

The Research of the Data Platform System for the Systemwide Supervision and Management of the Intelligent Mine in the Opencast Coal Mine

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Abstract. This paper discusses in detail the characteristics, design basis, functional framework, process management and implementation mode of the data platform system for the systemwide supervision and management of the intelligent mine in the opencast coal mine, and expounds the application prospect of the data platform.

Introduction

The intelligent mine wisdom expresses various objects and phenomena related to mining activities and applies them to the management and decision-making of each link. It integrates informationization, digital technology and big data organically on the basis of digital mine, so as to realize the intelligent decision-making and control of each process or link in the mine. One of the core systems of the intelligent mine is the system-wide supervisory management data platform, which can achieve: 1) Subsystem data sharing and fusion analysis, effectively improve the level of mine production, operation and management[1]; 2) Promote the development of efficient new mining technology, improve the efficiency of resource allocation, and improve the quality of management; 3) Effectively release part of the labor force in mining operations; 4) more effectively safeguard the safety of personnel operations; 5) improve mine labor efficiency; 6) conducive to environmental control [2,3].

System Features

The intelligent mine whole-system supervision and management data platform is established on the basis of mine digitization, which can complete accurate and timely collection, network transmission, standardized integration, visual presentation, automatic operation and intelligent services of all information of mining enterprises.

System Features

1) Data processing. Process mine-related work content into digital information that can be stored, copied, processed, and transmitted by network and ensure the integrity; 2) Accurate and timely collection. Accurate and timely collection of safety, production and management information required at any time at any place; 3) Networked transmission. Real-time data, multimedia data and management data can be timely, reliable and safe transmission through LAN and wan, and necessary data can ensure clock synchronization; 4) Canonical integration. The data warehouse defined by the standard data format, open communication protocol and unified management specification realizes the interconnection and interflow of information in various applications to ensure the unique entrance and consistency of data; 5) Visualization. Geographic information system technology, virtual reality technology, simulation technology, multimedia technology and visual analysis technology express and display all the information and models in the data warehouse, to achieve transparent management; 6) Unmanned operation. In the main production implementation link, monitoring and monitoring link, the link with strong timeliness and high accuracy, as well as the link with bad environment and easy fatigue, the operation is basically unmanned; 7) Intelligent services. Provide intelligent tools and

comprehensive decision support in areas such as hazard identification, disaster warning, accident alarm, program design, planning, process control, economic analysis, and scheduling optimization.

Design and Research of the Data Platform

Design Consideration

In view of the control problems existing in opencast coal mines, many aspects need to be improved. The production unit information and video monitoring are not shared. The sales system data and the report are both entered and filled manually. The geodetic system also requires manual measurements. The dispatching function is not fully utilized. Some of the management processes are cumbersome. The dispatching communication system equipment is backward, and some systems are low in automation. Through the accurate and timely collection of information, network transmission, canonical integration, visual display, automatic operation and intelligent services, the enterprise informationization, production process automation, security monitoring digitalization, information management intensive information sharing and collaborative application platform are constructed. In this way, it can cover all business departments of opencast coal mine, realize information standardization, centralize information resources, and visualize information globally through the construction of intelligent mines, thereby continuously promoting management institutionalization, standardization and modernization, and promoting production safety and efficiency.

Basic Functional Architecture Research

The intelligent mining system of an opencast mine will be based on the all-regional cloud platform, including control and equipment layer, data layer, manufacturing execution layer, management layer, and decision-making layer. It can effectively realize the complete sharing of information and the seamless integration of various businesses. The system structure of the open system mine intelligent mine system supervision and management data platform is shown in Figure 1.

