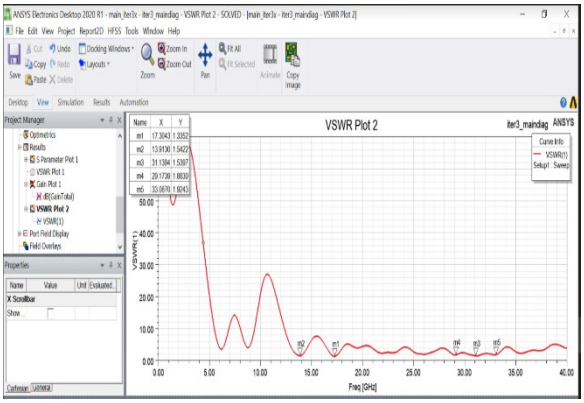

Fig. 18. Representing the VSWR value at 17.206GHz as 1.327.

This design model for the antenna at size of 6.358 mm for equilateral triangle at n=3 iteration. The variation of 0.1806 GHz from 17GHz, at 13.8261GHz with variation of 1.1739GHz from

15 GHz, 31.1906 GHz, 29.0201 GHz, and 32.9666GHz is observed from the fractal antenna for a value of -17.06dB, -13.0646 dB, -10.829dB, -13.3227dB and -10.4768dB with the frequency sweep of 300 iterations. The overall gain of the antenna is observed with 33.7 dB in total as (max-(-min)). Maximum gain with 1.4dB is observed.

ITER 4:

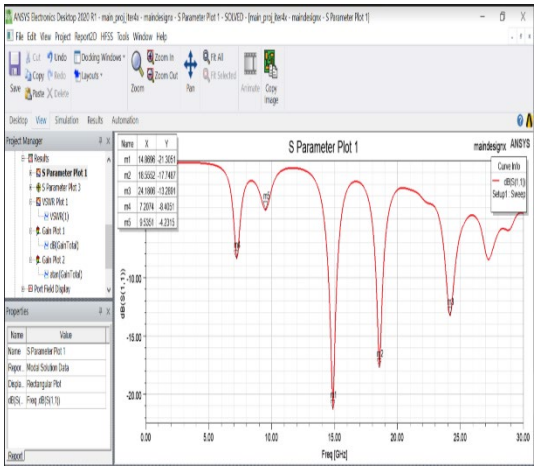

Fig. 19. Representing the reflection coefficient S_{11} value of -21.305 with the frequency value at 14.8696GHz.

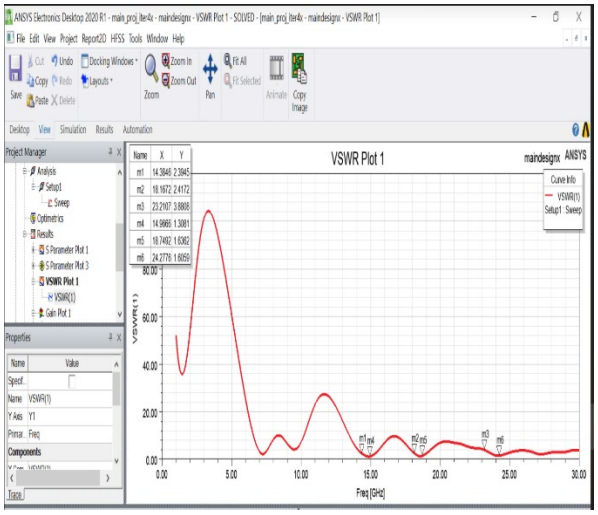

Fig. 20. Representing the VSWR value at 17.206GHz as 1.327.

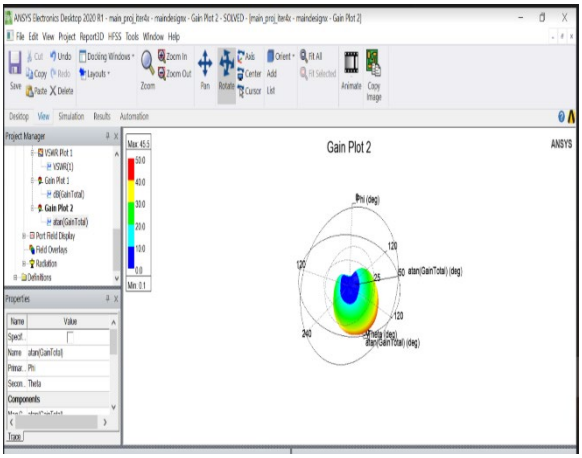

Fig. 21. Representing the tan-1-Gain 3-D plot for each frequency sweep.

This design model for the antenna at size of 6.358 mm for equilateral triangle at n=4 iteration. The variation of 0.1304 GHz from 15GHz, at 18.5552 GHz, 24.1806 GHz is observed from the fractal antenna for a value of -21.3051 dB, -17.7487, and -13.2891 with the frequency sweep of 300 iterations. The overall gain of the antenna is observed with 29.7 dB in total as (max-(-min)). Maximum gain with 0.2 dB is observed.

Table 1. Representing the observed Tabulated Results for Sierpiniski Triangle gasket.

Parameters	S11 in dB max	VSWR (minimum)	Gain in dB total
ITER 0	-19.608	1.2337	27.2
ITER 1	-21.19	1.3217	26.8
ITER 2	-15.36	1.3867	34.8
ITER 3	17.6	1.3352	33.7
ITER 4	-21.30	1.3081	29.7

The proposed SA gasket with each iteration is tabulated with the performance factors of S11, VSWR and Total Gain. The designed antenna with the iterations are observed with different gaps at each section of the fractals which are estimated on the simulation environment. Since the Gap and other features can be remodeled with a script tool. We improvise a multiple solutions to ensure better performance characteristics as mentioned in Table1. As per the designed iterations we could observe that overall gain and VSWR are at maximum for the iteration 2 while similar case on S11 would be the minimum. These iterations improvises to create different Ku, K band features on the frequencies ensuring the different performance characteristics as mentioned via formulation in section 3.

6. Conclusion

The design aims to improvise the improved factors each iteration levels depending upon the design characteristics for the bands Ku and K as mentioned in section 5. VSWR seems to vary between from 1.2 to 1.4 at max which improvises the design antenna accuracy with the transmission line matching criteria. The Gain factor and S11 values are depends on the frequency of operations where each set of the variations at gap of 0.39*0.45 is estimated with each iterations except for iteration 2. The size of the equilateral triangles are changed for only for iteration 2 since as of at least 3 drops of frequencies are observed between 10-20 GHz. Hence the design changes of transmission line from step induced to M shape have been implemented to provide the correct response outputs.

7. Future Scope

The prime scenarios for mathematical modelling and structure representing the different designs are explained and implemented successfully. This scenario on the low-profile, cheaper, less weight antennas are prime aspects of the design criteria even for fractal models which are discussed with sierpinski model only with the iteration of 0 to 4. Based on the geometry of the ground plane is estimated with deflected ground surface (DGS) modelling for improved gain values and its S11 characteristics.

8. References

[1] Zhang Guanghai, Wang Lixin, Tang Zhen. “Design of a binary tree fractal dipole antenna”. Electronic Components and Materials. 2020; vol. 39:pp.56-61.

[2] Liu Guo, Design and Research of Fractal Structure Scattering and Several New Fractal Antennas, China: Xidian University, 2015.

[3] Y. Braham Chaouche, I. Messaoudene, I. Benmabrouk, M. Nedil and F. Bouttout, "Compact coplanar waveguide-fed reconfigurable fractal antenna for switchable multiband systems", IET Microw. Antennas &Propag., 2018; vol. 13(1): pp. 1-8.

[4] Yogesh K. Choukiker et al., "Wideband frequency reconfigurable Koch snowflake fractal antenna", IET Microw. Antennas &Propag., 2016.

[5] R. Vivek, G. Yamuna, Y. P. Kosta, S. Suganthi and M. N. Jivani, "Crown shaped broadband monopole fractal antenna for 4G wireless applications", 2017 International Conference on Wireless Communications Signal Processing and Networking (WiSPNET), 2017, pp. 1073-1077.

[6] L. Liangtao, L. Jun, Q. Liyong and M. Yao, "Complex Permittivity and Permeability Measurement Method of Multiple Free-Space Incident for Structured Absorbing Materials", 2017 5th International Conference on Mechanical Automotive and Materials Engineering (CMAME), 2017, pp. 11-14.

[7] D.V. Mayboroda, S.A. Pogarsky, A.V. P1oznyakov, V.N. Sukhov and E.V. Shcherbatiuk, "The Quasi-Fractal Microstrip Antenna", IEEE 2018 9TH International Conference On Ultrawideband and Ultrashort Impulse Signals (UWBUSIS), 2018, pp. 349-352.

[8] I.I. Sliusar, V.I. Slyusar, Y.V. Polishchuk and E.I. Stas, "Analysis of space-frequency characteristics of a quasi-fractal dra based on a cube and truncated pyramid", Naukaistudia. Przemysl, 2018; no. 11, pp. 3-12.

[9] P. Z. Petkov, M. R. Kolev and B. G. Bonev, "Fractal Yagi antenna", 2015 Conference on Microwave Techniques (COMITE'2015), 2015, pp. 1-3.
[10] S. Jindal, J. S. Sivia and H. S. Bindra, "Hybrid Fractal Antenna Using Meander and Minkowski Curves for Wireless Applications", Wireless Personal Communications, 2019; vol. 109 (3), pp. 1471-1490.

BIOGRAPHIES

K.LakshmiBhavani obtained B.Tech degree in Electronics and communication engineering from JNTU .She received her M.Tech degree from JNTUH. She is doing her Ph.D program in ANU Guntur. She is currently working as Asst.Professor,Department of ECE in University College of Engineering and Technology, AcharyaNagarjuna University, Guntur, India.

Dr. P Siddaiahobtained B.Tech degree in Electronics and communication engineering from JNTUA College of engineering in 1988. He received his M.Tech degree from SV University Tirupathi. He did his Ph.D program in JNTU Hyderabad.
He is the Chief Investigator for several outstanding Projects sponsored by Defence Organizations,AICTE, UGC& ISRO. He is currently working as Professor & DEAN, Department of ECE in University College of Engineering and Technology, AcharyaNagarjuna University, Guntur, India. He has taught a wide variety of courses for UG & PG students and guided several projects. Several members successfully completed their Ph.D under his guidance. Several members pursuing their Ph.D degree. He has published several papers in National & International Journals & Conferences. He is the life member of FIETE, IE & MISTE.

An Interactive E-Tool for Maintaining and Monitoring Medical Records using Blockchain Technology

S.Baghavathi Priya[1], M.Muni Prasanna Kumar[2], A.S.Reshma[3], K.Sahana[4]
{baghavathipriya.s@rajalakshmi.edu.in[1], muniprasannakumar.m.2017.it@rajalakshmi.edu.in[2], reshma.as.2017.it@rajalakshmi.edu.in[3], sahana.k.2017.it@rajalakshmi.edu.in[4]}

Department of CSE, Rajalakshmi Engineering College[1], Department of IT, Rajalakshmi Engineering College [2,3,4]

Abstract. Healthcare has become one of India's largest sectors. The growing concern is to find the right doctor and adhere to medication as prescribed. This brings the necessity for a medium where one could find doctors and book appointments for consultation. The proposed system provides a medium to discover doctors under certain specializations sorted based on user reviews, location, and availability and book appointments for consultation. The doctor will be able to fill in a form replacing the traditional paper prescriptions that can be accessed by the patient at any time. All the other medical reports can also be stored in this application which will be secured with a password known only to the patient. For editing a prescription given, two passwords: 1 - Patient, 1- Doctor will have to be used. In addition to password protection, storing the records through blockchain will ensure data integrity and provide more security. This system also provides a way to make patients get alerted for taking pills, for next reviews, tests to be taken, and surgery dates. These reminders can be very useful to elderly people to ensure medication adherence. This application also comes with some additional features like an emergency button, tapping which a call will be connected to the Doctor.

Keywords: Book appointment, Medical records, Reminders, Security, medication adherence, Blockchain.

1 Introduction

Health refers to the well-being of an individual both mentally and emotionally. Health is directly related to productivity in ones job leading to absenteeism or presentism. In order to maintain a good health comes the health care. The demand for health care is unlike the demand for most consumer products and services. Buying products or services comes from direct desire whereas healthcare is treated to be an option. This desire for health care is not derived directly from the consumption of the medical procedures themselves. But, it comes from the direct value of improved health that is produced by health care. With the fast-paced world, time spent on one's health is minimal. Medication non-adherence and non-compliance is a growing concern. This system is an attempt to address these issues and also help people find and manage their medical records easily. This system provides a way to search doctors based on their specializations specific to a location, book appointments. A secure system to store medical records with 2 factor authentication and also to set reminders.

The proposed system overcomes some of the major challenges in the existing applications especially this system concentrates on providing more security to the user data by providing 2

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factor authentication while the recent survey states that 71% of the applications are vulnerable security [21]. Integrating block chain technology in storing medical records will play a major role in maintaining data security and integrity. This will also ensure that the prescriptions aren't tampered by others. An interactive tool that is helpful for both patients and doctors in order to connect with each other and also help patients maintain their personal health records and improve medication adherence. To ensure security blockchain might be used. Blockchain is a way of storing sensitive data in a decentralized format. It uses SHA -256 algorithm to encrypt the data to be stored. SHA -256 algorithm returns a constant has of 256 bits irrespective of the input data size. This mitigation method would make it harder and even impossible for hackers to penetrate data storage systems. Many storage service companies are assessing ways in which blockchain can protect data from hackers.

2 Related Work

IoT-based Health Monitoring System with Medicine Reminder using Raspberry Pi is an health monitoring device. Pulse and temperature sensors are attached to monitor patient's pulse and temperature and quantify them. Based on the predefined values set by the user, at any point if the obtained value exceed the specified value, the system sends the predefined message to the doctor immediately via the IoT. It was developed by M. Amru et al [1], in 2020. The time, date and number of capsules are provided to the system by using the personal computer and the device is turned on after it calculates and reminds the timing of the capsule consumption. It also gives the heartbeats and temperature of the user. The reminders are made on time. As it creates a bell sound it is easy to identify the reminders. Stores the prescription as compressed image. The capsule timings are entered by the user. It is important to have a personal computer to enter the capsules. Other than pills reminders there is no searching of doctor applications. Cost of the hardware requirements are higher. Need to take care of hardware equipment.

A Smartphone Based Application for Health Care Management System is an Android application for booking an appointment, checking availability of beds, with pills remainder. This paper was proposed by Dr. Sangeetha. V et al [2], in the year 2020. Patients can find the right doctor based on ratings, location, and feedback from other patients. They can set reminders for medicines or drinking enough water. A person who is too busy or lazy to go to the clinic can chat with the respective doctor online at any time of the day. Anyone can upload prescriptions, medical reports etc. to keep them safe and hand. The patient can choose hospitals based on cost and quality. Application will provide an emergency button to make an emergency call for an ambulance. Provides facilities to choose the doctor based on the category of the disease and making an appointment with the doctor.Information about the hospitals and presenting their locations. · Application will provide a pills remainder. Major drawback is that prescriptions are uploaded as a picture which makes the patients difficult to understand and it also takes more space to save the images.

Fall Detection Application for the Elderly in the Family Heroes System proposed byMoustafaFayad et al [3]. This is a machine learning approach to recognize activities and obtain results based on the threshold of the movements using the wearable sensors. Approaches of deep learning are gaining popularity especially for visual sensors and sensor fusion and are becoming the state-of-the-art for fall detection and other activity recognition. For fall detection Deep reinforcement learning is another promising technique. The main

objective is to monitor elderly people in home or instituitions. This fall detector can also detect if some one is in same position for longer than normal which could mean that there is some problem, the caretaker can be alerted immediately. This can help them to check on the elderly people. The major challenge user faces are the rarity of data of real falls, detection in real-time, security and privacy, platform of sensor fusion, limitation of location, scalability and flexibility.

Effective Online Medical Appointment System is a web application to view doctors and book appointments according to doctor's schedule that overcomes the issue of managing and booking appointments according to user's choice or demands. Here the user can select good doctors by viewing their details and reviews. S.Hema Kumar et al [4], developed this application in 2019. The doctor can see the patient request and sends the notification to the patients if the appointment is available. But, it does not provide a medium to store prescriptions and set reminders. Patient cannot choose the appointment time. This is the major drawback.

Android Application of Hospital for Karjat Taluka is an android application for Patients Appointment System and to view and manage appointments.This paper was published by Rahul Raj Verma et al [5].This system will provide the patient to schedule an appointment with the doctor. It also provides the patient a medium to interact and communicate with doctors without making any physical appointments with them. It is a medium to book and manage doctor appointments. Also provides chat options to connect with a doctor. Only the doctor can see the history of the patient.Itis made only for one specific hospital. There is no feature for searching other doctors or to set reminders.

3 Existing Systems

All the system available are mostly an android application. It doesn't have proper security for storing data. The users are either doctor and patient or admin and patient. Anyone can register as doctor and access the records. There will be no confirmation message from doctor after booking appointments.

Pills reminder is also not efficient since notifications will be sent to registered emails. More space needed since prescriptions should be scanned and uploaded. Incase of emergency, there is no provision to call doctor immediately. If the doctor is not available due to unavoidable conditions, patients will not be notified about the change in appointment timing. All the existing systems are centralized and specific to one hospital.

4 Proposed System Architecture

The main goal of the systems is to make it easier for the patients to find and book appointments with doctors based on the problems they're facing, from a single platform. The patient can view a list of doctors and filter doctors based on specializations and needs. The medical history of each and every patient will be maintained in a centralized store allowing for easy access. Data of the patients will be secured, meaning that the patient will not have to worry about the leakage of personal data. The doctor will be able to fill in and upload prescriptions which can be viewed by the patient through a two factor authentication. Reminders will be based on the timings set in the prescriptions to notify the patient

accordingly. The medicals records are stored using encryption algorithm to ensure that the records cannot be tampered or viewed by third party.

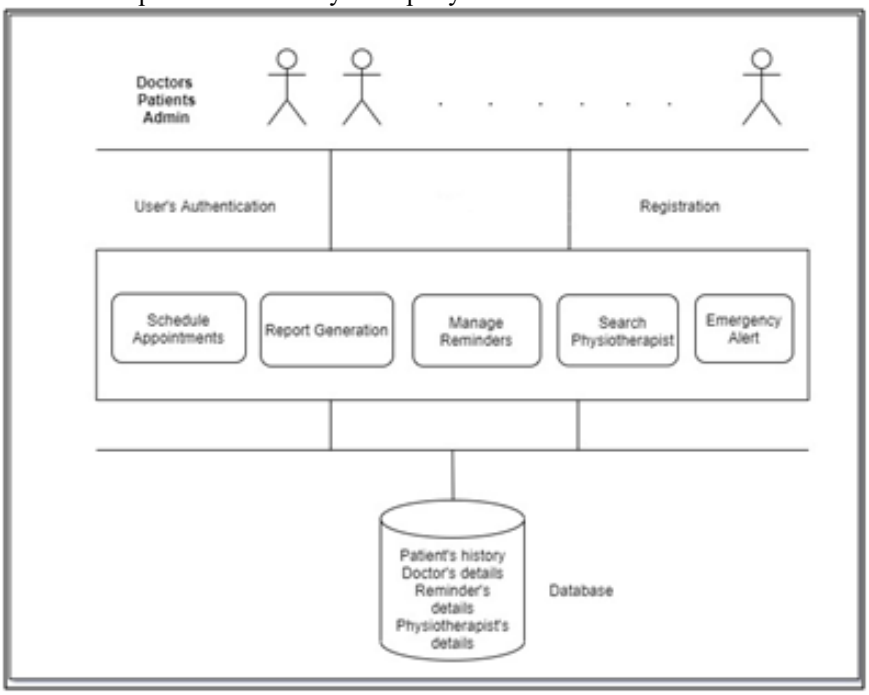

Figure 3.1 Proposed Architecture

The above diagram explains how this architecture works. User can identify themselves as Patient, Doctor and Admin and authenticate by entering login credentials. The role of the admin is to maintain patient and doctor lists. Doctor can upload prescriptions, manage the appointments and contact the patient whereas the patient can search doctors, book appointments and upload/View medical records and also make use of the reminders.

The main goal is to provide security to the records stored. This is done by encrypting the details using SHA – 256 encryption algorithm. Only the authorised person with correct credentials will be able to access them.

4 Implementation

The proposed system is to develop both web and android applications that provide a medium to make interaction between doctor and patient easier. Also, an automatic alarm ringing system that can be used to set reminders to take pills, take tests or to go for appointments. The system will also help to find all the prescriptions and reports in one place. Initially, users will be directed to a login page where a new user can register by entering their personal details. Every user will be given an unique user ID and using their password, one can login. There are three types of users, the administrator, the doctor and the patient. The administrator does the role of managing the doctors. If any doctor wants to get started with this platform, then he/she has to go through the admin, after which, if his/her credentials are approved, any patient can book an appointment with that doctor.

An index of doctors is developed, so that the patients can search for doctors all over the country. This process has to start from a small area and then branch out to other areas, and eventually other cities. The registered doctors will have a time window setup from their dashboard, and a patient is allowed to book appointments only between the time windows that the doctor entered. The doctor can also update his status as unavailable, in such cases, the patients who've booked an appointment will be notified of the cancelled appointments.

On medical consultation, the doctor will update the prescription to the online form, which will set up reminders based on the inputs provided by the doctor, making sure the patient takes the medication correctly. This reminder system also works for reminding the patients of their upcoming tests, surgeries and the next reviews. For editing a patient's medical records, both the patient and the doctor have to authorize the edit. This prevents any unauthorized edits to the medical records. Either the doctor or patient can view the records, but if a new doctor wants access to the records, then the patient has to authorize the request. This provides Security on the Logical layer. To secure data on the data layer, all the patient data is hashed so that the data is not immediately legible. All the patient's data is tied to an ID, and no personal information is stored along with the medical data, which will prevent the exploitation of the data even in case of unauthorized access to the data.

The proposed system consists of five modules.

1. **Login Module:**
   - Three different types of login: Admin, Doctor, Patient.
   - Initially the user registers themselves as doctor or patient
   - With the correct credentials, the user is logged into the system successfully.
   - Respective dashboard is displayed.
2. **Appointment Module:**
   - Patients will be able to view list of doctors based on specialisation and user reviews.
   - For the selected doctor, based on availability appointments can be booked.
3. **Reminder Module:**
   - The doctor will be given a form through which prescription can be filled.
   - Based on the prescription given, reminders are set for pills, lab tests and next reviews.
   - Patient will get alerted for the reminders set.
4. **Authentication – Blockchain:**
   - Doctors will be given a form with which they can upload the prescription.
   - Patient and doctors can access the records using a One time Verification Code or a Password they set initially.
5. **Integration of web interface:**
   - Web application provides some of the features that the android application provides such as searching doctors and uploading/viewing medical records.
   - The doctor will be given a prescription form where one can enter all the details about tablets – timings, dosage etc.and also enter the details of the lab tests that need to be taken.

5 Result And Discussions

- This work mainly focused on providing security to the patient records, provide a medium to store, and access the same easily.
- The data is encrypted using SHA – 256 algorithm before storing it into the database.
- In comparison with the existing system, the proposed system provides an user friendly interface – both web and mobile.
- In addition to the features provided by the existing system like appointment booking and reminders, the proposed system ensures integrity of the message being stored.

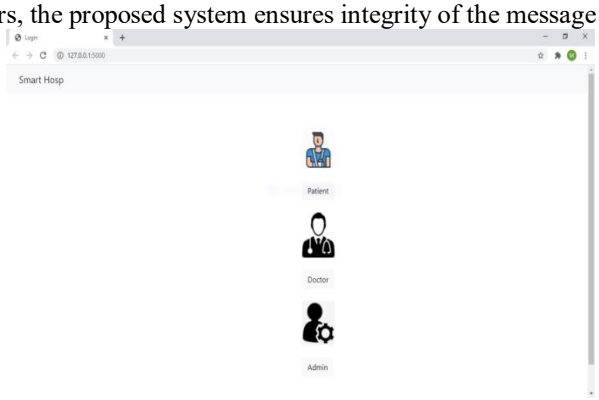

Fig 5.1 Web Login

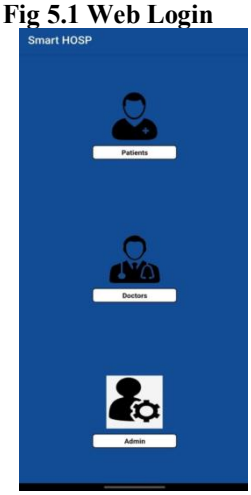

Fig 5.2 Mobile login

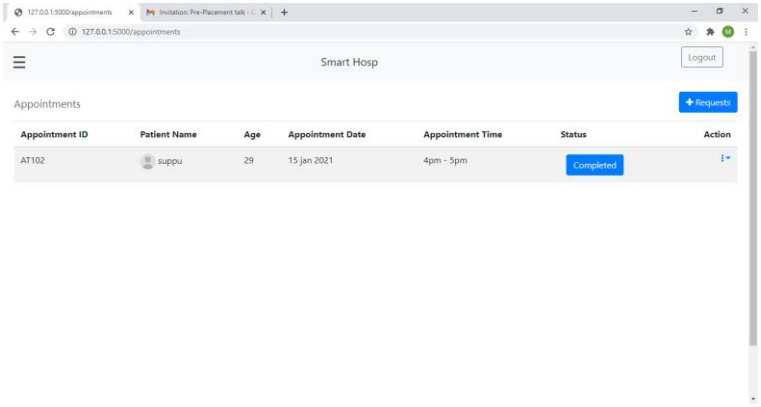

Fig 5.3 Doctor appointment dashboard

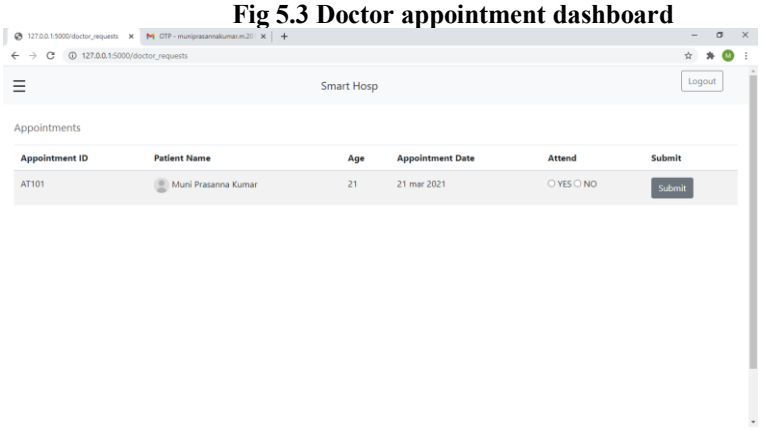

Fig 5.4 Appointment confirmation by Doctor

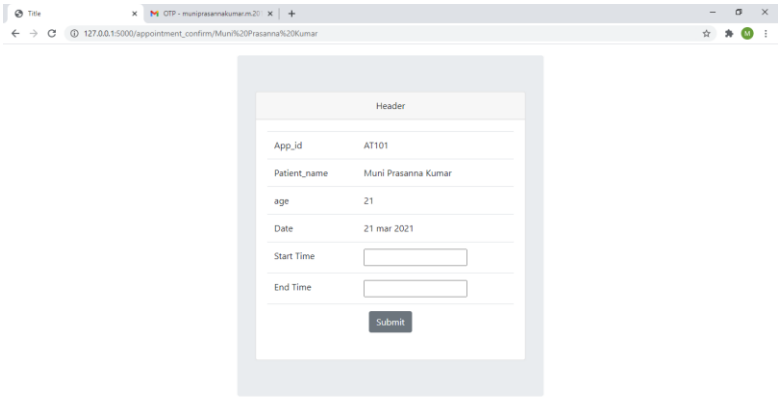

Fig 5.5 Scheduling appointments

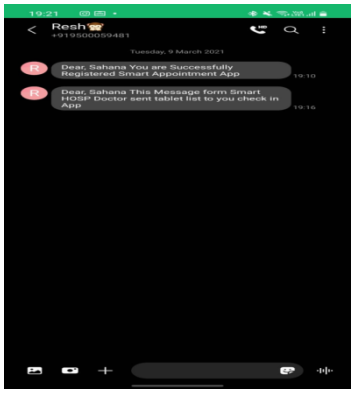

Fig 5.6 Appointment confirmation to patients

Fig 5.7 Prescription reminder

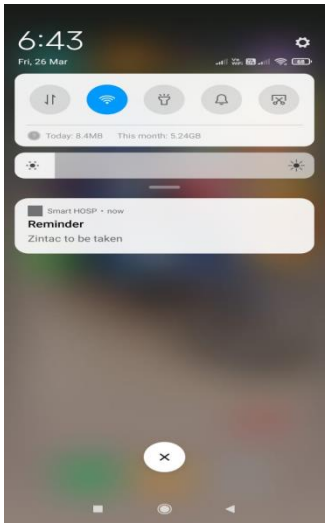

Fig 5.8 Reminder notification

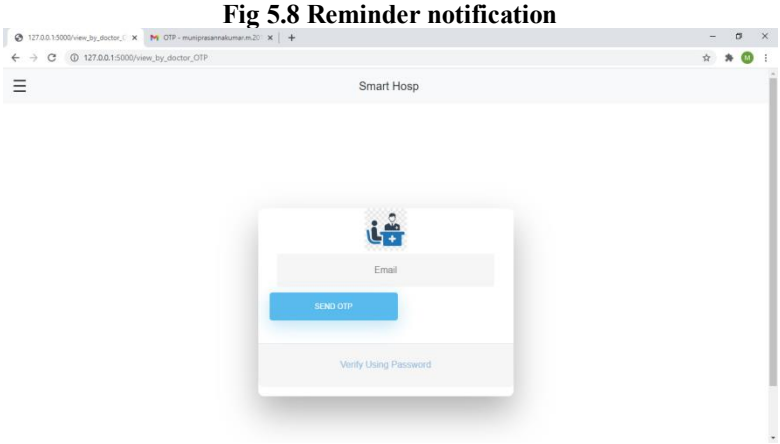

Fig 5.9 Verify using OTP

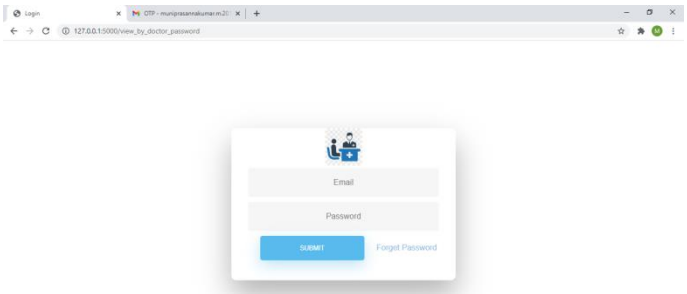

Fig 5.10 Verify using Patient credentials

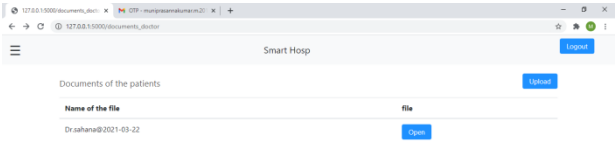

Fig 5.11 Documents of the patient

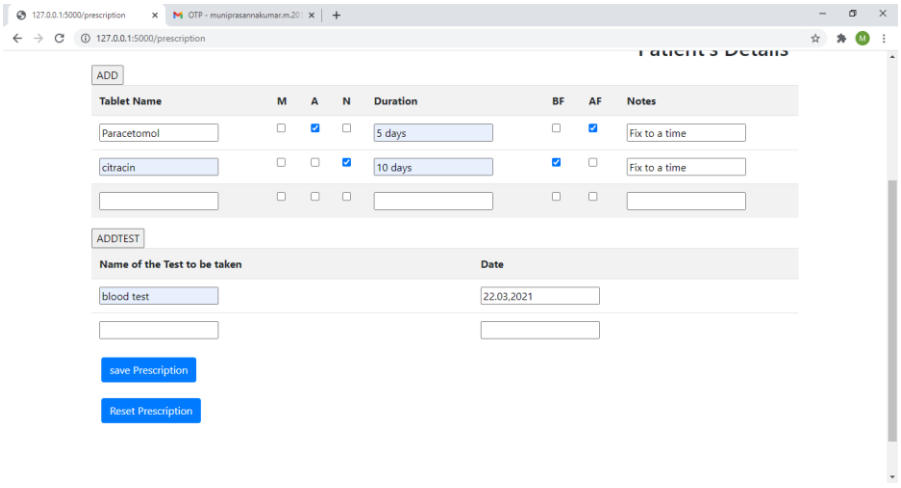

Fig 5.12 Prescription form

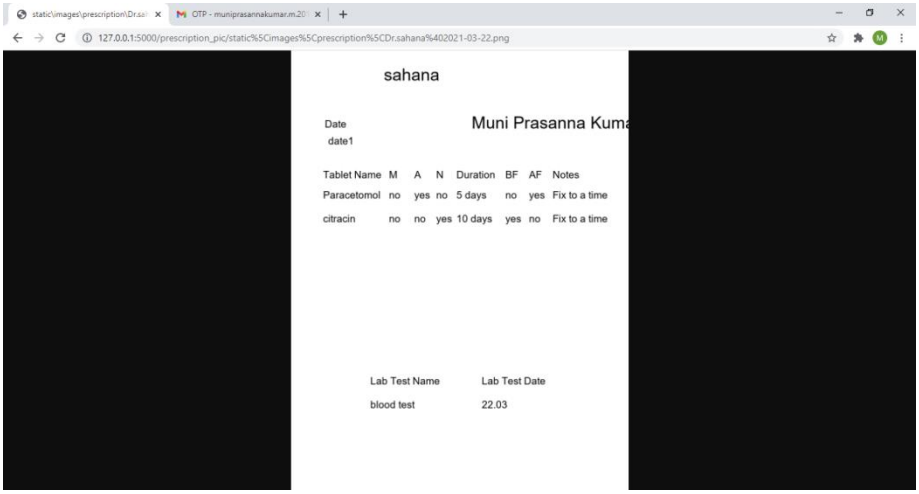

Fig 5.13 Viewing patient prescriptions

6 Conclusion And Future Enhancement

CONCLUSION:

The major goal of this application is to create an interactive medium to solve the basic needs of the people. Through this app, patients can book their appointments with the doctor and they are provided with the facility to schedule alerts for all the health related reminders. It is made sure that no medical records can be tampered or accessed by intruders. To make sure that the application is available to all and easily accessible, both web and android applications are available in order for user convenience.

FUTURE ENHANCEMENT:

The system can be enhanced further in future by providing some more functionalities such as video call consultation, 24/7 chat facilities with doctor and ordering medicines through online pharmacy. More features, such as sentiment analysis for the user reviews can be added. Also, a FYI section can be added to keep the users updated about the current trends in the medical world.

References

[1] M. Amru, AllamVenkata Naga Mahesh2, PotharajuRamesh, "IoT-based Health Monitoring System with Medicine Reminder using Raspberry Pi", International Conference on Recent Advancements in Engineering and Management (ICRAEM-2020), 9-10 October 2020.

[2] V, Dr.Sangeetha and H V, Prathap and Koushik, Shreyas S and S C, Nithin and M N, Nikhil, A Smartphone Based Application for Health Catr Management Svs Tem, Institute of Scholars (InSc), August 7, 2020.

[3] MoustafaFayad, Ahmed Mostefaoui, Samir Chouali and SalimaBenbernou, "Fall Detection Application for the Elderly in the Family Heroes System", Proceedings of the 17th ACM International Symposium on Mobility Management and Wireless Access, Pages 17–23, November 2019.

[4] S.Hema Kumar, J.Uday Kiran, V.D.Ambeth Kumar, G.Saranya, Ramalakshmi V, "Effective Online Medical Appointment System", International Journal of Scientific & Technology Research, Vol. 9, Issue 9, September 2019.

[5] Rahul Raj Verma , Harish Ramesh Varma , Mahesh ShridharKanojiya , AkshataLaddha, "Android Application of Hospital for Karjat Taluka", International Journal of Science & Engineering Development Research, Vol.4, Issue 5, page no.120 - 122, May-2019.

[6] TabSafe :https://www.tabsafe.com/

[7] Shah MdMonirul Islam, FariaHoque Khan, Md. NajmusSwaqeeb, "An Android and Web based Application 'Urban Healthcare Service'", at BRAC University, Bangladesh, 16 April 2018.

[8] UndeGorakh Shankar, Ranjeet Kumar, Khan Abdullah Z and Asst.ProfDagadkhair Pooja, "Scan Med: A Healthcare Application using QR Code", International Journal for Research Trends and Innovation, Vol. 6, Issue 2 April 2018.

[9] Md. Abdul Majid, Mohammad Jahangir Alam and Md. Nurul Mustafa, "Smart Doctors Appointment and Prescription System", IOSR Journal of Computer Engineering (IOSR-JCE), Vol. 19, Issue 6, Nov.- Dec. 2017.

[10] Noorsyahira Ismail, ShahreenKasim, Yusmadi Yah Jusoh, Rohayanti Hassan and AyuAlyani, "Medical Appointment Application", Acta Electronica Malaysia (AEM), November 2017.

[11] MedMinder :https://www.medminder.com/

[12] Pillboxie :https://apps.apple.com/us/app/pillboxie/id417367089

[13] Ahmed Imteaj and Muhammad Kamrul Hossain, “A Smartphone based Application to Improve the Health Care System of Bangladesh”, at International Conference on Medical Engineering, Health Informatics and Technology (MediTec), 17-18 December 2016.
[14] MayureshWaykole, Vatsalya Prakash, Himanshu Singh, Nalini N, “ArduMed - Smart Medicine Reminder for Old people”, International Journal of Scientific & Engineering Research, Vol. 7, Issue 5, May-2016.
[15] IrinSherly. S ,Mahalakshmi. A ,Menaka. D , Sujatha. R," Online Appointment Reservation and Scheduling for Healthcare- A Detailed Study", International Journal of Innovative Research in Computer and Communication Engineering , Vol. 4, Issue 2, February 2016.
[16] DeeptiAmeta, KalpanaMudaliar and Palak Patel, “Medication Reminder and Healthcare – An Android Application”, in International Journal of Managing Public Sector Information and Communication Technologies, Vol. 6, No. 2, June 2015.
[17] Muhammad WasimMunir, Syed Muhammad Omair, M. ZeeshanUlHaque, “An Android based Application for Determine a Specialized Hospital Nearest to Patient's Location”, International Journal of Computer Applications, Vol. 118 – No. 9, May 2015.
[18] iTriageHealth :http://myhealthapps.net/app/details/65/itriage
[19] ArvieCarpio, Jessub Kim, RashinaHoda, Duncan Miller, “MedTouch: Towards the Development of Smartphone-based Software Solutions for Mobile Health Care”, in Proceedings of Australasian Software Engineering Conference, 4-7 June 2013.
[20] MediSafe :https://www.medisafe.com/
[21] Article: https://www.healthcareglobal.com/technology-and-ai-3/most-healthcare-apps-have-weak-security-report-finds

Neuromorphic Computing – The Principal of Development

R. Sathya Bama Krishna[1], D. Usha Nandini[2], J. Albert Mayan[3],
Nehal Veeramachaneni[4], Nidhi Sawarn[5]
{rsathyarajeswari@gmail.com[1], usha.cse@sathyabama.ac.in[2], albertmayan@gmail.com[3]
vn001030@gmail.com[4], nidhisawarnn29@gmail.com[5]}

[1,2]Assistant Professor, Department of Computer Science and Engineering, Sathyabama Institute of Science and Technology, Chennai 600119, India, [3]Associate Professor, Department of Computer Science and Engineering, Sathyabama Institute of Science and Technology, Chennai 600119, India,
[4,5]Student, Department of Computer Science and Engineering, Sathyabama Institute of Science and Technology, Chennai 600119, India

Abstract. Due to the subsequent decline of Moore's Law, everyone is in the search for an approach to push computing technology much further. Neuromorphic Computing is a way through which we can approach the next generation of computer technology. Neuromorphic chips have been the current trending topic as it deals with a diverse range of tactics to formulate the given information to not just make a particular decision but it also modifies the network to memorize the information and finish the work more efficiently. The progress in VLSI mechanics through time and the further research and development on neuromorphic computing lead to a stable growth in the ability and competence of neuromorphic engineering in applications. These chips perform complex tasks such as image recognition, navigation and problem solving. In this paper we present the history, the need for Neuromorphic computing, the functionalities, the current projects, their main features and technical capabilities of Neuromorphic computing.

Keywords: neuro-inspired model, neuromorphic computing, artificial intelligence, computational modelling.

1 Introduction

Neuromorphic computing or engineering is a subset of artificial intelligence in which scientists develop devices which work on the principles of the human brain. It is more like making devices which mimics the function of the human brain. The computing of neuromorphic devices involves the development of components which are analogous to the human brain. Talking about the structure of these devices, these are definitely not in the shape of the brain; however they do fulfil the roles of their organic counterparts. To sum it up, neuromorphic computing involves making inorganic brains.

Traditional computers or digital computers work in binary. It understands and responds in either 0s or 1s or yes or no. This type of mechanism is very narrow in the field of developing science. Therefore, the way to solve problems in digital computers is structured in a very rigid way. These mechanisms cannot move beyond the binary language. On the other hand, neuromorphic computers are very flexible and their approach to solving problems is very

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broad. One of the ways to move past this threshold is by making computers more like human brains. Neuromorphic computing is a concept in which the computer chips are designed in a way which uses the science of computation based on the human nervous system. Neuromorphic computers are more energy efficient than the digital computers. It is designed so that the neurons can learn as they perform tasks. The hope behind this new revolutionary discovery is to make a computer that behaves like a brain which will give us enough computing power to simulate something as complicated as the brain.

2 Neuromorphic Computing

One of the most powerful computers out there in the world is a human brain. It consists of 100 billion neurons while each neuron is having 100-1000 of synapses. A neuron (cell which transmits information to other parts of the body from the brain). Synapses are the connection to other neurons. A human brain can perform 1 billion calculations per second. Many researches are being done to make supercomputers which can reach this exa-scale performance. Simulating a human brain requires millions of processors and high-speed memory using power consumption in the order of megawatts per hour. While a brain can do all of this with just 20 watts of power consumption and will still outperform these supercomputers.

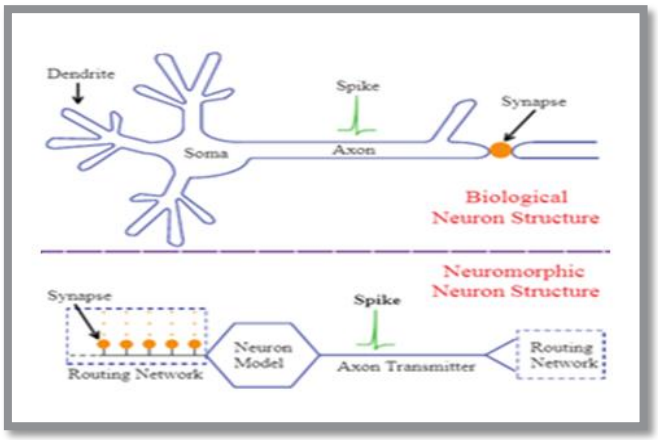

Fig.2.1 Simplified biological and neuromorphic neuron structure

All of this is due to the differentiation of modern computer architectures and a biologically cognitive brain. A modern computer's architecture is based on von Neuman architecture, in which memory and computation is isolated with a data bus connecting them. Whereas a biological brain has memory and computation tightly coupled together. The von Neuman architecture is the best architecture for digital computers. But to simulate the brain and make computers work the way the brain works, we need a different kind of structure more similar to the human brain,

Neuromorphic architecture where the Spinal neural network is the population of neurons connected to other neurons by the help of synapses. Synapses are the junction between neurons. This network connection is responsible for the transmission of information to

different parts of body. Neurons have axons, a protoplasmic protrusion (in simpler words a joint) which is extended to different parts of body.

These connections between neurons are much more complex than artificial neural network (ANN). Synapses are of two types.

- Chemical synapses
- Electrical synapses

Some examples of neural circuits are

1. Trisynaptic circuit in the hippocampus
2. Papez circuit (links hypothalamus to limbic lobe)
3. Central pattern generators in spinal cord.

The main part of this whole neuromorphic computing is the artificial neural networks (ANN). These neural networks are framed with artificial neurons which are microscopic computational units designed to carry out simple mathematical functions. Our brain is composed of neurons. Neurons are the cells which transfer the information to other parts of the body from the brain. But the Artificial Neurons is not of much use alone. To use them efficiently, they need to be stacked up in layers to perform complex tasks. For example, object detection within given images, converting voice and audio as to texts. Recently, some of the artificial intelligence researchers exhibited a self-driving bicycle that navigates around and detects obstacles, follows a particular person and also responds to his voice commands. To manufacture bicycles of such advancement, a neuromorphic chip was used.

Traditional computing system relies on processing units which poses a lot of power and could perform complex tasks with high speed, but it is tough to run neural networks on these computers. However, processing units designed for Graphics, hardware's employed for games mostly perform a lot of parallel processing jobs. Matrix multiplication, a core application with neural networks can also be done using GPUs. GPU arrays play a vital role in most neural network applications. Neuromorphic computers run AI models role over much better than CPUs and GPUs with less power consumption.

Digital computers work on the principle of determinism. The work of a digital computer is to perform a task or solve a problem based on some inputs given by users. Its work is predetermined. Whereas, neuromorphic computers are designed to think and process, to learn from the applications performed just like human brain works. Plasticity of neurons makes it the more suitable feature of nervous systems to modify its activity in response to intrinsic or extrinsic stimuli thereby transforming its functions, structure, or connections. This is one of the phenomena, neuromorphic engineers are hoping to simulate.

3 The Saga of Neuromorphic Computing

Neuromorphic computing, a vivacious concept which was evolved by Carver Mead during late 1980s in which he employed a very large-scale integration system with electric analog circuits that mimic the functional portions of the nervous system.

The idea of neuromorphic computing was first given by Turing a scientist who formally proved that a machine can perform any complex mathematical computation if it is represented

as an algorithm. He wrote a book called Intelligent Machinery which was published in 1958. In his book, he described a machine consisting of artificial neurons arranged in any pattern with modifier devices. He explained those modifiers could be configured to pass or destroy a signal and the neurons were composed of NAND gates.

Later on, Synaptic plasticity came into picture. It is basically the ability of synapses to strengthen and weaken themselves over time in order to increase or decrease their activity, basically, a mechanism for learning and memory. It was given by Hebb in 1949.

In 1980, VLSI pioneer Mead along with Conway published the landmark text introduction to VLSI systems. Later, he teamed up with John Hopfield and Feynman to study how animal brains compute. This study catalyzed the field of neural networks (Hopfield), neuromorphic engineering (Mead) and physics of computation (Feynman).

Mead created the world's first neural-inspired chips including an artificial retina and cochlea, which was documented in his book Analog VLSI Implementation of Neural Systems published in 1989.

In the year 2008, HP Laboratories had set forth the production of postulated electronic equipment of Chua's, the memristor and stated their usages as synapses within neuromorphic circuits.

A. THE NEED

Moore's law defines that every two years, quantity of transistors within a microchip doubles, with the cost of computer being halved. In 1965, Gordon & Moore, the co-founder of intel, made this observation that became Moore's law.

In today's scenario, the way we are moving forward and the excessive demand of memory chips being smaller and smaller in size, it will be practically impossible to store so much of data into smaller chips. As Moore's law is nearly towards the end, silicon processing technology is being pushed towards its limits. But we can't continue with decreasing the size of chips for better computational powers. Volleytronic transistors are being developed having size in nanoscale. They have proved to be promising to save the growth potential of this technology. But many other developments are being done to save Moore's law.

Neuromorphic computing is one of the many developments being made in this technology. Neuromorphic computing aims to make computers better at operating. It would allow computers to adapt and learn faster, this makes the use of programming to be reduced accordingly. The architecture of neuromorphic computers and its ability to learn makes it work more efficiently at running neural networks. The structure is designed in such a way that the Artificial Intelligence versions runs with much faster speed than the central processing units and GPUs while using less amount of energy. Which is an important aspect since Artificial Intelligence gives a concern for the efficient usage of energy.

Neuromorphic computers use less energy, are small in size and it can process data and take decisions on its own without the need to depend upon a certain connection. This technology in the Global Sector could mean gigantic development and upgrade of industries in various environments. This could accelerate the progress of mankind in development of robotics and autonomous technology.

B. NEUROMORPHIC CHIPS THE MOVEMENT OF AI

The life span to traditional programming-to manually formulates or code rules are coming to an end. Moore's law says that the number of transistors in a dense integrated circuit double

for every two years has come to a break down point. The transistors currently in market are about 70 silicon atoms wide, therefore the chances of making them even smaller are diminishing. So, it is needed for us to change the approach by taking a step further by improving the abilities that a computer can do.

Fig.3.1 Neurosynaptic Chip

A neuromorphic chip is an analog processor chip whose functionalities are being designed to operate like a human brain. It resembles the natural organic structures of our nervous system by enacting neurons in silicon. In the brain the neurons and their connections are synapses. The neuromorphic chips are arranged in such a way that they act like artificial neural networks. Each neuromorphic chip has a tiny computation unit that represents an artificial neuron. An artificial neuron network has a layered structure and each network node has the ability to process input and send output to other nodes. This artificial neural network contributes the neuromorphic chip to act like a brain.

Artificial Neural Networks have the ability to handle and analyze nonlinear and complex data therefore generalizing and predicting data. The network structure has an input layer, hidden layer and output layer. Due to the presence of multi layers it is also known as Multi-Layer Perceptron. The objective of Multi-Layer Perception is to process the input of a node and to convert it to an output signal. While this output gets used as input in the next layer. These layers of connections help Artificial Neural Networks in learning knowledge from data sets. This structure makes sure that the Artificial Neural Network doesn't make unwanted data predictions before any prior information.

In a multi-layered network, neurons are parallelly arranged in interconnected layers. The computation unit communicates with other neurons through some type of electrical signal. Every neuron doesn't need to be activated every single time instead only the ones which are needed are activated and due to this the energy consumption is reduced. This promotes them to store data and communicate at much higher speed. This allows the usability of Neuromorphic chips in various applications. The physical connections between artificial neurons are just like organic brains which consist of biological neurons and the connection between them is called synapse.

Neuromorphic chips are characterized by the number of artificial neurons, they consist of. The neuromorphic chips launched by INTEL are Loihi and pohoiki computers.

- One loihi chip contains 1,31,000 neurons and 130 million synapses.

- Whereas pohoiki chips contain 8.3 million neurons.
- Tianjic chip contains 40,000 artificial neurons and 10 million synapses in an area of 3.8 square millimeters.
- IBM's TrueNorth chip has 1 million neurons and over 268 million synapses. It is 10,000 times more energy-efficient than conventional microprocessors and only uses power when necessary.
- Alexnet, an image classification network has more than 62 million parameters.
- OpenAI's GPT-2 language model contains more than one billion parameters

Compared to GPUs, the tianjic chip performs 1.6-100x faster and consumes 12-10,000x less power. Also, The Pohoiki delivers 1000x better performance and is 10,000x more energy efficient than equivalent GPUs.

C. DEEP DIVE INTO NEUROMORPHISM

Neuromorphic scientists deeply study the functioning of human brain, the role of neurons and build a neural network based on their understanding of neurons. But there has not been any work done on the basis of synapses yet. Synapse is a part of nervous system. It is a structure that permits a neuron to pass an electrical or chemical signal to another neuron or to the target effector cell. In many synapses, the presynaptic part is located on an axon and the postsynaptic part is located on a dendrite or soma.

Synapses are the main reason our brain works; our body functions and we respond. And, the more connected neurons are the more efficient the biological system becomes at solving problems. So, when we want to take a decision the neuron fires a signal which allows other neurons to allocate themselves accordingly for the other neurons make decisions regarding the issue.So, synapses play an important role in the neural network. Therefore, the greater number of neurons in the chip, the better the functionality and results the chip can provide.

Fig.3.2 Function of Human Brain

To make synaptic connections, is one of the most significant challenges that scientists had to overcome to build neuromorphic processors. But continuous research and development in this field by MIT researchers led them to the invention of artificial synapse which works somewhat similar and gave promising results. After the invention of artificial synapse, they also built synaptic chips and were able to monitor signal strength flowing through them accurately. By testing of these chips, developers found that, in simulations, the chip and its

synapses could be used to recognize samples of handwriting with up to 95% accuracy. Memristors can be used as super dense non-volatile memories for building instant turn on computers.

Neuroscientists after continuous research have observed learning at the level of single synapse and have gained a deep insight in how learning occurs at this scale. Psychologists have studied deeply about how a neural network work and have experimented with mammals such as rats to develop their understanding of living intelligent behaviours. Neuromorphic scientists have developed neural models to describe how a neural network works and their resulting behaviours. But they are facing many challenges as they dig deeper into the matter. One of the biggest challenges is to develop a hardware which gives following benefits:

- More computation
- Less energy consumption
- Less time consumption
- Simpler structure
- Robustness to noise
- Fault tolerance
- Physical size

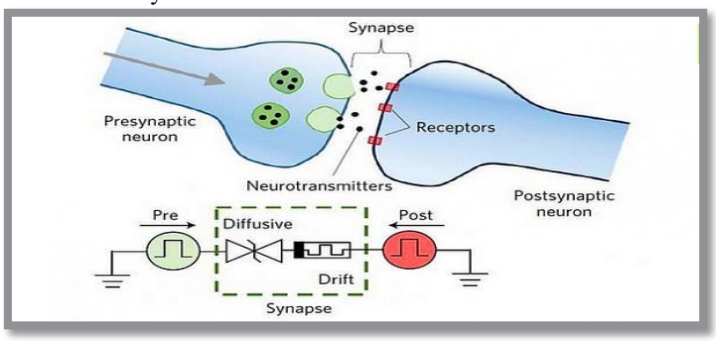

Fig. 3.3 Synapses process

These are few limitations too in the development of neuromorphism. Different types of hardware's are being designed for neural computing. Recently, the development of memeristors has increased the hope of neuromorphic scientists' community to provide low power building block to design high density memory systems for intelligent machines. These machines are designed and developed in a way keeping in mind that it not only favours scientists and narrows down to make machine intelligence but also be used and demanded by businesses to solve problem in their domains.

D. PRESENT-DAY PROGRESS

There are many companies and researchers experimenting on the neuromorphic models to make a working model but few of them are ahead in the race of development. The important developments made so far are:

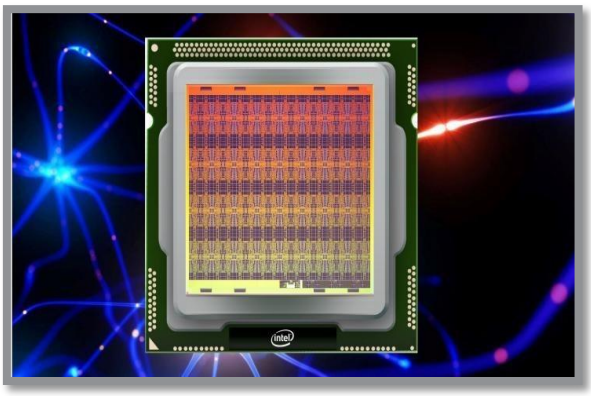

Fig.3.4 Intel's Loihi chip

Intel's Loihi: - Intel has introduces a self-learning 14-nanometer chip with over 2billion transistors, having three managing cores and having a programmable engine for on chip training of spiking neural networks. The cores have a built-in learning module in each of them and around 131,000 neurons that can convey information between one another, allowing the chip to adapt and operate based on the various conditions received from the environment. Loihi is capable of identifying 10 hazardous materials by smelling them faster than sniffer dogs. Above this it can even detect toxic fumes and diseases and can enhance its learning. It is expected to make its own decisions in the future. This energy structured chip can use date to comprehend itself and make changes. Loihi learns to be smart overtime without the need for training.

Fig.3.5 IBM's TrueNorth chip

IBM's TrueNorth: -

The abilities of TrueNorth are it can solve problems like vision, audition and multi-sensory fusion. It can even process the noisy sensory data efficiently. It has 4,096 cores, Samsung's 28nm process with 5,.4 billion transistors. TrueNorth is IBM's biggest chip in terms of number of transistors and it consumes less amount of power while stimulating the process. The density of TrueNorth chips power is 20W/cm2.It has the ability to bring a change in present computers by stimulating brain like functions inside the computer by changing the way present time concept of power and speed. It supports standard frameworks in deep

learning which can be used during training. It's the present lead in transistors compared with other neuromorphic chips.

Fig.3.6 SpiNNaker supercomputer

SpiNNaker:-

Engineers of Germany's Julich Research Centers Institute of Neuroscience and Medicine, associated with United Kingdoms Advanced Processor Technologies Group at the University of Manchester. Spinnaker conducted the largest stimulation of so called largest neural network till now, which involved around 80,000 neurons connected by around 300 million synapses. Spinnaker is a low-grade supercomputer which had the ability to run such a function so-called cortical microcircuit. It simulated on a slower time scale than it was expected.

MIT's: -

A chip with more than 100 trillion synapses that act like neural network in the brain was made from silicon germanium in MIT. It showed 95 percent accuracy in human handwriting in a simulation conducted. It could also perform inference tasks like improving the detail or blurring the original image on command. This chip could help mankind in making humanoids and autonomous driving technology.

Qualcomm Zeroth: -

Qualcomm is in the process of developing a new computer structure that eliminates the old theory of computer. Working on main goals of Biologically inspired learning, making it possible for technology to reach the world has humans do and enabling the devices to view and creating and defining Neural Processing Unit (NPU), it is new technology initiated by Qualcomm which will allow devices to train for human-like interaction and responses.

AkidaNSoc: -

A brain chip has been developed by the company. Describing it as a neuromorphic engineered chip which runs on a digital logic process. Based on the biological functions so called spiral neural networks (SNNs) which consume less power than the convolutional neural networks (CNNs). The algorithmic based intensive convolutions and Propagation training methods of CNNs are replaced with neuron functions and feed forwarding training ideas.

4 Neromorphic Computing Analysis

The focus of research is majorly to make developments in the field of learning from unstructured stimuli using less energy has much as possible. The building blocks in the system are analogous to neurons. Every neuron the system is capable of firing independently which then sends signals to others neurons allowing them to arrange their electric state of accordingly.

The key challenge faced by the researchers is to modulate the uncertainty and noise into natural data, which humans are able to do but the system is having trouble with. The ability to overcome this will let it to analyze a situation properly and understand the uncertainties to compute with, allowing this kind of technology in different domain applications. This kind of decision making allows them to understand and adapt to the environment which helps in predicting the further events to take a more accurate decision.

Algorithms are one of the major questions when it comes to neuromorphic computing. Since the algorithm chosen has an impact on the neuron, synapse and neural network. So, the question rises on what algorithm should be chosen. Beyond that another issue faced by the computing is whether the training of the chip should be on its own or the algorithm should be trained and then put on the chip. But since it works on learning from its surroundings the idea of chip on its own is preferred for making more better decisions in the near future by analysing each and every case.

Another issue is what happens when the algorithms are on the chip should it be monitored or shouldn't it be. So, should it learn offline and then act being monitored. One of the major reasons for neuromorphic computing to be of much interest is due to the declining of Moore's law. Even though all the perceptions are being taken most of the well-funded companies are still working hard to develop algorithms which can be used in the hardware for better efficiency of the chip. All over algorithms play a vital role in the development of neuromorphic computing.

A. THRIVING OF NEUROMORPHIC COMPUTING

The advances in transistors from a long time have reduced the size time by time, but there could be a limit to the limits extension of reducing the size where increasing the workload may not have any effect or better results. Neuromorphic computing shows a positive response in the leap towards future. The seek to make a machine on the rational theory of how the human mind may work will pay off. The attribute of neuromorphic computing is that due to its low power consumption it can be used in mobile devices and sensors in real time.

Neuromorphic computing is not a tool to make more calculations easier or create better software; the aim of it is to take decisions, responses and behaviour like a human by analysing and learning each and every scenario. In the upcoming few years, neuromorphic computing technology will become common and change the perspective we view and work with technology. The scope of Neuromorphic computing coming is promising due to its collaborative way of thinking of making computers think and work as humans. The systematic improvement in technology will thrive neuromorphic computing as a major criterion for all AI based applications and devices in the near future.

B. GOALS OF NEUROMORPHIC COMPUTING

One of the many aspects of this research is that, while we research about the human brain and how it works and try to implement, we also get to know what it cannot do. Digitals computers are designed in a way that it can solve only particular problems and their reach is limited. If a new problem is given, it won't be able to do. On the other hand, a human being first analyses the situation and act according to its intellect. This sophistication is not developed into computers. But the problem is that a human being sometimes makes wrong decisions based on their intellect. So, the goal is to make a computer which acts and works like brain, whose structure is based on synaptic networks but in a better way.

Fig.4.1 Synaptic Network

Neuromorphic computing initially came into picture in early 1980s. carver meads was verykeen to know the communication among the dense collection of wires on a transistor chip.Deep diving into the machinery, if the wires are structured more like neural networks inbrain, it could achieve its best efficiency.Many researches have been done since then by some of the big names in the industry likeIBM, HP and many more.

Human brain is efficient and there is no comparison between the efficiency of a humanbrain and digital computers. This efficiency is due to the spikes used in human brain. If aspiking artificial neuron is made, power consumption would decrease with a higher speed. This observation was made by machine learning pioneer Terry Sejnowski.

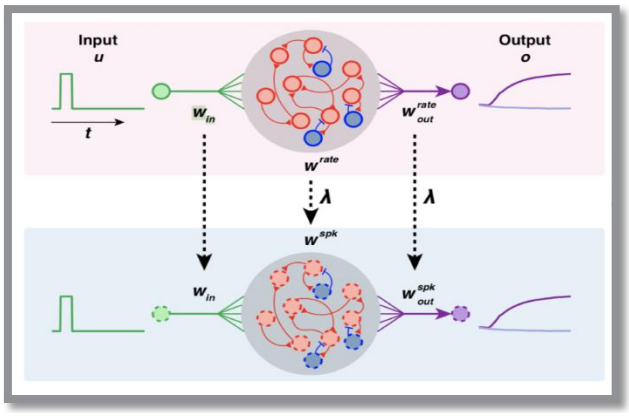

Fig.4.2 Spiking Neurons

C. THE HURDLES

This is a technology which is still being researched which created a spark in advancement due to recent attempts at the practical use of neuromorphic computing architectures. The recent developments in neural networks have shown the potential to improve the efficiency in neuromorphic hardware. We are not able to see a constant growth in software field in this technology due to lack of software engineers and software developers. On the other hand, there are a handful of hardware developers, neuroscientists and researchers in the hardware sector of the field which are showing promising results.

The main challenge faced by researchers is mapping the algorithms to the architecture. It is lacking in developers and engineers whose thought should surpass our current one step at time thinking to programming. Since this field is still in the emerging stage a lot individuals do not have any particular knowledge regarding this domain, which needs to considered seriously and measures should be taken should popularize this sector. A different kind of approach is needed to access and monitor this subject. The need to combine with other fields of research such as analysis sector is needed to overcome the difficulty to manage learning continuously, accountability and the ability to handle noisy input.

