



STUDY ON MINE-MAPS DYNAMIC MANAGEMENT INFORMATION SYSTEM BASED ON WHOLE LIFECYCLE

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ABSTRACT

According to the shortcoming of traditional artificial management mine-maps, the solutions of dynamic management digital mine-maps were proposed. Analyzing of the main tasks and characteristics in lifecycle stages of mining engineering maps, based on the idea and meaning of lifecycle, first we divided mine-maps lifecycle into seven stages, such as design drawing task assignation, design drawing, review approval, use and execution, revision, cancellation, qualitative archiving. Then put forward concept and system model of mine-maps lifecycle management, design B/S three layer network structure of mine-maps dynamic management information system on the basis of whole lifecycle, function modules of each subsystem by using CAD technology, ASP technology and database technology. Finally, we discussed the key technologies implementation of system as parametric drawing technology, database connection, online review and cooperative design etc. Field application shows that realization of whole lifecycle management automatization for mine engineering drawings improves office efficiency.

Keywords: *Whole Lifecycle, Mine-map, Dynamic Management, Information System, CAD*

1. INTRODUCTION

Mine-map is important technology information, which is the basis for mining engineering design, planning of mine ventilation, drainage, transportation, power supply system, as well as the guidance of production safety avoiding the accident etc. However, the management work of mine-maps in China's coal mine enterprises is still using the traditional manual management mode, a lot of problem are existed that approval cycle is difficult to control, maps management work difficulty is big etc. Especially with the increase of production technology in coal, the face is pushed in advance, the updating of mine-maps accelerates, the complexity of mine-maps management task creases. Especially computer technology and network technology are gradually applied in coal mine enterprises, the defect of traditional management mode is more apparent, can not meet the current construction requirements of high yield and efficient modern mine. Especially at present, the modern mining industry takes the computer as the foundation, and a large number of electronic drawings generated by CAD are stored in the computer. When entering into the network age,

network CAD/CAM has become the development trend of mining industry in the future. So how to take the effective management and utilization of electronic drawings up, how to makes electronic drawings information in the enterprise to transmit, share and manage rapidly and safely in a greater range, are problems waiting for solving in many enterprises[1,2].

Lifecycle is a term first appeared in the field of biology, which is used to describe evolution for creature from appeared to perish. Its basic connotation can be popularly understood as "from cradle to grave" throughout the process. With the development of society and the interdisciplinary fusion, lifecycle concept is gradually introduced into the economy, management, social organization and environment and other fields, and spawn a series of theory and methods on the basis of lifecycle[3,4].

According to the connotation of lifecycle, the authors think that the lifecycle idea is suitable for the business process management of mine-map documents 'description and management. Because there has not research on application lifecycle theory to mine-map documents management at

present in China, so this paper proposes a dynamic management system model of mine-maps based on whole lifecycle. The model not only realizes mine-map documents process automation management, but flexibly makes mine-maps management processes according to the actual needs of mining engineering, to achieve seamless connection between mine-map documents lifecycle business process, and solve the existent problems in mine-map documents management system. To sum up, this paper will study and design structure and functional module structure of mine-maps dynamic management information system based on whole life cycle on the basis of the analysis on the main tasks and characteristics of mine-maps whole lifecycle stages, and the key technology of its realization are discussed.

2. MINE-MAPS DYNAMIC MANAGEMENT INFORMATION SYSTEM BASED ON WHOLE LIFECYCLE

2.1 Mine-Maps Whole Lifecycle

Mine safety production management involves a variety of graphics data, including mining engineering plan, comparison map up and under mine, floor contour map, reserves calculation map, mine topographic and geologic maps, ventilation system graph, dustproof system map etc. These mine-maps especially mine engineering design drawings involve a number of departments and staff from planning, design task assignment, putting into practice application finally to archives management [5]. But by analysis of its process, which can be divided into seven stages such as design drawing, review approval, use and execution, revision, cancellation, qualitative archiving. This paper believes that the process is mine-map lifecycle, also refers to mine-map whole lifecycle, the whole process is a ring cycle, as is shown in Figure 1.

2.2 Mine-Map Lifecycle Management

Mine map lifecycle management (MLM) as a kind of management model, is designed to require the corresponding strategies and technologies through mine-maps whole life management. Mine-map lifecycle management for mining enterprise users is an information technology strategy, a concept, rather than just a product or solution. Mine-map lifecycle management implementation will break technical barriers among task orders, design and drawing persons, managers and users, make the participants through the use of mine-maps information in mine-map lifecycle achieve "in the most appropriate time, use the most appropriate

method, to find the most appropriate resources of solution problem", reduce mine-map task orders, design and drawing persons, managers and users in time, information and material waste, to help enterprises at all stages of mine-map lifecycle gain maximum value with minimal cost. Through the implementation of mine-maps whole lifecycle management can effectively solve information sharing, interactive and collaborative problem at different lifecycle stages and various information isolated islands, advance mine enterprise information construction process, improve the production quality and efficiency, the quality of mine-maps use and the core competitiveness of enterprises.

