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Safety for Underground Coal Miners using ZigBee

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Abstract - *In recent days we have seen many hazardous activities taking place in mines which had an adverse effect to the eco-system and human life. Mining is a risk prone activity and has many difficulties regarding stability of health condition and mechanism of mining. And miners face these issues due to harmful evolution of gases, temperature changes and suffocation due to humidity. And underground mining holds severe effects when the miners experience gas poisoning, gaseous explosion or top roof collapse. There are many greenhouse gases which are emitted in mining process such as butane, methane, propane, Carbon-di-oxide, these gases show huge impact on health conditions of workers in the coal mine. So, keeping this in mind we have designed a system i.e Smart Helmet for Coal Miners using Zig Bee which alerts the user from environmental changes in the surroundings such as temperature, gases and humidity. In this proposed system we use three types of sensors namely smoke sensor or MQ2 gas sensor which detects CO_2, methane, propane, i-butane, hydrogen fumes. And temperature changes are recorded along with humidity and these can be monitored at the base station carrying zigbee receiving module where as zigbee transmitter module is at sensors. In this way the person at the base station can alert the miners in the mine. And to know the position of the miners in the underground mine an accelerometer is arranged on the helmet.*

***Key Words*: Underground mining, gas poisoning, gaseous explosion, Transmitting module, Receiving module, accelerometer**

1. INTRODUCTION

In the previous years of mining safety methodology, LED was deployed to the helmet of the miners in the underground mines, as helmet was mandatory for the safety of the workers in the mine it has been a easiest form to carry LED, which was of high usability with much intensity of light and low power consumption. Using this aspect which is a must for every miner in mine we have developed a system which detects gases, temperature and humidity with the help of sensors, attached to the helmet along with an accelerometer which predicts the position of worker with respect to the ground level i.e either the worker is perfectly alright or the worker is fainted just by utilizing ZigBee wireless modules where transmission and reception is just performed with the help of radio. And these potentials provide safety by early intelligence warning, With such useful strategies this system has become reliable in all circumstances.

2. BLOCK DIAGRAM

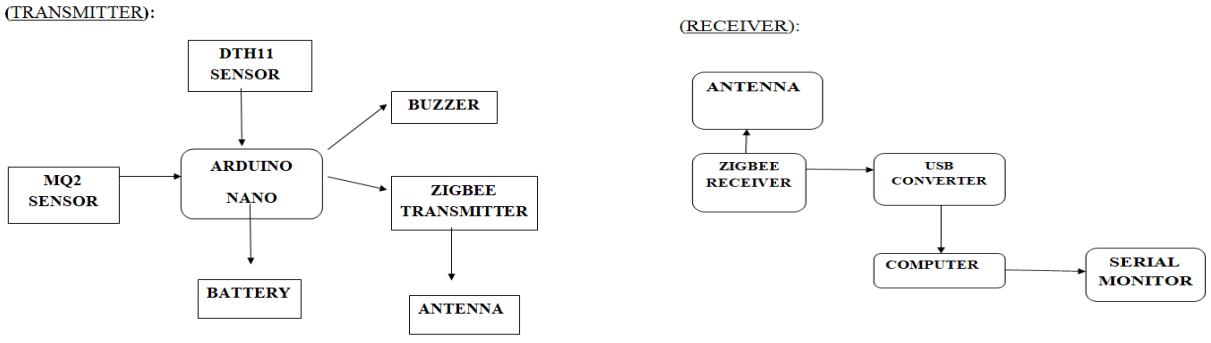


Fig -2.1: BLOCK DIAGRAM

3. WORKING PRINCIPLE

Here we are going to produce results by making use of zig-bee technology and three sensors like temperature, humidity and gas sensing element. These three sensors can observe the amendment in setting parameters and that they can provide the data to microcontroller. Then microcontroller can verify these values continously, if any of the worth exceeds than the

rated, then an alert is given to that particular person through the buzzer. This data is passed to the communication base station through the zig–bee module. Then the department at the base station can take safety precautions to save the lives of people operating within the coal mines quickly as soon as possible they receive alert from the mine.