The lack of perspective in programmers to develop algorithms to implement it in hardware is also another difficulty being faced by all the researchers in the recent times. The technology in which we are developing the chip isn't enough to improve the models as the capacity of better output is being limited due to the compression is size. Therefore, a new procedure is needed to implement the process.

Neuromorphic perspective has shown a significant result in identifying patterns with less amount of energy and the speed of identification can still be increased to solve numerous numbers of problems. Such a processor helps in analysing and processing data of images and videos more rapidly. Researchers need to find ways to evaluate and analyse the potentials of the available programming models and architectures to be enhanced. Regardless of all the challenges being faced, there has been enormous funding in this field.

5 Upcoming Reach

When Neuromorphic computing will come into use, they would be able to run algorithms (or) decisions on their own according to the necessary situation. They would be competent enough to adjust to their surroundings and will be able to differentiate between the tasks which are important and gather the information needed for the task much like a regular human brain. Rather than working on a specific set of codes. This connection between the brain and AI can help the new generation researchers in getting a better perception of the brain. The impact of neuromorphic computing can change our interface in relation to machines. Neuromorphic computing seeks to change the way machines work by letting them to analyse through monitoring.

Let's say for example, a program to recognize all kinds of animals is done by providing it with a lot of photos of all kinds of animals by a coder. A neuromorphic computer then would be able to work out the difference between all the animals and start making its own distinguished layout configurationally, which lets it to characterize much faster for the

upcoming times. This shows that neuromorphic computing uses information given to it to understand the basic line of instructions and then, starts computing its own set of codes to make the program run quicker.

Some applications of neuromorphic computing will include the systematic understanding of irrigation between a farmer and the crop, detection of biological or chemical explosives, fraud in cheques, helping in detection of cancer, monitoring or surveillance of traffic, drones with neuromorphic technology could monitor the traffic all the time and adjust the route for traveller's time to time, Neuromorphic chips can be implanted into Robots to make autonomous decisions in fields of recruitment and warfare.

Coming to the environment point of view it could analyze the previous data, predict the exact circumstances and take measures to stop it from happening. Neuromorphic computers could bring a great knock to the stock analysis and weather forecasting. This kind of technology sees that the work gets finished faster and more effectively by always letting its network adjust and adapt to the new information. The use of this kind of technology is endless.

These are just a few capable abilities of neuromorphic computers. This technology in the upcoming days will bring an evolution to the human computers by enhancing their strengths, abilities and efficiency. Few real-world examples of neuromorphic computing are listed here:

- **TianjicChip:**

This chip is used in a self-driving bike which has the ability to follow a person, overcome obstacles and respond to the person's voice commands.

- **Intel's Loihi chip**:

This chip could recognize the smell of 10 hazardous chemicals, even chemicals such as acetone, ammonia and methane. It was able to do this even when there was a lot of noise.

- **IBM's TrueNorth chip:**

This chip showed that it could differentiate between pedestrians, bicyclists, cars and trucks.

The major players in neuromorphic approach are IBM, Samsung, Intel, HP, HRL, LLC, General Vision, Applied Brain Research and BrainChip Holdings.

6 Conclusion

Neuromorphic chips portray a solution on Nero biological concepts regarding the technical queries on computing that are being raised. Numerous applications that are being developed require enhancing large amounts of data at the initial stages and then to draw different kinds of conclusions to make a perfect decision in the environment. The expectations on the super computers which can act like a brain is to be embraced but still, as these chips are under experimental phase of development much is unexplored. Although questions are being raised on the capabilities, several researchers believe that the ability to bring a revolution to algorithms is neuromorphic computing.

References

[1] Ankayarkanni B, Albert Mayan J, Aruna J,"Support vector machine for effective robust visual tracking", Journal of Computational and Theoretical Nanoscience,Vol.16, No.8, pp. 3571-3575, 2019.

[2] https://bdtechtalks.com/2019/10/28/neuromorphic-chips-artificial-intelligence/

[3] https://www.zdnet.com/article/what-neuromorphic-engineering-is-and-why-its-triggered

[4] https://www.pnnl.gov/computing/HPDA/ResearchAreas/Tasks/HPDA_NeuromorphicComputing _17.pdf.

[5] Sathya Bama Krishna R, Usha Nandini D, Prince Mary S , 'A study on unsupervised feature selection",Journal of Advanced Research in Dynamical and Control Systems, Vol.11, No. 8 , pp. 1252-1257 , 2019

[6] https://www.google.com/imgres?imgurl=https://www.intel.com/content/dam/www/public/us/en/images/research/16x9/labs-article-neuromorphic-research-loihi-background-16x9.jpg.rendition.intel.web.864.486.jpg&imgrefurl=https://www.intel.com/content/www/us/en/res.

[7] Prince Mary S, Ankayarkanni B, Usha Nandini D, Sathya Bama Krishna R, Aravindhan S,"A Survey on Image Segmentation Using Deep Learning",Journal of Physics: Conference Series, Vol.1712, No.1, 2020

[8] Albert Mayan J, Velmurugan A, Nitin Narayanan Kokkoori, Lokesh Koleti,"Forecasting Hospital Admissions in Emergency Department using Data Mining",Journal of Critical Reviews, Vol. 7, Issue.15,pp. 356-362,2020.

[9] Anto Praveena M.D. , Bharathi B,"Computation of missing fields based on neural network in the field of healthcare", International Journal of Advanced Science and Technology,Vol. 28, No. 13, pp. 366-375, 2019.

[10] Feynman Rambus. (n.d.). Retrieved from Rambus: https://www.rambus.com/blogs/lets-talk-about-neuromorphic-computing.

[11] https://en.wikipedia.org/wiki/Neuromorphic_engineering.ieved from YouTube: https://www.youtube.com/watch?v=TetLY4gPDpo.

[12] Christina R, Liz Shajan G, Ankayarkanni B,"CART- A Statistical Model for Predicting QoE using Machine Learning in Smartphones",IOP Conference Series: Materials Science and Engineering,Vol.590, No.1,2019.

Application of IoT for Counterfeit Prevention in Fast Moving Consumer Goods

A.Mohamed Abbas[1], S. Vimal[2], U. Maheswaran[3], T. Porselvi[4], B. Meenakshi[5]
{abbasasfaq@gmail.com[1], vimalshan@gmail.com[2], er.maheswaran@gmail.com[3], hod.eee@sairam.edu.in[4], Meenakshi.eee@sairam.edu.in[5]}

[1]Senior Faculty, Computing and Informatics Department, Mazoon College, Muscat, Sultanate of Oman, [2]Assistant Professor, Department of Information Technology, Jeppiaar Engineering College, Chennai, India, [3]Assistant Professor, Department of Electronics and Communication Engineering, Rajalakshmi Institute of Technology, Chennai, India, [4]Professor and Head, Department of Electrical and Electronics Engineering, Sri Sairam Engineering College, Chennai, India, [5]Professor, Department of Electrical and Electronics Engineering, Sri Sairam Engineering College, Chennai, India,

Abstract. The current research provides research into the techniques used and in making fraudulent identification of fast-moving consumer goods, which can be used to combat the distribution of counterfeit goods in various domains. Different strategies can be used to identify and control the distribution of counterfeit goods at different levels. The list of strategies and methods explored in this report include: asset verification technology, which can be used to distinguish between real and counterfeit goods, tracking and tracking technology, which can be used to control the purchase and distribution of chains to make it easier to find counterfeit goods in the supply chain. and marking ecommerce web analytics technology, which can be used to identify fraudulent product vendors and set up organizations and processes. Each method may not be a valid solution to the problem of production and distribution of counterfeit products. The fraud problem is related to many different domains and assets..

Keywords: FMCG, Top Companies, Counterfeit Prevention, Brand Protection, smart labels.

1 Introduction

Long haul market stuns, abrupt changes in standards of conduct, and sensational vacillations sought after, have made issues in the store network, particularly shopper products chains (FMCGs). There are contrasts between the organic market for fundamental food sources (e.g., oil, flour, sugar, salt, milk, meat). There are postponements and blunders in conveyance, item shakiness, upset stockpiling conditions, and so on Proficiency, straightforwardness, and soundness of the FMCG store network are addressed.

The truth of the matter is that this is a market where the assistance area overwhelms. Of the complete number of enlisted lawful elements, 35% to 40% of enrolled organizations are in the FMCG distribution stage. As a rate, the most noteworthy number of representatives is in the FMCG situation class (about 10%), with the FMCG deals income share in WB absolute GDP of 11%. What's more, the WB district is fascinating in research since it is a business

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opportunity for in excess of 20 million purchasers, portrayed by critical financial and social contrasts in all areas, making it serious.

Settle, Procter and Gamble, and Coca Cola are among the biggest buyer products organizations on the planet. Settle in Switzerland, for instance, works in excess of 2,000 brands that incorporate everything from nutrients to cold food sources. Critically, inside the quick buyer merchandise area, piece of the overall industry rivalry is high. Accordingly, organizations center more around bundling not exclusively to pull in clients, however to keep up the timeframe of realistic usability and item trustworthiness.

2 Related Study

The top Indian FMCG organizations with their subtleties available

Hindustan unilever limited company – Debt to equity - 0, Cratioeffiency – 1.31, yield – 1.08, Price – 11.66, sales – 11.87, PE – 74.16, ROE – 86.11, ROCE – 117.25, MCAP – 543560.

ITC company– Debt to equity - 0, Cratioeffiency – 4.02, yield – 4.55, Price – 4.77, sales – 5.61, PE – 21.07, ROE – 25.66, ROCE – 31.55, MCAP - 274588.57.

Nestleindiacompany – Debt to equity - 0.03, Cratioeffiency – 1.78, yield – 1.22, Price – 55.32, sales – 13.35, PE – 76.14, ROE – 70.27, ROCE – 98.16, MCAP - 158549.38.

Britanniacompany – Debt to equity - 0.28, Cratioeffiency – 1.45, yield – 1.01, Price – 33.6, sales – 7.53, PE – 46.7, ROE – 35.94, ROCE – 41.47, MCAP - 83488.56.

Marico company– Debt to equity - 0.03, Cratioeffiency – 1.71, yield – 2.32, Price – 8.15, sales – 12.5, PE – 46.88, ROE – 28.95, ROCE – 35.69, MCAP - 51008.02

3 Methodology

Current section contains the materials and methods of this research work. The dataset collected from UCI repository and tradebrains. The data set contains laboratory values of companies profile with detailed information. The below information have given about the list of the attributes.

1. Mass Serialization Technologies
2. One dimension-Bar Code
3. QR code
4. Physical Fingerprint Technology
5. Other overt technologies
6. Other covert technologies
7. Radio Frequency Identifier

The Weka 3.8.9 has implemented to get the optimal solution of the above dataset. The below approaches have implemented and got optimal solution.

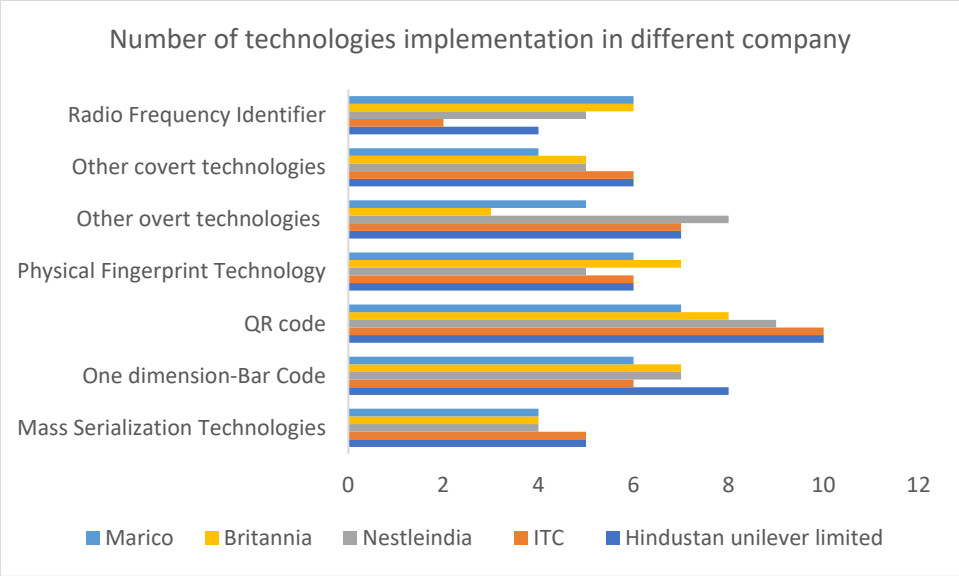
4 Results And Discussion

Study results indicates the significance of IoT implementation in FMCG for counterfeit prevention based various technologies. Quality analysis of various parameter including Mass Serialization Technologies, One dimension-Bar Code, QR code, Physical Fingerprint Technology, Other overt technologies, Other covert technologies, Radio Frequency Identifier.

Table 1. Number of technologies implementation in different company

S.No	Techniques	Hindustan unilever limited	ITC	Nestleindia	Britannia	Marico
1.	Mass Serialization Technologies	5	5	4	4	4
2.	One dimension-Bar Code	8	6	7	7	6
3.	QR code	10	10	9	8	7
4.	Physical Fingerprint Technology	6	6	5	7	6
5.	Other overt technologies	7	7	8	3	5
6.	Other covert technologies	6	6	5	5	4
7.	Radio Frequency Identifier	4	2	5	6	6

Figure 1. Number of technologies implementation in different company



QR code based technologies in implemented in almost all top companies. Still there are technical and logical issue in implementing.

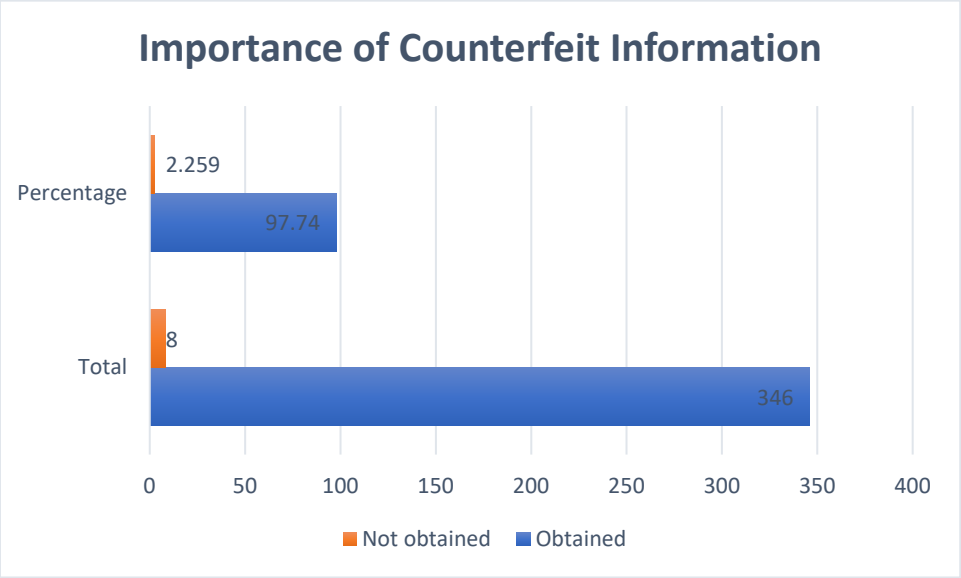
5 Importance of Counterfeit information

Counterfeit information should be known be the consumer in general. Information on counterfeit products enable consumer for choosing good products. The statistical analysis of Counterfeit information on products identification on smart tags is 97.74, 2.259 percentage incounterfeit information obtained by consumer is higher than not obtained consumers (Figure 2& Table 2).

Table 2. Importance of Counterfeit information

	Total	Percentage
Obtained	346	97.74
Not obtained	8	2.259

Figure 2. Importance of Counterfeit information



The need to combat counterfeiting in the global manufacturing network is widely recognized and various alternatives and approaches have been proposed to address this issue [1,2]. These processes apply to the product business [2,14]. There are arrangements based on the IoT based technologies that may be below the lower stage, as IoT based technologies users are less available [15,16]. Then again, preparations based on ink are highly adaptable to the point of execution [11,15], but they are easy to imitate [14]. A few experts suggest the use of preparations based on glittering materials [9] or unusual examples [10], but there is a need for more help with these methods. Product tracking and tracking arrangements based on the use of single product bottle numbers using the OCR method can be considered, but the disadvantage

is that the accuracy of the reading and use of different text styles and numerical programs for different product types [7-11]. Frameworks of object identification and anti-fraud based on the use of QR codes are generally accepted by consumers and often require a camera with a camera [2-6]. The naming of Blockchain similarly finds its use in the production network of application managers [15,16], and its new record recording could allow for the selection of cloud-based frameworks soon.

6 Conclusion

This paper outlines the implementation of a pilot project that uses a variety of methods to create a product validation framework and false arguments in the product business. This method is powered by IoT, distributed by archiving and investigating information, mobile applications, and randomly labelled based on unique QR codes. The use of awesome labels creates a parallel space, where everything that happens is visible, using the new techniques provided by Horizon 2020 TagItSmart! project [1-4]. If it is not a very common problem, note that the standard standard tags distinguish the type of object that currently does not provide data for the same item [5-7]. It is worth noting that the GS1 Digital Link Standard has been redesigned in TagItSmart! making and donating marks the use of QR code, (IoT based Smart Tags), closed field communication (NFC), and Bluetooth to transmit information to their customers [8-10]. The common idea is to provide limited web-enabled provision to improve consumer purchasing experience, strengthen product reliability, and improve store network availability and efficiency.

Surprisingly the use of smart labels is that the general protests of the massive market that are not considered part of the IoT biological system can be provided by sharp labels that allow them to radically change their individual status by relying on environmental changes [11-14]. Another important part of this method used to detect human-enabled detection is cell phone access everywhere with their cameras [15].

References

[1] Wang, L.; Wells, P. Automobilities after SARS-CoV-2: A Socio-Technical Perspective. Sustainability 2020, 12, 5978.

[2] Obrenovi´c, B.; Du, J.; Godinic, D.; Tsoy, D.; Shafique Khan, M.A.; Jakhongirov, I. Sustaining Enterprise Operations and Productivity during the COVID-19 Pandemic: Enterprise Effectiveness and Sustainability Model. Sustainability 2020, 12, 5981.

[3] Agbehadji, I.E.; Awuzie, B.O.; Ngowi, A.B.; Millham, R.C. Review of Big Data, Artificial Intelligence and Nature-Inspired Computing Models for Performance Improvement towards Detection of COVID-19 Pandemic Case and Contact Tracing. Int. J. Environ. Res. Public Health 2020, 17, 5330.

[4] Hirata, A.; Kodera, S.; Gomez-Tames, J.; Rashed, E.A. Influence of Absolute Humidity and Population Density on COVID-19 Spread and Decay Durations: Multi-prefecture Study in Japan. Int. J. Environ. Res. Public Health 2020, 17, 5354.

[5] Worldometer. Reported Corrona Cases and Deaths by Country, Territory, or Conveyance. Available online: https://www.worldometers.info/coronavirus/ (accessed on 25 July 2020).

[6] Nientied, P.; Shutina, D. Tourism in Transition, the post Covid-19 Aftermath in the Western Balkan. Co-PLAN Resil. Ser. 2020, 2, 1–20.

[7] Ivanov, D. Viable supply chain model: Integrating agility, resilience and sustainability perspectives—Lessons from and thinking beyond the COVID-19 pandemic. Ann. Oper. Res. 2020, 1, 1–21.
[8] Y.G. Kim *et al.* Consumer acceptance of a quick response (QR) code for the food traceability system: Application of an extended technology acceptance model (TAM). (2016)
[9] L. Li. Technology designed to combat fakes in the global supply chain (2013)
[10] H. ScholtenDefining and analysing traceability systems in food supply chains"chapter in "Advances in food traceability techniques and technologies" (2016)
[11] G. Baldini, I.N. Fovino, R. Satta, A. Tsois, E. Checchi, "Survey of techniques for the fight against counterfeit goods. N.C.K. Yiu. An NFC-Enabled Anticounterfeiting System for Wine Industry. (2014)
[12] A. Chéron. La protection et la contrefaçon de vins en France et à l'étranger" [The protection and counterfeiting of wine in France and abroad] Le Journal du Net (28 June 2013)
[13] B. Lecat. Fraud and counterfeit wines in France: an overview and perspectives. Br. Food J. (2017)
[14] R. Pender. Counterfeit Wine – Its Impact on the Business of Wine. (March 2010)
[15] Harald Sundmaeker "Internet of Food and Farm 2020", Chapter in "Digitising the Industry"(2016).
[16] W. SarniFrom Dirt to Data, The second green revolution and the Internet of Things" Deloitte Rev. (2016)

A Novel Watchdog Timer for Real-Time Intensive Applications

Dr.R.SenthamilSelvan[1], Dr.V.Mahalakshmi*[1], Dr.S.P.Vijayaragavan[2], Dr.S.Arulselvi[3], Dr.M.Jasmin[3]
{senthamilselvan87@gmail.com[1], mahachandru18@gmail.com*[1], vijayaragavansp@gmail.com[2], arulselvi2003@gmail.com[3], rifriz@gmail.com[3]}

Associate Professor, Department of ECE,Chadalawada Ramanamma Engineering College, Tirupati, Andhra Pradesh, India.[1], Associate Professor, Department of EEE, Prince Shri VenkateshwaraPadmavathy Engineering College, Chennai[1*], Associate Professor, Department of EEE, Bharath Institute of Higher Education and Research[2]

Abstract. Integrated systems utilized in security-critical applications require the very best accuracy. Externic monitoring watches are utilized in that structure naturally manages to get over failures associated with operating time. Most vacant exterior watch watches use extra circuits are regulate rest interlude and supply just partial appearance in terms of the performance. A document explains planning, style of enhanced arrangement of watchdog timer which utilized in security-demanding use. Various errors finding method are constructing watchdog, adding to its strength. A process is fairly common and not to observe procedure of a few relative method. This enables a planning is simply tailored to diverse use as dropping common price of a system. The efficiency of planned surveillance device to notice error is initially deliberate by examine the simulation outcome.

Keywords: FPGA, Watch Dog Timer (WDT), Hardware Description Language (HDL), Input and Output Interface, Verilog and VHDL.

1 Introduction

For applications where framework disappointment can cause injury, most extreme unwavering quality is required. Such frameworks must have adaptation to non-critical failure components that consider the sudden to guarantee satisfactory operational security. These frameworks ought to have the option to recuperate from a mishap without human help. This adaptation to internal failure components recognize when a deficiency happens, to cure the issue and breaking point framework personal time [1]. One approach to accomplish adaptation to non-critical failure is to execute framework repetition. The utilization of numerous duplicates of basic framework parts improves the dependability of the whole framework [2]. Notwithstanding, this improved unwavering quality of the framework is acquired gratitude to an expanded equipment and programming intricacy relying upon the sort of design utilized. By building up a shortcoming lenient framework, the guard dog is one of the most financially savvy strategies for identifying and dealing with blunders identified with uptime [3]. A guard dog clock (WDT) is an equipment subsystem that screens framework activity and makes certain move if a blunder is identified [4]. In the event that the WDT lapses, this is an auxiliary sign of an issue with the watched framework [5]. On the off chance that the

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processor can't reset the guard dog, the choice is made either to restart the framework, or to place it in a known state from which it recoup, which forestalls consecutive harm. Inward observing diminishes unpredictability and equipment costs; however it's anything but a strong arrangement. Hence, the system is associated with processor-clock, the guard dog can't screen the equipment for mistakes because of a quartz blunder [6]. At the point when the unwavering quality of an on-board framework is basic, outer guard dogs are unavoidable. The impediments of interior guard dogs and prompts substantially more vigorous & issue open minded framework structures[7]. A class of self-governing checking chips just offers fixed timespans, which makes them less broad. Different gadgets permit you to modify the lapse times utilizing extra outer circuits. While this technique is valuable, it builds the intricacy of the equipment and expands the general expense of the framework. The expanded expense and unpredictability of outer guard dogs can be figured out how somewhat by actualizing guard dog usefulness in an on location programmable entryway arrange (FPGA). Numerous cutting edge inserted frameworks in at least one of the organization's FPGA gadgets accomplish the ideal framework usefulness [8],[9]. Putting the checking clock on a FPGA can prompt a productive and hearty arrangement. The structure didn't offer a clock for the processor; despite what might be expected, a sufficiency look at was conveyed for specific factors and an essential check of the program progress. EL-Attar gives a successive checking clock shows pre-owned records to decide if a blunder had happened[10]. Be that as it may, barely any arrangement alternatives were offered and the mistake discovery capacities actualized were restricted. In [11], the creators talked about the nuts and bolts of a checking clock framework with different equipment parts in FPGA, yet kept the plan of observing basic. By actualizing field programmable gate array plan, a similar observing equipment can be associated with various processors and frameworks with just minor alterations to the related HDL code (Hardware Description Language) [8]. It likewise permits the incorporation of a few observing clocks for multicore designs. The proposed checking clock functions admirably for wellbeing basic on-board frameworks that utilization excess channels to improve framework unwavering quality. The plan of the WDT as a reusable IP center additionally addresses the out of date quality issues of the segments experienced by numerous.

II. Design Of Watch Dog System

A valid watchdog should have the ability to identify all irregular programming modes and return the frame. It must be in good condition to allow the restoration of the equipment if all or some of the peripherals are cut [3]. The watchdog offered in this article works freely from the processor and uses a busy watch for its abilities. Engineering follows a use of window monitoring, in which window times are often designed by the merchandise during installation. A bomb banner is raised when the watchdog clock ends and after a hard and fast measurement of your time to raise the banner, a reset is activated. Time in the medium is often used by the goods to store important bearing data on an unpredictable medium. In frame, for example due to unlimited circles running code. The control contributions to the monitoring clock, ENABLE and RD / WR, develop a chain and limit contact with the disposition register. The ABUS and DBUS flags in an image show the transport of addresses and the transport of knowledge separately.

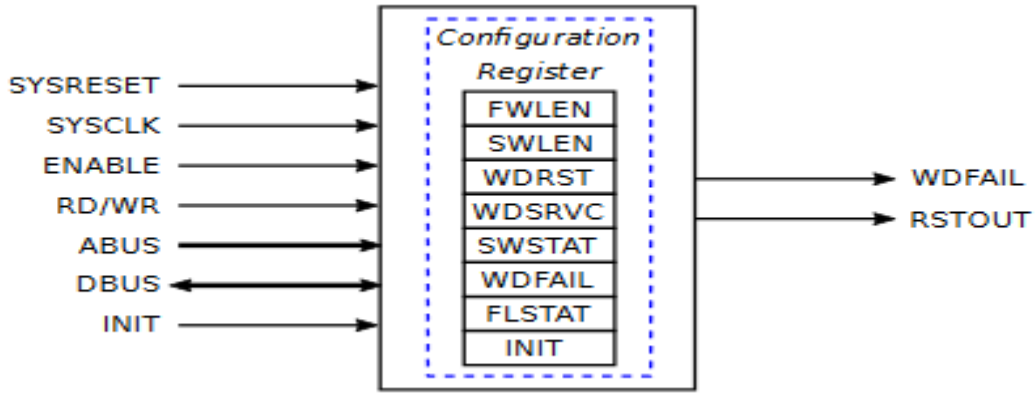

Fig 1: windowed watchdog design

An Initial Setup of Timer

During startup or restart, the observer activates in a blinking state, which means that WDFAIL performance is high. It is the duty of the property to present and manage the guard dog. Figure 2 shows the waveform for resetting the guard dog and entering general activity. Therefore, in order to get the watchdog up and running, the watchdog reset field (WDRST) in the configuration record must first be changed from bottom to top. This cancels the WDFAIL header caused by the redesign of the watchdog in the management window and makes it working. Since the window window remains larger than the frame outline, another help window starts before this window expires. When the spotter has been successfully overhauled, the window will be restored. Regardless of how long the window counters work, the observer will not take a clock.

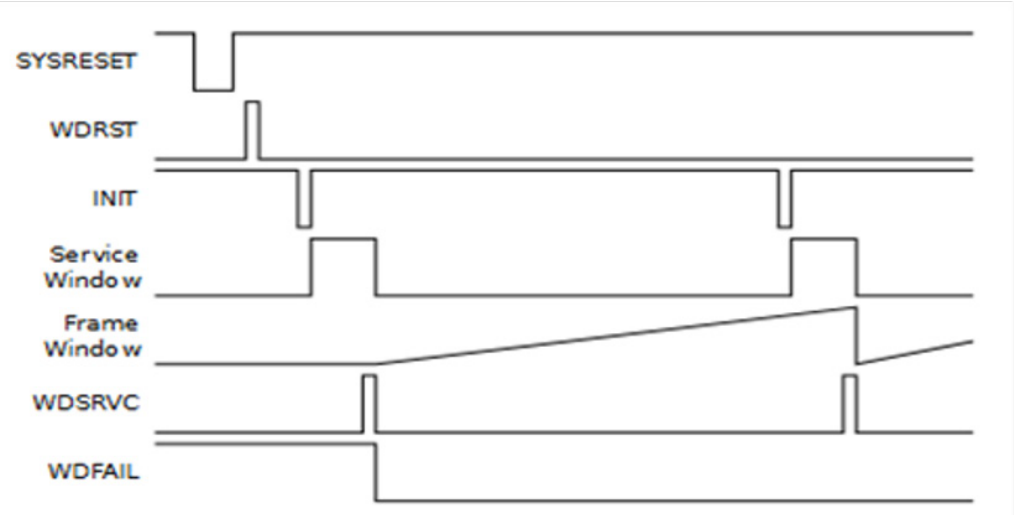

Fig 2: Initialization of Watchdog Timer and its working

III. Watchdog-Timer Implementation

These segments capture the recognition of the surveillance fists presented in the FPGA. The high-level diagram of the monitoring equipment is illustrated in Figure 6. The structure is synchronized with the SYSCLK input released by the processor clock. plan. These attributes are usually selected after the force, in the location register - SWLEN for the application window and FWLEN for the navigation window - set to the correct bits. When choosing shades, the length zones of residential windows are naturally bolted; that is, sticking to these bits is disabled. In cases where the window lengths have to be changed again, there are 16 open records in the structure [10]. Therefore, when the length of the window changes, products must perform two-step registrations based on that registration with the information 0xAAAA and 0x5555. To successfully create most samples, you must create the following within 10 μs, after which there is a period of 10 μs to modify the length order fields of the goods. If these timings are not carefully controlled, staying tuned for these bits will be deficient. When a change from top to bottom of the INIT signal is detected, the administration window opens. The administration window uses a much slower specific time (SWCLK) than SYSCLK. Slow validation can reduce the number of comparators required, limiting the use of resources in FPGA. The management windows have a balanced SYSCLK up / down counter and a basic counter which runs in SWCLK. The counterweight counter balances the INIT input and therefore the subsequent growth eaves of SWCLK (Toffset). This is often necessary because the INIT flag cannot be determined simultaneously and SWCLK may appear each time during Tswclk time. The prediction of the balance is recorded then the main counter is started, at this time (SWLEN - 1) executed. When the master counter expires, the counter falls for a Tswclk-Toffset period [18]. This counting strategy takes into account a certain authority for the length of the window. The operational status of the administration window is also regularly updated in the monitor configuration log. When the monitoring is effectively modified, the counters in the management window stop quickly, then the integrated window starts. The container window also uses a specific slow clock (FWCLK) for its activities. It is a main counter with functions such as a balanced / decreasing counter and that of the administration window. The balance counter here finds the counterweight between the top of the application window and therefore the subsequent growth eaves of the FWCLK. The first counter displays the hours (FWLEN - 1) then the counter. In the next length of the help window, the window counters are reset when the guard management activity occurs before the window ends. A. Restart initialization and failure detection The graph in Figure 7 shows State Machine Limited (FSM) running for the causes of watchdog restart and failure detection. It has been confirmed that the performance of WDFAIL was disappointing for the watchdog during its operation [19]. The rising edge on the WDRST bit prepares the watchdog for installation. When the management window is open, the rising edge on the WDSRVC bit cancels the performance of WDFAIL and, consequently, the window counters start to run. In all cases, if the watchdog is incorrectly configured, the entire input process is deleted and the product must therefore repeat the entire method. The WDFAIL signal is deactivated as soon as the watchdog connects correctly. If one of the frustration modes described in zone III occurs, the performance of WDFAIL is checked again while the watchdog is fully operational [11]. The edition register is updated with the bombed situation and therefore the idea of disappointment. Watchdog Failure Validation also activates a reset counter for a reinvented time measurement. The length of the counter is generally determined by measuring the troubleshooting data to be cleared. When the counter expires, WDT describes the high performance of RSTOUT. The reset counter will not be practical at power up and therefore the

RSTOUT efficiency will now be set at a low level. When presented to the observer simply because the gauge is finally getting stronger.

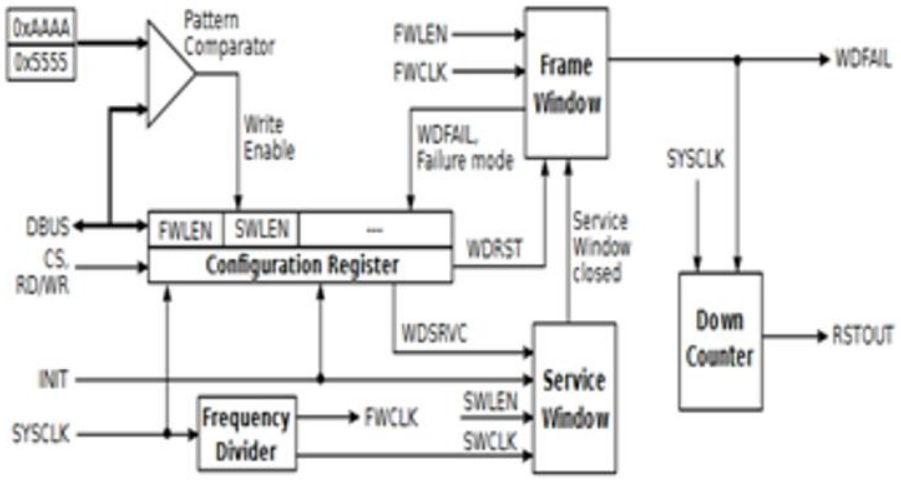

Fig 3: A Novel Watchdog Timer Functional Block

IV. Simulation Results And Discussion

Project Navigator

Project Navigator is a maximum-level manager of the CPLD design and also Xilinx FPGA, you can do the following. [Sources] to add and create a design source file to be displayed in the window. Edit the source file in the workspace. Run the process of source file in the process window.

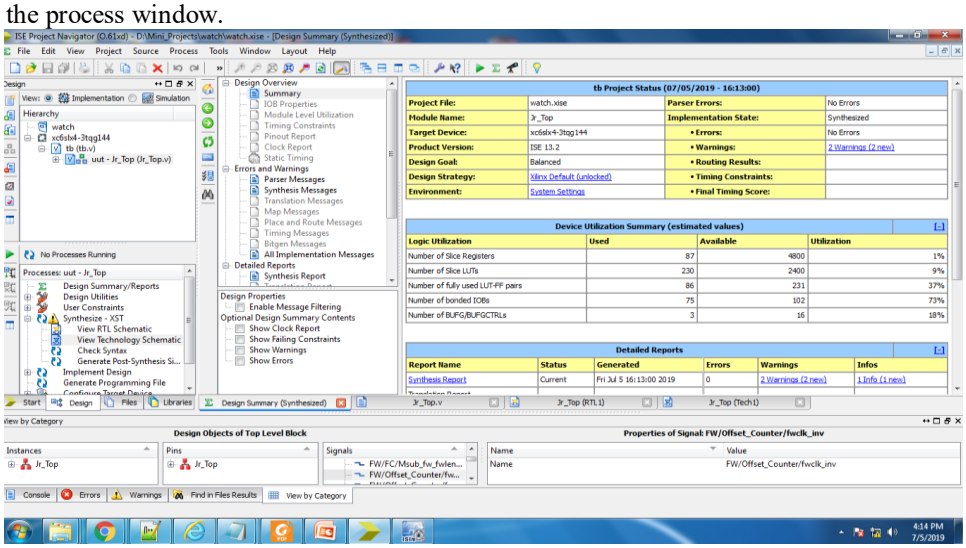

Fig 4: Project Navigator

Simulation Output

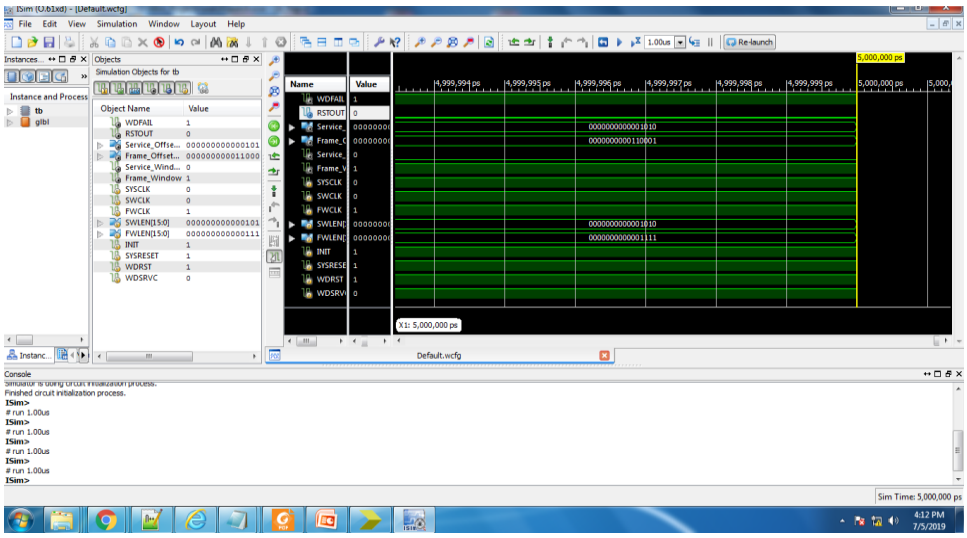

Fig 5: Xilinx Simulation Output

Design Objects of Top Level Block Output

In a run of the mill configuration stream, a FPGA application engineer will reenact the plan at various stages all through the structure procedure. At first the RTL portrayal in VHDL or Verilog is mimicked by making test seats to reenact the framework and watch results. At that point, after the combination motor has mapped the structure to a netlist, the netlist is meant an entryway level portrayal where reenactment is rehashed to affirm the blend continued without blunders. At last the structure is spread out in the FPGA so, all things considered proliferation postponements can be included and the reproduction run again with these qualities back-commented on onto the netlist.

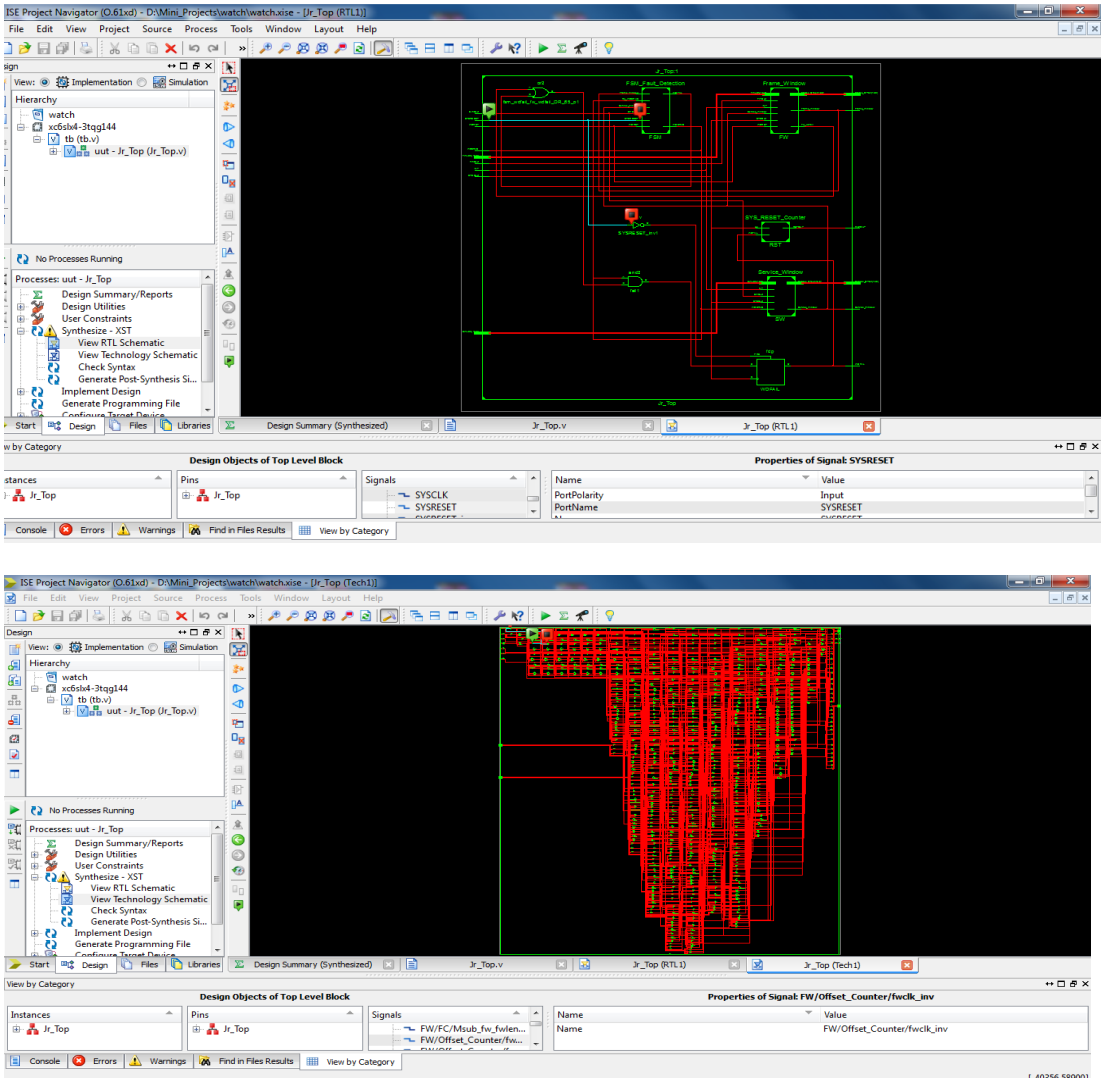

Fig 6: Top Level Block Output using RTL Schematic

Timing Summary

The Timing Summary segment is a diagram of the plan that incorporates: Timing blunders, which is the combined number of mistakes for the whole structure. Requirements inclusion, which shows the quantity of ways, net and associations secured by limitations.

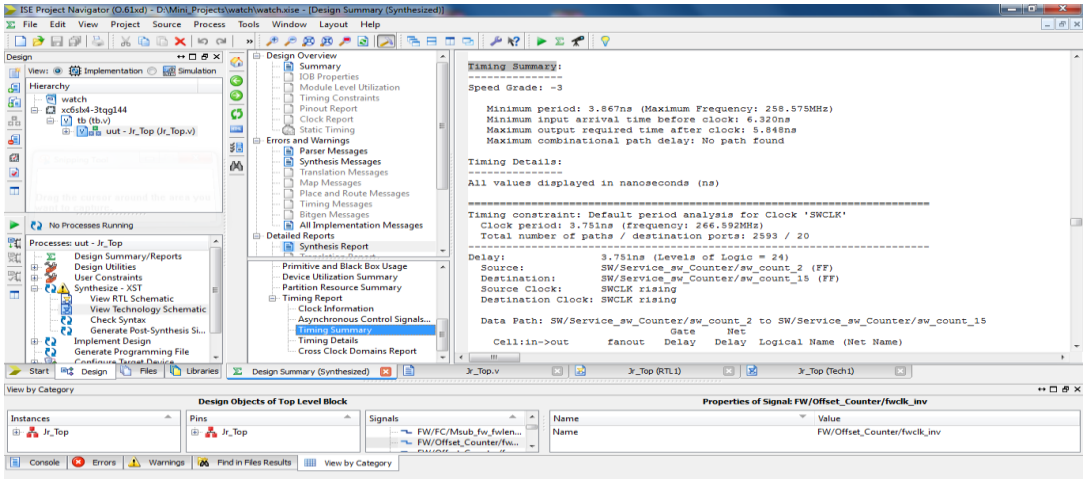

Fig 7: Timing Design Summary

V. Conclusion

This paper introduced intimately the engineering and plan of an improved windowed watchdog timer and effecting in FPGA. A watchdog timer runs completely freed from computer and grants altering timer parameters as signify the appliance. A couple of flaw identification measures are included with watchdog first location of inconsistent encoding form. The ability to differentiate frustration style and record it and may get significant as examine. Once recognizing a regret the watchdog timer additionally allow merchandise enough instance for scant troubleshoot information by opening a retune.

References

[1] S. N. Chau, L. Alkalai, A. T. Tai, and J. B. Burt, “Design of a fault-tolerant COTS-based bus architecture,”IEEE Transactions on Reliability, vol. 48, no. 4, pp. 351–359, Dec. 1999.

[2] A. M. El-Attar and G. Fahmy, “An improved watchdog timer to enhance imaging system reliability in the presence of soft errors,” in Signal Processing and Information Technology, 2007 IEEE International Symposium on. IEEE, Dec. 2007, pp. 1100–1104.

[3] M. Pohronsk´a and T. Kraj˘covi˘c, “FPGA implementation of multiple hardware watchdog timers for enhancing real-time systems security,” in EUROCON-International Conference on Computer as a Tool (EURO-CON), 2011 IEEE. IEEE, Apr. 2011, pp. 1–4.

[4] H. Guzman-Miranda, L. Sterpone, M. Violante, M. A. Aguirre, and M. Gutierrez-Rizo, “Coping with the obsolescence of safety- or mission-critical embedded systems using fpgas,”IEEE Transactions on Industrial Electronics, vol. 58, no. 3, pp. 814–821, 2011.

[5] H. Amer and A. Sobeih, “Increasing the reliability of the Motorola MC68HC11 in the presence of temporary failures,” in Electro technical Conference, 2002. MELECON 2002. 11th Mediterranean. IEEE, May2002, pp. 231–234.

[6] Karthick, R and Sundararajan, M. (2017), “A Reconfigurable Method for Time Correlated MIMO Channels with a Decision Feedback Receiver,” International Journal of Applied Engineering Research, 12.

[7] Karthick, R and Sundararajan, M.(2017), “PSO based out-of-order (ooo) execution scheme for HT-MPSOC” Journal of Advanced Research in Dynamical and Control Systems, 9.

[8] Karthick, R and Sundararajan, M. (2017), "Design and Implementation of Low Power Testing Using Advanced Razor Based Processor," International Journal of Applied Engineering Research,12.
[9] Karthick, R and Sundararajan, M. (2018),"A novel 3-D-IC test architecture-a review," International Journal of Engineering and Technology (UAE),7.

Evolution of Internet of Things (IOT) & Its impact on Smart Agriculture Environment

Usha K.P.[1], Dr.D.G.Anand[2], Dr. H.G. Chandrakanth[3]
{[1]ushakp@aitckm.in, [2]dga.ece.rgit@gmail.com, [3]ckgowda@hotmail.com}

[1] Research Scholar, AIT, Chikmagalur,
[2] Professor & Rector-Research, Rajiv Gandhi Institute of Technology, Bangalore,
[3] Principal, Sambram Institute of Technology, Bangalore, Karnataka,
Visvesvaraya Technological University, Belagavi, Karnataka

Abstract. In the present world scenario, due to global warming and abnormal climate changes there is challenging situation in field of agriculture. This field of Agriculture is the backbone of the Indian economy. The development of agriculture sector in terms of area of land under cultivation, use of modern equipment's with technology and financial assistance to the grower is absolutely very essential. Numbers of updates in the real-time technologies are coming in agriculture to reduce the production cost and also to improve total productivity. Water is a very important resource in agriculture. We need to focus on new concept to monitor the usage water, manure & human intervention in modern agriculture i.e. Soil testing, Humidity and water regulations etc. The development in Wireless Sensor Networks, the technology made it possible to use it in monitoring agriculture requirements in rural India. In this paper we are focusing mainly on the measurement & monitoring of various parameters like soil moisture, water supply along with humidity and temperature using wireless sensor nodes through internet.

Keywords: Measuring temperature, humidity, and controlling water supply, wireless sensor network, modern agriculture.

1 Introduction

The rapid developments of IOT based system redesigned the agriculture environment from the existing ,traditional methods and creating new avenues to study this field in both qualitative and quantitative approaches [1, 2]. This drastic, developments and recent study in blending of agriculture technology with IOT could improve in the field of agriculture sector, thereby increase in the production with reduced man power and land usage [3-7]

The goal is to confront an upcoming technology with one of the important problem across the globe, the sustainability of farming for farmers living especially in rural area. As the rain water is not not uniform throughout the season and unpredictable situation , the growers find it difficult in monitoring. At present, we do not have any designated irrigation method. Inview of this based on the received data's of from various location and its dynamics, minerals in the soil, season of rain, quantum of rain, climatic condition the type of crops to be cultivated may be decided. By this, crop yielding can be increased with lesser labor along with minimum usage of water.
Acute shortage of water across the globe is expected as the population is increasing ,deforestation with global warming. This is leading to shortage of cleaned drinking water in and aroung 1.1 billion people.In the present scenario, with the increasing population & ground water level is decreasing, the proper utilization of water is our prime objective. In this context, an correct water management approach, fertilizer, minerals feeding & multiple crop growing to avoid wastes can mitigate the above mentioned effects.

International Centre for soil Fertility and agricultural Development(IFDC), reported that cautions the formers, the limitations in type of farming practices such as usage of fertilizers (Manures), the declining status of soil nutrients at an annual rate of 30 Kg /ha in more than 75 % of African land. Formers must cultivate more and more land only to grow by cutting forest in turn because of deforestation, worsen soil erosion and that if erosion rates is not stopped, the yield of some crops could reduce by 1730% by 2025. It also suggests the need for monitoring using a Wireless Sensor Network. In our country ,formers depends mainly on traditional seasonal crops. These seasonal crops depends on unpredictable monsoon and floods which are causing damage to the small growers.

1.1 Statement of Problem

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As per the World Health Organization (WHO), the world is expecting the food production growth by 50% by 2025. This motivates the usage of modern technologies in all stages of food production, processing & preservation including transportation system, intern seed to consumer.
It is observed that farmers follow old traditional method of growing crops. The climatic condition is unpredictable. Sometimes formers undergo financial losses due to heavy rain fall or draught. In this paper, we are presenting a system with the recently developed IOT, which can be incorporated to monitor the crops using wireless sensor devices, in the automated environment. The IOT based precision farming system is will be studied to manage the system so as to improve the function with reduced water and human interference with higher productivity and profitability.

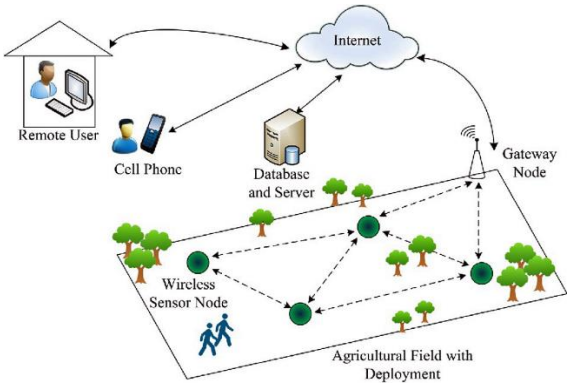

Figure 1. IOT based agriculture field

2. Related Work

The author [7], studied the agro climate in the US for studying the usage of WSN in agriculture. They noticed that distant sensing motes exhibited performance loss because of longer distance while shorter distant motes performed better.

In [8], authors presented a centralized database system, which can monitor climatic condition like rain fall, weather & status of moisture in the soil using wireless sensing motes.

The wireless sensors were deployed on selected locations and coordinates of these locations were collected with Global Position System and then, based on the collected data's were studied using the Geographic Information System [9].

The proposed system is capable of monitoring and analysis for precision water monitoring in agricultural system using zigbee and employed internet server with GPRS [10] & The author [11] developed a prototype purely for lab application for distant soil , temperature wireless measurement with13.56 MHz RFID tag which exhibited around 99% accuracy with the available thermo coupler .

2.1. Precision Agriculture

In late 90s , due to the developement of wireless sensing tecnology and its applications , the researchers and scientists made it possible to employ the development in this field in agriculture sector to help agriculture sector to improve the efficiency in productivity and reduced manpower

The IOT based precision agriculture provides real-time information about the field, through which the formers can predict or the decision about the crop can be decided based on the expected rainfall, present mineral condition of the soil along with the pricing condition in the market. The realtime based decision taking data analytics improved & yielded better approach and result than the hypothetical traditional decision making [12-14]

2.2 Wireless Sensor Network (WSN) Requirements

This WSN consists of sensing nodes deployed across the identified field. These sensor are a typical transceivers, which can receives, transmit the information along with battery and storing of data.

- Scalability:

- Multi-hop transmission
- Latency:
- Static/Mobile network
- Size
- Price
- Robust to physical environment
- Power consumption
- Low data rate

3. Different Advanced Technologies Used Agriculture

Some of the critical issues related to agriculture field and are can be resolved by newer technologies enlisted below

Technology	Utility
Wireless Sensor Networks	Irrigation Automation & Environment computerization
Remote sensing	Soil moisture, Humidity & rainfall details, Plant Health & Disease monitoring , data acquisition & controlling from the fields
Mobile App technology	Forms water flow regulating, Nutrients feeding ,Form equipment's controlling : CCTV / Energy level monitoring, Automated fire & smoke alarming techniques.

Sensor Motes Used For Agriculture

This below mentioned table shows different sensors available in the market for smart agriculture application.

Sensor Platforms	Sensors	Applications
TelosB	Temperature, Humidity& Light	Sensing light , humidity, temperature & GPS positioning
IRIS	Temperature , Humidity & Soil moisture	Sensing temperature, light & humidity Measuring soil moisture & regulation the flow of water

Sensor Types and Monitoring Parameters

It is known that carbon dioxide and water changes to starch and glucose by using sun light and water as plant food. The nutrients nitrogen, Phosphorus helps in the growth of plants and Potassium helps in photosynthesis, quality of yields and reduces the diseases in the crops.

The fertility of the soil is studied by taking samples from various parts of the identified field and experiments were carried out at laboratory as this is very difficult to the growers to carry out the same at their level as costing is involved and lack of updated technology. These tests includes

- ***Humidity Sensor***

  It is observed that if the plantation has too high or too less moisture, it creates problems in plant. In order to keep the moderate moisture, humidity sensor is used to maintain normal. This will help the formers to monitor the condition of humidity as required by the crop and regulate the same.Wang.et al. [16] reported that TelosB –humidity sensor is device which detects and indicates the required quantum of water vapor present.

- ***CO_2 Sensor***

The required quantity of oxygen level must be there in the root system to keep the system metabolism in nutrition. It is very important that if oxygen comes below the normal, it affects the root respiration system. Thus CO_2 Sensor is employed to overcome this drawback and also to monitor the real-time level. H.Soffer [17] advice to employ CO2 sensor to detect and monitor its level, so as to have healthy plantation.

- ***EC and pH Sensor***

  It is noted that pH and EC level should be moderate and are controlled for preventing of barrier growth. Its measurement is very important since the ion concentration [18]. Solubility of chemicals in the alkaline and acid changes.It is one of the important parameter to be measured and to be regulated fulltime growth of the plant. If the concentration level is abnormal, the rate of absorption of required nutrients also differs and intern results in plant growth

- ***Light Intensity Sensor***

  The smart agriculture refers to the usage of controlled light intensity of the plantation. There are good number of light sensors is available in the markets to detect the light and darkness. They include photo resistor, Photodiodes & photo transistor for varying light intensity. The light sensing devices includes phototransistors and photodiodes. The authors proposed web based system with Internet of Things to handle enormous data's handling system .They used LDR to measure intensity of light. [19].

  The population of India and China crossed 2.9 billion people as on today and 70% of water is being used for agriculture sector. The croplands irrigated is only around 17%, but they account for 40% of the earth. The population is still increasing, the demand of water also rising. The smart usage of water in farming sector is the

only way to compensate the demand of water supply. By adopting smart agriculture system, the wastage of water can be controlled to the maximum extent by at least by 20% [20]

2.3. Realtime Ground Test Results

For this implementation and evaluation of this realtime results , we had created the agricutural environment for observing and monitoring realtime updates.

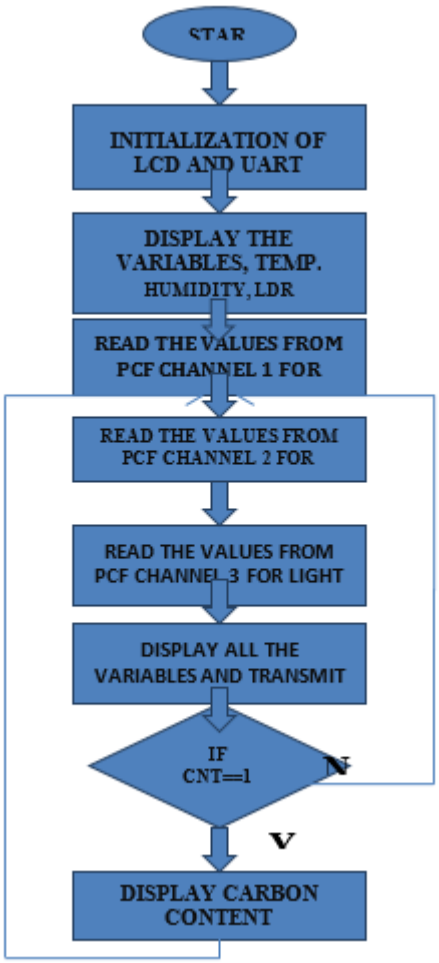

Figure 2. Transmitter Section Design Flow

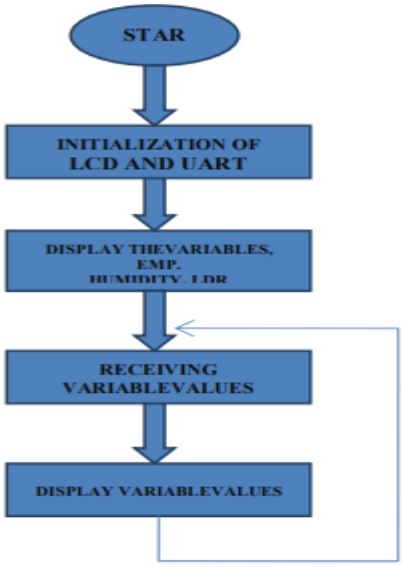

Figure 3. Receiver section design flow

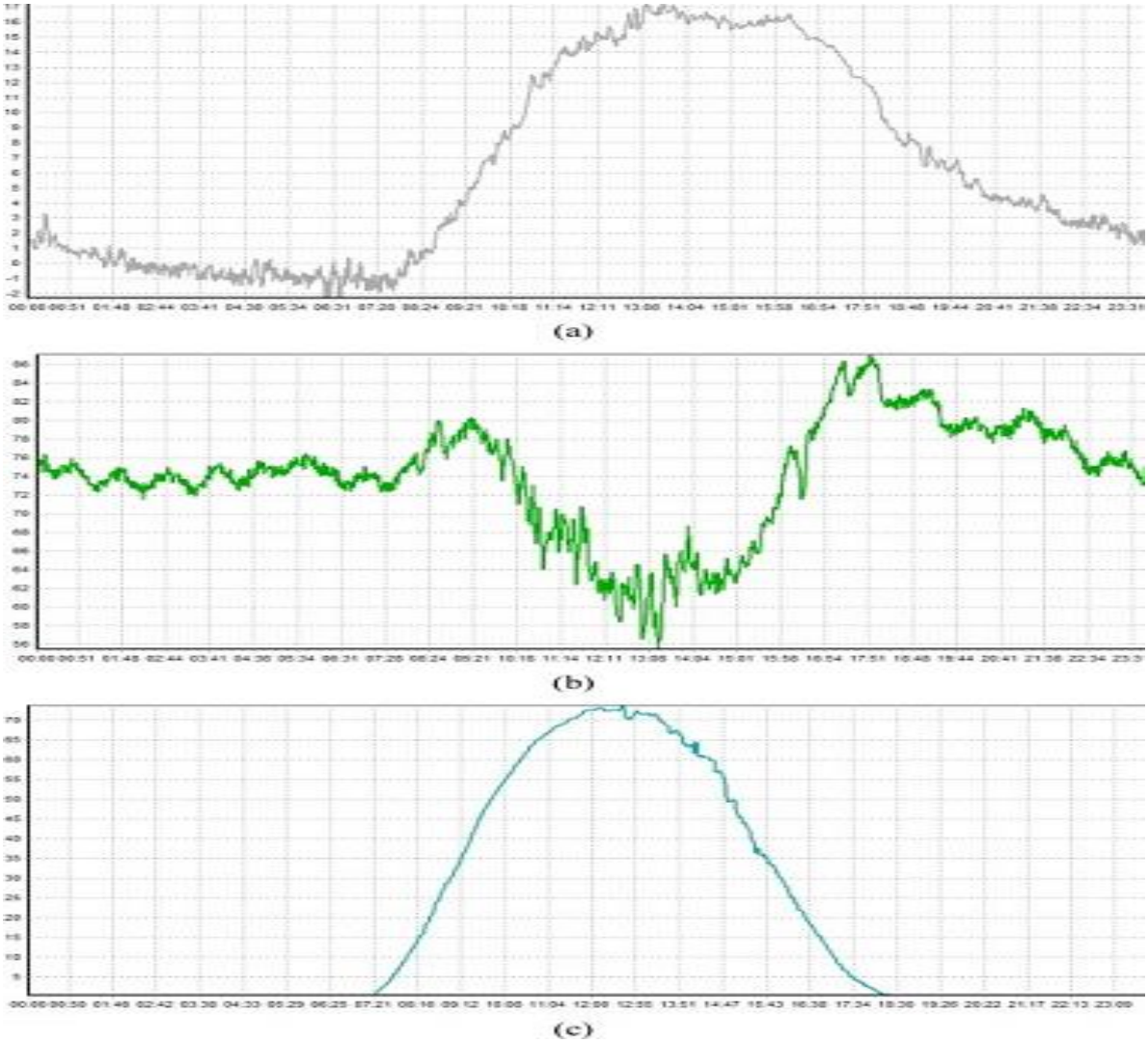

Fig 4. Measured Environmental Data Graph. **(a)** Temperature Graph ; **(b)** Humidity Graph **(c)** Luminance Graph .[Courtesy: Study on an Agricultural Environment Monitoring Server System using Wireless Sensor Network, Sensor , J Hwang, Cashing, H.Yoe-pp 11189-11211]

Figure 4. is a graph that represents environmental data measured by the proposed agricultural environment monitoring server system that is installed to be operational in the real agricultural environment, and it could be seen from this graph that the agricultural environment monitoring server system normally processes information sensed from sensor nodes installed outdoors without malfunction.

4. Conclusion

The cableless , wireless sensor network system is very attractive as its very dynamic in nature. These WSN consists of transeivers with energy storing arrangement & memory segment. Hence this IOT backed WSN is cost effective as it consists of very small sensor nodes. In our work , we focused mainly on temperature , CO2 in precision forming and humidity of the soil . The reliabilty in WSN in agriculture is unproven and is reisky and but very challenging.

