Railway Safety Vehicle Detection Method Based on Information Technology

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Abstract. Safety is the top priority in railway development. At present, the rapid progress of economy and science and technology makes the speed of China's railway operation and the density of the railway network are increasing, which have a direct impact on China's railway safety. The research on railway safety detection technology can quickly realize the detection and elimination of related safety hidden dangers and prevent the occurrence of safety accidents, which not only ensures the safety of people's lives and property, but also is conducive to the establishment of a harmonious and safe railway environment in China and can promote further economic development. The emergence and development of information technology provides a relatively new technical means for railway safety detection, which can realize the rapid progress of detection technology. Based on the information technology and with the help of the security location algorithm, this paper briefly analyzes the problems encountered in railway safety detection, and puts forward the specific components and Suggestions of railway safety technology. On the one hand, it promotes the improvement of railway safety detection technology and ensures the safety of railway operation. On the other hand, it provides a certain theoretical basis for future research.

Keywords: Information Technology, Railway Safety, Testing Technology, Safety Orientation

1. Introduction
With the rapid development of China's economy, China's transportation has also achieved rapid development, opening up a vast transportation market [1]. Especially in railway transportation, especially in recent years, the continuous progress of railway technology has promoted the rapid development of railway transportation. Meanwhile, due to the innovation and change of railway management, people pay more and more attention to railway safety [2-3]. Rail safety is closely related to economic development and the construction of the railway environment, although China's current railway safety testing technology have made great progress, however, for various reasons, detection technology, there are many insufficiencies, restrict the railway in China to further improve the safety level, also brought the good sustainable development of China's railways block [4-5]. In this case, the in-depth study of railway safety detection technology has become an urgent problem to be solved.

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facing a new situation. First, with the rapid social and economic progress, China's railway safety began to enter the "prone period" of accidents; Second, the continuous improvement of railway operation speed greatly increases the risk of railway safety in China [7-8]. Fourth, the high density railway network makes it more difficult to manage the safe operation of the railway. Fourth, with the improvement of scientific and technological level, more and more new technologies are applied to railways, which makes the management requirements for railway safety greatly improved [9-10]. Fifth, the development speed of China's railway is far faster than that of other countries, and the emergence of high speed makes the railway have many unadaptable safety risks [11]. It can be seen that the current situation of railway safety in China is serious, so it is urgent to study its safety detection technology. The progress and development of information technology provide a new approach and technical guarantee for the research of security technology, which can help deal with a large amount of security operation data [12-13]. At present, information technology has been gradually applied to railway safety detection.

At present, domestic and foreign scholars have conducted in-depth studies on railway safety, including operation, management, monitoring and other aspects. Through consulting relevant data, it is found that these studies are usually specific aspects of safety detection, and the research is one-sided to some extent. At the same time, only a few studies have combined information technology with railway safety detection technology [14]. Therefore, there is still much room for improvement in this aspect. Based on the information technology and with the help of the security location algorithm, this paper briefly analyzes the problems encountered in railway safety detection, and puts forward the specific components and Suggestions of railway safety technology. On the one hand, it promotes the improvement of railway safety detection technology and ensures the safety of railway operation. On the other hand, it provides a certain theoretical basis for future research [15].

2. Method

2.1. Overview of Information Technology and Railway Safety

Information technology is based on the rapid development of network communication. It covers six aspects of network development, including communication technology network, iot network and flat-panel data display. At present, the main goal of information technology is to realize the security of information infrastructure and integration with other industries, and to promote the use of cloud computing and other network technologies. The current information technology has gradually realized a wide range of applications, with a strong vitality, which is mainly determined by the advantages of information technology. Information technology is based on the construction of basic network. It always adheres to the combination of innovation, application and service, and has significantly improved the efficiency, security and technology fusion of information technology. Railway safety involves various aspects of railway operation, including road safety, operation safety and management safety. The content of railway safety is extensive, so it involves a large number of detection links and data processing. Traditional railway safety detection technology can not pay attention to all aspects of railway safety, there are inevitably safety detection loopholes, has been unable to adapt to the development of railway speed. Based on this, the innovation of railway safety detection technology is an inevitable development trend. Today's railway development has put forward high speed and omni-directional requirements for railway safety detection technology, which are in line with the advantages of information technology itself. Therefore, it is reasonable and scientific to apply information technology to the improvement of railway safety detection technology.

