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Minesite monitoring system design and implementation

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ABSTRACT

The coal industry in China's industrial base position in industry, is currently China and beyond for a long time with the main primary energy. However, due to the characteristics of the coal industry's own decision making coal mining operations is very dangerous, even if the technology developed is now, the probability of occurrence of coal mine accidents remains stubbornly high, occur frequently, bring about social insecurity factors, but also to countless families brought a huge threat. So how can we achieve the coal industry safety issue aroused people's attention, has become the primary problem we have now, you want to solve this problem, the implementation of the mine site monitoring is an important tool. In this paper, through the safety science, management theory and computer network technology, the use of knowledge to undertake a study on coal mine safety, coal mine site monitoring system design. And domestic and international coal mine safety supervision relevant case analysis to identify the existence of the problems of coal mining enterprises to find a reasonable solution.

KEYWORDS

Coal industry; Site control system; Design.



Energy, the basic physical material for the human race, is indispensable and fundamental for the emerge and the development of a civilization. In 2004, according to some documents, the daily energy output is less than the usage in China, which threatens the further development of China^[1].

THE SIGNIFICANCE OF THE SITE CONTROL SYSTEM

As an large energy consuming country, the energy industry is the lifeline of the development of China. With the shortage of petroleum increasing, the coal industry which has already accounted the biggest share of energy industry flourishes and the exposes lots of problems^[2]. Although efforts have been made by all sectors of society, the numbers of coalmine accidents do not show a tendency of depletion. The site control system contains several different technologies which means the update of sensor and the development of the computer will leads to the improvement of the system.

Development Of The Coalmine Site Control System

Development of the coalmine site control system outside China

Due to the technical level in some countries is superior, the coalmine site control system began to appear in 1960s, and now the fourth generation is in use. The upgrading happens in less every ten years. At the very beginning of its development, the system mainly relied on the air separation. It was kept in the second generation in which the time frequency analysis method is also carried to cut down the usage of the cable core which reduce the cost. With the appearance of the integrated circuit, time-division system was used to the coalmine site control system. The coal industry of Britain successfully researched the MINOS which is one of the third generation. At the beginning of the 1980S, MINOS, as a mature controlling system, was promoted nationwide and even exported to other countries. Even today the coalmine site control system of China haven't changed the basic structure but made a little improvement to some techniques and functions.

Development of the coalmine site control system in China

Because of the restriction of the technology, the start of the building of the system is rather late. However we absorbed their technologies based on which we firmly develops our own system step by step. KJ1 developed by Changzhou institute of automation is the first coalmine site control system we researched and developed voluntarily. MINOS was introduced into China IN 1980s when it was popular. After the import of the advanced equipment, researchers were organized to research the system and improvements were continuously made to our own system. From 1990s to now, our coalmine site control system keeps pace with the world and the operation level is lifted and the security of the miners are more ensured.

ANALYSIS OF THE SITE CONTROL SYSTEM

Data collection

When monitoring the coalmine site, the data are analyzed and disposed abide by the data collected. The data collection is vital in the process which the analog quantity are transferred into the digital quantity and the storage and printing are operated.

Convertor

From the Figure (2), the A/D conversion, sampling, quantization, coding are achieved by the application of the A/D convertor in the data collection system. The analog quantity(collected data) are coded into digital quantity, as it shows in Figure(1):

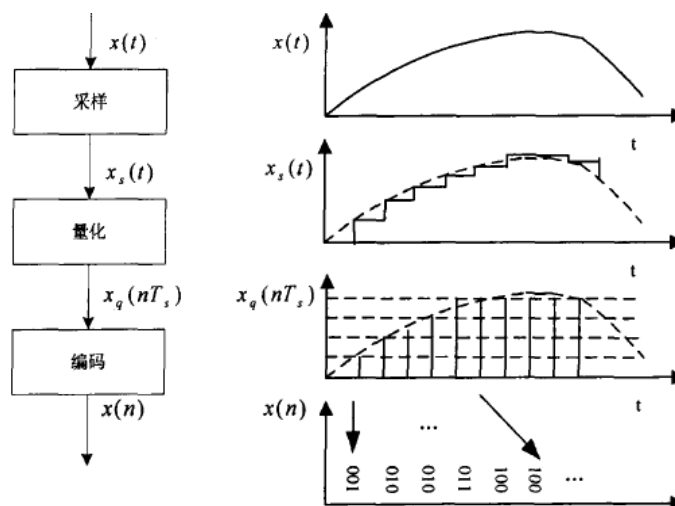


Figure 1 : Process of data collection

MODBUS agreement

The criteria is provided by the MODBUS, excluding the process of the network communication, for the identifiable information structure of the controller. First the exact address of the controller is conforming by the MODBUS agreement, then information sent by the addresses are analyzed. Finally responses are made according to the results got from the analysis.

PROJECT DESIGNED FOR THE COALMINE SITE CONTROL SYSTEM

Analysis for the requirements of control system

When the coalmine site control system is at work, the lower computer monitors the safety factors of coalmine shafts and provides the monitoring results to the upper computer. The upper computer gives commands to the lower computer^[6]. meanwhile the statistical processing and inductive analysis are made to the date by the upper computer and then send the results, as the network signal, to the test centre.

