

Mines Parameter Monitoring and Warning Indication using Microcontroller

S. Tamilselvi, A. Pragatheesh, K. Prasanth, R. Sowndarya, N. Rathimeena

¹Assistant professor, Nandha College of Technology, Erode, India

²³⁴⁵ UG Scholars, Nandha College of Technology, Erode, India

Abstract:- The objectives of this project is to protect the people who are under the work in the mines. Heart beat level of a worker in the mine industries should be measured and display it digitally in the LCD display by using wireless communication. Measurements are taken by using sensors. Pulse sensors should be placed anywhere in the workers coat. It will sense the workers heart beat level and monitoring it in the display. Gas sensor will check the gas level if it exceeds buzzer will gives beep sound. Heart beat and pH level are very important parameters, because it shows the body status of the worker. If anyone of these parameters exceeds the reference, the micro controller automatically gives information in the receiver section.

Keywords:- PIC microcontroller, zigbee, Sensors(gas, temperature, heart beat), Rescue system.

1. INTRODUCTION

Safety which is important for every person who are works in different types of industries, especially in mines. Because safety and security are the fundamental aspects of all. Still there is no required safety level in the mine field. In recent years there are lot of disaster happened because of irregular maintenance and less safety measures. so there is loss of life of mining workers. So to avoid all this problem coal mine industry must take precautions [1]. The key factor is the communication to monitor different parameters & take necessary steps to avoid any type of accident. Because of this there is loss of human life. So safety is necessary in coal mines. To enhance safety and to avoid loss of material and human life a communication which is reliable must be established between workers.

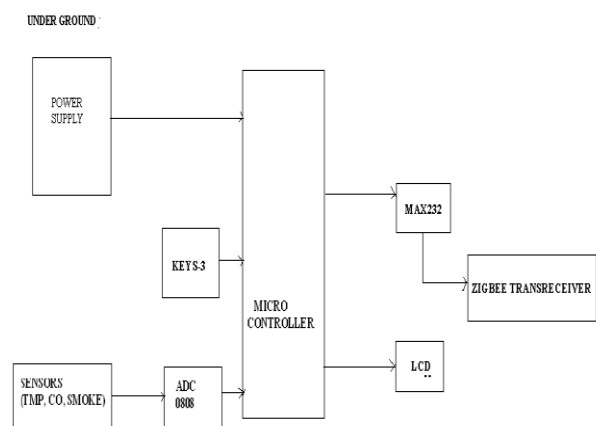
In mining industry or in coal mines wired communication is not suitable. Because it is not cost effective and inconvenient. Problem in coal mine improper trouble shooting and monitoring of gas level and delay in intimation. There is number of environmental parameters like carbon monoxide, methane, toxic gases, temperature, oxygen etc are not monitor. More emission in coal mine is methane. Methane release after the mining is coal mine methane(CMM). When methane comes in contact with oxygen there is violent methane explosion. So monitoring such a environmental parameter is very much important. By using the gas sensors, worker should periodically monitor the gas level for safety and security.

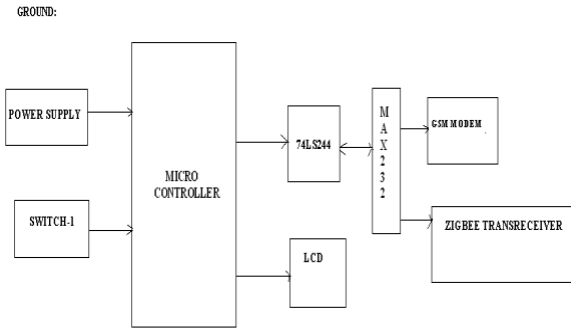
2. EXISTING SYSTEM

In the existing system various sensors like carbon monoxide MQ7, temperature LM35 and water level detector take analog measurements from local site of various parameters such as carbon monoxide, increasing temperature, different water level and through ADC give digita output to the microcontroller AT89C52.

