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VEHICLE MODELING IN COAL MINES USING ZIGBEE COMMUNICATION

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ABSTRACT:

This paper designs a monitoring system for coal mine safety based on ZIGBEE wireless sensor network. In this project there are two sections. The first section is vehicle section placed in underground and another section is monitoring section. In underground section the sensors will sense the conditions such as temperature, load of the vehicle, along with we will provide accident recognisation, location identification, and this information is send to the micro controller. Micro controller displays this information in the LCD and sends through ZIGBEE transmitter. In monitoring section ZIGBEE receiver take that information and send to the controller and controller sends the information to LAN and as well as displaying on the LCD. Here ETHERNET MODULE sends the data to PC when the sensors exits there threshold level.

Key words: ***ETHERNET, ZIGBEE Wireless technology, sensors.***

1. INTRODUCTION

The existing monitoring systems underground of coal mine mostly use cable network. This kind of network has poor performance of expansion. The cables are easy to aging and wear, and have high incidence of failures. With the working surface expanded, a blind area for monitoring appears, and then the new cost for installation and maintenance is needed. When an accident happened, especially explosion, the sensors and cables usually were damaged fatally, and couldn't provide information for rescue search and detection events [1]. Wireless sensor network can solve the key issues of communication bandwidth, mobile data transmission, staff orientation, working surface real-time monitoring, synchronization monitoring and soon. This article designs a monitoring system based on ZIGBEE technology to build wireless communication network. The sensor nodes, modules will send the collected data to an embedded network controller based on ARM kernel through multi-hop method. And then the controller receives the data and sends them to the monitoring section PC by the conversion of ZIGBEE protocol, ETHERNET module and as well as displaying on the LCD

2. Proposed hardware system

Micro controller:

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on.

The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI:

ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display:

LCD is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which

7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

ZIGBEE:

Compared with the current wireless technology, ZIGBEE is more suitable for data collection. ZIGBEE is a new wireless network technology with short range and low rate. It is a technology between labeling technology and Bluetooth, and the cost is much lower than Bluetooth. It has its own standards. The sensors sent the data to computer by multi-hop method, and the communication efficiency is very high. The system can be divided into monitoring management layer, underground data collection and transmission layer according to the location. Underground data collection and transmission layer can be divided into the ZIGBEE data collection network and information receiving and processing terminal.

3. Design of Hardware System

The design of entire system consisted of two part which are hardware and software. The hardware is designed by the rules of embedded system, and the software designed according to the user requirement.

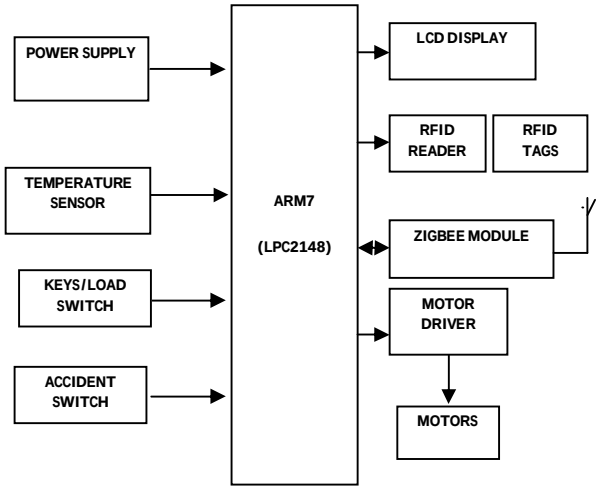


Fig: Vehicle Section

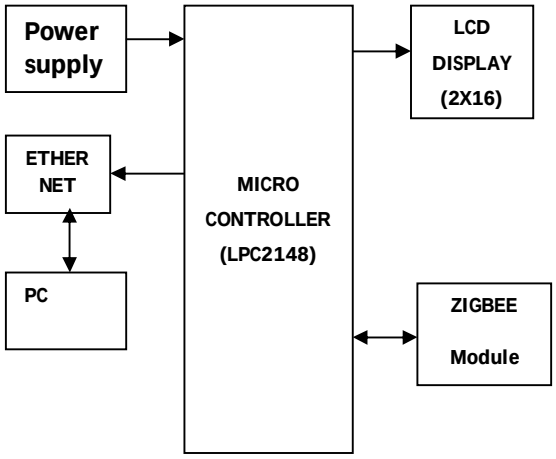


Fig..Monitoring Section

In this project there are two sections. The first section is underground section and another section is monitoring section. In underground section the sensors; switches will sense the vehicle environment conditions such as temperature, accediante recognisation, Bogies loading level and this information is send to the micro controller. Micro controller displays this information in the LCD and sends through Zigbee transmitter. In monitor section Zigbeereceiver take that information and send to the controller and controller sends the information to ETHERNET modem and as well as displaying on the LCD. Here ETHERNET modem sends the information to PC.

