A Smart Helmet for Hazardous Event Detection for the Mining Industry

Ramesh A[1] Kiruthika R[2] Kowshika V[3] Mahalakshmi L[4]
[1]Assistant Professor [2,3,4]Student
[1,2,3,4]Sri Eshwar College of Engineering, India

Abstract— The main object of this paper is to design a smart helmet for coal miners using zigbee technology. This project utilizes zigbee and sensor technology and upload data to the cloud and notification is given to the user by e-mail and miner gets led alert. To monitor the surrounding sensors like infrared, humidity, sound and gas sensors are used and it is interfaced to arduino Uno. These sensors will observe the change in environment and this data is transmitted to raspberry pi. The passed information is uploaded in Thingspeak.

Key words: Raspberry pi, ZigBee, ThingSpeak, Sensors and IoT

I. INTRODUCTION

The most important part of any type of industry is safety. In the mining industry safety and security is a first aspect of all. To avoid any types of unwanted conditions, every mining industry follows some basic safeguard. Communication is the most vital key factor today, to monitor different parameters such as sound, increasing humidity level, and carbon monoxide gas continuously using sensors such as sound sensor, humidity sensor, gas sensor MQ2 to take necessary actions accordingly to avoid any types of hazardous event and gives an alert using led. To achieve safety in underground mines, a suitable communication system must be created between workers, moving in the mine, and a fixed base station. The wired communication network technology system will be not so effective. Under the mines due to uncomfortable situation the installation cost as well as maintenance cost is high for wired communication networks. For the successfully wireless data transmission, in this work a low cost zigbee is used. A cost effective based wireless mine supervising system with early-warning security system on carbon monoxide, temperature, sound in mining area are proposed

II. EXISTING SYSTEM

In this existing system temperature sensor, gas sensor, pressure sensor and IR sensor are used to measure the environment conditions and these data are displayed in LCD display, if any sensor range exceeds buzzer alert is given to the miner. If they work in a noisy environment buzzer sound will not be heard will leads to danger. And no notification is send to other person other than miners working there which leads to delayed rescue operation.

III. PROPOSED SYSTEM

In the proposed system there is a regular updating of data in ThingSpeak which is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates and mail notification. There is no need of additional portable devices for receiving data, in proposed system we can update through mobile using ThingSpeak. Alert for the miner is given through LED only if any sensor range exceeds the normal value.

A. Transmitter module

Fig1.1 represents the helmet section of the design. Here in this section, it consists of four sensors carbon monoxide sensor, humidity sensor, IR sensor and pressure sensor. These sensors will monitor the environment for data. The sensed data will be received by ARDUINO UNO microcontroller, microcontroller converts sensed data into digital format with the help of 10 bit ADC. It matches data from 0 to 1023. The matched data will be converted into string and is sent wirelessly to monitoring section.

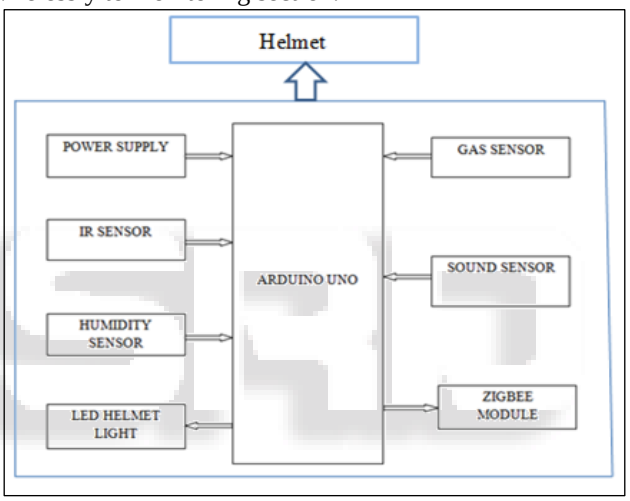

Fig. 1.1: Block Diagram of Transmitter section

B. Receiver module

Fig1.2 represents the monitoring section. It consists of ZigBee module, Raspberry pi controller. The data from the helmet section is received wirelessly by ZigBee module. This data is collected by Raspberry pi controller and the data will be monitored by raspberry pi module and if it finds that the sensed data is out of specified range, then an automatic alert e-mail is generated and will be delivered to authorized personnel.