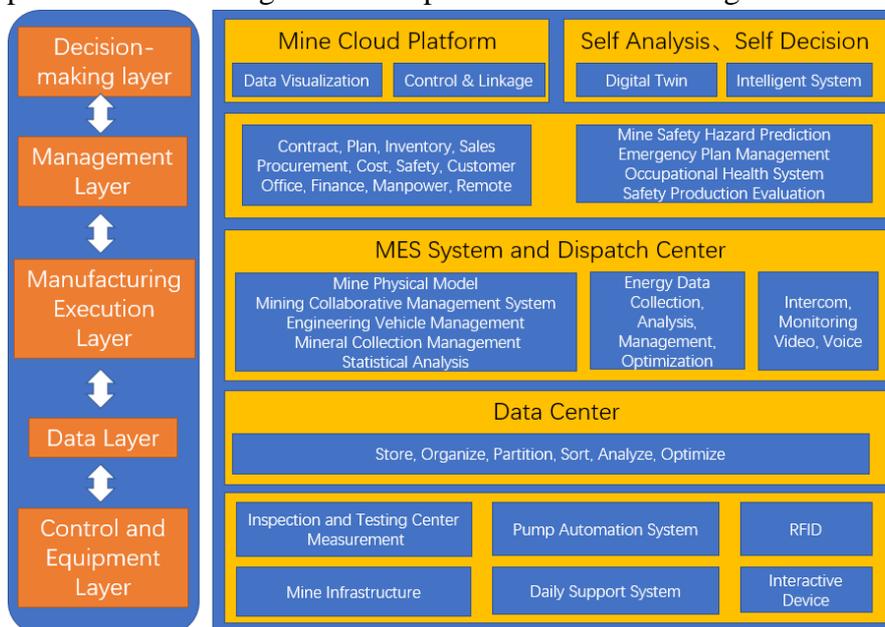


Figure 1. System structure of intelligent mine systemwide supervision and management data platform in opencast coal mine

Control and Equipment Layer. This layer mainly includes the construction of network facilities such as servers, switches, routers, lines and channels, and acquisition equipment. It mainly involves basic automation and daily security control system. The data transmission network based on industrial Ethernet, wired + wireless + artificial data acquisition system, wired + wireless data

transmission mode and C/S+B/S data access mode are adopted. The interface is canonical and standardized, laying a foundation for data and control for the construction of intelligent mines.

Data Layer. It mainly includes graphic workstation, big screen, TV wall, video meeting, projection equipment, inkjet equipment and other related facilities construction and comprehensive query. In order to facilitate the management and improve the retrieval efficiency, the data center database is divided into static database, real-time database and multimedia database. Static database for ordinary data and static documents, real-time database for real-time monitoring data, multimedia database for video and audio clips of industrial TV system and communication system. This layer is mainly used for information storage, sorting, partitioning, sorting, analysis and optimization.

Manufacturing Execution Layer. Production management includes: mine physical model, mining collaborative management system, engineering vehicle management, mineral collection management, statistical analysis, etc.; Energy includes: energy data collection, analysis, management, optimization; Interactive communication includes: intercom, monitor, video, voice. This layer of control is mainly for mining area management.

Management Layer. It includes benefit analysis, plan formulation and adjustment, project schedule control, collective consultation of production and safety hazards, visual command and scheduling and dispatch, etc., as well as safety inspection and quality inspection. The effect determines the benefit of intelligent mine construction.

Decision-making Layer. Comprehensive query, benefit analysis, query result interaction, and self-analysis and production forecasting. Establish an expert system and strive to realize self-determination.

Process Management

The process is divided into production and operation main process and auxiliary process. The management process directly related to production, products, customers, funds, etc. is the main process of production and operation, which mainly includes: business plan (including budget), production management, quality management, logistics management, and financial management. Other management processes that support these services are support processes. According to the strategic control requirements and annual goals, the business plan is formulated, and the sales operation plan and resource plan in the business plan are taken as one of the basis for signing the sales order, and the main and auxiliary processes such as planning, production, sales, logistics, and finance are managed.

Basic Mode of Implementation

The host platform adopts cluster and load balancing technology to ensure the stable and reliable operation of the system. The storage system adopts the storage LAN structure to ensure the speed of data access, data security and extensibility, and realize the function of lan-free centralized data backup. The basic software adopts the basic platform software with high reliability and has applied precedent in large enterprises. The application system structure adopts three-layer structure, and the front end is the application presentation layer, which is responsible for the presentation of business data. The middle application layer is responsible for data retrieval and operation on the system. The background is the data storage layer, which is responsible for saving the result data and historical data after the processing of the system, providing a basis for big data analysis.

Conclusion

China's "13th Five-Year National Science and Technology Innovation Plan" proposed: green development of coal resources. Focusing on the goals of "safety, green, intelligence", we will carry out coal green resource exploration, safe green mining, intelligent coal machine equipment, low-quality coal upgrading, coordinated development of coal-related resources, comprehensive material circulation planning and carbon emission control in mining areas. We will work with technology to promote the construction of major scientific and technological demonstration projects

for ecological mines, intelligent mines, and coal clean processing and comprehensive utilization, promote coal intensive development, and provide strong scientific and technological support for the coal industry to transform its development mode and improve quality and efficiency. Therefore, with the continuous transformation and upgrading of mining enterprises, the core of mine competition has been gradually transformed from traditional resource advantage competition to highly informationized and integrated scientific and technological competition. The intelligent construction of mines has become an important part of competition. As a core subsystem, the systemwide supervision and management data platform will have a large development space.

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