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Study of Management Information System of Railway Permanent Way Safety Risks and Comprehensive Evaluation

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Abstract

The safety of railway permanent way is what the railway department highly concern about, railway permanent way department is one of the most important departments, it manages all railway infrastructure, railway infrastructure's good condition and normal operation is the foundation of railway transport safety. In this paper, management information system of railway permanent way safety risks and comprehensive evaluation is built through the integration of existing resources of the railway permanent way department, to achieve scientific and standardized management. It provides the effective solution for innovation of railway permanent way management and the mode of administration. This system is operational in February, 2008 in the Kunming railway bureau.

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Key words: Railway; Railway Permanent way; Management Information System; Informationization

1. Introduction

China has launched its sixth railway speed upgrade on April 18, 2007. Compared with the previous five railway speed upgrade, the range of the speed, content and technology have a qualitative change, but there are still many of the key technologies needed to be studied, running safety of train have become a more highlighted problem. Railway infrastructure keep in good condition is the most important safeguard to ensure running safety of train, and establish an effective, accurate and reflect the problems of decision support for management and evaluation system. Many scholars have done a lot of research work [1,2,3,4].

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This is the goal that management information system of railway permanent way safety risks and comprehensive evaluation to achieve.

2. Key technology

Management information system of railway permanent way safety risks and comprehensive evaluation based on daily inspection data, equipment information data, basic geographic information data, data standards and regulations. Its goal is to achieve the collection, storage and management of dynamic inspection data, static inspection data, railway lines, bridges, large and medium repair data, bridges and tunnels maintenance data, bridge and tunnel failure data, and data collection, storage and management of railway lines, bridges and tunnels equipment, combined with the permanent way departments daily operations and management processes, to achieve the informationization of railway permanent way management.

B/S is a popular online information services technology in WWW, it exchange and delivery information between the Web browser and Web server based on standard http protocol. It is different from the traditional C/S mode, B/S system is installed on the client without special client software, and just standard browser software such as Microsoft IE can handle a variety of information based on http. Because there are many glitches in the traditional C/S mode, each user is required to install special client software, so that upgrades, maintenance and other work is difficult, therefore, it is not appropriate. Large database (Oracle) technologies meet the requirements for mass data storage, retrieval and extraction. WEB-GIS technology can enhance the management of railway permanent way spatial data, it can do the management and distribution of GIS data, geology, hydrology, weather, railway line design drawings, construction drawings and photos of key equipment, also provides an intuitive management platform.

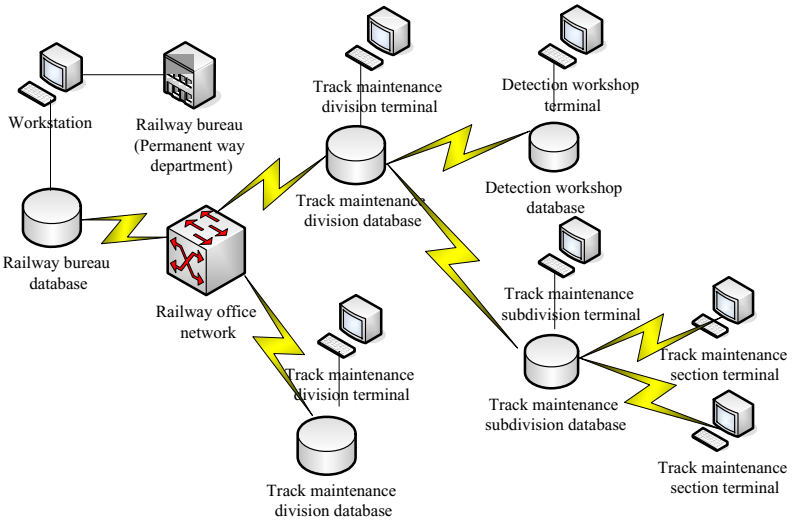

Fig.1 Hardware structure of system

3. System design

3.1 Track Composite Irregularity Analysis

The characteristic of B/S (Browser/Server) architecture is easy to use, scalability, strong, quick release, low maintenance, security, performance advantages. Users can query and analysis all kinds of information (inspection data, inspection reports, risks information, geographic information, property information, multimedia information) easily in the browser.