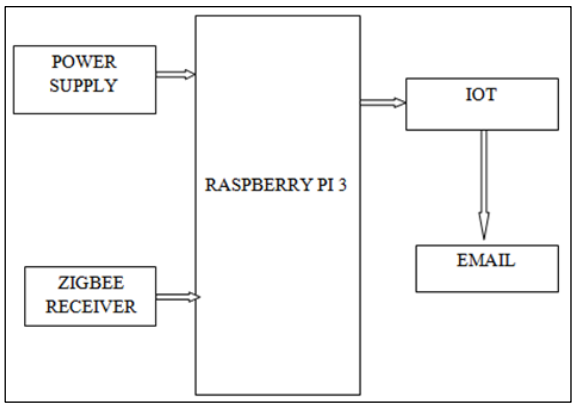

Fig. 1.2: Block diagram of receiving section

IV. TECHNOLOGIES USED

A. Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 which is used at the transmitter side. It has 14 digital input/output pins of which 6 can be used as PWM outputs, 6 analogue inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller which can be connected it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

B. Raspberry pi

In this project raspberry pi 3 model B is used at the receiver side. The Ethernet adapter is internally connected to an additional USB port. The Raspberry Pi 3 uses a Broadcom (BCM2837B0) SoC with a 1.4 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache.

C. IR Sensor

IR sensor is used to detect the helmet removal and alert the receiver An IR sensor can measure the heat of an object as well as detects the motion.

D. Humidity Sensor

A humidity sensor (or hygrometer) senses, measures and reports both moisture and air temperature. It senses the temperature of the mining area and alerts the user if the range exceeds.

E. Gas Sensor

It needs to be connected to any one analog socket in Grove Base Shield. This is an analog output sensor. Grove module to Arduino can be connected directly by using jumper wires.

F. Sound Sensor

Sound sensor detect the noise level in mining area if the value reach beyond normal human hearing capacity then alert will be given to miner.

G. ZigBee module

ZigBee transmitter is connected to Arduino which is used to send these sensors values to ZigBee receiver which is connected to Raspberry pi where these sensor values are converted to digital form and uploaded in cloud.

V. RESULT

Fig. 1.3: E-mail notification

Fig1.3 shows the value of the sensors which is fixed in the smart helmet and continues updating is received

Fig. 1.4: displays the data which is uploaded in ThingSpeak which is a popular medium in IoT

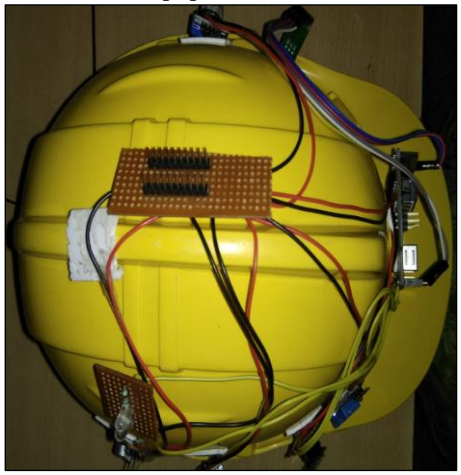

Fig. 1.5: Smart Helmet

Fig1.5 shows the Smart helmet where the sensors and arduino board are fixed on it

VI. CONCLUSION

This smart helmet is able to detect four types of hazardous events such as danger level of hazardous gases, miner helmet removing, humidity level and surrounding noise level monitoring. So the above project provide a strong security for the people who are working in the coal mining the purpose of this paper is to provide a solution to mining a wireless communication. With the help of zigbee module communication can be done. And data are uploaded in the cloud.

VII. FUTURE SCOPE

The system can be enhanced by adding extra measuring equipment to check the worker's heart rate and blood pressure. With ZigBee wireless positioning devices, it will improve system scalability and extend accurate position of underground miners can be determined and data speed can be increased.

REFERENCES

[1] Jagadeesh R, Dr. R. Nagarajan "IoT based Smart Helmet for unsafe event detection for mining industry" International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 01 | Jan -2017

[2] Hem Chandra Joshi and Satyajit Das "Design and Simulation of Smart Helmet for Coal Miners using Zigbee Technology" International Journal on Emerging Technologies (Special Issue NCETST) 8(1) (2017)
[3] Bushra Tabassum, Dr. Baswaraj Gadgay"A Smart Helmet for Air Quality and Hazardous Event Detection for the Mining Industry" International Research Journal of Engineering and Technology (IRJET) Volume 5 Issue VI, June 2017
[4] Shirish Gaidhane1, Mahendra Dhame"Smart Helmet for Coal Miners using Zigbee Technology" Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-6, 2016

