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ENTERPRISE AND CONTRIVANCE OF MINE VENTILATION SECURITY STATISTICS SYSTEM

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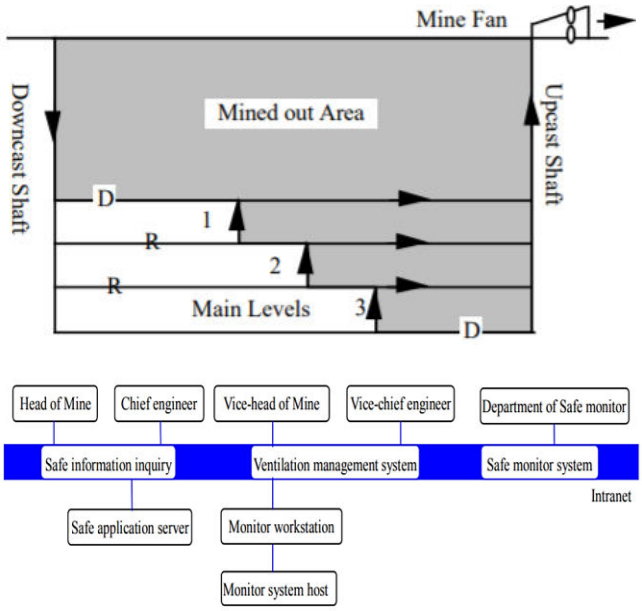
ABSTRACT

Analyzing and processing complex information by using computer aim at mine ventilation manage system in coal mine, this paper put forward feasible and reliable technical decision to the urgent requirements of coal mine safe technology and locale status. By studying middle component and application server, the design approach of building coal mine ventilation safe information network centered on safe application server was proposed, build ventilation safe information integrated system and the system was realized. Practices prove that it creates a new mode to the development of mine ventilation calculation mode and provide timely exact monitor and assistant decision information undermine, and enhance efficiency of ventilation manage system.

INTRODUCTION

Ventilation is the control of air movement, its amount, and direction. Although it contributes nothing directly to the production phase of an operation, the lack of proper ventilation often will cause lower worker efficiency and decreased productivity, increased accident rates, and absenteeism. Air is necessary not only for breathing but also to disperse chemical and physical contaminants (gases, dusts, heat, and humidity). In the U.S., as well as in the rest of the world, mine ventilation practice is heavily regulated, especially in coal and gassy (noncoal) mines, and other statutes relate to air quantities required to dilute diesel emissions, blasting fumes, radiation, dusts, battery emissions, and many other contaminants. To ensure adequate ventilation of a mine, provision is made for suitable paths (airways or aircourses) for the air to flow down the mine to the working places and suitable routes out of the mine when it has become unsuitable for further use. The primary ventilation system thus consists of an intake or intakes (or downcasts) through which the fresh air passes, the mine workings, and an exhaust or exhausts (or upcasts) where the air passes after having ventilated the working places of the mine. Mine fans can be installed on intake airshaft, return airshafts, or both, either on the surface or underground.



System Structure

Mine System and Control Devices

A well designed and properly implemented ventilation system will provide beneficial physiological and psychological

side effects that enhance employee safety, comfort, health, and morale. In planning a ventilation system, the quantity of air it will be necessary to circulate to meet all health and safety standards must be decided at the outset. Once the quantity required has been fixed, the correct size of shafts, number of airways, and fans can be determined. As fresh air enters the system through the intake airshaft(s) or other connections to the surface, it flows along intake airways to the working areas where the majority of pollutants are added to the air. These include dust and a combination of many other potential hazards, such as toxic or flammable gases, heat, humidity, and radiation. The contaminated air passes back through the system along return airways. In most cases, the concentration of contaminants is not allowed to exceed mandatory threshold limits imposed by law. The return (or contaminated, exhausted) air eventually passes back to the surface via return airshaft(s), or through inclined or level drifts.

