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Swarm robotics: design of monitoring system for coal mine safety based on wireless sensor network

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Abstract

The coal industry takes the issue of safety very seriously. The safety of workers should always be a primary consideration in any form of coal mining. Coal mining deep underground involves a higher safety risk than coal mined in opencast pits, due primarily to problems associated with mine ventilation and the potential for mining collapse.

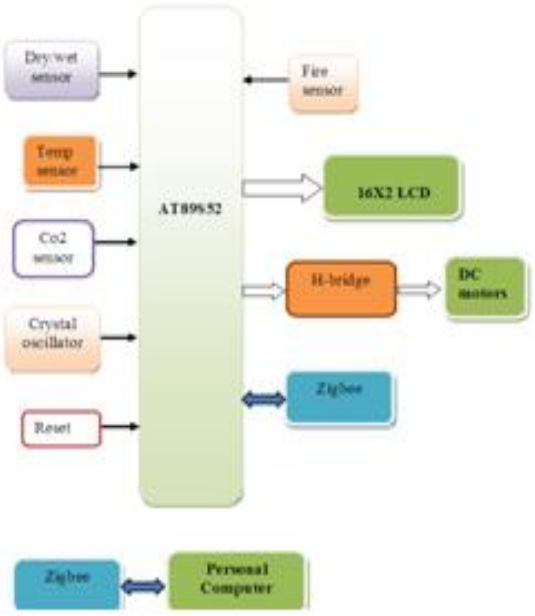
However, there are safety risks associated with all forms of coal mining, not least because of the heavy machinery utilized in coal excavation. Mining explosions are a particularly prevalent safety risk in underground mining.

Gas released from the coal seam and surrounding rock strata during the process of mining can present a high risk of explosion at concentrations in air of 5-15%.The project is built around the AT89S52 micro controller from Atmel.

This micro controller provides all the functionality. It also takes care of filtering of the signals at the inputs. Here we are using Co2 sensor to detect dangerous gas, temperature sensor to notice abnormal temperature, Dry/wet sensor to verify wet condition and a fire sensor to identify fire and also to intimate the people about this using zigbee. The robot can be driven using zigbee. This robot uses battery power supply.

Keywords: Mine safety, Coal Mines, Monitoring System, Gas Leaks, zigbee.

Block Diagram:



I.INTRODUCTION

India is a large country with rich coals. However, the current safe production level of coal mine is still low, especially in recent years, disasters in coal mine occur frequently, which lead to great loss of possession and life. The safety problems of coal mine has gradually become to the focus that the nation and society concern on. The disasters happening in coal mine are due to the complexity of mine environment and the variety of work condition of coal mine, so it is very necessary to monitor mine working environment. Traditional coal mine monitoring systems tend to be wired network systems, which play an important role in coal mine safe production. With continuous

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enlarging of exploiting areas and extension of depth in coal mine, many laneways become blind areas, where in there are lots of hidden dangers. Moreover, it is inconvenient to lay cables which are expensive and consume time. In order to solve the problems, we will design a coal mine safety monitoring system based on wireless sensor network, which can improve the level of monitoring production safety and reduce accident in the coal mines Wireless sensor networks is composed of a large number of micro-sensor nodes which have small volume and low cost. It possesses self-organized capability by wireless Communication. In recent years, it is widely used in the fields of our lives, scientific research, military, intelligent traffic, environmental monitoring, intelligent weapon, and so on. Compared to the traditional mine monitoring, we use wireless sensor networks in coal mine safety monitoring. It has three significant advantages:

(1) It is unnecessary to lay cables, and can be installed in monitoring blind areas to reduce the costs of extending the system. More number of nodes can be arranged to eliminate blind areas. Wireless sensor nodes can make general communication and allocate the goal; (2) The nodes are dense, which can ensure data acquisition high accuracy and efficiency of data transmission, and realize the real- time monitoring of coal mine working environment, Sensor nodes with a certain computing ability, storage capacity, data fusion are ideal for remote monitoring.

Proposed System's Block Diagram

System consists of slave as sensor nodes and master control unit with wireless zigbee module. The master node will collect the information of temperature, humidity, gas and smoke detection these parameters from slave nodes and depending on values of slave sensor nodes, the PC or master will give command to the ventilating fan driver circuitry of slave through wireless Zigbee module and then Exhaust fans will start doing operation.

