



Supervene Bag A Smart Luggage Carrier

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Abstract. The Supervene Bag stands out as an innovative smart luggage carrier designed to autonomously follow individuals without requiring any physical effort, with a specific focus on air travelers. With over six million people utilizing air transportation, there is a substantial demand for such smart carriers. Unlike conventional RFID tags, which pose challenges due to potential unauthorized access, high initial costs, and compatibility issues, the Supervene Bag addresses these concerns effectively. In contrast to RFID technology, which may face issues if luggage is mishandled or exposed to harsh weather, the Supervene Bag offers advanced features to mitigate these challenges. Equipped with GPS monitoring, automatic mobility, biometric security, integrated charging, and remote-control capabilities, this smart luggage overcomes the limitations of RFID tags. The user-friendly design is further enhanced by easy operability through a mobile phone. This innovative solution aims to provide a seamless and secure travel experience for air passengers, acknowledging and overcoming the drawbacks associated with current RFID technology.

Keywords: Supervene · GPS tracker · Mobility · bio-metric · Remote-control · Integrated · RFID tags · system compatibility

1 Introduction

In the ever-evolving landscape of travel, where convenience and efficiency have become paramount, the SUPERVENE BAG emerges as a beacon of innovation, revolutionizing the conventional luggage experience through embedded technology. Traditional luggage, while pervasive, grapples with a multitude of challenges - from security concerns and handling difficulties to the constant threat of loss or misplacement, additional costs incurred due to overweight baggage, and a glaring absence of theft prevention measures. It is against this backdrop that smart luggage, epitomized by the SUPERVENE BAG, has carved a niche for itself, addressing these limitations head-on.

By leveraging embedded technologies, the SUPERVENE BAG transcends the confines of traditional luggage, ushering in a new era of intelligent travel solutions. These cutting-edge bags seamlessly integrate advanced features to enhance security, connectivity, and organization, promising a more streamlined and optimal travel experience for users. In a world where the travel industry is in perpetual flux, travelers are increasingly vocal about their yearning for intelligent solutions that not only elevate comfort but also bolster the efficiency of their journeys.

Built to cater to this escalating demand, the SUPERVENE BAG is not merely a luggage carrier; it is a sophisticated travel companion. Offering stress reduction through its ability to eliminate the physical strain associated with lugging baggage, this smart bag ensures a positive travel experience. The risk of losing belongings diminishes significantly, thanks to its embedded tracking and security features. Moreover, the bag aligns seamlessly with the contemporary traveler's lifestyle by allowing convenient operation through a mobile phone, adding an extra layer of appeal and user-friendliness.

In this project, we delve into the intricacies of the SUPERVENE BAG, exploring how embedded technology transforms it into a pivotal asset for modern travelers. As we navigate the landscape of smart luggage, we uncover how these innovations contribute not only to the ease of travel but also to the overall satisfaction and peace of mind for globetrotters worldwide. Join us on this journey, where technology meets convenience, and the SUPERVENE BAG redefines the very essence of travel.

2 Literature Survey

[1] According to a study by Sharma (2021), scientists have developed a robot capable of autonomously following people within a predetermined range. The system uses infrared and ultrasonic sensors to monitor human movement. An ultrasonic sensor is a device that uses ultrasonic echoes to measure the distance between itself and an object. These waves are emitted, strike an object, and then reflect back [2]. Automated luggage carriers and other applications can benefit from robots' ability to track moving goods. The Wi-Fi control robot utilized ESP8266 Wi-Fi module and Arduino UNO development boards, along with Node MCU, to enable wireless management of the robot using Wi-Fi technology. Robots can now be remotely controlled using an Android smartphone through the Blynk app [3]. The aim of P.L. Sanathana Krishnan conducted a study to develop a smart luggage carrier system that aims to minimize human effort in transportation and address security concerns. The system includes features such as instantaneous monitoring, theft prevention, and nano Arduino construction. An autonomous luggage carrier, compact and lightweight, follows the user wherever they go using signals from the wearer's smartwatch [4]. Voice instructions can be used to control the robot automobile, and these commands can be accessed through a voice-to-text application. The robot can move in all directions (left, right, forward, and backward) through voice command or manual mode [5]. The Raspberry Pi 3 microprocessor is used in this study. The bag is equipped with anti-theft sensors that interact with a mobile app and connect to a local host. The website and the GSM module are in communication, and the GSM module is an essential component for its independence. The antitheft sensors detect whether the bag is open or closed and alert the owner [6]. This article discusses the development and

