



Research on Emergency Communication Command and Scheduling Algorithm Based on Pattern Recognition

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Abstract. In the process of regular pattern recognition, due to the limitation of the algorithm, the emergency communication command and dispatch has a delay and a certain deviation. In order to solve the above problems, an emergency communication command and scheduling algorithm based on pattern recognition is proposed. The delay time constraint is determined by the time interval calculation, and the channel line selection is performed on the basis of the established condition, and the control transmission amount is below the maximum amount supported by the selected channel line, according to the information length, the priority level is divided and the ratio of the command scheduling algorithm is studied. The proposed algorithm is compared with the traditional command and dispatch algorithm, and the balance is more than 10% higher than the traditional algorithm; the scheduling time is also saved by about 30 s, which fully proves the feasibility of the scheduling algorithm.

Keywords: Pattern recognition · Emergency communication · Scheduling algorithm

1 Introduction

Command and dispatch generally refers to a behavior that is taken when an emergency situation occurs, and can command evacuation and solve problems in an emergency. This method is referred to the pattern recognition, and the data is transmitted and monitored in real time during the recognition operation of the computer [1]. When an emergency situation occurs, the command and dispatch will be started immediately to avoid network communication and ensure the smooth communication. The general communication command and dispatch system will be established according to the scope and characteristics of communication, and the dispatching systems at all levels will be closely connected to each other, thus establishing a more complete command and dispatch system. The dispatching command system is the future intelligent information digital conference system will replace the traditional analog system, and enter digital, network and intelligent. Therefore, the communication usage rate of communication data information will become more and more frequent, and with the development of society, the communication data exchange volume will continue to increase, and the construction of dispatching command system is the inevitable development

trend of search and rescue dispatching command. With the acceleration of social information, the dispatching command system has brought communication and communication environment and convenient command and dispatch operation environment to all relevant units. The construction of dispatching command system is an indispensable information infrastructure for information systems.

2 Design of Communication Command and Scheduling Algorithm

The communication command and dispatch algorithm mainly achieves four basic objectives: to ensure that the system throughput of the communication system achieves the best performance, and to ensure that the packet loss rate of the communication system is controlled within a reasonable range, to ensure that the quality of communication meets the normative standards and that the speed of communication can meet the standards for emergency handling. The pursuit of maximizing system throughput is an important aspect of wireless communication system design. In the communication scheduling [2], it is necessary to ensure that the communication system has sufficient throughput under the premise of comprehensive consideration of various factors. Packet loss rate is an important indicator to measure the reliability of communication transmission. If the communication system cannot be guaranteed to have sufficient reliability, the communication quality of the system will be greatly reduced. Reducing the packet loss rate can also effectively reduce the number of retransmissions, thereby reducing the load on the transmitter. The emergency communication command and dispatcher issues dispatching instructions during operation, and then each line and equipment implements scheduling processing. Therefore, the communication command and dispatch needs to coordinate the quota allocation of each line, select the optimal scheduling path, and avoid the conflict in the execution of the scheduling process. In the process of efficient scheduling of emergency information resources for pattern recognition, the emergency task set in the communication line is first expressed, and the value density of the emergency task is calculated. The priority of all emergency task scheduling sequences in the line is obtained, the resource priority is calculated, the emergency information resource scheduling criterion is given, and the emergency information resource is efficiently scheduled. Data communication mainly includes three parts: communication source system, communication transmission system and communication destination system. The main function of the source system is to encode the data of the input end data. The main function of the transmission system is to transmit and receive the signal. The main function of the destination system is to decode the analog signal at the output end. The access network scheduling algorithm ensures the reasonable state distribution of the data stream, mainly for the source system of the pattern recognition data communication and the destination system for scheduling. Through the data transmission mechanism, the modem capability is improved to ensure stable data communication in the whole frequency band. Its pattern recognition scheduling communication data structure is shown in Fig. 1.

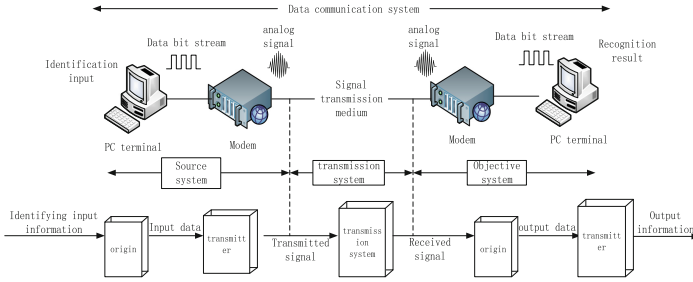


Fig. 1. Pattern recognition data communication structure

It can be seen from the figure that the structure of pattern recognition data communication is divided into three layers, which is more perfect than the previous communication structure, and this structure provides the basic security for pattern recognition emergency communication scheduling.

