DESIGN OF INTELLIGENT HELMET FOR COAL MINERS

Dr S.S Morade , Vaishnavi Dhundale , Prachi Jaiswal , & Ankita Rajguru

Department of Electronics And Telecommunication Engineering
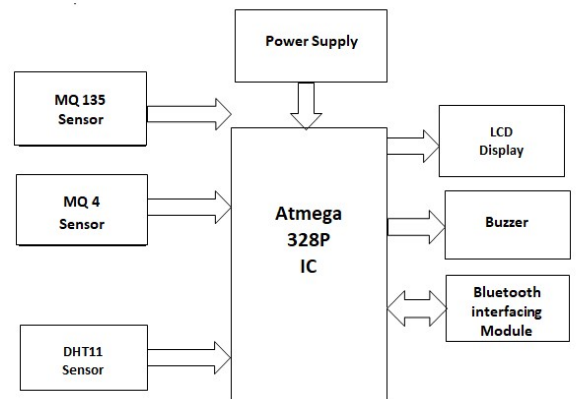K. K. Wagh Institute of Engineering Education And Research, Nashik

---*********---

Abstract –
A smart helmet has been developed that is able to detect of hazardous events in the mines industry. In the development of helmet, we have considered the three main types of hazard such as air quality, helmet removal, and collision (miners are struck by an object). The first is the concentration level of the hazardous gases such as CO, SO2, NO2, DHT temperature and Humidity and particulate matter. The second hazardous event was classified as a miner removing the mining helmet off their head. The layout of the visualisation software was completed, however the implementation was unsuccessful. Tests were successfully done to calibrate the accelerometer. PCB's that were designed and made included a breakout board and a prototype board. A whole software implementation was done based on Eagle of the measuring of sensors and of calculations done with the measured values. This paper presents the undertaken design detailing solutions to issues raised in previous research.

I.   INTRODUCTION

India is known for its extensive and diverse mineral resources and large mining industry. Mining is the process of extracting valuable minerals from the earth .In today's world, mining plays an important role due to need for metals and other minerals. The material obtained from mining include aluminium, copper, lead, Zinc, gold, diamond, metals, coal etc. Coal plays an important role in the generation of electricity. Coal is extract from the earth by surface mining and underground mining. In underground mining, disaster is very serious issue.
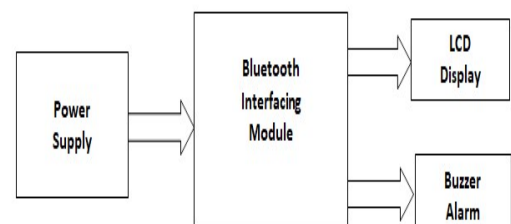
People working in the coal mining have to suffer various environmental change in their mining. They also have the danger from gases such as the methane, carbon monoxide, and temperature. So, strong safety and security of life mine workers is an important factor for society.

II.   SYSTEM OVERVIEW

Figure1. Block Diagram of Transmitter Unit

Figure 2 . Block Diagram of Receiver

The system has following components:

1.ATMEGA328P : Atmega328P is a 8-bit AVR Microcontroller with 32K Bytes In-System Programmable Flash.

2.MQ 4 GAS SENSOR : In this project MQ-4 sensor is used as a gas sensor. It is able to identify various gases in the air like CO, CH_4, LPG and natural gases. MQ-4 sensor is highly sensitive to LPG . Methane gas is released from coal beds to the surrounding atmosphere.

3.MQ135 AIR QUALITY SENSOR: Air quality sensor for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in office or factory. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benze steam, also sensitive to smoke and other harmful gases. It is with low cost and particularly suitable for Air quality monitoring application.

4.TEMPERATURE AND HUMIDITY SENSOR :

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requirescareful timing to grab data.
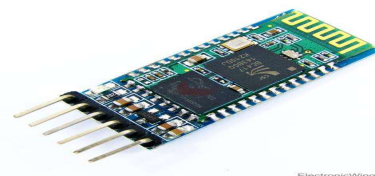
5.BUZZER AND LCD DISPLAY:

To alert the miner and display values on lcd display.

6. HC 05 BLUETOOTH MODULE :

It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

III. SYSTEM SPECIFICATIONS:

|	
Atmega328p ic	Number of : 28 Pins Number of : 23 programmable I/O lines ADC Module :6channels, 10-bit resolution ADC
MQ135 sensor	Power consumption of 150Ma, analog output: 0-5 v
DHT11 sensor	Humidity range: 20-90% Temperature: 0 - 50 celsius
MQ 4 sensor	Working voltage: 5v Detects methane
Hc-05 bluetooth module	Frequency: 2.4 GHZ, Serial port

IV. ADVANTAGES AND APPLICATIONS

- ### Advantages :

  - Low cost and reliable circuit.
  - Life saver safety device.
  - Prevent from the high temperature and humidity.
  - Detection of the poisonous gases.
  - Quick Searching and can able to give the warning.

