Safety Device for Mine Workers

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*Abstract—***This paper provides reliable and efficient solution for the safety of mine workers against various harmful parameters by the use of 3 sensors and it also gives the mine workers a unique way of communicating with the base station.**
Keywords—

Safety Device, Mines, Surveillance, Zigbee, RFID.

I. INTRODUCTION

Industrial safety is one of the main aspects of industry specially mining industry. In the mining industry safety is a very vital factor. To avoid any types of unwanted phenomena all mining industry follows some basic precaution and phenomena. Communication is the main key factor for any industry today to monitor different parameters and take necessary actions accordingly to avoid any types of hazards. To avoid loss of material and damaging of human health, protection system as well as faithful communication system is necessary inside the underground mines. To increase both safety and productivity in mines, a reliable communication must be established between workers, moving in the mine, and a fixed base station.

Inside mines, the wired communication system is not so effective. The reliability and long life of conventional communications systems in harsh mining environments has always been a problem. Inside mines due to uncomfortable situation the installation cost as well as maintenance cost is high for wired communication networks. It is very difficult to reinstall the wired communication system inside mines after a landslide or damage due to any reason. Due to roof fall, if by any means some workers trapped inside mines, to maintain the continuity of the communication system is very much important to know the actual position and condition of the trapped workers. To monitor other parameters during this condition it is very much necessary to maintain the communication system as usual. Accordingly, development of mine monitoring system to accurately detect temperature, pressure, flammable and poisonous gas and to track underground miners and vehicles on real-time has significant meaning to safety production and rescue of coal mine disaster.

Coal mine safety monitoring system based on wireless sensor network can timely and accurately reflect dynamic situation of staff in the underground regions to ground computer system. A hybrid tunnel radio propagation model consisting of the free space propagation and the modified waveguide propagation is proposed in. But, using this popular radio communication inside mines has some disadvantages. When radio signals are transmitted, diffraction, attenuation, multi-path and scattering are often very serious. So, wireless communication is the burning need today for the fast, accurate, flexible safety and production process in underground mines. There are different other research ideas proposed by different people on wireless communication. For the successfully wireless data transmission, in this work the ZigBee specification is utilized. A cost effective ZigBee-based wireless mine supervising system with early-warning intelligence on methane, temperature, humidity in mining area is proposed in. ZigBee specification is incorporated by many manufacturers in their devices because of its low power consumption and decreasing development cost. In the work presented here, XBEE24 product is used for transmitting and receiving data wirelessly. We are providing 3 keys to mine workers to communicate with the base station using zigbee. In addition to this we also using RFID device to locate the location.

II. DESCRIPTION OF SCHEME

Project which we are making can be divided into two sections. First is the hardware circuit which will be attached to the body of mine workers. This can be preferably attached to the helmet of the mine workers. The circuit has three sensors which measures real time underground parameters like temperature, humidity and gas concentration . Gas concentration of various harmful gases like methane ,carbon monoxide etc can be measured and monitored. A Microcontroller is used with the sensors to receive the sensor outputs and take the necessary decisions. Once the temperature , humidity or gas concentration level exceeds the pre programmed threshold level, the buzzer beeps alarms with different intensities. Along with this an urgent message via zigbee will be displayed at the LCD Display which is inside the mine. In addition to this, urgent message will also be displayed at the PC or Laptop placed at the Base station. The zigbee which we are using here is XBEE24, two zigbees are required; one zigbee is placed at Transmitter side and other at the Receiver side. XBEE24 is specifically used because it is cost effective and efficient in utilization. RFID Tags and Readers are also used in this project. With the help of RFID Tags and Readers we can locate the location of the mine workers inside the mine in case if they are trapped. For communication purpose, we are providing three keys to the mine workers since voice communication cannot be successfully established inside the mine. These three keys are medical assistance, fire breakout and labour Assistance. The MicroController ATMega16 is used here which is the heart of our project. It consists of 40 pins. It is a 8 bit microcontroller.

The AVR core combines a rich instruction set with 32 General Purpose working Registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing 2 independent Registers to be accessed in one single instruction executed in one clock cycle. The resulting Architecture is more code efficient while achieving throughputs upto 10 times faster than conventional CISC microcontroller. For the programming part we will be using Visual Basic software. Also we will be using Embedded C language. Visual Basic software will help in displaying the different received parameters at the base station on PC or Laptop. Fig. 1. below shows the block diagram of Transmitter and Receiver.
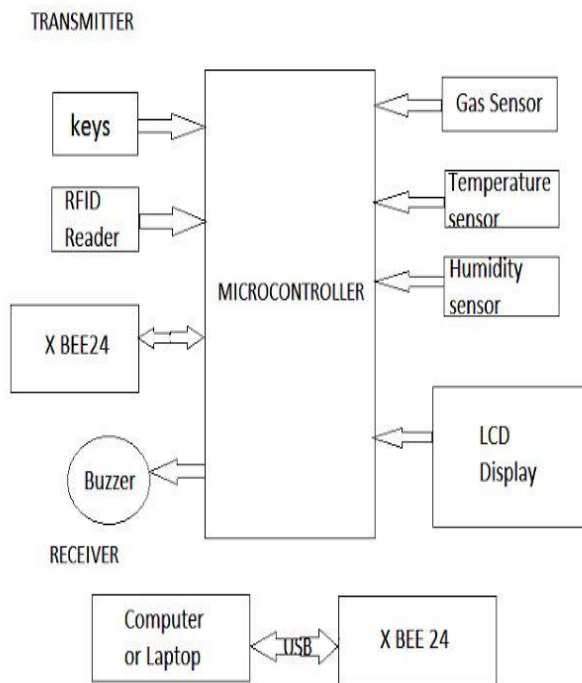

Fig. 1. Block diagram of Transmitter and Receiver.

III. DATA TRANSMISSION THROUGH ZIGBEE AND USE OF RFID.

The main characteristics of Zigbee are are simple implementation, low power consumption, low cost interface, redundancy of devices, high node density per physical layer and medium access control layer (MAC). Besides, they allow the network to work with a great number of active devices. As mentioned earlier certain preprogramming is done at the microcontroller. So whenever the level of temperature, humidity or harmful gases will exceed the threshold level an alarm will beep with different intensities and the XBEE 24 at the Transmitter side will send an urgent message to the base station. This message will be received by the XBEE 24 at the Receiver side and eventually it will be displayed on the PC or Laptop present at the Base station. This is how data will be transmitted through ZIGBEE. The use of RFID is for detecting the location of the mine workers inside the mine. This is useful in order to trace the mine workers.

IV. DATA MANAGEMENT SOFTWARE

The software which we are going to develop for our project will be a reliable one, which will help in monitoring and managing the received data. The system software will be made using Visual Basic. The language which we will be using as mentioned earlier is embedded C. The received data will include temperature, humidity, concentration of gases etc. The computer stores the parameter in the hard disc and ground staff can choose any of the parameters for recording and replaying.

VI. CONCLUSION

Traditional mine security system can be effectively replaced by the surveillance and safety system proposed in the paper. A larger area and more depth inside hazardous underground mines are now can be covered and potential accidents can be controlled effectively. The system combined the low power, low cost Zigbee based high frequency wireless data transmission technology with small size sensors. The sensor and zigbee module can be preferably installed. Proper monitoring and conversation is possible between the workers and the ground staff which can help to take appropriate actions more rapidly and smartly. The system also can be easily extended with ZigBee wireless image transmission facility in future; it will improve scalability of underground environment and extend accurate position of miners.

VII. REFERENCES-

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