2.1 Determining the Delay Time Constraint

The main factor of delay generation is limited by the line resources, and is related to the transmission protocol, topology, line load, node driving method, information frame loss and other factors used in the communication control system. Its delay characteristics may be random, fixed, bounded or unbounded [3]. The stability and real-time performance of the system are constrained by the induced delay. Especially in systems with high real-time requirements, it is necessary to improve the real-time performance of the network, which is sufficient to ensure the practicability and security of the communication system. In pattern recognition, delays can generally be summarized into two categories, one is due to hardware delays caused by processor resources due to operations such as computing data. The other type is the transmission waiting delay due to the mutual constraint between the lines. Expressed as:

$$D = \sum_k D_k^c + \sum_l D_l^p \tag{1}$$

The D_k^c in the above formula represents the delay overhead spent on the k-th processor resource for the data that needs to be calculated. It is not only related to the type of specific processor resources, but also to the size of the amount of data that needs to be processed. And D_l^p represents the delay overhead incurred when the transmitted data is transmitted over the l link. In another case, when the two are on different processor resources, the delay generated is not only related to the amount of delayed data generated $c_{i,j}$, but also related to the positional relationship between the two. In any time interval t, the minimum time sent by the message i can be calculated by using Eq. 1:

$$X_i(t) = \left\lceil \frac{t}{T_{RL}} \right\rceil w_i \tag{2}$$

In Eq. 1, TRL represents the channel rotation period, and w_i represents the assigned weight, and each message in the message set has sufficient time to be transmitted within its allowed minimum delay time.

2.2 Channel Line Selection

In the emergency command and dispatch of pattern recognition, in the case of an emergency, the line that is normally operated and not occupied by other signals should be selected for grooming. Each line should be reasonably evenly distributed to avoid congestion, local conflicts, etc. The pattern recognition channel line is shown in Fig. 2.

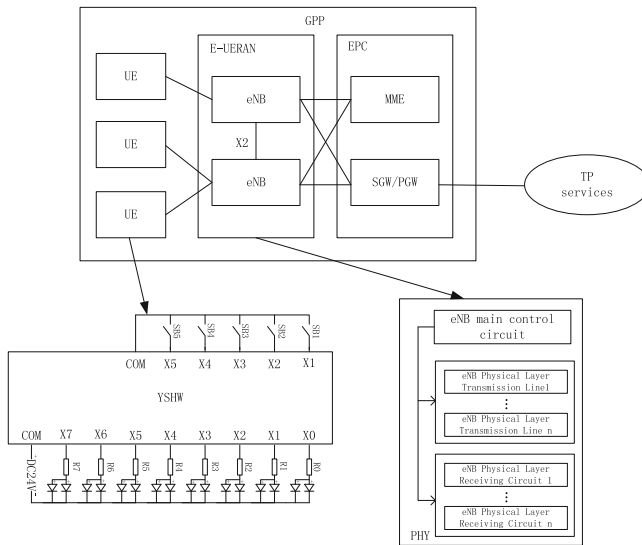


Fig. 2. Channel wiring diagram

It can be seen from the figure that there are multiple lines running in parallel in the entire communication system, and physical equipment is used to detect the line quality in the process of command and dispatch. Determining the allocation of the line to be used for scheduling after the line channel does not have a hardware failure, in the distributed scheduling algorithm, each node can only generate conflict-free scheduling plans and aggregation trees based on local information, such as its own information and surrounding one-hop neighbor information. This undoubtedly brings greater challenges to the MLASDC problem [4]. In order for nodes to avoid conflicts locally, this chapter first investigates the causes of conflicts. Under the protocol interference model, when scheduling node u , the following two conflicts may occur: The parent node $p(u)$ of node u is located within the transmission radius of a certain sending node, and this conflict is called a negative conflict; A node that is receiving a packet is located within the transmission radius of node u . This conflict is called a positive conflict. Assume that node x : has generated its own transmission schedule, ready to send the packet to node

has generated its own transmission schedule, ready to send the packet to node y_2 at time slot 3. To handle negative conflicts, this chapter defines a special set, $F2R(u)$ (forbidding the collection of time slots). For each node $u \in V$, $F2R(u)$ stores a set of time slots in which node u cannot be selected as a parent node by other nodes, such as a time slot in which u 's neighbor node v is transmitting. This collection can be updated by the following formula:

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$$F2R(u) = \{t | t = sch(v) \cdot t(v), \forall v \in NB(u) \ \& \ sch(v) \in S\} \quad (3)$$

After the neighbor node v of the node u completes scheduling and broadcasts its own scheduling information, the node u will receive the scheduling information and update $F2R(u)$. When node x_2 has generated its own transmission schedule, it is ready to send the packet to node YZ at time slot 3, and the "Schedule" information will contain the transmission schedule [$x_2, y_2, 3$], and it will be broadcast by node x_2 to its neighbors. When the node y_1 receives the information, it puts the time slot 3 into its own set of forbidden reception time slots. In this case, if node x_1 wants to select y_1 as its own parent node in time slot 3, y_1 will directly return a "Forbidden" message, prohibiting x_1 from selecting y_1 in time slot 3 as its own parent node. In this way, congestion and negative conflicts are avoided.

