Rescue and Protection System for Underground Mine Workers Based On ZIGBEE

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Abstract- **There are a great many risks to your health which can be linked to coal mining operations. Though there are obvious workplace hazards associated with working in a coal mine, these are not the only risks associated with mining activities. Simply living within proximity of a mine can actually cause a variety of health concerns, and both types of mining (deep and surface) pose their own set of problems. A smart helmet has been developed that is able to detect hazardous events in the mines industry. In the development of helmet. The concentration level of the hazardous gases such as CO,SO2,NO2, and particulate matter. Hazardous event was classified as a miner removing the mining helmet off their head. The environment temperature and heart beat rate also finds to identify the worker's health conscious. The concentration level of the hazardous gases such as methane, carbon monoxide, hydrogen sulfide and particulate matter. This project, aims to design a mine safety system using wireless sensor networks with measurement of parameters such as temperature, air-flow, humidity, noise , dust, and gas concentration.**

Key words: Hazardous gas, temperature measurement, sensor system, mining industry

1. INTRODUCTION

At present the mine gas concentration is detected by fixed gas sensor which mounted at fixed locations in coal mine, and then connect to the working station through the underground cable ,at last connect to the monitoring center. With the extension of the mining face, The distance between the main roadway and the mining face can stretch to several hundred meters or several kilometers, a large number of gas emission will cause gas overrunning and abdominal mass near the mining face in the process of mining, The gas concentration can not be detected effectively in the conditions of movement and the on-site maintenance of big mechanism equipment in the temporary working location, including laying the communication lines out of time, sensor cannot meet the requirements of dynamic detection, real-time transmission and rapid deployment.

We propose a wireless mine gas sensor based on RF which mainly monitor mine gas concentration where the staff and machines operating location is and the exploitation of the monitoring of surface, can be installed in the miner lamp, mine car, excavators and other machinery and equipment, or the position of gas emission make up for the lack of wired communication systems.

At present RF technology is more and more widely used in industrial and agricultural production, RF is a rising wireless network technology which is of short space, low complicacy, low power consumption, low data rate and low cost. The RF stack architecture is made up of a set of block called layers. Each layer performs a specific set of services for the layers.

2.PROPOSED SYSTEM

To detect mine gas concentration effectively in the Temporary working location of underground, This paper introduces a mine gas sensor based on ZigBee which is adapting to environment of coal mine underground, then gives the overall design of physical structure of system, network topology and its hardware and software designed of the composed module. When the received values cross the threshold level then buzzer will start alarming, at the same time data will be displayed on the LCD screen which is present at both ground and underground section. So that everyone present in/outside the coalmine should be alert about the accident to be happened and it should be possible to provide an immediate help if necessary.
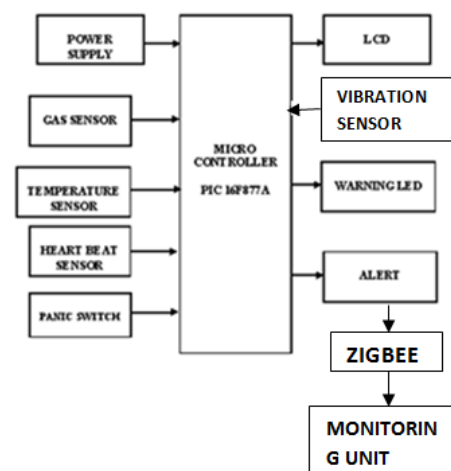

Fig-1: Block diagram

The proposed monitoring system collects following quantities

- Temperature,
- Heart beat rate,
- Environment gas,
- Vibration level of the surface
- Methane values at underground section of coalmine.

The input from the sensor is sampled by the micro controller, which forms the central processing Unit(CPU) of the measurement module. A wireless communication module is also integrated into the microcontroller for transmitting data to the data collection station. The proposed system uses ZigBee 802.15.4 wireless protocol for wireless communication. The data collection station has also a wireless communication module and a microcontroller. The data collection center has the necessary hardware and software capabilities to process, display and store these data values.
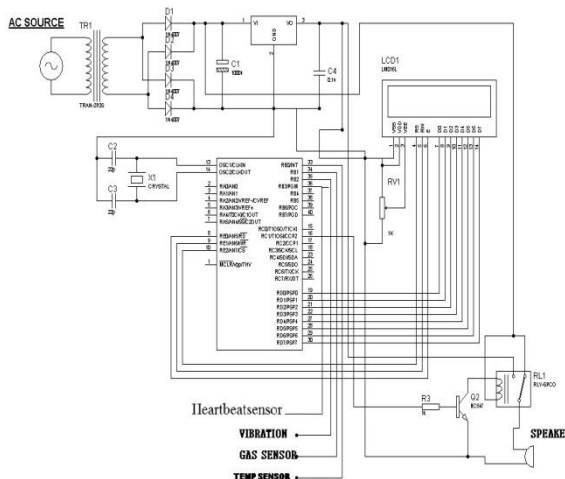
3.SYSTEM DESIGN

Fig-2: Circuit diagram

A.Temperature sensor:

This sensor is used to measure ambient air
temperature. There are a variety of different methods which can be used to design temperature sensor from first principles, the two alternatives which were considered are the use of a thermistor and the use of a thermocouple. After evaluating these two alternatives in the context of this project it was decided that a thermistor based temperature sensor will be designed.