deployment of a cloud-based luggage tracking and handling system using RFID tags. The information on travelers and airlines is retrieved using a highly secure technique. A prototype is created at the check-in and check-out locations. To determine the exact location and status of each passenger's luggage, they need to enter their unique RFID number on the website. If the luggage is lost, stolen, or tampered with, having this information allows the traveler to take the necessary steps [7]. The study "Smart Bag with Theft Prevention and Real-Time Tracking" conducts experiments on smart bags. This technology enhances the bag's ability to be activated solely by the owner and track its location using GPS and GSM [8]. The proposed system shows the train's location and the number of passengers in each carriage. The user can track the train from any location and easily catch it. An image processing approach will be used to determine the number of people. The GPS system will be utilized for train tracking [9]. This article presents a hypothetical intellectual travel scenario that may be somewhat restricted. It can be used in airports, train stations, and other locations. In a spacious environment, the travel case can detect and monitor the user's location. In a crowded area, it can also manage the user's movement direction [10]. The article presents the development of the Green Airport luggage monitoring system, including its RFID architecture, components, functionality, and middleware responsibilities. Access to RFID data allows for more reliable and adaptable identification techniques [11]. The suggested approach is applied to a wheelchair follower using a color tracking system. The front wheel is controlled by a servo motor, the transaxle motor is powered by a motor driver, and collisions are prevented by an ultrasonic sensor [12]. The proposed solution utilizes an Android-based remote bag system that offers real-time bag location as an optional feature. The advantage of this feature is that if the bag is lost, it can be located by sending a message to the owner indicating its location. The system includes a self-contained GSM module [13]. A map is created and synchronized to track the location of a lost bag. The advantage of the alarm is that it helps the owner locate and identify the bag. It can be challenging to communicate with an application when using Arduino. Since Arduino is being used, the system may be inflexible and challenging to use [14]. In recent years, several luggage manufacturers have been creating smart bags. Aruna developed a smart luggage in 2019 that features a unique RFID-identified design and a digital locking mechanism.

3 Motivation

The primary objectives for developing embedded-based smart luggage are to enhance the overall travel experience and cater to the requirements of the present-day modern travelers. Furthermore, enterprises have a promising opportunity to capitalize on the swiftly expanding market for smart travel products by incorporating advanced features into their luggage carriers. Imagine a piece of baggage that functions as both a storage unit and a companion System aims to revolutionize the travel experience by ensuring the security, efficient organization, and continuous accessibility of all personal belongings. This is more than just baggage because every element has been designed by keeping the modern traveler in consideration.

4 System Architecture and Design

4.1 Overview

This smart luggage system comes with two operating modes such as automatic mode and manual mode. This switching feature makes it more user friendly and unique.

4.2 Hardware Components

We have utilized sensors such as IR (Infrared sensors) and Ultrasonic sensors for automatic operation. These sensors play a major role in locating a person within a certain radius and enabling the system to track their movements (Fig. 1).

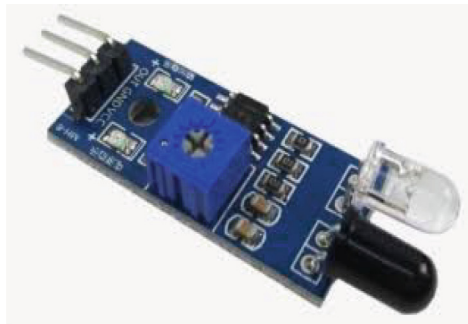


Fig. 1. IR Sensor.

An infrared sensor emits light to detect objects in its surroundings. An infrared sensor can not only detect motion but also measure an object's heat. Typically, all objects emit infrared heat radiation. An infrared sensor can detect these invisible radiations that are not visible to the human eye. An IR LED serves as the emitter, while an IR photodiode detects IR light of the same wavelength as the LED. The resistance and output voltage of the photodiode change in response to the amount of infrared light it receives (Fig. 2).

