Design and Implementation of Geographic Information System Based on Environmental Dynamics in Mine Scheduling

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Abstract. With the development of computer technology, it is possible to visualize the demand of mine safety and production process. At the same time, the demand of mine resources for social construction and the people's lives has been showing a rapid upward trend, which invisibly brings opportunities and challenges to the development of mine undertakings. Under the dynamic environment, mine production, transportation, ventilation, gas, power supply and industrial television operation are monitored at any time, and enterprise panoramic information is displayed from multiple angles, so as to realize timely shunt processing and tracking of dispatching information. User staff can obtain real-time information such as location, thus ensuring the safety of mining personnel and property, improving work efficiency and enterprise benefits, and further promoting the design key components of the environmental dynamic geographic information system in mine scheduling. With environmental dynamics as the regulating variable, geographic information system is an information system that collects, stores, manages, describes and analyzes data related to the earth's surface, space and geographic distribution.

Keywords: Environmental Dynamics, Geographic Information System, Mine; Dispatch.

1. Introduction
Mine safety management is a complex system engineering, which takes environment, machinery, equipment, products, raw materials and related human and environmental integrated systems as the management object. The ultimate goal is to protect the safety of human beings and means of production [1]. China's coal mine production level and technological level of development is extremely unbalanced, there are high and low, both high-grade coal mines and small coal mines totally depending on the operation of workers, the safety factor is very low, coupled with the particularity of the coal mine production industry environment, coal mine accidents occur frequently, which not only caused great losses in coal mine production in China, but also posed a serious threat to the personal safety of coal mine employees [2]. Improve economic efficiency and management level. Coal enterprises have successively implemented reforms in safety, production, transportation, monitoring and control systems, and some units have also equipped with industrial television video surveillance system. Integrate the existing emergency dispatching command system, improve the operability and interaction of various
emergency dispatching systems, provide more convenient and friendly man-machine interface for dispatchers, improve the level of command and decision-making space-time management, and make the internal office of dispatching center more humane, automated and intelligent [3]. Traditional measurement technology can not meet the actual needs of current mine measurement. As an advanced space processing technology, geographic information system has obvious advantages compared with traditional measurement technology [4]. The simulation virtual technology is multi-dimensionally expressed, and has high-resolution, massive data storage and multiple data fusion and can be spatialized, digitized, networked, intelligent and visualized [5].

Environmental dynamics is a very important concept. It focuses on the uncertainty brought by the external environment. In view of the advantages of geographic information system (GIS) over traditional surveying technology, it can be seen from the actual application that the application of GIS plays a very important role in promoting the efficiency and quality of mine surveying [6]. Inherited the map drawing function of GIS, expanded the ability to query and update various information sources at the same time, and enhanced the data calculation, analysis and statistical functions. It brought the traditional security information into the visual space and formed various security information that can be generated on the basis of graphics. Levels are the dynamic nature of digital space and the diversification of business and management [7]. Digital mining is a dynamic concept, as new data is constantly updated, mining faces are constantly updated, and data in digital three-dimensional space and space is changing [8]. With the continuous recovery of problems related to geographic information and dispatch management, China's emergency dispatch system based on research and development has entered the stage of industrialization [9]. The areas involved in the system have also been broadened, from the earliest desktop systems to the later Web GIS to the embedded GIS, which are the evolution of GIS from static to dynamic environments. These changes extend the original GIS. In the application category, geographic information systems have gradually shown unique advantages in terms of mobility, ease of integration, and cross-platform [10].

