Wireless Sensor Network's Application in Coal Mine Safety Monitoring

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Abstract. Aimed at the current status and existing problems of safety monitoring of domestic coal mines, a computer-controlled coal mine safety monitoring system is proposed. The integrated system is composed of three subsystems: monitoring, communication and control subsystems. Monitoring subsystem is composed of gas, wind speed, negative pressure, temperature etc sensors, which are distributed in the mine and used to carry out real-time monitoring. The communication subsystem consists of Coordinators, Routers and End node and performs wireless communication. These two subsystems establish contact with the central control computer located on the surface by the CAN buses. The system can simultaneously transmit real-time data to the host computer in the management center and the mobile-phones of the responsible personnel by GPRS module, and when the data exceed the limited values, an alarm will occur. Compared with data transmission through conventional bus, application of wireless sensor network and GPRS network technologies reduces investment on underground lines-laying and maintenance difficulties, ensures timely, accurate and rapid transmission of data in all key underground mining zones and improves efficiency of the system. The system has such dominants as easy-building up, powerful-function, high-reliability, good-extendibility and etc. The system is an advanced approach to solve the present key problem that wireless communication distance is limited in the mine and has great benefits for coal mine safety production.

Keywords: underground of coal mine, Wireless Sensor Networks, monitoring system.

1 Introduction

Mine disasters which cause great loss to life and property of the people are frequently seen in China, especially in the medium-small sized local mines, so the safety production of coal mine has been a weighty topic that affects production of the mine industry, even social stability. Generally, safety accidents mostly occur in the production process of small local mines. Hence, an integrated coal mine safety monitoring system based on combination of Wireless Sensor Networks and GPRS network is proposed, which bears such features as low price, reliable performance and easy installation & maintenance etc.

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2 System Design

In whole, the system is composed of various sensors, Wireless Sensor Networks, CAN Bus, GPRS module and Central control computer. Wireless sensor networks use IEEE802.15.4/ZigBee standard. Main monitoring parameters of coal mine safety are gas information, temperature information and wind information etc. The system, which carries out automatic and continuous monitoring on the relevant underground parameters, continuously collects data of all parameters that require monitoring by various sensors, The environmental information in the mine pot is real-timely monitored by the sensors, is collected and transmitted into network Coordinators by Routers and End node, and finally is transmitted to the central control computer set up on the surface by Coordinators. When the gas density exceeds the limited value 1%, an alarm will occur. Figure 1 shows the general structure of the system.

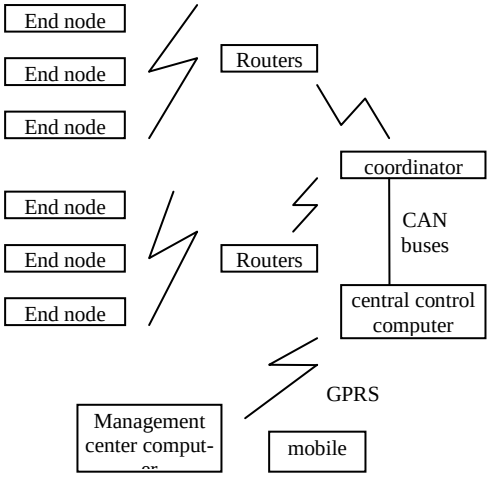

Fig. 1. Shows the general structure of the system

It is seen carry out real-time detection of relevant parameters through various sensors installed underground for CH4, CO, H2S, O2, SO2, NO2, NH3, wind speed, negative pressure, temperature etc. The monitored data are transmitted to ZigBee Routers by ZigBee End points of wireless sensor network, then transmitted to ZigBee Coordinators by the Routers, and finally transmitted to the central control computer set up on the surface through CAN bus connector.

The central control computer is the main task: computer through the CAN bus and ZigBee coordinator, and through the ZigBee coordinator or receive data to or send command control equipment, son of the whole system, data processing and control are compared and timbres alarm, According to the default open executive equipment such as fan, The whole system of data backup, reports, etc. from there the date are