4. HARDWARE COMPONENTS

In this project, we have used hardware components such as arduino, smoke sensor MQ-2, DTH 11 sensor, zigbee transmitter, zigbee receiver. Sensors: Smoke sensor, DTH 11 sensor

4.1 SMOKE SENSOR

Smoke sensor detects gases such as methane, alcohol, hydrogen, fumes, LPG, i-butane, propane and the smoke sensing device works on the main principle of low conduction in clean air and it is carried out by stannic oxide in the sensor. MQ-2 gas detector has high sensitivity to alcohol checker, device, also could be used to methane series and alternative flamable steam, it's with low price and appropriate for various application

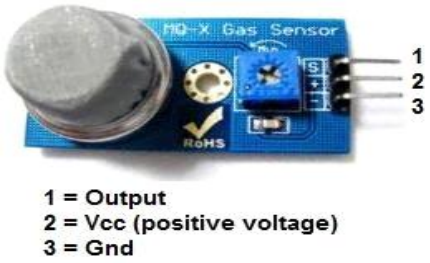


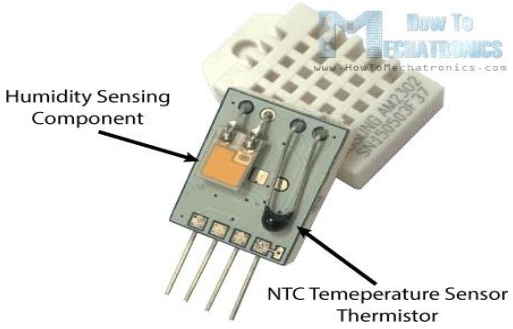
Fig -4.1:SMOKE SENSOR

Features of smoke sensor

- Operating fixed voltage: 5V
- Provides perfect utilization of each digital and analog output
- Adaptable sensitivity
- Output semiconductor diode indicator
- Adaptable with Arduino and Microcontroller
- TTL Compatible device
- Onboard for simple and ease of installation

4.2 DTH-11 sensor (TEMPERATURE AND HUMIDITY SENSOR)

DTH sensing device detects heat and moisture contents, the detector includes a resistivity sense of wet elements associated an NTC temporal measure devices, and it is connected with a superior 8 bit specified microcontroller.



Applications of DTH-11

Humidity demultiplexer, HVAC, dehumidifier, testing, inspection equipment, consumer forum type goods, automotive, automatical appliance control, data logger, weather forecasting reporting stations, home appliances humidity regulator, medical and other humidity measurement and control.

Features of DTH-11

cost effective, high resistivity to temperature, relative humidity and temperature measure, wonderful quality, quick response to changes, long way signal transmission, digital processing signal output, and precise processing standardization.

5. SOFTWARE

Arduino IDE

Arduino will determine the surroundings changes by accepting the inputs from different types of sensors which will eventually have an effect on motors and different actutators. The microcontroller is programmed using arduino artifical language and thus arduino bases its processing. Arduino has a communication with the software of computer such as Flash, processing, MaxMSP. And theres a difference in the directions to be followed in personal pc i.e arduino is a cross platform.

6. Results and Observations

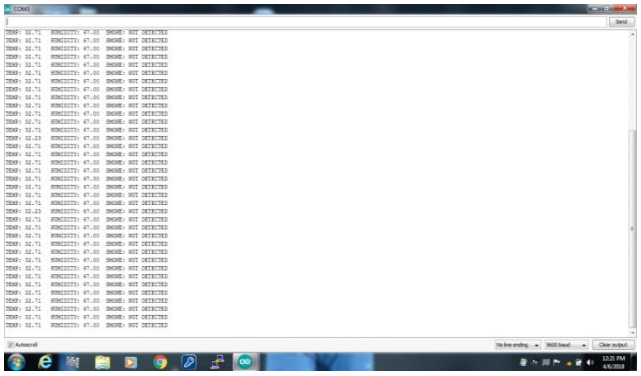


Fig -6.1: SERIAL MONITOR OUTPUT

7. CONCLUSION

The main theme of this system is that saferty of the coal miners in the underground and can guarantee the lives of the miners who are operating in the mine. In future the one who works in mine will face various gaseous effects, tempereature and abrupt short returing injuries in mine. Hence we have inclined to exploit this condition using "ZigBee based Smart Helmet for Coal miners", this is not just for coal miners but also can be used for underground workers and can be used for achieving individuals safety.

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