2. Materials and Methods
To cope with the increasingly strong internal and external pressures caused by environmental changes calmly, it is necessary to transform into an effective learner. In industries with more technological opportunities and fast technological change, the technological environment is dynamic. Increase the content of management to facilitate user expansion, and also carry out various statistical analysis, such as buffer analysis, network analysis, topology analysis and watershed analysis. It can realize three-dimensional modeling including surface, surface building, surface water body, road, borehole, underground roadway, underground ketone chamber, stope, fault, coal seam, ore body and so on, and can be superimposed and synthesized. Graphic files describe the shape and location of identifying data, extend attribute files record all necessary attribute information of data objects, establish point-line extended attribute data by means of topological mapping, connect independent data files through relational structure, and form a complete GIS database. The database information layer is used to store the remaining attribute information of the geographic information entity. The location quick query is mainly completed in the dictionary layer and the module index header layer. After the location query is successful, the database information layer provides the attribute information of the relevant geographic information entity. Fast, accurate, complete, clear, real-time collection and transmission of various types of environmental indicators, equipment working conditions, personnel information, operating parameters and scheduling instructions of mines, mining engineering geological data applications as shown in Table 1, mine geographic information system The function diagram is shown in Fig 1.

Table 1. Application of Mine Engineering Geological Data

|              | Query | Operation |
|--------------|-------|-----------|
| Text data    | 13.61 | 3.64      |
| Tabular data | 12.50 | 4.81      |
| Graphic and image | 9.32 | 6.06      |
In the process of coal mine production, massive information related to mine system needs to rely on Geographic Information System (GIS). Through its powerful spatial analysis ability of geographic information, the dynamic environment of operation technology such as information capture, storage, update, application, analysis and display brings challenges and opportunities for faster development. The application of Geographic Information System (GIS) not only improves the accuracy of survey data, but also has certain advantages in storage. It can store a large amount of mine geographic information and reduce the probability of mining design error under the condition of effective utilization of data. Because the HTTP protocol adopts a C/S-based request/response mechanism and has strong user interaction capability, it can transmit and display multimedia data on the browser, and the information in the GIS is mainly spatial data that needs to be represented by graphics and images. Mine geological body data model design, database design and user interface design, etc., mainly to achieve mine engineering geological information data management, mine geological three-dimensional modeling, mine geological model visualization and some common engineering software interfaces. The query method does not consider real-time traffic information. The query result is the only dynamic path query. It is based on real-time traffic information and user-defined information. The optimal path is dynamically changed according to different environmental information.

The application of Geographic Information System (GIS) in mine surveying is, first of all, the application of GIS in mine geological prospecting and mineral mining design, which can provide some effective data with reference value for the smooth implementation of various work. The display, statistics, analysis and storage of spatial information and attribute information can be carried out by combining them. The data and curves displayed can be analyzed routinely and complex, which has certain assistant decision-making functions. It can also detect the status of dust-proof facilities, various environmental factors affecting safety and the start-up and stop of mechanical power equipment, providing valuable reference data for the command of safe production. Queries of various mine geological bodies and mining engineering attributes and simple statistical output of information, multi-format and multi-purpose output of data, such as general processing file format output. The enrichment of scheduling process module broadens the scope of user scheduling, and is more conducive to the interaction between users and scheduling center. The separation of video module is also conducive to the management of video scheduling and information acquisition of emergency scene. The data of various systems are classified, recombed and coded, and the data is input into the computer according to the dotted line, thereby establishing the main graphics/attribute database of the mine. In the database, the complete information of each data object contains graphic information, and corresponding graphic files and extended attribute files are formed in the database. The software interface for writing computer-
aided design software interface and numerical analysis to realize the design of mining method and the simulation of mining engineering and post-harvest ergonomics are shown in Table 2 and Fig 2.

Table 2. Numerical simulation

| Spatial stability analysis | Simulation | Testing |
|---------------------------|------------|---------|
|                           | 5.08       | 7.51    |
| Analysis of Surface Presentation | 6.42       | 7.63    |

![Graph showing monitoring index vs simulation index]