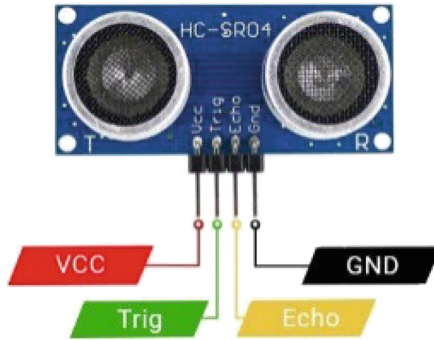


Fig. 2. Ultrasonic sensor.

The ultrasonic sensor is a non-contact sensor that measures the distance and velocity of an object. This sensor utilizes sound waves to measure the distance and velocity of an object. The ultrasonic sensor utilizes a sound wave with a frequency that is beyond the range of human perception. The ultrasonic sensor measures the distance between an object and the point of wave origin by calculating the velocity and time it takes for the wave signal to travel to the object and back (Fig. 3).

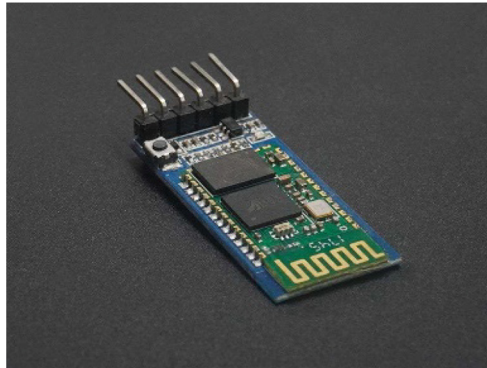


Fig. 3. Bluetooth module (HC-05).

The HC-05 Bluetooth Module is a simple Bluetooth SPP (Serial Port Protocol) module that allows for the creation of a wireless serial connection. It uses serial communication to easily interact with a PC or controller. For manual mode of operation we incorporated Bluetooth module HC-05 with the system which is then connected with the mobile (in-stalled with 'serial Blue-tooth terminal app') Bluetooth (Fig. 4).

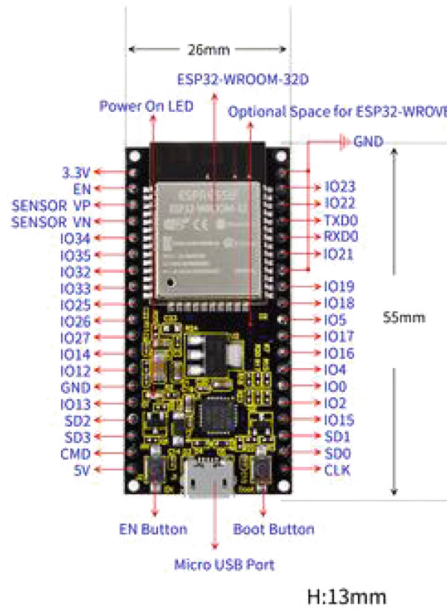


Fig. 4. Node MCU module.

The ESP32 is a highly versatile System On a Chip (SoC) that can function as a general purpose microcontroller with a wide range of peripherals, including WiFi and Bluetooth capabilities. It serves as the central microcontroller. The system allows for real-time tracking using GPS, remote locking or unlocking via Bluetooth, and seamless luggage management and alerts through communication with a user's smartphone (Figs. 5 and 6).

5 Block Diagram

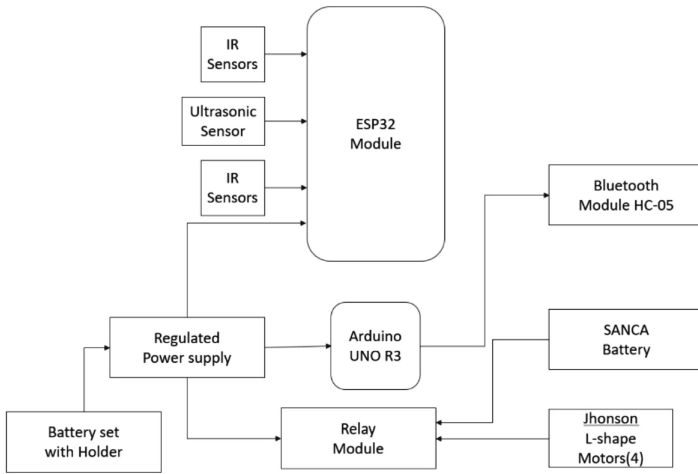


Fig. 5. Block diagram.