Air always flows along the path of least resistance, but this may not be where it is required for use. To direct the air where it is needed, ventilation devices are necessary; the primary means of producing and controlling the airflow for the entire system are mine fans (either in the form of single fan installation or multiple fans). In addition, many other control devices also are necessary for effective underground air distribution:

1. Stoppings - Temporary or permanent: Stoppings are simply air walls made of masonry, concrete blocks, pre-fabricated steel, gob walls, fire-proofed timber blocks, or any other material used to channel airflow for effective air distribution. Depending on the size of mining entries, stopping sizes range from as small as 4-ft by 20-ft in low coal to as large as 30-ft by 40-ft in limestone mines.
2. Overcast/undercast: Overcasts are air bridges where intake and return airways are required to cross each other. They could be constructed of masonry, concrete blocks, or pre-fabricated steel.
3. Regulator: Regulators commonly are used to reduce the airflow to a desired value in a given airway or section of the mine. Depending on its permanency and the pressure differential to be experienced across the regulator, materials used in the construction of regulators range from a simple brattice sheet blocking the airway to a sliding shutter in a stopping.
4. Man-doors: These generally are steel access doors mounted in stoppings between intake and return airways.
5. Air locks: When access doors between intake and return airways are necessary and their pressure differential is high, man-doors generally are built as a set of two or more to form an air-lock. This prevents short-circuiting when one door is opened for passage of vehicles or personnel. The distance between doors should be capable of accommodating the longest train of vehicles required to pass through the air-lock.

As an important measure to ensure the safety production of mine, protect the life safety of underground workers, and prevent and control the accidents of underground, the control of mine ventilation system has an overall impact on the safety of mine ventilation. The mine ventilation system not only should has a well-structured ventilation network and a well-matched ventilation facilities, but also should contains ventilation structures for guiding, isolating and regulating air volume, to ensure that the airflow is oriented and quantified in accordance with requirement. The causes for the occurrence and expansion of major disasters in the mines have an closely related to mine ventilation

structures. For example, the reason for the occurrence of a coal mine fire accident in the Dafoshi coal mine of Binchang mining group in 2012 was that the unreasonable mining methods and techniques led to small quantity ventilation structures in the inlet air section, and most ventilation structures were located in the return air section. During the production process, due to the inadequate maintenance and management for ventilation structures, air penetrate directly into the return airway through gaps in the ventilation structure, the goaf zone or the surface subsidence area, which resulted in a large amount of air leakage in the return air system, caused underground air turbulence and the further expansion of fire smoke. Therefore, the installation of reasonable and well-maintained ventilation structures can effectively control the air flow during the accident or disaster period, reduce air leakage and improve the reliability, stability and resilience of ventilation systems. For example, the blast door must be installed at the outlet of the main ventilator to prevent the expansion of gas explosion accidents; when a fire occurs in the intake shaft, it is necessary to take the anti-wind or close the wellhead fire door.

For many years, the adjustment and control problems of mine ventilation have attracted the attention of ventilation experts. Many research results of mine air conditioning and control technology have been applied to production, which has played a positive role in the safety production of mine. However, due to the complex and changeable conditions of mine and mining technology, there are many air flow control problems in the process of mine ventilation, such as air leakage, airflow short circuit, air flow circulation and no air blind area, etc, which seriously affect the stability of the ventilation system. On the basis of the theoretical models of nonlinear control, ejected air flow, neural network control, mining air curtain barriers and fuzzy control, numerous experts have studied and developed many mine ventilation regulation and control techniques, such as technology and equipment of mine leakage risk control system, mining air curtain technology, expert system control technology, controllable circulating ventilation technology and automatic control technology of mine shaft ventilation. However, these control model and technology of ventilation systems have neglected the structure of mine ventilation system and the characteristics of air volume distribution. Therefore, in light of the structure of mine ventilation system and the characteristics of air volume distribution, we have proposed a hierarchical control model of mine ventilation system based on the full monitor of mine ventilation system by safety surveillance control system.

Based on the analysis of the nonlinear control, the neural network control and the fuzzy control that active in the current control areas, this paper puts forward following control criterion of the underground roadway air volume:

1. According to the regulations of Chinese《Coal Mine Safety Regulations》, comprehensively considered the ventilation requirements, mine exploitation modes and roadway layouts in different periods during the whole mining years, and in light of the methods of mine ventilation design and mine air quantity verification, the air volume in the underground mining face, the driving working face, the chamber and other roadway must be actively distributed to meet the basic requirement for the safety production. Based on the requirement of air volume for each site, all the ventilation roadways have the matched air volume that is known as the effective air volume of underground roadways.

