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Construction and Application of Electromechanical Management Platform in Mine

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Abstract

In this paper, a electromechanical management platform for 18 producing mines and the majority of mines been constructed has been built up on the base of the comprehending of the equipment management processes and features in coal mining enterprises, and based on the communication of Gigabit Ethernet channel. The fully sharing and collaborative exchanges of the operational information in electromechanical management are achieved, so facilitated the leaders, units and departments for information exchange, query, and service. This system has been used to regulate the process of electromechanical management, and improve the management efficiency, and has set a foundation to promote and create the digitized mine.

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Keywords: mine electromechanical equipment; management; platform

1. Introduction

Shandong Xinwen Mining Group Corporation of China is a cross-regional, inter-provincial company, and has a larger number of producing mines and being constructed mines. It has a wide range of different equipments covers ventilation, drainage, hoisting, and other aspects, especially with the company's rapid development and the application of the advanced equipment, the original work that recording the information, operation, maintenance, and management by hand are not suitable for large data information exchange in mine, so the data sharing, querying, statistics, decision-making support are more difficult.

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Electromechanical management platform of coal mine integrated use of electronic technology, database technology and intelligent system, which can be used for automated equipment monitoring and diagnosis. In reference [1], a flexible and scalable innovation management system is designed. In reference [2], a Web-based electromechanical management platform is designed, and achieved the functions of fast feedback, dynamic tracking, remote resource sharing and management. In reference [3], the platform enabled the safety management, intelligence analysis and data security warning in coal mine, and reduced the accident rate and improved the management capacity of coal mine safety monitoring.

2. System function

This system is used to regulate the process of electromechanical management, improve the management level, achieve the information sharing and exchange level among various units in coal mine. The main functions including technical data management, reporting and subtotals, output daily report and monthly reports, realize document downloads, etc..

2.1. The implementation of life cycle tracking management of electromechanical equipment

Life cycle management of electromechanical equipment is an important part of the production management in mine enterprises. It needs to fully integrate the established operation management system to realize the electromechanical equipment's planning, arrival, storage, recipients, transferring, recycling, maintenance, borrowing and lending, transferring out, internal leasing, scrapping, inspection, training and other business aspects of tracking managing. According to the different points of the business, it can sets different warning models, strengthens the advanced equipment maintenance, advanced care and advanced maintenance, so it can realize the pre-control of accidents, improves the operation quality.

2.2. Enhance safety management and control

Through implementing dynamic management of the electromechanical equipment, it can centralize equipment's management data coming from different mines (units), different work areas and different equipments in order to standardize and promote the construction of electromechanical equipment operation and management system. By using the system, it will realizes the cooperative and centralized control of the electromechanical equipment among the different units, reduces the management costs, and improves safety management and control of the equipment.

2.3. Realization of electronic file management and convenient querying

Mine electromechanical equipment have the characteristics of long life cycle, high security, heavy tracking manage content, etc. With the equipment management information system the users can query the device's various types of file and information timely, so reduces the workload of manual sorting and query, regulates the management mode mechanical and electrical equipment, and providers electronic data to the decision-making.

2.4. Realization of integrated statistical and decision support

Through timely, effective and fast extracting management operation data of the electrical and mechanical equipment, it can provide timely data sources for comprehensive statistical analysis. According to the management authority, the system can achieve general statistics of the existing mechanical and electrical equipment's control data (such as mining machinery and electronics, electric,

energy, personnel training management, etc.), and provides timely query functions for decision-making hierarchy, so the management level of electrical and mechanical equipment within the group and mining units will be enhanced roundly.

2.5. System Hierarchy

According to the principles of system security and data independence, the system architecture is divided into five levels, named as the network and operating system layer, the database system layer, database management layer, system application layer and user layer.

Network and Operating System Layer. Through the management mechanism of the network and operating system and with the appropriate management software and firewall technology, it prevents viruses and hackings intrude the enterprise information management network. By encrypting key data and the transmission data, it can prevent all illegal staff log into the database and application systems.

Database System Layer. Through the management mechanism of the large database operating system (e.g.: ORACLE) and the corresponding management software, it achieves the testing of user registry and controlling of various operations access (query, modify, etc.) of data.

Database Management Layer. Through the application of software products and the principles of the database system to achieve the database management, including dual-user qualification verification, main access control and other functions.

System Application Layer. The main system functions include power permissions, data permissions, the operation permission settings, application control mechanism, operating log management, etc.. Through the application layer, the system achieves the management and supervision of each operator.

User Layer. Client operating environment supports Windows XP, Windows Vista, Windows 7 and other operating systems.