Hardware foundation of the system is the existing railway office networks, it include railway bureau, track maintenance division, track maintenance subdivision and track maintenance section four user platforms. The network of management information system of railway permanent way safety risks and comprehensive evaluation must be extended to workshop and it will be complete closed-loop management. System's hardware structure is shown in Figure 1.

3.2 Logic analysis and software structure design

Railway permanent way equipment management and equipment inspection management is the data base of the entire system; State analysis is reliable basis to achieve system management functions in the use of equipment; equipment maintenance management is necessary means to strengthen quality of equipment to ensure the safe operation of equipment; alert management strengthen automatic monitoring equipments state in use, it is the most reliable methods of management to ensure that the equipment in good condition. Study the law of track state changes through long-term accumulation data, and establish a scientific track state prediction model, and achieve radical change from the present "repair after over limit" and "repair after failure" to the "preventive maintenance" and reliable science-based "repair according to condition" changes according to prediction model, railway permanent way management will be long-term stability by the use of scientific and reliable way.

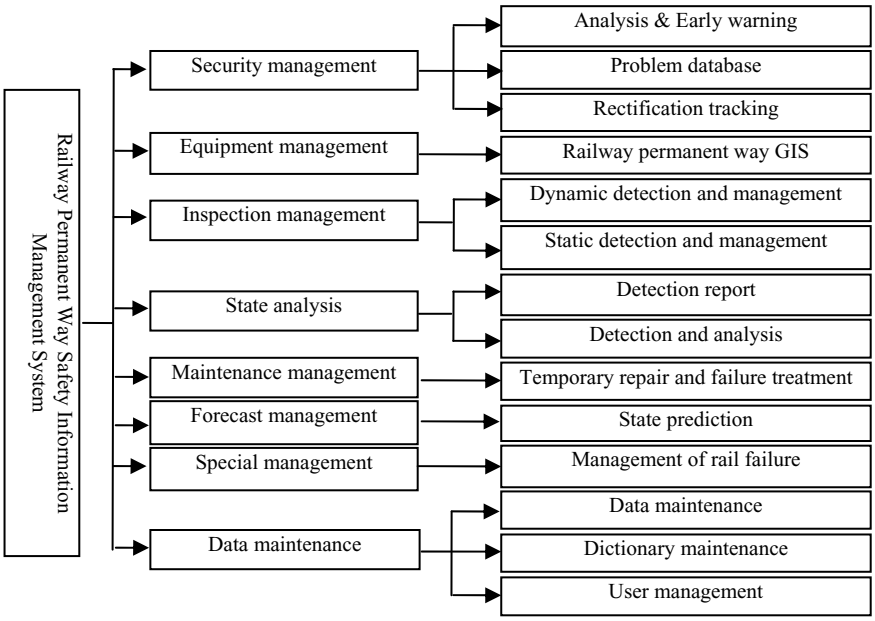

Fig.2 Software structure of system

The system divided into four levels from the inside to the outside through the above analysis: the inner layer is synthesis management and special management, risks found → deal with →evaluation is main line of treatment, it is the key issue that the analysis and mining of railway permanent way management;

Followed by the production management layer, the main line is a closed-loop: equipment inspection → state analysis → state forecast → repair equipment → repair evaluation → equipment inspection, it include equipment inspection, inspection plans, equipment repair, evaluation, provide service for production dispatch; Second outer layer is equipment management layer, mainly involve the basic equipments management (PWMIS, geographic information systems) These systems for the detection and management, project management, and analysis module provides information support; The outermost layer is basic data layer, the inspection data, equipment attribute data, repair data, DMIS data, TMIS data, etc. Software structure of system is shown in Figure 2.

