

Mine Safety System Based on the Internet of Things

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Abstract: This article summarizes the mine safety situation of the Internet of Things, proposes a mine safety system scheme that combines a sense of unity with a sense of isolation, and a sense of mobility with a sense of fixation. It analyzes in detail the feasibility and scientificity of the mine safety system scheme, laying a good foundation for establishing a mine safety system.

Keywords: Internet of Things; Mines; Safety System

At present, the current situation of energy in China is basically characterized by a shortage of coal, oil, and gas. Due to the complex production conditions of coal mines, most of them are produced in underground environments. In addition, the demand for underground workers is high, and the production equipment is more outdated, which leads to a relatively backward safety monitoring and control system. Moreover, due to the inadequate management of staff, the safety situation of mine production is not optimistic. In the process of coal mine production, coal mine safety is not only related to the life safety of staff, but also related to the national economy and the people's livelihood.

In order to build a reasonable mine safety system, it is necessary to use Internet of Things technology to effectively manage coal mine workers. Moreover, because there are no signs of danger in underground mining work, the safety management system needs to maintain close contact with workers. If danger arises, the safety system will use its various sensor devices to understand the actual situation of the mine disaster and promptly contact mining personnel, And obtain various physical data of mining personnel.

1. Research background

Mining resources, as one of the important natural resources in China, are essential and important materials in China's economic development. According to relevant statistics, mining resources provide a large amount of production resources for China's agriculture, provide a large amount of industrial raw materials for China's industry, and are also the main source of energy in China. With the continuous development of China's economy, the country's demand for mining resources is also increasing. This not only brings more development opportunities to the mining industry, but also poses greater challenges to the management of mining resources. The safety production of mines is an important guarantee for the sustainable development of mining. At present, most of the mining methods in China are underground mining. However, due to the complex underground environment, dangerous accidents occur frequently, which increases the difficulty of mine safety management. With the development of science and technology in our country, the emergence of the Internet of Things technology has brought hope to mine safety management. The popular form of the Internet of Things is the "Internet of Things", which integrates network, communication and other technologies to achieve effective use of technology. In response to the safety management issues in mines, this article constructs a mine safety management system based on the Internet of Things technology. With the help of various transmission equipment, sensing equipment, and computer technology, it effectively perceives and controls the mining environment.

2. Overview of the Internet of Things

The concept of the Internet of Things originated from the radio frequency identification system proposed by MT, which mainly links item information to the Internet through sensing devices such as radio frequency identification, achieving intelligent and comprehensive management of items. Since 2009, with the proposal of the concept of "perceiving China" in China, the Internet of

Things has achieved comprehensive development from concept, supporting facilities, policies, to technology. As a result, the Internet of Things has comprehensively opened up further development in China's information field, which is another major development innovation since computers and the Internet. The characteristics of the Internet of Things technology mainly include intelligent processing, reliable transmission, and comprehensive perception. By installing various sensing devices in the human body and objects, the Internet of Things technology can effectively understand the status of the human body and objects, thereby achieving intelligent recognition, tracking, management, positioning, and monitoring of them.

3 .Mining IoT

In order to manage the mining system under the technology of physical networking, it is necessary to fully cover the wireless signal area under the mine and support control of WIFI terminal products such as wireless cameras, identity cards, smartphones, etc. Through wireless network links to infinite couplers and extenders, the received terminal information can be input into the switch, and then the switch can transmit it to the fiber optic network through the fiber optic coupler, Thus, the terminal information is transmitted to the command post of the mine, which completes comprehensive management and monitoring. The safety monitoring system of the mine is mainly composed of the following parts: mainly wired wireless communication network, personal information terminal, management application platform, etc. The functions of the personal information terminal are relatively comprehensive, including temperature monitoring under the mine, sending sensing information to the upper computer, sending distress information to the upper computer, monitoring the life status of mining workers, and formulating disaster avoidance routes for the mine. The nodes used for transmitting information in the mine safety system have the advantages of flexibility, large quantity, and small size. After installing sensor networks in the mine, it can effectively monitor the mine environment, mining equipment, mining personnel, and other information. Based on the Internet of Things technology, the overall architecture of the mine safety system mainly includes perception layer, network layer, and application layer.