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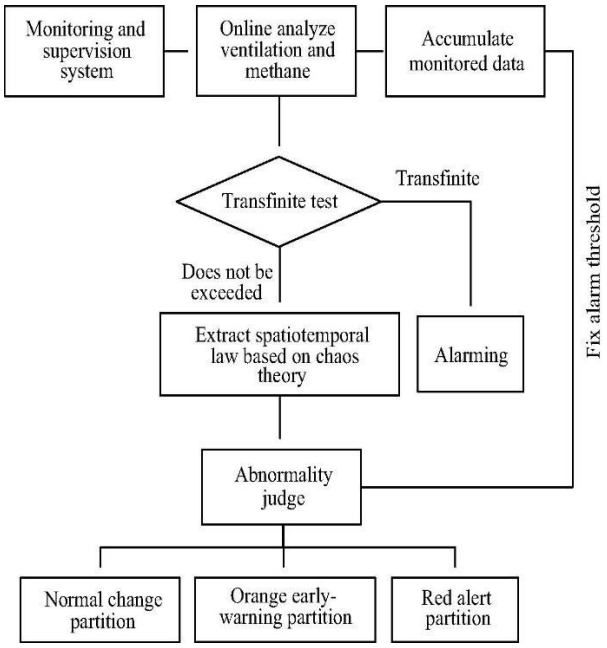
2. In the normal mining and exploitation of the mine, no matter in the wind location or ventilation roadway, when the actual air volume is deviated from its effective air volume, it would pose a safety risk. Therefore, it is necessary to automatically correct the deviation in time. Because the air volume distribution characteristics of mine ventilation system presents the hierarchical classification characteristics, determining the local or small amount of air conditioning should be orderly adjusted along a oriented path.

3. The occurance of gas outburst, fire and other disaster would change the environment security status of mine. The volume control measure of anti-air, closure, etc in the ventilation system should be implemented sometimes for timely, effective control of airflow in the disaster period. Due to the uncertainty of disaster environment, and human's inaccessible to underground to adjust the ventilation equipment, the system must be automatically switched to the manual adjustment mode in order to prevent the disaster from uncontrollably expanding and greatly improve the safety factor of mine ventilation system.



LITERATURE REVIEW

Yu et al. (2005) proposed a real-time forest fire detection system based on wireless sensor network. The system collects the data and processes it in the WSN for detecting the forest fire. They designed the monitoring and detecting sensor networks using neural network.

Joseph et al. (2007) focused on the problems and hazards of fire in libraries or archives and described the necessary preventive steps to be adopted. They identified the diverse parts which are applied for fire detection and alert system and also provided necessary strategies for the selection and installation of an ideal fire alarm system.

Fischer (2007) considered the simulation technique and applied this technique to design a fire detection system. This system detects the fire as well as differentiates fire and non-fire spot to decrease the false alarm rate in the non-fire event.

Lin-Song Weng et al. (2009) planned a framework, which is viably observing all circumstances in mine, particularly for the wellbeing of mineworkers. They named the system the real-time mine auxiliary monitoring system (RMAMS), which is embraced for a real-time mine-monitoring system. Mine auxiliary sensor system (MASS) consists of an intelligent activity sensor and repeater and arrives at decision to resolve the procedure of processing.

Hua Fu et al. (2009) studied the fuzzy theory and neural network technology and by using this information they designed an intelligent fuzzy neural network sensor system for coal mine. This technology can make accurate detection of different parameters.

Shi Wei et al. (2009) designed a multi parameter monitoring system for coal mine tunnel, which is based on WSN network. This system uses the RS-485 communication protocol and hardware modular. It automatically sends warning signals to the main control room and accomplishes corresponding control.

Li-Chien Huang et al. (2011) designed a system for building electrical safety. No-fuse breakers (NFBs) and electrical wall plugs are the main components of traditional distribution, which is used for power transmission and overload protection. NFBs have the utilization of over-burden security and are not completely compelling in forestalling electrical flames created by poor contact or dust pollution. This plan is built with assurance instruments so as to upgrade the parts of customary circulation frameworks. The effects on other equipment in the same branch circuit can be avoided by the threshold limit of the system when the outlet disconnects the power.

METHODOLOGY

Advances in smart ventilation controls

There is no need to ventilate the entire mine because production may only be concentrated in, say, 20% of the facility at any one time.

Although the concept of ventilation in underground mines may seem relatively simple, getting the right quantity and quality of air to where it's needed, when it’s needed, in an expanding mining environment is an elaborate operation that requires an array of ventilation components.

Typical ventilation systems consist of the main fan system, air regulators and doors that distribute air through the mine. There are also auxiliary systems that ventilate local production areas and workshops. Air requirements in an area depend on its location, the number of people there and which machines are being used.

CONCLUSION

The coal mine safe information network based on safe application server system, recurs to the support platform that application server provides. Integrated the advantages of multi-layer distributing calculation mode and object oriented software developing technology, a new requirement to calculation mode was put forward, which is suitable to coal mine industry and meet current requirement of the industry. It creates a new mode to the development of coal mine safe ventilation calculation mode and has widely developing view and huge popularizing value.

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