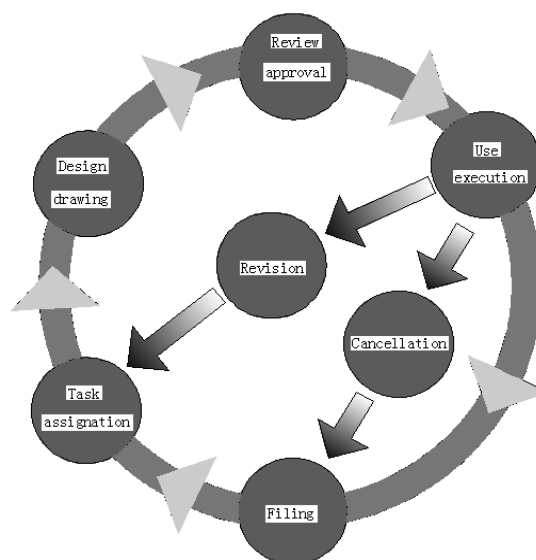


Figure 1 Mine-Maps Whole Lifecycle

2.3 Mine-maps Dynamic Management Information System Based On Whole Lifecycle

According to the main task of each phase and characteristic, mine-maps dynamic management information system based on whole lifecycle makes full use of modern computer technology, network technology and database technology, realizes whole lifecycle management of various types of mine-maps from design task assignment, design drawing, review approval to qualitative archiving, science, standardization, automation and real-time design drawing and management of mine-maps, improves work quality, flexibility and efficiency mine-maps design, approval and management. It is beneficial to information exchange and resource sharing within the different sectors and different locations in mining group companies. Mine-maps whole lifecycle dynamic management system in essence should be a complete and unified, advanced

technology, efficient and stable, safe and reliable human-machine system on the basis of modern tools and means such as computer and communication networks etc and gathering standardization, automation, digital and informationization of mine-maps design, drawing and management for a body[6].

3. OVERALL STRUCTURE OF SYSTEM

3.1 System Structure Design

Mine-maps dynamic management information system based on whole lifecycle is achieved generally relying on enterprise broadband and high speed network. The system is carried through integration customization and secondary development by using document and program development on the basis of AutoCAD, data management platform uses Microsoft SQL Server 2000, based on the three layers structure system of Browser/Server (B/S) mode such as data layer, application layer and user layer [7-9], accesses the corresponding database by using itself data safety management and quality control system of SQL Server database and access password the database providing, to ensure the database security, system structure diagram is shown in Figure 2. The data layer is database server layer, which is the core of organization, planning and maintenance various data, mainly includes special database (for storage of DWF documents, DWG files), user database (for storing users basic information), and other databases. Application layer is application server layer, to receive the user's request, to carry out various operations, and forwards the request to the database server, and back database information to the users. Users' layer is the client layer, which is the users' interface with the system, is an information interactive interface. The client connects with the server through a network. The main function is to mine design personnel carry through design and drawing mine-maps, the electronic document of good design upload to mining group company server after design. Mining group management personnel or mine management carry through examination, inspection and so on. At the same time it will accept the user information request and feedback the results to show.

3.2 Design Of System Function Modules

Aiming at the lifecycle of mine-map, according to the actual needs of mine-maps in the whole lifecycle dynamic management, in the basic principle of simple and practical, data sharing, safe and stable, standards, the system is determined. The system is divided into two parts: one is mainly used

for mine engineering and technical personnel to carry out standardization, automation design and drawing work of mine-maps, called mine digital mapping system. This system is mainly to complete all work in second phases of mine-maps whole lifecycle, mainly based on the secondary development of AutoCAD system. After mine engineering technical personnel design mine-maps, upload the saved information to mining group server; From a workflow perspective, another, aiming at mine-maps compilation and design task assignation, compilation and design, review approval by using and executive, revision, qualitative filing Another carries through transactional dynamics tracking management called mine-maps digital information management system. This system mainly completes all work in other phases of mine-maps' whole lifecycle, mainly based on three layer system structure design of B/S. Two systems complement each other; mine digital mapping system decides whether mine-map digital information management system can correctly and effectively function. The mine-maps digital information management system is responsible for safe and effective operation of whole system.