Master node architecture

The master node architecture is as shown in figure 2.The master node and the slave nodes will be deployed with unique ID. The master node will send request packet to slave node ID via zigbee wireless module. In response the requested slave sensor node sends the data packet of four type's sensors values to the master node ID which provides routing security to the network.

Slave sensor node architecture

The proposed node system of wireless sensor network consists of Zigbee wireless transceiver module, low power MSP430 as MCU of the system and sensors of temperature, humidity, rain detection and soil moisture and motor valve control circuit for controlling the solenoid valves. SPI serial communication port connects the Zigbee wireless communication module and the microcontroller module. The slave node 1 is same as slave node 2 and 3 only the motor valve control circuitry is absent in slave node 2 and 3 which is used to control the valve mechanism

The MSP430G2553 series are ultra-low-power mixed signal microcontrollers with built -in 16-bit timers, up to 24 I/O touch-sense- enabled pins, a versatile analog comparator, and built - in communication capability using the universal serial communication interface. In addition have a 10 - bit analog – to - digital (A/D) converter. Wireless Zigbee module Tarang F4 is IEEE 802.15.4 compatible wireless communications standard. It operates on 3.3v. Its operating frequency is ISM 2.4 GHz. RF data rate is 250 kbps. Indoor Communication range is 100 ft (30 m) and outdoor line – of - sight range is 300 ft (90 m). The humidity sensor module SY - SH220 converts relative humidity (30 - 90%RH) to voltage with linearity of 0.33mV/%RH and can be used in weather monitoring application. The temperature sensor LM35 is precision integrated- circuit temperature sensor, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature as + 10 mV/°C. The LM35 is rated to operate over a −55° to +150°C temperature range.

A smoke detector is a device that detects smoke , typically as an indicator of fire. Commercial, industrial, and mass residential devices issue a signal to a fire alarm system , while household detectors, known as smoke alarms, generally issue a local audible or visual alarm from the detector itself. Sensitive material of MQ - 6 gas sensor is SnO2, which with lower conductivity in clean air. When the

target combustible gas exist, The sensor's conductivity is more higher along with the gas concentration rising. Please use simple electro circuit, Convert change of conductivity to correspond output signal of gas concentration. MQ- 6 gas sensor has high sensitity to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane; it is with low cost and suitable for different application.

CONCLUSION

Wireless sensor network has great impact on industry and our daily life, this Project presents a coal mine safety monitoring system based on wireless sensor networks, and hardware and software design of wireless sensor network are described in detail, this system can detect concentration of the gas, temperature, humidity, Smoke and trace the location of miners in underground mine tunnels. Wireless sensor networks applied in monitoring coal mine security breaks through the traditional methods and ideas, which improves the practical ability and flexibility of monitoring system. This system not only can monitor all kinds of parameters under the coal mine, but also can alarm automatically when environment parameters are abnormal to exceed the limitation, which help improve the level of monitoring safety production and reduce accident in the coal mine. Therefore, the coal mine Safety Monitoring system put forward in this article quite meets the need of coal mine safety monitoring.

REFERENCES

[1]. Rong Yan. Design of Mine Safety Monitoring System Based on the Wireless Network [D]. Ji'nan: Shandong University, 2007

[2]. Yu Hai - bin, Zeng Peng. Intelligent Wireless Sensor Network Systems [M]. Beijing: Science Press, 2006

[3]. "AQ6209 - 2007 Digital methane detecting and alarm miner's lamp",Industry standards for Safety production of P.R. China, January, 2007.

[4]. Qiao Ying - xu, Design of Wireless Sensor Networks Node Based OnTinyOS Operating System.The 3th International Conference on Computer Science and Education[C] 2008.7 1201 - 1204

[5].Tao Zhiyong, Li Xin. "Wireless Temperature System Design Based on nRF905", Journal of Zhongguo Technology Imformation, 2007.22, p.53.

[6]. Nordic VLSL Single chip 433/868/9 15MHZ Transceiver nRF905,Reversion; l.1 July2004,1 - 3.

[7]. Zhanglin Guo, Chao Zhang, Jing Zhang,"The Study of Coal Mine Safety State Warning and Assistant Decision - making Support Systems Construction ,"2008

[8]. Yang Zhou et al. "Wireless temperature & humidity monitor and control system" Hangzhou dianzi University