Zigbee transmits this digital sensor data to the remote monitoring site located at maximum distance from local site(100m). Whenever the sensor data exceeds the specified threshold value of sensed data at removed site is transmit alert signal to local site by blowing buzzer continuously. I urgent situation, monitoring units wants to call to any employee then buzzer blow and the employee number displays on LED display.

The first section is underground section and another section is ground section. In underground section the sensors will sense the environment conditions such as temperature, gas etc., and this information is send to the micro controller. Micro controller displays this information in the LCD and sends through Zigbee transmitter. In ground section Zigbee receiver [1] take that information and sends it to the controller and controller sends the information to GSM modem and as well as displaying on the LCD. Here GSM modem sends the [7] message to mobile when the sensors exits there threshold level.





3. PROPOSED SYSTEM

In this proposed system, PIC microcontroller, gas sensor and zigbee transceiver are used. Our aim is to protect the workers from unexpected disaster by giving intimation about the gas leakage through alarm. Workers body conditions and heart beat levels are monitor frequently by using different sensors.

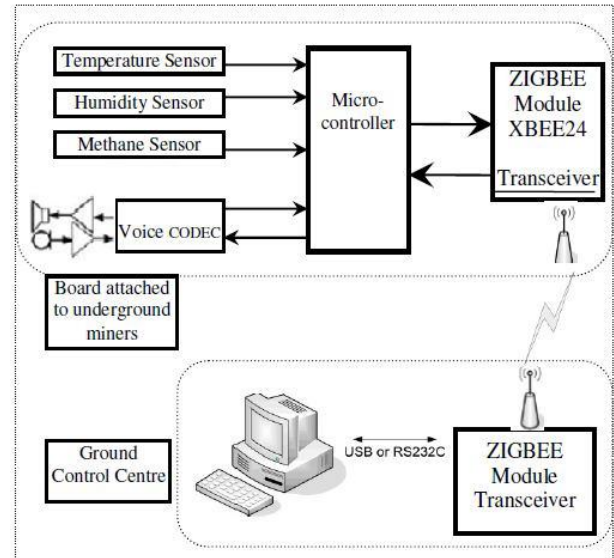
Here gas sensor plays major role to measure the gas required level. If the level exceeds buzzer gives intimation to the workers to escape from that place. Gas sensor is used to measure the concentration of pollution in terms of PPM. Gas sensor is sensitive to some harmful gases like methane, carbon monoxide, methyl iso-cynate etc. PIC microcontroller is used for data transmission and receiving purpose.

4. ARCHITECTURE OF THE SYSTEM

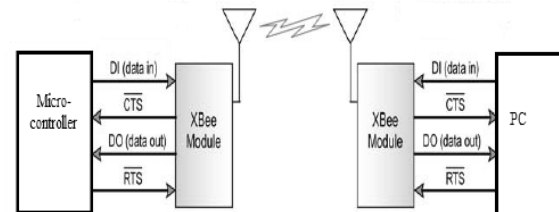
The developed system can be divided into two sections. First is a hardware circuit that will be attached with the body of the mine workers. This may be preferably fitted with the safety helmet of the workers also. The circuit has a sensor module consisting of some MEMS based sensors that measures real-time underground parameters like temperature, humidity and gas concentration.

Gas concentration is meant for the harmful gases like methane and carbon-monoxide. A microcontroller is used with the sensors to receive the sensor outputs and to take the necessary decision. Once temperature is more than the safety level preprogrammed at microcontroller, it decodes beep alarms through the headset speaker connected with controller.

Again, once the measured humidity value is more than the safety level preprogrammed at microcontroller, it decodes different type of beep alarms.