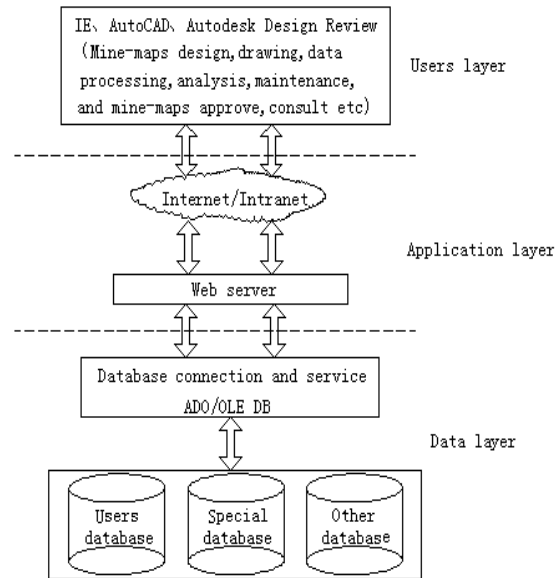


Figure 2 System Structure Diagram

Mine digital mapping system is mainly used for mine-maps standardization, automation design and drawing. The main function modules include original data (digital) input module, AutoCAD mining geological drawing environment development module, mine-maps digital processing module, construction maps computer aided parametric design module, network connection and cooperative design module. Mine-maps digital



information management system embodies the advantages of mine-maps management on the basis of CAD technology, network technology and database technology, which has the features such as rapid information exchange, resource sharing convenience etc, really plays network interactive function compared with the traditional manual mine-maps management. According to the characteristics mine-maps online approval exchange and dynamic management, mine-map digital information management system is mainly made up of main interface module, system settings module, task assignment module, maps check module, qualitative archiving module, cooperative design module.

4. KEY TECHNOLOGIES OF SYSTEM IMPLEMENT

4.1 Parametric Drawing Technology Of Mine-Maps

AutoCAD system is the man-machine interactive graphics software. Itself does not have the parameter driven drawing functions, and it can only record graphic element itself geometric information, layer and color type etc, not record topology and constraint relations with graphic elements, so in development of parametric drawing module, not only record non geometry information of graphical elements, but also consider the geometry structure, topology and constraint relation. Parametric drawing module establishment is the use of AutoLISP/Visual LISP, AutoCAD VBA language, parametric drawing module mainly uses menus, dialog boxes and database mode, achieving of parameter drawing mainly adopts interactive and data file type[10].

4.2 ASP(Active Server Pages) Technology

ASP is an application of script program Microsoft develops instead of CGI (Common Gateway Interface), it can be associated with the database and other programs, thus it is a simple, convenient programming tools[11]. ASP may easy access to the data on the database server through ADO (ActiveX Data Objects) of ActiveX component. ADO is COM component for accessing data sources Microsoft launches. It provides a programming language and an intermediate layer of uniform data access OLE DB(Object Linking and Embedding Database). Developers are allowed to access to the data code and not care how database is realized, and only care about the connection of database. Because OLE DB database connection is the most popular, provides all the connection details in string, is the fastest way, so the system uses the

OLE DE to realize ASP and SQL Server 2000 database connection.

4.3 Maps Online Review Technology

DWF(Design Web Format) is an open, compression, secure file format developed by Autodesk, it can distribute efficiently rich design data to anyone need view, review or print these data, save the time of management design and review process, is the ideal medium of realization of lifecycle management. Autodesk DWF Composer plug-in is software developed specifically for the DWF file format and engineering design data, specifically for sharing of data rich engineering graphics, maps and models, it is through the use of complete workflow, drawing browse, approval and labeling functions. Maps online approval function realization is on the basis of marking function of Autodesk DWF Composer, this system uses the VBScript script language, embeds DWF graphics in the Microsoft Internet Explorer HTML page through Autodesk DWF Composer API (Application Programming Interface), in internal controls procedures, to achieve different users review and approve maps authorized, also may carry on the function customization.

4.4 Cooperative Design Technology

Cooperative design refers to the process that different design departments and professional internal of design corporations carry through coordination and cooperation to complete a project together by means of information. Cooperative design can integrate enterprise design advantages, timely information sharing and exchange, reduce unnecessary operation and avoid the inconsistencies of data, improve the design efficiency and quality, shorten design cycle. The traditional mine-maps design commonly is used for human-computer interaction in the single computer. It is difficult for the designers to exchange information, because often not timely information communication and information sharing, repeated design, data inconsistency and repeated copying etc are caused to affect the quality of design and progress. With the rapid development of computer network technology and depth application in mining enterprises, condition is offered for cooperative design development and application. Cooperative design module supports designers commonly commit to design task in group mode, namely designers distributing in different sectors and different locations are around a design graphic object (mine-map), to assume the corresponding part of design task, and in different working space



interactively carry through design work. Finally, the gain design maps meet the specification requirements.

5. CONCLUSIONS

By using the whole lifecycle idea, dynamic management information system of mine-maps based on CAD technology, network technology and database technology are applied in mine-maps management of mining company. It improves the enterprises' management level of mine-maps, realizes the line production of mine-maps management, such as mine-maps design task assignment, review, approval, use, preservation, consult and filing etc, which play an important role in mine-maps approval and management efficiency and the development of digital and informationization of mining enterprises. Thus, it plays a very good protection function for the enterprise's normal production. But in view of the capacity constraints of the author, the design and development of the system just do a preliminary exploration research, in order to enable the system to obtain the widespread application and the promotion in mines, there are still many problems need to be further studied such as mine-maps information automatic recognition and extraction, the combination of graphic data and attribute data and so on.

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