2.2. Security Location Algorithm

Security location algorithm is based on information technology to accurately detect the railway safety problems. In comparison with the traditional rail safety technology, rail safety detection based on information technology to solve the cost of traditional test speed requires a lot of work, and shorten the testing time, only need to network signal detection signal structures, can complete the quick
positioning of the target of safety, it is incomparable advantage over the traditional railway safety testing technology. The positioning scheme is A hybrid positioning scheme combining CDMA network technology and GPSone positioning principle. The specific positioning mode can be briefly summarized as GPSone= a-cdma + advanced triangulation algorithm (AFLT) + cell-id (target cellular positioning), and also combined with the hybrid sector positioning algorithm. The specific formula is as follows:

\[ R_i^2 = (X_i - x)^2 + (Y_i - y)^2 \] (1)

Where, \( x\)-x represents the distance difference between mobile network base station \( X_i \) and network service base station \( x \), and \( y \) is the transmission speed of network radio waves. Combining CDMA and GPSone design scheme can effectively alleviate the problem of insufficient security positioning capacity, improve the accuracy and reliability of security positioning service. AFLT algorithm is a unique positioning algorithm based on CDMA information technology, which belongs to a relatively advanced link triangulation algorithm. Its specific formula is as follows:

\[ r_i = \sqrt{(x_i - x)^2 + (y_i - y)^2} = c(t_i - t) \] (2)

In this formula, \((x, y)\) and \((x_i, y_i)\) represent the position of the undetermined security terminal and the location of the base station. The terminal and base station are located on the same plane. The time when the terminal transmits the signal is expressed as \( t \). In CDMA network, the terminal and base station are synchronized, and the time difference of each base station pilot signal arriving at the terminal is detected. Finally, the location of the terminal of security problem is obtained by using the triangle algorithm.

3. Steps of Railway Safety Detection Technology

3.1. Experimental Steps

The first step is the collection of sample data; With the help of information technology network to consult the relevant information of railway safety, the data of railway safety accidents in recent five years were collected. Through the collection of the data, we can find out the new situation of railway safety and the problems of railway safety technology in China.

The second step is the analysis of railway safety technology. Consult a large number of data, the composition of railway safety technology under the information technology for a comprehensive grasp. And statistical analysis of the data to find out the relatively important components of railway safety detection technology. And draw the relevant data graph, based on this can quickly get the key of railway safety detection technology.

The third step is the experimental detection of railway safety detection technology; By means of information network technology, the simulation experiment of railway safety detection technology is carried out, and relevant safety data of railway operation is obtained by means of safety location algorithm. Then, the obtained railway safety data are accurately recorded and analyzed. The main purpose of this experiment is to test the reliability and scientificty of railway safety detection technology.

3.2. Composition of Railway Safety Detection Technology of Information Technology

Railway traffic is a very complex system, composed of many subsystems, including many small equipment and links. Any problems in any link will have a great impact on railway safety and bring huge hidden dangers. Therefore, it is an important technical support to make full use of information technology, strengthen the safety detection of railway equipment and facilities, railway operating environment and operation state at any time, and timely deal with them according to the safety detection status. After consulting a large number of materials, the main proportion of its railway safety technology is obtained. The specific data are shown in figure 1 below, in which the author collates the
As can be seen from figure 1, the composition of railway safety detection technology is relatively complex, among which the main technical components are comprehensive railway detection technology, communication signal detection technology, train operation status detection technology and line infrastructure detection technology. Therefore, this paper mainly explains the railway safety detection technology from the following four aspects:

First, comprehensive railway detection technology. Under the information technology, most of the current trains use information technology to carry out a series of safety tests on the fixed equipment of the railway. With the help of the most advanced information detection technology, the fixed equipment for a comprehensive, rapid and accurate detection. The current information technology integrated inspection vehicle includes six inspection systems, namely: track, bow network, dynamics, communication, signal and integrated system. These systems can realize the following aspects of safety detection: the detection of the railway general system, the railway safety data processing detection, the basic equipment safety detection and so on.