Framework of monitoring system

The repeated coalmine shaft accidents influence the stability of the society and the happiness of families, so the all-level governments devote great efforts to reduce the accidents and established a network structure consist of State Administration of Coal Mine safety to the individual coal mines. As it shows in Figure(2):

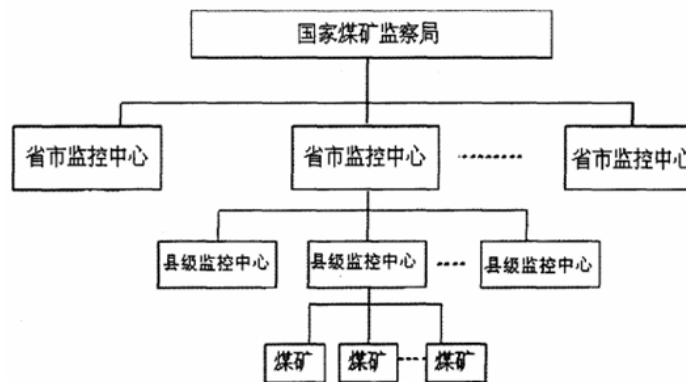


Figure 2 : network structure of monitoring system

- The state administration of coal mine safety
- The provincial and cities' administration of coal mine safety
- The county administration of coal mine safety
- Coal mine

Figure(2) reveals the exact relations between several government monitoring centre, which enable all departments to realize the information of related coal mines. Researching the county level in Figure(2), Figure (3) can be got:

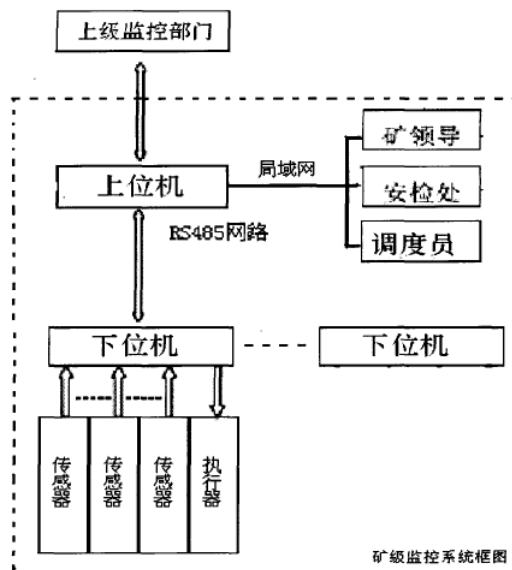


Figure 3 : Monitoring system in individual mines

Superior monitoring department
 Upper computer
 Local area network
 Leader of coal mine
 Security Control department
 Dispatcher
 Lower computer
 sensor

The monitoring systems of individual coal mines have two part, one is the upper computer and the other is lower computer. The single chip microcomputer use sensor convert the different environment conditions into analog quantities. The lower computer transfer the analog quantities into digital quantities through A/D conversion and send to the upper computer. The upper computer analyze the digital quantities. If any abnormalities are noticed, alarm signals are sent and corresponding operations are made to the external plant which reduce the possibilities of accidents.

Function designation

Lower computers designation

As it mentioned before, the design of the coalmine site control system is the design of the lower and upper computers. The lower computers plays a vital role in the whole system, so the equipment components must be the best and the design idea must be the advanced^[7]. Multiple data must be collected, so the lower computers need to utilize the 16-bit resolution and 8-channel analog quantities collection system. The functional diagram is showed in Figure(4)

Upper computer designation

In the monitoring system, the major jobs of the upper computers are collecting the data from different lower computers, sending command to the lower computers when abnormalities is noticed, displaying, analyzing and storing the malfunctions when it occurs.

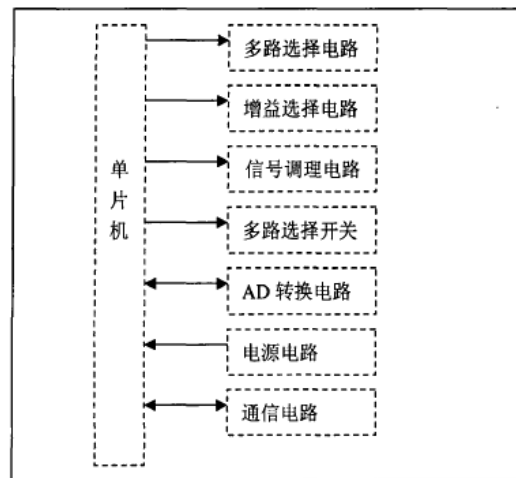


Figure 4 : Function block of lower computers

Singlechip
 Multiple selection circuit
 Gain selection circuit
 Signal processing circuit
 Multiplexer switch
 The AD conversion circuit
 Power circuit
 Communication circuit

CONCLUSION

Coal industry is the foundation for China’s industry. Due to its own feature, the exploitation is quite dangerous even in today when the technologies is advanced. The ratio of accident remains high. In order to reduce the possibilities of accidents, the application of coalmine site control system is necessary. The start of using of this system is later than some foreign countries. After the import of the advanced equipment, researchers were organized to research the system and

improvements were continuously made to our own system. Nowadays the technological level of China in this field can match the worlds. The site control system introduced in this paper is small sized, easy carrying but has a formidable statistical function and effectively reduced the possibilities of accidents.

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