5. Future Scope

In the nearby future, this can be updated using data analitics for the study of aquired previous datas , for growing right crops at right time and availability of storage arranegement with best price in the market.The artificial intelligence is playing vital role in developing agriculture sector and also finding solution for improving plantation and productivity. It is expected much higher with faster rate .At present good lot of research work is in progress to cut down the usage of water and sensible usage of other minerals and growing pattern along with cropping

.Moreover, the principal of AI in smart forming is one where intervention of human is relatively reduced and machine takes care of the environment and fertility of the field.

References

[1] ETRI Electronic Communications Trend Report; Kim, M.K.; Park, J.H.; Cho, Y.W. "Current Trends and Industrial Strategies of ITS Convergence"; Electronics and Telecommunications Research Institute: Daejeon, Korea, February 2010; Volume 25, No. 1.

[2] ETRI Electronic Communications Trend Report ;Lee, K.H.; Ahn, C.M.; Park, G.M. "Characteristics of the Convergence among Traditional Industries and IT Industry" Electronics and Telecommunications Research Institute: Dejon, Korea, April 2008; Volume 23, No. 2.

[3] Proceedings of Korean Institute of Information Technology, Gim, B.-G.; Lee, W.-J.; Heo, S.-Y. "Construction of a Test bed for Ubiquitous Plant Factory Monitoring System Using Artificial Lighting". 2010 Summer Conference, Suwon, Korea, May 2010; pp. 272-275.

[4] Journal of Entomology and Zoology Studies : Saeed Azfar, Adnan Nadeem, Abdul, "Pest Detection and Control Techniques using wireless sensor network: A review", Date Added to IEEE Xplore: 23 November 2016

[5] Humanitarian Technology Conference (R10-HTC): Pushkar Singh and Sanghamitra Sikia ," Arduino-based smart irrigation using water flow sensor, soil moisture sensor, temperature sensor and ESP8266 Wi-Fi module", , 2016 IEEE Region 10, Agra, India, University of Tezpur.

[6] 3rd International Conference on Advances in Electrical, Electronics, Information, Communication and Bio-Informatics (AEEICB17). R.Devi, R.Hemalatha, S.Radha, "Efficient Decision Support System for Agricultural Application", Year of Publication 2017, 978-1-5090-5434-3©2017 IEEE

[7] Electronics : Muhammad Shoaib Farooq 1, Shamyla Riaz 1, Adnan Abid 1, Tariq Umer 2 and Yousaf Bin Zikria 3, "Role of IoT Technology in Agriculture: A Systematic Literature Review" 2020, 9, 319

[8]. International Conference on Recent Advances in Electronics and Communication Technology (ICRAECT).:S. Prathibha and A. Hongal and M. Jyothi, "IOT Based Monitoring System in Smart Agriculture," , 2017.

[9] Proceedings of Symposium GIS Ostrava 2009—Seamless Geoinformation Technologies : Aydan, C.; Safak, S. "Application of Wireless Sensor Networks with GIS on the Soil Moisture Distribution Mapping". In Ostrava, Czech Republic, 25–28, January 2009.

[10] Proceedings of 2008 ASABEAnnual International Meeting : Han, W.; Zhang, N.; Zhang, Y. "A two-layer Wireless Sensor Network for Remote Sediment Monitoring". In, Rhode Island, RI, USA, 29 June–July 2008.

[11] Advanced Materials Research : Lin, Yuan Guai. "An Intelligent Monitoring System for Agriculture Based on Zigbee Wireless Sensor Networks", 2011

[12] Walter de Gruyter GmbH: "Energy Harvesting for Wireless Sensor Networks" , 2019 Publication

[13] International Journal of Research in Engineering and Technology: S R Mani Sekhar."A Survey On BioInspired Security In Wireless Sensor Networks", 2015 Publication

[14] IEEE Access: Vippon Preet Kour, Sakshi Arora. "Recent developments of the Internet of Things in Agriculture: A Survey" , 2020 Publication

[15] http://www.gpoaccess.gov/uscode/index.html : "USC Precision Agriculture"; Available online: (accessed on 3 December 2010)

[16] Abstract and Applied Analysis, : C. Wang, A. Zhang, and H. R. Karimi, "Development of La^{3+} doped CeO_2 thick film humidity sensors," vol. 2014, Article ID 297632, 6 pages, 2014.

[17] Journal of the American Society for Horticultural Science: H. Soffer and D. W. Burger, "Effects of dissolved oxygen concentration in aero-hydroponics on the formation and growth of adventitious roots," vol. 113, pp. 218–221, 1988.

[18] International Journal of Research in Engineering and Technology: Rajesh's. " CFD Analysis Of Biofuel (CNSL BLENDED WITH DIESEL) run Diesel Engine", 2016

[19] International Journal Of Innovative Trends In Engineering (IJITE) : Deepak Sharma, Yash Agarwal , Prof. Gauri Rao , Akshay Kapoor, "Light Intensity and Moisture Level Detection for Greenhouse using IOT" ISSN: 2395-2946 Issue: 48, Volume 29, Number 01, 2018

[20] Int.J.Appl.Eng.Res. : Guptha, A., Mishra, S., Bokde, N., Kulat, K., 2019."Need of smart water system in India." 11 (4), 2216-2223

Graphical Solutions of Fuzzy Models

S. Sindu Devi[1],K Ganesan[2]
{sindudes@srmist.edu.in[1], ganesan.k@srmist.edu.in[2]}

[1]Department of Mathematics, Faculty of Engineering and Technology, SRM Institute of Science & Technology, Ramapuram, Chennai – 89, [2]Department of Mathematics, Faculty of Engineering and Technology,SRM Institute of Science & Technology, Kattankulathur, Chennai – 603 203

Abstract. In the knowledge of dynamical system Fuzzy Initial Value Problems (FIVPs) have been vigorouslyinvestigatedover the modeling of numerousexhilaratingactual world problemwith all branches of engineering andscience. In this paper, numerical solution isassociated(1)gh and (2)gh differentiability. We propose a fuzzy versions of Picard's Method, solutionsinlinear fuzzy differential equations with first-order. The proposed technique is exemplified by a real-life sample and found to be in good agreement. The efficiency and accuracy of the suggestedtechnique is demonstrated in a series of graphical representations.

Keywords: Fuzzy Number, Generalized differentiability, Fuzzy initial value problem, Fuzzy Picard's method..

1 Introduction

Fuzzy Picard's method is an iterative technique for finding solutions of fuzzy difference equation through successive approximations. It is used for transforming fuzzy linear differential equation to integral equation. The solution of this method gives accurate results for fuzzy linear differential equations as it uses the same step size and degrees of precision in the integration procedure. The Picard's existence and uniqueness theorem is used for higher instruction fuzzy differential equation and also for systems of simultaneous fuzzy differential equation. The fuzzy Picard's process resembles that of Fuzzy Taylor's expansion. The nth approximation is added to integral equation and is used for computation of (n + 1)th element of the sequence.

SadighBehzadi .Sh [1]and others received the Picard technique for addressing the thePainlevé I and quadratic Riccaticonditions below fluffy climate and summed up H differentiability. SinduDevi.S and K Ganesan [2] suggested iterative plan arrangement of additional request fluffy differential conditions fluffy beginning condition utilizing fluffy picard strategy under summed up H – differentiability. Ettoussi, S et.al[3] has examined to discover the force arrangement of an intuitionistic fluffy introductory worth issues by utilizing progressive estimate strategy and we demonstrate that the rough arrangement combine consistently in t to the specific arrangement. Hussein ALKasasbeh et.al [4] have proposed new guess techniques for tackling frameworks of common differential conditions (SODEs) by fluffy change (FzT). A class of Volterraintegro-differential conditions, has been stretched out to tackle issues including Caputo fluffy fragmentary differential conditions Picard-like [numerical conspire by, Jorge E. Macıas-Dıaz[5].and StefaniaTomasiello

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In this article, we introduce first order fuzzy differentials equation under (i) – gh and (ii) – gh differentiability using fuzzy Picard's techniquebeingwithindividuality solutions set satisfies the given system with a certain possibility. It shown that at anytime the solution constitutes a fuzzy region and alpha-cuts in the graphical representation.

2 Preliminaries

This segment contains some elementarydefinition which is very useful throughout this paper.

Definition 2.1. "Fuzzy set $\tilde{a}$clearreal number Rsupposed fuzzy number association functions$\tilde{a}$: $R \to (0,1)$succeeding:

i. $\tilde{a}$are convex, i.e, $\tilde{a}\{(\lambda x_{1-0} + (1-\lambda))x_2 \geq \min\{(\tilde{a}(x_1), \bar{a}(x_2))\}$, for all $x_1, x_2 \in R \& \lambda \in [1,0]$
ii. $\tilde{a}$areregular i.e., occurs an $x \in R$ such $\tilde{a}(x) = 1\text{-}0$
iii. $\tilde{a}$are piece-wise continuou

Definition 2.2. "A triangular fuzzynumber is denoted as $\tilde{a} = (a_1, a_2, a_3)$andis definite by the membership function

$$\tilde{a} = \begin{cases} 0, & x \leq q, \\ \dfrac{x - a_{1-0}}{a_2 - a_1}, & a_1 \leq x \leq a_2, \\ \dfrac{a_3 - x}{a_3 - a_2}, & a_2 \leq x \leq a_3, \\ 0,0 & x \geq a_3. \end{cases}$$

2.1. **Parametric Representation offuzzy numbers.**

A fuzzy number $\tilde{a} \in F(R)$ also signifiedduo$\tilde{a} = (\underline{a}, \bar{a})$ of function $\underline{a}(\alpha)$ and $\overline{a}(\alpha)$ for $0 \leq \alpha \leq 1$contents the subsequent requirement:

i. $\underline{a}(\alpha)$is a circumscribed monotonic cumulativeveraciousincessant functions.
ii. $\overline{a}(\alpha)$is a circumscribed monotonic lesseningleftwardincessant functions.
iii. $\underline{a}(\alpha) \leq \overline{a}(\alpha)$, $0 \leq \alpha \leq 1$.

3 Fuzzy Derivative

Definition 3.1. [Hukugara Derivative] Deliberate a fuzzy mapping $F: (a,b) \to R$ and $t_0 \in (a,b)$. F is differentiable $t_0 \in (a,b)$if existelement $F'(t_0)\, Rh > 0$adequatelyslight$\exists F(t_0 + h) \ominus F(t_0), F(t_0) \ominus F(t_0 - h)$limit$D$)

$$\lim_{h \to 0_+} \frac{F(t_0 + h) \ominus F(t_0)}{h} = \lim_{h \to 0_-} \frac{F(t_0) \ominus F(t_0 - h)}{h}$$

exists and are equal to $F'(t_0)$.

Fuzzy Initial Value Problem

initial value problem is a systems of usual differential equation together with the first conditions. Consider a function of n^{th} fuzzy differential equations initial complaint are

$$\tilde{y}^n(t) = \tilde{f}(t, y(t), y'(t), \dots, y^{n-1}(t)$$
$$\tilde{y}(t_0) = y_0, \dots, \tilde{y}^{n-1}(t_0) = y_0.$$

By using Extension principle, the membership functions are

$$[\tilde{f}(t,\tilde{y})]^{\alpha} = \tilde{f}(t,[\tilde{y}]^{\alpha}) = \tilde{f}\left(t,\left[\underline{y}_{\alpha},\tilde{y}_{\alpha}\right]\right) = \left(\min \tilde{f}\left(t,\left[\underline{y}_{\alpha},\tilde{y}_{\alpha}\right]\right), \max \tilde{f}\left(t,\left[\underline{y}_{\alpha},\tilde{y}_{\alpha}\right]\right)\right)$$

4 Analysis of the method:

In this segment, we exemplify the idea of the method. Let us deliberate the subsequentoveralldifference equations.

$$y'(t) = u(t,y). \quad \tilde{y}(t_0) = y_0$$

Alteration of variables to alter the original condition to the origin.Openly, describe $w = y - y_0$ and $x = t - t_0$. With a new f, the differential equations is

$$y'(t) = u(t,y). \qquad \tilde{y}(0) = 0$$

$$y_{n+1}(t) = y_n(s) + \int_0^t (f(s,y(s))ds$$

werelate the picardtechnique for (i) – gH differentiability

$$\begin{cases} u_{n+1}(t,\alpha) = u_n(s,\alpha) + \int_0^t f(s,u_n(s,\alpha))ds, \\ u_{n+1}(t,\alpha) = u_n(s,\alpha) + \int_0^t f(s,u_n(s,\alpha))ds. \end{cases}$$

werelate the picardtechnique for (i) – gH differentiability

$$\begin{cases} u_{n+1}(t,\alpha) = u_n(s,\alpha) - \int_0^t f(s,u_n(s,\alpha))ds, \\ u_{n+1}(t,\alpha) = u_n(s,\alpha) - \int_0^t f(s,u_n(s,\alpha))ds. \end{cases}$$

Example 1: Solve $y' = -y + t + 1.$ with initial conditionsy(0) = (0.96, 1, 1.01) then find the solution at t = [0,1].

Use (i) – ghdifferentiabily $\begin{cases} u_{n+1}(t,\alpha) = u_n(s,\alpha) + \int_0^t f(s,u_n(s,\alpha))ds, \\ u_{n+1}(t,\alpha) = u_n(s,\alpha) + \int_0^t f(s,u_n(s,\alpha))ds. \end{cases}$

and (ii) – gh differentiability $\begin{cases} u_{n+1}(t,\alpha) = u_n(s,\alpha) - \int_0^t f(s,u_n(s,\alpha))ds, \\ u_{n+1}(t,\alpha) = u_n(s,\alpha) - \int_0^t f(s,u_n(s,\alpha))ds. \end{cases}$

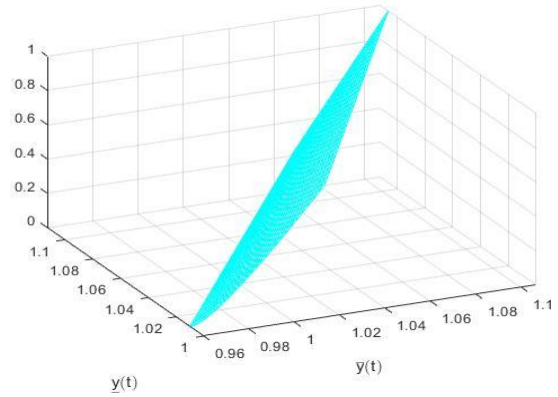

Figure 1: Approximate solution of fuzzy laplace transform under (i) –gH differentiability.

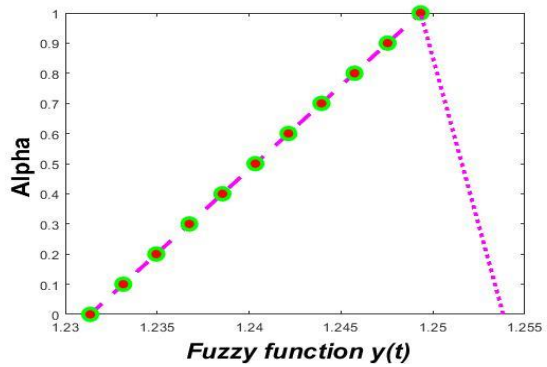

Figure 2: Graphical demonstration of fuzzy solution for t = 0.8under (i) –gh differentiability.

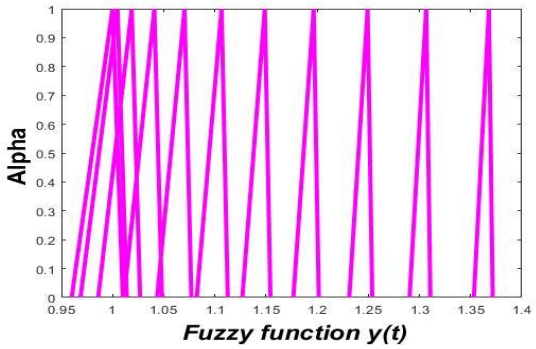

Figure 3: Graphical demonstrationof fuzzy solution for t = 0, 0.1, 0.2, ……., 1at fifth approximation under (i) –gh differentiability.

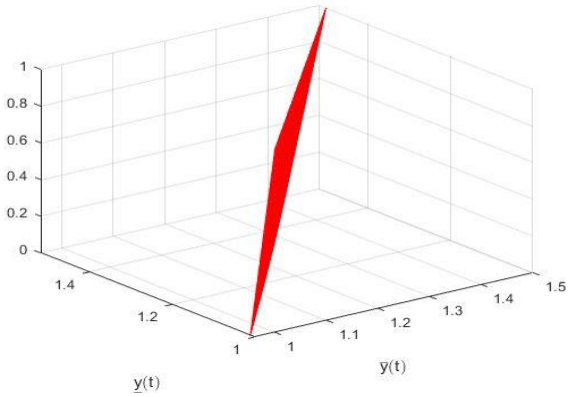

Figure 4: Approximate solution of fuzzy laplace transform under (ii) –gH differentiability.

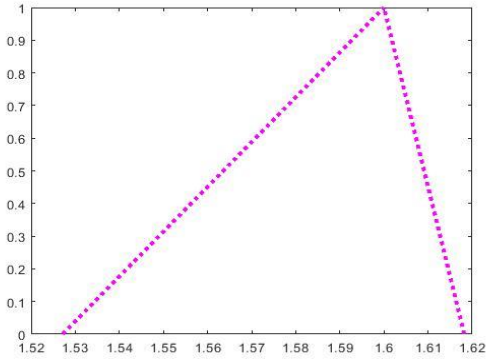

Figure 5: Graphical demonstration of fuzzy solution for t = 0.8under (ii) –gh differentiability

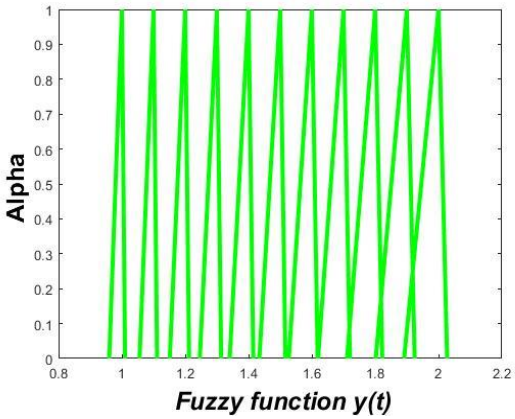

Figure 6: Graphical demonstration of fuzzy solution for t = 0, 0.1, 0.2, ……., 1under (i) –gh differentiability.

Example 2:A tank at first contains 300 ladies of saline solution disintegrated in c lbs of salts. Approaching the cisternat 3 ladies/min is brackish water with focus k lbs salts very much mixed combination greeneries rate 3 ladies/min. Let y(x) lbs be the salt in tanks at any time $t \geq 0$. At that point $dy(x)/dx+(1/100)y(x) = k$, $x \in [0,1]$ with $y(0) = c$, if underlying disorder is existence displayed as fluffy number c = (1,2,3) and k = (1,2,4). Discover arrangement x =0.4.

The below figures shows the approximate solutions of (i)-gh and (ii)-gh differentiability

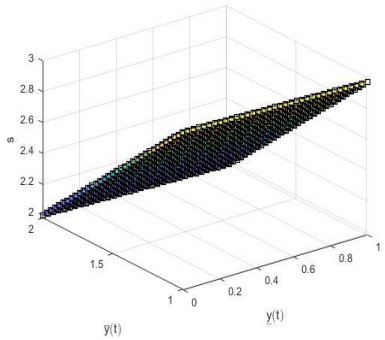

Figure 7: Approximate Solution of Fuzzy Picard's method under (i) –gh differentiability.

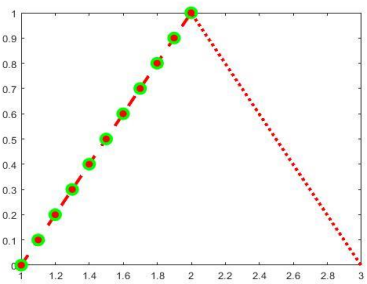

Figure 8: Graphical demonstration of fuzzy solution for t = 0.1.under (i) –gh differentiability.

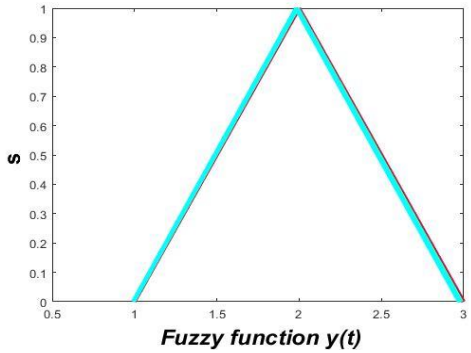

Figure 9: Graphical demonstration of fuzzy solution for different values t = 0, 0.1, 0.2, …….., 1at fifth approximation under(i)-gh differentiability

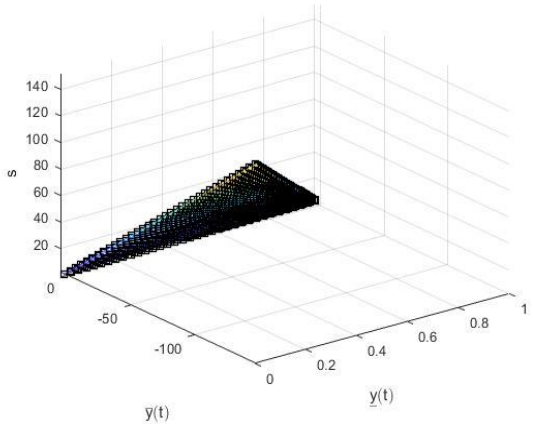

Figure 10: Approximate Solution of Fuzzy Picard's method under (ii) –gH differentiability.

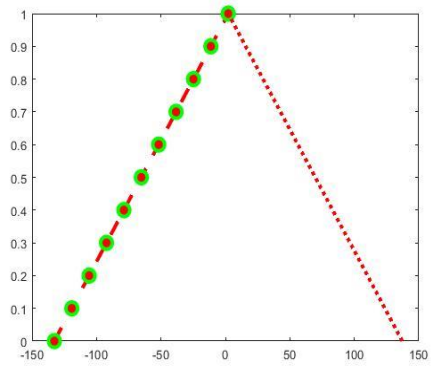

Figure 11: Graphical demonstration of fuzzy solution for t = 0.1 under (ii) –gh differentiability.

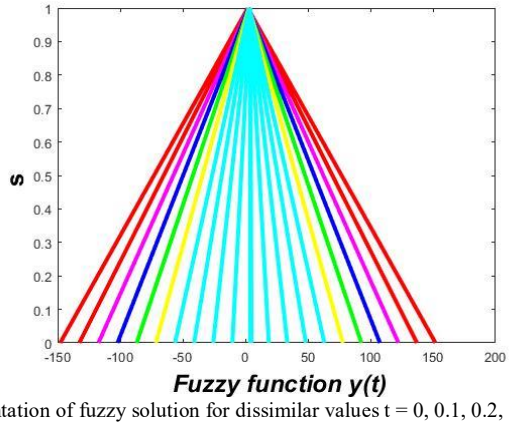

Figure 12: Graphical representation of fuzzy solution for dissimilar values t = 0, 0.1, 0.2, ……., 1 under (ii) –gh differentiability.

Conclusions

In this article, we have discussed Picard's technique for first order fuzzy differential equation proved under (i) – gh and (ii) – gh differentiability. For the efficacy of the suggested technique demonstrated by generous example, in the upcoming investigation relate the Picard technique to resolve a great class of FDEs.

References

[1] Sh. SadighBehzadi a , , BehnamVahdani b , T. Allahviranloo c , S. Abbasbandy , Application of fuzzy Picard method for solving fuzzy quadratic Riccati and fuzzy Painlevé I equations , Applied Mathematical Modelling 40 (2016) 8125–8137.

[2] S. Sindu Devi and K Ganesan, Fuzzy Picard's method for derivatives of second order, IOP Publishing IOP Conf. Series: Journal of Physics: Conf. Series 1000 (2018) 012038 doi :10.1088/1742-6596/1000/1/012038.

[3] R. Ettoussi, S. Melliani and L. S. Chadli, Approximate solution of intuitionistic fuzzy differential equations by using Picard's method , . Notes on Intuitionistic Fuzzy Sets 3 Vol. 24(2), 2018, 52–62 DOI: 10.7546/nifs.2018.24.2.52-62.

[4] Hussein ALKasasbeh , Irina Perfilieva D , Muhammad Zaini Ahmad 1 and ZainorRidzuanYahya New Approximation Methods Based on Fuzzy Transform for Solving SODEs:*Applied System Innovation,* , 1, 29(2018); doi:10.3390/asi1030029.

[5] StefaniaTomasiello and Jorge E. Macıas-Dıaz, Note on a Picard-like Method for Caputo Fuzzy Fractional Differential Equations, Appl. Math. Inf. Sci. 11, No. 1, 281-287 (2017).

Hybrid Natural Disaster mapping and Mitigation Plans

C.Amuthadevi[1][0000-0003-1066-5893] ,Gayathri MonicaSubarnan*[2] [0000-0002-5886-1554]
D.S.Vijayan[3][0000-0003-0128-5397]
[1]Department of CSE, SRMIST KTR campus, Tamil Nadu, India.
[2]Department of Electrical and Electronics Engineering,SRMIST, Ramapuram Campus, Tamil Nadu, India
[3]Department of Civil Engineering, AarupadaiVeedu Institute of Technology, VMRF, Tamil Nadu, India.
[1]camuthadevi@gmail.com, [2]monigaya5281@gmail.com , [3]vijayan@avit.ac.in
*Corresponding Author: Gayathri Monica Subarnan

Abstract. Many of the natural disasters are threatens the human lives and also assets of the people. Hazard mapping is one way to connect the particular location into kind of hazardous based on the history of the events in the specific geographic zone. The weather changes may trigger into many natural disasters. In this chapter, Multi-hazard is focused. All kinds of natural disasters happened in particular zone like floods, earthquakes, tsunami and landslides for the past years are used for prediction. It will be useful to save many lives and reduce the damages.

This chapter attentions on

- ✓ Hazard category and Cruelty
- ✓ Hazard-mapping
- ✓ Detection of Risk and mapping
- ✓ Awareness Engendering
- ✓ Reserve plan
- ✓ Approaches and plan for evacuation

The hybrid approaches are used by using history of information, prediction strategy by automated learning strategy and real time data collection from satellite images and sensors. Different mitigation plans will be analysed and summarize the useful solutions in the plan.

Keywords: Hazard Mapping, Prediction, Mitigation, Evacuation Plan, Natural Hazards

1 Introduction

Sufferers by natural hazards and calamities carriage momentous threats to the publics. It becomes a main alarm that with the global warming, and also weather structure drive more inconsistent and the occurrence and cruelty of calamitous proceedings may rise in future. Recently, this alarm has established gradually, added care and it was recommended that natural hazards have converted further expensive in admiration of victims triggered over in past 2 eras [1]. Earthquakes, hot cyclones, landslides,

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floods and forest-fires are most of the causes and create highest loss event and source substantial harm to the community.

Using the occurrence and cruelty of natural threats growing universally, community and natural researchers are revolving the consideration in resiliency, a multi-faceted idea that description differs dependent in the investigator(s) and this kind of study directed [2,3]. Investigate that classifies the weakness within societies and efforts to measure flexibility is ahead momentum.

1.1 Hazard Category and Cruelty

Natural Hazards are happening because of sudden or slow on-set of events happening. These categories are listed in the Table 1.

Table 1: Hazard categories

S.No	Hazard Category	Hazard events
1.	Geography	earthquakes, landslides, tsunamis and volcanic activity
2.	Hydrology	floods
3.	Climatic	risky temperatures, drought and wildfires
4.	Meteorology	cyclones and hurricanes/wave surges
5.	biology	disease waves and fly/animal outbreaks

Human-made disaster comprises ecological deprivation, contamination and accidents. Technical or man-made hazards (multifaceted disasters/struggles, scarcity, expatriate populations, industrial coincidences and transportation accidents). Cruelty of hazards makes the disaster survivors suffers from stress disorder to severe complications such as comorbid stages and need medical treatments [4].

1.2 Multi-hazards

When more than single danger in a specified location and the relations among these counting their concurrent or cumulative incidence and the possible connections. A Multi-Hazard Early Warning System (MHEWS) is ableto discourse numerous dangers and/or influences of comparable or dissimilar kind in conditions where dangerous proceedings might happen, concurrently, flowing or cumulatively with time, and captivating into interpretation the possible consistent effects. As most disaster-prone areas in the ecosphere, recurrent natural hazards (range from tsunamis to floods to volcanic eruptions) loom livings of most of the people about the Pacific

Border and outcome in disastrous obliteration and damage. The fatalities and influences that describe disasters has abundant to do by experience and susceptibility of people and locations as they prepare with the harshness of the danger event.

Although natural dangers/threats will not be eradicated, through distribution of best preparation, information, and investigation, people and government can better know the dangers and diminish the danger to people life. Over the historical period, the Multi-Hazards Hub held by Tohoku University in Sendai, Japan operated to nature of the communal abilities for cutting-edge investigate on the common danger of natural hazards fronting the zone.

2 Related Works

The initial collection of hazard maps in Indian subcontinent for retort spectrum amplitudes in designated natural aeras with the PSHA method was organized by the training prepared in National Disaster Mitigation Agency (NDMA) [5]. Hazard mapping is used to map the particular zone or location into one of the categories of Hazards. Preparation of hazard maps will be helpful to save many peoples by execution proper plans and strategies. Some zones may fit into multi-hazard mapping parameters.

2.1 Hazard Mapping

Iran has zones which have multi hazard prone. Based on the subcategory like floods combined with landslide may affect 70% of zones [6]. Totally 11 parameters relate to territory and land-usage had been nominated in training of landslide and flood vulnerability mappings. Probabilistic Seismic Hazard Analysis (PSHA) was prepared and the association between the hazards were identified. The founded outcomes by representations had confirmed with ROC (Rate of Change) curves. The resultant AUCs (Area Under Curve) of the proof showed precisions of 84% & 80% for floods and landslides, correspondingly, and 87% and 82.6% for flood and landslides founded on the exercise data, correspondingly. Then all hazard maps were collectively generating a multi-hazard likelihood plot of the Lorestan Province and map helps as an appreciated means for land use preparation, supportable substructure change in Lorestan Province.

Heat pressure and forestry fires are repeatedly measured and extremely connected threats, as dangerous temperatures are crucial roles in all occurrences. This cohesion can affect in what way public shield and local respondents position resources on the ground and can prime to an under assessment of possible effects, as individuals can be fewer resilient after uncovered to multi-hazards. In Europe (June 2017) heat and fire affected many lives and the combined event along with the affect-

ed zones were mapped by Multi-Hazard Early Warning System [7] and can be used for evidence-based detection system.

Heavy water falls causes flash floods and facing this is a very big challenge in all the countries [8]. Rising facts of flash-flood information confirms that the morpho-metric parameters of the catchment regulator and its hydrological retort. From this, the Geomorphological Unit Hydrograph (GUH) was one of the furthermost prevalent approaches for guessing hydrological procedures, if data are insufficient. The technique is grounded on the measurable association among catchment geomorphology (for example, catchment zone and silhouette, geography, and torrent concentration) and hydrological developments.

Earthquake-activating landslides might source fatal actions and grave financial losses [9]. In the earthquake susceptible zone, vulnerability drawing of earthquake- activating landslides was actual significant to safe preparation, disaster supervision, and hazard extenuation. Various representations were useful for landslide vulnerability mapping. For example, heuristic functions, probabilistic methods, and soft-computing approaches, like Artificial Neural Networks (ANN) and Support Vector Machines (SVM).From multiple methods, the conditional probabilistic models were widely practiced. [10].

Mining-induced quakes and seismic earthquakes remain mostly erratic and have a contrary influence in the resident populations and constructions. For this motive, specialist care of this singularity is a difficult task. The claim of interferometric SAR in the assessment of ground drive was carried acceptable outcomes in the previous 20 years largely in the districts wherever no additional dimensions were showed throughout ground subsiding [11].

In the universal gauge, sandy coasts are (because of climate change) progressively unprotected for hazards by coastal floods and corrosion. Predictable variations in temperature may influence the sea level rise, amplified wildness in centre of latitudes, also variations in sea-wave settings by complex waves and tempest flows. Survey says that 24 percentage in ecosphere's sandy coasts take an erosion amount of greater than 0.5 m/year then around 16% greater than 1 m/year. Nearly, 27% in sandy-coasts remain experiencing deposit and around 18% take a lump amount completed 1 m/year. France has 23% of sandy-coasts remain accreting in that, 40% are steady and 37% are corroding. In sandy-coast of Vendee [12], the vulnerability is evaluated by long term and short-term. The danger is evaluated i) using long-term through measurement of past development of seashore among the years 1950 and 2016 ii) through short term through measurement the sudden evacuations owing to dangerous events.

2.2 Detection of Risk and mapping

Acknowledgement of the necessity to tie seeming gap among the research and executive have been recognized, both in the framework of disaster danger and additional normally crossways knowledge to act schemes. Non-Government Organizations show a critical part in dropping risks where clear stages of deficiency and disparity prime to developed susceptibility and disaster influences.

climatical variations style the city zones added and more unprotected to landslide, waterway floods, coastal attrition and marine blizzard proceedings that develop disastrous if deserted by the social order. Susceptibility lessening alone showed to be not sufficient to lessen the penalties of natural events. Resilience is the capability in scheme, civic or civilization bare to hazards to battle, engage, billet, familiarize to, alter and improve after the hazard in a appropriate and effectual way, with by means of the conservation and repair of its vital elementary constructions and purposes over risk management [13].

Hazards can be categorized based on the affected area range from local to global, based on the time period mapping from long term to short term forecasting. Catastrophe modelling permits insurers and reinsurers, economic organizations, companies, and communal works to assess and be able to natural disaster risk from dangers extending from quakes and hurricanes, floods and wildfire. Hazard should be fitted into loss models and shown in the Figure 1.

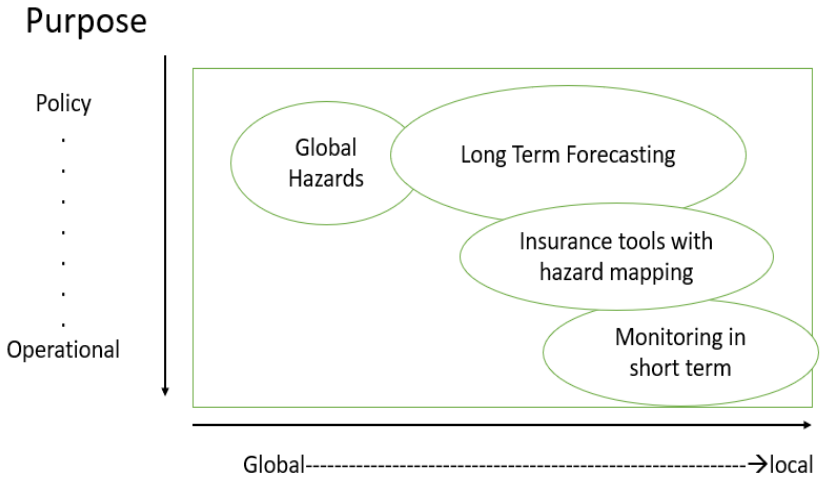

Figure 1: Hazard and Risk Mapping

Risk mapping includes both risk management and disaster management [14]. The disaster risks supervision reflects all actions that permit the urban to handle through hazardous measures and guarantee the lowermost cost for civilization. The disaster management understands the activities essential to re-establish regularity afterwards the incidence of risky events**.** Risk managing founds a relationship among its stages (mitigation, preparedness, response, recovery) and flexibility goal line (make for, handle with, retort to, and improve from) to recognize the flexibility status in city system on both longer time (response and recovery) and shorter time (mitigation and readiness phases) durations.

2.2.1 Mitigation:

This phase attentions for actions needed to style the public added strong earlier the incidence of dangerous proceedings. For Example, mitigation trials were the variations in resident structure codes, land use administration, retrofitting of buildings to survive usual hazards, defence erections.

2.2.2 Preparedness:

This phase intentions are to progress the cognizance of public and their skills to respond compared to hostile events, both in before and after-event, over instructive plans. Evacuation arrangement, the meeting of commercial communal and other actions like supplying necessary food and water which can be passed out throughout this stage. The two stages are connected to make goal line of flexibility what suggests that individuals and organizations were talented to quickly discover the various behaviours to see their requirements throughout the incidence of disastrous proceedings. The attainment of goal might deliver funds to predict the conceivable upcoming situations, establish priorities, and retort. For example, through activating and coordinative broader human, economic and physical capitals.

2.2.3 Response:

This phase discourses the activities occupied directly subsequently the incidence of the hazardous events to decrease the damage of survives and properties, bound the significance on structure, environment and to meet the basic requirements (food, water, housing, dress). The renovation of efficacies and belongings as well as the steadying of community facilities are also actions comprehended during emergency time. Response scheduling goals in speedy assessment of the possessions of hazardous events. This is connected with retort and endure goals of flexibility and hinge on the strength, idleness and elasticity of a system.

2.2.4 Recovery:

This phase includes both short-term and long-term activities in reconstruction and renaissance of affected societies, directing in to a grade of physical, ecological, financial and communal constancy. The short-term stage includes transporting instant facilities, counting the renovation of episodic usefulness facilities, the reinstatement of carriage ways and the delivery of food and shelter into expatriate persons, although the long-term stage necessitates planned actions to discourse the impressions of a tragedy. Recovery can be connected to the acclimate resilience goal and absorbed by notionwhere system has methods to endlessly progress and the solutions are founded on the position must be avoided.

Natural hazard danger modelling includes combination of danger influence situations through acquaintance data and susceptibility purposes. The outcome is an estimation of damage, portrayed in numerous conducts counting financial cost; humanoid fatalities; construction of harm states; social disturbance; and other types of significance specified the harshness of the danger.

3 PREDICTION BY AUTOMATED LEARNING STRATEGY

Prediction is not a simple method. It differs from zones, time and related to other hazards. Some of the Machine learning approaches with past history of data and evacuation methods executed may be helpful for mapping, and assessment of risks. In the country Indonesia at zone Palu, the intensity of earthquake was analyzed using the clustering method [15]. The following work was done:
i) conducted the cluster investigation to classify the earthquake-expected regions,
ii) established a CNN prototypical for likelihood approximation, and
iii) assessed and comparation of risk by means of 2 calculation equations (Risk 1 and 2).

Due to the greater forecast capability, the CNN prototypical measured the likelihood although Silhouette clustering (SC), Pure Locational Clustering (PLC) were applied to recognize the longitudinal clustering, Euclidean distance between clusters, spatial association and cross-correlation between the projected Mw, PGA and strength counting actions complexity. At last, AHP was applied to evaluate the vulnerability**.** Earthquake's probability assessment (EPA), susceptibility to seismic amplification (SSA) and earthquake vulnerability assessment (EVA) were used to produce risk 1, although earthquake danger assessment (EHA), SSA and EVA were utilized to make risk B. After that the risk maps were associated and the changes in outcomes were found. This training attained 89.47% accurateness for EPA although for EVA a constancy

proportion of 0.07. All of consequences take significant inferences for forthcoming risk valuation, land use development and threat mitigation.

$$\text{Risk}(1) = \text{EPA} * \text{SSA} * \text{EVA}(\text{Probability} * \text{Expected loss}) \quad (1)$$

$$\text{Risk}(2) = \text{EHA} * \text{SSA} * \text{EVA}(\text{Hazard} * \text{Expected loss}) \quad (2)$$

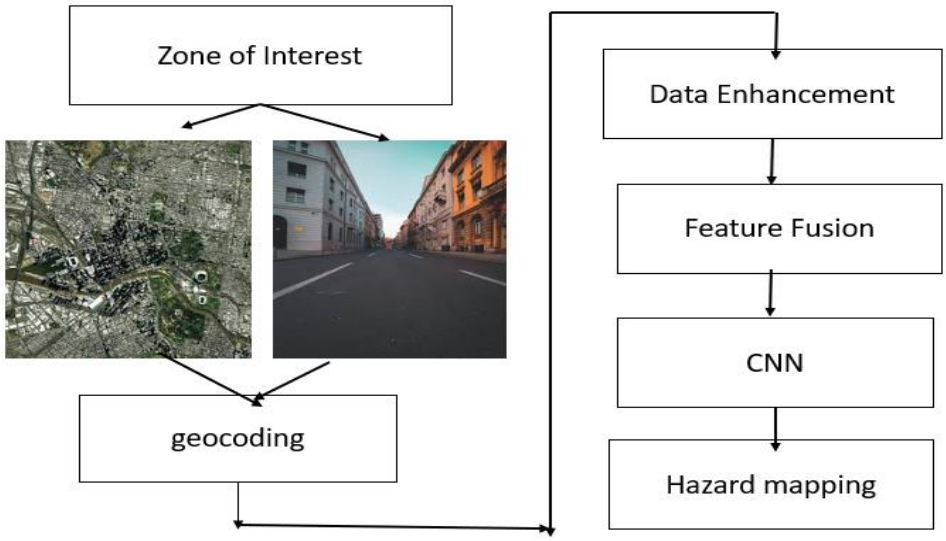

Figure 2: Automatic Prediction Strategy

Collecting the information manually from the affected regions and building a model is a most time consuming and laborious task. To make as fast, the modern technologies such as collection of data from satellite with time and location range can be utilized. Geocoding is the procedure to transform the details about a location like couple of coordinates, or the area name into a position on the ground's surface. User can geo-code through giving one place description as input or many places at once as a table. Then, subsequent positions are output with geographic features containing attributes, which will be utilized for plotting or spatial study.

The features collected from the geocoded data; the features of images can be fused to get more information. Then applying convolution Neural Networks (CNN) give output that will be useful information for building the inventory. If noise exists because of uncertain information, pre-processing will be applied for better enhancement [16].

After that, Inventory information is mapped to hazard maps which will be useful for prediction and risk management.

4 PLANS AND APPROACHES FOR EVACUATION

Sensitivity and risk are the most critical criteria in humanitarian emergency logistics, where most models reduce response times, evacuation time and distance, transport rates, the number of open installations, installation costs or operating expenses, discovered requests, exposed demands and risks, as well as optimising the demand points. Responding to a problem, the problem can be implemented in many ways for various issues, such as verdict theory, queue theory and fuzzy approaches, the problem position problem and other technologies. The main focus of humanitarian emergency supply research was on earthquakes, hurricanes, floods and epidemics across the globe.

The first response to alerts is in most cases successful evacuation. It is so necessary to establish escape routes and refuges. Where assessors target details, the matter is minimized. Evaluating state of crisis and responding behavior, for example, appears to be easier. Application of exercises and incidents will assess alert and evacuation procedures. It is reasonably easy to isolate each variable jointly for review within the preparedness answer system. Early alerts responses are studied on a variety of occasions and thus the efficacy of alert systems is negligible for group attitudes. Such information has helped to assess the situation of early warning systems in refined ways.

The activities of a disaster will be split into 2 phases, one before or proactive, the other after a disaster and the other post-reactive. Humanitarian supply for three phases of Disaster Management (DM) activities is one of the operations concerned: planning, response and recovery.

Humanitarian (HL) is the strategy of evacuating the people from disaster-stricken zones to safe places and of preparing for the efficient flow and storing of goods and materials, introducing and dominating them, while aggregating knowledge for the reason of origin to the detriment of the needs of the defenseless people [17], [18].

Expansion and retrofitting of public infrastructure and buildings to satisfy the additional difficult necessities created by international climate change. All new buildings should abide by building standards.

- Improvement of the physical living conditions in depressed rural and concrete areas by increasing the social safety web and rising housing project standards
- Integration of DRM into poorness reduction methods and productive sector programme planning.
- This may increase the resilience of lower financial gain teams whose livelihoods are typically coupled to agriculture, fishing, and different primary activities.

- Distinctive risk regions around the island and establishing dedicated funds for risk management.
- Adopting bio-engineering solutions in elevated hazard areas, for example shrubs on slopes, in role of onerous engineering.
- Property management of natural resource by using firmer planning controls.
- Enactment of correct management and conservation methods with relevance biodiversity, watersheds, and forestry; and therefore, the implementation of a comprehensive Coastal Zone Management Efforts have recently been focused on strengthening the look of urban avoidance systems and infrastructure to safeguard against flooding [19].

This has enclosed institutional and restrictive risk reduction measures with the technical help of the World Bank. One major goal of this set up is that the improvement of the standard of project management, that is predicted to be increased through relevant trainings, courses, networks and technical guidance.

The subsequent strategic outcomes are anticipated as:

- The introduction of enormous legislation is subject to due regard for adapted laws and rules and a long strategy that reduces the impact of rising water levels, dangerous acts of humans and river meandering
- Right irrigation and violation of areas of growth and production, residential and various special areas of management by appropriate facilities, physical facilities and utilities, modified legislation and economic administrative control and funding.
- In compliance with sectoral and regional development programmes, the structure and physical infrastructure of the transport sector was extended and strengthened and complies with international safety and environmental requirements.

Existing emergency caring logistics' improvement mock-ups consume few limits in large-scale data, this will be complicated to compute and finding the optimal can yield an extreme quantity of period and computation power. So, the event of innovative algorithms that may be useful in emergency caring supplying is important to feature to this stable of genetic algorithms, locate-allocate heuristics. In some situations, 2 disasters might occur, similar to an earthquake followed by a tsunami. Therefore, a lot of analysis is required that considers multi-disaster situations. Combined disaster point managing is additionally necessary within the decision-taking method in emergency caring logistics' facility setting problems. Normally, investigators have continuously targeted on every stage and a couple of studies have targeting combination disaster stage management. Consequently, integrated disaster stage management is recognized as a serious gap that ought to be thought of successful onward [20].

4.1 Essential awareness Disaster categories:

4.1.1 Vulnerability valuation:

Start line for coming up with preparation, coupled to longer-term extenuation and expansion interventions additionally as disaster state.

4.1.2 Forecasting:

Coming up with Disaster preparation strategies united in place, that are attainable and that commitment and resources are comparatively assured.

4.1.3 Organized outline:

Well-co-ordinated catastrophe preparedness and response scheme in the least grade levels, with promise in applicable stakeholders. Roles and tasks evidently defined.

4.1.4 Info systems:

Economical and reliable systems for gathering and sharing information like forecasts and warnings, information on relevant capacities, role allocation and resources between stakeholders.

4.1.5 Reserve base:

Product like stocks in food, alternative shelter and alternative resources, facilities like search and rescue, medicinal, engineering, nourishment experts and tragedy liberation money like and also things not just stored or not expected obtainable and available.

4.1.6 Alert structures:

Strong communications schemes like skills, substructure, capable of transmission cautions efficiently to public during risk.

4.1.7 Response devices:

Recognized and acquainted to disaster response activities and tragedy sufferers may include: evacuation actions and accommodations, exploration and saving squads, wants assessment squads, initiation of also emergency support amenities, response centres and accommodations for evacuated.

4.1.8 Instruction and coaching:

Coaching courses, workshops and allowance programmes to at-risk teams and tragedy responders. information of risk and applicable response communal by public information and teaching systems.

4.2 Risk reduction after disaster

Post-disaster assessments, such as Disaster Assessment and Needs Analyses, will allow authorities to evaluate the damage incurred, identify at risk populations, and determine the priorities and resources required for the resumption of normal operations. As part of the rehabilitation phase of the recovery process outlined, the Government will invite international and regional organizations, to compile detailed assessments of the social and economic impact and sectoral damage caused by the disaster. The Plan recognizes that training and capacity building programmes are fundamental elements of professional development for members of the Disaster Assessment and Needs Analysis Disaster Committee and thus form part of the National Emergency Management Organization's annual agenda. The recommendations garnered from Disaster Assessment and Needs Analyses form the basis of post-disaster development plans for resilient reconstruction, and are expected to place on the path to sustainable development.

Post-disaster recovery, a chance for property expansion Underdevelopment and unsuccessful or unsuitable progress programmes rise susceptibility to hazards, and therefore cause a lot of disasters. In turn, emergencies build succeeding development harder for disaster exaggerated societies which had lost the support properties, thus in establishments that are attempting to assist these. The need to incorporate relief, recovery and growth more closely is generally appropriate. This indicates a long-term possibility of post-disaster measures [21]. Different approaches are available specific to disaster[22,23]. In essence, it means that relief and recovery should lead to long-term growth and vulnerability reduction, wherever possible – they should not simply rebuild the current risk. The hope of a "normal" development that will restart shortly after the crisis phase is obviously unreal. Help services and growth programmes must be compelled to adhere. While efforts to protect livelihoods and reduce the risks of food and cash for work will aid, success will rely on smart management.

4.3 Limitations in success:

Maximum of arrangements aims to offer financial gain and community amenities, however in practice these 2 aims will be tough to settle. Release and post-relief initiatives tend to work on totally different scales, with mass coverage being a lot of simply attained in relief processes. Preservation of supports is vitally necessary to poor and vulnerable people, and vulnerability is closely connected to living safety. once a tragedy, receiving a legal document shortly be an importance for the sufferers.

Recovery framework incorporates many actions that it hopes will accomplish the following:

• Promoting a come to accessibility of services and also the availability of products which support traditional life.

• Promoting courses of action which is able to contribute to a discount within the vulnerability of the while this receipts a protracted time to line up a lot of substantial, advanced initiatives attributable to the extent of technical, social control and different inputs required.

• Deprived directing flops to care persons maximum in want or makes divisions among groups through choosing few people and not others. there's still some dialogue regarding the most effective ways of choosing beneficiaries.

• Inadequate designing and consultation, resulting in effort being wasted on mitigation structures that aren't a priority for the community, or won't work.

• Deficiency of assurance by recipients, sometimes since they're not members within the scheme, however are treated simply as employees. this may lead to poor quality of construction. It conjointly makes it less probably that the community will still maintain the newly-built facilities once the food or money payments come back to an end. population to a variety of hazards.

• Stimulating native initiatives to retort to the results and impacts of a disaster.

• Developing plans and techniques to boost the method of long-run rehabilitation.

Chances of success at community level could also be improved by:

• Acting quickly before the worry or enthusiasm for amendment created by the disaster have lessened;

• Basing interventions on acquainted technologies and native resources as way as possible; concentrating on a tiny low range of necessary actions, not introducing a full portfolio of changes that dissipate efforts;

• Specializing in what's possible – communities already hit by a disaster have several pressing issues to attend to, and that they won't respond if they believe the planned mitigation measures are on the far side their reach; and

• Cheering and involving societies as members in change.

This needs earlier involvement, a lot of stress in reconstruction livings and inspiring positive socio-economic alteration.

5 CONCLUSION AND FUTURE WORK

Existing emergency caring logistics' improvement mock-ups consume few limits in large-scale data, this will be complicated to compute and finding the optimal can yield an extreme quantity of period and computation power. So, the event of innovative algorithms that may be useful in emergency caring supplying is important to feature to this stable of genetic algorithms, locate-allocate heuristics. In some situations, 2 disasters might occur, similar to an earthquake followed by a tsunami.

References

1. David Pitt , Stefan Trück , Rob van den Honert , Wan Wah Wong : Modeling risks from natural hazards with generalized additive models for location, scale and shape, Journal of Environmental Management 275,111075 (2020).
2. S.L. Cutter, L. Barnes, M. Berry, C. Burton, E. Evans, E. Tate, J. Webb: A place-based model for understanding community resilience to natural disasters, Global Environ. Change 18 (4) 598–606, (2008)
3. S. Henly-Shepard, C. Anderson, K. Burnett, L.J. Cox, J.N. Kittinger, M. A. Ka'aumoana : Quantifying household social resilience: a place-based approach in a rapidly transforming community, Nat. Hazards 75 (1) 343–363, (2015)
4. Isa M. Gargano, Robyn R. Gershon, AminotuOgunyemi, Danica Dorlette, Lysa J. Petrsoric, James E. Cone,Comorbid posttraumatic stress disorder and lower respiratory symptoms in disaster survivors: Qualitative results of a 17-year follow-up of World Trade Center disaster survivors, Progress in Disaster Science, Volume 4, 100050, https://doi.org/10.1016/j.pdisas.2019.100050. (2019).
5. Alan Scaria, Ishwer D. Gupta, Vinay K. Gupta: An improved probabilistic seismic hazard mapping of peninsular shield region of India, Soil Dynamics and Earthquake Engineering, 106417, 2020 https://doi.org/10.1016/j.soildyn.2020.106417.
6. Hamid Reza Pourghasemi, Amiya Gayen, Mahdi Panahi, FatemehRezaie, Thomas Blaschke : Multi-hazard probability assessment and mapping in Iran, Science of The Total Environment, Volume 692, Pages 556-571,(2019) , https://doi.org/10.1016/j.scitotenv.2019.07.203.
7. Claudia Vitolo, Claudia Di Napoli, Francesca Di Giuseppe, Hannah L. Cloke, Florian Pappenberger, Mapping combined wildfire and heat stress hazards to improve evidence-based decision making, Environment International, Volume 127, Pages 21-34, (2019), https://doi.org/10.1016/j.envint.2019.03.008.
8. Da-wei Zhang, JinQuan, Hong-bin Zhang, Fan Wang, Hong Wang, Xiao-yan He : Flash flood hazard mapping: A pilot case study in Xiapu River Basin, China, Water Science and Engineering, Volume 8, Issue 3, Pages 195-204,(2015), https://doi.org/10.1016/j.wse.2015.05.002.
9. Keira O Kane : Mapping boundary interactions across earthquake science and humanitarian-development communities for disaster risk reduction, International Journal of Disaster Risk Reduction 49 ,101729,((2020), https://doi.org/10.1016/j.ijdrr.2020.101729.
10. Chong Xu, Xiwei Xu, Fuchu Dai, Arun K. Saraf : Comparison of different models for susceptibility mapping of earthquake triggered landslides related with the 2008 Wenchuan earthquake in China, Computers & Geosciences, Volume 46,Pages 317-329,(2012), https://doi.org/10.1016/j.cageo.2012.01.002.
11. Agnieszka A. Malinowska, Wojciech T. Witkowski, ArturGuzy, RyszardHejmanowski:Mapping ground movements caused by mining-induced earthquakes applying satellite radar interferometry, Engineering Geology, Volume 246, Pages 402-411, (2018)https://doi.org/10.1016/j.enggeo.2018.10.013.
12. MorganeAudère, Marc Robin:Assessment of the vulnerability of sandy coasts to erosion (short and medium term) for coastal risk mapping (Vendée, W France), Ocean & Coastal Management, Volume 201,105452, (2021) https://doi.org/10.1016/j.ocecoaman.2020.105452.
13. Ines Alberico , Roberta Iavarone , Paola Petrosino: A procedure for the resilience mapping in urban systems exposed to natural hazard: The Ischia Island (southern Italy) test ar-

ea, International Journal of Disaster Risk Reduction, 50, 101893, (2020), https://doi.org/10.1016/j.ijdrr.2020.101893
14. Rockefeller Foundation – ARUP City Resilience Framework, 2015. New York, https://www.rockefellerfoundation.org/report/city-resilience-framework/. (Accessed 1 May 2019).
15. Ratiranjan Jena, Biswajeet Pradhan, GhassanBeydoun, Abdullah M. Alamri, Ardiansyah, Nizamuddin, HizirSofyan, Earthquake hazard and risk assessment using machine learning approaches at Palu, Indonesia, Science of The Total Environment, Volume 749, 141582, (2020), https://doi.org/10.1016/j.scitotenv.2020.141582.
16. Chaofeng Wang a, Qian Yu , Kincho H. Law , Frank McKenna , Stella X. Yu , Ertugrul-Taciroglu , Adam Zsarn´oczay , WaelElhaddad , BarbarosCetiner : Machine learning-based regional scale intelligent modeling of building information for natural hazard risk management, Automation in Construction, 122 , 103474, (2021).
17. M.S. Habib, Y.H. Lee, M.S. Memon Mathematical models in humanitarian supply chain management: a systematic literature reviewMath. Prob. Eng. (2016)
18. A. SauerHumanitarian Supply Chain Performance Management: Development and Evaluation of a Comprehensive Performance Measurement Framework Based on the Balanced Scorecard (Doctoral dissertation) Munich Business School, German (2016)
19. Ding C, Song Y, Knaap G, Huang Y. 2005. Urban planning and spatial structure: urban sustainable development strategy (In Chinese). Beijing: China Architecture & Building Press.
20. Deb K, Karthik S. 2007. Dynamic multi-objective optimization and decision-making using modified NSGA-II: a case study on hydro-thermal power scheduling. Paper presented at the International conference on evolutionary multi-criterion optimization, Berlin, Heidelberg.
21. John Twigg, 2004 “Disaster risk reduction Mitigation and preparedness in development and emergency programming HPN Humanitarian Practice Network”.
22. DS Vijayan, A Leema Rose, S Arvindan, J Revathy, C Amuthadevi, 2020 “Automation systems in smart buildings”Journal of Ambient Intelligence and Humanized Computing.https://doi.org/10.1007/s12652-020-02666-9
23. C Amuthadevi, DS Vijayan, Varatharajan Ramachandran,2021” Development of air quality monitoring(AQM) models using different machine learning approaches “Journal of Ambient Intelligence and Humanized Computing. https://doi.org/10.1007/s12652-020-02724-2

Mean Square Cordial Labeling Of Some Pentagonal Snake Graphs

S Dhanalakshmi[1], S.Thirunavukkarasu[2]
{dhanalas1@srmist.edu.in[1], thirunavukkarasu.it@bharathuniv.ac.in[2]}

Department of Mathematics, Faculty of Engineering and Technology, SRM IST, Chennai -600089, India
Department of Information Technology, Faculty of Engineering and Technology, BIHER, Chennai - 600073, India

Abstract. The A Mean Square Cordial labeling of a Graph G(V,E) with p vertices and q edges is an onto from V to {0, 1} such that each edge uv is assigned the label $\left(\left\lceil (f(u)^2 + f(v)^2)/2 \right\rceil\right)$ where $\lceil x \rceil$ (ceil(x)) is the least integer greater than or equal to x with the condition that the number of vertices labeled with 0 and the number of vertices labeled with 1 differ by at most 1 and the number of edges labeled with 0 and the number of edges labeled 0 and the number of edges labeled with 1 differ by at most 1.In this paper we analysed that Pentagonal snake PS_k, Subdivision of a pentagonal snake $S(PS_k)$,Double pentagonal snake $D(PS_k)$ and Alternate pentagonal snake $A(PS_k)$ are mean square cordial graphs.

Keywords: Mean Square Cordial Labeling, Pentagonal snake $S(PS_k)$,Double pentagonal snake $D(PS_k)$, Alternate pentagonal snake $A(PS_k)$.

1 Introduction

Graph theory is one of the most comprehensive and growing areas of mathematics which is a graph analysis concerned with the relationship between vertices and edges. Over 200 graph labeling techniques [1] have been explored in thousands of research papers, leading to the participation of the researchers over the past 60 years. Label graphs serve as useful models with more applications such as coding principles, crystal analysis, radar detection, astro studies, circuit design, communication network addressing, database management, exchange of secret messages, simulating many restricted programming in a finite number of domains. We follow Harary[2] for the basic terms and notations. Cordial labeling was introduced by Cahit[3] and Ponraj et al[4] initiated the mean cordial labeling of a graph. Mean square cordial labeling introduced by A.Nellaimurugan et al and discussed it for some special graphs[5]. Furthermore, the mean square cordial labeling for certain tree and cycle based graphs[6,7] was discussed. Dhanalakshmi et al discussed mean cordial square labelling related to certain cyclic and acyclic graphs and their rough approximations[8,9]. Some interesting findings have been discussed by Dhanalakshmi et al in mean square cordial marking of some star based graphs[10].

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2Preliminaries

Definition 1:Let G = (V,E) be a graph with p vertices and q edges. "A Mean Square Cordial labeling of a Graph G(V,E) with p vertices and q edges is an onto mapping from V to {0, 1} such that each edge uv is assigned the label $\left(\left| (f(u)^2 + f(v)^2)/2 \right| \right)$ where $\lceil x \rceil$ (ceil(x)) is the least integer greater than or equal to x with the condition that the number of vertices labeled with 0 and the number of vertices labeled with 1 differ by at most 1 and the number of edges labeled with 0 and the number of edges labeled 0 and the number of edges labeled with 1 differ by at most 1".

Definition 2: The pentagonal snake $P(S_k)$ is obtained from a path $u_1,u_2,\ldots\ldots u_k$ by joining u_i and u_{i+1} for $1 \le i \le k-1$,to two new vertices v_i , w_i , x_i and then joining v_i , x_i and x_i ,w_i.That is the path P_n by replacing each edge of the path by a cycle C_5.

Definition 3: Let G be a graph. The subdivision graph S (G) is obtained from G by subdividing each edge of G with a vertex

Definition 4: Double pentagonal snake D (PS_k) is obtained by two pentagonal snakes that have a common path.

Definition 5: An alternate pentagonal snake A(PS_k)is obtained from a path $u_1,u_2, \ldots , u_n$ by joining u_i and u_{i+1} to two new vertices v_i ,w_i and by joining v_i and w_i to a new vertex x_i respectively .That is, every alternate edge of a path is replaced by a cycle C_5

3Main Results

Theorem 1: Pentagonal snake PS_kadmits mean square cordial labelling $\forall k \geq 2$.