The system uses a compact circuitry built around LPC2148 (ARM7) microcontroller Programs are developed in Embedded C. Flash magic is used for loading programs into Microcontroller.

4. Board Hardware Resources Features

Ethernet:

Networking is playing vital role in current IT era where data distribution and access is critically important. As

the use of communication between two or more entities increases the networking technologies need to be improved and refurbished over time. Similarly the transmission media, the heart of a network, has been changed with the time improving on the previous one. If you know a little bit about networking you surely have heard the term Ethernet which is currently the dominant network technology. Wide spread of the Ethernet technology made most of the offices, universities and a building uses Ethernet technology or establishment of local area networks (LANs).

Fig. Ethernet module

Wi04 is the new third-generation embedded UART- ETHERNET/Wi-Fi modules studied by VSDTECH. UART- ETHERNET/Wi-Fi is an embedded module based on the UART serial, according with the Wi-Fi wireless WLAN standards, it accords with IEEE802.11 protocol stack and TCP / IP protocol stack and it enables the data conversion between the user serial and the wireless network module. Through the UART- ETHERNET/Wi-Fi module, the traditional serial devices can easily access to the wireless network. The module supports quick networking by specifying channel number. In the usual course of wireless networking, devices would first scan automatically on the current channel, in order to search for the network (or Ad hoc) built by the target AP. This module provides working channel configuration, when the channel of the target network is known, users can specify the working channel directly, the networking time will be reduced from 2 seconds to about 300 milli seconds, and then quick networking is achieved.

ZIGBEE Technology

ZIGBEE is a new wireless technology guided by the IEEE 802.15.4 Personal Area Networks standard. It is primarily designed for the wide ranging automation applications and to replace the existing non-standard technologies. It currently operates in the 868MHz band at a data rate of 20Kbps in Europe, 914MHz band at 40Kbps in the USA, and the 2.4GHz ISM bands Worldwide at a maximum data-rate of 250Kbps.The ZIGBEE specification is a combination of Home RF Late and the 802.15.4 specification.

The specification operates in the 2.4GHz (ISM) radio band - the same band as 802.11b standard, Bluetooth, microwaves and some other devices. It is capable of connecting 255 devices per network. The specification supports data transmission rates of up to 250 Kbps at a range of up to 30 meters. ZIGBEE's technology is slower than 802.11b (11 Mbps) and Bluetooth (1 Mbps) but it consumes significantly less power. 802.15.4 (ZIGBEE) is a new standard uniquely designed for low rate wireless personal area networks. It targets low data rate, low power consumption and low cost wireless networking, and its goal is to provide a physical-layer and MAC-layer standard for such networks.

Zigbee module:

Zigbee modules feature a UART interface, which allows any microcontroller or microprocessor to immediately use the services of the Zigbee protocol. All a Zigbee hardware designer has to do in this ase is ensure that the host's serial port logic levels are compatible with the XBee's 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-

232 IC or logic level translators such as the 74LVTH125 when the host is directly connected to the XBee UART. The below table gives the pin description of transceiver. Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART.

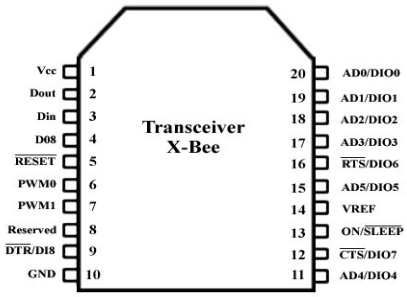


Fig. ZIGBEE Transrecevier

Temperature sensor:

In this Thermistors are used as a temperature sensorThermistors are a type of resistor whose resistance varies significantly with temperature, more so than in standard resistors. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting over current protectors, and self-regulating heating elements. Thermistors differ from resistance temperature detectors (RTD) in that the material used in Thermistors is generally a ceramic or polymer, while RTDs use pure metals.

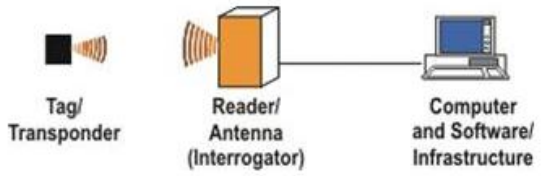
RFID :

Before RFID can be understood completely, it is essential to understand how Radio Frequency communication occurs. RF (Radio Frequency) communication occurs by the transference of data over electromagnetic waves. By generating a specific electromagnetic wave at the source, its effect can be noticed at the receiver far from the source, which then identifies it and thus the information.

In an RFID system, the RFID tag which contains the tagged data of the object generates a signal containing the respective information which is read by the RFID reader, which then may pass this information to a processor for processing the obtained information for that particular application.