**Fig. 2** Numerical simulation

3. Result Analysis and Discussion

The application of Geographic Information System in mine surveying can provide effective data for the development of mine surveying. At the same time, geographic data play a very important role in the formulation of the survey plan, which mainly refers to the mineral reserves and the distribution of ore deposits. The data sources of mine information system mainly include geological topographic map of mining area, engineering geological profile map, engineering geological data and engineering site construction monitoring data. Mine information system includes four basic functions: mine engineering geological information data management, three-dimensional geological modeling, three-dimensional visualization display and engineering application. The whole mine safety situation is quantified into a comprehensive evaluation system, which includes five subsystems: coal mining, tunneling, flood prevention, electromechanical and transportation. The system uses some scientific algorithms, such as exponential smoothing, Grapp method, etc., and establishes mathematical models, which produces a quantitative safety evaluation system. Combined with the original geographic information data, the dynamic path finding module of the server is called to calculate the optimal path in real time, and the optimal path is returned to the user. The optimal path for this process is not unique. All data is stored in the server. All operations are sent by the program to the server program to send SQL (Structured Query Language) commands to update the query database to ensure the integrity and security of the database.

Geographic base map data processing (geographic base map data entry, editing, modification, preservation, output and geographic base map database generation) can be processed using GIS graphics editing system, spatial analysis system, output system, base map database management system, correction system, etc. Environmental dynamics is taken as a regulating variable to ensure the integrity, reliability and timeliness of information, master the whole production progress, safety of working environment, actual output and other information, and carry out real-time monitoring and visual transparent management of mine production conditions. The process of creating a shared custom map is relatively complicated, requiring the map composition module to continuously collect, synthesize and distribute information. Therefore, the correctness check of map editing needs to be added in the process,
and multiple users are not allowed to edit a map information entity in the same time period. In the virtual environment of the computer, simulate various mining production activities with extremely realistic effects, such as virtual mining, virtual blasting, etc., to provide judgment basis for the feasibility and safety of production activities, reduce unnecessary risks in production activities and loss. Do a good job of daily data compilation to ensure that the role of GIS is fully realized. Therefore, the relevant staff needs to effectively sort out the new information acquired by the GIS, and then timely optimize the mine production plan according to the latest data.

The corresponding values are dynamically extracted from the browsing table corresponding to the map through a loop statement, and the data in the browsing table is imported from the database. Mine production process integration. With the maturity and popularization of integrated technology, mine design and mining will develop towards the goal of integration. In this process, virtual technology can be used to visualize three-dimensional, providing effective data for the preparation of mining plans. A comprehensive and detailed description of mining and excavation work body is presented. The hierarchy is to embedding all relevant information in this digital three-dimensional space, that is, the relative change information indirectly related to the spatial location. The geographic information system can display the operation status of equipment at various locations under the panoramic view of the mining area, and receive real-time data from the power dispatching system. The layout of the underground substation power distribution lines is based on the development of the roadway and shows the operation of the equipment at each location. The attribute library of various objects in the graph can be defined, the attributes of each object can be configured and queried, and the interaction between the graphic and the gallery can be realized. The user can establish or modify the database according to the needs, and the place name information input by the scheduling task may be incomplete. The query system is required to query similar place name information for the user to select. Since the road condition information of the map changes in real time, the patrol scheduling algorithm is dynamically updated to maintain the optimality of the patrol scheduling at all times.

4. Conclusion
In this paper, the design and implementation of geographic information system (GIS) with dynamic environment in mine scheduling are studied. With the strengthening of modern management, geographic information system and computer network will bring greater economic and social benefits to mines. In mining area, construction data and survey data are the basic information of Mine Geographic Information system. Basic construction drawings and thematic maps are the basic data sources of Mine Geographic Information system. The server supports the user's optimal path query, which is based on the historical records of the geographic information database. Develop a mobile version of the geographic information system and establish a real-time, mobile, integrated, visual, and intelligent coal mine application platform. The unified mode is used to quickly release all kinds of data information, which better shows the various operating states of the mine. When the mine is being mined, the preparatory work is more adequate, and the topography of the mining area and the distribution of mineral resources are known. In the process of measuring the geology, remote operation can be carried out without entering the mining face of the mining area. The system can be used to analyze and predict the production process to guide the production.

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