Similarly when gas concentration crosses the safety level, microcontroller decodes siren alarms. In all such cases, this will send an alarm through an urgent message and alarm sound to the ground control terminal through zigbee. For the voice CODEC the low size, low power,CMX639 is used which is a continuously variable slope delta modulation (CVSD) digital voice communication systems. With its robust and selectable coding algorithms, 8kbps to 128kbps Data/sampling rates, supported internal clock signals makes it versatile [1]. It has analog input interface with encoder that connects the microphone and microcontroller and also an analog output interface with decoder that connects speaker/headset and microcontroller. Communication through these encoding and decoding of voice and alarm signals is effectively established with the help of microcontroller.



The microcontroller data is transmitted through two separate boards i.e. ZigBee transmission module to the data collector or receiver module. The microcontroller used here is PIC 16F877A with 20MHz operating frequency. It has five I/O ports, eight A/D input channels and 368 bytes data memory. The data receiving terminal of Zigbee XB_RX and data transmitting terminal XB_TX are cross connected to the microcontroller corresponding transmitter and receiver terminals TxD and RxD respectively. No extra component like MAX 232 and MAX233 is required between these connections. This is the advantage of PIC 16F877A.

If the structure of UART (Universal Asynchronous Receiver Transmitter) system is completed, sending and receiving signal is possible using ZigBee, after installing necessary software. The RESET pin of Zigbee is used to provide an optional reset facility of user through a reset button. A transistor is used for this purpose.

The Zigbee Modules used in the interfacing boards, are engineered to meet IEEE 802.15.4 standards. It is low-cost, low-power, reliable 20 pin device that operates within the ISM 2.4 GHz frequency band. It has 30 to 100 metre data transmission capability with rate of 250,000 bps.

5. HARDWARE DESCRIPTION

5.1 Power supply

In this system we are using 5V power supply for microcontroller of Transmitter section as well as receiver section. We use rectifiers for converting the A.C. into D.C and a step down transformer to step down the voltage.

5.2 Microcontroller

In this work the micro-controller is playing a major role. Micro-controllers were originally used as components in complicated process-control systems. However, because of their small size and low price, Micro-controllers are now also being used in regulators for individual control loops.

The purpose of this work is to present control theory that is relevant to the analysis and design of Micro-controller system with an emphasis on basic concept and ideas. It is assumed that a Microcontroller with reasonable software is available for computations and simulations [3] so that many tedious details can be left to the Microcontroller. The control system design is also carried out up to the stage of implementation in the form of controller programs in assembly language OR in C-Language.

5.3 GSM module

A GSM modem can be an external modem device, Insert a GSM SIM card into this modem, and connect the modem to an available serial port on your computer. Or, A GSM modem can be a PC Card installed in a notebook computer, such as the Nokia Card Phone. A GSM modem could also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port on your computer.



A dedicated GSM modem (external or PC Card) is usually preferable to a GSM mobile phone. This is because of some compatibility issues that can exist with mobile phones. For example, if you wish to be able to receive inbound MMS messages with your gateway, and you are using a mobile phone as

5.7 LCD display section

This section is basically meant to show up the status of the work. This work makes use of Liquid Crystal Display to display / prompt for necessary information.

your modem, you must utilize a mobile phone that does not support WAP push or MMS. This is because the mobile phone automatically processes these messages, without forwarding them via the modem interface.

For pages other than the first page, start at the top of the page, and continue in double-column format. The two columns on the last page should be as close to equal length as possible.

5.4 Gas Sensor

This sensor is used to measure the concentration of pollution in air in terms of PPM. MQ6 is a semiconductor sensor for combustible gas. It is highly sensitive to propane, iso-butane, methane and LPG also responsible to natural gas. It provides fast response, stable and long life.

5.5 Zigbee module

ZigBee is an established set of specifications for wireless personal area networking (WPAN), i.e. digital radio connections between computers and related devices. WPAN Low Rate or ZigBee provides specifications for devices that have low data rates, consume very low power and are thus characterized by long battery life. ZigBee makes possible completely networked homes where all devices are able to communicate and be controlled by a single unit.