Proof: Let $P_k$be the path $u_1,u_2,\ldots,u_k$ .Let $V(PS_k) = V(P_k) \cup \{v_i,w_i ,x_i : i$ varies from 1 to k-1} and $E(PS_k)=\{[(u_iu_{i+1}):i$ varies from 1 to k-1] $\cup$ [$(u_iv_i$: i varies from 1 to k-1 } $\cup$ [$(v_ix_i$:i varies from 1 to k-1] $\cup$ [$(x_iw_i$: i varies from 1 to k-1 } $\cup$ [$(w_iu_i$:i varies from 1 to k-1]

Here $|V| = 4k-3$ *and* $|E| = 5k-5$

Define f maps $V(PS_k)$ to { 0,1}

Case (i) k is odd

$$f(u_i) = \begin{cases} 0, i \text{ var } ies \ from \ 1 \ to \ (k+1)/2 \\ 1, i \text{ var } ies \ from \ (k+3)/2 \ to \ k \end{cases}$$

$$f(v_i) = f(w_i) = f(x_i) = \begin{cases} 0, i \text{ var } ies \ from \ 1 \ to (k-1)/2 \\ 1, i \text{ var } ies \ from \ (k+1)/2 \ to \ k-1 \end{cases}$$

Then the induced edge labelling is as follows

$$f(u_iu_{i+1}) = \begin{cases} 0, i \text{ var } ies \ from \ 1 to \ (k-1)/2 \\ 1, i \text{ var } ies \ from \ (k+1)/2 \ to \ k-1 \end{cases}$$

$$f(u_i v_i) = f(v_i x_i)$$
$$= f(x_i w_i) = f(u_{i+1} w_i) \quad = \quad 0, i \text{ var ies from } 1 \text{ to } (k-1)/2,$$
$$1, i \text{ var ies from } (k+1)/2 \text{ to } k-1$$

The vertex and edge cardinality of 0 label and 1 label are shown in the following table

T	0	1
$\lvert v_f(t)\rvert$	$2k-1$	$2k-2$
$\lvert e_f(t)\rvert$	$\frac{5k-5}{2}$	$\frac{5k-5}{2}$

Case (ii) k is even

$$f(u_i) = 0, i \text{ var ies from } 1 \text{ to } k/2$$
$$1, i \text{ var ies from } (k+2)/2 \text{ to } k$$

$$f(v_i) = f(x_i) = 0, i \text{ var ies from } 1 \text{ to } (k-1)/2$$
$$1, i \text{ var ies from } (k+1)/2 \text{ to } k-1$$
$$f(w_i) = 0, i \text{ var ies from } 1 \text{ to } (k-2)/2$$
$$1, i \text{ var ies from } k/2 \text{ to } k-1$$

Then the induced edge labelling is as follows

$$f(u_i u_{i+1}) = f(x_i w_i) = f(u_{i+1} w_i) = 0, i \text{ var ies from } 1 \text{ to } (k-2)/2$$
$$1, i \text{ var ies from } k/2 \text{ to } k-1$$

The vertex and edge cardinality of 0 label and 1 label are shown in the following table

T	0	1
$\lvert v_f(t)\rvert$	$2k-1$	$2k-2$
$\lvert e_f(t)\rvert$	$\frac{5k-6}{2}$	$\frac{5k-4}{2}$

Hence pentagonal snake PS_kadmits mean square cordial labeling$\forall k \geq 2$.
Illustr:

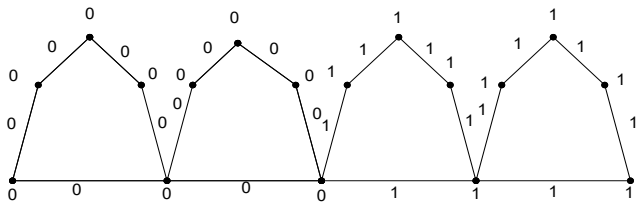


Figure 1: Mean square cordial labeling of pentagonal snake PS_5

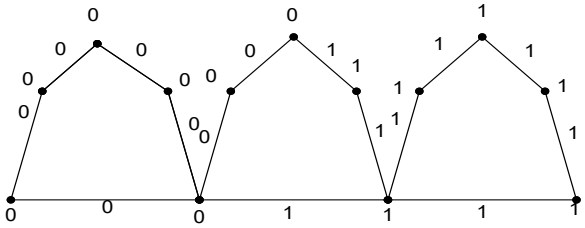


Figure 2: Mean square cordial labeling of pentagonal snake PS_4

Theorem: 2 Subdivision of a pentagonal snake $S(PS_k)$ admits mean square cordial labeling$\forall k \geq 3$ *and k is odd.*

Proof: Let $P_k$be the path $u_1,u_2,\ldots,u_k$. Let $V(PS_k) = V(P_k) \cup \{v_i,w_i,x_i: \text{varies from 1 to k-1}\}$ and $V(S(PS_k)) = V(PS_k) \cup \{ a_i,b_i,c_i,d_i ,e_i:\text{i varies from 1 to k-1}\}$ Then $E(S(PS_k)) = \{[(u_ib_i): \text{i varies from 1 to k-1}] \cup [(b_iv_i): \text{i varies from 1 to k-1}] \cup [(v_ic_i: \text{i varies from 1 to k-1 }\} \cup [(c_ix_i :\text{i varies from 1 to k-1}] \cup [(x_id_i :\text{i varies from 1 to k-1}] \cup [(d_iw_i: \text{i varies from 1 to k-1} \cup [(w_ie_i: \text{i varies from 1 to k-1} \cup [(e_iu_{i+1}: \text{i varies from 1 to k-1 }\} \cup [(a_iu_{i+1}: \text{i varies from 1 to k-1 }\} \cup [(a_iu_i: \text{i varies from 1 to k-1 }\}$

/Here $|V| = 9k-8 \; and \; |E| = 10k-10$

Define f maps $V(S(PS_k))$ to $\{0,1\}$

$$f(u_i) = \begin{matrix} 0, i \text{ var ies from } 1 \text{ to } (k+1)/2 \\ 1, i \text{ var ies from } (k+3)/2 \text{ to } k \end{matrix}$$

$$f(v_i) = f(w_i) = f(x_i) =$$
$$f(a_i) = f(b_i) = f(c_i) =$$
$$f(d_i) = f(e_i) = \begin{matrix} 0, i \text{ var ies from } 1 \text{ to } (k-1)/2 \\ 1, i \text{ var ies from } (k+1)/2 \text{ to } k-1 \end{matrix}$$

Then the induced edge labelling is as follows

$$f(u_ib_i) = f(b_iv_i) = f(v_ic_i) =$$
$$f(c_iw_i) = f(d_iw_i) = f(d_ix_i) =$$
$$f(x_ie_i) = f(e_iu_{i+1}) = f(u_{i+1}a_i) =$$
$$f(a_iu_i) = \begin{matrix} 0, i \text{ varies from } 1 \text{ to } (k-1)/2, \\ 1, i \text{ varies from } (k+1)/2 \text{ to } k-1 \end{matrix}$$

The vertex and edge cardinality of 0 label and 1 label are shown in the following table

T	0	1
$\lvert v_f(t)\rvert$	$\frac{9k-7}{2}$	$\frac{9k-9}{2}$
$\lvert e_f(t)\rvert$	$5k-5$	$5k-5$

Hence subdivision of a pentagonal snake S(PS_k) admits mean square cordial labeling$\forall k \geq 2$ and k is odd.

Illustration:

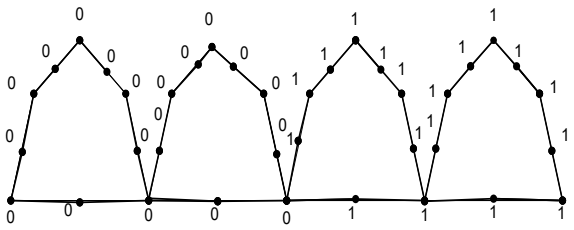


Figure 3: Mean square cordial labeling of pentagonal snake S(P S_5)

Theorem 3: Double pentagonal snake D(PS_k), k is odd and $k \geq 3$ admits mean square cordial labeling .

Proof: Let $P_k$be the path $u_1,u_2,u_3,....u_k$ .Let V(D(PS_k)) = V(P_k)$\cup$ { v_i, w_i, x_i : i varies from 1 to k-1} $\cup$ { v_i', w_i', x_i' : i var$ies\ from\ 1\ to\ k-1$} and E(D(PS_k))={[$u_i u_{i+1}$:i var$ies\ from\ 1 to\ k-1$} $\cup$[($u_i v_i$: i var$ies\ from\ 1 to\ k-1$ } $\cup$[($v_i w_i$: i var$ies\ from\ 1 to\ k-1$]$\cup$[($w_i x_i$: i var$ies\ from\ 1 to\ k-1$ }$\cup$ [($u_{i+1} x_i$: i var$ies\ from\ 1 to\ k-1$)}$\cup$[($v_i' w_i'$: i var$ies\ from\ 1 to\ k-1$]$\cup$[$w_i' x_i'$: i var$ies\ from\ 1 to\ k-1$ }$\cup$ [($x_i' u_{i+1}$: i var$ies\ from\ 1 to\ k-1$)].

Here $|V| = 7k-6$ and $|E| = 9n-9$.

Define f maps V(PS_k) to {0,1}

$$f(u_i) = 0, i \text{ var}ies\ from\ 1\ to\ (k+1)/2$$
$$1, i \text{ var}ies\ from\ (k-1)/2\ to\ k$$

$$f(v_i) = f(w_i) = f(x_i) = 0, i \text{ var}ies\ from\ 1\ to (k-1)/2$$
$$1, i \text{ var}ies\ from\ (k+1)/2\ to\ k-1$$

,

$$f(v_i') = f(w_i') = f(x_i') = 0, i \text{ var}ies\ from\ 1\ to (k-1)/2$$
$$1, i \text{ var}ies\ from\ (k+1)/2\ to\ k-1$$

Then the induced edge labelling is as follows

$$f(u_i u_{i+1}) = 0, i \text{ var}ies\ from\ 1 to\ (k-1)/2$$
$$1, i \text{ var}ies\ from\ (k+1)/2\ to\ k-1$$

$$f(u_iv_i) = f(v_iw_i) = f(w_ix_i) = f(u_i'v_i') = f(v_i'w_i') = f(w_i'x_i') = 0, i \text{ varies from } 1 \text{ to } (k-1)/2,$$
$$1, i \text{ varies from } (k+1)/2 \text{ to } (k-1)/2,$$

$$f(v_iw_i) = \begin{matrix} 0, i \text{ varies from } 1 \text{ to } (k-1)/2 \\ 1, i \text{ varies from } (k+1)/2 \text{ to } k-1, \end{matrix}$$

$$f(x_iu_{i+1}) = f(x_i'u_{i+1}) = \begin{matrix} 0, i \text{ varies from } 1 \text{ to } (k-1)/2 \\ 1, i \text{ varies from } (k+1)/2 \text{ to } k-1, \end{matrix}$$

From the following table , we can conclude that the above vertex labeling, say f, is a mean square cordial labeling

T	0	1
$\lvert v_f(t)\rvert$	$\frac{7k-6}{2}$	$\frac{7k-6}{2}$
$\lvert e_f(t)\rvert$	$\frac{9n-9}{2}$	$\frac{9n-9}{2}$

Illustration:

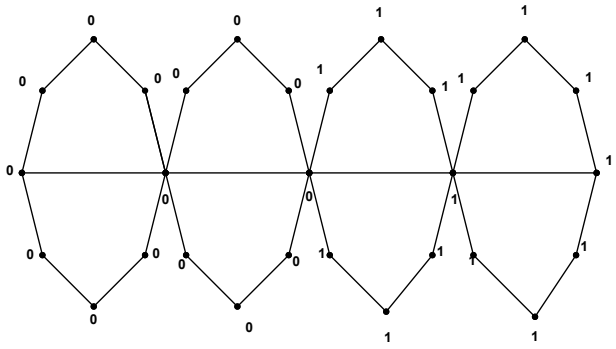


Figure 1: Mean square cordial labeling of pentagonal snake D(PS_5)

Theorem: 4 Alternate pentagonal snake A(PS_k), $k \geq 2$ and the pentagon starts from first vertex and ends with last vertex of a path admits mean square cordial labeling.

Proof : Let $P_k$be the path $u_1,u_1',u_2,u_2',\ldots,u_k,u_k'$. Let V(A($PS_k$)) = V($P_k$)$\cup$ {v_i,w_i,x_i : i varies from 1 to k} and E(A(PS_k))={ [(u_iu_i'):i varies from 1 to k]$\cup$[($u_i'u_{i+1}$):i varies from 1 to k]$\cup$ [(u_iv_i: i varies from 1 to k}$\cup$[(v_ix_i :i varies from 1 to k-1]$\cup$ [(v_ix_i :i varies from 1 to k-1] $\cup$ [(x_iu_i': i varies from 1 to k]}.

Here $|V| = 5k$ *and* $|E| = 6n - 1$.

Define f maps V(A(PS_k)) to { 0,1}

Case (i): k is even

$$f(u_i) = f(u_i') = f(v_i) = f(w_i) = f(x_i) = 0, i \text{ var } ies \text{ } from \text{ } 1 \text{ } to \text{ } k/2$$
$$1, i \text{ var } ies \text{ } from \text{ } (k/2)+1 \text{ } to \text{ } k$$

Then the induced edge labelling is as follows

$$f(u_i u_{i'}) = 0, i \text{ var } ies \text{ } from \text{ } 1 \text{ } to \text{ } k/2$$
$$1, i \text{ var } ies \text{ } from \text{ } (k+2)/2 \text{ } to \text{ } k$$

$$f(u_i u_{i+1}) = 0, i \text{ var } ies \text{ } from \text{ } 1 \text{ } to \text{ } (k/2)-1$$
$$1, i \text{ var } ies \text{ } from \text{ } k/2 \text{ } to \text{ } k-1$$

$$f(u_i v_i) = f(v_i w_i) = f(w_i x_i) = f(x_i u_i') = 0, i \text{ var } ies \text{ } from \text{ } 1 \text{ } to (k)/2$$
$$1, i \text{ var } ies \text{ } from \text{ } (k+2)/2 \text{ } to \text{ } k$$

From the following table , we can conclude that the above vertex labeling, say f, is a mean square cordial labelling

T	0	1
$\lvert v_f(t)\rvert$	$\frac{5k+1}{2}$	$\frac{5k-1}{2}$
$\lvert e_f(t)\rvert$	$\frac{6n-1}{2}$	$\frac{6n}{2}$

Case (i): k is odd

$$f(u_i) = f(v_i) = f(w_i) = 0, i \text{ var } ies \text{ } from \text{ } 1 \text{ } to \text{ } (k+1)/2$$
$$1, i \text{ var } ies \text{ } from \text{ } (k+3)/2+1 \text{ } to \text{ } k$$

$$f(x_i) = f(u_i') = 0, i \text{ var } ies \text{ } from \text{ } 1 \text{ } to \text{ } (k-1)/2$$
$$1, i \text{ var } ies \text{ } from \text{ } (k+1)/2+1 \text{ } to \text{ } k$$

Then the induced edge labelling is as follows

$$f(u_i u_{i'}) = 0, i \text{ var } ies \text{ } from \text{ } 1 \text{ } to \text{ } (k-1)/2$$
$$1, i \text{ var } ies \text{ } from \text{ } (k+1)/2 \text{ } to \text{ } k$$

$$f(u_i u_{i+1}) = 0, i \text{ var } ies \text{ } from \text{ } 1 \text{ } to \text{ } (k-1)/2$$
$$1, i \text{ var } ies \text{ } from \text{ } (k+1)/2 \text{ } to \text{ } k-1$$

$$f(u_i v_i) = f(v_i w_i) = 0, i \text{ var } ies \text{ } from \text{ } 1 \text{ } to (k-1)/2$$
$$1, i \text{ var } ies \text{ } from \text{ } (k+1)/2 \text{ } to \text{ } k$$

$$f(w_i x_i) = f(x_i u_i') = 0, i \text{ var } ies \text{ } from \text{ } 1 \text{ } to (k+1)/2$$
$$1, i \text{ var } ies \text{ } from \text{ } (k+3)/2 \text{ } to \text{ } k$$

From the following table , we can conclude that the above vertex labeling, say f, is a mean square cordial labelling

T	0	1
$\lvert v_f(t)\rvert$	$\frac{5k}{2}$	$\frac{5k}{2}$
$\lvert e_f(t)\rvert$	$\frac{6n-1}{2}$	$\frac{6n}{2}$

Hence alternate pentagonal snake A(PS_k), $k \geq 2$ and the pentagon starts from first vertex $u_1$and ends with last vertex u_k'admits mean square cordial labeling.

Illustration:

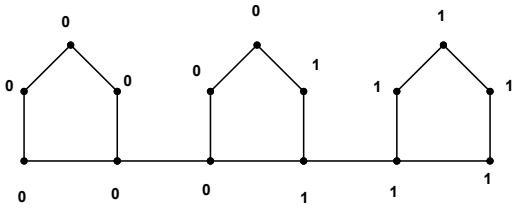


Figure 4: Mean square cordial labeling of pentagonal snake A(PS_3)

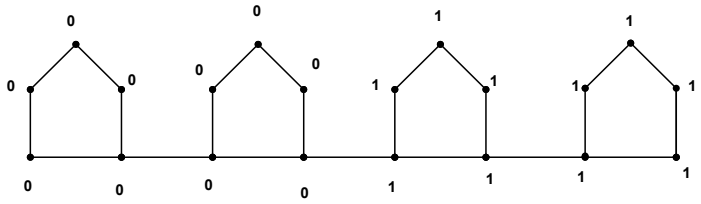
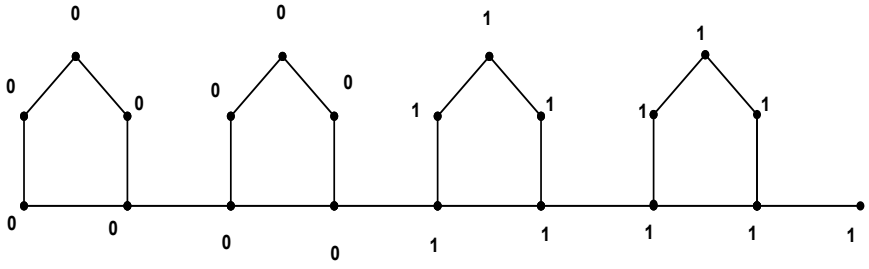


Figure 5: Mean square cordial labeling of pentagonal snake A(PS_4)

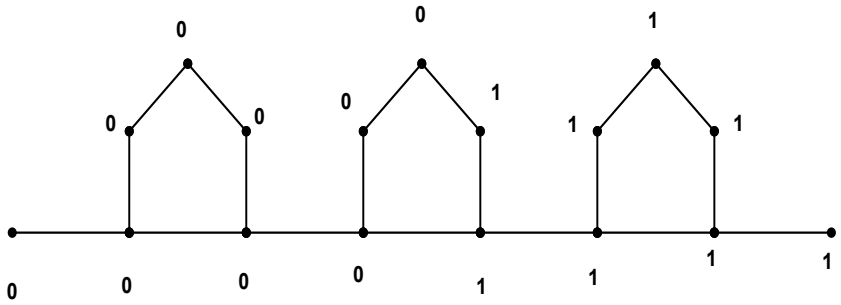
Corollary (i): **Alternate pentagonal snake A(PS_k), for all $k \geq 2$ and the pentagon starts from first vertex and ends with second last vertex admits mean square cordial labeling.**

Illustration:



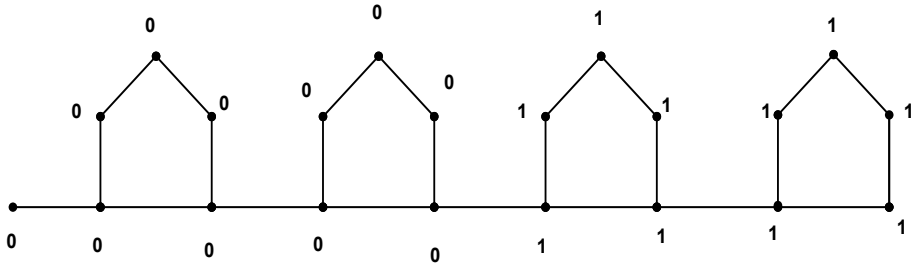
Corollary (ii): **Alternate pentagonal snake A(PS_k), for all $k \geq 2$ and the pentagon starts from second vertex and ends with second last vertex admits mean square cordial labeling.**

Illustration:



Corollary (iii): **Alternate pentagonal snake A(PS_k), for all $k \geq 2$ and the pentagon starts from second vertex and ends with last vertex admits mean square cordial labeling.**

Illustration:



4Conclusion

In this section mean square cordial labeling is investigated for some pentagonal snake graphs. It can be further investigated by the researcher for some more snake related graphs like alternate triangular snake graphs, double triangular snake graphs, alternate quadrilateral snake graphs, double quadrilateral graphs etc.

5Future Scope

The same labelling technique can be verified for some other family of graphs.Also graph operations like union, intersection, corona of two graphs etc., can also be analysed for mean square cordial labeling in future.

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References

[1] A. Gallian A Dynamic Survey of Graph Labeling Electronic Journal of Combinatorics, Vol. 18, 2011, pp. 1-219
[2] F. Harary Graph Theory Narosa Publishing House, New Delhi, 1988.
[3] I. Cahit Cordial Graphs: A Weaker Version of Graceful and Harmonious Graphs ArsCombinatoria, Vol. 23, No. 3, 1987, pp. 201-207.
[4] Ponraj, M.Sivakumar and M.Sundaram, Mean cordial labeling of graphs ,Open journal of Discrete Mathematics, 2(4)(2012), 145-14
[5] A.NellaiMurugan, S.Heerajohn Special Class of Mean Square Cordial Graphs, International Journal of Applied Research 2015; 1(11): 128-131
[6] S.Dhanalakshmi and N.Parvathi Mean square cordial labelling related to some cyclic graphs , International Journal of Engineering and Technology.
[7] A.NellaiMurugan, S.Heerajohn Cycle related of Mean Square Cordial Graphs, International Journal of research and development organization.
[8] S.Dhanalakshmi and N.Parvathi Mean square cordial labelling related to some acyclic graphs and its rough approximations , National Conference on Mathematical Techniques and its Applications (NCMTA 18) IOP Publishing IOP Conf. Series: Journal of Physics: Conf. Series 1000 (2018) 012040 doi :10.1088/1742-6596/1000/1/01204
[9] A.NellaiMurugan, S.Heerajohn Tree Related Mean Square Cordial Graphs ,outreach IX 2016 126-131 ,A multidisciplinary refereed journal
[10] S.Dhanalakshmi and N.Parvathi, Mean square cordial labeling on star related graphs , Journal of physics ;Conference series ,Volume 1377,Page No.1-15,doi:10.1088/1742-6596/1377/1/012027

Recycling of Used Vegetable Oils from Cafeteria's of Arba Minch City for Bio-Fuel Production

Habte Wolde Ababu[#1], Joshua SC Isaac JoshuaRameshLalvani[#1], Ramesh Duraisamy[*2], AbiyuKereboBerekute[*2]
{[1]habtzeroha@gmail.com, [2] isaaclalvani@yahoo.com, [3]drrameshmcas@gmail.com, [4]abiyu.kerebo@amu.edu.et}
[#1] Faculty of Mechanical and Production Engineering, Arba Minch Institute of Technology, Arba Minch University, Ethiopia
[*2] Department of Chemistry, College of Natural Sciences, Arba Minch University, Ethiopia

Abstract. The initial survey was done at Arba Minch, Ethiopia. It is found that there are many cafeterias and restaurants around Arba Minch are using a considerable amount of vegetable oils for preparing varieties of food and snacks. After deep-frying of foods they are disposing the used cooking oil (UCO) down the sink and also discharged into the water bodies and become the cause of water living organisms. It is estimated that approximately around 430 liters of Used cooking oil (UCO) arise from catering annually in each cafeteria of Arba Minch town. In this concern, the raw UCO use to obtain more than 79% as bio feedstock for the production of biodiesel at the end of the process. An even enormous amount of collectible household cooking oil waste is also likely available. Hence, this research was focused on making a profit of community in addition to save the environment from the used cooking oil. The appropriateness of used cooking oil has been set up in this research. In this study, used cooking oil has been collected, purified, transesterified and properties of transestefied used cooking oil biodiesel (TUCO) were studied and it is evident that the properties obtained were nearer to the conventional existing diesel. The performance characteristics of a single-cylinder, four-stroke, direct injection diesel engine, fuelled with TUCO are analysed and compared to local diesel results. The research has been done at a constant speed of 3500 rpm, and then it was gradually loaded. Also, the experiments were conducted at different loads, by increasing torque, for compression ratios of 22:1 and injector pressure of 210 bar. Among the two samples (Diesel, TUCO tested), the best performance is achieved by biodiesel. Furthermore, the end values revealed that the test engine performance such as brake thermal efficiency, energy consumption, and fuel consumption is similar to diesel, when fuelled by transesterified used cooking oil reduction of power-output by 5.51% was noticed. The total fuel and specific fuel consumption also perceived to be an increased by 0.331% and 0.064%. Even though TUCO performance is reduced it may be improved by varying different engine parameters and by additives.

Keywords: Diesel, Performance, Transestefied Used cooking oil, Biodiesel, Engine.

1 Introduction

Most employed fuel for heavy-duty and light-duty engines are diesel. The requirement for source of energy is elevating everywhere in the world, specifically the need for petroleum based fuels. In the present situation ninety percentage of demand for the energy covered by conventional combustible fossil fuel, predominantly by products from petroleum, these fuels

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are neither in adequate quantity nor at affordable prices. In the subsequent years, exploring replaceable different fuels for engines have to be procured from indigenous sources favourably sources from renewable category. Vehicles operating with diesel fuel were becoming popular because of superior efficiency and inferior emission. Diesel engines are used in most of the transportations, diesel power plants, building constructions and most of industrial applications. Used cooking oil is also called as Waste edible oil (WEO). Oils used for the purpose of cooking food materials can't be reused for the food consumption again.

Scrapping of huge quantity of UCO has become a problematic issue with maximum of countries. UCO not to be scrapped into sewages or drainage. In day to day usage, this will restrict the flow and vermin problems. These causes watercourse and also arising issues for wildlife. From the selected countries around the world, around 15 million tons of used cooking oil has been generated.

In Ethiopia, a considerable number of hotels, samosa & chips shops, etc., disposes the used cooking oil in the drainage. Its effect the water, fauna, flora, and human also. Numerous complications will be created in the engine while using directly used cooking oil or vegetable oil.

Short term problems are:

- Starting engines during cold weather.
- Gumming of the filter.
- Knocking of the engine.

Long term problems are:

- Injector coking.
- Deposits of carbon on the piston and head of the engine.
- Significant rise in engine wear.
- Lubrication oil polymerization [1].

2. Different Method of using used cooking oil in engine

Pre-heating the vegetable oil

The viscosity of vegetable oil can be reduced by heating them before injection. By preheating to about 75°C, the viscosity of vegetable oil nearly equal to the viscosity of diesel [2].This will enhance the spray & mixture attributes between fuel and air in the cylinder. Pre-heated vegetable oil results in enhanced performance attribute with a reduction in emission attribute [3].

Dual Fuel Operation

A prevailing diesel engine can be effortlessly altered to work in this mode. This engine can accept a wide range of fluids & gaseous fuel as the primary energy source. The dual-fuel engine can catalyze in good brake thermal efficiency& significant low smoke emission mainly at the elevated power output.

Alcohols, LPG, Hydrogen, etc., have been widely used as instructed fuels in the dual-fuel engine [4].

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Emulsion

The emulsion is attained by mingling two immiscible liquids by employing either an electrical or mechanical homogenizing machine. A surfactant accompanied to the blend reduces the oil & water surface tension, stimulates the surfaces & enhances the ostensible contact areas to make an emulsion. The selection of surfactant is made based on the basis of HLB (HydrophileLipophile Balance) values, not more than 7 in order to compose water in oil emulsions.

Blends with diesel or alcohol

The fusing of vegetable oils accompanied by diesel fuel would settle the hindrances of diesel engine proceeding with raw vegetable oils. Vegetable oil disintegrates well off in diesel fuel. The diesel engine would operate effectively on a fusion of vegetable oil and diesel fuel devoid of detriment to engine accessories for short-term functioning. To eliminate these obstacles is to diminish fuel viscosity and thus enhancing injection attributes.

Transesterification of vegetable oil

Transesterification is the mechanism of transforming the triglycerides of vegetable oil to these monoesters by treating them with alcohol in the presence of a catalyst such as KOH (Potassium Hydro oxide), NaOH (Sodium Hydro oxide), etc., to produce glycerol & fatty acids. This mixture of fatty esters produced by this reaction is referred to as biodiesel [5].

A research was therefore, attempted with the initiative of determining the maximal feasible substitution of diesel by using transesterified used cooking oil and to study the performance attributes of a constant speed C.I. engine operated with TUCO and Diesel. Since the transesterification technique was widely used for the formation of biodiesel, this process has been used in this research for obtaining renewable fuel.

3 Materials and methods

Usedcooking oil (UCO) was collected from the cafeterias located in Chamokebele, Arbaminch. The used oil specimen was obtained from the Oil fryer which was used for frying chips and farther food items. The temperature noticed around frying was in the limits of 130˚C - 170˚C. This temperature could be compared with the temperature around 140 - 180˚C for preparing French fries.

Fig.1 Cafeteria Owners receiving Green Bin from Research Team

The collected UCO was stored in a plastic container in the laboratory for further processing. These are the raw materials sources for the preparation of biodiesel. Also, these raw materials include triglycerides, free fatty acids, including other contaminants. Figure 1 shows the collection of used cooking oil from the cafeteria owner means of the green bin.

4. Production of biodiesel by transesterification

A. Filtering and Drying

The used cooking oil wants to be filtered to eradicate any food leftover particles which could affect fuel production. This was done during the sample preparations. The filtration process has been done by sedimentation as shown in figure 2 and the Centrifugation process as shown in figure 3. The oil was dried as much as possible because water reduces the efficiency of transesterification. The filtered and purified used cooking oil is shown in figure 4.

Fig. 2 Sedimentation Process

Fig. 3 Centrifugation Process

Fig. 4 Purified UCO

Transesterification process

The base-catalyzed transesterification method was adopted for the preparation of biodiesel. Accurately weighed volume (100ml) of the oil sample was poured in a 250ml three-necked round bottom flask (see Figure 5). The oil has been pre-heated to 50˚C by using a water bath with a temperature regulator. About 1.5g of catalyst potassium hydroxide (KOH) was dissolved in 20ml of methanol. The potassium methoxide solution has been appended to the pre-heated oil containing flask. The experimental setup was placed on a hot plate magnetic stirrer at 65˚C with a constant speed at 500 rpm. The corresponding alcohols-hydroxide solution with vegetable oil was heated about 2 hours to complete the transesterification. Afterwards, 50ml of water has been carefully checked and flowed genially on the produced specimen to refine it. The blend has been smoothly mixed to prevent foam production and allowed throughout the night for perfect settlement of two phases, specifically: water phase and biodiesel phase [6]. The biodiesel has been abstracted from glycerol by employing separating funnel. The resultant product has been taken into the separating funnel having biodiesel and glycerine. Beyond 24 hours, glycerin was observed and settles down at the bottom of the funnel and biodiesel settles on top of separating funnel. Glycerin was separated by opening the valve of the separating funnel as shown in Figure 6.

Washing

The produced methyl ester of biodiesel necessarily to be washed again to extract the remaining methanol (about 10th by volume) and soapy lay downs. The glycerol sort out as a segregated surface by settling. Potentially glycerol can be utilized by domestic soap-manufacturing companies. Charcoal filtration is used to remove the colour noticed by dyes from the used cooking oil. The separated biodiesel was obtained (shown in Figure 7) and it has been heated to 100˚C for 60 minutes to vaporize the residual water molecules on it.

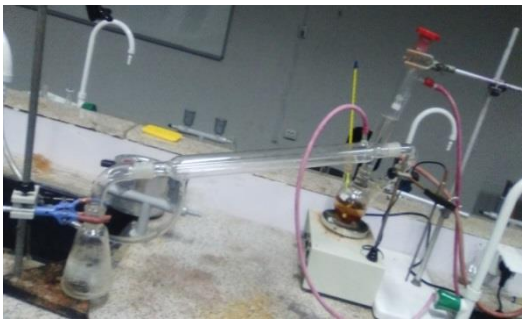

Fig.5 Experimental setup

Fig. 6 Biodiesel Separation

Fig. 7 Refined biodiesel

The percentile of the transesterified used cooking oil obtained was calculated by correlating the mass of layer of transesterified used cooking oil with the weight of UCO has been used.

$$\text{Biodiesel yield (\%)} = \frac{\text{Grams of methyl esters produced}}{\text{Grams of oil used in reaction}} \times 100$$

5. Physiochemical Description of UCO and TUCO

The physiochemical characteristics of UCO and TUCO were described according to ASTM D6751-02 [7].

A. Measurement of Moisture Content

The samples of filtered UCO and transesterified used cooking oil (TUCO) (1g) weighed accurately and taken into pre-weighed clean dry crucible. The samples were placed at 105˚C in a hot air-oven for 2hrs and placed in desiccators; the weight of the samples was taken every 30 minutes until a constant weight was obtained. The outcome of individual try sample has been found and noticed. The amount of moisture on the samples was determined by using:

$$\text{Percentage moisture content} = \frac{W_i - W_f}{W_i} \times 100$$

Where,

W_i- initial weight of the sample before drying

W_f- final weight of the sample after drying

The primary raw materials were used for the production of TUCO via transesterification is UCO. The percent yield of UCO is about 90.24% of unfiltered UCO was recovered after the removal of food residues and sediments under the action of gravitational sedimentation and by chemical coagulation by using Al2SO4 (2%) as a coagulating agent. Also, there is no unreacted oil were observed on the TUCO, which was produced from UCO.

The results (see Table 1) were revealed that there is no water and sediments were found in TUCO, that were produced from UCO, even fewer amount of moisture (0.27% in UCO) was observed. A rotator evaporator has been employed to remove the water and leftover alcohol. The experiments were revealed that the whole eradication of water and non-reacted alcohol has been measured upon the observation of constant weight approached during the rotator evaporation. According to the ASTM standard value for water and the sediment is 0.5% by volume of the sample was recommended. Thus, the results shown that the TUCO produced from UCO were purified and refined well in this present study.

B. Measurement of Saponification Value (S.V), Acid Value (A.V), Iodine Value (I.V), Ester Value and Free Fatty Acid Content

About 2g of an UCO and TUCO were added in to 250ml conical flask and 25ml of 0.5M ethanolic KOH, which is prepared by dissolving KOH pellet in 95% ethanol, was added to the samples. Similarly, the blank solution (all chemicals except samples) was prepared in another conical flask. Reflux condenser was attached to both sample and refluxed for an hour by constant stirring. After complete refluxing, 5 drops of phenolphthalein indicator was added, while it was hot; titrated against standard 0.5M HCl and the finishing point was noticed. The saponification value was determined using the following formula:

$$\text{Saponification value (mg KOH)} = \frac{56.1 \times N \times (V_o - V_1)}{W}$$

Where,

N - Concentration of hydrochloric acid

V_0- Volume of HCl used for the blank

V_1- Volume of HCl used for the sample

W - Weight of sample (in g) taken

56.1 - molar mass of KOH

Accurately measured amount (2g) of UCO and TUCO samples were added into 250ml round bottom flask and the blend has been heated to 700^0C for 3 minutes. Then, 25ml of 1:1

ratio of absolute ethanol and diethyl ether solution was added to the UCO under continuous stirring. Phenolphthalein indicator (5 drops) has been incremented to the each sample solution and titrated against standard 0.1M KOH to the end point, which is the appearance of faint pink color. Similarly, the blank solution was prepared and titrated against 0.1 M KOH to the finishing point. Acid values of the samples were calculated as:

$$\text{Acid value (mg KOH)} = \frac{56.1 \times N \times (V_o - V_1)}{W}$$

Where,

N - Concentration of KOH;

V_0- Volume of HCl used for the blank

V_1- Volume of HCl used for the sample;

W - Weight of sample (in g) taken

56.1 - molar mass of KOH

About 0.25g of samples was taken in clean 250ml conical flask, 10ml of chloroform and 30ml Hanus iodine solution was introduced to it. The flask was securely closed and left for shaken, and then 100ml of distilled water was introduced. The blend has been titrated accompanied by the iodine solution opposed to 0.1 N sodium thiosulphate solutions until the yellow color originated. Later 2-3 drops of starch solution have been introduced. The titration was performed until the finish point has attained, while the volume of $Na_2S_2O_3$ was noted.

$$\text{Iodine value (mg KOH)} = \frac{12.69 \times N \times (V_o - V_1)}{W}$$

Where,

N - Concentration of sodium thiosulphate

V_o - Volume of sodium thiosulphate used for blank

V_1 - Volume of sodium thiosulphate used for sample

W - Mass of the sample

The transesterification process of glycerides with catalyst and alcohol has been much influenced by free fatty acid content. To find the free fatty acid value, 1g of individual sample has been diluted in a 23ml of neutral blend (same mass of diethyl ether and methanol). The obtained sample solution has been titrated with 0.1 M NaOH solution along a phenolphthalein indicator mixed in drops.The titration has been processed up to finish point has been attained. The final point has been noted as the pink color origination.

$$\text{Free Fatty Acid (\%)} = \frac{TV \times 0.0282 \times 100}{\text{weight of sample}}$$

Where,

TV is the titre value

0.0282 is the constant (weight of oleic acid neutralized by 1mg of KOH)

The ester value of the oil samples was calculated as the variation within the saponification value and the acid value. Therefore,

Ester value = Saponification value – Acid value

The saponification value of UCO is observed as 133.24 mg/g while that of its TUCO is 56.1 mg/g respectively. This shows that the triglycerides of UCO have the greater molecular weight of fatty acids (saturated and unsaturated) and the results of this present study are well agreed and a similar trend was observed in reported literature. This result obtained compares favourably with the saponification value of palm oil (187-205), olive oil (185-187), and soy oil (187-193). Saponification is highly used in checking adulteration.

Edible oils iodine value has been observed lesser than 100mgI2. In common, higher the iodine value, the greater degree of unsaturation and more it prone to oxidative rancidity.

However TUCO is 120.53 mgI2, which one is comparatively more, as per Europe's EN14214 specifications of iodine value, which shows the UCO are the worthy source material for the manufacturing of alternative fuel. This justifies the highest iodine value shows the higher numbers of unsaturated double bonds occur in the molecule structure and lower the viscosity [8].

The total acid number for transesterified vegetable oil has been given as 0.8mgKOH/g by ASTM standards. The whole number of potassium hydroxide required for neutralizing the free fatty acid available in vegetable oil/transetereified vegetable oil samples is denoted as acid value. The acid value of ethanol assisted transesterified canola oil, linseed oil, rapeseed oil and sunflower oil were 0.869, 0.884, 0.873 and 0.876 mg KOH/g consecutively as reported by literature [9]. The experimental acid value of TUCO was identified as 0.50mg KOH/g UCO and 0.42 mg KOH/g. These acid values can be further enhanced by managing the Transesterificaton process. The acid value with higher number shows the poor or unrefined source of vegetable oil, these higher values leads to filter clogging and damaging of rubber parts..

The major measure of the biodiesel property was the fatty acid content. Matching samples have been employed for determining the fatty acid content of vegetable oil/transetereified vegetable oil. The results were presented in Table 1 and it was estimated about 1.88% and 1.128% in UCO and TUCO respectively. The UCO and TUCO contain more FFA, among 60% fatty acid is from monounsaturated (C18:1). Poly unsaturated fatty acids identified to be 26% (C18:2 & C18:3), only roughly 8 % fatty acids were saturated. As per the reported literatures [10], the prime saturated fatty acids are Palmitic acid and stearic acid. The viscosity of vegetable oil/transetereified vegetable oil is identified to be depending on the type and amount of fatty acid content. Thus, implies that TUCO derived from UCO of the study was observed at viscosity of 5.23mm^2/sec.

The alkaline catalyst used for transesterification of raw materials with free fatty acid content has a greater impact on the yield and the quality of the resultant product. The extraction of biodiesel from the total products will be more complex when the free fatty acid content of the feedstock is more than 3%. i.e. the viscosity of the biodiesel will be increased by soap formation [11].The free fatty acid value was 1.13% for TUCO, which comes within the allowable range for transesterification with alkaline catalyst. The result was obtained from 1.88% of UCO; this implies that the oil converted into methyl fatty esters.

Determination of Specific Gravity and Viscosity

About 5ml capacity of density bottle was pre-weighed (W_0). It was filled with UCO/TUCO, then inserted stopper and weighed again (taken as W_1). The UCO/TUCO was substituted with water after washing and drying the bottle and weight of the density bottle was measured again weighed (taken as W_2). The specific gravity of the samples was calculated as:

$$\text{Specific gravity, S.G. (\%)} = \frac{W_1 - W_o}{W_2 - W_o}$$

$$= \frac{\text{Mass of the sample}}{\text{Mass of an equal volume of water}}$$

Viscosity is an amount of the obstruction of a fluid being crippled by anyone of shear stress or tensile stress. Exactly taken 15ml of water has been drawn by suction pipe until it crosses the top mark of the viscometer, and the time taken by the water to flow from top-mark to low-mark was noticed with the use of a stopwatch. Then 15ml of test samples were taken in a viscometer. It has been drawn by suction pipe till the sample crosses the top mark of the viscometer. Now, the time needed by the samples to flow from top-mark to low- mark was noted [12]. Relative viscosity of the sample found by the equation as:

$$\text{Relative viscosity} = \frac{T_o}{T_w}$$

Where,

T_o - Time taken for oil/ UCO/TUCO to travel from top mark to low mark

T_w - Time taken for water to travel from top mark to low mark

The results in Table 1 show that the specific gravity was reduced from 0.9258 to 0.91 on UCO after transesterification and it is coming under acceptable limit and also well agreed with ASTM standard and other reported literatures. The greater viscosity is the utmost problem restricting the access of vegetable oils and animal fats directly into diesel engines. The viscosity of the used cooking oil was measured by use of a falling fluid viscometer. The results observed that the average viscosity of UCO were measured (at room temperature) to be 65 mm^2/sec respectively. The viscosity of the TUCO was obtained from UCO were reported as 5.23 mm^2/sec respectively, that value is within acceptable limits by ASTM. The ASTM limit for biodiesel viscosity was reported 1.9-6.0 mm^2/sec at 30oC

Measurement of Higher Heating Value and Cetane Number

Higher heating value (energy content per unit quantity) of UCO/TUCO was estimated from their saponification value and iodine value using the following correlation:

HHV = 49.43 - [0.041(S.V) + 0.015(I.V)]

Cetane number is used to determine the ignition delay after injection of fuel. In this present study, the cetane number of UCO/TUCO was estimated based on its saponification value and iodine value using the following correlation [13]:

$$\text{Cetane number (C.N.)} = 46.3 + \frac{5458}{S.V} - \text{I.V.}$$

The ignition standard of the diesel fuel is measured by certain numbers. Enhanced cetane number eases the starting of the engine. Cetane number is the percentage of available hexadecane by volume in a cetane and 1-methylnapthalene (combustible mixture), which property of ignition equals of the fuel being tested. The cetane number of the TUCO was identified to be 87, which is more than that of local diesel of 48 - 65 as in reported literature. The increased cetane number reduces the ignition delay period, thus facilitates smoother combustion and efficient ignition. Biodiesel has an increased cetane number than the local diesel by their oxygen content by nature. The performance and emission properties of the engine are enhanced by a superior cetane number. Since the biodiesel produced have a higher cetane number, it possess a positive credit.

The thermal energy produced per unit amount of fuel after complete burning and retained to initial temperature is called as Heating value of a particular fuel. It is basically a resource to identify the energy content of a particular fuel. ASTM standard methods are used to study this property by using the Iodine and saponification value of the particular fuel.

The higher heating values (HHVs) of studied oil 43.19 MJ/kg for UCO are good agreement with literature and TUCO are relatively high (see Table 1). The HHVs of studied biodiesel's 48.94 MJ/kg for TUCO is moderately inferior compared to diesel (49.65 MJ/kg). The combustion process has been enhanced by content of oxygen available in biodiesel, similarly it reduces the oxidation potential. Combustion efficiency of the engine is increased by the homogeneity of oxygen content in the biofuel. HHV of the biodiesel can be estimated depending on the physical properties i.e flash point, boiling range, viscosity, density, cloud point, pour point, boiling range, freezing point and refractive index.

Table 1. Physicochemical characterization of UCO and TUCO

Sl.No	**Properties**	**Estimated values**	
		UCO	**TUCO**

1	Yield of oil (%)	90.24	78.56
2	Moisture content (% wt.)	0.27	0.18
3	Specific gravity	0.9528	0.91
4	Relative Viscosity (mm^2/sec)	65	5.23
5	Saponification value(mg/g)	56.1	133.237
6	Iodine value(mg I2/g)	51.74	120.53
7	Acid value(mg/KOH)	0.50	0.42
8	Free fatty acid (%)	1.88	1.128
9	Cetane Index	137.5	87
10	High Heating Value (MJ/kJ)	43.19	48.94

6. EXPERIMENTAL SETUP

The diesel engine used for this experiment. Diesel engine used is a mono cylinder, 4 stroke, air cooled, Constant Speed, Direct Injection, coupled with a dynamometer. The digital RPM indicator is employed to study the speed of the Engine. The burette (Glass tube) is used to evaluate the flow rate of fuel used by the running condition and controlled with the help of three way valve system. The stop watch is used to measure the quantity of fuel flow from a burette.

A. Experiment Procedure

The block illustration of the test setup has been given in figure 8. Test engine used in the experiment is a Gunt CT 110 4-stroke (bio) diesel engine as shown in figure 9. It is air-cooled mono cylinder 4-stroke Diesel Engine. A mono cylinder, air cooled, 4 stroke direct injection, compression ignition engine developing 5.5 kW at 3500 rpm with a compression ratio of 22:1, developing 5.5 kW at 3500 rpm was used for the present study. Different load experiments are done for no load, 5, 10, 15, and 20 kg power output at a stable speed of 3500 rpm and 210 bars fuel injection pressure.

The standard injection timing of the engine is 27^0bTDC. The governor has been employed to keep speed constant during variable load condition. This made possible by governor by controlling the flow of fuel during the change of load. The engine used has an open type combustion chamber with push rod controlled overhead type valves. The time utilized for 10cc consumption of fuel was measured by employing stop watch for fuel and at different loads. The performance characteristics of the engine are measured by brake thermal efficiency, specific energy consumption, and total fuel consumption. The performance characteristics of biodiesel blend are set against with the results of the baseline diesel engine.

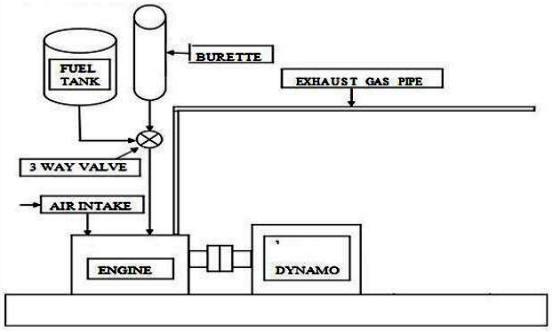

Fig. 8 Experimental Setup

Fig. 9 Test Engine setup

7. PERFORMANCE CHARACTERISTICS

A. Brake Thermal Efficiency for Tuco and Diesel

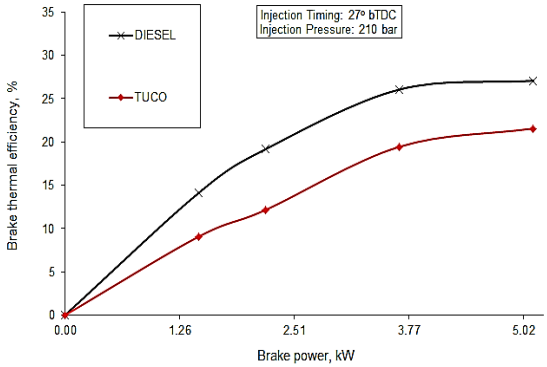

Fig. 10 Variations of Brake Thermal Efficiency with respect to brake power

Brake thermal efficiency shows the achievement as energy source of the distinct fuel. Brake thermal efficiency is simply the opposite of the specific fuel consumption [14]. Higher

loads show the higher brake thermal efficiency. The performance of the specific fuel will be evaluated by brake thermal efficiency. Transesterified used cooking oil has a lesser brake thermal efficiency than the local diesel efficiency. Transesterified used cooking oil shown 5.51% lesser brake thermal efficiency compared to the diesel efficiency as shown in figure 10. The reduction of efficiency in TUCO is due to lesser calorific value and the marginal viscosity increase compared to diesel. Because of these properties it exhibits inferior atomization of the fuel, lesser heat release rate and combustion incompleteness.

Total Fuel Consumption for TUCO and Diesel

It is observed that the total fuel consumption of the diesel is lesser, while it is higher for transesterified used cooking oil [15]. This is because of the diesel have better combustion compare to transesterified used cooking oil and the heating value of the diesel is higher than the transesterified used cooking oil. Due to this reason the total fuel consumption for diesel is lesser than the Transesterified used cooking oil. Total fuel consumption for transesterified used cooking oil is 0.331% higher compared to the diesel as shown in figure 11.

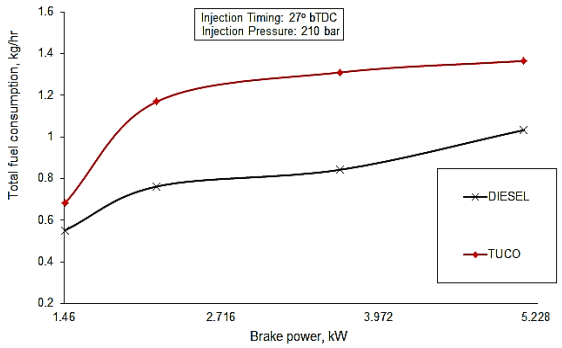

Fig. 11 Variations of Total Fuel Consumption with respect to brake power

Brake Power with Respect to Specific Fuel Consumption for TUCO and Diesel

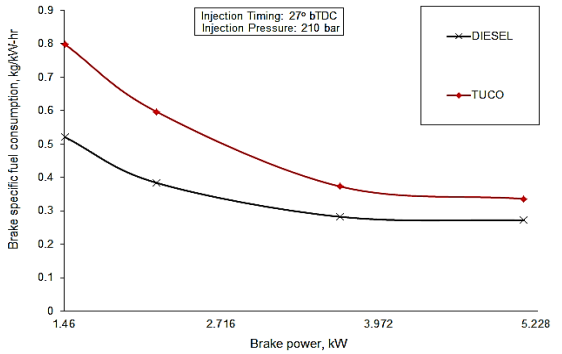

Fig. 12 Variations of Specific Fuel Consumption with respect to brake power

Specific fuel consumption is a vital fact to be examined. It is observed that the specific fuel consumption of the diesel is higher for transesterified used cooking oil [16]. Specific fuel consumption for transesterified used cooking is 0.064% higher compared to the diesel. The high viscosity of the transesterified used cooking leads to the inferior atomization, thus the

ignition delay period has been increased. These reasons lead to the increase in specific fuel consumption as shown in figure 12.

8. EXPERIMENTAL SETUP

The subsequent conclusions are formed from the current investigation of performance characteristic of diesel – transesterified used cooking oil. Physiochemical properties obtained from transesterified used cooking oil were closer to diesel. Diesel engine would be operated using transesterified used cooking oil without any modification. Transesterified used cooking oil shown 5.51% lesser brake thermal efficiency compared to the local diesel efficiency. Specific fuel consumption found to be 0.064% more for transesterified used cooking oil compared to local diesel. Total fuel consumption found to be 0.331 % more for transesterified used cooking oil compared to local diesel. Using of transesterified used cooking oil reduced engine performance, due to the decrease in the calorific value and the higher viscosity. Considering above reasons, used cooking oil has a lesser performance than the diesel. But the source of fuel is renewable and locally available; it can be justified as an alternate source of energy.

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References

[1] B Kegl, M Kegl and S Pehan. Green diesel engines: Biodiesel usage in diesel engines, Springer Science & Business Media, London, 2013, p. 95-125.
[2] M Balat. Modeling vegetable oil viscosity. Energ Source Part A. 2008; 30(20), 1856-1869.
[3] D Subramaniam, A Murugesan, AAvinash, and A Kumaravel. Bio-diesel production and its engine characteristics—Anexpatiate view. Renew SustEnerg Rev. 2013; DOI: 10.1016/j.rser.2013.02.002.
[4] IJ Lalvani, K Kirubhakaran, M Parthasarathy, R Sabarish, and K Annamalai K. Performance characteristics and emission analysis of a single cylinder diesel engine operated on blends of diesel and waste cooking oil. In: International Conference on Energy Efficient Technologies for Sustainability. Nagercoil, India, 2013, p. 10-12;DOI: 10.1109/ICEETS.2013.6533484.
[5] G Lakshmi Narayana Rao, B Durga Prasad, S Sampath and K Rajagopal. Combustion analysis of diesel engine fueled with Jatropha oil methyl ester - Diesel blends. Int J Green Energy. 2007; DOI: 10.1080/15435070701665446.
[6] SY No. Inedible vegetable oils and their derivatives for alternative diesel fuels in CI engines: A review. Renewable and Sustainable Energy Reviews, 2011; DOI: 10.1016/j.rser.2010.08.012.
[7] ASTM D6751 - 20 standard specification for biodiesel fuel blend stock (B100) for middle distillate fuels. Available at: https://www.astm.org/Standards/D6751.html, accessed January 2020.
[8] SE Mahesh, ARamanathan, KM Begum, and A Narayanan. Biodiesel production from waste cooking oil using KBr impregnated CAO as catalyst. Energ Convers Manage. 2015; DOI:10.1016/j.enconman.2014.12.031.
[9] X Lang. Preparation and characterization of bio-diesels from various bio-oils. Bioresource Technol. 2001; 80(1), p.53-62.

[10] MA Raqeeb and R Bhargavi. Biodiesel Production from Waste Cooking Oil. J. chem. Pharm. 2015; 7(12), p.670–681.
[11] M Mujeli, HM Kefas, AShitu and I Ayuba. Optimization of Biodiesel Production from Crude Cotton Seed Oil Using Central Composite Design. Adv. Biochem. 2016; 4(6), 94-100; DOI:10.11648/j.ajcbe.20160101.12
[12] M Maheshwar. A review article on measurement of viscosity. Int. J. Res. Pharm. Chem. 2018. 8(1), p. 69-77.
[13] A Demirbas . Relationships derived from physical properties of vegetable oil and biodiesel fuels. Fuel. 2008; DOI: 10.1016/j.fuel.2007.08.007.
[14] M Parthasarathy, J Lalvani, B Parthiban, and K Annamalai. Comparison of performance and emission characteristic of tamanu, mahua and Pongamia biodiesel in a Di diesel engine. Adv Mat Res. 2013; 768, p. 218-225; DOI:10.4028/www.scientific.net/AMR.768.218
[15] G Balaji, and M Cheralathan. Experimental investigation to reduce emissions of CI (compression ignition) engine fuelled with methyl ester of cottonseed oil using antioxidant. Int. J. Ambient. Energy. 2013; 35(1), p. 13-19; DOI:10.1080/01430750.2012.759150
[16] MS Islam, AS Ahmed, A Islam, SA Aziz, LC Xian, M Mridha. Study on Emission and Performance of Diesel Engine Using Castor Biodiesel. J. Chem. DOI: 10.1155/2014/451526.

Study on –"The Stern Tube Oil Pollution in Ocean and Bio Composite Stern Tube Bearings Used To Reduce the Oil Spill Pollution"

Jagadale K.M.[1], Dr. P. Sengottvel[2]
{kmj.pvp@gmail.com[1], dr.p.sengottuvel@gmail.com[2]}

Research Scholar, Mechanical Department, Bharath Institute of Higher Education and Research, Chennai, &Assistant.Professor., AITRC, Vita[1],
Professor, Mechatronics Department, Bharath Institute of Higher Education and Research, Chennai[2]

Abstract. This paper explains the oil lubricated bearings as a cause of the stern tube oil pollution in ocean. These articles give the idea of water lubricated composite material stern tube bearings to eliminate the oil pollution in the ocean. This paper gives an idea about bio composite material use for the water lubricated stern tube bearing. The new special methods are suggested for the manufacturing the bio composite from the wheat gluten polymer resin.

Keywords: Stern Tube oil pollution; water lubricated bearings; stern tube bearings; propeller shaft bearings; ship source pollution, bio composites, bio polymers.

1 Introduction

The contamination of the world's seas has expanded impressively from most recent couple of many years. The standard and worldwide guidelines are getting increasingly more severe for any sort of boat source contamination it should be zero resilience. On the off chance that the delivery organizations saw as blameworthy of contaminating US water nearly US $140m in illegalpenalties have been required by US Court in contradiction of them. The harsh cylinder oil will stream out into the ocean because of seal harmed by basic fishing net or rope got on ships turning shaft. There is demonstrated trend setting innovation which will keep away from the oil slick into seawater. The seawater is siphoned and utilized for the grease of the harsh cylinder. No oil is needed to grease up the harsh cylinder course. Gentle steel direction requires the insurance in contradiction of the consumption from the salt water. [3]

Presently day epoxy tar composite material are utilized for harsh cylinder course. Natural dishonorable bio leaves composite material utilized harsh cylinder heading a cutting edge innovation. The wheat gluten material is having very good thermal as well as combustion properties. [15] The gluten is extracted from the wheat with help of special method in the form of very fine powder. With the help of this powder the bio polymer resin is formed, it is explained further in the process. The stern tube bearings are made with the bio polymer resin. As that propeller shaft bearings are oil lubricated they reduce the oil spill pollution in the ocean.

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2. Problem Statement-

2.1 Stern Tube Lubricating oil is an issue [1]

Presently, most of business maritime boats work with an impetus framework utilizing a propeller shaft regularly upheld by oil greased up white heading oil surrounded harsh cylinder by shaft seals. This fixed harsh cylinder framework is loaded up with mineral oil and fixed commonly with aonward rearward lip typesclosure at everyfinish. Commonplace harsh cylinder contains 1500L (396 US lady) of minerals oil. The white metals harsh cylinder manner in a fixed framework accommodates unsurprising and control attirelifetime of shaft heading. This framework has been being used since the 1950's the point at which it supplanted ocean water greased up lignum wood heading where wooden direction wear life was eccentric and erosion show was an issue. Anyway there are a few issues with oil greased up harsh cylinder bearing framework and the gave have develop significantly additional predominant nowadays with worry over any boat source contamination.

Subsequent is the pie graph presentation the sea contamination because of various reasons.

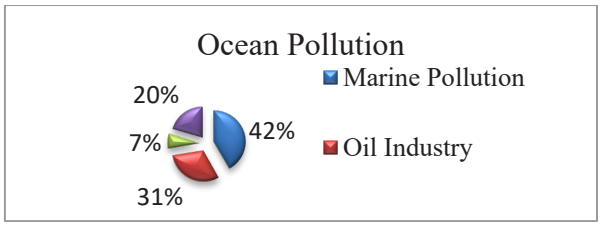

Fig 1: Ocean oil pollution [1]

2.2 Causes of Stern Tube oil pollution.

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Oil contamination from seal harm is a major issue because of following reason.

a) Expensive to fix seal

b) Criminal fine or prison term for transport group, supervisor, and proprietor.

c) Loss of agreements or licenses.

d) Bad advertising or protection issues.

e) There is demonstrated choice to keep away from the oil contamination.

f) Sea water greased up composite material direction.

g) Eliminate harsh cylinder oil and contamination hazard

h) Viable choice to oil greased up white metal propeller shaft direction

2.3 Problems due to the metallic stern tube bearings.

Subsequent figure show the issues because of the metallic harsh cylinder heading. Figure no 2 show the totally harmed oil greased up slide course and fixing of boat propeller shaft.

In figure no 3 the consumed cantilever open attitude propeller shaft is appeared. In figure no 4 Impairment of a merged shrubbery, coming about because of edge push coming about because of slant position of shaft pivot (up); is appeared, during fix the harmed authority was pounded to stay away from breaks and de-cover of the composite (down)

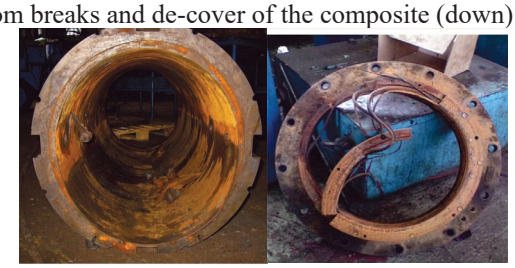

Fig 2. Completely damaged oil-lubricated slide bearing and sealing of ship propeller shaft [4]

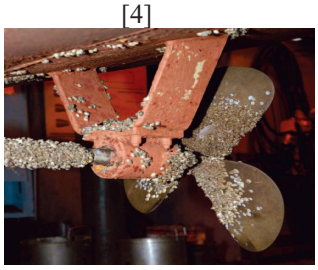

Fig 3.Cantilever open bearing of yacht's propeller shaft [4]

Fig 4. Damage of a composite bush, resulting from edge thrust resulting from skew position of shaft axis (up); during repair the damaged edge was grinded to avoid cracks and de-lamination of the composite (down) [4]

Figure 5. Composite material seawater lubricated stern tube bearings –no oil required [1]

4 Bio Composites

Bio composites are the material made with one or additional phase materials resulting from organic origins. In this method the carbon fiber are reinforced with gluten polymer resin matrix. The matrix defend the reinforced fiber beside environmental changes and external impact. Existing composites are made by polymer materials matrix. But this matrix is non degradable generates some environmental concerns. To solve this conflict there is need to develop bio degradable materials. Present matrix materials are formed with the petroleum products and these petroleum products are going to deplete in upcoming days, due to this there is need to develop the some alternative bio polymer resins. [18]

The utilization of bio composite relies upon the properties of normal strands utilized in them. The utilization of characteristic strands in composites having a few hindrances like low modulus of flexibility, high dampness assimilation, disintegration in basic ecological fluctuation in mechanical and physical properties.[18] Due to these reasons the harsh cylinder direction are shaped with carbon filaments built up with wheat gluten polymer pitch.

5 Methods for the formation of Wheat gluten polymer bio resin -

Wheat gluten is the by-product of the starch formation plant from wheat. It is easily accessible in high amount and littleprice. Wheat gluten contain2 main group of protein, which are gliadin and glutenin. [16] Gluten is fully biodegradable and non toxic. Wheat gluten is having good properties like visco-elasticity, film formation, foam formation, and bio degradability. Due to these properties wheat glutens are used in composite materials. During plastic making the wheat gluten is heated from 80˚C to 170˚C allowing the properties to make cross links which defines the properties of the materials. [19]

Wheat gluten polymer resin can be formed by following two methods.

1.1. By plasticizing-

The fine particles of wheat gluten are mixed with plasticizer. Mostly used plasticizer is the Glycerol or triethanolamine. The gluten and plasticizer is mixed in torque rheometer.. Temperature is adjusted to 80°C.

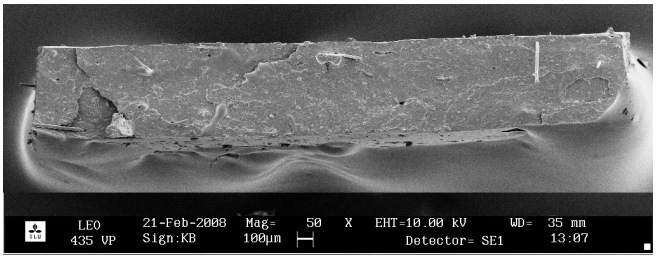

Figure 6.SEM image of a wheat gluten plastic fracture surface.Imagecourtesy of Kerstin Brismar, SLU Alnarp.[20]

Above figure no 7 shows the high content of hydrogen bonds in wheat gluten, it creates low oxygen permeability under dry condition, and it makes the gluten film brittle. Therefore it is important to use polar plasticizer to break the polypeptides bonds. It increases the toughness of the plastic film. Wheat gluten polymer materials can be manufactured by methods like, extrusion, compression molding and solution casting. [20]

1.2. By mixing with synthetic polymers-

The fine particles of wheat gluten are mixed with the commonly used synthetic polymers that are polypropylene, HDPE, PVC, PS, epoxies and polyesters. The synthetic polymers are used as binders in composites because they are cheaper than other alternatives. However, they are not eco friendly this disadvantage will give chance to the new researcher to think for the natural polymers. The new trend is arrived to replace the synthetic polymers with renewable and bio degradable wheat gluten polymer. [20]

6 Formation of Stern tube bearings

The resin is formed by above method is used to manufacture the stern tube bearings using hand layup or vacuum method. The dimensions of the bearings are decided by the requirement, where it is used.

