



A management information system for mine railway transportation equipment

LI Mei-yu¹, HAN Ke-qi¹, ZHANG Xiao-yong¹, LI Xiao-lin¹, ZHAI Yong-jun², YU Wei-hu²

¹*School of Mines, China University of Mining & Technology, Xuzhou, Jiangsu 221008, China*

²*Railway Operators and Manufacturers of Shanxi Luan Mining Group Company, Changzhi, Shanxi 046000, China*

Abstract: Good equipment management is essential for the day to day management of an enterprise. Targeted at production operation of the railway transportation department of a mining group and aimed at mine railway equipment management, we have established a management information system for the equipment in the entire process of the life cycle of equipment. The project deals with basic data about equipment, initial management, maintenance, operation and even disposal, based on a C/S and B/S structure. We adopted an object-oriented approach, dealing with software engineering, information engineering, economic and organizational measures. Thus, effective monitoring and control of the operation of railway equipment and its status in the entire process has been achieved.

Key words: mine railway; transportation equipment; management information system

1 Introduction

The railway of a mine is a transportation system which consists of a number of different types of assets such as locomotives, a permanent railroad bed and communication & signals (c & s) etc. Compared with other industries, it has many specific characteristics, including complicated and changeable production conditions, abundant and extensive equipment and a mass of mobile devices. As well, there are continuous changes in the use of the equipment. The safety of production of the enterprise depends on real-time monitoring of equipment to ensure it is in good working order^[1]. For these reasons, the dissemination of information about railway equipment management by means of modern management is indispensable.

At present, most of the software of the equipment management system developed in our country is for general purposes, which makes it difficult to meet the personal and particular need of the mining industry. Especially for the mine railway where its equipment management system has special and very distinct mining characteristics, railway management is very different from equipment management in other industries. Mine railway equipment management is required to comply strictly with the “Equipment

Management of Regulations for Coal Industry Enterprises” and the “Overhaul and Maintenance Regulations for Railway Equipmen”, in order to carry on with its dynamic management of equipment, with regard to plans, purchase, acceptance, operation, maintenance and disposal and to maintain monitoring the entire life cycle of its equipment.

2 Main target and function of the system study

For our investigation, we have, delved into development technologies, the practical environment and robustness of the system, its running performance and its hardware needs. In our system design we have adopted the idea of a three-tier structure: i) the façade layer (also called the interface layer) offers a visual interface to the user, who can enter and obtain data through this layer. The interface, simultaneously, provides the user with a certain amount of security; ii) the logic layer, the bridge between the façade layer and data layer. It responds to requests by users from the façade layer, executes tasks, acquires data from the data layer and transfers necessary data to the façade layer; iii) the data layer defines and maintains the integrity and security of the data, responds to requests from the logic layer and accesses the data.

2.1 Main target of the system

The aims of the system are as follows:

1) Realizing electronic management of railway equipment in the entire mining area and setting up statistical databases for the equipment.

2) Using computers to comply with statistical accounting demands about mass data and produce various required reports to provide evidence for daily routine management and decision making in the enterprise.

3) Providing related accurate, timely and complete information for the people who are engaged in the provision of transportation, dispatch and command.

4) Implementing real-time dynamic management of railway equipment, effectively improving the capacity and work efficiency of equipment management and enhancing the utilization ratio and service life of the equipment. It provides powerful support for scientific decisions about equipment management in order to achieve highly efficient production, it ensures the safety of railway transportation and finally it promotes production benefits^[2].

2.2 Main functions of the system

The main functions of the system are as follows:

1) In view of the massive amount of information and the constantly changing state of the mine railway equipment, an integrated management information system of equipment (EMIS) has been established. It consists of a universal equipment management, equipment management of the locomotive depot, a permanent railway bed equipment management, c & s equipment management and vehicle equipment management. This EMIS contains a great deal of information and covers a wide range of aspects, involving production, technology, management, etc.

2) Given the "Equipment Management of Regulations for Coal Industry Enterprises" and "Overhaul and Maintenance Regulations for Railway Equipment", a related function module is established to carry out tracking and for issuing warnings. At the same time, an actual dynamic management of equipment process, relating to plans, purchases, acceptance, contracts, maintenance and disposal, is carried out^[3].

Realization of these system functions is shown in Fig. 1

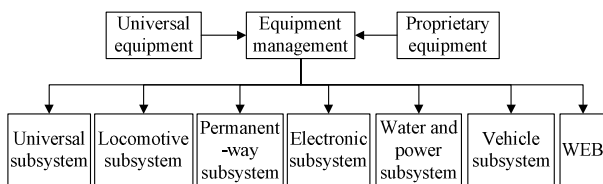


Fig. 1 Schematic diagram of system functions

3) Introducing modern management methods and making use of network charts and critical path techniques to optimize the maintenance procedures of

locomotive and vehicle equipment.

4) Based on a unified database, the system adopts both C/S and B/S mode. The C/S mode is adopted for the department which has to deal with large amounts of exchange and input of data and needs frequent, routine maintenance. The B/S mode is used for the management layer which queries and browses information about equipment management. Users can choose either mode according to their own situation.

5) Based on the web of EMIS with its unified database, statistical inquiries, uploading and downloading of reports, data, images, etc. are provided. As well, the function of graphic navigation, which is aimed at the permanent railway line and signaling and communication equipment of the electrical department, by web, is realized.

3 General structural design of system

3.1 Components of the system

Based on the LAN and the C/S & B/S structures, the system includes both a WEB and a development information system. The components of the system are shown in Fig. 2.

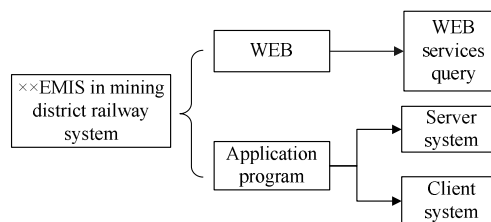


Fig. 2 Components of the system

3.2 Structural constitution of equipment management

Considering the characteristics of universal and proprietary equipment in a mine railway, a universal equipment management model and proprietary equipment management model has been developed. These models include systems for the following purposes: permanent railway equipment management, electronic equipment management, locomotive equipment management and vehicle equipment management. Some advanced functions are controlled by a server.

Every station and depot has both universal and proprietary equipment:

1) Universal equipment includes basic universal and special equipment, unified by the universal equipment management model.

2) Different stations and depots have different special equipment: the permanent railway depot includes lines (main lines, tracks), sleepers, switches, crossroads, bridges and culverts. The electronic depot includes communications, signals and power. The vehicle depot largely includes vehicles while the locomotive

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