Two Zigbee modules are used for the transmitter and the receiver. The experiment is done as per the IEEE 802.15.4a channel models i.e. for R (LOS and NLOS) and IO (LOS and NLOS). Prior to doing the experiment each Zigbee module is connected to each PC and the X-CTU software is installed in those PC's.

5.6 MAX323

The data which we are entering in to the hyper terminal editor is available at the COM1 port. Then the data enters in to the MAX232 voltage converter via the RS232 cable. [5]The MAX232 converts the voltage levels of the RS232 to the TTL level and then sends to the UART of the microcontroller. So the main duty of the max232 is for the voltage conversions.

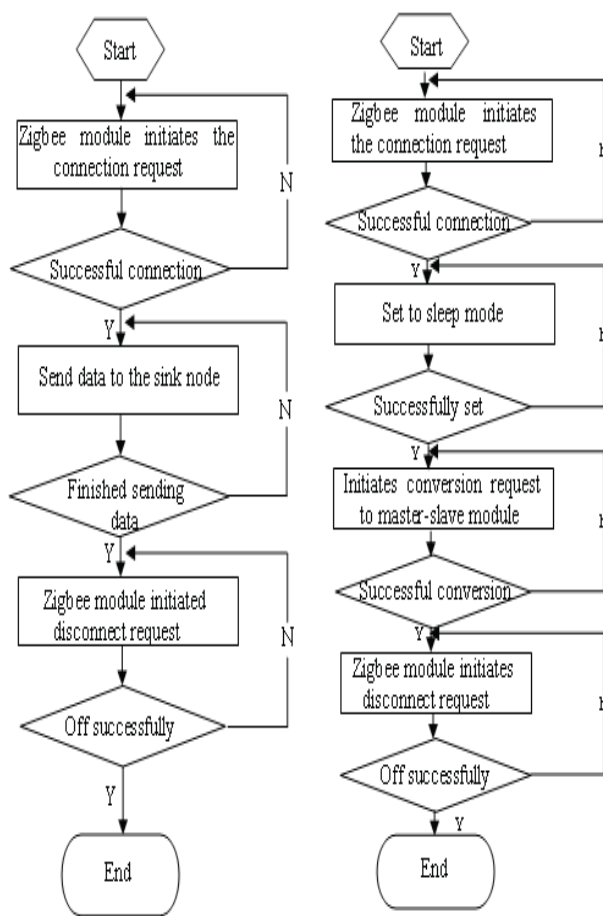
6. SOFTWARE DESIGN FLOW

In software design, communication protocol layers have the energy conservation for the center. Take the communication between the sensor nodes and the network coordinator as an example to introduce the flow of communication between the

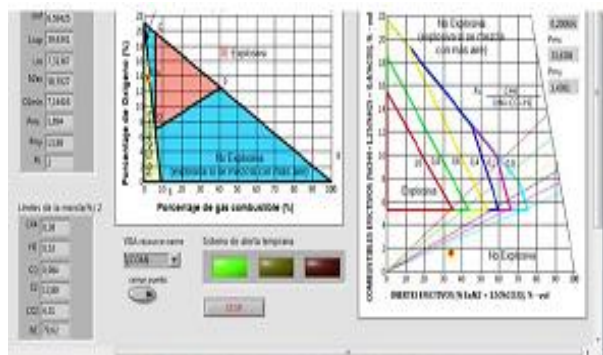
ZigBee modules. Before making communication, ZigBee module needs effective initialization.

The initialization process between ZigBee sensor nodes and the network coordination. During initialization, the network coordinator issues a active signaling request to connect the sensor nodes. After the sensor nodes successfully receive and verify a data frame and MAC command frames.

The most important among these tools are Keil IDE, Flash Magic and Hyper terminal. Keil is free software that solves many of the pain points for an embedded programmer. This is an integrated text editor to write a compiler to compile it and convert source code to text file. The Hyper terminal tool is used to monitor Serial ports in PC. Thus at the remote station, the collected data from RF receiver displayed as mentioned results.