7 Conclusion

The operational and coincidental harsh cylinder oil contamination while lessening transport proprietor upkeep expenses and setting aside cash over the assistance life of the boat is killed by the boat exchanging organizations the world. New composite Bearings have brought about seawater greased up harsh cylinder direction contributionbetterattire life, appropriate and checking techniques to meet Class Society endorsements which are the demonstrated bearing plan. The exhibition of seawater greased up composite heading to date has been similar to oil greased up white metal harsh cylinder course. Any danger of illegal, common and managerial punishments and other unfavorable responses, for example, terrible advertising for the boat proprietor that may happen oil spilling the harsh cylinder is killed by the composite manner method. [3]

References

[1] Thordan Bearings Inc. 3225 Main way Drive, Burlington, Ontario L7M 1A6 Canada Tel: +1.905.335.1440 Fax: +1.905.335.4033 www.ThordonBearings.com Published: August 26, 2011

[2] "Oil Spills in the Australian Marine Environment: Environmental Consequences and Response Technologies"

[3] C. D. Carter MBA (Director of Marketing, Thordon Bearings Inc., Canada) Elimination of a Ship Source Pollutant -STOP (Stern Tube Oil Pollution)

[4] WojciechLitwin, Ph. D., Gdansk University of Technology Water-lubricated bearings of ship propeller shafts - problems, experimental tests and theoretical investigations

[5] Thordan Bearings, Manual, 3225 Mainway, Burlington, Ontario L7M 1A6 Canada Tel: (905) 335-1440 Fax: (905) 335-4033 E-mail info@thordonbearings.com www.thordonbearings.com

[6] Tristar, Engineered Plastic Solutions, Manual, 2011 Mill5 M.

[7] Bearings Design Guide, Greaseless Composite Bearings, "BUST RUST" Polygon Company, 103 Industrial Park Dr. Walkerton, IN 46574 USA (800) 918-9261 I (574) 586-3145 polygoncomposites.com

[8] TECHNOLOGY OVERVIEW BIOCOMPOSITES, Knowledge Transfer Networks Accelerating business innovation: a Technology Strategy Board programme.

[9] Anshuman Srivastava1, MadhusoodanMaurya, "Preparation And Mechanical Characterization Of Epoxy Based Composite Developed By Biowaste Material", IJRET: International Journal Of Research In Engineering And Technology, Volume: 04 Issue: 04 Apr-2015.

[10] R. Siva Shankar, Review article on wheat flour/Wheat bran/Wheat husk based bio composite, International Journal of Scientific and Research Publications, Volume 4, Issue 4, April 2014

[11] Sada, Hiroyuki, Seiji Yamajo, David W. Hawkins and Tsuyoshi Kawazoe, Kobelco Eagle Marine Engineering Co. Ltd., Japan," An Environmentally Compatible Lubricants for Stern tube shafting and Bearing system, "Presented at the 11th shafting symposium of the society of Naval architects and Marine engineers, Sept. 12-12-2006, Williamsburg, VA, USA, pp 1

[12] Gilmour, Dr. David. BP-Control marine Lubricants, "Biodegradable Range," Sea trade, Jan. / Feb.2008, pp 91

[13] "Etkin, Dagmar Schmidt. Environmental Research Consulting "Worldwide Analysis of In-Port Vessel Operational Lubricant," Arctic and Marine Oil Spill Program Technical Seminar of Environment Canada, 8 June 2010, Halifax, Canada

[14] "Smith, Andrew, Lloyd's Register Global Technology Leader-Engineering Systems., "Shaft Alignment Problems Analyzed," Marine Engineers Review April 2009, pp. 16

[15] Thomas O.J. "Thermal Conductivity and ConbutionPropertits of Wheat Gluten"ACS Applied Materials and Interfaces, 2012, PP 01

[16] Isabelle Vroman, "Biodegradable", Materials 20019, pp 317.

[17] J.W. Lowton, "Corn Gluten Meal as a Thermoplastic Resin: Effect of Plasticizers and Water Content", Ceral Chemistry, 2008, pp 01,05.

[18] R. Shivshankar,"Review Article on Wheat flour/wheat bran/ wheat husk based bio composites", International Journal of Scientific and Research Publications, Volume-04, Issue-04, 4 April 2014.

[19] FarazMuner, "Bio composites from Natural Polymers and Fibers", Crop Publication December 2015.

[20] ChristerWretfors, "Hemp Fiber and reinforcements of wheat gluten plastics", Licentiate Thesis, Swedish University of Agricultural Science 2008.

[21] http://www.mcsuk.org/marineworld/pollution.html

[22] http://www.worldstats.org/general_world/principal _environmental_treaties.html

[23] http://www.cmc-ocean.org

[24] http://www.oceanlink.island.net/ask/pollution.html

$M^x/G/1$ Retrial Queue with Priority, Collisions and Feedback Customers

M.Nila [1], Dr. D. Sumitha [2]
{ *brightmoon02@gmail.com*[1], *sumitha4677@gmail.com*[2]}

Research Scholar, Department of Mathematics, Avinashilingam Institute for Home science and Higher Education for Women,Coimbatore, Tamil Nadu, India[1]
Associate Professor, Department of Science and Humanities, Avinashilingam Institute for Home science and Higher Education for Women, Coimbatore, Tamil Nadu, India.[2]

Abstract. This articles provides a detailed study of retrial queueing model with collisions, feedback and priority customers. The motive for this model come from various application in packet switching networks, random access protocols in local area networks, e-commerce systems, production systems and real time situations. The objective of the work is to derive the performance measures like stable state probabilities, regular systems extent and regular orbit size of the proposed model by Supplementary variable Method. Accept that customer attain the systems conferring to Poisson procedure. If the servers is demanding the incoming consignment either enter to the retrial queue or one of the customer disrupts the customers in facility to get his service and the disrupted customer with remaining customers join the retrial queue or creates a collision with existing customer and all being shifted to the retrial queue. When the server is free, the customer in the incoming batch begins the service directly and breaks change to the path. The customer is allowed to make a feedback. We discuss special cases for this model and we analyse the numerical results of effects in various limits on the system presentation actions.

Keywords: Batch arrival, Retrial queue, Pre-emptive resume, priority, Collisions, Feedback, Orbital search.

1 Introduction

Retrial queues are identify by the detail that a consumer alighting when all accessible server are earnest leave the facilities area but afterward sometime repeat the adjure. This feature plays a vital role in telecommunication networks, cognitive networks, cloud computing systems, production, manufacturing systems etc. The incentive for learning a batch entrance retrial queueing system comes from some requests faced in call centers, optical burst switching networks, CSMA protocols etc. The present paper deals with lot advent retrial queueing model with Pre-emptive recommence importance, Collisions, Orbital and feedback Search.

The articles is prearranged as tracks. The survey of the earlier pertinent works is given in segment II. In section III, we analyse the prescribed model. The steady state distributions and solutions are deliberated in section IV. In section V, Performance measures are derived. Special cases are discussed in section VI. Section VII, Stochastic rottenness law has been verified for this model. Section VIII, explores the numerical results for this model.

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2. Literature Survey

Precedence queues, together non-pre-emptive and pre-emptive have critical uses inside the modelling and exploration of computers system, verbal exchange network, production models, running systems and are broadly utilized in production exercise and transportation control. carrier priority is sincerely nowadays a main function of any production machine. Many authors have mentioned pre-emptive resume precedence queueing structures. Krishna Kumar et al. (2002) taken into consideration queueing machine with two segment service and pre-emptive resume. Jain and Charu Bhargava (2008) studied bulk arrival retrial queue with untrustworthy server and precedence subscriber. Chen and Zhu (2010) dealt retrial queue with importance, balking and response customer. Dimitriou (2013) illustrated pre-emptive resume precedence retrial queue with national recognized influxes, untrustworthy serverand terrible clients. Peng (2016) illustrated discrete time retrial queueing gadget with pre-emptive resume and Bernoulli feedback. Ammar and Rajadurai (2019) analyzed overall performance measures of pre-emptive precedence retrial queueing machine with disaster underneath running failure service.

Retrial queue with collision are commendable for modeling the procedure in communique community, nearby location network with institution allocation and a couple of get right of entry to protocol. Krishna Kumar et al. (2010) discussed single servers feed-back retrial queue with collision. Tao et al. (2012) examined M/M/1 retrial queue with collision and running vacation interruption under N coverage. Liu et al. (2014) investigated retrial G-queue with pre-emptive resume precedence and collision subjects to the server breakdown and behind schedule repair. Kvach and Nazaro (2015) mentioned markovian retrial machine with collisions. Toth et al. (2017) considered retrial queue with non reliable server and collisions. Tong et al. (2019) dealt retrial queue with working excursion and collision.

Model Description

In this segment, we contemplate consignment arrival retrial queue with pre-emptive resume importance, collision, response and detour search. Customer reach at the systems in accordance with Poisson stream of rate λ. If Y is a random capricious, then batch size distribution is given by$P\{Y=k\} = C_k$, k =1, 2, 3...., $\sum_{k=1}^{\infty} C_k = 1$, the possibility generating function (PGF) C(z) having dual instants m1 and m2. If an arriving consignment discoveries the server indolent, one of the clients from the batch gets the carrier proximately, and the relaxation input into the retrial queue and try again subsequently a few random quantity of time. The cumulative distribution characteristic (cdf), opportunity density characteristic (pdf), Laplace Stieltjes transform (LST) of retrial time are represented by way of A(x), a(x), A*(s) respectively.

on the other hand, if the servers is busy, then the arrival batch proceed to the servers with possibility τ. when the incoming batch proceeds to the server, one of the purchaser inside the batch both disrupts with the patron in provider to get his personal service with opportunity κ

and the disrupted customer at the side of others arrive into the retrial queue or crash with the consumer in service resulting in each being transferred to the retrial queue in conjunction with arriving batch with complementary opportunity. The cdf, pdf and LST of service time are represented with the aid of B(x), b(x), B*(s) respectively with first moments μ1 and μ2. After executing provider, the purchaser may go returned to the retrial queue as a comments consumer for purchasing another provider with chance δ or departs the machine. On each service crowning glory the server takes clients from the retrial queue for carrier with possibility θ or stays idle.

$\eta(x) = a(x)/1- A(x)$ and $\mu(x) = b(x)/1- B(x)$.

Steady state Distribution

The Steady state equation leading the model are given below

$$\lambda R_0 = \bar{\delta} \int_0^\infty S_0(x)\,\mu(x)dx \quad (1)$$

$$\frac{d}{dx}R_n(x) = -[\lambda + \eta(x)]R_n(x), \quad n \geq 1 \quad (2)$$

$$\frac{d}{dx}S_n(x) = -[\lambda + \mu(x)]S_n(x) + (1-\tau)\,\lambda \sum_{k=1}^{n} C_k S_{n-k}(x), \quad n \geq 0 \quad (3)$$

With boundary condition

$$R_1(0) = \bar{\theta}\bar{\delta} \int_0^\infty S_1(x)\mu(x)\,dx + \bar{\theta}\delta \int_0^\infty S_0(x)\mu(x)\,dx \quad (4)$$

$$R_n(0) = \bar{\theta}\bar{\delta} \int_0^\infty S_n(x)\mu(x)\,dx + \bar{\theta}\delta \int_0^\infty S_{n-1}(x)\mu(x)\,dx + \bar{\kappa}\,\tau\lambda \int_0^\infty \sum_{k=1}^{n} C_K S_{n-(k+1)}(x)dx, \quad n \geq 2 \quad (5)$$

$$S_0(0) = \lambda c_1 R_0 + \int_0^\infty R_1(x)\eta(x)dx + \theta\bar{\delta} \int_0^\infty S_1(x)\mu(x)\,dx + \theta\delta \int_0^\infty S_0(x)\mu(x)\,dx \quad (6)$$

$$S_n(0) = \tau\lambda\kappa \int_0^\infty \sum_{k=1}^{n} C_K S_{n-k}(x)dx + \lambda c_{n+1} R_0 + \int_0^\infty R_{n+1}(x)\eta(x)dx + \lambda \int_0^\infty \sum_{k=1}^{n} C_K R_{n-k+1}(x)dx + \theta\bar{\delta} \int_0^\infty S_{n+1}(x)\mu(x)\,dx + \theta\delta \int_0^\infty S_n(x)\mu(x)\,dx, \quad n \geq 1 \quad (7)$$

The normalizing conditions is

$$R_0 + \sum_{n=1}^{\infty} \int_0^{\infty} R_n(x)dx + \sum_{n=0}^{\infty} \int_0^{\infty} S_n(x)dx = 1 \qquad (8)$$

To solve these equations define the probability making function as

$$R(x, z) = \sum_{n=1}^{\infty} R_n(x)z^n, \; S(x, z) = \sum_{n=0}^{\infty} S_n(x)z^n$$

Multiplying equations (1) – (7) by z^n and solving we have the following equation

$$\left(\frac{\partial}{\partial x} + \lambda + \eta(x)\right) R(x, z) = 0 \qquad (9)$$

$$\left(\frac{\partial}{\partial x} + \lambda(1 - \bar{\tau}c(z)) + \mu(x)\right) S(x, z) = 0 \qquad (10)$$

$$R(0,z) = (\bar{\theta}\bar{\delta} + \bar{\theta}\delta z) \int_0^{\infty} S(x, z)\mu(x)\, dx + \lambda\tau\bar{\kappa}\, zc(z) \int_0^{\infty} S(x, z)\, dx - \lambda R_0 \qquad (11)$$

$$S(0,z) = \frac{\lambda c(z) R_0}{z} + \frac{1}{z}\int_0^{\infty} R(x, z)\eta(x)\, dx + \frac{\lambda c(z)}{z}\int_0^{\infty} R(x, z)dx + \left(\frac{\delta\theta z + \theta\bar{\delta}}{z}\right) \int_0^{\infty} S(x, z)\mu(x)dx + \kappa\, \tau\lambda c(z) \int_0^{\infty} S(x, z)dx \qquad (12)$$

Solving the partial differential equations (9) – (12),

$$R(x, z) = R(0,z)e^{-\lambda x}(1 - A(x)) \qquad (13)$$

$$S(x, z) = S(0,z)e^{-\lambda[1-\bar{\tau}c(z)]x}(1 - B(x)) \qquad (14)$$

Using the equations (13) - (14) in (11) - (12) we obtain

$$R(0, z) = \lambda R_0\{(1 - \bar{\tau}c(z))[z - c(z)\bar{\theta}(\bar{\delta} + \delta z) B^*(\lambda - \bar{\tau}\lambda c(z)) - \theta(\bar{\delta} + \delta z)B^*(\lambda - \bar{\tau}\lambda c(z))] - \tau zc(z) (1 - B^*(\lambda - \bar{\tau}\lambda c(z)))[\kappa + \bar{\kappa}\, c(z)]\} / D(z) \qquad (15)$$

$$S(0,z) = \lambda R_0 (1 - c(z))A^*(\lambda)(1 - \bar{\tau}c(z))/D(z) \qquad (16)$$

$$D(z) = (1 - \bar{\tau}c(z))\{[c(z) + (1 - c(z))A^*(\lambda)]\bar{\theta}(\bar{\delta} + \delta z)B^*(\lambda - \bar{\tau}\lambda c(z)) + \theta(\bar{\delta} + \delta z)B^*(\lambda - \bar{\tau}\lambda c(z)) - z\} + [c(z) + (1 - c(z))A^*(\lambda)]\, \tau zc(z)\bar{\kappa}(1 - B^*(\lambda - \bar{\tau}\lambda c(z))) + \tau zc(z)\kappa(1 - B^*(\lambda - \bar{\tau}\lambda c(z)))$$

Putting R(0, z) and S(0, z) in the expressions of R(x, z) and S(x, z) and integrating with admiration to x , we get

$$R(z) = R_0\big(1 - A^*(\lambda)\big)\{\big(1 - \bar{\tau}c(z)\big)[z - c(z)\bar{\theta}(\bar{\delta} + \delta z)B^*\big(\lambda - \bar{\tau}\lambda c(z)\big) - \theta(\bar{\delta} + \delta z)B^*\big(\lambda - \bar{\tau}\lambda c(z)\big)] - \tau z c(z)(1 - B^*(\lambda - \bar{\tau}\lambda c(z)))[\kappa + \bar{\kappa}\, c(z)]\} / D(z)$$

$$S(z) = R_0\big(1 - c(z)\big)A^*(\lambda)\,[1 - B^*\big(\lambda - \bar{\tau}\lambda c(z)\big)] / D(z)$$

4 Performance Measures

The probability of the idle server during retrial time is

$$R = (1 - A^*(\lambda))R_0\{(1 - B^*(\tau\lambda))[\tau + m_1 + \tau m_1\bar{\kappa}] - \tau[1 - \delta B^*(\tau\lambda) - \bar{\theta}m_1 B^*(\tau\lambda)]\} / T_1$$

The probability of the busy server is given by

$$S = R_0 m_1 A^*(\lambda)[1 - B^*(\tau\lambda)] / T_1$$

$$T_1 = \tau B^*(\tau\lambda)\bar{\delta} - m_1(1 - B^*(\tau\lambda)) - m_1\big(1 - A^*(\lambda)\big)[\tau B^*(\tau\lambda)\bar{\theta} + \tau\bar{\kappa}(1 - B^*(\tau\lambda))]$$

Normalising condition (8) is equivalent to $R_0 + R + S = 1$, relieving the vocabularies of R, S we get

$$R_0 = T_1 / \tau\,\bar{\delta}\,A^*(\lambda)B^*(\tau\lambda)$$

The PGF of system size is

$$P_s(z) = R_0 + R(z) + zS(z)$$

$$= R_0 A^*(\lambda)(1 - \bar{\tau}c(z))B^*\big(\lambda - \bar{\tau}\lambda c(z)\big)(1 - z)\bar{\delta} / D(z)$$

The PGF of orbit size is

$$P_q(z) = R_0 + R(z) + S(z)$$

$$= R_0 A^*(\lambda)\{\big(1 - \bar{\tau}c(z)\big)[B^*\big(\lambda - \bar{\tau}\lambda c(z)\big)(\delta z + \bar{\delta}) - z] + (1 - B^*(\lambda - \bar{\tau}\lambda c(z)))[zc(z)\tau + 1 - c(z)]\} / D(z)$$

The average orbit size is given by

$$L_q = \lim_{z\to 1} \frac{d}{dz} P_q(z) = \frac{N_2 D_1 - D_2 N_1}{2(D_1)^2}$$

Where

$$N_1 = -I_0 A^*(\lambda)\tau\,\bar{\delta}\,B^*(\tau\lambda)$$

$$N_2 = -2I_0 A^*(\lambda)\,[\tau\,\bar{\delta}\,k_1 + m_1(\tau + \delta\bar{\tau})B^*(\tau\lambda) + m_1]$$

$$D_1 = m_1(1-B^*(\tau\lambda)) - \tau B^*(\tau\lambda)\bar{\delta} + m_1\left(1 - A^*(\lambda)\right)$$

$$[\tau B^*(\tau\lambda)\bar{\theta} + \tau\bar{\kappa}(1 - B^*(\tau\lambda))]$$

$$D_2 = \left(1 - B^*(\tau\lambda)\right)\{m_2 + \tau\bar{\kappa}\,(1-A^*(\lambda))\,[\,m_2 + 2m_1$$

$$+2m_1^2]\} + \tau m_2\bar{\theta}B^*(\tau\lambda)\,(1-A^*(\lambda)) + 2m_1(1-A^*(\lambda))$$

$$\{\bar{\theta}B^*(\tau\lambda)[\tau\,\delta - \bar{\tau}m_1] + \tau\,k_1(\bar{\theta} - \bar{\kappa})\} + 2m_1(1 - k_1) -$$
$$2m_1 B^*(\tau\lambda)[\bar{\tau}\,\delta + \tau] - 2\tau k_1\,\bar{\delta}$$

$$k_1 = \lim_{z\to 1}\frac{d}{dz} B^*\left(\lambda - \bar{\tau}\lambda c(z)\right)$$

The average system size is given by

$$L_s = \lim_{z\to 1} \frac{d}{dz} P_s(z)$$

$$= L_q + S$$

5. SPECIAL CASES

Case (i)

If $\tau = 0$, $\theta = 0$ (no priority, no collision, no orbital search) then the model reduce to single phase M/G/1 retrial queue with feedback. In this case

$$R(z) = R_0\left(1 - A^*(\lambda)\right)[z - c(z)(\bar{\delta} + \delta z)$$

$$B^*\left(\lambda - \lambda c(z)\right)] \;/\; D(z)$$

$$S(z) = R_0 A^*(\lambda)\,[1 - B^*\left(\lambda - \lambda c(z)\right)] \;/\; D(z)$$

$$P_s(z) = R_0 A^*(\lambda) B^*\big(\lambda - \lambda c(z)\big)(1- z)\bar{\delta} \,/\, D(z)$$

$$P_q(z) = R_0 A^*(\lambda)[\,1 - z]\,(1 - \delta B^*(\lambda - \bar{\tau}\lambda c(z))) \,/\, D(z)$$

$$D(z) = [c(z) + \big(1 - c(z)\big)A^*(\lambda)](\bar{\delta} + \delta z)$$

$$B^*\,\big(\lambda - \lambda c(z)\big) - z$$

The above result agree with the result of Sumitha and Udaya Chandrika [2011] with β=θ=0.

Case (ii)

Suppose that C(z) → z, δ =0, κ =1,θ=0 (Single arrival, no feedback, no collision, no orbital search) then the model reduces to sole influx retrial queueing classical with pre-emptive recommence importance. In this case

$$R(z) = R_0\big(1 - A^*(\lambda)\big)(1 - B^*(\lambda - \bar{\tau}\lambda z))$$

$$z(1 - z) \,/\, D(z)$$

$$S(z) = R_0(1 - z)A^*(\lambda)\,[1 - B^*(\lambda - \bar{\tau}\lambda z)] \,/\, D(z)$$

$$P_s(z) = R_0 A^*(\lambda)(1 - \bar{\tau}z)B^*(\lambda - \bar{\tau}\lambda z)(1- z) \,/\, D(z)$$

$$P_q(z) = R_0 A^*(\lambda)(1 - z)\,(1 - z + z\,\tau\, B^*(\lambda - \bar{\tau}\,\lambda\, z)) \,/\, D(z)$$

$$D(z) = B^*(\lambda - \bar{\tau}\lambda z)\{(1 - \bar{\tau}z)[z + (1 - z)A^*(\lambda)] - \tau z^2\} - z(1 - z)$$

The above results agree with the result of Krishna Kumar et al.[2002] with p=0.

6. Stochastic Decomposition

on this segment, we speak the Stochastic decomposition stuff of the system size circulation. From the rottenness belongings the probability producing characteristic of the device size distribution may be disintegrated as ps(z) = Π(z) x Ψ(z) where Π(z) is the opportunity generating characteristic of the number of clients within the batch onset column with precedence, collisions, remarks and orbital seek and Ψ(z) be the possibility producing feature of the quantity of clients inside the path while the machine is idle.

$$\Pi(z) = \frac{(\tau B^*(\tau\lambda)-\delta\tau B^*(\tau\lambda)-m_1\,(1-B^*(\tau\lambda)))(1-z)(1-\bar{\tau}\,c(z))}{\tau\{\left(zc(z)-\tau zc(z)B^*(\tau\lambda)-z+B^*(\tau\lambda)(\delta z+\bar{\delta}\,)(1-\bar{\tau}\,c(z))\right)\}}$$

$$\Psi(z) = \frac{R_0+R(z)}{R_0+R}$$

$$= \frac{\left\{\left(zc(z)-\tau zc(z)B^*(\tau\lambda)-z+B^*(\tau\lambda)(\delta z+\bar{\delta}\,)(1-\bar{\tau}\,c(z))\right)\right\}X}{D(z)(\tau B^*(\tau\lambda)-\delta\tau B^*(\tau\lambda)-m_1\,(1-B^*(\tau\lambda)))}$$

where $X= \tau R_0 A^*(\lambda)B^*(\lambda-\bar{\tau}\lambda c(z))\bar{\delta}$

7 Numerical Results

In this segment, we achieve some arithmetical outcomes the usage of MATLAB. assume that retrial time, provider times are exponentially disbursed with price η and μ. We pick a few arbitrary values for the parameters λ=2; θ=0.3; c1=zero.5; c2=0.5; τ=0.3; κ=0.3; η=10; δ=0.2; μ=20; The effect of various parameters at the enactment measure R0 –the opportunity that the machine is blank, R- the probability that the server is idle in the non-empty machine and S- the chance that the servers is hectic are calculated and outcomes are offered in the table 1 and 2.

Table 1 shows that

- R0 proliferations with upsurge in μ and η and reductions with upsurge in λ
- R reductions with upsurge in η and μ and proliferations with upsurge in λ
- S upsurges with proliferation in λ, reductions with upsurge in μ and autonomous of η

Table 2 presents that

- R0 upsurges with proliferation in θ and κ and reductions with upsurge in τ
- R reductions with upsurge in θ and κ and proliferations with upsurge in τ
- S is independent of θ, τ and κ

Table 1 Performance measures versus λ, μ , η

λ	μ	η	R_0	R	S
2	15	4	0.4425	0.3075	0.2500
		8	0.5963	0.1537	0.2500
		12	0.6475	0.1025	0.2500
		16	0.6731	0.0769	0.2500
	20	4	0.5428	0.2697	0.1875
		8	0.6777	0.1348	0.1875
		12	0.7226	0.0899	0.1875

		16	0.7451	0.0674	0.1875
	25	4	0.6030	0.2470	0.1500
		8	0.7265	0.1235	0.1500
		12	0.7677	0.0823	0.1500
		16	0.7882	0.0618	0.1500
	30	4	0.6431	0.2319	0.1250
		8	0.7591	0.1159	0.1250
		12	0.7977	0.0773	0.1250
		16	0.8170	0.0580	0.1250
2.2	15	4	0.3701	0.3549	0.2750
		8	0.5476	0.1774	0.2750
		12	0.6067	0.1183	0.2750
		16	0.6363	0.0887	0.2750
	20	4	0.4846	0.3091	0.2062
		8	0.6392	0.1546	0.2062
		12	0.6907	0.1030	0.2062
		16	0.7165	0.0773	0.2062
	25	4	0.5533	0.2817	0.1650
		8	0.6942	0.1408	0.1650
		12	0.7411	0.0939	0.1650
		16	0.7646	0.0704	0.1650
	30	4	0.5991	0.2634	0.1375
		8	0.7308	0.1317	0.1375
		12	0.7747	0.0878	0.1375
		16	0.7967	0.0658	0.1375
2.4	15	4	0.2947	0.4053	0.3000
		8	0.4973	0.2027	0.3000
		12	0.5649	0.1351	0.3000
		16	0.5987	0.1013	0.3000
	20	4	0.4242	0.3508	0.2250
		8	0.5996	0.1754	0.2250
		12	0.6581	0.1169	0.2250
		16	0.6873	0.0877	0.2250
	25	4	0.5018	0.3182	0.1800
		8	0.6609	0.1591	0.1800
		12	0.7139	0.1061	0.1800
		16	0.7405	0.0795	0.1800
	30	4	0.5536	0.2964	0.1500
		8	0.7018	0.1482	0.1500
		12	0.7512	0.0988	0.1500
		16	0.7759	0.0741	0.1500
2.6	15	4	0.2163	0.4587	0.3250
		8	0.4456	0.2294	0.3250
		12	0.5221	0.1529	0.3250
		16	0.5603	0.1147	0.3250
	20	4	0.3614	0.3948	0.2438

		8	0.5588	0.1974	0.2438
		12	0.6246	0.1316	0.2438
		16	0.6575	0.0987	0.2438
	25	4	0.4485	0.3565	0.1950
		8	0.6268	0.1782	0.1950
		12	0.6862	0.1188	0.1950
		16	0.7159	0.0891	0.1950
	30	4	0.5066	0.3309	0.1625
		8	0.6720	0.1655	0.1625
		12	0.7272	0.1103	0.1625
		16	0.7548	0.0827	0.1625

Table 2 Performance measures versus θ , τ , κ

θ	τ	**k**	$\mathbf{R_0}$	**R**	**S**
0.1	0.4	0.30	0.6270	0.1855	0.1875
		0.45	0.6292	0.1833	0.1875
		0.60	0.6315	0.1810	0.1875
		0.75	0.6337	0.1788	0.1875
	0.5	0.30	0.6244	0.1881	0.1875
		0.45	0.6272	0.1853	0.1875
		0.60	0.6300	0.1825	0.1875
		0.75	0.6328	0.1797	0.1875
	0.6	0.30	0.6218	0.1907	0.1875
		0.45	0.6251	0.1874	0.1875
		0.60	0.6285	0.1840	0.1875
		0.75	0.6319	0.1806	0.1875
	0.7	0.30	0.6191	0.1934	0.1875
		0.45	0.6231	0.1894	0.1875
		0.60	0.6270	0.1855	0.1875
		0.75	0.6309	0.1816	0.1875
0.2	0.4	0.30	0.6645	0.1480	0.1875
		0.45	0.6667	0.1458	0.1875
		0.60	0.6690	0.1435	0.1875
		0.75	0.6712	0.1413	0.1875
	0.5	0.30	0.6619	0.1506	0.1875
		0.45	0.6647	0.1478	0.1875
		0.60	0.6675	0.1450	0.1875
		0.75	0.6703	0.1422	0.1875
	0.6	0.30	0.6593	0.1532	0.1875
		0.45	0.6626	0.1499	0.1875
		0.60	0.6660	0.1465	0.1875

		0.75	0.6694	0.1431	0.1875
	0.7	0.30	0.6566	0.1559	0.1875
		0.45	0.6606	0.1519	0.1875
		0.60	0.6645	0.1480	0.1875
		0.75	0.6684	0.1441	0.1875
0.3	0.4	0.30	0.7020	0.1105	0.1875
		0.45	0.7042	0.1083	0.1875
		0.60	0.7065	0.1060	0.1875
		0.75	0.7087	0.1037	0.1875
	0.5	0.30	0.6994	0.1131	0.1875
		0.45	0.7022	0.1103	0.1875
		0.60	0.7050	0.1075	0.1875
		0.75	0.7078	0.1047	0.1875
	0.6	0.30	0.6968	0.1157	0.1875
		0.45	0.7001	0.1124	0.1875
		0.60	0.7035	0.1090	0.1875
		0.75	0.7069	0.1056	0.1875
	0.7	0.30	0.6941	0.1184	0.1875
		0.45	0.6981	0.1144	0.1875
		0.60	0.7020	0.1105	0.1875
		0.75	0.7059	0.1066	0.1875
0.4	0.4	0.30	0.7395	0.0730	0.1875
		0.45	0.7417	0.0708	0.1875
		0.60	0.7440	0.0685	0.1875
		0.75	0.7462	0.0663	0.1875
	0.5	0.30	0.7369	0.0756	0.1875
		0.45	0.7397	0.0728	0.1875
		0.60	0.7425	0.0700	0.1875
		0.75	0.7453	0.0672	0.1875
	0.6	0.30	0.7343	0.0782	0.1875
		0.45	0.7376	0.0749	0.1875
		0.60	0.7410	0.0715	0.1875
		0.75	0.7444	0.0681	0.1875
	0.7	0.30	0.7316	0.0809	0.1875
		0.45	0.7356	0.0769	0.1875
		0.60	0.7395	0.0730	0.1875
		0.75	0.7434	0.0691	0.1875

Conclusion

In these articles, we explored consignment advent retrial queueing version with pre-emptive recommence importance, collisions, remarks and orbital search. Constant kingdom

equations, possibility producing characteristic for the numbers of clients in the machine and in the queue are determined by means of additional adjustable approach. Enactment measure like likelihood of the idle servers, probability of the busy server, average orbit length and average gadget size are computed. unique cases for this version are deliberated. The impact of the limitations on the enactment measure is computed mathematically. Our recommended version has capability practical real existence application in optical burst switching community to ahead the packets inside a network for transmission. Different actual life programs are call centres, random get admission to protocols, mobile networks, software designs and manufacturing device and so on. The overall decay rule has been recognized for this classical. In future, this model can be further extended with many features like, vacation, breakdown, optional service, impatient customers etc. And we can find cost optimization for this prescribed model.

References

[1] Ayyapan, G. and Udaya Geetha, J. "Analysis of pre-emptive priority retrial queueuing system with starting failure, modified bernoulli vacation, with vacation interruption, repair immediate feedback and impatient customers", International Journal of Mathematics and its Applications, vol.6, (1-E), pg. 1013–1023, 2018.

[2] Chakravarthy, S.R., Krishnamoorthy, A. and Joshua,V.C. "Analysis of a multi-server retrial queue with search of customers from the orbit", Performance Evaluation, vol. 63, no.8, pg.776-798, 2006.

[3] Deepak, T.G., Dudin, A.N., Joshua, V.C and krishnamoorthy, A. "On an Mx/G/1 retrial system with two types of search of customers from the orbit", Stochastic Analysis and Applications", vol.31, no. 1, pg. 92-107, 2012.

[4] Dimitriou, I. " A pre-emptive resume priority retrial queue with state dependent arrivals, unreliable server and negative customers", TOP , 21, pg. 542-571, 2013.

[5] Gao, S. and Wang, J., " Performance and reliability analysis of an M/G/1 – G retrial queue with orbital search and non persistent customers", European Journal of Operation Research, vol.236, pg. 561-572, 2014.

[6] Jain, M. and Charu Bhargava , " Bulk arrival retrial queue with unreliable server and priority subscribers", International Journal of Operations Research, vol. 5, no. 4, pg. 242-259, 2008.

[7] Juntong Li, Jinping Xu and Tao Li, " An M/M/1 retrial queue with working vacation and collision", International Journal of Research and Reviews in Applied Sciences, vol. 39, no.1, pg. 40-46, 2019.

[8] Ke , J.C and Chang, F.M, " Modified vacation policy for M/G/1 retrial queue with balking and feedback", Computational Industrial Engineering, vol. 57, pg. 433-443, 2009.

[9] Krishnakumar, B., Vijayakumar, A. and Arivaudainambi, D. "An M/G/1 retrial queueing system with two phase service and preemptive resume", Annals of Operation Research, vol. 113, pg. 61 – 79, 2002.

[10] Krishnakumar, B., Vijayalakshmi, G., Krishnamoorthy, A., and Sadiq Basha, S., " A Single server feedback retrial queue with collisions", Computers and Operations Research, vol. 37, pg.1247-1255, 2010.

[11] Kvach , A. and Nazarov, A. " Sejourn time analysis of finite source markov retrial queueing system with collisions", Proceedings of 14 th International Scientific Conference, pg. 18-22, 2015.

[12] Lakshmi, K. and Ramanath, K. " An M/G/1 two phase multi optional retrial queue with Bernoulli feedback, non-persistent customers and breakdown and repair", International Journal of Operational Research, vol. 19, no. 1, pg. 78-95, 2014.

[13] Liu, z., Peng, Y. and Wu, J. " An M/G/1 retrial G-queue with pre-emptive resume priority and collisions subject to the server breakdown and delayed repairs", Journal of Applied Mathematics and Computing, vol 44, no. 2, pg. 187-213, 2014.
[14] Meer, H.D. " Finite source M/M/S retrial queue with search for balking and impatient customers from the orbit", Computer Networks, vol 53, no. 8, pg. 1264-1273, 2009.
[15] Murugan, P.B., and Vijaya Krishnaraj, R., " A bulk arrival retrial queue with orbital search and exponentially distributed multiple working vacation", AIP Conference Proceedings, vol. 2177, doi.org/10.1063/1.5135240, 2019.
[16] Peishu Chen, Yongwu Zhou and Changwen Li , " Batch arrival retrial G- queue with orbital search and non persistent customers", Journal of Interdisciplinary Mathematics, vol 19, no. 1, pg. 95-109, 2016.
[17] Peng, Y. "On the discrete time Geo/G/1 retrial queueing system with pre-emptive resume and Bernoulli feedback", Opsearch, vol.53, no.1, pg. 116-130, 2016.
[18] Rajadurai, P., Chandrasekaran, V.M. and Saravanarajan, M.C," Steady state analysis of batch arrival feedback retrial queue with two phases of service, negative customers, bernoulli vacation, and server breakdown", International Journal of Mathematical Operations Research, vol. 7, pg. 519-546, 2015.
[19] Peishu Chen, Yijuan Zhu, " An M/G/1 retrial queue with priority, balking and feedback customers", Journal of Convergence Information Technology, vol 5, no. 02, pg. 155-162, 2010.
[20] Sherif Ammar, I. and Rajadurai, P. " Performance analysis of pre-emptive priority retrial queueing system with disaster under working breakdown services", Symmetry MDPI, vol 11, no 419, pg. 01-15, DOI. 10.3390, 2019.
[21] Sumitha,D. and Udaya Chandrika, K. "Performance measures of feedback batch arrival retrial queue with optional second service and orbital search", Advances in Applied Research, vol. 3, no. 2, pg. 179-186, 2011.
[22] Tao, L., Liu, Z. and Wang, Z.," M/M/1 retrial queue with collisions and working vacation interruption under N policy", RAIRO Operations Research, vol. 46, pg. 355-371, 2012.
[23] Toth ,A. ,Berczes, T., Sztrik, J.,Kvach, A." Simulation of finite source retrial queueing system with collisions and non reliable server", International Conference on distributed Computer and Communication networks, pg. 146-158, 2017.
[24] Varalakshmi, M., Chandrasekaran, V.M. and Saravanarajan, M.C.,"An unreliable two phase retrial queue with immediate Bernoulli feedbacks", International Journal of Pure and Applied Mathematics, vol. 115, no. 9, pg. 447-457, 2017.

Study Analysis of IoT in FMCG Smart Tags and their Significance in Counterfeit Prevention

Kedri Janardhana[1], Razmah Mahaboobjan[2], M. Vijayaragavan [3], K. Vinoth[4], N.Kanagavalli[5]
{janardhankedri@dei.ac.in[1], razmah.eee@sairamit.edu.in[2], mrvijay.ragavan@gmail.com[3], kvinoth@veltech.edu.in[4], kvalli.818@gmail.com[5]}

[1]Assistant Professor (Senior Grade), Department of Electrical Engineering, Faculty of Engineering, Dayalbagh Educational Institute (Deemed to be University), Agra, India
[2]Assistant Professor, Sri Sai Ram Institute of Technology, Chennai, India
[3]Assistant Professor, Department of Electrical and Electronics Engineering, Mailam Engineering College, Mailam, India
[4]Assistant Professor, Department of Electrical and Electronics Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, India
[5]Assistant Professor, Department of Computer Science and Engineering, Rajalakshmi Institute of Technology, Chennai, India

Abstract. Current study portrays a novel method for counterfeit prevention and brand security in the FMCG business. The introduced approach consolidates Internet of Things, Cloud, and Mobile advancements with the utilization of specially crafted savvy labels (smart tags) applied to each product to give track and follow capacities. The smart labels join QR code with extra data printed with an imperceptible photochromatic ink. The labels are enacted by spotlight on cell phones during the checking. Prior to checking, clients are provoked to choose the setting of the products (available, sold, and consumed) to give extra data about each product container as it travels through the inventory network. Consumer family types reveals essential information on family types and roles in selecting the product for purchasing. The statistical analysis of family type is 84.7 and 15.2 percentage (out of 354 members) in nuclear and joint family respectively. Awareness percentage on smart tags is 49.15, 32.17 and 18.07 percentage in consumer awareness, unaware and may be respectively. Analysis of fake products identification on smart tags is 53.67, 27.96 and 18.36 percentage in consumer identification, unidentified, and may be respectively. Counterfeit information on products identification on smart tags is 97.74, 2.259 percentage in counterfeit information obtained by consumer is higher than not obtained consumers. Analysis of benefit percentage on products is 94.63, 5.37 percentage in benefit percentage is higher than non- obtained consumers. Likeliness of IoT - Smart Tags on products is 76.28, 23.72 percentage (out of 354 members) in interested percentage is higher than not interested consumers.

Keywords: Digital Transformation, Human Sensor Network; Smart Tags; Brand Protection, Counterfeit Prevention, Fast Moving Consumer Goods.

1 Introduction

Fast Consumer Goods (FMCG) there is a complete issue of non-brand goods and products [1]. The product business is not a special case and the counterfeit product is a real problem for

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manufacturers and customers [2,3]. Fraudulent product influences the shape and profit of the manufacturer, however it can also harm consumers. The overall product market analysis shows that the market share of counterfeit in the product industry falls in the range of 0.2% to 1%, while a few tests have increased to 4-5% [4,5]. Many emotional tests come from China where a fraction of the total counterfeit product imported from Europe has been tested to be about 20% and in some cases very high, while product consumption is rising which makes China a fast-growing product market, ahead of the US and Russia [3,6,7].

The most popular way to create a product is to print a fake logo that takes a different brand name and invisible changes in the brand name and logo of friends to deceive the buyers of the products. Often, forgers use valid names derived from more expensive products and see them in less expensive products with similar jars. Finally, in some cases the drink inside the bottles is a counterfeit product, representing a major health concern, and [7]. This is a real issue in Montenegro, as a remnant of Southeast Europe, which was one of the formal promotions of this work. Figure 1 shows cases of fraudulent Montenegro products sold in the Western Balkans and Eastern Europe. In these cases, words that have the same appearance as the first one are used. The most curious model is a five-liter jug of product that has never been sold for a five-liter bulk.

Food security is an important and increasingly fundamental problem due to population growth and the current approach to agribusiness creation [8,9]. The design of the Internet of Things (IoT) is another unique benefit of farming and networking in general. Combined with other fine data (IT) patterns, it will play an important role in the advanced transformation of agriculture and food production through brilliant associations of compatible materials that can be detected, detected and remotely controlled [10], [11], [12]. The basic development of IoT applications in transmission and distribution is common in precision farming, food tracking and subsequent, welfare and quality management, food preparation and integration, and food consumer [8]. Food identification frameworks, often restricted by applicable laws, are often achieved through cultural frameworks, within an independent organization or part of a food production network using important developments and paper routes [13].

The arrangement furnishes a portable application that collaborates with purchasers such that each time clients check a QR code remarkably recognizing an item moment (for example product bottle), they give a report on the status and area of that specific container. In this manner, each jug is independently followed and followed all through the store network and these data updates can be utilized to recognize whether there is an expected fake issue with that specific jug.

2 Research Methods

A semi-structured qualitative preliminary study that focused on consumer's perceptions of smart labelling. The study involved 354 members who were generally familiar with smart labelling - IoT. The results indicate that the respondents could see the benefits of the technology.

DataCollection

A quantitative approach was taken through a large-scale data collection via an online survey research. This research was able to call upon members whom met the predetermined demographic criteria of the survey, in this case, household grocery decision makers between the ages of 18 and 65.

S.No	Attributes
1	Name
2	Age
3	Sex
4	Educational qualification
5	Marital status
6	Residential location
7	Occupation
8	Family type
9	Household shopping
10	Do you aware of smart ags
11	can you identify the fake products
12	Reliability of smart tags
13	Is it important to gather information regarding counterfeit?
14	Do you think that our community will benefit from IoT based Smart tags
15	Is it important to educate consumer about counterfeit and how to report one? Do you think consumer would like the smart tags
16	Did you find this study useful?

Weka 3.9.8. tool has implemented for the analysis and the below methods have implemented in this research work.

3 Results And Discussion

Study results indicates the significance of IoT based smart tags. Quality analysis of various parameter including consumer family type, awareness on smart tags, Identification of fake products, importance of counterfeit information, benefits of smart tag, likeliness of IoT smart tags

Qualitative analysis:

Analysis of consumer family

Consumer family types reveals essential information on family types and roles in selecting the product for purchasing. The statistical analysis of family type is 84.7 and 15.2 percentage (out of 354 members) in nuclear and joint family respectively (Figure 1 & Table 1).

Table 1. Analysis of consumer family

S.No	Family Type	weight	Percentage
1	Nuclear	300	84.7

2	Joint	54	15.2

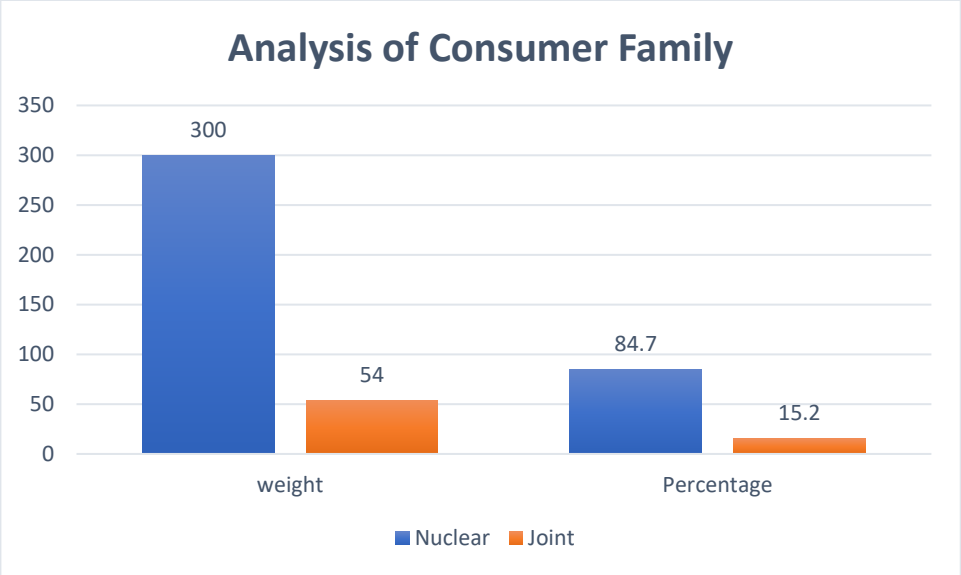

Figure 1. Analysis of consumer family

4 Awareness on smart tags

IoT based Smart tags predict the essential data information on selecting the product for purchasing. Awareness on smart tags by consumer is needed for betterment of IoT. The statistical analysis of awareness on smart tags is 49.15, 32.17 and 18.07 percentage (out of 354 members) in consumer awareness, unaware and may be respectively(Figure 2& Table 2).

Table 2. **Awareness on smart tags**

S. No	Label	Weightage	Percentage
1	Aware	174	49.15
2	Unaware	116	32.7
3	May be	64	18.07

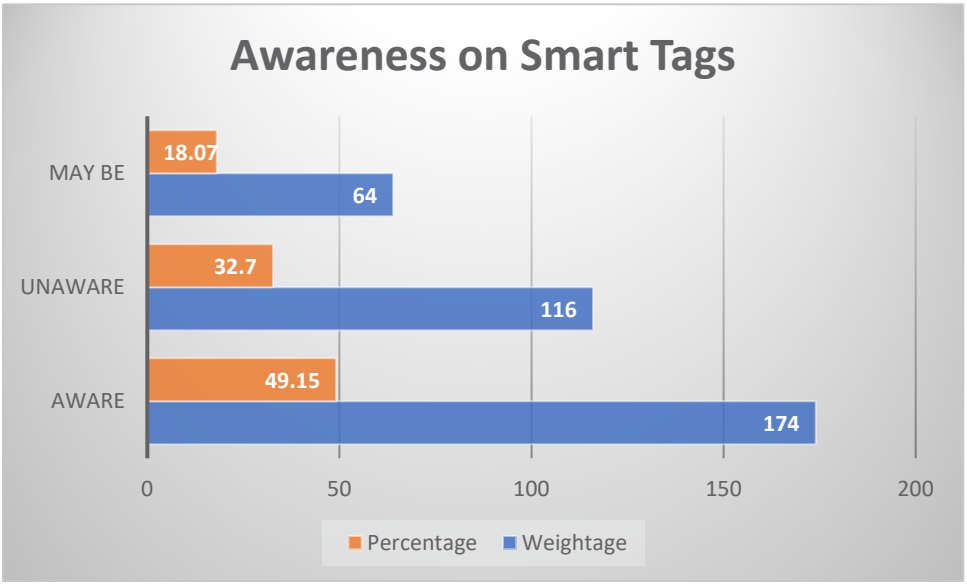

Figure 2. Awareness on smart tags

5 Identification of fake products

IoT based Smart tags predicting the fake products for choosing the product for purchasing. Identification of fake products by consumer is needed for betterment of IoT. The statistical analysis of fake products identification on smart tags is 53.67, 27.96 and 18.36 percentage (out of 354 members) in consumer identification, unidentified, and may be respectively(Figure 3& Table 3).

Table 3. Identification of fake products

Parameter	Count	Percentage
Identified	190	53.67
Unidentified	99	27.96
May be	65	18.36

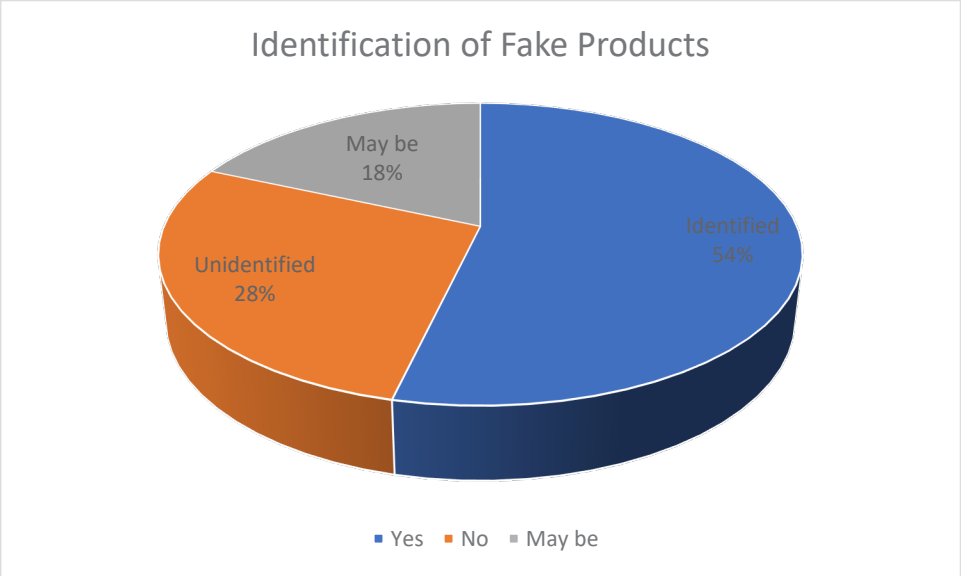

Figure 3. Identification of fake products

6 Importance of Counterfeit information

Counterfeit information should be known be the consumer in general. Information on counterfeit products enable consumer for choosing good products. The statistical analysis of Counterfeit information on products identification on smart tags is 97.74, 2.259 percentage (out of 354 members) in counterfeit information obtained by consumer is higher than not obtained consumers(Figure 4& Table 4).

Table 4. Importance of Counterfeit information

	Total	Percentage
Obtained	346	97.74
Not obtained	8	2.259

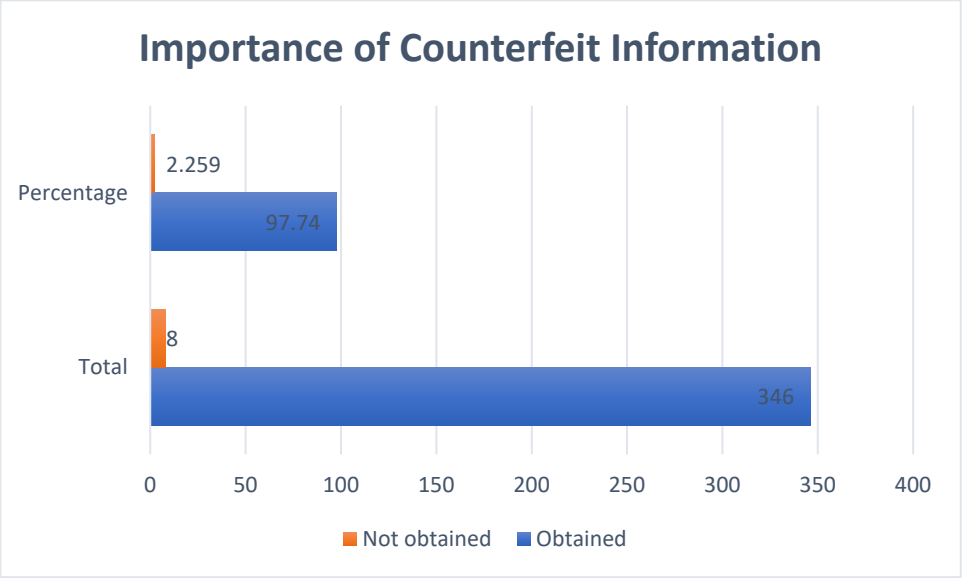

Figure 4. Importance of Counterfeit information

7 IoT Smart tags - Benefit percentage

Smart tags benefit percentage is very essential for fast moving consumer good. Information on benefit percentage enable consumer for aware more on choosing good products. The statistical analysis of benefit percentage on products is 94.63, 5.37 percentage (out of 354 members) in benefit percentage is higher than non- obtained consumers(Figure 5& Table 5).

Table 5. IoT Smart tags - Benefit percentage

	Total	Percentage
Benefited	335	94.63
Not benefited	19	5.37

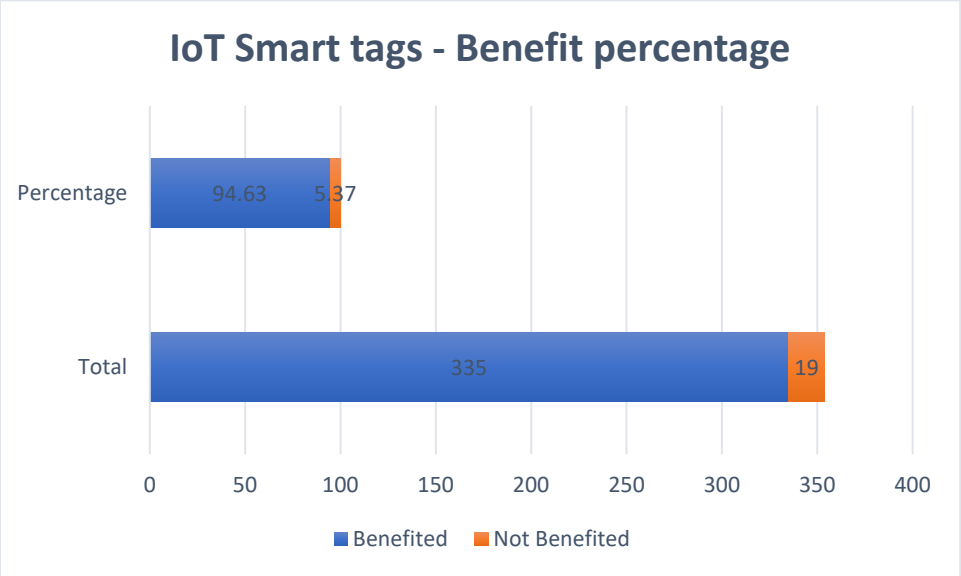

Figure 5. IoT Smart tags - Benefit percentage

8 Likeliness of IoT - Smart Tags

Smart tags likeliness percentage is one of essential criteria for fast moving consumer good. Information on Likeliness of IoT - Smart Tags enable consumer for aware more on choosing good products. The statistical analysis of Likeliness of IoT - Smart Tags on products is 76.28, 23.72 percentage (out of 354 members) in interested percentage is higher than not interested consumers(Figure 6& Table 6).

Table 6. Likeliness of IoT - Smart Tags

	Total	Percentage
Interested	270	76.28
Not Interested	84	23.72

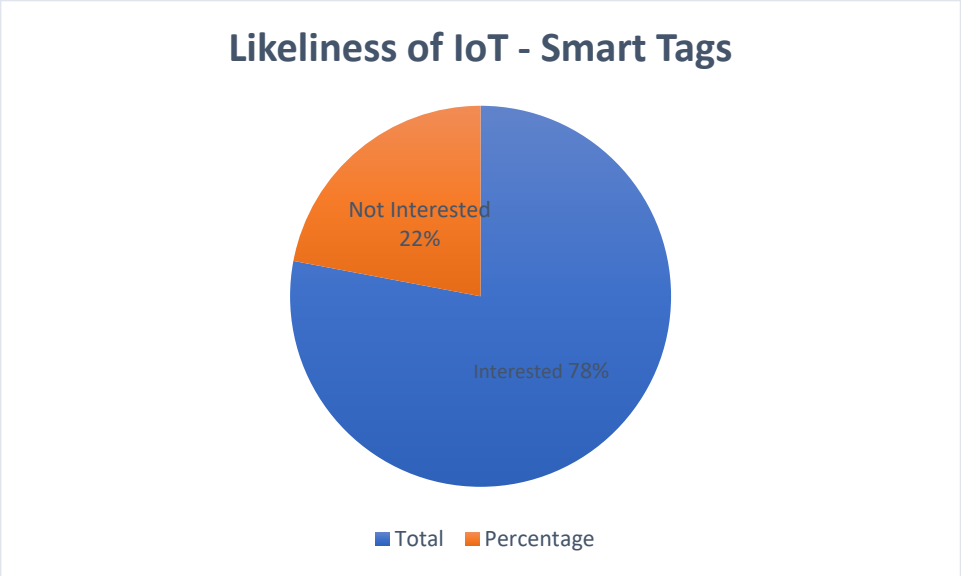

Figure 6. Likeliness of IoT - Smart Tags

The need to combat counterfeiting in the global manufacturing network is widely recognized and various alternatives and approaches have been proposed to address this issue [1,2]. These processes apply to the product business [2,14]. There are arrangements based on the IOT BASED SMART TAGS label that may be below the lower stage, as IOT BASED SMART TAGS users are less available [15,16]. Then again, preparations based on ink are highly adaptable to the point of execution [17,18], but they are easy to imitate [14]. A few experts suggest the use of preparations based on glittering materials [19] or unusual examples [20], but there is a need for more help with these methods. Product tracking and tracking arrangements based on the use of single product bottle numbers using the OCR method can be considered, but the disadvantage is that the accuracy of the reading and use of different text styles and numerical programs for different product types [21]. Frameworks of object identification and anti-fraud based on the use of QR codes are generally accepted by consumers and often require a camera with a camera [22,23]. The naming of Blockchain similarly finds its use in the production network of application managers [24,25], and its new record recording could allow for the selection of cloud-based frameworks soon.

This paper outlines the implementation of a pilot project that uses a variety of methods to create a product validation framework and false arguments in the product business. This method is powered by IoT, distributed by archiving and investigating information, mobile applications, and randomly labelled based on unique QR codes. The use of awesome labels creates a parallel space, where everything that happens is visible, using the new techniques provided by Horizon 2020 TagItSmart! project [26,27]. If it is not a very common problem, note that the standard standard tags distinguish the type of object that currently does not provide data for the same item [28]. It is worth noting that the GS1 Digital Link Standard has been redesigned in TagItSmart! making and donating marks the use of QR code, (IoT based Smart Tags), closed field communication (NFC), and Bluetooth to transmit information to their customers [29]. The common idea is to provide limited web-enabled provision to

improve consumer purchasing experience, strengthen product reliability, and improve store network availability and efficiency.

Surprisingly the use of smart labels is that the general protests of the massive market that are not considered part of the IoT biological system can be provided by sharp labels that allow them to radically change their individual status by relying on environmental changes [30, 31]. Another important part of this method used to detect human-enabled detection is cell phone access everywhere with their cameras [32].

Conclusion

This data is utilized by the uniquely designed heuristic to help clients and manufacturer recognize issues with singular cases of the item. The framework was carried out as a pilot project that was executed during a time of a half year. End clients showed an incredible interest in the likelihood to carry out such a framework, customers preferred the cooperation with the item utilizing the portable mobile application and smart labels, while product manufacturer communicated their advantage in the arrangement. Other than fake that influences benefit, the advantages of such frameworks incorporate improved brand security and diminished danger of health hazards.

References

[1] Brandel, M. (2003). Smart tags, high costs. ComputerWorld (Dec. 15, 2003).

[2] Hoy, M. B. (2013). Near Field Communication: Getting in Touch with Mobile Users. Medical reference services quarterly, 32(3), 351-357.

[3] Lee, Y., Kozar, K. A., & Larsen, K. R. (2003). The technology acceptance model: Past, present, and future. Communications of the Association for Information Systems, 12(1), 50.

[4] Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. the journal of marketing, 20-38.

[5] Östman, H. (2013, 11 April 2013). Grocery industry operations are facing a real paradigm shift. IOT BASED SMART TAGSAreana.Retrievedfromhttp://www.IoT based smart tagsarena.com/2013/4/11/grocery---industry--- operations---are---facing---a---real---paradigm---shift.aspx

[6] Pikkarainen, T., Pikkarainen, K., Karjaluoto, H., & Pahnila, S. (2004). Consumer acceptance of online banking: an extension of the technology acceptance model. Internet research, 14(3), 224-235.

[7] J.M. Soon et al. Developing anti-counterfeiting measures: the role of smart packaging. (2019)

[8] Y.G. Kim et al. Consumer acceptance of a quick response (QR) code for the food traceability system: Application of an extended technology acceptance model (TAM). (2016)

[9] L. Li. Technology designed to combat fakes in the global supply chain (2013)

[10] H. Scholten Defining and analysing traceability systems in food supply chains" a chapter in "Advances in food traceability techniques and technologies" (2016)

[11] G. Baldini, I.N. Fovino, R. Satta, A. Tsois, E. Checchi, "Survey of techniques for the fight against counterfeit goods. N.C.K. Yiu. An NFC-Enabled Anticounterfeiting System for Wine Industry. (2014)

[12] A. Chéron. La protection et la contrefaçon de vins en France et à l'étranger" [The protection and counterfeiting of wine in France and abroad]Le Journal du Net(28 June 2013)

[13] B. Lecat. Fraud and counterfeit wines in France: an overview and perspectives. Br. Food J.(2017)

[14] R. Pender. Counterfeit Wine – Its Impact on the Business of Wine. (March 2010)
[15] E. Przyswa, Counterfeiting In The Wines And Spirits Market: Key Issues And Presentation Of Anti-Counterfeiting...
[16] E. Przyswa, "Protecting Your Wine: Stop counterfeiters from selling cheap imitations of your premium brand", article in..
[17] Harald Sundmaeker"Internet of Food and Farm 2020", Chapter in "Digitising the Industry"(2016).
[18] W. SarniFrom Dirt to Data, The second green revolution and the Internet of Trhings"Deloitte Rev.(2016)
[19] C.N. Verdrouw. Virtualizaion of food supply chains with the internet of things. J. Food Eng.(2015)
[20] S. Li. The internet of things: a survey. (2015)
[21] Z. Pang. Value-centric design of the internet-of-things solution for food supply chain: Value creation, sensor portfolio and information fusion. (2015)
[22] A. Rida et al.Development and Implementation of Novel UHF Paper-Based IOT BASED SMART TAGS Designs for Anti-counterfeiting and Security Applications
[23] B. Yan et al.Application of IOT BASED SMART TAGS and internet of things in monitoring and anti-counterfeiting for products.
[24] S.C.Z. Chen et al.Anti-counterfeit authentication system of printed information based on a logic signing technique
[25] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS quarterly, 319-340.
[26] Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. Management science, 35(8), 982-1003.
[27] Dawes, J. G. (2008). Do data characteristics change according to the number of scale points used? An experiment using 5 point, 7 point and 10 point scales. International journal of market research, 51(1).
[28] Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. Journal of marketing research, 382-388.
[29] Fry, R. (2013). A Rising Share of Young Adults Live in Their Parents' Home. http://www.pewresearch.org: Pew Research Center. Retrieved from http://www.pewsocialtrends.org/files/2013/07/SDT---millennials---living---with---parents---07---2013.pdf
[30] Furrer, O., & Sudharshan, D. (2001). Internet marketing research: opportunities and problems.
[31] Qualitative Market Research: An International Journal, 4(3), 123-129.
[32] Fusaro, R. A. (2004). None of our business?