- ### Application :

  - This can be used by a persons who are working in the underground.
  - It can be used for detecting the dangerous environment situations.
  - It can also be applied at any weather Conditions.
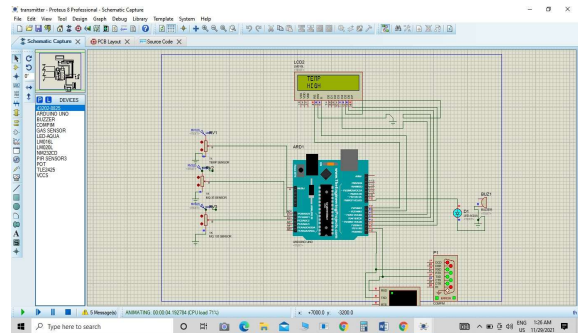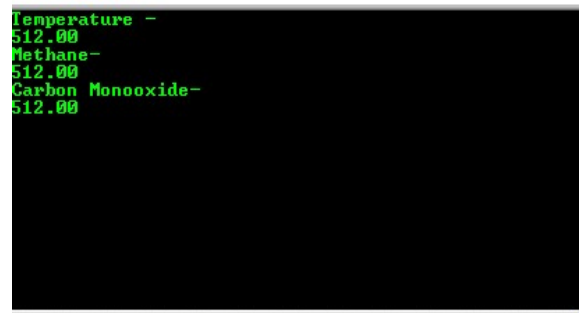
V. ALGORITHM

Step 1 : start of the program

Step 2: system gets initialized and check connectivity of all sensors.

Step 3: check all parameters like gas, temp, can be read by sensors .

Step 4: checking threshold values of sensor if it is greater than set value then go to below

step.

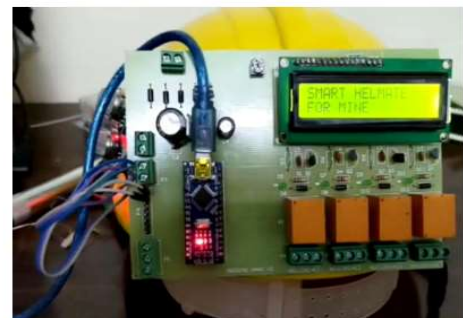**Step 5:** Alert the miner through buzzer and values display on LCD.

Step 6: sends this data to other miners through communication module.

Step 7: End of the program.

Step 8: Follows the step 2 again.

VI. SYSTEM IMPLEMENTATION

Simulation in proteus as shown in figures.

VII. CONCLUSION AND FUTURE SCOPE

The proposed system deals with the detection of harmful gases and temperature in coal mines. Atmega 328 p controller is the heart of the system which helps in taking the decisions when the values of gases beyond its threshold value in the system. MQ 135 air quality sensor will be activated to detect co2 and dht11 for sensing temperature .

The above system can be further developed using the various sensors for monitoring the heart rate and blood pressure of the miners .

Also this system may be enhanced by using the database that monitors different sensor modules in the system and this data can be given to the cloud and the user can access

and monitor this data with the help of IOT (Internet Of Things) technology.

Further we can also add different sensors and GPS technology for the location purpose.

and Knowledge Discovery, 2009.

[10] Cowsalya T , Tamizhselvi J , Pavithra B "Smart Helmet For Underground Hard Rock Miners By Using Wireless Sensor Network", Volume 7, Issue 10, 2018 .

VIII.   REFERENCES

[1] 'T.Pathan' , 'Puja G. Panchbuddhe', "A Microcontroller Based smart helmet for coal miners for air quality and hazardous event detection", Volume 4 Issue-3,2018.

[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-2017).

[3] Chandrashekar S,Dr. Sarika Tale, "An Intelligent Ultrasonic Helmet System for Miner ,International Journal of Engineering Research & Technology (IJERT), Special Issue-2017.

[4] 'BOLLA SRAVANI' , K RAMBABU', "A Smat And Secured Helmet For Mining Workers",Vol. 4 Issue 3, 2017.

[5] Beena M Varghese, Binisha Balan, Neethu Varghese, Reshma Gangadharan , Shaima, "Intelligent safety system for coal miners", International Journal of Engineernig and Innovative Technology volume 4,Issue 9, 2015.

[6] Kiran Kishore, E Narasimha, Y Shruti, "Smart helmet for coal miners using zigbee technology", Issue 2,volume 2 ,2013 .

[7] GARIMA TIWARI ,RUTUJA KSHIRSAGAR , M.P.GAJARE,"Intelligent Helmet For Coal Miners Using Zigbee Technique", JETIR Volume 5, Issue 5, 2018.

[8] T Mary Santhi Sri, K Kranthi Kumar, "Design and development of coal mine safety system using wireless technology",volume VII, Issue VII, 2019.

[9] H. Fu, T. Wang and C. Yang, "Intelligent Fuzzy Sensing System in Coal Mine Safety Monitoring," 2009 Sixth International Conference on Fuzzy Systems