6 Prototype

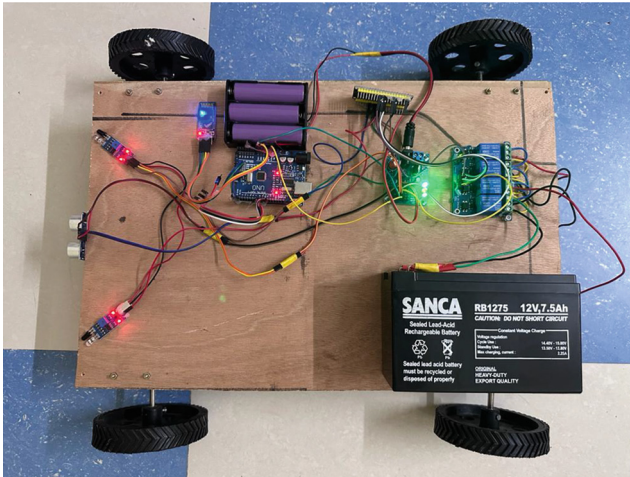


Fig. 6. Prototype.

7 Features and Functionalities

Multiple Modes of Operations

Automatic mode of operation

Mobile operation (manual mode)

Users have the option to select the mode of operation that aligns with their interests and the available environment.

Battery Life and Charging Solutions

The device includes a charging port, allowing users to charge their gadgets conveniently and on-the-go.

GPS Tracking

Continuous tracking and monitoring of luggage is achieved through GPS, providing real-time updates to the user.

Anti-Theft Measures

This bag is equipped with a biometric unlocking system. If a user's mobile device is hacked or lost, biometric unlocking allows them to access their luggage without needing their mobile device. The presence of a smart locking system ensures that only the owner can access the luggage, making it more secure than traditional luggage carriers.

User-Friendly

Users are provided with multiple user-friendly modes that can be easily understood and operated by people of all ages.

Customizable

This bag can be customized with fingerprints and other features according to the user's requirements.

Longer Life Time

This bag is made with durable and high-quality materials, including strong zippers and locks that can withstand the demands of travel.

8 Security and Privacy Considerations

The system incorporates GPS tracking to guarantee constant visibility for the user. To enhance security, only one mobile device can be connected at any given time, ensuring exclusive access for the owner. Adding an additional layer of protection, the bag features a biometric unlocking system. In the event of a compromised or lost mobile device, the user can employ biometric authentication to access their luggage independently. Ensuring the ongoing reliability and trustworthiness of the smart luggage system requires a proactive approach, including regular updates on the luggage's location and a meticulous review of these security considerations. These measures collectively safeguard the integrity of the system, providing users with a secure and dependable smart luggage experience.

9 Working Principle

The bag can be operated in two modes.

Automatic Mode, also Known as Sensor Mode

The functioning of this mode depends on sensors positioned on the bag's front panel. Utilizing technologies like infrared (IR) and ultrasonic, these sensors measure distance and confirm the user's presence. The system persists in tracking the user until encountering a breaking point or signal disruption. This operational mode proves advantageous in scenarios where users lack a mobile device or face insufficient battery charge. Enhancements to this device can be made by incorporating AI features and providing access to a front camera.

Manual Mode (Mobile Usage)

In Manual Mode, designed for mobile usage, the bag integrates a Bluetooth module, specifically the HC-05, which connects to the user's mobile device equipped with the 'Serial Bluetooth Terminal' app. By configuring the necessary settings in the app to connect the bag and set up the terminal, users can initiate movement with a simple tap on the terminal options. These options include Forward (F), Backward (B), Stop (S), Right (R), and Left (L). Resembling the functionality of a remote control car, this mode enables effortless luggage movement in crowded areas without physical exertion, providing ease of operation and enjoyment, especially for kids during travel.

