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Design and development of safety production management information system based on a digital coalmine

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Abstract

Safety production management information system is an important component of digital coalmine. Based on the sufficient demand analysis of digital coalmine, this paper puts forward the structure of safety production management information system and construction of subsystem, and describes the functions of related subsystem.

Keywords: digital coalmine; safety production; management information system

1. Introduction

Coalmine information is a kind of information which changes dynamically and relates closely with the spatial position. The rationalization management of information will directly influence the prediction and prevention of coalmine safety problems. How to realize the spatial information share and network service is very important since the information quantity involved is huge which includes geodetic surveying, ventilation safety, realtime monitor and supervision, and video data etc. Digital coalmine is complicated huge system[1].The overall objective of digital coalmine is to realize coalmine safety production, green exploitation, high yield and high efficiency, and sustainable development under the uniform data management platform based on the technology of mechanical and electrical integration of coalmine, computer science, 3S (GIS, GPS, RS), modern enterprise management system, and network technology. In detail, digital coalmine can achieve the aim of multisource coalmine information collection, input, storage, index, query and professional spatial analysis. It can further make multimode output of multisource information, realtime online analysis, process and decision, expert consultation coalmine accident controlling. Digital coalmine is the integration outcome of traditional coalmine profession technology, mechanical & electrical integration, computer technology and 3S technology. The theories and technologies involved in digital coalmine are the forelands of current information technology development [2].

Generally speaking, digital coalmine comprises three subsystems under uniform data management platform, namely, monitor and supervision and other electromechanical equipments integration management subsystem, administration management (or office automation) subsystem, safety production management information subsystem. Nowadays, the development and application of the first two subsystems has obtained a stage achievement in China, and parts of their application shows remarkable results (such as office automation, gas

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monitor etc). The mechanism of research and development team and talents training is relatively mature. The weakest part of digital coalmine is the subsystem of safety production management information subsystem[3-4], that is, the development and application of safety production management information system. The reason of being weak can be listed as follows: 1) Theories and technique method fall behind; 2) The specialties are over-divided and can't be integrated. The cross-sectional research achievements among different specialties are relatively less; 3) Network techniques are not fully used; 4) The system has not been executed strictly according to the thought of software engineering and there is no an information-oriented management system; 5) Software development units have no sustainable core technique, management structure and economic strength.

Aiming at the above-mentioned problems, the joint laboratory for digital coalmine of the Institute of Remote Sensing and Geographical Information System of Peking University & Beijing Longruan Software Science and Technology Limited Company have made lots of research in recent years. They put forward the theory of grey geographical information system and a series of core technique and methods [5], and developed professional coalmine geographic information system platform and safety production management information system. The major purposes of the development of safety production management information system are: 1) Change the safety production management mode of the mining industry groups, namely, from the traditional manual management mode to the information based management mode in order to greatly improve the production techniques and safety management level and lower down safety problems. 2)Realize the information based management of mine production process of mining industry groups (such as geodetic surveying, ventilation and gas-proof, dust-proof, fire-proof, mining and power supply design, mechanic and electronic equipments management, scheduling, safety management, remote monitor and supervision, operation regulation compiling, dangerous source early warning, etc.), such as the automatic processing of figure and chart and decision-making analysis. 3) Implement the sharing and dynamic management of all production information by the group company, mine production related technique and management department based on the uniform geographic information system and database management platform, and get rid of "information isolated island". 4) Ensure the management and technical personnel can carry out querying, processing, analyzing and deciding of the mine production information as long as they can access the network. 5) Construct the collaboration platform according to the characteristics of multiregional distribution of production mine among mining industry groups, and achieve the aim of "normalized management, responsibility to person, keep in house, commanding the overall situation".

2. Structure of coalmine safety production management information system

The design and structure of the system is listed as Fig. 1. This system can manage the data and graph of coalmine geology, surveying, hydrology, reserves, ventilation, design, safety, machine electricity , transportation, and digging based on C/S + B/S mode. Founded on the group company network platform, the system can also realize the function of multilayer (production and technique team, mine management team, group company decision-making team) user management, query and analysis, remote controlling, monitoring, and supervising base on WebGIS. According to the overall system structure, the graph system is developed under GIS mode, the database adopt SQL Server or Oracle, the remote management system is developed and integrated according to.NET environments, and the C/S mode of professional fundamental application system adopt VC++, etc. Furthermore, the graph processing system should provide the data interface of the format of AutoCAD, MapGIS and MapInfo as well as support the output in Excel format. Therefore, the system is a typical spatial information sharing and Web cooperation platform for geology, surveying, ventilation, and safety data variation management among multi-department, multi-specialty, and multilayer. Among the system, coalmine geodetic surveying data is an important part of system running and data processing whose change will result in the change of coalmine related theme map and group company theme graph. Geodetic surveying data is a kind of dynamic accumulated data and time series data. From the stage of resource prospecting, coalmine development to production process, geodetic surveying information becomes more and more huge which can more appropriately reflect the subterranean spatial entities. The increase of geodetic surveying information will result in the dynamic modification or adjustment of related production and safety information which needs long-term storage so that they can be called at any time to realize the information sharing, comprehensive analysis, application, and Web cooperative processing among multi-specialty.

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