3. System Design

3.1. The overall framework of the system

The system design is based on the .NET framework model, uses B/S architecture model. Through writing web applications in ASP.NET language, it implements all the required functionality. ASP.NET is a unified web development model and a part of the .NET framework, which supports a visual way to create enterprise-level web site. B/S model means the Browser/Server model which is based on web-centric, using TCP/IP, HTTP transport protocols. So the client users access system server and back-end database through the system browser. The overall framework of the system is shown in Fig.1.

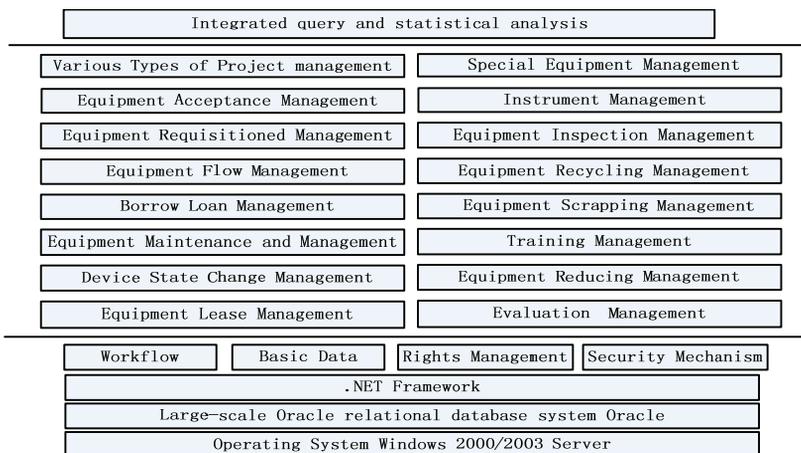


Fig.1 Diagram of the overall framework

3.2. The design of the various parts of the system

In accordance with different functions, the system is divided into several functional modules, each module completes a specific function, and each module connects with others via the application interface.

User Management Module. The function of user management module is relatively simple. The initial system administrator named Admin is added into the database by the programmer, and the other users (including administrator users and ordinary users) will be created by the system administrator. Ordinary users can access the web resources but only modify their own user name and password.

Basic Information Module. This module mainly realizes basic information management. It mainly includes institutional information management, department information management, factory information management, group rights management, the operator information management and the device type management sub-modules. Each sub-module’s function is independent, and it makes statistics in tabular forms.

Equipment Management Module. Based on demand analysis this module is divided into program management, equipment inspection management, equipment requisitioned management, the device flow management, borrowing and lending, equipment maintenance and management, device status changing, equipment lease management, special equipment’s instrument management, equipment inspection management, device recovery and equipment obsolescence management sub-module. The entire life cycle includes equipment use, maintenance and the obsolescence.

3.3. Database Design

Database design directly determines the quality of the system, in this system, it involves large amount of information, therefore, the database design must follow the appropriate specifications. After the requirements analysis is completed, the abstraction and analysis for the involved equipment management information are made, and the corresponding conceptual model and mode of all levels are created, then the view design is made. Based on entity’s contacts map, the logical design of the database is carried out, and then the corresponding primary keys between the relationship models are established and the necessary data specification normatively are encoded.

During the database design, it needs to general consider the relationship between various subsystems, minimize data duplication as much as possible, take full advantage of the characteristics of database systems and improve the database efficiency. System database is mainly divided into two major types, namely, resource data and operating data. The resource data is mainly about public data which seldom changes and the maintenance based on basic information management module, and the operating data refers to continually produced and changeable data in the operation process of the system, that use the corresponding operation modules to add, modify, and delete. The data of contract management, equipment management and maintenance management can be classified into operating data.

4. Conclusion

Through the management information platform, it realizes the unity collecting and reporting of the various types of information (technical data, field data, etc.) of the electromechanical equipment during the operation and management process. It realizes full sharing of information resources between various coal mining equipment in the group enterprise, facilitates all levels of management timely understand the dynamics of various types of equipment (such as device management status, running status, etc.), and can help improving equipment management level of refinement. It also strengthens the whole mining equipment's repair and maintenance management, identifies problems and reports the treatment timely, and ensures the normal operation of the regional facilities in mine, so it helps to improve equipment's operation safety management. By improving the quality and efficiency of submitted various statistical reports, it strengthens the exchange of information between various mines, helps to improve the standardization and coordination of the equipment operation management. It solves the extensive operation quality control and management scattered issues effectively, further enhances the ability to control by the group enterprise, so it's useful for the scientific decision-making by senior leadership and conducive to promote a comprehensive manner within the enterprise management level. It makes a solid foundation for the continuous improvement of equipment management and for promoting and building the ultimate digital mine.

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