2.3 Control Transmission Scheduling Quota

If the quota is too large during the transmission process, problems such as overheating of components and unstable processor performance may occur. Therefore, the command and dispatch of emergency communication of pattern recognition needs to calculate and control the maximum amount of scheduling that the line can bear, ensuring that the communication information can smoothly pass through the channel line and maintain the normal operation of the entire schedule. In each priority packet queue, when the queue is not empty, counting starts, and for each data, the queue length is incremented by 1, until the operation of the queue transmission is performed. The maximum number of frames sent by the transmitted data in one time slot is N . In the process of transmitting data, the number of transmitted messages is subtracted [5]. The determining rule of the maximum number of transmitted information N is to determine the maximum number of bytes that can be sent in one time slot according to the network transmission rate. The number of bytes sent by N messages should be no more than the maximum number of bytes, and the maximum amount can be obtained. The calculation of the maximum amount will not only affect the rate of transmission, so the transmission rate factor needs to be considered in the calculation.

2.4 Priority Ratio

To control the amount of scheduling, the order of scheduling is arranged, and the arrangement is calculated and assigned according to the priority level. The specific priority comparison process is shown in Fig. 3.

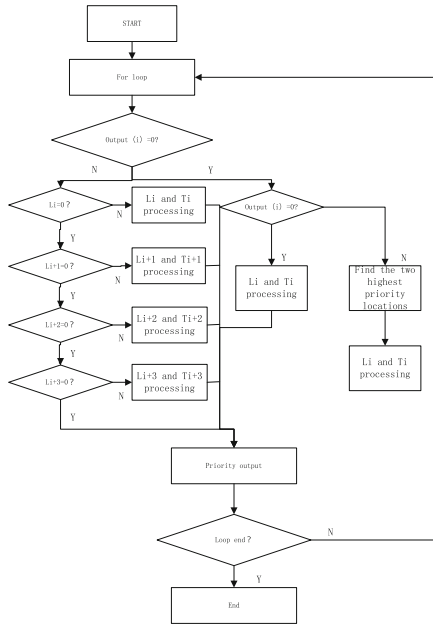


Fig. 3. Output priority flow chart

Priority allocation: set the information period to x , the information arrival time to y , the information deadline to z , and the comprehensive evaluation period to T . The comprehensive evaluation time is a combination of information cycle time, information arrival time, and information deadline by weight distribution, in order to assign priorities. Let the pre-overrun length flag of each queue be $lengthflag(i)$, if a queue length exceeds the preset value, then $lengthflag(i) = 0$; Otherwise, $lengthflag(i) = 1$. Similarly, the pre-timeout flag $lengthflag(i)$ can be set, timeout $lengthflag(i) = 0$; no timeout is $lengthflag(i) = 1$; The information priority is determined based on the obtained comprehensive evaluation time T , and the information frame priority is allocated in comparison with the clock cycle division section.

2.5 Command and Dispatch

The shortest path selection process divides the communication node into five parts: source node, untagged node, temporary marker node, permanent marker node, and multiple target nodes. Let S be the set of the end points of the shortest path that has been found from S_0 , initialize it to an empty set, and let i be the number of shortest paths that

have been searched, and set its initial value to 0. Use d to indicate the shortest possible distance from S_0 , to the end point v_i , take the initialization value and select v_j to:

$$d_i = L_{(s_0, v_i)} \cdot W_{(s_0, v_i)}, v_i \in V \quad (4)$$

$$d_j = \min\{d_i | v_i \in V - S\} \quad (5)$$

It satisfies $\text{Dis}(S_0, v_j) < R$, where $\text{Dis}(i, j)$ is a distance calculation function, representing the linear distance from node i to node j , then v_i is the end point of the shortest path starting from S_0 , if $v_j \in D$ is let $i = i+1$, let

$$\begin{aligned} S &= S \cup \{v_j\} \\ V &= V - \{v_j\} \end{aligned} \quad (6)$$