3.3 Data source and data accuracy

The data of system required are: dynamic inspection data in track recording car (original data, analysis data), inspection data of vehicle-mounted track monitoring unit, and inspection data of rail flaw detection car; static test data is track artificial inspection data.

Accuracy of the data is the key issue to the system, true data can reflect the actual situation but inaccurate or wrong data not only does not reflect the actual situation but also make unnecessary trouble and waste of resources. Some data cannot be uploaded to the system in time and data needs to be uploaded to the server manually, so it need to do well on management, make data upload in time and complete. The system add features about inspection of data attributes, such as No. of inspection equipment, inspection date, the size of uploaded files, data file is complete or not and other information.

Taking the above-mentioned problems into full account, add features about data validation and staff appraisal in system, so this system can be: data upload in time, uploading data is tested, data proved to be true and valid. The relationship between subsystems of the system is shown in Figure 3.

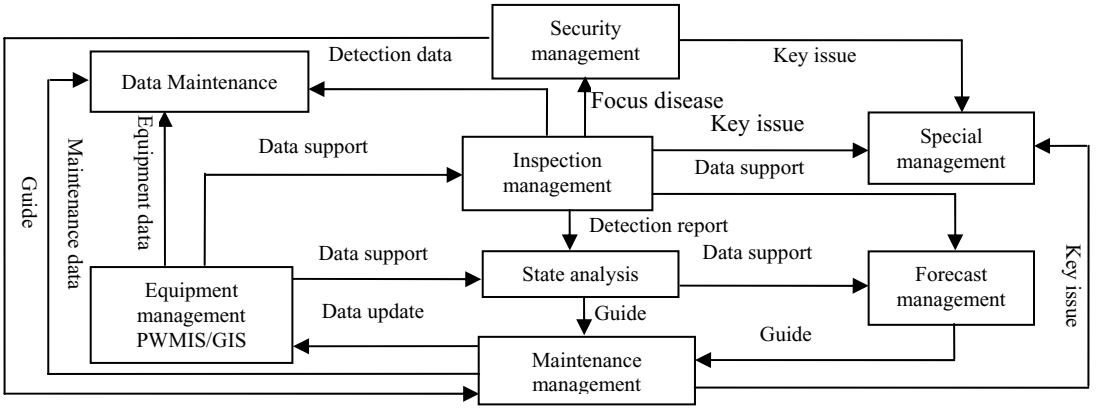

Fig.3 The relationship between subsystems

4. System application

The system applied in Kunming railway bureau in 2008. It changed the traditional mode of railway permanent way management, managers at all levels can browse the data through computer terminals, to find out the real situation. All levels managers and policy makers of railway permanent way department can monitor railway permanent way equipment in real time and dynamic by the implementation of the system. It handling all types of railway permanent way equipment failures and various risks timely, improved management efficiency and management level. System enables users of different permission

levels maintenance inspection and implementation data in system, also can display a variety of inspection, testing, maintenance and other comprehensive data; make at all level managers and policy makers accurate to view the variety of information of railway permanent way equipment status based on dynamic inspection, static inspection and other various detection methods timely, fully grasp the tube basic situation of railway permanent way safety management. The system combine macro-management and detailed management, provide principle of decision-making for managers all level.

5. Conclusion

Establish an effective management information system of railway permanent way safety risks and comprehensive evaluation is a complicated systematic project. Its purpose is to enable railway permanent way safety risks management to a new level through a variety of data integration and analysis. The sixth railway speed upgrade different from the past five speed upgrade in nature, which requires a new management concept and matching rule, How to combine mature management ideas of foreign and actual situation of Chinese railways, it is not a simple copy mode, the purposes of the system is intended to promote the development of relevant rules and guidance, develop effective management strategies and standards with the characteristics of Chinese railway, Make hidden safety risks becomes clarity and establish scientific maintenance programs.

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