Intensive Batch Scheduling Application for Parallel Programming In the Cloud Computing Infrastructure

K.M.Azaraffali[1], Dr.T.Krishnakumar[2], Dr.M.Sriram[3]
{azaraffali@gmail.com[1], drkk@bharathuniv.ac.in[2], msr1sriram@gmail.com[3]}

Research Scholar, CSE, Bharath Institute of Higher Education and Research, Chennai, India[1], Professor, CSE, Bharath Institute of Higher Education and Research, Chennai, India.[2], Assistant Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai[3]

Abstract. Enterprises are gathering and analyzing an increasing number of large amounts of facts to be able to derive enterprise insights. Two challenges to fulfill. First, in parallel programming is together time-consuming and error-susceptible. Second, the developing Cloud Computing paradigm executes the primary infrastructure, which armies Enterprises to reconsideration their request structure. Now we advocate massive scale data-intensive batch troubles below the Cloud infrastructure restraints. A programming version and fleeces the difficulty of parallel programming, it offers the customers broad manipulate on facts separated and distribute calculation the applications. We reap high overall performance in computing Cloud and parallel programming is much less time and performance.

Keywords: Cloud Computing, Intensive Batch Scheduling, Parallel Programming.

1 Introduction

To remain in front of rivalry, Enterprises are gathering and investigating huge measure of information to determine business bits of knowledge, ideally continuously or close to constant. For instance, Enterprises need to comprehend their clients better to build up a superior promoting plan, or inspect their production network to search for freedoms to recover productivity, or investigate sensors information to anticipate machine disappointment and forestall income lost before [7].

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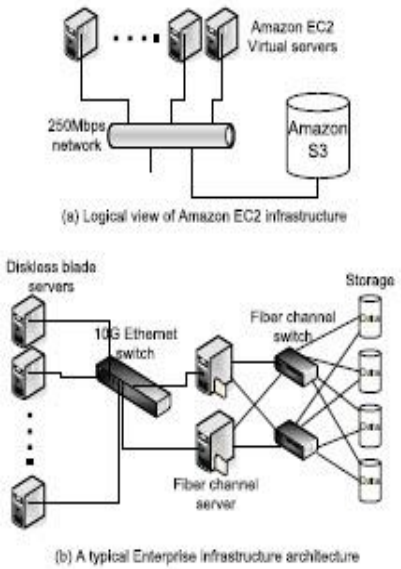

Figure 1. Comparison of infrastructure architectures

The patterns on information development and processor speed development propose that certain type of parallelization is needed to investigate the information. To begin with, because of the needs to determine improved business bits of knowledge recover exactness, measure information gathering is developing at an outstanding rate. Second, uniprocessor speed has halted remarkable development unevenly [8]. Numerous applications are as of now requiring hours to long stretches of calculation time to deal with the information nowadays, and it will revenue any lengthier after some information volume develops. handling postpones put Enterprises at serious drawbacks can't respond sufficiently quick. It is regularly equipment part disappointment and inconsistent information recuperation.

The Propose Grid Batch framework, which targets tackling huge scope information concentrated clump issues under the Haze foundation constraints[9]. GridBatch is a programming perfect and related collection that conceals the intricacy of equal software design, yet it stretches the clients unlimited oversight on how information are apportioned and how calculation is circulated so application container have the best conceivable. GridBatch accomplishes elite in Amazon's EC2 figuring Cloud. GridBatch which performs well in a Cloud framework, yet additionally makes it simple to compose equal projects for information concentrated cluster applications. A powerful urge to investigate the information in the arising Cloud Computing framework on account of its solid incentives.

2 Related Work

Conventional data sets can be utilized to carry out numerous examination applications we are focusing on. Lamentably, they don't scale for huge informational collections for two reasons.

1. In the first place, information bases present a significant level SQL language fully intent on concealing the execution subtleties. Albeit simple to utilize, this general language powers clients to communicate calculation in manners that are definitely not execution proficient. Some of the time, the most effective technique would possibly filter the informational index once. Despite the fact that methods have been created to consequently upgrade inquiry handling, the exhibition is still a long way from accomplished software engineer comprehends the applications well.

2. Second, information bases route glowing in a conventional Enterprises framework engineering network transfer speed abundant, however endure seriously in a Cloud Computing foundation since can't abuse the nearby plate I/O data transmission. Despite the fact that most information base frameworks, including Oracle's business items, utilize modern storing instruments, numerous information gets to in any case navigate the organization, devouring valuable data transmission.

3 Gridbatch System

There are two urgent data type in Grid Batch table or documented table (procured from informational collection phrasing). A table contain a lot of records (pushes) that are liberated from each other. All records in a table follows a comparable planning, and each record may contain a couple of field (sections). Documented table resembles table beside that each record also has a connected rundown, where the rundown could basically be one of the field or other data gave by the user[10]. Table is undifferentiated from the vector thought in vector or SIMD machine or the stream thought in stream processors [7] in Computer Architecture. Basically, table grants us to design an item structure which can deal with the records in equivalent across various machines in the Cloud. The GridBatch system contains two pieces of connected programming parts: the appropriated archive structure (DFS) and the work scheduler.

A The distributed file system

DFS is an augmentation of GFS [5] that upholds another sort of record. DFS store two sorts of records: fixed-piece size documents or fixed-num-of-lump documents. For filed table, let us think about another kind of documents: fixed-num-of-piece records, where each record has a fixed number of lumps and every lump could have self-assertively enormous size[11]. At the point when another information record should be composed, the DFS customer call the parcel capacity to decide the lump number, at that point it annexes the greatest to the furthest limit of the chunk.

B Job Scheduling

The work planning framework incorporates an expert hub and numerous slave hubs. The slave hub is answerable for running an errand appointed by the expert hub. The expert hub is liable for separating a task into numerous more modest undertakings as communicated in the client programs. It disperses the undertakings crossways all slave hubs in the framework, and it screens the errands to ensure every one of them whole effectively. A slave hub is regularly an information hub. At the point when the expert timetables an undertaking, it could plan the assignment on the hub which holds the piece of information to be prepared. By preparing information on the neighborhood hub, we save money on valuable organization transmission capacity.

4 Gridbatch Operators

GridBatch doesn't endeavor a developer reasons the superlative way to deal with program an applications. All things being equal, it intends to give a bunch of ordinarily utilized natives, called administrators, which the software engineer money on programming endeavors. The administrators handle the subtleties of circulating various machine, in this way the client may not have to stress over equal programming. All things considered, the client simply needs to apply a bunch of administrators consecutively, similarly as though composing a customary successive program. GridBatch separates MapReduce into rudimentary administrators, and moreover, presents extra administrators. GridBatch presently comprises of the accompanying administrators:

A Map Operator

The Map operator smears a user-defined purpose finished all annals of a table.

B Distribute Operator

The Distribute administrator changes a table or a recorded table over to additional ordered table with an alternate file. The subsequent listed table is put away as a solitary fixed-num-of-piece DFS document. This includes rearranging information from whichever lump the information was on beforehand to another piece as shown by the segment work for the new file.

C Join Operator

The Join administrator takes two filed tables and union the relating record if the list field competition. The GridBatch framework tracks down the comparing record that have a coordinating with file, and afterward conjures a tradition capacity characterized by the client. The client characterized capacity can basically combine the dual record, as in a customary information base joint, or it can play out some exceptional activity as it wants.

D Cartesian Operator

In contrast to the Join administrator, which possibly coordinates with records when their list field matchs, the Cartesian administrator coordinate with each records of Table X each record of Table Y , and smear a client characterized work.

E Recurse Operator

Many decrease activities are commutative and cooperative, and thus, request autonomous. For these request autonomous lessen tasks, we present the Recurse administrator.

F Neighbor Operator

Examination capacities, like our customer's interweaving discovery issue, need to dissect the grouping to determine significant outcomes. The Neighbor administrator bunches adjoining records and conjures a client characterized capacity to dissect the sub-succession.

5 Conclusion

Because of cutthroat pressing factor, Enterprise needs to dissect a lot of information in a short measure of time, under a clashing objective of utilizing the smallest expense conceivable. There a few difficulties in gathering these objectives. To begin with, the measure of information we gather is huge to such an extent now past ability of a uniprocessor measure in a sensible measure of time. The development pattern of information volume and uniprocessor limit recommends issue can't be settled by innovation climbing. All things being equal, some type of equal handling is essential. Sadly, composing equal projects is intrinsically troublesome because of the disseminated nature.

Second, despite the fact that Cloud Computing vows to significantly bring down the expense, particularly for time-fluctuating calculation requests, its foundation is altogether different from the customary Enterprise framework. Utilizing a genuine customer application model, we presented how these administrators might be utilized to tackle genuine issues. Finished tests, we presented that the administrators stretch the clients not just straight control on information development and capacity yet additionally adaptability in piece, so the application can accomplish better, not just contrasted with the customary methodology in a conventional Enterprise framework, yet in addition contrasted with MapReduce in a Cloud foundation

References

[1] M. Atkinson. Uk e-science grid infrastructure meets biological research challenges. http://www.nesc.ac.uk/talks/mpa/BioGridCambridge2Oct02.ppt, Oct. 2002.

[2] H. chih Yang, A. Dasdan, R.-L. Hsiao, and D. S.Parker. Map-reduce-merge: Simplified relational data processing on large clusters. In Proc. SIGMOD, 2007.

[3] T. H. Davenport and J. G. Harris. Competing on Analytics: The New Science of Winning. Harvard Business School Press, 2007.

[4] J. Dean and S. Ghemawat. Mapreduce: Simplified data processing on large clusters. In OSDI'04: Sixth Symposium on Operating System Design and Implementation, December 2004.

[5] S. Ghemawat, H. Gobioff, and S.-T. Leung. The google file system. In 19th ACM Symposium on Operating Systems Principles, October 2003.

[6] M. Isard, M. Budiu, Y. Yu, A. Birrell, and D. Fetterly. Dryad: Distributed data-parallel programs from sequential building blocks. In European Conference on Computer Systems (EuroSys), March 2007.

[7] Dr. Kaliyamurthie K.P "An Application Of Non-Uniform Cellular Automata For Efficient Cryptography" , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4648-4652 May 2013.
[8] Dr. Kaliyamurthie K.P "K-Anonymity Based Privacy Preserving For Data Collection In Wireless Sensor Networks" , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4604-4614 May 2013.
[9] Dr. Kaliyamurthie K.P "Highly Secured Online Voting System Over Network" , Indian Journal of Science and Technology, Vol 6, Issue 6S page 4831-4836 May 2013.
[10] Dr. Kumaravel. A "Vehnode: Wireless Sensor Network Platform For Automobile Pollution Control" IEEE explore, Vol Page(s): 963 – 966, 2013.
[11] Dr. Kumaravel. A "Multi- Classification Approach For Detecting Network" IEEE explore, Page(s): 1114 –1117,April 2013.
[12] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.
[13] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9
[14] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.
[15] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020
[16] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2
[17] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.
[18] Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

Efficient Learning Management Tool for Web-based Education using an Evolutionary Algorithm

P.Arumugam[1], Dr.T.Krishnakumar[2], Dr.M.Sriram[3]
{ ararun513@gmail.com[1], drkk@bharathuniv.ac.in[2], msr1sriram@gmail.com[3]}

Research Scholar, CSE, Bharath Institute of Higher Education and Research, Chennai, India[1], Professor, CSE, Bharath Institute of Higher Education and Research, Chennai, India.[2], Assistant Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai[3]

Abstract. The goal of Effective Web based E-Learning is to connection the space among the presentlygeneral technique to Web-based totally education, that is targeted on getting to know control systems (LMS) . The influential however underused technologies in smart teaching and adaptive hypermedia. Ontology have end up a key era for permitting semantic-driven resource control. We present a sub ontology-based totally method for resource reuse by way of the use of an Evolutionary set of rules..

Keywords: Web based E-Learning, Efficient Learning Management Tool, Evolutionary Algorithm.

1 Introduction

A key, general objective for some dedicated instructor is to guarantee that the student has a significant and important cultureinvolvement while accomplishing the ideal culture results. In this tabloid it is contended that to accomplish such an objective, a technique should be set up that is equipped for giving understudies a completely integrated[3], comprehensive learning climate. The thinking, just, is that taking in won't really exude from one explicit basis and when it occurs, it will happen through various methods, for various individuals. One of the extraordinary qualities of the web based knowledge space is that, saddling the force of the different data and correspondence innovations (ICTs), there is more noteworthy extension for cooking for singular adapting needs. In view of this, the paper advances a system that contains various covering 'sub-conditions' which, together, give the platform thought about vital development really comprehensive knowledge climate.

Learning Management System (LMS) – an assortment of e-Learning devices accessible finished common authoritative line. A culture the board framework can be considered as the stage online sequences or sectionsonline sequences gathered and utilized since.

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2 Semantic Web Views

The objective semantic web create empowering guidelines and advancements intended to assist machineries with understanding data on the web so they can uphold more extravagant revelation, information joining, route, and mechanization of errands.

With semantic web we not just get more accurate outcomes while looking for Information, yet in addition know when we can incorporate data from various causes, Know what data to think about, and can give a wide range of mechanized administrations in various areas from future home and advanced public library to electriccommercial and Health service [4].

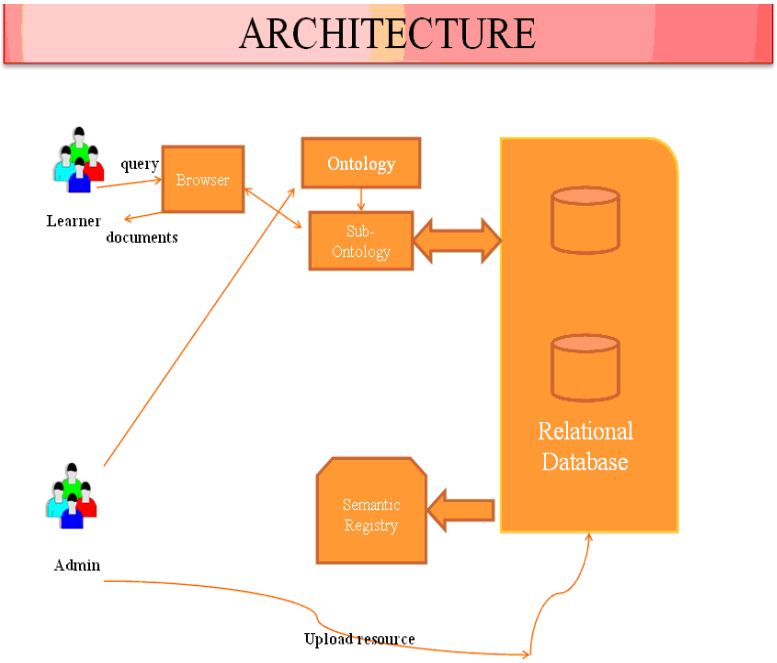
3 Ontology Views

Metaphysics arethe record or documentwhich officially characterizes the relation among the footings. The primary use for ontology are to upgrade the precision of web look. The journalists additionally characterize anything a URL and URI are capacities semantic web. URL's is most recognizable sort URI.

Ontologycomprise a fundamental and significant piece Semantic Web. emantic Web prosper, designers should make and coordinate various ontology, from general high level ontology, to area explicit and task-explicit ontology. first inspirations driving philosophy research was the conviction that ontology can assist with reclaim in information portrayal.

4 Existing System

Current work for Semantic-Web-or cosmology-based e-learning will in general utilize ontology or semantic model statical to intercede e-learning assets and recover e-learning practices. e-learning framework need to create significant assets composed to accomplish on-request and community-oriented e-learning Web. In any case, happensvaried portrayal issue to different e-learning assets Web.



5 Problem Representation

As sort of transformative calculation, the hypothetical establishments of GA were initially future by Hollands in the mid 1970 . It smears a portion of the common advancement standards like hybrid, transformation, and natural selection to enhancement and erudition. GA practical numerous issues improvement and characterization. WeadoptGA take care of issue of SubO development to help active asset the executives and recycle. For planning our concern to the GA definition, two stages are should have been achieved, to be specific, issue encoding and deciding the assessment/wellness work dependent on the philosophy semantic.

6 Evolution Algorithm

In light of the issue encoding and the wellness work, suggest a calculation for SubO advancement. The accompanying calculation advances a bunch of SubOs dependent on a bunch of asset demands and gets another arrangement of SubOs for asset recycle.

Calculation: Sub Evolve(K, R, O) STEPS

The advancement calculation is clarified as follow:

1. Recover distinctive SubOs from an archive or concentrate diverse SubOs from the source metaphysics as per distinctive asset demands.

2. Encode SubOs as a populace of chromosome.

3. Advance the populace dependent on GA.

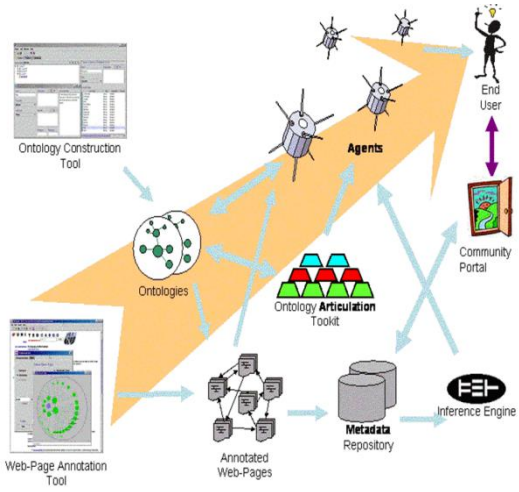
4. Analyze the chromosome in the populace and union one with high closeness.

5. Assess the chromosome in the populace. End if the general wellness is higher than an edge esteem. Something else, go to stage 3.

6. Interpret the chromosome in the populace to SubOs and reappearance another arrangement of SubOs.

7. Recover e-learning assets identified with the SubOs.

We can recover the asset the board and recycle for e-learning frameworks dependent on the SubO development calculation. The nearby information construction of e-learning frameworks turns out to be more versatile to asset demands through SubO development.



Use of metadata on the Semantic Web

7 Conclusion

We suggest a powerful SubO component versatile administration and recycle of e-learning assets disseminated climate the Web. That contend that to accomplish -request semantics-based asset the board for Web-based e-learning, one ought to go past utilizing area ontology stoical. We suggest a semantics planning system to incorporate e-learning data sets by utilizing philosophy semantic.

Characterize setting explicit parts from the entire philosophy SubOs and suggest a SubO-based asset reclaim method by utilizing an advancement calculation. Clarify the GA-based development calculation active e-learning asset reclaim element. Additionally lead a reproduction try and assess the suggested method TCM e-learning situation. The suggested SubO-based methodology for e-learning asset the executives and reclaim is a long way from existence adult.

References

[1] M. Nichols and D. Schedule, "A Theory for eLearning," Educational Technology and Soc., vol. 6, no. 2, pp. 1-10, 2003.

[2] T. Berners-Lee, J. Hendler, and O. Lassila, "The Semantic Web," Scientific Am., vol. 284, no. 5, pp. 34-43, 2001.

[3] Dr.Kaliyamurthie K.P "An Application Of Non-Uniform Cellular Automata For Efficient Cryptography" , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4648-4652 May 2013.

[4] Dr. Kaliyamurthie K.P "K-Anonymity Based Privacy Preserving For Data Collection In Wireless Sensor Networks" , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4604-4614 May 2013.

[5] Dr. Kaliyamurthie K.P "Highly Secured Online Voting System Over Network" , Indian Journal of Science and Technology, Vol 6, Issue 6S page 4831-4836 May 2013.

[6] Dr. Kumaravel. A "Vehnode: Wireless Sensor Network Platform For Automobile Pollution Control" IEEE explore, Vol Page(s): 963 – 966, 2013.

[7] Dr. Kumaravel. A "Multi- Classification Approach For Detecting Network" IEEE explore, Page(s): 1114 –1117,April 2013.

[8] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.

[9] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9

[10] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.

[11] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020

[12] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2

[13] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.

[14] Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

Malicious Email Tracking System for Prevention of Malicious Code Delivered via Email

A.StephenAntoJegan[1], Dr. K.P.Kaliyamurthie[2], Dr.M.Sriram[3]
{stephen_jegan@yahoo.co.in[1], kpkaliyamurthie@gmail.com[2], msr1sriram@gmail.com[3]}

Research Scholar, Department of CSE, Bharath Institute of Higher Education and Research, Chennai[1], Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai[2], Associate Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai[3]

Abstract. Despite the use of state of the artwork strategies to shield touching malicious packages, they maintain to threaten and damage pc structures around the arena. In this articles we existent MET, the Malicious Email Tracking device, designed to mechanically file records on the movement conduct of malicious software distributed through e-mail attachment together at a global and local degree. MET can assist decreasethe unfold of malicious software global, specially self-replicating viruses. Small quantity of site visitors (as an example, .1%) of a completely massive e-mail circulation is sufficient to come across suspicious. Consequently, moderately few MET connections would be vital to acquire enough information so that you can offer vast protection services.

Keywords: Malicious Email Tracking System MET, Malicious Code, Email.

1 Introduction

PC frameworks are continually enduring an onslaught by malignant programming joined to email. Email is liable for the blowout of 80% of PC infection. The most famous way to deal with safeguard against noxious programming is through enemy of infection scanners like Symantec and McAfee, just as worker based channels that channels email with executable attachments. These approaches have been fruitful in securing PCs against known pernicious projects However, they have not yet given a methods for ensuring against recently dispatched (obscure) viruses. Only as of late have there been ways to deal with recognize new or obscure vindictive programming by investigating the payload of an attachment. In ongoing years, not just have PC infections expanded drastically in number and started to show up in new and more unpredictable structures, yet the expanded between network of PCs has exacerbated the issue by giving the methods for quick popular proliferation. Since vindictive programming can not generally be identified ahead of time by investigating payload, we can lessen the harm brought about by malevolent programming by checking its conduct in spreading among hubs in networks[5].

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2 Existing System

At present observing frameworks exist through associations like WildList, Trend Micro World Virus Tracking Center. WildList does exclude those situations where a connection is considered dubious however not yet named malignant. This leaves PC frameworks powerless against assault from unreported viral incidents. Since the way toward detailing isn't computerized, vindictive programming can spread a lot quicker than admonitions created by WildList. Pattern's information is inadequate. Besides, if Trend's information base isn't refreshed at the time that an infection contaminates a framework, at that point the infection stays unreported [6].

3 Proposed System

In these articles, we extant the MET framework tends to issues. The key diaerence among MET and past checking frameworks, for example, Trend is that MET concentrates and logs a special identifier from the connections going through a shopping center worker. In the event that a connection is found to be pernicious afterward, the insights on its practices will have been recorded and accessible for additional investigation and announcing capacities. MET gives three significant, abilities. The primary capacity is the capacity to follow the worldwide spread of malignant programming through email. The subsequent ability is deciding the entirety of the marks of passage through email of malevolent programming into an organization. This can help the framework heads contain the harm brought about by the software[7]. The third capacity is to decrease the feast of self-reproducing infections through email,.

4 Unique Identifiers For Email Attachments

The way to following connections MET framework is the task of an extraordinary identifier email connection. MET customer removes a connection from an email and figures an identifier from the payload of the connection. This interesting identifier is utilized to total data about a similar connection proliferated in dlaerent messages.

4. MET Client

The MET customer comprises of a few parts. The center of the MET customer is a data set, which stores data pretty much all emall connections that go through the mail worker. The MET framework contains a segment to incorporate with the shopping center cut off. In our model execution, we coordinated the MET customer with send letters utilizing procmail. The MET customer likewise contain a segment to register the extraordinary identifiers for connections. An information investigation part extricates insights from the data set to answer to the MET worker and a correspondence segment handle the correspondence among the MET customer and the MET worker. Regardless of whether a logged connection was not at first recognized as vindictive however simply later sorted to be in this way, the places of passage

can in any case be recuperated since a record of all connections is put away in the information base.

MET Client Architecture

While checking the progression, all things considered, MET permits the framework executive to recognize email traffic covering non-malignant email influences and email traffic containing malevolent programming connections. These diaerences may turn out to be more obvious as all email is checked, and (transient) measurements are assembled cautiously inside that climate to build up standards for email streams.

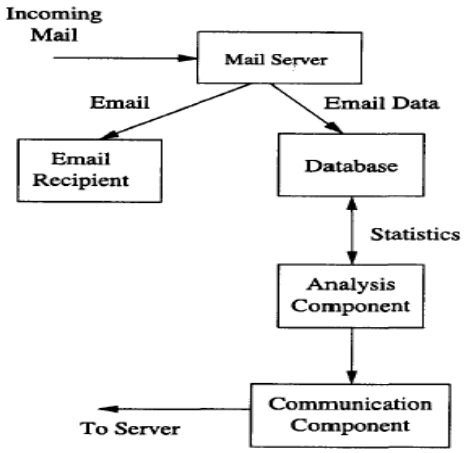

Figure1 MET Architecture

Each MET customer is needed to retain the base measure of data regardingemail that contains connections depicted in Table 1. Also, in the information base we stock the rundown of one of a kind identifiers for known malignant connections alongside the names of these attachments.Since MET can decide the marks of section of a vindictive connection into an organization, this can extraordinarily help the infection occurrence and the framework aclminlstraftor to decrease and contains the related harm.

Email Attachment Log Record:
Unique ID of every Attachment
Time Stamp
Attachment Classification (Malicious or enign)
Sender Email
Receiver Email

Table 1: Information stored in MET Client Database for each email that contains an attachment

Record reporting malicious attachment incident
ID of reporting server
Unique ID of attachment
Date/Time of report
revalence
irth Rate

Table 2: Information store on a central repository

The predominance is the occasions it was seen by the MET customer and the rate of birth is the normal number of duplicates sent from a similar client. Oth of these insights can be handily acquired from the information base. In segment 3 we show how we consolidate this data from different MET customers to measure the danger level and different insights on an infection from this essential data

5. MET Server

The MET worker run at a focal area and speaks with the MET customers conveyed at different mail workers. The MET worker can ordinarily be worked by a believed outsider and different organizations can settle on concurrences with this outsider to give the MET facility.The MET worker has a few capacities. The MET worker is answerable for spreading a refreshed rundown of special identifiers related with known vindictive infections to the MET customers. We bring up that the sort of data shipped off the MET worker are insights that secure the protection of separate clients who might have directed or gotten the malevolent connection.

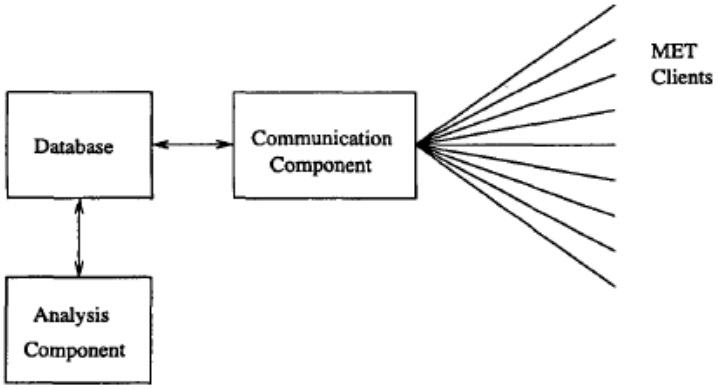

Figure 2. MET Server

7 Conclusion

Indeed, even with the utilization of cutting edge against infection programming, pernicious projects keep on making harm PC frameworks around the world. The Malicious Email Tracking framework was intended to assemble this data related to any enemy of infection scanners, and across has while keeping up protection and security policies. However, as the quantity of members expands, the measure of information acquired increases. The MET framework relies on the clients faith of the mail provider. The MET framework gathers and supplies data that is as of now gathered and put away by the mail worker. One benefit to this methodology is that we can measure the danger related with permitting the conveyance of the connection. This can permit managers of individual MET customers to put together their choice with respect to whether they ought to permit the emails to be conveyed dependent on this danger evaluation.

References

[1] B. Balzer. Assuring the safety of opening email attachments.
[2] HouseCall. Free online virus scan. Online Publication,2002. http://housecall.antivirus.com.
[3] D. M. C. Jeffrey O. Kephart and S. R. White.Computers and epidemiology. IEEE Spectrum. http://www.research.ibm.com/antivirns/SciArticless/Kephar
[4] Thomas C.Schmidt, Multimedia networking communication protocols- tschmidt@ieee.org
[5] Darren. L. Spohn, Data network design, TMH publications
[6] Daniel Minoli& Emma Minoli, Delivering Voice Over IP networks, Wiley Computer publishing.
[7] Dr. Kaliyamurthie K.P “An Application Of Non-Uniform Cellular Automata For Efficient Cryptography” ,Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4648-4652 May 2013.
[8] Dr. Kaliyamurthie K.P “K-Anonymity Based Privacy Preserving For Data Collection In Wireless Sensor Networks” , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4604-4614 May 2013.

[9] Dr. Kaliyamurthie K.P "Highly Secured Online Voting System Over Network" , Indian Journal of Science and Technology, Vol 6, Issue 6S page 4831-4836 May 2013.
[10] Dr. Kumaravel. A "Vehnode: Wireless Sensor Network Platform For Automobile Pollution Control" IEEE explore, Vol Page(s): 963 – 966, 2013.
[11] Dr. Kumaravel. A "Multi- Classification Approach For Detecting Network" IEEE explore, Page(s): 1114 –1117,April 2013.
[12] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.
[13] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9
[14] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.
[15] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020
[16] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2
[17] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.
[18] Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

Innovations of Web-based E-Erudition using Pedagogical Theory Aspects

P.Arumugam[1], Dr.T.Krishnakumar[2], Dr.M.Sriram[3]
{ ararun513@gmail.com[1], drkk@bharathuniv.ac.in[2], msr1sriram@gmail.com[3]}

Research Scholar, CSE, Bharath Institute of Higher Education and Research, Chennai, India[1], Professor, CSE, Bharath Institute of Higher Education and Research, Chennai, India.[2], Assistant Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai[3]

Abstract. In this technical international, Erudition comfort of E-Erudition . E-Erudition is prosperous a extensive in website results in treasured studying. It is stated the deliberate use of network material communication era coaching erudition . Web-primarily based E-Erudition gives teachers to elevate protection-associated understanding and competence. E-Erudition web sites indicates its wonderful evolution in instructive field and it need to please all of the pedagogical attributes. Pedagogy mentions to the precise use of informative techniques. The internet site that contents the Pedagogical attribute ought to measured groundbreaking E-Erudition website. The internet site has to be check in regards Erudition targets with the subject sorts as Knowledge, Attitude, and Skill, Meta-getting to know and Pedagogical strategies with the subject kinds as Drill, Presentation, Tutorials, Gaming, and Protest the usage of Pedagogical Attribute. Erudition objective and Pedagogical strategies of Pedagogical attribute are actual critical in the net doorway to offer the E-Erudition in extra powerful way. The fundamental goal of this rag is to make E-Erudition websites prosperous in studying. This paper has made a examine approximately the attribute of Pedagogical illustration and a case look at approximately how operative; the E-Erudition has been made with "Education" column of 'W3school' internet portal (online).

Keywords: E-Erudition , Pedagogy, Web based erudition , Instructor, Teaching.

1 Introduction

E-Erudition contains all types of automatically upheld erudition and educating. The data and correspondence frameworks, if networks, fill in explicit broadcasting, which incorporates web based erudition , cybernetic erudition , dispersed erudition , organization and electronic erudition [1]. Principally, allude to instructive cycles that use data and correspondences innovation. It tends to act naturally paced or teacher drove and incorporates media as text, picture, movement, real time video and sound. In E-Erudition , training is speedily cumulative and online doctoral schemes have uniform changed at heavy examination college.

E-erudition obtainable a few likely advantages over online erudition : The capacity to contact a wide crowd momentarily, Cost investment funds over homeroom based preparing, Measurable outcomes income up and execution, the possibility to make a local area of E-students. These are the difficulties and advantages that make E-erudition achievement.

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W3school is a site students a premium electronic erudition . The W3school website is stayed by electronic students a greater amount of a premium regular students. The website gets the condensing for the www; W3 is a numeronymg of WWW. It is made and possessed by Rejfsnes Data, Norwegian family-claimed programming advancement and counseling organization. The site generally comprises of novice's instructional exercises and orientations of the fundamental subject and dialects. It's astonishing data this site pack in a little spot. You peruse recently distributed programming book here [3]. W3school is quite possibly the greatest admired and regarded assets for online instructional exercises. W3 Schools awesome in cover exceptional instructional exercises on any language that the students need to learn. Alongside these instructional exercises, W3 Schools empowers students to cooperate with different segments, can rehearse perusing.

E-Erudition ought to be accomplished complete the instructive properties. It must be executed in the E-Erudition sites. In this way, e-students organizers can accomplish comfort in erudition .

2 Classification of Pedagogical attributes

The idea of E-Erudition arisen uniquely through recent year because of trading information amongst understudies, commercial associations, administration etc[11]. Specifically worry on E-Erudition expanded because of development web. The survey of E-Erudition is done now. Academic credits [9] are characterized into 3 classifications, Erudition Objective, Pedagogical techniques and Erudition Object. Every class numerous Topic type like Knowledges, Boldness, and Ability, Meta-erudition Etc[12]..

3 Case study

Teaching method, alluded right utilization educational procedures. In relationship with those informational systems, the educator's own philosophical convictions guidance are held and represented student's involvement information and experience, circumstance, and climate, just as knowledge objectives set by the student and organizer [2].

The e-erudition key subjects are knowledge goals and educational techniques. They depended on kind of the point, subject affiliations and its events [8]. The table 1 portrays the erudition destinations and educational strategies.

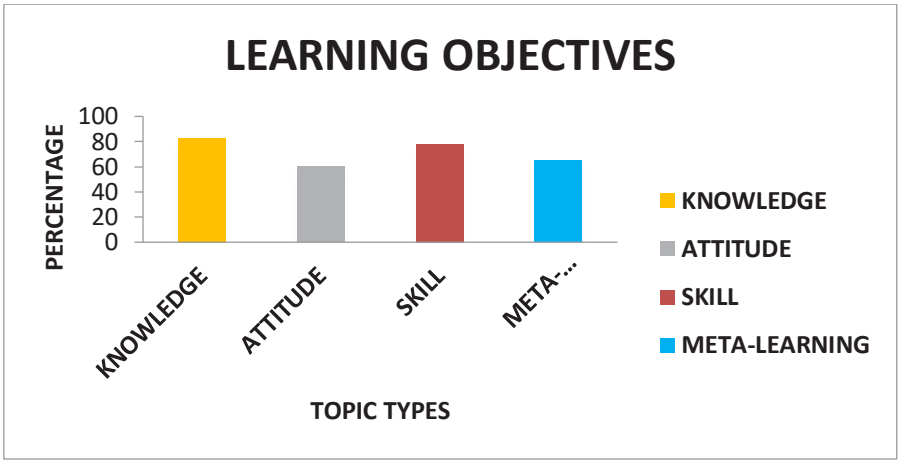

Chart 1: Erudition Objectives

Chart1 addresses the erudition goals where information is 84%, demeanor is 61%, expertise is 79% the meta-erudition is 66%[13]. On a normal of the point type, information, demeanor, ability and meta-taking in estimated as 73% the input.

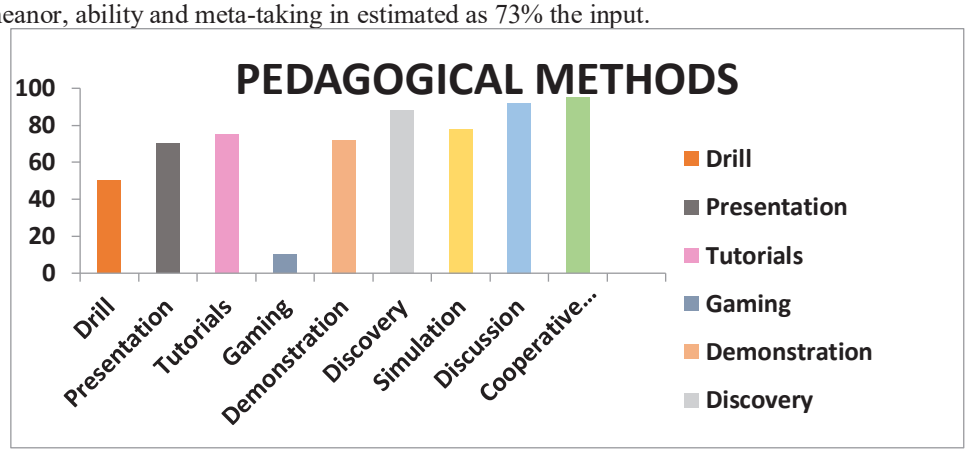

Chart 2: *Pedagogical methods*

Chart2 addresses the Pedagogical techniques wherein the theme type seen finished the variables of Drill[14], Arrangement, Tutorial, Game, demonstration, Detection, Imitation, Conversation, Obliging erudition .

From the exceeding diagram 2 we see that the Drill - half, Performance - 71%, Tutorial - 76%, Game - 11%, exhibit - 73%, Detection - 89%, Imitation - 79%, Conversation - 93%[15], Obliging erudition - 96%.

4 Conclusion

E-erudition site depends on the maxim that the erudition happens anyplace, whenever. The abilities for obtaining information assume a larger part in progress than information ideas. It is getting progressively unmistakable in instructive sites. E-erudition as an educational issue has carried numerous advantages to students. The instructive quality builds up a thick compatibility among the student and the facilitator. Among the most apparent and important properties of e-erudition strategies and conveyance is that they possibly give students more prominent admittance to schooling, in contrast with conventional erudition . The sites that are created by fulfilling every one of the qualities of the academic techniques is viewed as the greatest and furthermore it sparkles well. The examination on the "W3school" clarifies that more instructive traits fulfilled remember profundity for ascribes like Attitudes, Meta-erudition , Drill, Performance and Game. On off chance that the E-Erudition sites fulfills every one of the instructive traits which has been referenced in this investigation, at that point it is careful as the respected E-Erudition sites. Upcoming examination can prompt every one of the fields of the site, recognizable proof of absence of instructive traits in the entryway, ideas to recover the E-erudition sites can likewise be incorporated.

References

[1] McGhee, R. and Kozma, R. (2003). New Teacher and Student Roles in the Technology-Supported

[2] Classroom Available: http: //edtechcases.info /papers/ teacherstudentroles.pdf

[3] Britain, S. and Liber, O. (2004). A Framework for the Pedagogical Evaluation of eErudition Environments. http://www.cetis.ac.uk/members/pedagogy/files/4thMeet_framework/VLEfullReport

[4] http://en.wikipedia.org/wiki/W3school

[5] Salmon, G. (2000). E-moderation – The Key to Teaching and Erudition Online. Kogan Page, 0-7494-3110-5

[6] Itmazi, J. A. and M. M. Gea (2005). Survey: Comparison and Evaluation Studies of Erudition Content Management Systems. MICROERUDITION 2005: Erudition & Working in New Media Environments. International Conference, Innsbruck, Austria.

[7] Woelk, D. (2002, June). E-erudition : Semantic Web services and competency ontologies. In Proceedings of ED-Media 2002 Conference.

[8] Kljun, M., J. Vicic, et al. (2007). Evaluating Comparisons and Evaluations of Erudition Management Systems. Proceedings of the ITI 2007 29th Int. Conf. on Information Technology Interfaces, Cavtat, Croatia, IEEE.

[9] Piccoli, G., Ahmad, R., & Ives, B. (2001). Web based virtual erudition environments: a research framework and a preliminary assessment of effectiveness in basic IT skills training. MIS Quarterly, 25, 401–427.

[10] Line Kolås (2008). Topic Maps in E-erudition : An Ontology of Computer and Information Science.

[11] Dr. Kaliyamurthie K.P "An Application Of Non-Uniform Cellular Automata For Efficient Cryptography" , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4648-4652 May 2013.

[12] Dr. Kaliyamurthie K.P "K-Anonymity Based Privacy Preserving For Data Collection In Wireless Sensor Networks" , Indian Journal of Science and Technology, Vol 6, Issue 5S, page 4604-4614 May 2013.

[13] Dr. Kaliyamurthie K.P "Highly Secured Online Voting System Over Network" , Indian Journal of Science and Technology, Vol 6, Issue 6S page 4831-4836 May 2013.

[14] T. Vijayan , M. Sangeetha , A. Kumaravel & B. Karthik (2020): FeatureSelection for Simple Color Histogram Filter based on Retinal Fundus Images for DiabeticRetinopathy Recognition, IETE Journal of Research, DOI: 10.1080/03772063.2020.1844082.

[15] D. S. Vijayan, A. Leema Rose, S. Arvindan, J. Revathy, C. Amuthadevi, "Automation systems in smart buildings: a review", Journal of Ambient Intelligence and Humanized Computing https://doi.org/10.1007/s12652-020-02666-9

[16] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Gabor filter and machine learning based diabetic retinopathy analysis and detection", Microprocessors and Microsystems,2020. https://doi.org/10.1016/j.micpro.2020.103353.

[17] Vijayan T, SangeethaM, Karthik B, "Trainable WEKA Segmentation of Retinal Fundus Images for Global Eye Disease Diagnosis Application," International Journal of Emerging Trends in Engineering Research,Vol 8, No.9, pp. 5750-5754, Sep 2020. https://doi.org/10.30534/ijeter/2020/136892020

[18] C. Amuthadevi, D. S. Vijayan, Varatharajan Ramachandran, "Development of air quality monitoring (AQM) models using different machine learning approaches", Journal of Ambient Intelligence and Humanized Computing, https://doi.org/10.1007/s12652-020-02724-2

[19] Vijayan T, Sangeetha M, A. Kumaravel, Karthik B, "Fine Tuned VGG19 Convolutional Neural Network Architecture for Diabetic Retinopathy Diagnosis," Indian Journal of Computer Science and Engineering (IJCSE), Vol. 11, No. 5, pp. 615-622 Sep-Oct 2020. DOI: 10.21817/indjcse/2020/v11i5/201105266.

[20] Vijayan T, Sangeetha M, Karthik B, "Efficient Analysis of Diabetic Retinopathy on Retinal Fundus Images using Deep Learning Techniques with Inception V3 Architecture," Journal of Green Engineering, Vol 10, Issue 10, pp. 9615-9625. Oct 2020

An Efficient Nonnegative Matrix Factorization Topic Modeling for Business Intelligence

[1]K PrashantGokul, [2]M.Sundararajan
{[1]kprashantgokul@gmail.com ,[2]msrajan69@gmail.com}

[1]Research Scholar, Dept. of ECE, Bharath Institute of Higher Education and Research, Chennai, India. [2]Professor & Pro-VC, Bharath Institute of Higher Education and Research, Chennai, India.

Abstract. Topic models can give us a knowledge into the basic latent design of an enormous corpus of documents. A scope of strategies have been planned in the writing, including probabilistic topic models and methods dependent on matrix factorization. Notwithstanding, the subsequent topics frequently address just broad, in this manner excess information about the data instead of minor, yet possibly significant information to clients. To handle this issue, we propose a novel sparseness improvement model of negative matrix factorization for finding excellent nearby topics. In any case, in the two cases, standard executions depend on stochastic components in their instatement stage, which can possibly prompt various outcomes being produced on a similar corpus when utilizing a similar boundary values. To address this issue in the context of matrix factorization for topic modeling, we propose the utilization of ensemble learning procedures. We show the useful utility of ENMF on New York Times dataset, and find that ENMF is particularly helpful for applied or expansive topics, where topic key terms are not surely known. We find that ENMF accomplishes higher weighted Jaccard similarity scores than the contemporary strategies..

Keywords: Topic modeling, Factorization, Ensemble, Clustering.

1 Introduction

As our collection of computerized documents keeps on being put away and gets immense, we just don't have the human ability to peruse the entirety of the documents to give topical data. Therefore, we need customized instruments for removing the effective data from the assortment. Theme displaying is such a factual model that has been shown viable for this endeavor including discovering subjects and their examples as time goes on. Theme displaying is an unaided learning as in it needn't waste time with names of the archives. The points are mined from text based substance of the archives. All things considered, the general issue for point displaying is to use the saw archives to find the mysterious subject designs. Furthermore, with the discovered themes we can organize the assortment for certain reasons, for instance requesting, overview, dimensional reduction [1] , Latent Dirichlet portion (LDA) [3] is a renowned probabilistic point model. It was made to fix a couple of issues with an in the past developed theme model probabilistic dormant semantic investigation (pLSA) [6]. LDA expects that a report typically addresses various points which are demonstrated as spread over a language. Each word in the record is made by indiscriminately picking a point from an appointment over subjects, and a while later discretionarily picking a word from a spread over the language. The normal procedures to enlist back of the model are harsh allowance

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techniques. Incredibly, the most limit probability approximations are NP-hard. Along these lines, a couple of specialists continue arranging calculations with provable confirmations for the issue of learning the subject models. These calculations consolidate nonnegative network factorization (NMF) [2]. In various applications, the records may contain metadata that we ought to fuse into subject demonstrating. Titles and labels are occurrences of the metadata that by and large go with the records in various applications. This metadata is truly made by human to depict the effective data of archives. It gets huge considering the way that reflects the essential subjects of reports just as has a limited construction. In like manner, a fitting technique to consolidate this metadata to theme displaying is depended upon to improve the show of point demonstrating. Clearly, the techniques that address the issue of fusing these metadata into NMF-based point models are at this point phenomenal. The fundamental method to manage fuse the metadata into NMF-based point demonstrating is by uniting the metadata and the text based substance of records, and a while later separating themes from this affiliation set. The relationship of both text based informational substance structures are found by a NMF calculation from tags. Having these topic-element structures, the separated topics are enhanced by words existing in textual substance identified with the element utilizing a NLS calculation at more significant level. As of late, a strategy called nonnegative various matrix factorization is proposed [11]. This technique incorporates the metadata as an assistant matrix that imparts segment to the substance matrix and afterward decays the two matrices at the same time. According to specialized perspective, this strategy is like OLLH which extricates topics from the substance and the metadata together. In addition, this strategy is material just for a particular NMF calculation.

In this paper First the technique is reached out to be appropriate for overall NMF algorithm. At the inferior level, topics is found by a NMF calculation substance. Given the topics and the substance, topic-content constructions are approximated utilizing a NLS calculation. Having these topic-content designs, the separated topics are improved by words existing in the metadata utilizing a NLS calculation at more significant level. For instance, some online news entries share total titles and just little piece of substance, yet different applications may share the two titles and substance in a total structure. Besides, the analyses show that TLLH isn't just more proficient yet it additionally gives higher interoperability scores than OLLH. The patterns of removed principle topics throughout a time-frame might be utilized as foundation information for different applications, for example sentiment analysis [13].

Notwithstanding, when practical in visual examination, LDA has a few reasonable inadequacies in term of constancy from numerous runs and exact assembly. Besides, because of the complicatedness in the detailing and the calculation, incorporating different sorts of client criticism with LDA is relatively difficult. As a methodology for topic modeling, NMF works like LSI in that the two of them tackle a matrix deterioration issue given a specific position esteem relating to the quantity of topics. Nonetheless, as the name recommends, NMF forces non-antagonism requirements on each component of the subsequent matrices with the goal that it can look after interpret-ability. In addition, the NMF calculation is deterministic. Subsequently, except if the client modifies an underlying specification, she will acquire a similar outcome from the calculation. These attractive practices of NMF fill in as significant grounds to make UTOPIAN basically valuable and intelligent in true visual investigation by empowering the client to dynamically improve a specific outcome by intuitively changing the calculation specifications. The way wherein the embraced semisupervised NMF strategy

considers the client intercessions is instinctive on the grounds that the semi-management will be in a similar structure as the two above-portrayed topic modeling yields which the client is now acquainted with all through his/her analysis. This trademark eliminates any extra requirement for changing the client mediations back to the calculation boundaries or limitations in a vague manner.

2 RELATED WORK

Therefore, we need customized instruments for removing the effective data from the assortment. Theme displaying is such a factual model that has been shown viable for this endeavor including discovering subjects and their examples as time goes on. Theme displaying is an unaided learning as in it needn't waste time with names of the archives. The points are mined from text based substance of the archives. All things considered, the general issue for point displaying is to use the saw archives to find the mysterious subject designs. Furthermore, with the discovered themes we can organize the assortment for certain reasons, for instance requesting, overview, dimensional reduction [1] , Latent Dirichlet portion (LDA) [3] is a renowned probabilistic point model. It was made to fix a couple of issues with an in the past developed theme model probabilistic dormant semantic investigation (pLSA) [6]. LDA expects that a report typically addresses various points which are demonstrated as spread over a language. Titles and labels are occurrences of the metadata that by and large go with the records in various applications. This metadata is truly made by human to depict the effective data of archives. It gets huge considering the way that reflects the essential subjects of reports just as has a limited construction. In like manner, a fitting technique to consolidate this metadata to theme displaying is depended upon to improve the show of point demonstrating. Clearly, the techniques that address the issue of fusing these metadata into NMF-based point models are at this point phenomenal. The fundamental method to manage fuse the metadata into NMF-based point demonstrating is by uniting the metadata and the text based substance of records, and a while later separating themes from this affiliation set.

3 An Ensemble approach for NON NEGATIVE MATRIX FACTORIZATION (ENMF)

3.1 Sparseness

The idea of thin coding alludes to an illustrative plan where a couple of units are viably used to address ordinary data vectors. In actuality, this infers most units taking values near nothing while just scarcely any take significantly non-zero values. Various sparseness events have been future and utilized in the writing to date. Such measures are mappings from Rn to R which evaluate how much energy of a vector is pressed into a couple of parts. On a standardized scale, the sparsest conceivable vector ought to have a sparseness of one, though a vector with all components equivalent ought to have a sparseness of nothing. We utilize a thinnessamount dependent on the connection among the L1 standard and the L2 standard:

Sparseness (x) = √n−(∑|xi|)/q∑x2 i √n−1 (3.1)

where n is the dimensionality of x. This capacity assesses to solidarity if and just if x contain just a solitary non-zero part, and takes an estimation of nothing if and just if all segments are equivalent, introducing easily between the two limits. Our point is to oblige NMF to find arrangements with wanted levels of that point: what precisely ought to be sparse? The premise vectors W or the coefficients H? This is an inquiry that can't be offered an overall response; everything relies upon the specific application being referred to. Further, simply rendering the data matrix switches the job of the two, so it is not difficult to see that the decision of which to compel should be made by the experimenter. For instance, a specialist dissecting infection patterns may expect that most sicknesses are uncommon yet that every illness can cause an enormous number of manifestations.

Algorithm: NMF with sparseness constraints

1. Prepare W and H to irregular positive matrice

2. If sparseness limitations on W smear, at that point project every segment of W to be non-negative, have unaltered L2 standard, however L1 standard set to accomplish wanted sparseness

3. If sparseness imperatives on H apply, at that point project each column of H to be non-negative, have unit L2 standard, and L1 standard set to accomplish wanted sparseness

4. Iterate

    a. If sparseness imperatives on W apply,

W := W−μW(WH−V)HT
W := W⊗(VHT) (WHHT)

    b. If sparseness imperatives on H apply,

H := H−μHWT (WH−V)

H := H⊗(WTV) (WTWH)

Above, and mean elementwise duplication and division, separately. Additionally, W and H are little positive constant which should be set fittingly for the calculation to work. Luckily, they client; our execution of the calculation naturally adjusts these boundaries.

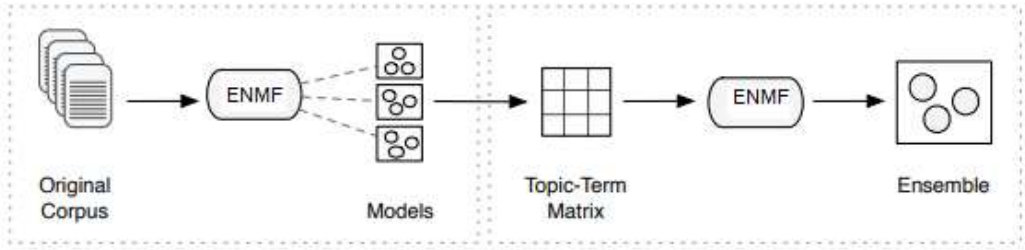

Fig 3.1 ENMF Architecture

We apply group learning for point displaying as two layers of network factorization. Fig. 3 shows a framework of the strategy, which can normally be disengaged into two phases, such as current systems in troupe grouping . Age: Create a lot of base theme models by executing r runs of NMF applied to a comparative corpus, tended to as a report term network A. Compromise:.

4.Experimental Setup

We utilize a solitary rundown of basic English stop-words for all datasets. ENMF works on bag-of-words text portrayals, as was applied to the crude frequency values. In our investigations, we think about two distinctive topic modeling draws near:

1. Standard NMF, NMF is usually introduced by allotting irregular nonnegative loads to the sections in the variables. By applying an advancement process, like rotating least squares, the elements are iteratively improved to decrease the guess blunder until a neighborhood least is reached. Therefore, the values in the underlying pair of variables will altogether affect the values in the last factors, even after countless emphasess have been performed [14].

4.1 Evaluation of Topic Models:

This segment presents the outcomes from the quantitative assessment of the ENMF, NMFD, NNDSVD algorithms by the Cv, UMass, and RS metrics. To start with, the outcomes from the assessment of ENMF, NMFD, NNDSVD algorithms models learned by the Newyorktimes data are introduced. The two ideal model's comparing algorithms from this assessment are then applied to assess how these algorithms sum up when learned with more heterogeneous data. The ENMF, NMFD, NNDSVD algorithms results are introduced in Table 6.1-Table 6.3 and Figure 6.2, Figure 6.3 and Figure 6.4,. A reasonable declining pattern was noticed for every one of the four learned ENMF models as the quantity of topics K expanded. The Cv pattern was not monotonic in its reduction nonetheless and had nearby variety spikes for little scopes of K, showing that there can be a neighborhood ideal of various topics to find in little neighborhood ranges of K.

Table 4.1 Cv coherence

Corpus	ENMF	NNDSVD	NMF
10	0.79	0.75	0.7
20	0.78	0.72	0.69
30	0.77	0.7	0.65
40	0.73	0.69	0.63
50	0.71	0.68	0.6
60	0.68	0.64	0.59
70	0.67	0.62	0.58
80	0.63	0.6	0.55
90	0.62	0.59	0.54
100	0.6	0.58	0.51

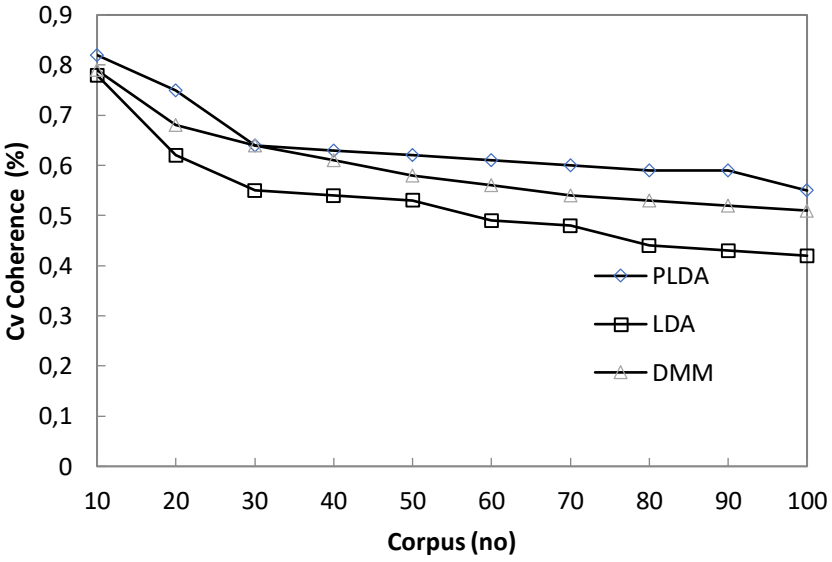

Fig .4.2 Cv Coherence

This declining trend was also observed for NMF, especially in UMass and RS, but it was not as pronounced as for ENMF. When comparing the ENMF and NNDSVD, NMFmodel it was even more clear, compared to the general case, that the optimal NNDSVD, NM did not have this notable declining trend. The ENMF achieved stable coherence scores for any number of topics up to 100 but had slightly decreasing coherence scores from 10 to 100 topics.

Table 4.2 UMass

	ENMF	NNDSVD	NMF
10	-3.2	-2.2	-1.3

20	-3.3	-2.3	-1.6
30	-3.8	-2.8	-1.9
40	-3.9	-2.9	-2.3
50	-4.2	-3.1	-2.5
60	-4.3	-3.3	-2.9
70	-4.6	-3.6	-3.2
80	-5.1	-3.7	-3.3
90	-5.2	-3.9	-3.6
100	-5.6	-4	-3.7

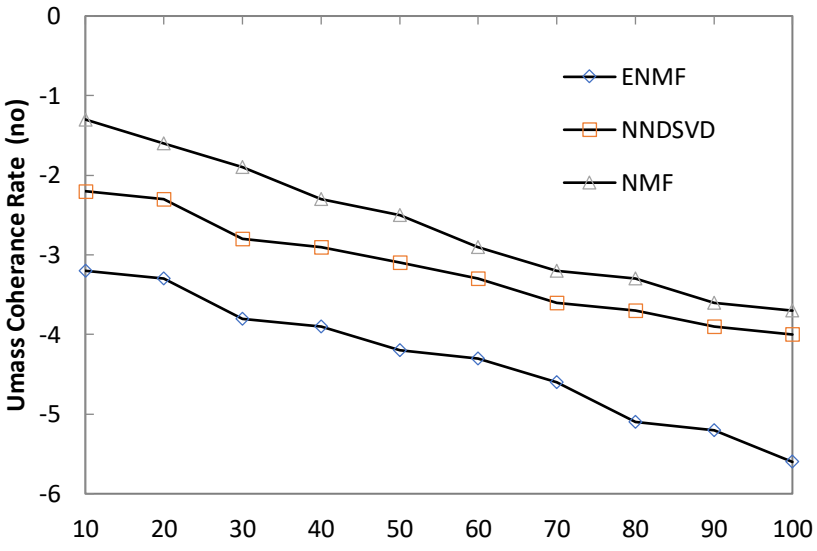

Fig .4.3 Umass Coherence

Although the ENMF model was superior in the Cv coherence score to the NMF, NNDSVD model for the lower end of the topic spectrum, they both had approximately the same coherence score for the higher end of the spectrum. For UMass these two versions were alike. The ENMF did perform better in the bottom 10 percent aggregation for both coherence scores, however, and in particular for UMass compared to the NMFD and NNDSVD. For the RS score, the ENMF exceeded the optimal NMF on average, while the bottom 10 percentile was alike.

Table 4.3 RS Score

No.of Corpus	**ENMF**	**NNDSVD**	**NMF**
10	0.45	0.4	0.38

20	0.48	0.41	0.39
30	0.52	0.42	0.41
40	0.56	0.45	0.42
50	0.61	0.49	0.45
60	0.62	0.51	0.47
70	0.63	0.53	0.52
80	0.67	0.54	0.59
90	0.7	0.57	0.61
100	0.71	0.61	0.62

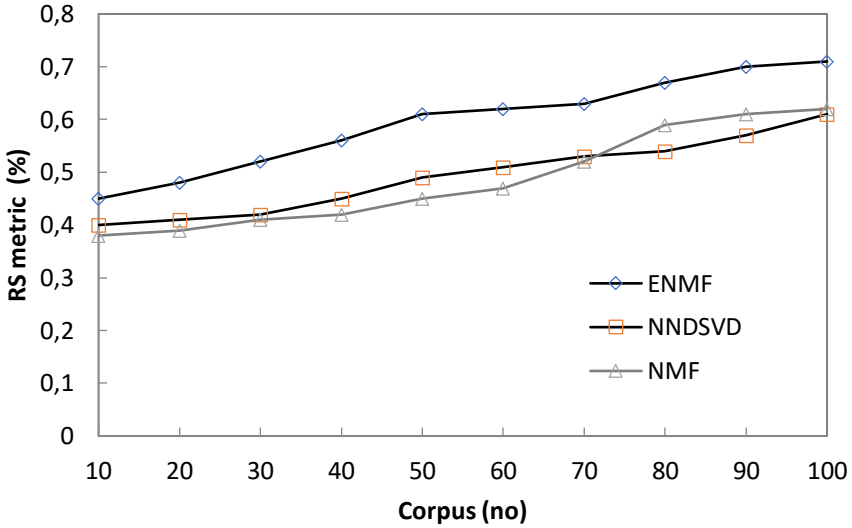

Fig .4.4 RS Metric

5. Conclusion

In these articles we introduced a novel subject demonstrating method, ENMF, that improves human interpretability of themes found from gigantic, deficiently understood corpora of reports. In such applications, ENMF engages the customer to fuse oversight by giving examples of archives needed point structure. Notwithstanding the way that we focused in on the enumerating of ENMF for subject demonstrating, this procedure can, with fitting choice of oversight, be instantly summarized to any non-negative framework decay application. We developed an iterative estimation for ENMF subject to multiplicative updates and exhibited the monotonic it of the computation and its association to a local ideal. Finally, we ran ENMF on the New York Times stood out the method from bleeding edge subject displaying techniques. We have shown that ENMF is an effective subject displaying methodology that should be considered in applications when human interpretability is critical.

References

[1] H Wu and Z Liu. “Non-negative matrix factorization with constraints”, In Proceedings of the 24th AAAI Conference on Artificial Intelligence, pp. 506–511, 2010.

[2] Gen Li, Dan Yang, Andrew B Nobel, and HaipengShen. “Supervised singular value decomposition and its asymptotic properties”, Journal of Multivariate Analysis, vol.146, pp.7–17, 2016.

[3] Jean-Philippe Brunet, Pablo Tamayo, Todd R Golub, and Jill P Mesirov. “Metagenesandmolecular pattern discovery using matrix factorization”, Proceedings of the national academyof sciences, vol.101, no.12, pp.4164–4169, 2004.

[4] Jonathan Chang, Jordan Boyd-Graber, Chong Wang, Sean Gerrish, and David M. Blei. “Read ing tea leaves: How humans interpret topic models”, In Neural Information Processing Systems,2009.

[5] Yanhua Chen, ManjeetRege, Ming Dong, and Jing Hua. “Non-negative matrix factorization for semi-supervised data clustering”, Knowledge and Information Systems, vol.17, no.3, pp.355–379, 2008.

[6] Steven Bird, Ewan Klein, and Edward Loper. “Natural Language Processing with Python”, O’Reilly Media, Inc., 1st edition, 2009.

[7] David M Blei. “Probabilistic topic models”, Communications of the ACM, vol.55, no.4, pp.77–84, 2012.

[8] S. Arora, R. Ge, Y. Halpern, D. Mimno, and A. Moitra. “A practical algorithm for topic modeling with provable guarantees”, In proceeding of the 30th International Conference on Machine Learning, 2013.

[9] S. Arora, R. Ge, and A. Moitra, “ Learning topic models-going beyond svd”, In Proceeding of the IEEE 53rd Annual Symposium on Foundations of Computer Science, pages 1–10, 2012.

[10] M. W. Berry, M. Browne, A. N. Langville, V. P. Pauca, and R. J, “Plemmons. Algorithms and applications for approximate nonnegative matrix factorization”, Computational Statistics and Data Analysis, vol.15, no.1, pp.155–173, 2007.

[11] V. Bittorf, B. Recht, C. Re, and J. A. “Factoring nonnegative matrices with linear programs”, In Neural Information Processing Systems, 2012.

[12] E. Cambria, B. Schuller, Y. Xia, and C. Havasi, “New avenues in opinion mining and sentiment analysis”, IEEE Intelligent Systems, vol.28, no.2, pp.15–21, 2013.

[13] R. Feldman. Techniques and applications for sentiment analysis. Communication of the ACM, vol.56, no.4, pp.82–89, 2013.