7. SIMULATION



By using sensors data's can be monitored continuously in LCD display. The approximate simulation of analysed data is shown below. In this simulation result gas level, temperature level are monitored and simulated for analysing the safety level.

8. SUMMARY

The Bureau of Mines/NIOSH electrical safety research program has focused on the variety of topics over its 100-year history. Research has been conducted to address safety issues associated with conducted to address safety issues associated with advancing technology as well as to develop new solution prompted by regulatory mandates. Future priorities will be driven by surveillance, customer/stake holder input and risk analyse, it should include overhead powerline, electrical maintenance, and lightning hazards.

The technical feasibility of an improved power line proximity warning system that does not depends on electric field detection should be studied. There will be a continuing need to provide effective training for both experienced and younger, inexperienced maintenance personnel to increase awareness of electrical maintenance can be systemized by developing job hazard methodologies for critical task. Finally, further investigation is needed in the future to achieve a better understanding of lightning and develop practical guidelines and recommendations that can help mine operators reduce the chance of ignitions and protect workers from the resulting hazards.

9. CONCLUSION

The existed mine security system can be effectively replaced by this proposed safety system. Our proposed system is to place the sensor on worker safety jacket to monitoring the place where the workers are available and to check the heart beat level of the workers for safety measures.

The depth of monitoring the dangerous mines frequently is easy to protect the workers and the people who live around the mines. This control circuit does not consume lot of power. Sensors used in this system should be placed easily in Miner's safety jacket. Monitoring data should be displayed in LCD display frequently to know the status of security system.

10. REFERENCES

- [1] [1] S. Wei, L. Li-li, "Multi-parameter Monitoring System for Coal Mine based on Wireless Sensor Network Technology", Proc. international IEEE Conference on Industrial Mechatronics and Automation, pp 225-27, 2009.
- [2] [2] N. Chaamwe, W. Liu, H. Jiang, "Seismic Monitoring in Underground Mines: A case of Mufulira Mine in Zambia Using wireless Sensor Networks for Seismic Monitoring", Proc. IEEE international Conference on Electronics and Information Engineering, vol. 1(V1), pp 310-14, 2010.
- [3] [3] 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.
- [4] [4] Jilin Li, "Status and Development Trend of Coal Mine Safety Monitoring System", Journal, Coal Technology, Harbin, 2008(11),pp. 4- 5.
- [5] [5] D. Koenig, M. S. Chiamonte, A. Balbinot, "Wireless Network for Measurement of Whole-Body Vibration", J. Sensors, vol. 8, pp. 3067-81, 2008.

- [6] [6] D. Egan, "The Emergence of ZigBee in building automation and industrial controls", J. IEE Computing & Control Engineering, vol. 16(2), pp. 14-19, 2005.
- [7] [7] Hu Huo. Kjl3 Mine Monitoring System Software Design and Implementation. Computer Development & Applications, 2008, 14,(5).
- [8] [8] Zhang Hong, Zhang Jie. Wireless sensor network technology based on coal mine safety monitoring system [J]. Microcontroller and Embedded Systems, 2009.
- [10] [9] G.Pradeep Reddy, Gerardine Immaculate Mary "Optimal node placement in wireless sensor networks" IJEST, Vol. 3 No. 2 Feb 2011,pp.1124-1129.
- [11] [10] Rajkumar boddu, p.balanagu "zigbee based mine safety monitoring system with gsm" International Journal of Computer & Communication Technology, Volume-3, Issue-5, 2012.
- [12] [11] Jahan, Narsimha and Rao, " Data perturbation and feature selection in preserving privacy", Ninth International Conference on Wireless and optical communications Networks (WOCN), pp 1-6, 2012.
- [13] [12] Sara Hajian and Josep Domingo-Ferrer, "A methodology for Direct and Indirect Discrimination Prevention in data Mining", Proceeding of the IEEE transaction on knowledge and data Engineering, VOL.25, NO. 7, PP.1445- 1459, July 2013.