Thus, an RFID System can be visualized as the sum of the following three components:

- RFID tag or transponder
- RFID reader or transceiver
- Data processing subsystem



An RFID tag is composed of an antenna, a wireless transducer and an encapsulating material. These tags can be either active or passive. While the active tags have on-chip power, passive tags use the power induced by the magnetic field of the RFID reader. Thus passive tags are cheaper but with lower range (<10mts) and more sensitive to regulatory and environmental constraints, as compared to active tags.

An RFID reader consists of an antenna, transceiver and decoder, which sends periodic signals to inquire about any tag in vicinity. On receiving any signal from a tag it passes on that information to the data processor. The data processing subsystem provides the means of processing and storing the data.

5. CONCLUSION

The application of wireless communication will improve the safety of coal mine. The main advantages are as follows:

(1)The wirelesses are more flexible and can avoid the trouble of rewiring, because wireless network can meet the moving and changing of topology [1]

(2) It will greatly improve the performance and efficiency of data transmission of the coal mine safety system, and reduce the costs of extending the system.

The results of these studies facilitate the employment of new technologies by the mining industry that ultimately improves work safety, productivity and Efficiency in mines.

6. REFERENCES

[1] "Mine 2010: Back to the boom," *Price Waterhouse Coopers*, 2010.

[2 "World mining equipment: Industry forecasts for 2013 and 2018,"*Freedonia Group*, 2009.

[3] D. G. Large, L. Ball, and A. J. Farstad, "Radio transmission to and from underground coal mines-Theory and experiment," *IEEE TransCommun.*, vol. 21, pp. 194–202, 1973.

[4 Y.-T. Yu, T. Punihaole, M. Gerla, and M. Sanadidi, "Content Routing in the Vehicle Cloud," in *IEEE MILCOM*, Oct. 2012.

[5] R. S. Nutter and M. D. Aldridge, "Status of mine monitoring and communications," *IEEE Trans. Ind. Appl.*, vol. 24, pp. 820–826, 1988.

[6] P. Delogne, "The INIEX mine communications systems," in *Proc. Radio: Roads Tunnels Mines, Apr. 1974, pp. 129–136.*

[7] J. Murphy and H. E. Parkinson, "Underground mine communications," in *Proc. IEEE*, Jan. 1978, pp. 26–50.

[8] D. J. R. Martin and R. Webster, "The use of radio in British coal mines," in *Proc. Radio: Road Tunnels Mines*, Apr. 1974, pp. 110–128.

[9] D. J. R. Martin, "Leaky-feeder radio communication: A historical review," in *Proc. IEEE VTC*, May 1984, pp. 25–30.

[10] P. Delogne, "EM propagation in tunnels," *IEEE Trans. Antennas Propag., vol. 39, pp. 401–406, 1991.*

[11] "Underground coal mining disasters and fatalities-U.S. 1900-2006." [Online]. Available: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5751a3.htm

[12] L. K. Bandyopadhyay, S. K. Chaulya, P. K. Mishra, and A. Choure,"Wireless information and safety system for underground mines," in *Proc. URSI*, Aug 2008, pp. 9–16.

[13] K. Srinivasan, M. Ndoh, and K. Kaluri, "Advanced wireless networks for underground mine communications," in *Proc. IEEE ICWCUCA*, Jun 2005, pp. 51–54.

14] W. H. Schiffbauer and J. F. Brune, "Coal mine communications," *American Longwall Mag.*, 2006
.

[15] P. Laliberte, "Summary study of underground communications technologies-Final project report," *CANMET*, 2009.

[16] "OMSHR." [Online]. Available: http://www.cdc.gov/niosh/mining/works/publicationlist.html

[17] S. Yarkan, S. Guzelgoz, H. Arslan, and R. Murphy, "Underground mine communications: A survey," *IEEE Commun. Surv. Tutorials*, vol. 11, pp.125–142, 2009.

[18] T. Sarkar, Z. Ji, K. Kim, A. Medouri, and M. Salazar-Palma, "A survey of various propagation models for mobile communication," *IEEE Trans. Antennas Propag., vol. 45, pp. 51–82, 2003.*

[19] D. G. Michelson and S. S. Ghassemzadeh, "Measurement and modeling of wireless channels," in *New Directions in Wireless Communications Research,, V. Tarokh, Ed. Springer, 2009, ch. 1, pp. 1–27.*

[20] W. Pittman and R. Church, "Through-the-earth electromagnetic trapped miner location systems: A review," *Bureau of Mines*, 1985.

[21] D. Hill and J. Wait, "Theoretical noise and propagation models for through-the-earth communication," *U.S. Bureau Mines*, 1982.