[14] Lee, D.D.: “Learning the parts of objects by non-negative matrix factorization. Nature” vol.401, no.6755, pp.788–791, 1999

[15] Gonzalez, E.F., Zhang, Y, “Accelerating the lee-seung algorithm for nonnegative matrix factorization”, Department of Computational Applied Mathematics Rice University(CAAM) Houston TX Technical, pp. 1–13, 2005.

[16] Ding, C.H.Q., Tao, L., Jordan, “M.I.: Convex and semi-nonnegative matrix factorizations”. IEEE Transactions on Pattern Analysis and Machine Intelligence, vol.32, no.1, pp.45–55, 2010.

[17] M. Berry, M. Browne, A. Langville, V. Pauca and R. Plemmons, "Algorithms and Applications for Approximate Nonnegative Matrix Factorization", *Computational Statistics and Data Analysis*, vol. 52, no. 1, pp. 155-173, 2007.

[18] M. Gupta and J. Xiao, "Non-Negative Matrix Factorization as a Feature Selection Tool for Maximum Margin Classifiers", *Proc. IEEE Conf. Computer Vision and Pattern Recognition*, 2011.

[19] Z. Yang, H. Zhang, Z. Yuan and E. Oja, "Kullback-Leibler Divergence for Nonnegative Matrix Factorization", *Artificial Neural Networks and Machine Learning*, vol. 6791, pp. 250-257, 2011

Palmprint Biometric System using Line based Feature Extraction Methods

Sathish R[1], Baskar D[2], Vinod Kumar D[3]
sathishlec25@gmail.com, basindia.kd@gmail.com, vino.kd@gmail.com

[1]Research Scholar - Electronics & Communication Engineering, [3]Professor & Head - Biomedical Engineering, Vinayaka Mission's Kirupananda Variyar Engineering College, Vinayaka Mission's Research Foundation (Deemed to be University), Salem, Tamil Nadu, India.
[2]Assistant Professor - Electrical & Electronics Engineering, Annai Teresa College of Engineering, Viluppuram, Tamil Nadu, India.

Abstract: Biometrics is the study of estimating human qualities to confirm or recognize the personality of a person. Palmprint is one of the human physiological attributes acquiring consideration among analysts as the mean of security. The Chinese Academy of Sciences Institute of Automation (CASIA) database is used for investigations. Lines or boundaries carry vital information for object recognition. Principal lines, Wrinkles and Ridges are categorized as line features. Competent Line-based feature extraction methods used for various object recognition are selected and discussed. The palmprint line features are extracted using Prewitt Edge Detector, Sobel operator, Canny Edge Detector, Kirsch Operator and Multiscale Edge Detector. In which Kirsch Operator performs good and achieves 94.95% accuracy for 1% of FAR and 94.85% accuracy for 2% of FAR.

Keywords: Biometrics, Palmprint, Authentication, Line features Object Recognition

1 Introduction

Biometrics is obtained from the Greek words "Bio" signifes life and "Metrics" signifies to measure. Biometrics is the study of estimating human qualities to confirm or recognize the personality of a person. It is additionally used to recognize people in bunches that are under reconnaissance. Biometrics are mainly classified as physiological and behavioral characteristics.

2 Palmprint

Palmprint is one of the human physiological attributes. It is special in light of the fact that each palmprint is unique in relation to other people. It is demonstrated that palmprint contains rich hereditarily disconnected highlights for ordering indistinguishable twins. Palmprint is lasting or indivisible from the individual contrasted with recognizable proof things. Palmprint is not difficult to gather and steady since it doesn't change essentially after some time [1,2,3,4,5]. It can be used to compare digitally with other individuals. Due to its size and features rich it is hard to imitate. It consists of various features such as geometry, point, line, texture, and statistical.

3 Line-Based Operators

Principal lines, wrinkles and ridges are the three line features of palmprint. Heart line, life line and head line are the three major types of principal lines. The coarse lines are called as wrinkles and the fine lines are called as ridges. The palmprint line features are shown in Fig 1. To accurately extract the line features is the main challenge in line based feature extraction. The direction of lines on Palmprint is difficult to predict.

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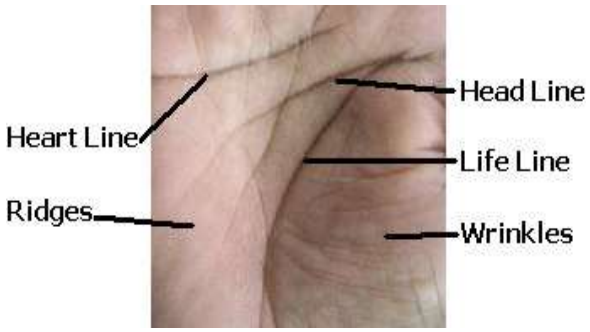

Fig 1. Palmprint Line Features

Lines or boundaries carry vital information for object recognition. There are many line detection methods applied widely for object recognition system. Some of the established line detection methods and certain emerging methods are investigated as feature extraction for palmprint. For remote sensing application Canny edge detector is used for feature extraction the result was robust [8]. Prewitt edge detector is used as a edge detection algorithm in mammographic images. Parametes such as tumor location, brest boundary and pectoral region are viewed clearly. This was used specifically for enhancing the tumor area in mammographic images [9]. Sobel operator is used in applications involving observation framework and clinical determination under low illumination or lack of visible light or medical requirements, thermal imaging [10]. The adaptation and optimization of Sobel and Canny edge detector algorithms are used in various applications such as augmented reality, computer vision & mobile phone videos processing softwares.

The proposed solution was robust and can be efficiently used in power device which use very low power [11]. Sobel Edge Detection was used to detect vehicle number plates [12]. Various sourrses of noise currupt the real images. Multi Scale edge Detector is used to preserve the quality of the image comparing to linear filters [13]. Multiscale Edge Detection is used in medical ultrasound signals [14].

The Kirsch Edge Detector and Prewitt edge Detector also showed good results in mammographic images [15]. These operators are not investigated for feature rich object like palmprint However these entire operators have demonstrated high efficiency for various computer vision and biomedical applications.

4 Line Detection for Palmprint

Palmprint line features can be extracted using Prewitt Edge Detector, Sobel operator, Canny Edge Detector, Kirsch Operator and Multiscale Edge Detector.

4.1 Prewitt Edge Detector

Edge detection is found out by differentiating the changes in image intensity. It is important to implement averaging within the edge detection process. The Prewitt edge detection method consist of two templates, *Mx & My*, over the three columns. The length of the vector is *M* and θ is the angle of the vector.

The rate of change of brightness is illustrated in Fig 2. The appropriate quadrant for the edge direction is determined using the signs of *Mx* and *My*.

$$M = \sqrt{Mx(x,y)^2 + My(x,y)^2} \tag{1}$$

$$\theta(x,y) = \tan^{-1}\left(\frac{My(x,y)}{Mx(x,y)}\right) \tag{2}$$

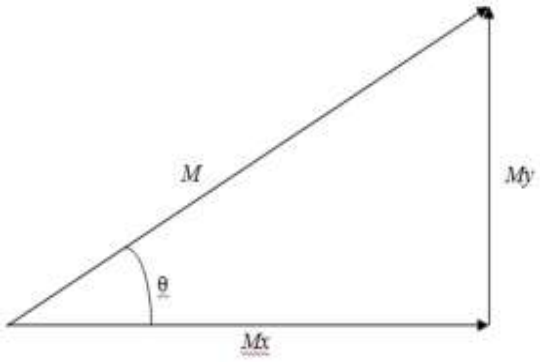

Fig 2. Edge Detection in Vectorial Format

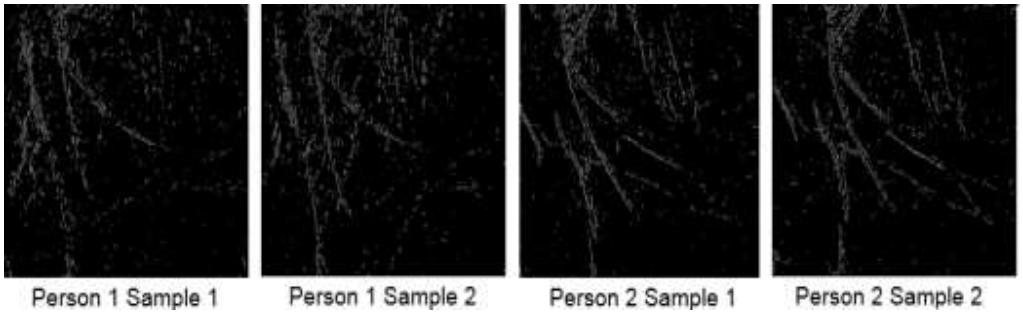

Fig 3. Results for Prewitt Edge Detector

Table 1. FAR, FRR and Accuracy Table for Prewitt Edge Detector

Threshold	FAR	FRR	Accuracy
0.25	0.29	0.22	74.49
0.5	0.25	0.20	77.33
0.75	0.22	0.19	79.44
1	0.18	0.18	**81.99**
1.25	0.15	0.23	80.99
1.5	0.11	0.26	81.47
1.75	0.08	0.29	81.5
2	0.075	0.32	80.25
2.25	0.068	0.35	79.1
2.5	0.057	0.39	77.65
2.75	0.042	0.41	77.4
3	0.037	0.42	77.15
3.25	0.022	0.47	75.4
3.5	0.015	0.48	75.25
3.75	0.006	0.51	74.2

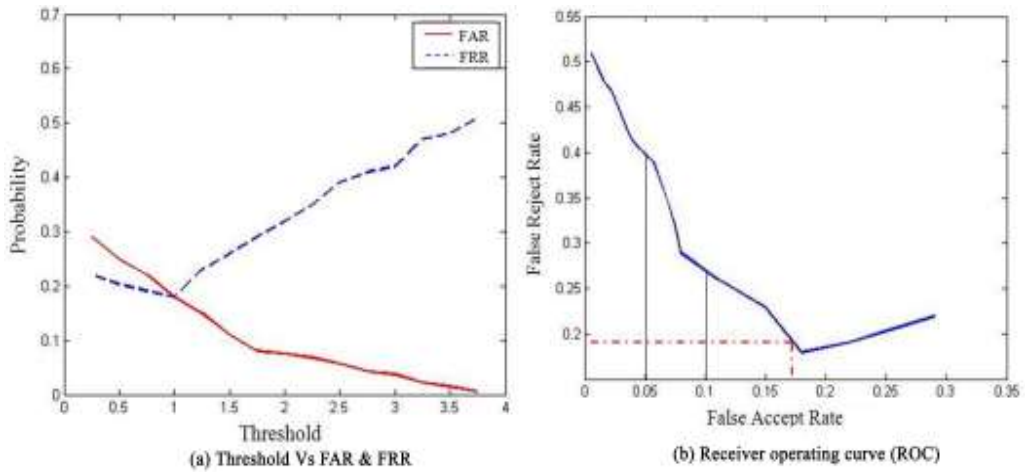

Fig 4. Accuracy plot for Prewitt edge detector

Prewitt Edge Detector results on palmprint images are given in Fig 3. From Table 1 it is observed the accuracy at approximate Equal Error rate is 81.995% and corresponding FAR and FRR values are 18% and 18.01% respectively. Prewitt Edge Detector achieves 77.65% accuracy for 5% of FAR and 81.5% accuracy for 10% of FAR. In Fig 4 Variations for FAR and FRR Vs Threshold and Receiver Operating Curve for Prewitt Edge Detector have been plotted respectively.

4.2 Sobel Operator

The sobel operator is popular because of its overall performance over further edge detection operators. Conventional (3 x 3) Sobel operators are used to detect horizontal and vertical lines.

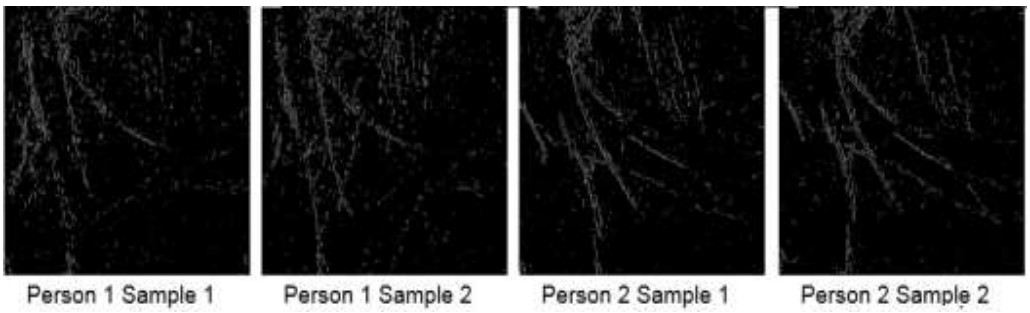

Fig 5. Results for Sobel Operator

The results for Sobel Operator on Palmprint images are shown in Fig 5. From Table 2 it is observed the accuracy at approximate Equal Error rate is 84.8% and corresponding FAR and FRR values are 15.2% and 15.2% respectively. It also achieves 79.01% accuracy for 5% of FAR and 84.385% accuracy for 10% of FAR. In Fig 6 Variations for FAR and FRR Vs Threshold and Receiver Operating Curve for Sobel Operator have been plotted respectively.

Table 2. FAR, FRR and Accuracy table for Sobel Operator

Threshold	FAR	FRR	Accuracy
0.01	0.20	0.16	81.55
0.02	0.19	0.15	82.6
0.03	0.18	0.15	83.1
0.04	0.17	0.14	84.25
0.055	0.15	0.15	**84.8**
0.06	0.13	0.18	84.35
0.075	0.11	0.19	84.54
0.08	0.09	0.22	84.38
0.09	0.07	0.28	82.20
0.1	0.05	0.37	79.01
0.25	0.03	0.39	78.51
0.55	0.02	0.41	78.08
0.75	0.011	0.42	78.38
1.1	0.01	0.45	77.27
1.5	0.004	0.48	75.68

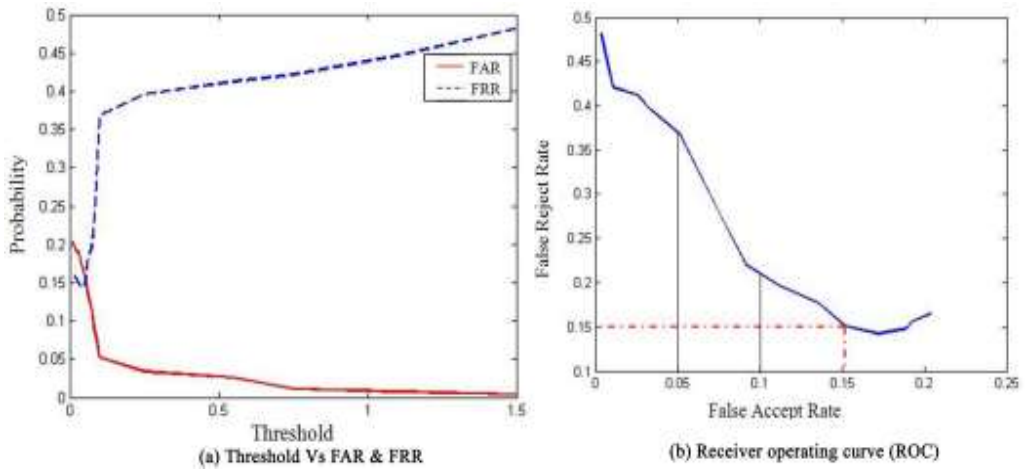

Fig 6. Accuracy plot for Sobel edge detector

4.3 Canny Edge Detector

The main objectives of Canny edge detector are Optimal detection, good localisation and true edge position. The signal to noise ratio is over come by Non linier suppression. It concerns location of a single edge point in response to a change in brightness. To detect the wide range of images multi stage algorithm is used. The maximum value of the edge is detected using gradient intensity matrix.

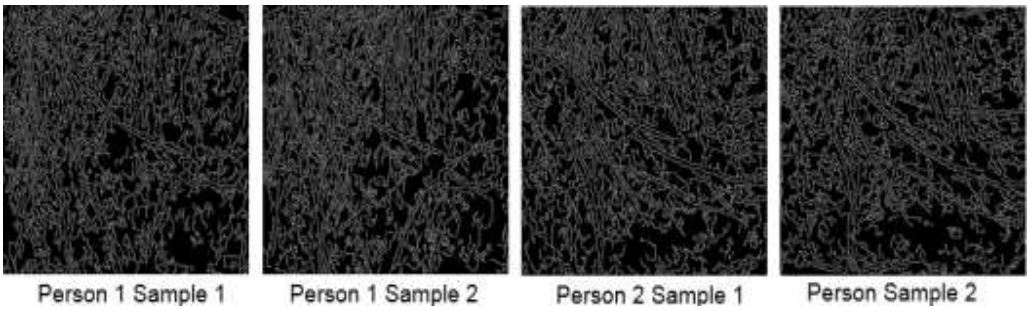

Fig 7. Results using Canny Edge Detector

Table 3: FAR, FRR and Accuracy Table for Canny Edge Detector

Threshold	FAR	FRR	Accuracy
0.25	0.14	0.11	87.51
0.5	0.14	0.11	87.12
0.75	0.12	0.12	**87.84**
1	0.11	0.14	87.63
1.25	0.10	0.15	87.72
1.5	0.10	0.15	87.51
1.75	0.09	0.16	87.69
2	0.08	0.17	87.70
2.25	0.07	0.18	87.55
2.5	0.06	0.19	87.62
2.75	0.05	0.20	87.78
3	0.04	0.21	87.7
3.25	0.03	0.22	87.72
3.5	0.01	0.24	87.39
3.75	0.01	0.25	87.69

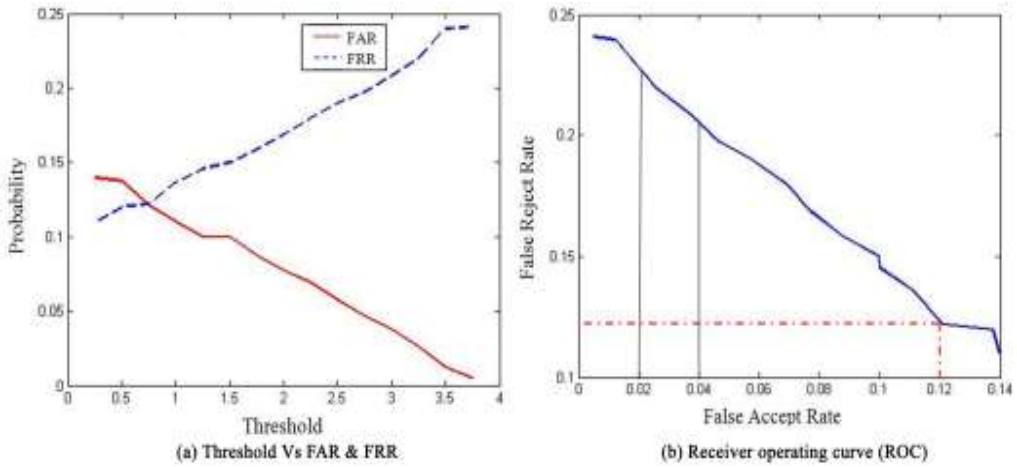

Fig 8: Accuracy plot for Canny edge detector

The results for Canny Edge Detector on palmprint images are shown in Fig 7. From the Table 3 it is observed the accuracy at approximate Equal Error rate is 87.84% and corresponding FAR and FRR values are 12.11% and 12.21% respectively. It also achieves 87.715% accuracy for 2% of FAR and 87.785% accuracy for 10% of FAR. In Fig 8. Variations for FAR and FRR Vs Threshold and Receiver Operating Curve for Canny Edge Detector have been plotted respectively.

4.4 Kirsch Operator

The Kirsch operator is an edge detection method that can find the maximum edge strength in eight predetermined directions or say using eight compass filters. The eight major compass orientations are respectively, N, NW, W, SW, S, SE, E, and NE. These filters are applied to the image with the maximum being retained for the final image.

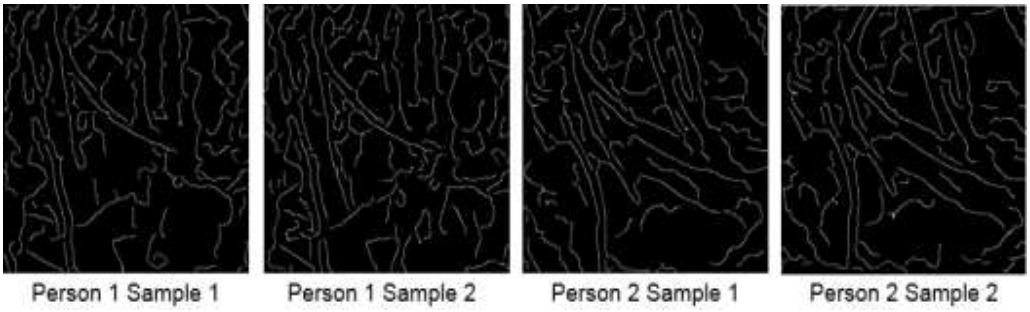

Fig 9. Results using Kirsch Operator

Table 4:FAR, FRR and Accuracy Plot for Kirsch Operator

Threshold	FAR	FRR	Accuracy
1.3	0.085	0.021	94.69
1.7	0.079	0.028	94.64
2.1	0.073	0.031	94.82
2.5	0.07	0.037	94.7
2.9	0.06	0.041	94.89
3.3	0.05	0.049	**94.95**
3.7	0.05	0.052	94.85
4.1	0.05	0.057	94.74
4.5	0.04	0.061	94.85
4.9	0.037	0.065	94.89
5.3	0.03	0.073	94.74
5.7	0.028	0.078	94.69
6.1	0.02	0.084	94.85
6.5	0.01	0.089	94.95
6.9	0.01	0.099	94.75

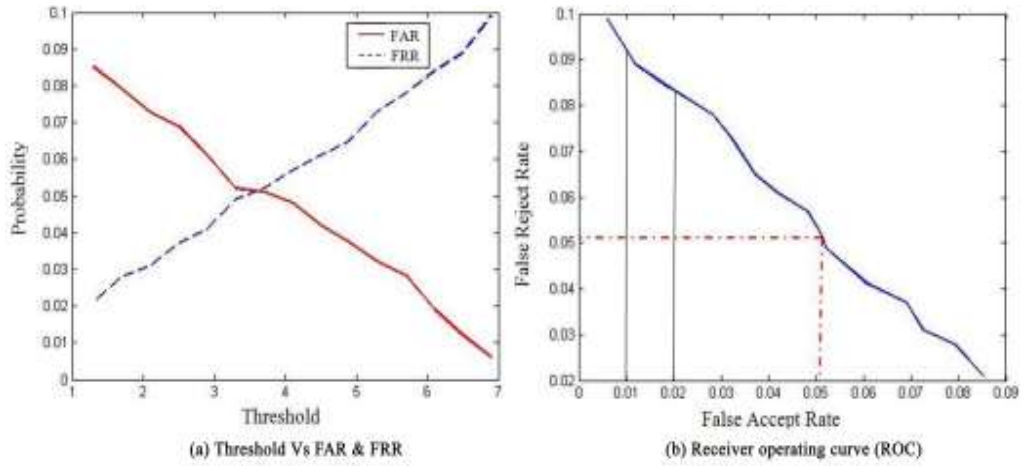

Fig 10. Accuracy plot for Kirsch edge detector

The results for Krisch Operator on Palmprint images are shown in Fig 9. From the Table 4 it is observed the accuracy at approximate Equal Error rate is 94.945% and corresponding FAR and FRR values are 5.21% and 4.9% respectively. It also achieves 94.945% accuracy for 1% of FAR and 94.845% accuracy for 2% of FAR. In Fig 10. Variations for FAR and FRR Vs Threshold and Receiver Operating Curve for Kirsch Operator have been plotted respectively.

4.5 Multiscale Edge Detector

In Multiscale Edge Detection method the aim is to simultaneously extract edges of all lengths, in both natural and noisy images. In order to minimize the amount of data edge detection is used. It is used to find the boundaries inside an image. It works by detecting disjointedness in brightness. The brightness of the image varies sharply are called the edges. Convolution techniques are used to to process high resulation images.

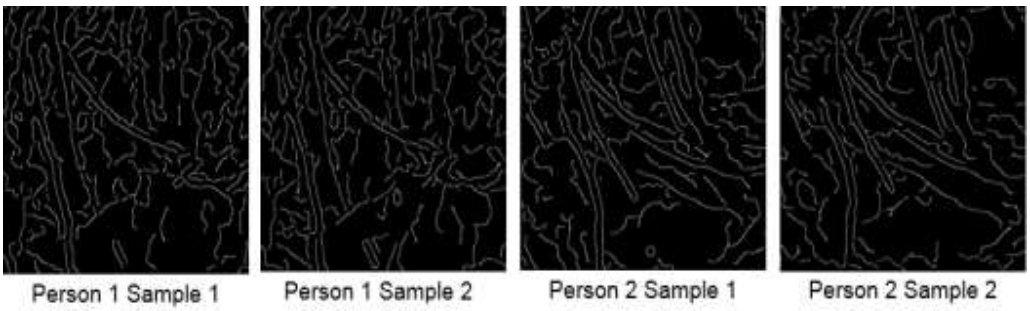

Fig 11: Results using Multiscale Edge Detector

The results for Multiscale Edge Detector on Palmprint images are shown in Fig 11. From Table 5 it is observed the accuracy at approximate Equal Error rate is 93.8% and corresponding FAR and FRR values are 6.4% and 6% respectively. It also achieves 93.28% accuracy for 1% of FAR and 94.045% accuracy for 2% of FAR. In Fig 12 Variations for FAR and FRR Vs Threshold and Receiver Operating Curve for Multiscale Edge Detector have been plotted respectively.

Table 5: FAR, FRR and Accuracy Table for Multiscale Edge Detector

Threshold	FAR	FRR	Accuracy
0.05	0.095	0.029	93.8
0.08	0.081	0.0309	94.405
0.1	0.078	0.041	94.05
0.13	0.075	0.048	93.85
0.16	0.07	0.052	93.9
0.17	0.064	0.06	**93.8**
0.18	0.062	0.06	93.9
0.19	0.059	0.063	93.9
0.21	0.046	0.072	94.1
0.23	0.038	0.087	93.75
0.24	0.032	0.08	94.4
0.26	0.021	0.093	94.3
0.29	0.0201	0.099	94.045
0.33	0.0124	0.122	93.28
0.35	0.005	0.14	92.75

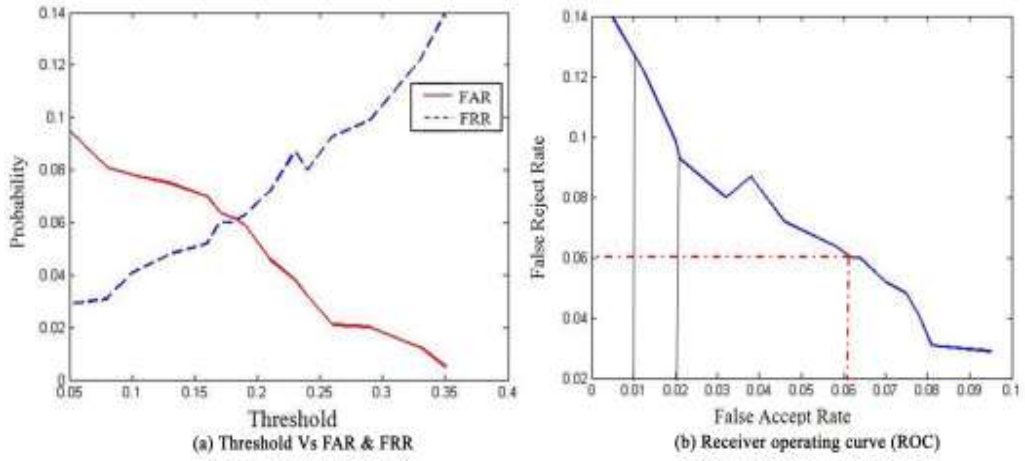

Fig 12: Accuracy plot for Multi-Scale edge detector

5 Result & Discussion

The line-based feature extraction method is applied on Palmprint extracted in the pre-processing stage. The graphs and tables corresponding to various line feature extraction methods such as Prewitt Edge Detector, Sobel Operator, Canny Edge Detector, Kirsch Operator and Multiscale Edge Detector are discussed. Table 6. presents the comparison of FAR, FRR and Accuracy of various Line based methods analysed. Based on the analysis Kirsch Operator shows better results than other line based methods. It achieves 94.945% accuracy for 1% of FAR and 94.845% accuracy for 2% of FAR.

Table 6: Comparison of FAR, FRR and Accuracy of various Line Based Methods

Method Name	Accuracy FAR = FRR	Accuracy for (FAR %)	Accuracy for (FAR %)
PREWITT	81.995	77.65 (5%)	81.5 (10%)
SOBEL	84.8	79.01 (5%)	84.385 (10%)
CANNY	87.84	87.715 (2%)	87.785 (10%)
MUTISCALE	93.8	93.28 (1%)	94.045 (2%)
KIRSCH	**94.945**	**94.945 (1%)**	**94.845 (2%)**

6 Conclusion

Individual verification utilizing palmprint is acquiring fame as a result of palmprint being a component rich and carefully designed biometric. The line based methods are scrutinized with MATLAB programming. The increase in FAR prompts to less security or legitimate verification leads to accept any person as genuine. Various performance measures such as FAR, FRR, ERR and Accuracy used to evaluate the performance of a biometric systems are discussed. Efficient line-based feature extraction methods used for various object recognition are selected and those methods are implemented on palmprint and their efficiency is analyzed. Based on the analysis Kirsch Operator shows better results than other line based methods. It achieves 94.945% accuracy for 1% of FAR and 94.845% accuracy for 2% of FAR.

References

[1] Muthukrishnan, A.; Charles Rajesh Kumar, J.; Vinod Kumar, D.; Kanagaraj, M. Internet of image things-discrete wavelet transform and Gabor wavelet transform based image enhancement resolution technique for IoT satellite applications. Cogn. Syst. Res. 2019, 57, 46–53.

[2] D. Vinod Kumar, A. Nagappan. "Performance Analysis of Security and Accuracy on Palmprint Based Biometric Authentication System," International Journal of Innovative Research in Computer and Communication-Engineering, Vol. 3, Issue 7, July 2015, pp 6697-6704.

[3] Charles Rajesh Kumar.J , Vinod Kumar.D, Baskar.D, Mary Arunsi.B, Jenova.R, ,M.A.Majid." VLSI design and implementation of High-performance Binary-weighted convolutional artificial neural networks for embedded vision based Internet of Things (IoT)".16th International Learning & Technology Conference (L&T), Procedia Computer science (Elsevier), Jeddah,2018.

[4] D. Vinod Kumar, A. Nagappan. "Study and comparison of various point based feature extraction methods in palmprint authentication system," International Journal of Computational Engineering Research (IJCER) , Vol. 2, Issue 8, December 2012, pp 82-89.

[5] D. Vinod Kumar, A. Nagappan, Jyoti Malik "Phase Congruency Corner Detection as Biometric Feature," IRACST - International Journal of Computer Science and Information Technology & Security (IJCSITS), Vol. 2, Issue 2, February 2012, pp 179-185.

[6] Kong A. W. K., Zhang D. and Lu G., "A study of identical twins' palmprints for personal verification", Pattern Recognition, Vol. 39, Issue 11, Pages 2149-2156, November 2006.

[7] Baskar. D, Selvam. P, "Machine Learning framework for Power System Fault Detection and Classification," International Journal of Scientific & Technology Research, vol. 9, no. 2, pp. 2002-2008, Feb. 2020.

[8] Mohamed Ali and David Clausi, "Using The Canny Edge Detector for Feature Extraction and Enhancement of Remote Sensing Images*", 7803-7031-7/01IEEE*, Pages 2298-2300, January 2001.

[9] Chunsun Zhang, Emmanuel Baltsavias and Armin Gruen, "Knowledge-Based Image Analysis for

3D Road Reconstruction", *Asian Journal of Geoinfomatics*, Vol.1, No. 4, Pages 3-14, June 2001.

[10] Ching Wei Wang, "Real Time Sobel Square Edge Detector for Night Vision Analysis", *ICIAR 2006, LNCS 4141*, Springer-Verlag Berlin Heidelberg Pages 404–413, May 2006.

[11] Marcelo G. Roque, Rafael M. Musmanno, Anselmo Montenegro and Esteban W. G. Clua, "Adapting the Sobel Edge Detector and Canny Edge Extractor for iPhone 3GS architecture", *IWSSIP 2010 - 17th International Conference on Systems, Signals and Image Processing,* Pages 486-489, Dec 2010.

[12] Suri P.K., Ekta Walia and Amit Verma, "Vehicle Number Plate Detection using Sobel Edge Detection Technique", *International Journal on Computer Science and Technology (IJCST)* Vol. 1, Issue 2, Pages 179-182, December 2010.

[13] Qimei Hu, Xiangjian He and Jun Zhou, "Multi-Scale Edge Detection with Bilateral Filtering in Spiral Architecture", *The Pan-Sydney Area Workshop on Visual Information Processing (VIP) 2003*, Sydney. Conferences in Research and Practice in Information Technology, Vol. 36, Pages, Nov 2003.

[14] Preben Gråberg Nes, "Fast multi-scale edge-detection in medical ultrasound signals", *Computer Vision and Pattern Recognition (cs.CV); Medical Physics (physics.med-ph)*, Vol. 1, July 2011.

[15] Sumit Chopra, Pankaj Bhambri and Baljit Singh, "Segmentation of the Mammogram Images to find Breast Boundaries", *IJCST* Vol. 2, Issue 2, Pages 164-167, June 2011.

Mapping the Research Productivity on Water Conservation: A Scientometric Analysis

Dr.PrabakarStanleay[1], Dr.M.Nagarajan[2], Dr.S.Sivankalai[3]
{stanleay@gmail.com[1], mnagarajanlib@gmail.com[2], skysivan@gmail.com[3]}

Librarian, B.I.H.E.R. – Deemed to be University, Selaiyur, Chennai. Orchid ID: 0000-0002-7079-4219[1], Assistant Librarian, AMET – Deemed to be University,Kanathur, Chennai. Orchid ID: 0000-0003-0180-2462[2], Librarian, PSN College of Engineering & Technology, Tirunelveli. Orchid id:0000-0002-1174-7594[3]

Abstract. The importance of "Water Conservation" and scientometric study has been highlighted in the introductory part of the article. A few literatures related to the scientometric study have been reviewed. To know the reflection of the responsibility of the global scientists to conserve the water towards the protection of the society is the aim of this scientometric study. The data selected for the scientometric study is limited to eight years from 2011 to 2018 and also the data is confined to the database "Web of Science". Appropriate hypotheses have been framed and tested with statistical tools such as Regression and Kolmogorov Smirnov Test. The deviation among the year wise number of publications are tested through Regression Test and found that the data are suitable for the calculation of doubling time. The minimum time to be taken for the doubling of records will be5 months and 8 days and the maximum time to be taken for the doubling of records will be 9 months. The "Journal Articles' and the language "English" played dominant role over the entire period of research publications. .Kolmogorov Smirnov Test proved that Lotka's Law of author productivity does not fit for the research publications author productivity on "Water Conservation". The Bradford's Law identified that 25 journals are most productive. The article is concluded with a suggestion to the concerned global ministries and sponsoring bodies to encourage the scientists to enhance the "Water Conservation"..

Keywords: Scientometric, Water Conservation, Regression Test, Doubling Time, Lotka's Law, Kolomogorov Smirnov Test, Bradford's Law.

1 Introduction

Water is one of the prime resource facets to live in the earth for each and every living being is a well-known concept. "Water Conservation" is an act of potential to protect the society from disaster. Not only the deficiency of the water, but also the excess of water through natural calamities such as flood and heavy rain will also bring disaster to the lives of this earth, if the water has not been conserved properly. Therefore, appropriate conservation of water is very much essential for the entire global countries. An article accessed from Google, clearly depicts that 96.5 percent is the volume of water on the surface of the earth and out of which, 2.5 percent are usable freshwater. The volume of freshwater in the form of ice-sheets and glaciers are 70 percent and the remaining 30 percent are stored in ground.[1]How the act of "Today's News will be the History of tomorrow", likewise, "Today's Conservation of

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Water will be enacted as Lives for the society, tomorrow". Water can be conserved through appropriate maintenance of ponds, lakes, rivers, dams, drip irrigation system and rain water harvesting. Some of the pictures collected from Wikipedia on "Water Conservation" are displayed below in figure number 1 and 2 to have a clear visualization.

Scientometric is a powerful metric to device the research output of any discipline, any individual scientist, educational institutions, country wise publications, language wise publications, document wise and journal wise publications. The data for the scientometric study can be collected either from print media or from an online indexing database such as Web of Science, Scopus, Google Scholar, and MEDLINE. Data for this research work has been downloaded from the core collections of Web of Science.

2. Review of Literature

Liu, Z., Lu, Y., &Peh, L. C. (2019). The Scientometric analysis was done on "Building Information Modelling". The data selected for the scientometric study was from 2004 to 2019. The data were collected from the Web of Science core collections. The analysis and visualization has been done by the Cite-Space software. The research study reveals that 1455 literatures were published from 2004 to 2019 and the same has been graphed in the article. The year 2018 was most prolific. The table number two shows the top ten authors. Xiangyu Wang of Curtin University located in Australia was placed first in the table with a record count of 41(2.82%). USA published most number of research papers with 341 publications. "Curtin University" of Australia published maximum number of research publications of 69 records. The journal "Automation in Construction" was most productivity with 294 research papers. The research publications have been bifurcated into three layers viz., (i) Formulating Stage, (ii) Accelerating Stage and (iii) Transformation Stage.[2]**Sivasamy, K., &Vivekanandhan, S. (2015).** The scientometric research assessment was done on "Environmental Education". The selected years for the research work were from 2009 to 2013. Required data for the scientometric research was downloaded from SCOPUS. It was identified that 2062 number of research papers were indexed in SCOPUS on "Environmental Education". The degree of collaboration was 0.68, which means a fair collaboration between the authors involved in publishing research publications on "Environmental Education". It was identified that USA published maximum number of research publications of 515.[3]**Morooka, K (2014)** the bibliometric study reveals the rise research and technology development of Japanese. The research period of the study was from 1990 to 2000. The research period has been bifurcated into two segments i.e., from 1990 to 1994 and from 1995 to 2000. It was identified that there was more frequency distribution among two periods between the subject disciplines, except biology. A total of 9389 articles were published in 1611 journals from the year of 1990 to 2000. The Bradford's law has been applied to categorize the publications into three zones to identify the core journals. The first zone was more productive publications through less number of journals. The second zone reveals that more number of journals were utilized to produce less number of articles. The third zone shows all the journals, which are responsible for publishing least number of articles. But, at the outset the three zone reveals the entire structure of the research output of the research and technology development of Japanese.[4]**Ren, J. L., Lyu, P. H., Wu, X. M., Ma, F. C., Wang, Z. Z., & Yang, G. (2013).**The research output on "Water Resources" indexed in Web of

Science from 1993 to 2008 has been taken for the bibliometric study. The study period has been categorised into four span of years. The study reveals that 18 numbers of documents were involved towards producing 96574 numbers of publications. Out of which 62258(64%) were journal articles. The language "English" dominated the research with a publication count of 60793 with an h-Index of 151. Cumulative numbers of publications were highlighted with pictorial representation. Bradford's law has been applied to identify the core journals and the law results that 59 journals were core journals that involved towards publishing 65528 articles**.** The country wise publications assessment states that two North American Countries were place in the top place followed by ten European countries, six Asian countries, South Africa and Australia. The institution wise assessment proves that US Geological Survey, USA leads the table with 1343 number of articles and 64 h-Index. The most cited paper were identified as the articles published in "Water Research" by Terns in 1998 with a citation score of 630 times up to the year 2008. The article was concluded with a word of possibility of further research directions on "Water Research".[5]**Biglu, M. H., Eskandari, F., &Asgharzadeh, A. (2011).**The scientometric study was done on the basis of the data downloaded from MEDLINE database on "Nanotechnology". The study period taken for the research was from 2001 to 2010. It was identified that 11991 research publications were published during the stipulated ten years. "English language played dominant role in publishing 11775 (98.2%) numbers of publication. The assessment of the type of publications reveals that the journal articles dominated the research publications with 41 percent of articles. USA leads the table with maximum numbers of publication with 55 percent and research papers with 39 percent. Time Series Analysis has been made by the author to find out that the "English Language" publications will reach almost double the publications in the year 2030.[6]

3. Research Design

3.1. Need for the Study

To know the reflection of the responsibility of the global scientists to conserve the water, as water is one of the prime factors for each and every living being to survive in this earth, by means of the assessment of their research contributions to enhance the "Water Conservation".

3.2. Limitation of the Study

Data for only 8 years from 2011 to 2018 are utilized. The source database is limited to only core collections of "Web of Science". The bibliometriclawutilized for this scientometric study is limited to the application and testing of Lotka's Law and Bradford's Law.

3.3. Hypotheses

1. H0: There is no significant relationship between the averages of the research publications

on "Water Conservation" from 2011 to 2018.

1. H0: There is no significant relationship between the actual author productivity and the

prediction of Alfred Lotka's author productivity theory.

3.4. Methodology

Data related to the research publications indexed in "Web of Science" on Water Conservation" from 2011 to 2018 has been downloaded. Appropriate hypotheses are formulated. A few scientometric techniques along with statistical tools such as Regression Test and Kolmogorov Smirnov Test have been utilized towards the completion of the research. The research is descriptive in nature.

4. Results and Discussion

4.1Year wise Research Publications on Water Conservation

The year wise research publications for 8 years tabulated in table number 4.1 reveals that a total of 2507 number of publications are published from 2011 to 2018. The percentage analysis is very clear that the growth of research publications on "Water Conservation" indexed in "Web of Science" inclined from one year to another year at a steady pace without any decline. The Local Citation Score with and without Self Citation have also been displayed. Local Citation Score, which includes self-citation score is 2108 and excluding self-citation score is 1473. The total number of publications of 2507 received 28506 as Global Citation Score for the above stipulated years.

No. of Years	Year of Publications	No. of Research Publications	Percentage Analysis	Local Citation Score		Global Citation Score
				Including Self Citation	Excluding Self Citation	
1	2011	227	9%	361	275	4949
2	2012	234	9%	318	215	4266
3	2013	263	10%	416	297	5186
4	2014	274	11%	313	229	3958
5	2015	316	13%	298	210	3755
6	2016	353	14%	241	160	3062
7	2017	391	16%	140	77	2360
8	2018	449	18%	21	10	970
Total		**2507**	100%	**2108**	**1473**	**28506**

Table 4.1. Year wise Research Publications on Water Conservation

4.2 Regression Test

The table number 4.2 shows a clear picture about Regression Test. The test has been conducted to find out the results to accept or reject the null hypothesis framed as below:

H0: There is no significant relationship between the averages of the research publications on "Water Conservation" from 2011 to 2018.

The result of the regression test reveals that the P-value of 0.04 is lesser than the critical value of 0.05, therefore the null hypothesis is rejected and an alternate hypothesis is being developed as:

H1: There is a significant relationship between the averages of the research publications

on "Water Conservation" from 2011 to 2018.

Regression Statistics	
Multiple R	0.96
R Square	0.92
Adjusted R Square	0.89
Standard Error	7.62
Observations	4

	Coefficients	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	105.352236	0.07	-21.47	232.18	-21.47	232.18
X Variable 1	957.9282817	0.04	122.18	1793.68	122.18	1793.68

Table 4.2. Regression Test

Further, the percentages of the average relationship between the variables were 92 percent. Therefore, the test further reveals that there are high possibility for calculating the doubling time of the research publications.

4.3 Doubling Time of Research Publications

Year	**No. of Records**	**Cumulative Records**	**W1**	**W2**	**R(P)**	**Mean of R(P)**	**DT= 0.693/RP**	**Average Doubling Time**	**Doubling Time**	
									Days	**Months**
2011	227	227	5.42	5.42	0.00	0.75		0.75	270 Days	9 months
2012	234	461	5.46	6.13	0.68		1.02			
2013	263	724	5.57	6.58	1.01		0.68			
2014	274	998	5.61	6.91	1.29		0.54			
2015	316	1314	5.76	7.18	1.43	1.59	0.49	0.44	158 Days	5 Months and 8 Days
2016	353	1667	5.87	7.42	1.55		0.45			
2017	391	2058	5.97	7.63	1.66		0.42			
2018	449	2507	6.11	7.83	1.72		0.40			

Table 4.3. Doubling Time of Research Publications

The eight years research publications from 2011 to 2018 have been segregated into two block years (i.e., from 2011 to 2014 and from 2015 to 2018) to assess the doubling time of the research productivity. On the basis of the number of research productivity from 2011 to 2014, the doubling time of records is assessed as 270 days or 9 months. On the basis of the number of research productivity from 2015 to 2018, the doubling time of records is assessed as 158 days or 5 months and 8 days.

4.4Type of Research Publications on Water Conservation

S. No.	Document Type	No. of Research Publications	% Analysis	Local Citation Score				Global Citation Score	h Index
				Including Self Citation	h Index	Excluding Self Citation	h Index		
1	Article	2307	92.02%	1957	14	1365	12	25580	58
2	Review	126	5.03%	105	5	75	4	2531	29
3	Article; Proceedings Paper	34	1.36%	14	2	7	2	145	6
4	Editorial Material	18	0.72%	4	2	2	1	43	3
5	News Item	6	0.24%	0	0	0	0	1	1
6	Review; Book Chapter	5	0.20%	25	2	22	1	131	4
7	Meeting Abstract	4	0.16%	0	0	0	0	1	1
8	Article; Book Chapter	2	0.08%	1	1	0	0	54	2
9	Article; Retracted Publication	2	0.08%	2	1	2	1	20	2
10	Correction	2	0.08%	0	0	0	0	0	0
11	Biographical-Item	1	0.04%	0	0	0	0	0	0
Total		**2507**	**100.00%**	**2108**	**27**	**1473**	**21**	**28506**	**106**

Table No.4.4 Type of Research Publications on Water Conservation

The table number 4.4. is crystal clear that 11 type of publications are involved in publishing research literatures on "Water Conservation". The type of document "Article" played vital role in publishing 2307(92.02%) publications and played dominant role. "Articles" received a local citation score of 1957, which includes the self-citation and gained an h-Index of 14. "Articles" received the local citation score of 1365, which excludes the self-citationand gained an h-Index of 12. "Articles" received 25580 global citation score and gained an h-Index of 58. "Reviews" placed second top in the table number 4.4. with 126(5.03%) research reviews. Papers published in conference proceedings placed in the third place with a publication count of 34(1.36%) followed by Editorial material 18(0.72%); News items 6(0.24%); Review of the Book Chapters 5(0.20%); Meeting abstracts 4(0.16%); Book chapters and retracted publications with 2(0.08%); Correction 2(0.08%) and Bibliographical item with only 1(0.04%) publication.

4.5 Language wise Research Publications on Water Conservation

The table number 4.5 shows that nine languages are involved towards publishing 2507 research publications on "Water Conservation". The language "English" played majority role with a maximum publication count of 2467(98.40%) publications. English language publications of 2467 received a local citation score of 2103, which is including self citation and the same gained an h-Index of 15. The local citation score of 1471, which is excluding self-citation for the "English" language gained an h-Index of 12. "English" language publications received a global citation score of 28407 and gained an h-Index of 61. "Portuguese" language placed in the second place with a publication count of 20nos.(0.80%). The language "Spanish" placed in the third place with a publication count of 7nos. (0.28%) followed by French 5nos.(0.20%); German 3nos. (0.12%); Turkish 2(0.08%); Chinese, Duthch and Polish with 1(0.04%) publication.

S. No.	**Language wise Publications**	**No. of Research Publications**	**% Analysis**	**Local Citation Score**				**Global Citation Score**	**h Index**
				Including Self Citation	**h Index**	**Excluding Self Citation**	**h Index**		
1	English	2467	98.40%	2103	15	1471	12	28407	61
2	Portuguese	20	0.80%	4	1	2	1	68	6
3	Spanish	7	0.28%	0	0	0	0	9	2
4	French	5	0.20%	1	1	0	0	12	3
5	German	3	0.12%	0	0	0	0	0	0
6	Turkish	2	0.08%	0	0	0	0	1	1
7	Chinese	1	0.04%	0	0	0	0	5	1
8	Dutch	1	0.04%	0	0	0	0	0	0
9	Polish	1	0.04%	0	0	0	0	4	1
Total		**2507**	**100%**	**2108**	**17**	**1473**	**13**	**28506**	**75**

Table 4.5. Language wise Research Publications on Water Conservation

4.6. Application and Testing of Lotka's Law

Alfred Lotka's author productivity theory has been applied for the research publications on"Water Conservation" and tested with Kolmogorov Smirnov Test. The meaning of the theory of Alfred Lotka's law is the entire number of productivity of publications are based on the inverse square of the total number of publications published by single author. Therefore, appropriate hypothesis has been framed and tested with KS test. The hypothesis is as follows:

H0: There is no significant relationship between the actual author productivity and the prediction of Alfred Lotka's author productivity theory.

The observed frequency has been found out. Lotka's Power Law has been applied to find out the expected frequency. The d-max (i.e., maximum deviation) between the observed frequency and the expected frequency is 0.63925. The Threshold Value is 0.03255. Since the d-max value of 0.63925 is greater than the Threshold Value of 0.03255, the null hypothesis is

accepted. Therefore, the Kolmogorov Smirnov Test proves that the Lotka's Law does not fit for the author productivity of the research publications published on "Water Conservation".

x	y	X (logx)	Y (logy)	XY	XX	"D"	cum=" O"	cum. "y"	1/xn	fe	cum fe	Dif
1	160	0.00	2.20	0.00	0.00	0.0638	0.0638	160	1	0.7031	0.7031	0.63925
2	395	0.30	2.60	0.78	0.09	0.1576	0.2214	555	0.20448	0.1438	0.8468	0.62545
3	535	0.48	2.73	1.30	0.23	0.2134	0.4348	1090	0.08080	0.0568	0.9036	0.46885
4	477	0.60	2.68	1.61	0.36	0.1903	0.6250	1567	0.04181	0.0294	0.9330	0.30798
5	360	0.70	2.56	1.79	0.49	0.1436	0.7686	1927	0.02508	0.0176	0.9507	0.18202
6	239	0.78	2.38	1.85	0.61	0.0953	0.8640	2166	0.01652	0.0116	0.9623	0.09830
7	133	0.85	2.12	1.79	0.71	0.0531	0.9170	2299	0.01161	0.0082	0.9704	0.05341
8	80	0.90	1.90	1.72	0.82	0.0319	0.9489	2379	0.00855	0.0060	0.9765	0.02751
9	45	0.95	1.65	1.58	0.91	0.0179	0.9669	2424	0.00653	0.0046	0.9810	0.01415
10	34	1.00	1.53	1.53	1.00	0.0136	0.9805	2458	0.00513	0.0036	0.9846	0.00419
11	17	1.04	1.23	1.28	1.08	0.0068	0.9872	2475	0.00412	0.0029	0.9875	0.00031
12	9	1.08	0.95	1.03	1.16	0.0036	0.9908	2484	0.00338	0.0024	0.9899	0.00091
13	1	1.11	0.00	0.00	1.24	0.0004	0.9912	2485	0.00281	0.0020	0.9919	0.00067
14	6	1.15	0.78	0.89	1.31	0.0024	0.9936	2491	0.00237	0.0017	0.9936	0.00005
15	5	1.18	0.70	0.82	1.38	0.0020	0.9956	2496	0.00203	0.0014	0.9950	0.00062
16	2	1.20	0.30	0.36	1.45	0.0008	0.9964	2498	0.00175	0.0012	0.9962	0.00019
17	2	1.23	0.30	0.37	1.51	0.0008	0.9972	2500	0.00152	0.0011	0.9973	0.00008
20	1	1.30	0.00	0.00	1.69	0.0004	0.9976	2501	0.00105	0.0007	0.9980	0.00042
21	1	1.32	0.00	0.00	1.75	0.0004	0.9980	2502	0.00094	0.0007	0.9987	0.00068
24	1	1.38	0.00	0.00	1.90	0.0004	0.9984	2503	0.00069	0.0005	0.9992	0.00077
26	2	1.41	0.30	0.43	2.00	0.0008	0.9992	2505	0.00058	0.0004	0.9996	0.00037
29	1	1.46	0.00	0.00	2.14	0.0004	0.9996	2506	0.00045	0.0003	0.9999	0.00029
46	1	1.66	0.00	0.00	2.76	0.0004	1.0000	2507	0.00016	0.0001	1.0000	0.00000
Total	**2507**	**23.09**	**26.92**	**19.14**	**26.62**	**1.00**			**1.4223**	**1**		

Table 4.6. Application and Testing of Lotka's Law

n value	**2.29**
c value	**1.4223**
d MAX	**0.63925**
Threshold Value	**0.03255**

Table 4.6.1. Results of Kolmogorov Smirnov Test to assess the fitness of Lotka's Law

4.7. Application of Bradford's Law

The table number 4.7.1 shows the details of the number of journals categorized into three zones through the application of Bradford's Law. The first zone consists of 25 journals, which are in-charge of the publications of 773 journal articles. The second zone consists of 109 journals, which are responsible for the publication of 769 journal articles. The third zone consists of 539 journals, which are responsible for the publication of 765 journal articles. According to Bradford's Law, the first zone, which consists of 25 journals and 773 articles are most prolific. The prolific concept of this lawreveals that the library can be benefitted by procuring 25 journals and enjoy the privilege of accessing 773 journal articles.

Zone	No. Of Journals	No. Of Journal Articles
1	25	773
2	109	769
3	539	765

Table 4.7.1 Zone segregated through the application of Bradford's Law

S. No.	Name of the Journal	No. of Articles	Local Citation Score				Global Citation Score	h Index
			Including Self Citation	h Index	Excluding Self Citation	h Index		
1	Water	61	9	2	6	1	275	9
2	Land Degradation & Development	48	124	6	96	5	1086	17
3	Journal of Cleaner Production	47	62	3	51	3	664	14
4	Agricultural Water Management	43	35	3	29	3	815	17
5	Catena	42	58	4	40	3	666	14
6	Journal of Hydrology	42	56	4	30	3	895	17
7	Sustainability	39	0	0	0	0	83	6
8	Environmental Earth Sciences	37	22	3	16	2	323	11
9	Journal of Environmental Management	34	144	6	125	5	773	14
10	Water Resources Management	34	44	3	36	3	433	14
11	Science of the Total Environment	32	56	5	38	3	719	16

12	Journal of Soil and Water Conservation	31	16	2	9	2	397	10
13	PLOS ONE	29	0	0	0	0	323	11
14	Journal of American Water Works Association	27	16	2	16	2	70	5
15	Soil & Tillage Research	26	19	2	12	2	368	11
16	Water Resources Research	25	17	3	13	2	333	12
17	Land Use Policy	24	17	2	13	2	332	10
18	Journal of the American Water Resources Association	22	22	3	14	2	171	8
19	Environmental Management	21	17	3	9	2	230	9
20	Environmental Monitoring and Assessment	21	14	3	14	1	196	8
21	Resources Conservation and Recycling	20	48	4	36	3	453	13
22	Journal of Irrigation and Drainage Engineering	18	13	1	3	1	77	3
23	Water Policy	17	9	2	6	1	100	5
24	Water Science and Technology-Water Supply	17	1	1	1	1	28	3
25	HORTSCIENCE	16	8	2	5	1	83	5
Total		**773**	**827**	**69**	**618**	**53**	**9893**	**262**

Table 4.7.2. Zone 1: Core Journals According to Bradford's Law

The Bradford's Law has been applied to find out the most productive journals responsible for the publication of the majority of articles on "Water Conservation". The table number 4.7.2 reveals the zone 1, which consists of 25 titles of journals in-charge of publishing 773 journal articles. The journal entitled "Water" placed first in the table with a maximum article count of 61 numbers, for which the journal received a local citation score (including self-citation) of 9nos. and gained 2 as h-Index. The journal also received a local citation score of 6nos. which excludes the self-citation score and gained one as h-Index .The journal entitled "Water" received a global citation score of 275 and 9 as h-Index.

5. Conclusion

"Water" is a God given natural resource, which is very much essential to safeguard the life of each and every living being of this world. The conservation of water should be

embedded in the sense of each and every human being to protect the contemporary generation and as well as the future generation. “Water” has to be conserved properly because “excess of water” or “lacuna of water” will leads to disaster. In an intention to bring out the current status of the research output on “Water Conservation”, this scientometric study has been articulated. The year wise efforts of the global scientists towards publishing research publications on “Water Conservation” are in increasing trend, which is appreciable as the act reveals about the care taking responsibility of the contributors. The doubling time proves that the publications are in increasing trend. English language played vital role, which further proves that propagation about the importance of “Water Conservation” has already been communicated to the majority of the countries in the world. Journal articles played dominant role among the other type of publications, which shows very clearly about the quality of the research. Further, the findings through the scientometric research proved that Alfred Lotka’s Law does not fit to the author productivity of the publications on “Water Conservation”. Through the Bradford’s Law the core journals are identified. Through this research work, it is suggested that each and every ministry of global countries leading the role of protecting the natural resources and the sponsoring bodies towards the same should encourage their respective scientists to contribute more towards the enhancement of the “Water Conservation” in an intention to take absolute care of the society and to make the living beings of the society to live and lead a happy long life.

References

[1] Liu, Z., Lu, Y., &Peh, L. C. (2019). A Review and Scientometric Analysis of Global Building Information Modelling (BIM) Research in the Architecture, Engineering and Construction (AEC) Industry Buildings 9.10 (2019): 210

[2] Sivasamy, K., &Vivekanandhan, S. (2015). Environmental education research literature output in SCOPUS database (2009-2013): A bibliometric study. International Journal of Information Sources and Services, 2(2), 84-93.

[3] Morooka, K., Ramos, M. M., & Nathaniel, F. N. (2014). A bibliometric approach to interdisciplinarity in Japanese rice research and technology development. Scientometrics, 98(1), 73-98.

[4] Ren, J. L., Lyu, P. H., Wu, X. M., Ma, F. C., Wang, Z. Z., & Yang, G. (2013). An informetric profile of water resources management literatures. Water resources management, 27(13), 4679-4696.

[5] Biglu, M. H., Eskandari, F., &Asgharzadeh, A. (2011).Scientometric analysis of nanotechnology in MEDLINE. BioImpacts: BI, 1(3), 193.

[6] Muthuraj, Surulinathi; Balasubramani, R.; and N, AMSAVENI, "COVID-19 research output in 2020: The Global Perspective using Scientometric Study" (2020).Library Philosophy and Practice, 4196. https://digitalcommons.unl.edu/libphilprac/4196

[7] Gunasekera, Chamani and Balasubramani, R., "Information Seeking Pattern of School Teachers in Sri Lanka: Discovering the Associate Factors" (2020). Library Philosophy and Practice (e-journal). 3699. https://digitalcommons.unl.edu/libphilprac/3699

[8] J, Arumugam and R, Balasubramani, "Scholarly Research Output of Kumaraguru College of Technology, Coimbatore: Scientometric Analysis" (2020). Library Philosophy and Practice, 4158. https://digitalcommons.unl.edu/libphilprac/4158

[9] Surulinathi, M., Balasubramani, R., &Kalisdha, A. (2013). Continent wise Analysis of Green Computing Research: a scientometric study. Journal of Advances in Library and Information Science, 2(1), 39-44.

[10] Balasubramani, R., &Parameswaran, R. (2014). Mapping the research productivity of Banaras Hindu University: A scientometric study. Journal of Theoretical and Applied Information Technology, 59(2), 367-371.

[11] Sivasekaran, K., &Srinivasaragavan, S. S. (2013). Mapping of research publications on Himalayas: A scientometrics exploration. International Journal of Scientific Research, 2(3), 58-60.
[12] Sivasekaran, K. (2015). India's Contribution on Renewable Energy Research Output: A Scientometric Study. Journal of Advances in Library and Information Science, 4(4), 311-316.
[13] pichai, janarthanan; Stanleay, . PrabakarDr.; and Kannan, .NithyanandamDr., "Dengue Hemorrhagic Fever: A Scientometric Study" (2019). Library Philosophy and Practice (e-journal). 3694. https://digitalcommons.unl.edu/libphilprac/3694
[14] Janaarthanan, Pichai Mr; Prabhakar, Stanleay Dr; and Nithayanandham, Kannan Dr, "Research Impact on Drone by means of Scientometric Analysis" (2019). Library Philosophy and Practice,2897.https://digitalcommons.unl.edu/libphilprac/2897
[15] Ramasamy, R. U., Sivasekaran, K., &Navasakathi, C. (2013). Scientometric Analysis of Thorium Research in India: A Case study. Global Research Analysis, 4, 80-82.
[16] Ashok Kumar, P., Navalur, S. A., &Sivasekaran, K. (2013). A Scientometric Study of Biodiversity Research in India: A special r. International Journal of Scientific Research.
[17] Gupta, B. M., Dhawan, S. M., Kumar, A., &Visakhi, P. (2018). E-Waste Research: A Scientometric Assessment of Global Publications Output during 2007-16. International Journal of Information Dissemination and Technology, 8(1), 31-36.
[18] Sivasekaran, K Dr.; Stanleay, Prabakar Dr.; and Ashok Kumar, P Dr., "Mapping the Study and Awareness on Early Death Research: A scientometric Analysis" (2020). Library Philosophy and Practice, 4368. https://digitalcommons.unl.edu/libphilprac/4368
[19] Kamatchi, SivasekaranDr.;Stanleay, PrabakarDr.; Subramanian, ChithiraivelDr.; P, Ashok Kumar Dr.; and Arumugam, ThirumagalDr., "Electric Car: A Research Impact BY Means OF Scientometric Analysis" (2019). Library Philosophy and Practice, 3660. https://digitalcommons.unl.edu/libphilprac/3660.
[20] Vivekanandhan, S., Sivasamy, K., &Prabhakar, S. (2016). Publications and Citations Analysis of Pollution Control Research Output from SCOPUS Database: A Scientometrics Analysis. International Journal of Next Generation Library and Technologies, 2(3), 1-13.
[21] Sivankalai, S., &Badhusha, K. N. (2020). Bibliometric study on COVID 19 Outbreak. International Journal of Library and Information Studies, 10(2), 1-19.
[22] Kademani, B. S., Vijai, K., Anil, S., Anil, K., Lalit, M., &Surwase, G. (2006). Scientometric dimensions of thorium research in India. DESlDOC Bulletin of Information Technology, 26(3), 9-25.
[23] Bala, A., & Gupta, B. M. (2010). Mapping of Indian neuroscience research: A scientometric analysis of research output during 1999-2008. Neurology India, 58(1), 35.
[24] Trivedi, Guptnath, "Scholarly Communication in International Journal of Digital Curation from 2006-2017: a DOAJ based study" (2019). Library Philosophy and Practice (e-journal). 2866. https://digitalcommons.unl.edu/libphilprac/2866
[25] Gupta, Brij Mohan Dr and Gupta, Ritu, "A Scientometric Assessment of Indian Himalayan R&D Publications during 2004-13" (2014). Library Philosophy and Practice (e-journal). 1203. http://digitalcommons.unl.edu/libphilprac/1203
[26] https://www.toppr.com/guides/geography/water-resources/an-introduction-to-water-resources/.