Second, communication signal detection and early warning technology. Communication signals ensure the normality and stability of railway operation signals, bearing not only wireless scheduling and information transmission tasks, but also the task of train operation control, which has a direct impact on the safety of railway operation. It mainly includes the following aspects: the first is gsm-r network management monitoring, which is the main way to achieve safety management and fault management, capable of real-time detection of the system equipment, and can quickly locate the fault. Secondly, the signal system security detection technology: This technology can realize several kinds of detection of signals of the whole railway network, and can self-diagnose related problems, and can give a quick warning after finding problems, thus minimizing the occurrence of safety problems.

Third, train running state detection technology. The detection technology based on information network technology, with the help of field detection, fault diagnosis, network transmission, expert system and database, by the means of information technology such as implementation of railway operation of main equipment running status detection, data collection, fault handling, and security monitoring and other functions, so as to ensure the running safety of railway. This technology mainly
includes three levels of safety detection, namely vehicle detection, remote detection and ground detection. With the help of these three levels of detection to achieve the comprehensive detection of the railway operation state, to ensure the safety of the railway operation.

Fourth, line infrastructure inspection technology. The safety environment of the railway line is an important prerequisite to ensure the safe operation of the railway. The safety of railway line environment is directly determined by the state of the infrastructure of railway line. Therefore, the detection of railway line is an important part of railway safety detection. The detection of line technical facilities mainly includes the detection of railway track structure, subgrade settlement and deformation, health detection of complex structure Bridges, safety detection of extra-long tunnels and other aspects. In a word, all the line facilities directly related to railway operation should be carefully inspected to further ensure railway safety.

3.3. Testing of Railway Safety Detection Technology for Information Technology
In order to understand the actual effect of railway safety detection technology in ensuring railway safety. It is necessary to carry out reliability simulation test for railway safety detection technology. In this paper, a series of simulation experiments were carried out on railway safety detection technology with the help of network information technology software, and the collected data were processed with the help of safety determination algorithm. Finally, the analysis table of railway safety data was made. The specific data is shown in Table 1.

| Table 1. Experimental data of railway safety detection technology |
|---------------------------------------------------------------|
| **Safety Improvement Index**              | **Fault Detection Rate** |
| Comprehensive Railway Inspection               | 42.1%                   | 76.5% |
| Communication Signal Detection                | 38.6%                   | 82.1% |
| Train Running Condition Detection             | 40.6%                   | 89.4% |
| Line Infrastructure Inspection                | 32.4%                   | 83.2% |
| Comprehensive                                  |                          | 89.9% |

*Data came from the in-depth analysis of financial data in the experiment*

As can be seen from table 1, railway safety detection technology based on information technology greatly increases the safety performance index of the railway, and the probability of railway fault detection also increases. Finally, the railway operation safety index reaches 89.9%. This indicates that the railway safety detection technology based on information technology is more scientific and has a promoting effect on improving railway safety. However, we must also see that there is room for improvement in railway safety, so we should continue to strengthen the improvement and innovation of railway safety detection technology.

4. Conclusion
Railway safety detection technology is closely related to the safety of railway operation and the life safety of railway crew and passengers. At present, China has improved and promoted the railway safety detection technology with the help of information technology, but due to various limitations, the current railway safety detection technology still has some deficiencies. Therefore, relevant departments must keep a clear understanding of railway safety detection, constantly innovate railway safety detection technology, build a perfect detection technology system, further strengthen the detection of railway safety, and ensure the safe operation of railway.

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