Application research of computer big data informatization technology in oilfield mining automation system

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Abstract. Science and technology are developing continuously, and oilfield exploitation has gradually realized informatization and automation. In order to meet the needs of the oilfield mining automation system and to better monitor the data in the oilfield mining process, the computer big data information technology application system has become an indispensable part of the oilfield mining operation enterprise. In this paper At the beginning, the status quo of the oilfield mining automation system is analyzed. In this paper, the role of the computer big data information technology automation system in oilfield mining is analyzed. This paper discusses the key points of the development and design of the automation system system. The ultimate purpose of this paper is to provide certain ideas for oilfield mining automation.

Keywords: Computer big data;Information technology;Oilfield exploitation automation system.

1. Introduction

The oilfield mining automation system application system is a system that collects and summarizes oilfield mining data, analyzes, organizes, warns[1] and applies. This system plays an important role in troubleshooting oilfield mining equipment failures and improving oilfield mining safety levels. The application system of the oilfield exploitation automation system has epoch-making significance at present, which marks that the oilfield exploitation, construction and maintenance have entered a new period. Information technicians of oil companies should devote more energy to the research[2] and development of system functions and contribute to the realization of modern oilfield construction.

2. Status Quo of Oilfield Exploitation Automation System

Mastering the situation and data in the process of oilfield exploitation has become an important basis for the decision-making of the oil company management. Various sensors and analyzers installed on the oilfield exploitation site, downhole, and on the equipment all provide support for the collection and summary[3] of oilfield exploitation data. The basis for the management to make decisions is more scientific and reasonable, so the application system of the oilfield exploitation automation system has become an important part of the modern oilfield construction. The oilfield exploitation automation system has received extensive attention from the management[4] of oilfield exploitation enterprises. At present, oilfield exploitation data cannot support managers and technicians to use mobile communication terminals to view data at home, which makes the drawbacks of the production automation system application system prominent. Information technicians need to further optimize the production automation system, and the system needs to obtain better The stability and quickness of the system, the scope of application of the system is further expanded, and the system can provide[5] greater technical support for oilfield development.

3. Functional Analysis of Petroleum Exploitation Information Management System

Based on the author's many years of practical operation experience, this paper derives the main functions of the oil exploration information management system through a detailed analysis of oil exploration, oil exploration, equipment management and other personnel. These functions include oil exploration information management, oil exploration progress management, Oil extraction equipment management, etc. These functions provide users with a powerful operational support to ensure real-time grasp of oil extraction information.

3.1 Petroleum Exploration Information Management

The main purpose of oil exploration is to find and identify oil and gas resources. Oil companies use various

advanced technologies and methods to understand the geological situation. Technicians are fully aware of the oil reserves. Technicians can also evaluate and analyze the prospect of oil and gas exploration. The technicians determine the favorable areas for oil and gas accumulation, the technicians find an area for storing oil and gas, the technicians find out the situation and production capacity of the oil and gas layers, and the technicians identify the relevant products for the country to increase the crude oil reserves. Petroleum exploration information management can provide users with strong operational support. Petroleum exploration information management records the exploration status of oilfield resources, which is convenient to determine the optimal path for obtaining resources and storage.See Figure 1.
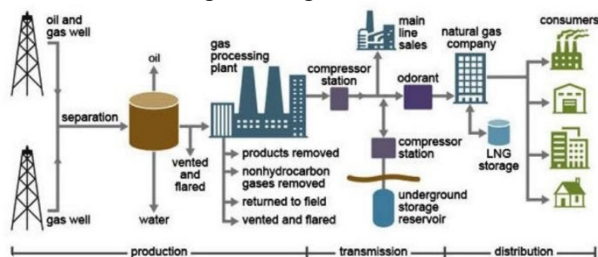

Fig. 1. Research on the Function of Petroleum Exploitation Information Management System

3.2 Oil exploitation progress management

In the process of oil extraction, each oil field involves a very wide range. In order for oil companies to better grasp the development of oilfields, the management of oil development progress can record and share the development progress according to the data collected by people, which has an important role and significance.

3.3 Management of oil extraction equipment

There are a lot of oil extraction equipment, and technicians need to purchase equipment, repair faults, scrap equipment, and manage equipment in the process of oil extraction. In oil extraction, if the oil extraction personnel need new equipment, they can apply for purchase at this time, and the oil company will provide the extraction tools in time. The fault maintenance can record the use time, the number of faults, and the fault maintenance of each equipment; the equipment scrap can provide equipment exit management for oil exploration, ensure the timely scrapping of equipment and improve the details of oil exploration; equipment classification management can provide users with powerful This can further improve the convenience and automation of equipment operation.