Uncertain multi objective multi item four dimensional transportation problem with vehicle speed

A.N.Revathi[1*], S.Mohanaselvi[1], Dipak Kumar Jana[2]
{revathin1@srmist.edu.in[1], mohanass@srmist.edu.in[2], dipakjana@gmail.com[3]}

Department of Mathematics, Faculty of Engineering and Technology, SRM Institute of Science and Technology, Kattankulathur, Chennai - 603 203, Tamil Nadu, India [1,*], School of Applied Sciences & Humanities, Haldia Institute of Technology, Haldia, Purba MidnaPur-721657, West Bengal, India.[2]

Abstract. The In this work, multi objectives multi item four dimensional transportation problem with vehicle speed consisting of uncertain variable parameters is studied. Due to bad road conditions, the rate of variation of speed of the vehicle may vary in different routes and the speed of different vehicles are also considered first time in the time minimization transportation model. Equivalent deterministic models for the uncertain programming model are proposed by using chance constrained and expected value method. Finally goal programming technique is applied to derive a suitable compromise solution of the uncertain multi objective multi item four dimensional transportations problems with consideration of vehicle speed. An illustrative real life situation is discussed and optimal results are displayed to demonstrate the proposed methodology..

Keywords: Four dimensional transportation problem _ Uncertain variables _ Goal programming.

1 Introduction

The primitive transportation problematic presented by Hitchcock[1] in 1941 and it is developed by Koopmans[2]. Currently transportation problem(TP) with single objective are not sufficient in today's market to manage day–to-day decision making problem. Thus, in order to maximize the profit for the firm, we consider many objectives at a time. Since there is no connection between the cost parameter of various objectives of the Transportation Problem: these are considered as conflicting and commensurable model of the multi objective transportation problem [MOTP]. Well known researchers like Lee et al 1973[3], Pandian et al 2011[4], Quddoos et al 2013[5] and Nomani et al 2017[6] etc., therefore worked on more efficient process to solve MOTP.

The transportation problem with conveyance is termed as solid transportation problem [STP] and it was presented by Haley[7]. Numerous models like multi objective solid transportation problem, solid transportation with secure responsibility etc., have been developed under STP from then. In global competition, STP is a major factor as it minimize solid transportation cost, time taken to provide the service and distance. Applying zero point principle Pandian et al[8] have provided a solution methodology for obtaining the minimized transported cost of STP. Furthermore, he extended his work by providing cost sensitivity of ranges[9].

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When we consider real life problem the presence of multiple routes/roads bring out other factor such as the condition of roads, the different distances between the routes. However all the transportation modes and routes may not be ideal. So while trying to maximize the profit, we need to factor in breakability. Also the breakability factor depends upon several other choices such as the roads condition, distance and the vehicle used. So considering the fair choice of routes plays a major role. A four dimensional solid transportation problem [4DSTP] is a STP wherein along with the conveyances different routes and vehicles are considered. The distinguishing factor between TP's, STP's and 4DTP's is that the distance too is considered. To solve the time minimization transportation problem, the speed of the vehicle also play a vital role. It might be possible that shortest road routes might not be in best condition. In such routes might affect the speed of transportation. The rate of disturbances of speed has not been considered by any researchers till date. Considering multiple objective and multiple product in a 4DTP converts a 4DTP into four dimensional multi objective multi item transportation problem [4DMOMITP].

real life situation all the parameters required for the STP are not always accurate or available. Contradicting in the STP problem we considered, we assumed to be fairly accurate. The parameters like availability of demand and constituent transportation charge are not exact continuously due to the uncertainty in human judgment and lack of information which are uncontrollable factors. But these uncertainties can be considered by fuzzy sets given by Zadeh[10]. Multiple researchers who proposed methods to solve TP'sutilized fuzzy numbers for representing the parameters' uncertainty.

To solve MOTP, Zimmerman[11] gave fuzzy programming method. It was later studied by bit et al[12] to solve multi objective solid transportation problem [MOSTP] where in genetic algorithm was applied by Liu et al[3] where objective function coefficient were taken as fuzzy numbers . The Method of solving fuzzy MOSTP, taking all parameters as fuzzy numbers excluding decision variable was proposed by Ojha et al[13] to solve fully fuzzy MOTP, the Mehar's method was introduced by Gupta et al[14]. Deepika rani et al[15] presented a technique to obtain the optimal compromise solution of FFMOMISTP. In fuzzy environment (intuitionistic L-R type) and vehicle speed, Dipakkumar et al formulated MOMITP in four dimensions[16].

Although Zadeh's Fuzzy set theory[10] is widely applied in many uncertain models, it could not handle human uncertainty in some contexts involving incomplete information. As an attempt to deal with such indeterminacies, Liu founded uncertainty theory[17],[18]. Nowadays, doubt theory is considered as a mathematical division for modelling belief degrees and has been adopted in many mathematical models like uncertain programming, logic, graph, statistics and finance[19],[20],[21]. The belief degree of an indeterminate event to happen is measured by indeterminate amount. To simultaneously contract with uncertainty and randomness, the usage of random indeterminate variable and chance measure was also introduced by Liu[22]. Post that, he also presented uncertain random programming to model optimization problems containing more than one random variable. Gao[23], in his paper, newly proposed certain properties based on continuously uncertain measures. SeyyedMojtabaChasence[24] introduced uncertain linear fractional programming problem and also presented few methods to convert uncertain optimization problem as an equivalent deterministic problem.

Liu[25] introduced a new uncertain multi objective programming and goal programming technique as a compromised method to solve uncertain multi objective programming using inverse uncertainty distribution. Uncertain goal programming method was proposed by Liu Chen[26] for an uncertain multi objective programming problem. To get the answer of the multi level indeterminate programming problems, Yao and Liu [27] developed programming methods. For an uncertain multi objective problem, a compromise programming models and interactive satisfied methods were presented by Zhou et al and Zhong et al[28],[29]. For uncertain STP, Cui and Sheng[30] presented an expected constrained model. Later, a transportation problem was studied by Guo et al[31] consisting of random supplies and uncertain costs. By using type-2 uncertain optimization methods, Yang et al[32] found the compromise solution for fixed charge STP. Multi objective multi item STP under uncertain situation was formulated by Hasan Dalman[33]. A solid transportation problem involving creation amalgamation was studied by Yuan Gao and SamarjitKar[34]. Motivated by above authors, we have tried to propose a solution methodology for an uncertain multi objective multi item four dimensional transportation model with vehicle speed[UMOMI4DTPS]. The prime motive of this prototypical is to exploit the income and minimize the transportation charge. In the time minimization objective function, the speed of the various conveyance and degradation of speed owing to poor road conditions have been factored in for the first time ever.

We created three different models. Out of the three models that we are presenting, First model has been procured considering the items whose breakability that depends on both conveyances and type of routes taken. The next one considers shipping of items that are damageable only because of its type. The last one involves shipping of non-breakable item. The equivalent classical models for UMOMI4DTPS are obtained by by predictable chance and value restraint technique. The models are demonstrated by numerical instance to know the efficiency of the suggested model for obtaining the best compromise solution.

The article has been structured thusly. We have presented the theories and descriptions of doubt theory which are used models in section 2. Notations used in the article is assumed in segment 3. In segment 4, the mathematical model of uncertain multi objective is introduced. Equivalent deterministic models by using expected value and chance constraint methodsare given in the sections 5 and 6 respectively. Fundamental ideas about goal programming technique and the procedure for solving the UMOMI4DTPS are given in section 7 and 8 respectively. A numerical example has been given in section 9. The discussion, practical implication, comparison and conclusions have been given in sections 10,11,12 and 13 respectively.

2 Preliminaries

Some fundamental concept of indecision theory, which have been use in the subsequent discussions are introduced below.

Definition 1: [20],[17] Let $\mathcal{L}$ be a σ –algebra of collection of events Λ of a universal set Γ . A set function $\mathcal{M}$ is said to be indeterminate portion defined on the σ –algebra where

$\mathcal{M}\{\Lambda\}$ designate the confidence grade with which we trust that the occasion will happens and satisfies the subsequent maxims:

1. Normality Axiom: For the universal set Γ, we have $\mathcal{M}\{\Gamma\}=1.$
2. Duality Axiom: For any event Λ, we have $\mathcal{M}\{\Lambda\}+\mathcal{M}\{\Lambda^{C}\}=1.$
3. Subadditivity Axiom: For every countable sequence of events $\Lambda_1,\Lambda_2,...,$ we have $\mathcal{M}\{\bigcup_{i=1}^{\infty}\Lambda_i\}\le\sum_{i=1}^{\infty}\mathcal{M}\{\Lambda_i\}$
4. Creation Axiom: Let $(\Gamma_i,\mathcal{L}_i,\mathcal{M}_i)$ be indecision spaces for i=1,2,3,…. The produce uncertain quantity is an uncertain measure holds $\mathcal{M}\{\prod_{i=1}^{\infty}\wedge_i\}=\bigwedge_{i=1}^{\infty}\mathcal{M}\{\wedge_i\}$ where $\Lambda_i\in\mathcal{L}_i$ for $i=1,2,3,....,\infty$.

Definition 2: [17] A function $\xi:(\Gamma,\mathcal{L},\mathcal{M})\to\Re$ is said to be an uncertain variable such that $\{\xi\in\mathrm{B}\}=\{\gamma\in\Gamma/\xi(\gamma)\in\mathrm{B}\}$ is an event for any Borel set B of real numbers.

Definition 3: [17] An indeterminate variable ξ defined on the uncertainty space $(\Gamma,\mathcal{L},\mathcal{M})$ is said to be non- negative if $\mathcal{M}\{\xi<0\}=0$ and positive if $\mathcal{M}\{\xi\le 0\}=0.$

Definition 4: [17] For any real number x, the indecision distribution $\phi(x)$ of an uncertain variable ξ is defined by $\phi(x)=\mathcal{M}\{\xi\le x\}.$

Definition 5: Let $\phi(x)$ be the regular indecision distribution of an uncertain variable $\xi.$ Then $\phi^{-1}(\alpha)$ is called inverse uncertainty distribution of ξ and it exists on (0, 1).

Definition 6: [17] The uncertain variable $\xi_i\quad(i=1,2,...,n)$ are said to be autonomous if

$$\mathcal{M}\left\{\bigcap_{i=1}^{n}(\xi_i\in B_i)\right\}=\bigwedge_{i=1}^{n}\mathcal{M}(\xi_i\in B_i) \tag{1}$$

where $B_i\quad(i=1,2,...n)$ are called Borel sets of real numbers.

Theorem 1: let ξ be an uncertain variable with regular uncertain distribution function ψ .Then its $\alpha-$ optimistic value and $\alpha-$ pessimistic values are

$$\xi_{\sup}(\alpha)=\psi^{-1}(1-\alpha),\quad \xi_{\inf}(\alpha)=\psi^{-1}(\alpha). \tag{2}$$

Theorem 2: [18] The regular uncertainty distributions of independent uncertain variables $\xi_i\quad(i=1,2,3,...,m,...,n)$ are $\phi_i\quad(i=1,2,...,m,...,n)$ respectively. If the function $f(x_1,x_2,...,x_m,...,x_n)$ is strictly increasing and strictly decreasing with respect to $x_1,x_2,...,x_m$ and $x_{m+1},x_{m+2},...,x_n$ respectively then the uncertain variable $\xi=f(\xi_1,\xi_2,...\xi_m,...,\xi_n)$ has an inverse uncertainty distribution

$$\psi^{-1}(\alpha)=f(\phi_1^{-1}(\alpha),\phi_2^{-1}(\alpha),...,\phi_m^{-1}(\alpha),\phi_{m+1}^{-1}(1-\alpha),\phi_{m+2}^{-1}(1-\alpha),...,\phi_n^{-1}(1-\alpha)) \tag{3}$$

Definition 7: [17] The expected value of uncertain variable ξ is given by

$$E(\xi)=\int_0^{\infty}\mathcal{M}\{\xi\geq x\}dx-\int_{-\infty}^{0}\mathcal{M}\{\xi\leq x\}dx \tag{4}$$

This is valid only if at least one of the integral is finite.

Theorem 3: [35] The regular uncertainty distributions of independent uncertain variables $\xi_i \quad (i=1,2,...,m,...,n)$ are $\phi_i \quad (i=1,2,...,m,...,n)$ respectively. If the function $f(x_1,x_2,..,x_m..,x_n)$ is strictly increasing and strictly decreasing w.r.to $x_1,x_2,...,x_m$ and $x_{m+1},x_{m+2},...,x_n$ respectively, then

$$E(\xi)=\int_0^{1}f(\phi_1^{-1}(\alpha),....\phi_m^{-1}(\alpha),\phi_{m+1}^{-1}(1-\alpha),....\phi_n^{-1}(1-\alpha))d\alpha \tag{5}$$

From the above theorem, we know that

$$E(\xi)=\int_0^{1}\phi^{-1}(\alpha)d\alpha \tag{6}$$

where ξ is an uncertain variable with regular uncertainty distribution Φ.

Definition 8: [17] A linear uncertain variable ξ is defined as

$$\phi(x)=\begin{cases}0 & ,if\ x\leq l\\ \dfrac{x-l}{m-l} & ,if\ l\leq x\leq m\\ 1 & ,if\ x\geq m\end{cases} \tag{7}$$

denoted by L(l, m), where in l, m ∈ R with l < m.

The inverse delivery function of a linear uncertain variable L (l, m) is given by

$$\phi^{-1}(\alpha)=(1-\alpha)l+\alpha m \tag{8}$$

Where $\alpha=0.5$ and its expected value is given by

$$E[\xi]=\frac{l+m}{2} \tag{9}$$

3. NOMENCLATURE

The following notations have been considered for constructing the proposed two models:

m number of origin
n number of destination
K number of mode of transport
R number of transportation routes
T number of products

$\tilde{Z}_w$ uncertain objective functions, where w=1,2,…

$\tilde{P}_{ig}$ i^{th} - origin, g^{th} good's purchasing price

$\tilde{S}_{jg}$ j^{th} destination, g^{th} good's selling price

$\tilde{C}_{ijkrg}$ the unit transportation cost of g^{th} good from i^{th} origin to j^{th} terminus by k^{th} transport via r^{th} road per unit distance.

β_{ijkrg} the rate of breakability per unit distance of g^{th} good from i^{th} origin to the j^{th} terminus by k^{th} transport via r^{th} road.

d_{ijr} distance from i^{th} origin to j^{th} terminus via r^{th} road.

V_k speed of the k^{th} transport

γ_{ijr} rate of disturbance of the speed due to r^{th} road from i^{th} origin to j^{th} destination.

$\tilde{\delta}_{ijkg}$ unloadingand loading time of the g^{th} good with admiration to the transportmovement from i^{th} origin to j^{th} destination by k^{th} transport

$\tilde{a}_{ig}$ quantity of g^{th} good available at i^{th} origin

$\tilde{b}_{jg}$ therequirement of g^{th} good at the j^{th} destination

$\tilde{e}_k$ capacity of a single vehicle of k^{th} transport.

D_w^- negative deviational value.

D_w^+ positive deviational value.

4.Mathematical Formulation Of UMOMI4DTPS:

A uncertain multi objective multi item four dimensional transportation problem with vehicle speed is formulated as follows. Let there be m origins O_i (i=1,2,…m), n demands D_j (j=1,2,……n) , R roads Q_r (r=1,2….R), G goods P_g (g=1,2,….G),K conveyances E_k (k=1,2,….K).The objective of this transportation model is to maximize the profit and minimize the time taken for transportation. Estimating the exact amount of parameters that are related is not so simple in the present situation. Application of transportation problem in real life situation involves lot of uncertainties for the decision makers such as availability of raw materials, fluctuation of unit transportation cost and demands in destinations. Hence the following are some unmanageable factors in transportation problems.

1. The product availability at the origin may be uncertain, considering time factor.
2. The decision maker may not always know the unit transportation charge for the 1st transportation operation.
3. The recently introduced products' total demand may be uncertain in the market.

So, we formulate considering all the parameters(availabilities, demands, purchase price , selling price, loading and unloading time, capacity of the conveyances and transportation cost) as uncertain variable which might be incorporated in the real life situation.

There are chances of goods or items are transported may be damaged during the transportation period. The reason for this breakability's are diverse. It may depend on the route through which the item is transported and also the nature of the goods that transported.

Mainly the glass items, especially ceramics and china clay have this concerns. For some items damageability may be due to its type only. Some items may not be damageable at all. Considering the above factor, we have introduced three different models by involving the rate of breakability and are given as follows.

Model 1: In model 1, we consider the transporting goods that are vulnerable to breakability, that depend on different mode of transports along different routes. Here, we use β_{ijkrg} the rate of breakability per unit distance from i^{th} origin via r^{th} road to j^{th} destination for the g^{th} goods via k^{th} transport.

Model 2: This model considers the goods that are damageable because of their nature. β_g is used to denote the rate of breakability per unit distance of the g^{th} goods.

Model 3: This model considers non-breakable goods.

4.1. Model 1: UMOMI4DTPS with breakable items based on mode of transports, roads and goods

The maximizing the total profit is the first objective and minimizing the transportation time is the second objective of the model which are given below. The transporting time will be taken into consideration if the goods are transported from i^{th} origin to j^{th} terminus by k^{th} transport via r^{th} road.

$$
\begin{cases}
\text{Max}\tilde{Z}_1 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[\tilde{S}_{jg}(1-\beta_{ijkrg} * d_{ijr}) - \tilde{P}_{ig} - (\tilde{c}_{ijkrg} * d_{ijr})] * x_{ijkrg} \\
\text{Min}\tilde{Z}_2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr} * y_{ijkr}}{v_k(1-\gamma_{ijr})} + \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}\tilde{\delta}_{ijkg} * x_{ijkrg} \\
\text{where,} \quad y_{ijkr} = \begin{cases} 1, \text{if} \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, \text{if} \sum_{g=1}^{G} x_{ijkrg} = 0, \end{cases} \\
\text{subject to,} \\
\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} \le \tilde{a}_{ig}, i = 1...m, g = 1...G, \quad \text{(supply constraints)} \\
\sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R}(1-(\beta_{ijkrg} * d_{ijr}))x_{ijkrg} \ge \tilde{b}_{jg}, j = 1...n, g = 1...G, \quad \text{(demand constraints)} \\
\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G} x_{ijkrg} \le \tilde{e}_k, k = 1...K, \quad \text{(Conveyance constraints)} \\
x_{ijkrg} \ge 0, \forall i, j, k, r, g.
\end{cases}
\tag{10}
$$

4.2 Model 2:UMOMI4DTPS with breakable items due to their nature

In this model we have formulated a case wherein the goods that are selected has damageability factor only because of its type. This model is same as of the previous model

except the objective and constraint which depends upon β_{ijkrt}. So, the required model is developed as shown below:

$$
\begin{cases}
\text{Max}\tilde{Z}_1 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[\tilde{S}_{jg}(1-\beta_g * d_{ijr}) - \tilde{P}_{ig} - (\tilde{c}_{ijkrg} * d_{ijr})] * x_{ijkrg} \\
\text{Min}\tilde{Z}_2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr} * y_{ijkr}}{v_k(1-\gamma_{ijr})} + \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}\tilde{\delta}_{ijkg} * x_{ijkrg} \\
\text{where,} \quad y_{ijkr} = \begin{cases} 1, \text{if} \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, \text{if} \sum_{g=1}^{G} x_{ijkrg} = 0, \end{cases} \\
\text{subject to,} \\
\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} \le \tilde{a}_{ig}, i = 1...m, g = 1...G, \\
\sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R}(1-(\beta_g * d_{ijr}))x_{ijkrg} \ge \tilde{b}_{jg} \forall j, g \\
\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G} x_{ijkrg} \le \tilde{e}_k, k = 1...K, \\
x_{ijkrg} \ge 0, \forall i, j, k, r, g.
\end{cases} \tag{11}
$$

4.3.Model 3: UMOMI4DTPS with no damageable goods

In this model, we have formulated a problem which involves no breakable goods.As we cannot deal uncertain environment directly, the above problem with uncertain supplies, demands, costs, filling and receipt time and capacities could be converted as equivalent deterministic model by employing the expected value and chance constraint methods.

5 Expected Value Models For UMOMI4DTPS

In this section, we have introduced the equivalent deterministic models for UMOMI4DTPS using expected value method.

5.1 Expected value method for Model 1

Equivalent deterministic form for model 1 by using expected value method is given in (13).

Applying the properties of theories of expectation in the (13), we have (14).

$$
\begin{cases}
\text{Max}\tilde{Z}_1 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[\tilde{S}_{jg} - \tilde{P}_{ig} - (\tilde{c}_{ijkrg} * d_{ijr})] * x_{ijkrg} \\
\text{Min}\tilde{Z}_2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr} * y_{ijkr}}{v_k(1-\gamma_{ijr})} + \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}\tilde{\delta}_{ijkg} * x_{ijkrg} \\
\text{where,} \quad y_{ijkr} = \begin{cases} 1, \text{if} \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, \text{if} \sum_{g=1}^{G} x_{ijkrg} = 0 \end{cases} \\
\text{subject to,} \\
\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} \le \tilde{a}_{ig}, i = 1...m, g = 1...G, \\
\sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} \ge \tilde{b}_{jg} \forall j, g \\
\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G} x_{ijkrg} \le \tilde{e}_k, k = 1...K, \\
x_{ijkrg} \ge 0, \forall i, j, k, r, g.
\end{cases} \tag{12}
$$

5.2 Expected value method for Model 2

Equivalent deterministic model after applying the properties of Expected value method is given in (15).

5.3 Expected value method for Model 3

Model 3's equivalent deterministic form after applying the properties of Expected value method is given in (16).

$$
\begin{cases}
\text{Max } \tilde{Z}_1 = \mathrm{E}\left[\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[\tilde{S}_{jg}(1-\beta_{ijkrg} * d_{ijr}) - \tilde{P}_{ig} - (\tilde{c}_{ijkrg} * d_{ijr})] * x_{ijkrg}\right] \\
\text{Min } \tilde{Z}_2 = \mathrm{E}\left[\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr} * y_{ijkr}}{v_k(1-\gamma_{ijr})} + \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}\tilde{\delta}_{ijkg} * x_{ijkrg}\right] \\
\text{where,} \quad y_{ijkr}\begin{cases} 1, \text{if} \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, \text{if} \sum_{g=1}^{G} x_{ijkrg} = 0 \end{cases} \\
\text{subject to,} \\
\mathrm{E}\left[\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} - \tilde{a}_{ig}\right] \le 0, i = 1...m, g = 1...G, \\
\mathrm{E}\left[\tilde{b}_{jg} - \sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R}(1-(\beta_{ijkrg} * d_{ijr}))x_{ijkrg}\right] \le 0, j = 1...n, g = 1...G \\
\mathrm{E}\left[\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G} x_{ijkrg} - \tilde{e}_k\right] \le 0, k = 1...K, \\
x_{ijkrg} \ge 0, \forall i, j, k, r, g.
\end{cases} \tag{13}
$$

Definition 9 A feasible solution $X^* = \{x^*_{ijkrg}\} \in S$ is an efficient (no dominated) solution for MOMI4DTP with vehicle speed iff there does not exist another $X = \{x_{ijkrg}\} \in S$ such that $Z_k(X) \le Z_k(X^*), 1 \le k \le K$ and $Z_l(X) \ne Z_l(X^*)$ for some $l, 1 \le l \le K$.

$$
\begin{cases}
\text{Max } Z_1 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[E[\tilde{S}_{jg}](1-\beta_{ijkrg} * d_{ijr}) - E[\tilde{P}_{ig}] - E[(\tilde{c}_{ijkrg} * d_{ijr})]] * x_{ijkrg} \\
\text{Min } Z_2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr} * y_{ijkr}}{v_k(1-\gamma_{ijr})} + \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}E[\tilde{\delta}_{ijkg}] * x_{ijkrg} \\
\text{where, } \quad y_{ijkr} = \begin{cases} 1, if \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, if \sum_{g=1}^{G} x_{ijkrg} = 0 \end{cases} \\
\text{subject to,} \\
\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} - E[\tilde{a}_{ig}] \le 0, i = 1...m, g = 1...G, \\
E[\tilde{b}_{jg}] - \sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R}(1-(\beta_{ijkrg} * d_{ijr}))x_{ijkrg} \le 0, j = 1...n, g = 1....G \\
\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G} x_{ijkrg} - E[\tilde{e}_k] \le 0, k = 1...K, \\
x_{ijkrg} \ge 0, \forall i, j, k, r, g.
\end{cases}
\tag{14}
$$

Definition 10 A feasible solution $X^* = \{x^*_{ijkrg}\} \in S$ is a week efficient solution for multi objective multi item four dimensional transportation problem with vehicle speed iff there does not exist another $X = \{x_{ijkrg}\} \in S$ such that $Z_k(X) \le Z_k(X^*)$ for $\forall k$.

$$
\begin{cases}
\text{Max } Z_1 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[E[\tilde{S}_{jg}](1-\beta_g * d_{ijr}) - E[\tilde{P}_{ig}] - E[(\tilde{c}_{ijkrg} * d_{ijr})]] * x_{ijkrg} \\
\text{Min } Z_2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr} * y_{ijkr}}{v_k(1-\gamma_{ijr})} + \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}E[\tilde{\delta}_{ijkg}] * x_{ijkrg} \\
\text{where,} \quad y_{ijkr} = \begin{cases} 1, if \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, if \sum_{g=1}^{G} x_{ijkrg} = 0 \end{cases} \\
\text{subject to,} \\
E[\tilde{b}_{jg}] - \sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R}(1-(\beta_g * d_{ijr}))x_{ijkrg} \le 0, \forall j, g \\
\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} - E[\tilde{a}_{ig}] \le 0, i = 1...m, g = 1...G \\
\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G} x_{ijkrg} - E[\tilde{e}_k] \le 0, k = 1...K \\
x_{ijkrg} \ge 0, \forall i, j, k, r, g.
\end{cases}
\tag{15}
$$

$$
\begin{cases}
\text{Max } Z_1 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[E[\tilde{S}_{jg}] - E[\tilde{P}_{ig}] - E[(\tilde{c}_{ijkrg} * d_{ijr})]] * x_{ijkrg} \\
\text{Min } Z_2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr} * y_{ijkr}}{v_k(1-\gamma_{ijr})} + \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}E[\tilde{\delta}_{ijkg}] * x_{ijkrg} \\
\text{where,} \quad y_{ijkr} = \begin{cases} 1, if \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, if \sum_{g=1}^{G} x_{ijkrg} = 0 \end{cases} \\
\text{subject to,} \\
E[\tilde{b}_{jg}] - \sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} \le 0 \forall j, g \\
\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} - E[\tilde{a}_{ig}] \le 0, i = 1...m, g = 1...G \\
\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G} x_{ijkrg} - E[\tilde{e}_k] \le 0, k = 1...K \\
x_{ijkrg} \ge 0, \forall i, j, k, r, g.
\end{cases}
\tag{16}
$$

6. Chance Constrained Method For UMOMI4DTPS

In this section, we have introduced the equivalent deterministic model for UMOMI4DTPS using chance constrained method.

6.1 Chance constraint method for Model 1

Suppose that $\tilde{S}_{jg}, \tilde{P}_{ig}, \tilde{c}_{ijkrg}, \tilde{\delta}_{ijkg}, \tilde{a}_{ig}, \tilde{b}_{jg}$ *and* $\tilde{e}_k$ are autonomousindeterminate variables with regular indecision distribution $\chi_{jg}, \phi_{ig}, \varphi_{ijkrg}, \theta_{ijkg}, \psi_{ig}, \kappa_{jg}, \lambda_k$ respectively. Model 1's equivalent deterministic model using the chance constrained method is given in (17).

6.2 Chance constraint method for Model 2

Equivalent deterministic form of Model 2 using the chance constraint method is given in (18).

6.3 Chance constraint method for Model 3

Model 3's equivalent deterministic form using the chance constraint model is given in (19).

$$
\begin{cases}
\text{Max } Z_1^* = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[\chi_{jg}^{-1}(\alpha_1)(1-\beta_{ijkrg} * d_{ijr}) - \phi_{ig}^{-1}(\alpha_2) - (\varphi_{ijkrg}^{-1}(\alpha_3) * d_{ijr})]x_{ijkrg} \\
\text{Min } Z_2^* = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr} * y_{ijkr}}{v_k(1-\gamma_{ijr})} + \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}\theta_{ijkg}^{-1}(\alpha_4) * x_{ijkrg} \\
\text{where, } \quad y_{ijkr} = \begin{cases} 1, if \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, if \sum_{g=1}^{G} x_{ijkrg} = 0 \end{cases} \\
\text{subject to,} \\
\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} \le \psi_{ig}^{-1}(1-\alpha_5), i = 1...m, g = 1...G \\
\sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R}(1-\beta_{ijkrg} * d_{ijr})x_{ijkrg} \ge \kappa_{jg}^{-1}[\alpha_6], j = 1...n, g = 1...G \\
\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G} x_{ijkrg} \le \lambda_k^{-1}[1-\alpha_7], k = 1...K \\
x_{ijkrg} \ge 0, \forall i, j, k, r, g.
\end{cases}
\tag{17}
$$

Where $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6$ and α_7 are predetermined confidence level and $\alpha_i \in (0,1), i = 1,2,...7.$

$$
\begin{cases}
\text{Max } Z_1^* = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[\chi_{jg}^{-1}(\alpha_1)(1-\beta_g * d_{ijr}) - \phi_{ig}^{-1}(\alpha_2) - (\varphi_{ijkrg}^{-1}(\alpha_3) * d_{ijr})] * x_{ijkrg} \\
\text{Min } Z_2^* = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr} * y_{ijkr}}{v_k(1-\gamma_{ijr})} + \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}\theta_{ijkg}^{-1}(\alpha_4) * x_{ijkrg} \\
\text{where,} \quad y_{ijkr} = \begin{cases} 1, if \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, if \sum_{g=1}^{G} x_{ijkrg} = 0 \end{cases} \\
\text{subject to} \\
\sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R}(1-(\beta_g * d_{ijr}))x_{ijkrg} \geq \kappa_{jg}^{-1}[\alpha_6], j = 1...n, g = 1...G \\
\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} \leq \psi_{ig}^{-1}(1-\alpha_5), i = 1...m, g = 1...G \\
\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G} x_{ijkrg} \leq \lambda_k^{-1}[1-\alpha_7], k = 1...K \\
x_{ijkrg} \geq 0, \forall i, j, k, r, g.
\end{cases} \tag{18}
$$

Where $\alpha_1,...,\alpha_6$ and α_7 are predetermined confidence level and $\alpha_i \in (0,1), i = 1,2,...7.$

$$
\begin{cases}
\text{Max } Z_1^* = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[\psi_{jg}^{-1}(\alpha_1) - \phi_{ig}^{-1}(\alpha_2) - (\varphi_{ijkrg}^{-1}(\alpha_3) * d_{ijr})] * x_{ijkrg} \\
\text{Min } Z_2^* = \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr} * y_{ijkr}}{v_k(1-\gamma_{ijr})} + \sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}\theta_{ijkg}^{-1}(\alpha_4) * x_{ijkrg} \\
\text{where,} \quad y_{ijkr} = \begin{cases} 1, if \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, if \sum_{g=1}^{G} x_{ijkrg} = 0 \end{cases} \\
\text{subject to,} \\
\sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} \geq \kappa_{jg}^{-1}[\alpha_6], j = 1...n, g = 1...G \\
\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R} x_{ijkrg} \leq \psi_{ig}^{-1}(1-\alpha_5), i = 1...m, g = 1...G \\
\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G} x_{ijkrg} \leq \lambda_k^{-1}[1-\alpha_7], k = 1...K \\
x_{ijkrg} \geq 0, \forall i, j, k, r, g.
\end{cases} \tag{19}
$$

Where $\alpha_1,...,\alpha_6$ and α_7 are predetermined confidence level and $\alpha_i \in (0,1), i = 1,2,...7.$

7. Goal Programming Approach

The goal programming is a technique proposed by Charnes clan cooper[36] for obtaining satisfactory solution even in the presence of more than one goals. This field was further developed by many authors like T.Chang[37], Pal[38],etc. Fuzzy goal programming approach was introduced by Mohammed[39] for solving MOTP. The same technique was implemented to solve MOTPwith linear membership function as well as non linear membership functions by M.Zangiabadi[40],[41]. Minimizing the distance between $Z = (Z_1,...,Z_w)$ and aspiration (or) target level $\overline{Z} = (\overline{Z}_1,...,\overline{Z}_w)$,which are set by the decision maker, is the purpose of goal programming. For this purpose, the negative and positive deviational variables have been introduced below.

$D_w^+ = \max(0, Z_w - \overline{Z}_w)$

$D_w^- = \max(0, \overline{Z}_r - Z_w)$

To minimize the distance between Z_w and $\overline{Z}_w$, we have to minimize either D_w^+, D_w^- or $D_w^+ + D_w^-$.When we have to maximize $Z_w, g_w(D_w^+, D_w^-) = D_w^-.$ While, when we have to minimize $Z_w, g_w(D_w^+, D_w^-) = D_w^+.$ When we desire $Z_w = \overline{Z}_w, g_w(D_w^+, D_w^-) = D_w^- + D_w^-.$

Membership functions are defined in order to express the satisfaction of decision maker along with the solution. Given below are the definitions of membership functions.

$$\mu_w(Z_w) = \begin{cases} 1 & \text{if} Z_w \le L_{Z_w} \\ 1 - \dfrac{Z_w - L_{Z_w}}{U_{Z_w} - L_{Z_w}} & \text{if} L_{Z_w} < Z_w < U_{Z_w} \\ 0 & \text{if} Z_w \ge U_{Z_w} \end{cases}$$

$\mu_w(Z_w)$ represents the decision maker's satisfaction. Therefore, it must be maximized i.e

$\max(\mu_1(Z_1(x)),..., \mu_w(Z_w(x)))$

Here U_{Z_w} and L_{Z_w} are the highest acceptable and aspired level of achievement for Z_w, (w = 1;2) objective function.

We know that the maximum value of any membership function is one. Therefore, to maximize any of the membership functions, we minimize its negative deviation from 1 to make them as close as possible to 1. The LPP can be formulated as below.

$\min(\max(g_w(D_w^+, D_W^-)))$

i.e min Q

subject to

$$\frac{U_{Z_w} - Z_w}{U_{Z_w} - L_{Z_w}} + D_w^- - D_w^+ = 1,$$

$Q \geq D_w^-$, where w = 1; 2.

$D_w^- . D_w^+ = 0,$

$D_w^-, D_w^+ \geq 0, 0 \leq Q \leq 1,$ and with given constraints. Here, we have considered UMOMI4DTPS type of problem; goal programming technique will be the most appropriate procedure for getting the most suitable compromise solution.

8. Algorithm For Solving UMOMI4DTPS

The following proposed algorithm is used to solve three different models of UMOMI4DTPS.

Step 1: Convert the uncertain MOMI4DTPS into deterministic model by applying the expected value and chance constraint models.

Step 2: Solve the profit and time objective function Z_w, (w = 1;2) individually subject to the supply, demand constraints including breakability and conveyance constraints.

Step 3: Compute the values of every of the objectives function Z_w, (w=1;2) at each solution obtain in step 2.

Step 4: From the set of solutions calculated from the step 2, obtained the upper U_{Z_w} and lower L_{Z_w} bound for each objective function. Here U_{Z_w} and L_{Z_w} are the highest satisfactory and aspired level of accomplishment for Z_w^{th}, (w = 1;2) objective function.

Step 5: Use goal programming technique to formulate the following LPP model for the given UMOMI4DTPS.

Min Q

subject to

$$\frac{U_{z_w} - Z_w}{U_{Z_w} - L_{Z_w}} + D_w^- - D_w^+ = 1$$

$Q \geq D_w^-$, where w=1,2.

$D_w^- . D_w^+ = 0$

$D_w^+ . D_w^- \geq 0, \quad 0 \leq Q \leq 1$, and with constraints given in the respective model.

Step 6: Solve the above model obtained in step 4 by using generalized abridged gradient method (LINGO-18.0 Suite Solver) to get the compromise solution.

9. Numerical Example

Numerical example of UMOMI4DTPS is presented in this section, whose parameters are linear uncertain variables, to showcase the effectiveness and efficiency of the presented methodology. Here, variables like availabilities, demands, purchase price, selling price, unloading and loading time and transportation cost are considered as indeterminate variables.

We consider two different sources (origins), customers (destinations) conveyances, roads and different goods each.

i.e m = n = K = Q = G = 2.

Table 1 contains the data for availabilities of goods in the sources.

Table 1: Available stock in each origin

i	g	$\tilde{a}_{ig}$
1	1	L(380,400)
	2	L(260,360)
2	1	L(180,380)
	2	L(217,377)

The following table contains the data for demands of goods in the destination.

Table 2: Demands in the destinations

1.1 j	**1.2** g	**1.3** $\tilde{b}_{jg}$
1.4 1	**1.5 1**	**1.6 L(100,164.084)**
	1.7 2	**1.8 L(50,150)**
1.9 2	**1.10 1**	**1.11 L(70,100)**
	1.12 2	**1.13 L(110,130)**

The purchasing prices of the goods are given in table 3.

Table 3: Purchasing price for the goods

1.14 i	**1.15** g	**1.16** $\tilde{P}_{ig}$
1.17 1	**1.18 1**	**1.19 L(8.250,20)**
	1.20 2	**1.21 L(12,14)**
1.22 2	**1.23 1**	**1.24 L(7,15)**
	1.25 2	**1.26 L(11,13)**

The selling prices of g^{th} goods in the j^{th} destinations are in the following table.

Table 4: Selling price for the goods

1.27 j	**1.28** g	**1.29** $\tilde{S}_{ig}$
1.30 1	**1.31 1**	**1.32 L(70,104)**
	1.33 2	**1.34 L(110,120)**
1.35 2	**1.36 1**	**1.37 L(100,124)**
	1.38 2	**1.39 L(100,104)**

Table 5 contains the data for capacity of the transports.

Table 5: Capacity of the transports

1.40 $\tilde{e}_1$	**1.41** $\tilde{e}_2$
1.42 L(300,496)	**1.43 L(330,500)**

The loading and unloading time of different goods are presented in table 6.

Table 6: loading and unloading timing

i	j	k	$\tilde{\delta}_{ijk1}$	$\tilde{\delta}_{ijk2}$
1	1	1	L(.3,.5)	L(.3,.5)

		2	L(.3,.8)	L(.2,.5)
	2	1	L(.5,.7)	L(.34,.5)
		2	L(.22,.60)	L(.22,.60)
2	1	1	L(.56,.7)	L(.6,.8)
		2	L(.3,.7)	L(.8,1)
	2	1	L(.8,1)	L(.1,.5)
		2	L(.32,.5)	L(.34,.5)

The unit transportation cost of various goods per units distance are in table 7. The breakability rates of goods per unit distance are given un table 8.

Table 7: Unit transportation cost of different goods per unit distance

i	j	k	r	$\tilde{c}_{ijkr1}$	$\tilde{c}_{ijkr2}$
1	1	1	1	L(.20,.48)	L(.20,.48)
			2	L(.32,.40)	L(.20,.40)
		2	1	L(.26,.40)	L(.16,.30)
			2	L(.40,.57)	L(.1,.3)
	2	1	1	L(.30,.56)	L(.12,.30)
			2	L(.34,.50)	L(.22,.30)
		2	1	L(.2,.6)	L(.28,.40)
			2	L(.3,.7)	L(.34,.60)
2	1	1	1	L(.38,.50)	L(.200,.270)
			2	L(.40,.52)	L(.12,.40)
		2	1	L(.2,.6)	L(.2,.4)
			2	L(.40,.56)	L(.30,.66)
	2	1	1	L(.340,.500)	L(.200,.012)
			2	L(.260,.700)	L(.1,.34)
		2	1	L(.400,.410)	L(.2,.4)
			2	L(.3,.7)	L(.1,.3)

Table 8: Rate of breakability per unit distance

i	j	k	r	β_{ijkr1}	β_{ijkr2}
1	1	1	1	0.014	0.024
			2	0.014	0.015
		2	1	0.009	0.01
			2	0.024	0.014
	2	1	1	0.015	0.025
			2	0.024	0.015
		2	1	0.014	0.015
			2	0.011	0.012
2	1	1	1	0.014	0.024
			2	0.024	0.024
		2	1	0.019	0.019
			2	0.016	0.009

	2	1	1	0.012	0.016
			2	0.014	0.01
		2	1	0.012	0.016
			2	0.012	0.011

The speed of different transports are in the following table 9.

Table 9: Speed of different transport

1.44 V_1	**1.45** V_2
1.46 35	**1.47 25**

Distance amongdissimilar sources and destination via dissimilar route are assumed by table 10.

Table 10: Distance from source to destination via different routes

i	j	d_{ij1}	d_{ij2}
1	1	33	45
	2	45	35
2	1	43	40
	2	56	45

Table 11 contains the data of rate of disturbance of speeds.

Table 11: Rate of disturbance

i	j	γ_{ij1}	γ_{ij2}
1	1	0.0122	0.03
	2	0.013	0.022
2	1	0.03	0.025
	2	0.011	0.04

Applying the abovedevelopedalgorithm for the problem taken, the steps are:

Here we have explained the procedure for expected value model 1 alone.

Step 1: For the above data, deterministic optimization problems of the given model is obtained using expected value method(14) and solved.

Step 2: Solving the above objectives separately, we have $Z_1 = -31077.4$ and $Z_2 = 278.967$

By using the calculated solutions, the value of each objectivespurpose is obtained as follow:

$Z_1(x_1) = -31077.4,\ Z_1(x_2) = -26711.88$

$Z_2(x_1) = 306.026,\ Z_2(x_2) = 278.967$

The upper and lower bounds of each objective functions are as follows:

$U_{z_1} = -26711.88,\ L_{z_1} = -31077.4$

$U_{z_2} = 306.027,\ L_{z_2} = 278.967$

Step 3: Using goal programming technique, the goal programming expected value method for Model 1 is expressed as follow.

$$
\begin{cases}
\text{Min } Q \\
\text{subject to} \\
-26711.88+\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}[E[\tilde{S}_{jg}](1-\beta_{ijkrg}*d_{ijr})-E[\tilde{P}_{ig}]-E[(\tilde{c}_{ijkrg}*d_{ijr})]]*x_{ijkrg} \\
+4365.520(D_1^- - D_1^+)=4365.520 \\
306.027-\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\frac{d_{ijr}*y_{ijkr}}{v_k(1-\gamma_{ijr})}+\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}\sum_{g=1}^{G}E[\tilde{\delta}_{ijkg}]*x_{ijkrg} \\
+27.060(D_2^- - D_2^+)=27.060 \\
Q \geq D_w^- \text{ where w =1,2} \\
\mathrm{D}_w^+ \cdot D_w^- \geq 0, 0 \leq Q \leq 1 \\
\text{where, } \quad y_{ijkr}=\begin{cases} 1, if \sum_{g=1}^{G} x_{ijkrg} > 0, \\ 0, if \sum_{g=1}^{G} x_{ijkrg} = 0 \end{cases} \\
\text{subject to,} \\
\sum_{j=1}^{n}\sum_{k=1}^{K}\sum_{r=1}^{R}x_{ijkrg}-E[\tilde{a}_{ig}]\leq 0, i=1...m, g=1...G \\
E[\tilde{b}_{jg}]-\sum_{i=1}^{m}\sum_{k=1}^{K}\sum_{r=1}^{R}(1-(\beta_{ijkrg}*d_{ijr}))x_{ijkrg}\leq 0, j=1...n, g=1....G \\
\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{r=1}^{R}\sum_{g=1}^{G}x_{ijkrg}-E[\tilde{e}_k]\leq 0, k=1...K \\
x_{ijkrg}\geq 0, \forall i,j,k,r,g.
\end{cases}
$$

(20)

Step 4: By using the generalizedabridged gradient method LINGO-18.0 Suite Solver, we obtain the efficient value of Q = 0:482 and the corresponding transportation plan is $D_1^- = .482, D_1^+ = 0, D_2^- = .482, D_2^+ = 0,$ Max $Z_1 = 28975.005$ and Min $Z_2 = 291.997, x_{11111} = 123.008, x_{11211} = 93.691,$

$x_{11212} = 183.098, x_{12221} = 138.211, x_{22122} = 218.182, y_{1111} = 1,\ y_{1121} = 1, y_{1222} = 1, y_{2212} = 1.$ The remaining decision variables values are 0. We can conclude that both the objectives are achieved with decision maker's satisfaction. Repeating the above steps from 1 to 4 for the remaining two expected value models and chance constraint models, we have the following results.

Table 12 contains the calculated objective values of each objective function (14),(15) and (16) in each model. The efficient solutions of each goal programming expected value models are given in detail in table 13.

Table 12: Objective values of expected value models

Model no.	**Max** Z_1	x_{ijkrg}	y_{ijkr}	**Min** Z_2	x_{ijkrg}	y_{ijkr}
Model 1	31077.4	$x_{11111}=179.82$	$y_{1111}=1$	278.967	$x_{11111}=179.82$	$y_{1111}=1$

		$x_{11211}=50.22$ $x_{11212}=226.57$ $x_{12221}=138.21$ $x_{22122}=218.18$	$y_{1121}=1$ $y_{1222}=1$ $y_{2212}=1$		$x_{11211}=50.22$ $x_{11212}=149.25$ $x_{12221}=138.21$ $x_{22122}=218.18$	$y_{1121}=1$ $y_{1222}=1$ $y_{2212}=1$
`Model 2	43324.36	$x_{11211}=152.75$ $x_{11212}=149.26$ $x_{12121}=237.25$ $x_{12122}=160.75$ $x_{21211}=5.73$ $x_{22221}=79.06$ $x_{22222}=28.21$	$y_{1121}=1$ $y_{1212}=1$ $y_{2121}=1$ $y_{2222}=1$	228.25	$x_{11111}=158.14$ $x_{11212}=149.25$ $x_{12221}=103.03$ $x_{22122}=218.18$	$y_{1111}=1$ $y_{1121}=1$ $y_{1222}=1$ $y_{2212}=1$
Model 3	70016.99	$x_{11111}=27.04$ $x_{11211}=105.00$ $x_{11212}=310.00$ $x_{12121}=85.00$ $x_{21112}=165.96$ $x_{22112}=120.00$	$y_{1111}=1$ $y_{1121}=1$ $y_{1212}=1$ $y_{2111}=1$ $y_{2211}=1$	174.49	$x_{11111}=115.43$ $x_{11121}=16.62$ $x_{11212}=50.00$ $x_{11222}=50.00$ $x_{12211}=15.62$ $x_{12221}=15.62$ $x_{22112}=77.73$ $x_{22122}=42.27$ $x_{22211}=15.62$ $x_{22221}=38.16$	$y_{1111}=1$ $y_{1112}=1$ $y_{1121}=1$ $y_{1122}=1$ $y_{1221}=1$ $y_{1222}=1$ $y_{2211}=1$ $y_{2212}=1$ $y_{2221}=1$ $y_{2222}=1$

Table 13: The efficient solution of Expected value MOMI4DTPS

Model no.	**Objective value**	**Max** Z_1		**Min** Z_1		**Max** Z_1	**Min** Z_1	**Objective value**
		D_w^+	D_w^-	D_w^+	D_w^-			
Model 1	0.48	0	0.48	0	0.48	28975	291.99	$x_{11111}=123.01, x_{11211}=93.69$ $x_{12221}=138.21, x_{11212}=183.1$ $x_{22122}=218.18, y_{1111}=1$ $y_{1121}=y_{1222}=y_{2212}=1$
Model 2	0.33	0	0.33	0	0.33	38784.04	285.04	$x_{11111}=158.14, x_{11212}=310$ $x_{12221}=104.32, x_{22122}=218.18$ $y_{1111}=y_{1121}=y_{1222}=y_{2212}=1$
Model 3	0.35	0	0.35	0	0.35	57575.34	247.85	$x_{11111}=132.04, x_{11212}=214.44$ $x_{12221}=85, x_{22112}=265.96$ $y_{1111}=y_{1121}=y_{1222}=y_{2211}=1$

By using goal programming technique, the efficient solution for UMOMI4DTPS are obtained as of table 13.

Table 14 contains the calculated objective values of each of the chance constraint model objectives(17), (18) and (19), where $\alpha_1 = 0.6, \alpha_2 = 0.9, \alpha_3 = 0.9. \alpha_4 = 0.9, \alpha_5 = 0.3, \alpha_6 = 0.9, \alpha_7 = 0.3.$

Table 14: Objective values of chance constraint model

Model no.	**Max** Z_1	x_{ijkrg} **and** y_{ijkr}	**Min** Z_2	x_{ijkrg} **and** y_{ijkr}
Model 1	30706.69	$x_{11111} = 147.96, x_{11211} = 111.06$ $x_{11212} = 208.8, x_{12221} = 128.98$ $x_{22121} = 47.77, x_{22122} = 241.47$ $y_{1111} = y_{1121} = y_{1222} = y_{2212} = 1$	281.8	$x_{11111} = 203.95, x_{11211} = 668.21$ $x_{11212} = 208.95, x_{12221} = 115.84$ $x_{22122} = 232.73, x_{22221} = 55.99$ $y_{1111} = y_{1121} = y_{1222} = y_{2222} = 1$ $y_{2212} = 1$
Model2	46675.4	$x_{11211} = 118.72, x_{11212} = 207.21$ $x_{12121} = 269.28, x_{12122} = 92.79$ $x_{22121} = 73.19, x_{21122} = 1.95$ $x_{22222} = 123.07, y_{1121} = y_{1212} = 1$ $y_{2112} = 1$	223.63	$x_{11111} = 188.83, x_{11212} = 208.96$ $x_{12221} = 117.58, x_{22122} = 232.73$ $y_{1111} = y_{1121} = 1$ $y_{1222} = y_{2212} = 1$ $y_{2222} = 1$
Model 3	78182.42	$x_{11111} = 8.68, x_{11211} = 149$ $x_{11212} = 300, x_{12121} = 147.52$ $x_{21112} = 153, x_{22112} = 128$ $y_{1111} = y_{1121} = y_{1212} = y_{2111} = 1$ $y_{2211} = 1$	169.22	$x_{11111} = 135.69, x_{11121} = 21.99$ $x_{11222} = 70, x_{11212} = 70$ $x_{12211} = 71.79, x_{12221} = 25.29$ $x_{22112} = 94.51, x_{22122} = 33.50$ $y_{1111} = y_{1112} = y_{1121} = y_{1122} = 1$ $y_{1221} = y_{1222} = y_{2211} = y_{2212} = 1$

By using Goal Programming technique, the efficient solution for UMOMI4DTPS are obtained as follows

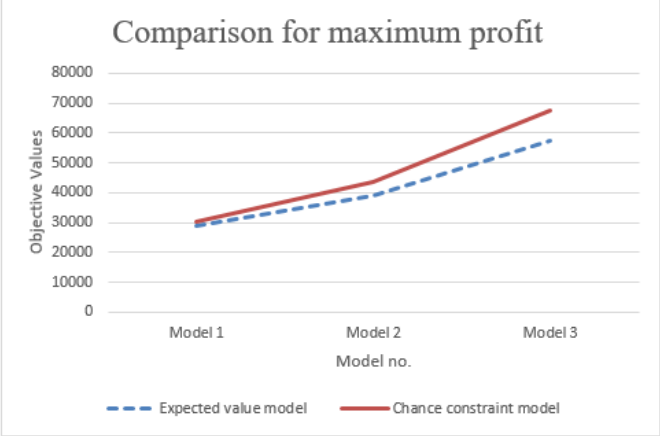
Table 15: Efficient solution of chance constraint UMOMI4DTPS

Model no.	**Objective value**	**Max** Z_1		**Min** Z_2		**Max** Z_1	**Min** Z_2	**Objective value**
		D_w^+	D_w^-	D_w^+	D_w^-			
Model 1	0.38	0	0.38	0	0.38	30471.09	290.91	$x_{11111} = 164.26, x_{11211} = 78.21$ $x_{12221} = 145.53, x_{11212} = 208.96$ $x_{21111} = 35.98, x_{22122} = 236.96$ $x_{22222} = 16.31, y_{1111} = 1$ $y_{1121} = y_{1222} = y_{2111} = 1$ $y_{2212} = y_{2222} = 1$
Model 2	0.28	0	0.28	0	0.28	43410.40	273.33	$x_{11111} = 209.31, x_{11212} = 273.40$ $x_{12122} = 26.60, x_{12221} = 175.60$ $x_{22122} = 201.29, y_{1111} = y_{1121} = 1$ $y_{1212} = y_{1222} = y_{2212} = 1$

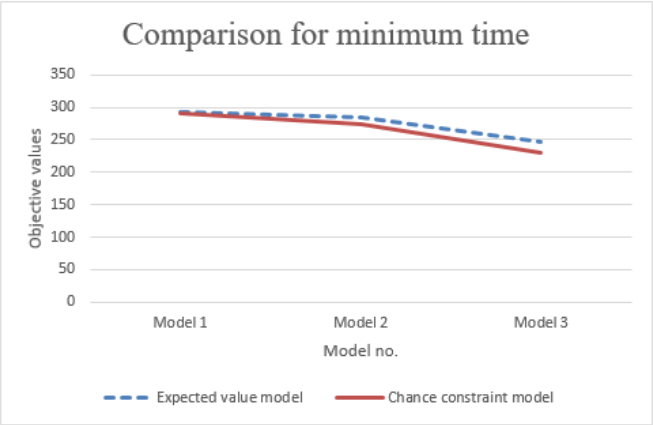
Model 3	0.29	0	0.29	0	0.29	67555.65	231.09	$x_{11111}=157.68, x_{11212}=254.64$ $x_{12221}=97, x_{22112}=279.52$ $y_{1111}=y_{1121}=y_{1222}=y_{2211}=1$

10. Discussion

In our investigation, we have obtained the satisfactory solution of UMOMI4DTPS by GP predictable value and GP coincidental constrained method. The efficient solutions of expected value UMOMI4DTPS and Chance constraint UMOMI4DTPS are obtained using goal programming technique and are given in tables 13 and 15 respectively. Thus the goal programming technique is a fitting technique for dealing multi objectives transportations problems. In Model 1, the breakability of items depend upon different conveyances, items and routes. Where as in Model 2 damage of items which is considered only because of its nature. In Model 3, the damage of items is not considered. We get maximum profit in model 3 as breakability hasn't been considered. In Model 2, there is considerable profit, while in Model1 we get minimal profit as we infer from the table 13. Unlike expected value model where the solution is fixed, in chance constrained model we get optimistic - pessimistic solutions as we can obtain different satisfactory solutions according to condition which is given higher weightage as preferred by the decision maker as inferred from the table 15.



(a) Profit objective function comparison



(b) Time objective function comparison

Fig. 1: Graphical analysis

The foremost impartial of this examination is to exploit the turnover and minimalize the transportations period. As we can clearly infer from the graphs (figure 1), the profit obtained in the chance constrained model is higher than of the expected value models. Similarly, the time taken for transportation has also been minimized. Also, the decision maker can obtain solutions according to his preferences which is an added advantage of the proposed method.

11 Practical Implications

The presented model can be very much beneficial in real world business applications. Mr.Akash is a television retailer. He deals different types of televisions and has three outlets in Chennai, Puducherry and Madurai. All these products are bought by him from manufacturer located in Tuticorin, Tiruchirappalli and Salem. He uses conveyances (transports) like Lorries, tempos and trucks. There are different paths like NH-7, NH-45, NH-46, NH-68 and other village paths. The distances differ because of the presence of different manufacturer and different outlets. Also, the variety of conveyances may affect the transportation speed. The speed can vary due to the road conditions too. Moreover, televisions are breakable items and the rate of breakability will also vary depending upon the roads. Due to the unpredictable nature of the consumer, the availabilities, prices at different manufacturing companies vary; these parameters are imprecise quantities and are represented through linear uncertain variables. Therefore the present investigation will definitely prove to be useful in real life cases.

12 Comparision Between Proposed Method And Existing Methods

The method presented is a type of UMOMI4DTPS with different parameters such as selling price, cost price, availabilities, demands, loading and unloading time, unit transportation cost and the vehicle speed. Till date no method accounted vehicle speed. The proposed method is the first ever model considering vehicle speed .Methodologies and environments to solve MOMISTP have been investigated by many researchers. In 2018, the

Bera et al[42] has provided a method for MOMI4DTP considering only budget constraints using rough and fuzzy interval environments. However the proposed model is the only model considering all parameters and aspects for the first time. As the proposed model considers diverse parameters, it is beneficial one for the managerial decision making under uncertain environment.

13. Conclusion

we have presented a multi objective multi item four dimensional transportation problem vehicle speed under uncertain environment. Unlike other transportation models, here we have considered the variance in vehicle speed because of the road condition. The equivalent deterministic models for UMOMI4DTPS have been obtained by using both expected value and chance constrained methods followed by compromise solution which is obtained by using goal programming technique. The suggested model is identicalinformal to apply, comprehend and is economically more beneficial for a firm as the profit is increased and the transportation time is efficiently minimized too. Hence, the decision maker can make better managerial decisions. The numerical example provided has keenly showed the ease of application of this method as well as provides an efficient solution for UMOMI4DTPS.

References

[1] F.L.Hitchcock, The distribution of a product from several sources to numerous localities, Journal of Mathematical. Physics, 20 (1941):224-230.

[2] T.C.Koopmans, Optimum utilization of the transportation System, Econometrica, 17 (1949):136-146.

[3] Lee, S.M and Moore.L.J, Optimizing transportation problems with multiple objectives. AIEE Transactions, 5(1973): 333- 338.

[4] Pandian.P, Anuradha.D, A new method for solving bi-objective transportation problem. Aust.J. Basic & Appl. Sci., 10(2011):67-74.

[5] Quddoos.A, Javiad.S and Khalid.M.M, A new method to solve bi-objective transportation problem.International journal of applied science, 26(4)(2013):555- 563.

[6] Nomani.M.A, Ali.I, Ahmed.A, A new approach for solving multi-objective transportation problems. International Journal of Management Science and Engineering Management, 12(2017):165-173.

[7] Haley.K, The solid transportation problem, operation research 10(1962):448-463.

[8] Pandian.P, KavithaAnuradha.D, A new approach for solving solid transportation problems,Applied mathematical Sciences 4 (2010):3603-3610.

[9] Pandian.P, Kavitha.K, Sensitivity analysis in solid transportation problems, Applied mathematical science, 6(136)(2012):6787-6796.

[10] Zadeh.L.A, Fuzzy sets. Inf. Control 8(1965): 338–353.

[11] Zimmermann.H.J, Fuzzy programming and linear programming with several objective functions, Fuzzy Sets system1 1(1978):45-55.

[12] Bit.A.K, Biswal.M.P and Alam.S.S, Fuzzy programming approach to multi-objective solid transportation problem. Fuzzy Sets Syst. 57(1993):183–194.

[13] Ojha.A, Das.B, Mondala.S and Maiti.M, An entropy based solid transportation problem for general fuzzy costs and time with fuzzy equality. Math. Comput. Model. 50(2009):166–178.

[14] Gupta.A, Kumar.A and Kaur.A, Mehar's method to find exact fuzzy optimal solution of unbalanced fully fuzzy multiobjective transportation problems. Optim. Lett. 6(2012):1737–1751.

[15] Deepika Rani and T.R.Gulati, Uncertain multi-objective multi-product solid transportation problems, Sadhana 41(2016):531–539.
[16] Dipak Kumar Jana et al, Novel Multi objective multi item and four diemensional transportation problem with vehicle speed in LR type intuitionistic fuzzy environment,Neural computing and Applications,32(2020):11937-11955.
[17] B.Liu, Uncertainty Theory, 2nd ed., Springer-Verlag, Berlin, (2007).
[18] B.Liu, Uncertaint Theory: A Branch of Mathematics for Modeling Human Uncertainty, Springer-Verlag, Berlin, 2010.
[19] Yuan Gao, Uncertain models for single facility location problems on networks, Applied Mathematical Modelling 36(2012):2592-2599.
[20] B.Liu, Some Research Problems in Uncertainty Theory, Journal of Uncertain Systems, 3(2009):3–10.
[21] Bo Zhang, Jin Peng, Uncertain programming model for uncertain optimal assignment problem, Applied Mathematical Modelling 37(2013):6458-6468.
[22] B.Liu, Uncertainty theory, Springer, Berlin, Germany, 4th edition, (2013)
[23] X.Gao, Some Properties of Continuous Uncertain Measure,Internaltional Journal of Uncertainty, Fuzziness and Knowledge-Based System,17(2009):419-426.
[24] SeyyedMojtabaGhasemi, Mohammad Reza Safi, Journal of Mathematical Analysis, 8(2)(2017):23-33.
[25] Liu, Uncertainty theory, Springer, Berlin, Germany, (2015).
[26] Liu.B, and Chen.XW Uncertain multi objective programming and uncertain goal programming, Journal of Uncertainty Analysis and Applications 3(1)(2015):1-8.
[27] Liu.B, and Yao.K Uncertain multilevel programming: Algorithm and applications, Computers and Industrial Engineering 89(2015):235-240.
[28] Zhou.J, Fan.Y, and Ke W Multi-objective optimization in uncertain random environments, Fuzzy Optimization and Decision Making 13(4)(2014):397-413.
[29] Zhong.S, Chen.Y, Zhou.J, and Liu.Y, An interactive satisficing approach for multi-objective optimization with uncertain parameters, Journal of Intelligent Manufacturing, 28(2017):535-547.
[30] Cui.Q, Sheng.Y, Uncertain programming model for solid transportation problem, An International InderdisciplinaryJournal,16(2(A))(2013):1207-1214.
[31] Guo et al, A Transportation Problem with Uncertain Costs and Random Supplies, International Journal of e-Navigation and Maritime Economy, 2(2015):1 – 11.
[32] yang et al, Reduction methods of type-2 uncertain variables and their application to solid transportation problem, Information science, 291(2015):204-237.
[33] Hasan Dalman1, Uncertain Programming Model for Multi-item Solid Transportation Problem https://arxiv.org/abs/1606.00002, (2016).
[34] Yuan Gao and SamarjitKar, A solid transportation problem with product blending, International journal of fuzzy systems,19(2017):1916-1926.
[35] Y.Liu, M.Ha, Expected values of function of uncertain variables, Journal of Uncertain Systems,4(3)(2010):181–186.
[36] A.Charnes and W.W.Cooper, Goal Programming and Multiple objective, European Journal of Operation research,1(1977):39-54.
[37] T.Chang, “Muti-choicegoalprogramming”,Omega, 35(2007):389-396.
[38] B.B.Pal, B.N.Moitra and U.Maulik, A goal programming procedure for fuzzy multiobjective linear fractional programming problem,Fuzzy Set Systems,139(2003):395-405.
[39] R.H.Mohamed, The relationship between goal programming and fuzzy programming, Fuzzy Sets and Systems 89(1997):215-222.
[40] M.Zangiabadi and H.R.Maleki, Fuzzy goal programming technique to solve multi objective transportation problem linear membership function,Journal of Applied mathematics and Computing, 24(2007):449-460.
[41] M.Zangiabadi and H.R.Maleki, Fuzzy goal programming technique to solve multi objective transportation problem with some non-linear membership function,Iranian Journal of Fuzzy Systems, 1, (2013):61-74.

[42] Bera S. GiriPK,Jana DK, Basu k, Maiti M, Multi-item D-TPs under budget constraint using rough interval, Appl Soft Computing 71 (2018),364-385.

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