10 Results and Observations

Automatic Mode (Sensor Mode)

The diagrams depict the functioning of the system in automatic mode, commonly referred to as sensor mode. As shown in Figs. 7 and 8, when the user is positioned within the sensor's range and lies in front of the bag, the bag autonomously advances towards the user. To enhance movement precision, the device is furnished with multiple sensors strategically placed on the front panel, ensuring an accurate and responsive interaction between the Supervene Bag and the user.

Manual Mode (Using Mobile)

When opting for manual mode, the user initiates a connection between the system and their mobile device via the Serial Bluetooth Terminal app. Once connected, the user configures the terminal, adjusting options to meet specific requirements. Movement activation requires selecting from options like F (Forward), B (Backward), L (Left), R (Right), and S (Stop). The terminal output in Fig. 9 illustrates the bag's continuous movement in the chosen direction until the user commands a halt (S). A robust connection between the terminal and Bluetooth is imperative for seamless operation, ensuring effective control over the Supervene Bag's movements.

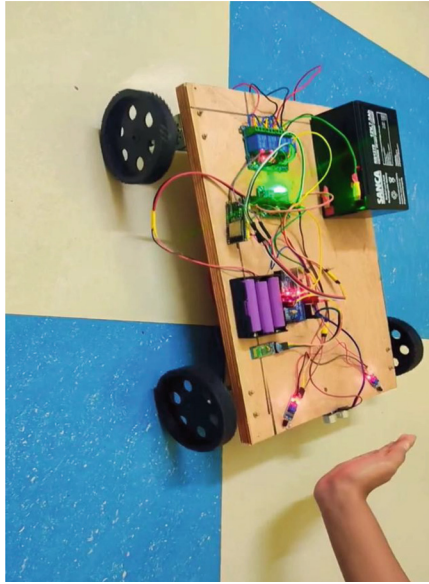


Fig. 7. Sensor working.

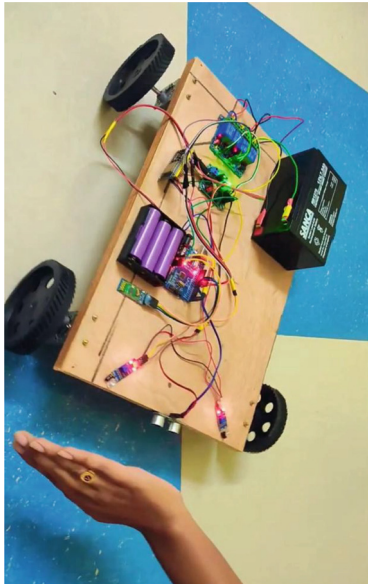
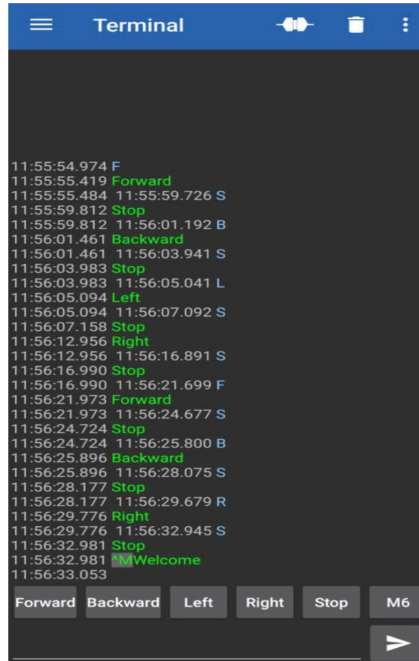


Fig. 8. Sensor working.



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Terminal
11:55:54.974 F
11:55:55.419 Forward
11:55:55.484 11:55:59.726 S
11:55:59.812 Stop
11:55:59.812 11:56:01.192 B
11:56:01.461 Backward
11:56:01.461 11:56:03.941 S
11:56:03.983 Stop
11:56:03.983 11:56:05.041 L
11:56:05.094 Left
11:56:05.094 11:56:07.092 S
11:56:07.158 Stop
11:56:12.956 Right
11:56:12.956 11:56:16.891 S
11:56:16.990 Stop
11:56:16.990 11:56:21.699 F
11:56:21.973 Forward
11:56:21.973 11:56:24.677 S
11:56:24.724 Stop
11:56:24.724 11:56:25.800 B
11:56:25.896 Backward
11:56:25.896 11:56:28.075 S
11:56:28.177 Stop
11:56:28.177 11:56:29.679 R
11:56:29.776 Right
11:56:29.776 11:56:32.945 S
11:56:32.981 Stop
11:56:32.981 Welcome
11:56:33.053
Forward Backward Left Right Stop M6

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Fig. 9. Terminal output.