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1/4°C at room temperature and ±3/4°Cover a full -55 to +150°C temperature range.

B.Gas sensor:

A gas detector is a device which detects the presence of various gases within an area, usually as part of a system to warn about gases which might be harmful to humans or animals. Gas detectors can be used to detect combustible, toxic, and oxygen' and CO2 gases. Ideal sensor for use to detect the presence of a dangerous LPG leak in your car or in a service station, storage tank environment. This unit can be easily incorporated into an alarm unit, to sound an alarm or give a visual indication of the LPG concentration. The sensor has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG and cigarette smoke.
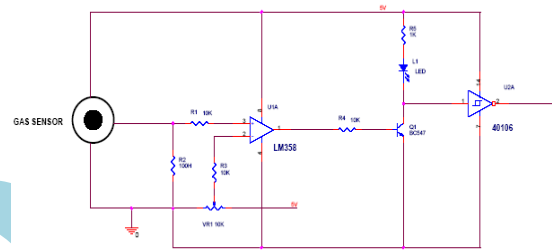

Fig -3:circuit diagram of gas sensor

The gas sensor is the special sensor which designed for sense the gas leakage. In the gas sensor the supply voltage is given to input terminal. The gas sensor output terminals are connected to non inverting input terminal of the comparator.

C.Heart beat sensor:

The IR based heart beat pulse sensor gives the output of low and high Pulse. Heart beat sensor is designed to give digital output of heat beat when a finger is inserted between the IR Transmitter and Receiver. When the heart beat detector is working, the beat LED flashes with each heartbeat. This digital output can be connected to microcontroller directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.
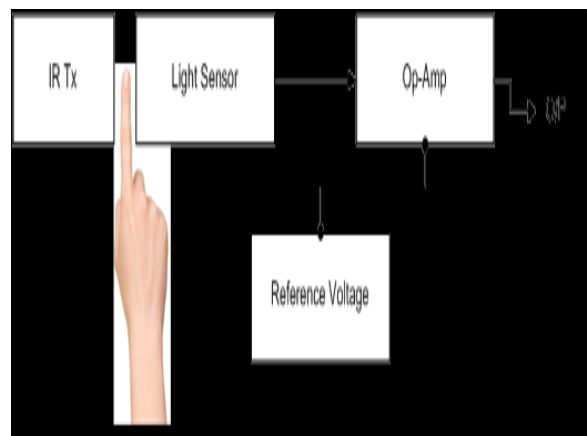

fig-4:circuit diagram of heart beat sensor

The sensor consists of an Infrared transmitter and Receiver. The Infrared ray emits from the transmitter and received in the receiver. When the blood is pumped in between the fingers correspondingly to the beats of the heart, the infrared rays are

blocked in between and released accordingly. With each heart pulse the detector signal varies. This variation is converted into the electrical signals and given as output voltage as 0 or 5 Volts DC. The output signal is indicated in LED which blinks on each heartbeat.

E.Zigbee:

ZigBee is a specifications for a suite of high level communication protocols using small, low-power digital radios based on an IEEE 802 standard for personal area. ZigBee devices are often used in mesh network form to transmit data over longer distances, passing data through intermediate devices to reach more distant ones. This allows ZigBee networks to be formed ad-hoc, with no centralized control or high-power transmitter or receiver able to reach all of the devices. Any ZigBee device can be tasked with running the network. ZigBee is targeted at applications that require a low data rate, long battery life, and secure networking.

F.LCD Display:

LCD stands for liquid crystal; this is a output device with a limited viewing angle. The choice of LCD as an output device was Because of its cost of use and is better with alphabets when compared with a 7-segment LED display. We have so many kinds of LCD today and our application requires a LCD with 2 lines and 16 characters per line, this gets data from the microcontroller and displays the same. It has 8 data lines, 3 control line, a supply voltage Vcc (+5v and a GND. This makes the whole device user friendly by showing the balance left in the card. This also shoes the card that is currently being used.

LCD displays the message of presence of hazardous gas and surrounding environment.

Also LCD is used to give the information about mine workers condition such as health problem

G.Panic switch:

A panic switch is an electronic device designed to assist in alerting somebody in emergency situations where a threat to persons or property exists.

A panic alarm is frequently but not always controlled by a concealed panic alarm button. These buttons can be connected to a monitoring center or locally via a silent alarm or an audible bell/siren. The alarm can be used to request emergency assistance from local security, police or emergency services. Some systems can also activate closed-circuit television to record or assess the event.

Many panic alarm buttons lock on when pressed, and require a key to reset them.

panic switch is an electronic device designed to assist in alerting somebody in emergency situation such as health problem.

The mine worker he can use this switch to intimate his problem , these switch can be connected to the monitoring center.

4.CONCLUSION

This paper gives a better solution for a safety system for coalmines with a new wireless specification i.e. Zigbee. The underground mine gas concentration detection based on the ZigBee network can realize the wireless data transmission and greatly improve the intrinsic safety of the mine gas detection system with the advantage of the low cost and flexibility. It will play a great role in the Coal Mine Safety Monitoring systems as a supplement to the present wire transmission.

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