4. Key technologies of oilfield informatization construction

4.1 IoT Technology

The Internet of Things technology belongs to a modern management technology. When using the Internet of Things technology, oil company technicians first extensively collect the latest technical information to ensure that information entry and information perception can be performed in oilfield mining operations, construction and other links, and the Internet of Things technology will gradually transform it into digital information. Afterwards, technicians should also reasonably apply the IoT management center to ensure the rationality of data control and data management. Only by combining the processed data and information can the managers of the oil company make correct decisions and instructions, and the managers can direct the information to be transmitted to the relevant institutions of production and operation in a timely manner.

4.2 Computer big data information technology

In order to realize oilfield informatization, oil companies must reasonably apply computer big data informatization technology. Oil companies ensure the security of computer big data informatization. The computer big data informatization technology reasonably applies virtual resources, and its goal is to quickly improve the efficiency of information processing to achieve information integration. The characteristics of computer big data informatization technology are fast information transmission, which can quickly complete the information mapping of the actual situation and upload it to the corresponding field area. Technicians build models with the help of Java to ensure that the final system conforms to actual needs. In the application of computer big data information technology, the technology is highly dependent on the three basic technologies. One is information collection technology and information storage technology. In the new era, the amount of information has increased significantly, and in the information collection process, the requirements of information collection technology on hardware equipment and facilities have gradually increased. On the one hand, technicians should actively improve the accuracy of information, to ensure the feasibility of the information entry scheme and the integrity of the information collection device. A large-scale storage base station can also be established to ensure that the storage space meets the requirements of the amount of information in the new era. In addition, technicians should also consider the supporting role of CPU technology in computing. The second is information transformation technology. The process of information scheduling and information processing will inevitably involve the conversion of virtual information and physical resources.

4.3 Setting up electronic duty

Electronic road cards are installed in relatively important production intervals, and electronic road cards can intelligently monitor the time when vehicles arrive at the oilfield well site. After the electronic road card takes pictures of the passing vehicles and then identifies the information, the electronic road card accurately determines the vehicle information and time for tracking. Such information technology not only realizes the intelligent function of electronic duty, but also effectively improves the management of roads near the oilfield well site, so that the oilfield has a certain safety.See Figure 2.
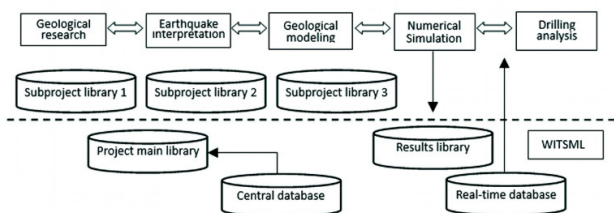
Fig. 2. The key technology of oilfield informatization computer construction

4.4 Using information technology to set up an alarm system

In the information technology of the oil field, the alarm system is also an intelligent technology. Oil companies collect information data from oilfield well sites through self-inspection technology. Information technology sets up an alarm system to diagnose the situation in production, and then analyzes and optimizes parameters. The information technology sets the alarm system to judge the fault of abnormal data, conduct regular inspections, make alarms and provide corresponding measures and suggestions. The information technology sets the alarm system to provide a guarantee for safe operation.

4.5 Application of digital skid-mounted booster integrated device

In order to realize the mixed output of oil and gas from pump to pump, oil companies need to heat, pressurize, control and buffer the oil and gas mixture. The oil company integrates these steps into one place through an intelligent control system, and Oil companies can operate these processes remotely. The oil company optimizes the entire process to digitize and integrate this set of procedures.

4.6 Using information technology to automatically pitch and remotely allocate water

The oil company uses the key technology of information technology to install the automatic ball pitching device in the oilfield well site. The number of balls loaded at a time is about 13. The technicians complete the pitching according to the set pitching time and collect the pressure and flow of the water source well, the pressure and the pressure of the water injection well. The technical personnel can remotely control the electric submersible pump of the water source well, and the water injection volume of the water injection well can be adjusted remotely, thereby improving the production efficiency.