11 Conclusions and Future Scope

The “SUPERVENE BAG” initiative has concluded with resounding success, garnering positive acclaim. This intelligent travel companion has proven itself as not only highly user-friendly but also exceptionally efficient. The real-time tracking feature has emerged as a valuable asset, keeping travelers well-informed throughout their journeys. The seamless implementation and favorable user feedback underscore the potential widespread adoption of this transformative technology within the travel industry. This project not only marks a significant achievement but also lays a robust foundation for future research and development in the realm of smart travel solutions, aligning with the continual evolution of technology. The envisaged inclusion of customizable features and personalized settings is poised to cater to individual preferences, ensuring heightened user satisfaction in the evolving landscape of travel technology.

References

1. Sharma, A.K., Pandey, A., Khan, M.A., Tripathi, A., Saxena, A., Yadav, P.K.: Human following robot. In: 2021 International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), pp. 440–446 (2021). <https://doi.org/10.1109/ICACITE51222.2021.9404758>
2. Sowmya, B.J., Supriya, M.: Robot controlled car using voice and wi-fi module. *Int. Res. J. Eng. Technol. (IRJET)* **08**(08) (2021)

3. Krishnan, P.L.S., Valli, R., Priya, R., Pravinkumar, V.: Smart luggage carrier system with theft prevention and real time tracking using nano Arduino structure. In: 2020 International Conference on System, Computation, Automation and Networking (ICSCAN), pp. 1–5 (2020). <https://doi.org/10.1109/ICSCAN49426.2020.9262445>
4. Khan, A., Nalwade, B., Kharshinge, N., Kamble, S.: Smart luggage system. *Int. Res. J. Eng. Technol. (IRJET)* (2019)
5. Shaikh, S., Jakahete, M.D.: Smart travelling bag using IOT. *Paripex- Indian J. Res.* (2019). ISSN No. 2250 - 1991
6. Nair, K.S., Kumar, A.J., Pillai, A.A., Greeshma, M.S., Joseph, J.: Smart luggage tracker. *Int. J. Res. Eng. Sci. Manag.* **2**(6) (2019)
7. Sutar, A., Kocharekar, T., Mestry, P., Sawantdesai, P., Goilkar, S.S.: Smart bag with theft prevention and real-time tracking. *Int. J. Trend Sci. Res. Dev.* **2** (2018)
8. Jadiwal, R., Parmar, A., Raut, L.: Rail rush system for crowd analysis. In: 2018 International Conference on Smart City and Emerging Technology (2018)
9. Wang, P., Zhang, T., Wang, S.: Remote control and tracking dual-mode smart suitcase. In: 2018 3rd International Conference on Robotics and Automation Engineering (2018)
10. Rouchdi, Y., Haibi, A., El Yassini, K., Boulmalf, M., Oufaska, K.: RFID application to airport luggage tracking as a green logistics approach. In: 2018 IEEE 5th International Congress on Information Science and Technology (2018)
11. Ahmad, M.F., Rong, H.J., Alhady, S.S.N., Rahiman, W., Othman, W.A.F.W.: Colour tracking technique by using pixy CMUcam5 for wheelchair luggage follower. In: 2017 7th IEEE International Conference on Control System, Computing and Engineering (2017)
12. Varma, R., Pavshe, P., Bhadane, A., Pagare, S.: Multifunctional bag monitoring system. *Int. Res. J. Eng. Technol. (IRJET)* (2018). ISSN 2395-0056
13. Senthilkumar, S., Brindha, K., Rathi, R., Charanya, R.: Luggage tracking system using IoT. *Int. J. Pure Appl. Math.* (2017). ISSN 1311-8080
14. Aruna, S., Bhavyashree, C., Suraboyana, K., Meghana, S., Radhika, K.R.: The intelligent suitcase. *Perspect. Commun. Embed.-Syst. Sig.-Process. (PiCES) – An Int. J.* **2**(10) (2019). ISSN 2566-932X