The emergency communication command and scheduling algorithm for pattern recognition can be realized by selecting the final path combined with the transmission quota:

```
public Insert()
{
    Input1=new TextField(15);
    input2=new TextField(15);
    input3=new TextField(15);
    Panel panel=new JPanelU;
    panel.setLayout(new GridLayout(5,2));
    paneLadd(new Label(' circuit'),BorderLayout.CENTER);
    panel.add(input1);
    paneLadd(new Label(' limit'),BorderLayout.CENTER);
    panel.add(input2);
    panel.add(new Label(' priority'),BorderLayout.CENTER);
    panel.add(input3);
    panel.add(new Label(' live location');
    Connection con=DriverManager.getConnection
    (dbURL,user,password);//get connected
    Statement st=con.createStatement();//obtain Statement object
    ResultSet rs=st.executeQuery(sqlStr);//operation dispatching
    con.close(); //close junction
}
```

3 Simulation Experiment

The simulation experiments were carried out using all the communication information of the same pattern recognition system. In the context of Grid Sim, a simulation platform for emergency communication command and dispatch of pattern recognition is built. Grid Sim is a simulation tool for analog communication systems. The parameter settings of the simulation platform are shown in Table 1.

Table 1. Simulation platform parameter configuration

Configuration item	Configuration parameter
Integrated environment	Eelipse6. 5, jdk1.5
Communication Systems	LTE, FDD, 5 M bandwidth
Operating system	Windows xp32bit
Processor	Intel (r) Core (tm)2 Duo CP, 2.53 Ehz
Channel environment	Ethernet connection, ideal channel
Database	Oracle9i

Use Grid Sim to set up 6 resources with different processing rates and prices, and set the local resource scheduling policy to SPACE_SHARED. And six task sets are formed to conduct experiments, and the task set includes the number of tasks in the order of 300, 600, 900, 1600, 2400, 2600. In the experiment, a value is randomly taken in the interval [5, 20] as the length of the information, and the unit is MIP (mega instruction).

3.1 Scheduling Equilibrium Experiment

In order to ensure the rigor of the experiment, the traditional command and dispatch method is adopted. As a comparison of experimental argumentation, the equilibrium of the algorithm scheduling is compared and analyzed. The experimental result curve is shown in Fig. 4.

From the experimental results in the figure, it can be concluded that with the increase of the number of tasks, the balance of emergency communication command and dispatch using pattern recognition algorithm is gradually increased. After smoothing, it is about 10% higher than the traditional scheduling method, thus greatly ensuring the stability of scheduling.

3.2 Scheduling Time Experiment

The same hardware equipment and data information are used in the experiment, which is compared with the traditional command and dispatch method. The experimental comparison results are shown in Fig. 5.

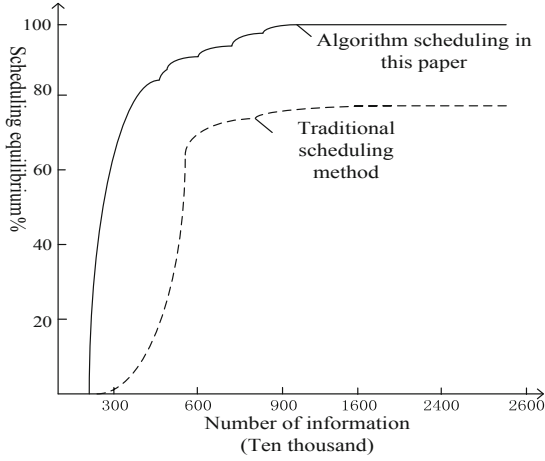


Fig. 4. Schematic diagram of scheduling equilibrium experiment results

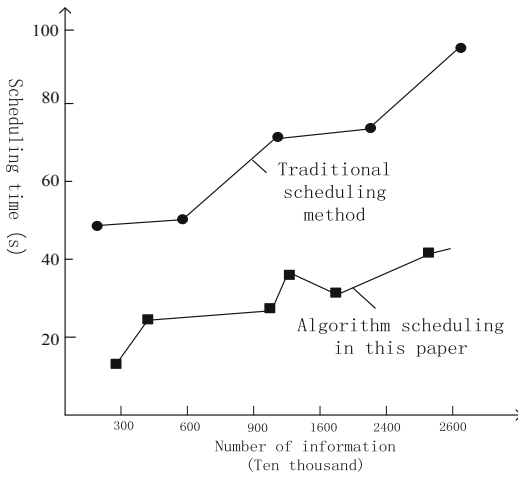


Fig. 5. Scheduling time experiment results

It can be seen from the figure that as the scheduling data increases, the time required for the scheduling process increases gradually. However, compared with the traditional scheduling method, the command scheduling algorithm proposed in this paper always saves about 30 s of scheduling time and solves the problem of scheduling delay in the past.

4 Conclusion

In response to the increasing use of pattern recognition in various industries, the requirements for emergency communication systems in pattern recognition have gradually increased. Through design and research, the algorithm which is more in line with the emergency standard is proposed, which greatly increases the scheduling efficiency. It is a good reference for the research of scheduling algorithms in the emergency communication system of pattern recognition in China.

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