3.1 Perception layer

The perception layer mainly achieves effective collection and management of data information through various sensing devices such as dynamic sensors and static sensors. Dynamic sensors are mainly based on the Internet of Things technology, utilizing wireless networks covered in the mine environment to provide effective perception services for objects and people, including monitoring personnel, equipment, mines, and the environment; Static sensors are mainly represented by objects and human bodies, building a comprehensive mobile sensing platform. By accessing the perception network in the network, they can sense the information executed by the Internet of Things.

3.2 Network layer

The network layer mainly achieves the effective integration of the Internet, local area network, and communication network through various devices. The network layer of the mining safety system is mainly built in the ground environment, which is the integration point of the entire mining data and can complete the effective transmission of data through its own convenience. The network layer transmission platform of mines is mainly the main part of the Internet of Things, which utilizes network technology, communication technology, and other technologies to effectively transmit perceptual information. During the production process of mines, production information and safety information are comprehensively integrated and transmitted to the control center of the mining system, thereby achieving effective information mining and information integration, and thus achieving the processing of intelligent information.

3.3 Application layer

The application layer mainly plays a role in processing and analyzing various data in mines. Through data collection and processing, the application layer platform can effectively and intelligently monitor and control the actual situation of the mine. In the process of collecting data, it is necessary to first effectively investigate the actual situation in the mining environment, which mainly includes mine automation management, video monitoring management, timely personnel management, emergency command management in the mining area Mine safety system scheduling management, etc. When an unexpected mining accident occurs in a mine, the application layer of the safety system will make corresponding actions in a timely manner, and guide the transmission and

application of various data in the application layer.

4. Mine safety system scheme under Internet of things technology

The application of Internet of Things technology can, on the one hand, achieve effective management and detection of mines by setting fixed mine perception nodes. During the perception stage, whether there is mining activity or not, it can monitor the actual situation of gas accumulation, movement of ore bodies, and changes in mines, and integrate relevant data to better detect the working environment of mines. On the other hand, in mining work, workers must wear positioning and assembly nodes, which can be changed through changes in absenteeism working positions, in order to monitor the actual situation of mine workers. It can also be said that the perception stage is related to the work situation of mine workers, and the collected data can also better monitor the actual situation of the mine in real time.

Due to the existence of various channels, shadow environments, and other factors, the information obtained in the single perception stage of the mine safety system may be relatively one-sided, with a detection rate and missed alarm rate of 0.7 and 0.2 respectively. If there are multiple nodes around the mine environment during a mining disaster, it will greatly affect the detection rate and missed alarm rate of the mine safety system. Unlike single perception nodes, in the process of joint detection and monitoring, multiple perception nodes can achieve a detection rate of 0.9 for dangerous mining accidents, and the missed alarm rate can also be controlled within 0.1. After the perception is completed and the mining accident situation is confirmed, the mining safety system will develop a mining accident solution to guide mining workers to evacuate as soon as possible, thereby ensuring personal safety.

5. Conclusion

Overall, this article discusses the key technologies and overall structure of mine safety systems under the Internet of Things technology, and analyzes the effective mine safety system solutions of joint detection combined with isolated detection, mobile detection combined with fixed detection. It also briefly describes the relevant characteristics of the mine safety system. With the gradual maturity of China's Internet of Things technology, it has played an important role in building a mine safety system, fundamentally and effectively maintaining the safety of the mine, for mine production staff, they can comprehensively monitor machines, personnel, and equipment during the mining process, in order to achieve the goals of safe, efficient, and green mining.

References

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Fund Project: Gansu Province University Student Innovation and Entrepreneurship Training Program Project: A Underground Personnel Positioning System for Mine Safety (Project Number: S202013933009).