5. The role of oilfield exploitation automation system in oilfield exploitation

The oilfield production automation system is an oil production engineering optimization analysis software for oil companies to monitor oil well conditions, analyze faults, evaluate oil displacement effects, and analyze oil production energy consumption. Energy consumption

analysis of oil well power grid: The quality and efficiency of power supply are directly related to the production cost and assessment indicators of the enterprise; the system provides analysis data of reactive power, harmonics and faults of oil and water well power supply lines and power supply transformers to avoid high energy consumption operation of power supply lines; oil and water wells Monitoring and analysis of the reactive power compensation equipment of the power supply transformer, the software actively reports the name and location of the reactive power compensation equipment running inefficiently or in failure. Oil well electricity safety early warning: It is difficult to monitor the working conditions of oil wells with electricity, leakage, and low insulation resistance, and the resulting safety accidents occur from time to time; the system provides fault early warning and alarm instructions such as line leakage, short circuit, open circuit, and equipment live The company can better prevent the occurrence of vicious accidents caused by such hidden dangers. Remote working condition monitoring of oil wells: Oil wells are widely distributed, complex terrain, inconvenient transportation in rainy and snowy weather, changes in oil well parameters or fault shutdown, and it is difficult for well patrol personnel to detect in time; the system provides remote working condition monitoring (data acquisition, remote start and stop of wells)) and fault alarms, thereby speeding up troubleshooting time, reducing the number of well inspections; improving production efficiency and reducing production costs.

5.1 Update data in real time

The data generated in the process of oilfield exploitation is in a state of constant change. If the data update period is long, the data cannot provide early warning of oilfield exploitation failures in time, nor can it meet the needs of management and technical personnel for real-time data, and the oilfield exploitation automation system The powerful and rigorous data processing system of the application system makes it possible to update the data of the oilfield portal website in real time. The oilfield exploitation automation system application system combines database technology with implementation processing technology. The system transmits data through SCDMA and establishes a mapping relationship with PEOFFICE data items. The system collects, analyzes, processes and feeds back data in a relatively short period of time. Form single-well ground power map, pump working condition map, and pump efficiency analysis map. These maps meet the needs of management and technical personnel for real-time data. This processing method requires strict process control to be realized in the case of massive data. During the operation of the real-time database, information technicians need to pay attention to its operation status when the data flow is too large, so as to avoid the problem of difficult data management. In comparison, the real-time database is more in line with the needs of modern oilfield exploitation than the traditional database.

5.2 Timely fault warning

Fault early warning is one of the very important functions of the application system of the oilfield mining automation system. The fault early warning is mainly realized through the system's real-time data collection and monitoring and analysis. The fault early warning system is widely used in oilfield portals, urban pipe network end management systems, etc. In the field, the fault early warning system can effectively monitor the flow parameters, pressure parameters, temperature parameters and other information in the process of oilfield exploitation and oil transportation. The system obtains possible fault information through analysis and processing, and then synchronously responds to the monitoring system and gives early warnings.See Figure 3,
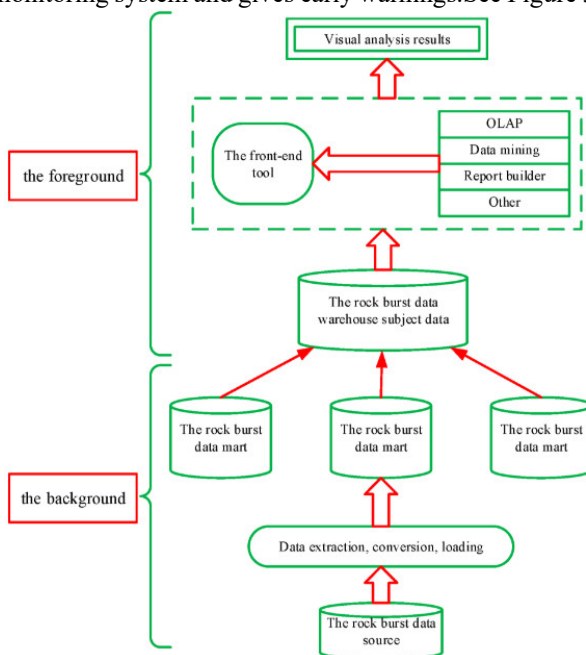

Fig. 3. Fault early warning is the oilfield mining automation system

5.3 Automatically provide processing comparison of historical data

The oilfield production data in the traditional data application system mostly exists in the form of Excel. The data stored in this way is not conducive to the application of the management and technical personnel, and cannot intuitively reflect the changes in the data trend. The traditional data application system limits the Management efficiency of oilfield mining enterprises. The development and implementation of the application system of the oilfield exploitation automation system allows the technical personnel and the management to process and compare the historical data. The oilfield exploitation automation system reflects the data trend in the form of charts. The oilfield exploitation automation system reduces the time consumed by manual data processing. The mining automation system improves the efficiency of oilfield mining data processing, thereby improving the efficiency of oilfield mining management. Application strategies of key technologies of oilfield informatization In order to ensure the steady progress of construction of major and detailed oilfield projects, oil

companies give full play to the advantages of key informatization technologies.

5.4 Strengthen the key technology research of informatization

At present, information technology emerges in an endless stream. Oil companies should strengthen the research on Internet of Things, computer big data information technology, big data and other technologies based on their own information construction. Oil companies formulate practical implementation plans based on the actual work of oilfield exploitation. On the one hand, oil companies should always pay attention to the development of key information technology, establish good cooperative relations with well-known domestic universities and research institutes, clarify the construction goals and key technologies of "digital oil fields", and strive for breakthroughs in key technologies. At the same time, do a good job in the integration research between key information technology and existing hardware equipment, do a good job in upgrading the functions of existing software and hardware equipment, and reduce the application cost of key information technology. See Figure 4
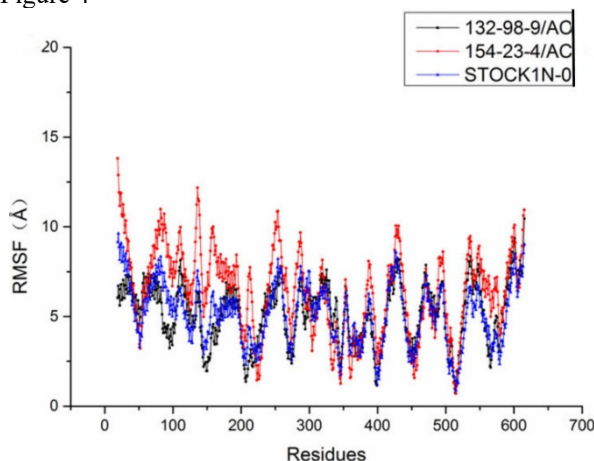

Fig. 4. Fault warning is a comparison of advantages of oilfield mining automation system

On the other hand, some large oilfield companies have achieved remarkable results in informatization construction. Therefore, oil companies should visit and study with similar enterprises to understand their achievements in informatization construction and the goals of future informatization construction. In particular, companies need to understand the breakthroughs made by similar companies in the Internet of Things and computer big data informatization technology. Oil companies can learn from their own actual situations. At the same time, in terms of key technologies, oil companies can also establish cooperative relationships with well-known domestic oilfield companies to jointly develop and research information technology to ensure that the Internet of Things and computer big data information technology can be better applied to oilfield exploitation.

5.5 A good job in the deployment of informatization construction

At present, with the rapid development of information technology, oilfield enterprises should do a good job in the rational deployment of informationization construction. Oilfield enterprises should ensure that information technology software and hardware not only meet the current work needs, but also have redundancy to facilitate the expansion of software and hardware performance in the future. When deploying informatization construction work, oilfield enterprises should pay attention to the implementation of the following contents: On the one hand, oilfield enterprises should do a good job in designing all parts of the informatization system. As we all know, computer big data informatization technology not only has strong professional knowledge, but also requires a reasonable network architecture. Computer big data informatization technology requires a reasonable arrangement of hardware to ensure information transmission and processing speed. Therefore, the oil company can establish a good cooperative relationship with the domestic well-known network service provider, and the oil company entrusts it to be responsible for the information construction service work. At the same time, the oil company clearly explained the informatization construction needs to the network service provider to ensure that the informatization construction plan is scientific and reasonable.

6. Conclusion

This paper comprehensively studies the application and development of oilfield exploitation technology in oilfield automation system. This paper carefully analyzes the practicability, real-time, easy maintenance and other functional characteristics of oil well monitoring system. Petroleum enterprises should continuously optimize the application of computer big data information technology in the oilfield exploitation automation system. Only when oil companies continuously improve their mining automation technology, can oil companies improve the efficiency, stability and safety of oilfield mining and promote the stable and healthy development of the energy industry.

Acknowledgements

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