Zig-Bee Based Intelligent Helmet For Coal Miners

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***Abstract*:** In recent days coal mining has been very dangerous activity for the workers .Who work in mine. Because of numbers of adverse effects an the environment. During mining operation dangerous gases. Like methane may be released into the air also underground mining hazards. Include suffocation, gas poisoning, roof collapse and gas explosion by keeping all those activity which done in underground coal mine we designed a system i.e. zig bee based intelligent helmet for coal miners [7]. For monitoring hazard gases, temperature condition and humidity. Level in air the improve safety features in our system dramatically increases life expectancy by alerting them about hazards. In this system, the helmet has three sensors temperature sensors, humidity sensor and gas sensor to monitor the condition in coal mining. If there is any hazardous condition occurs the buzzer get alarm which is positioned on helmet then gives the information to control station through the zig bee transreceiver [6]. so that miners have the chance to rescue his life from the hazards occurs in coal mines.

Keywords: Intelligent helmet, Zig bee Technology, Gas sensor, Humidity sensor, Coal mines, Safety.

I. INTRODUCTION

In earlier days simple helmet used as the technology increases wireless sensors network are investigated so that it's easier to transmit data from one place to another. By using this wireless technology we design intelligent helmet for coal miners which have different sensors which shows underground hazardous condition & timely transmits all the parameter to the control station [7]. Using this we

provide a strong security for the people who are working in the coal mining. Due to environment monitoring capabilities so by using wireless technology i.e. zig-bee which transmit data from underground coal mines to the control station, so potential safety problems can be avoid by early warning intelligence.

II.PROBLEM DEFINITION

The persons who are working in the coal mining has to face various environmental parameters in their mining .so to overcome that problem we are using zig bee based intelligent helmet for coal miners.

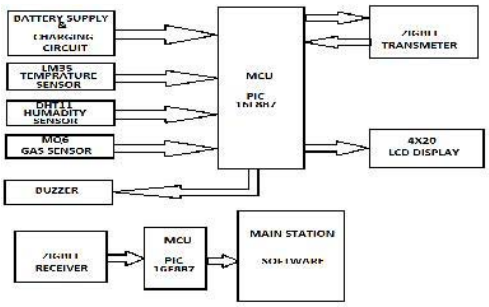

Figure1: Block Diagram of transmitter and receiver sections.

Transmitter and receiver section composed of microcontroller,zigbee communication (CC2420), sensor modules .Microcontroller which collects all the parameters from the different sensors if gas concentration is greater then buzzer(CMX639) get alarm[12].

A. circuit diagram

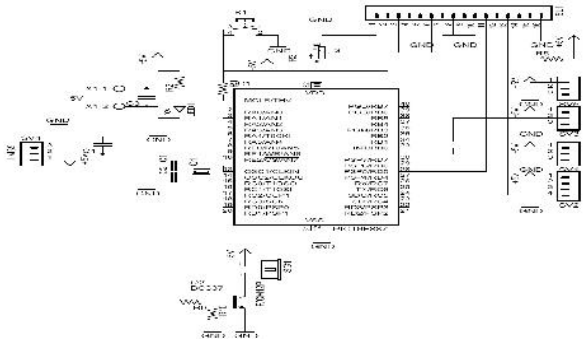

Figure2: Circuit diagram of transmitter Section

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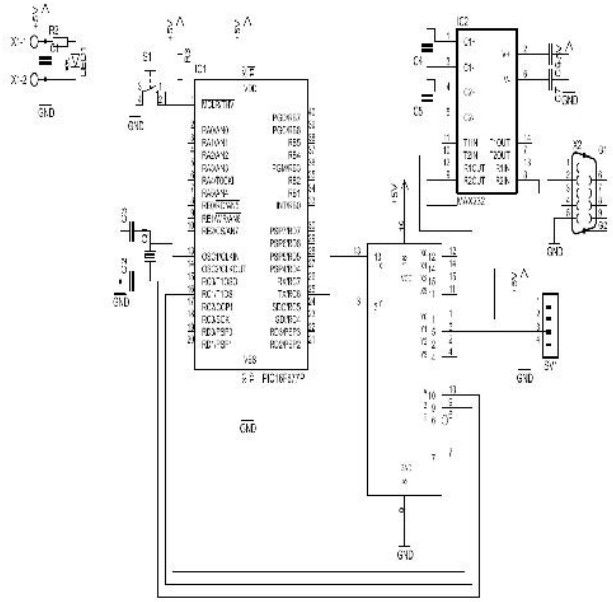

Figure3: Circuit diagram of receiver section

III.HARDWARE UNITS

Temperature and Humidity sensor Unit

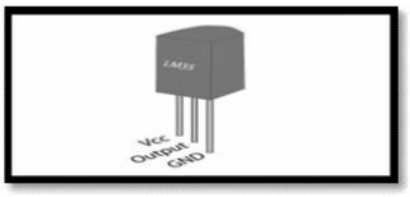

Figure 4: Temperature Sensor (LM 35)

Temperature sensor (LM 35) checks the temperature variation in the coal mines and if sudden changes occurs in hazardous condition it gives the approximation about temperature [4].The normal temperature Range of underground coal mine is 50 to 60 degree Celsius,and at the explosion area it is above 70 degree Celsius.

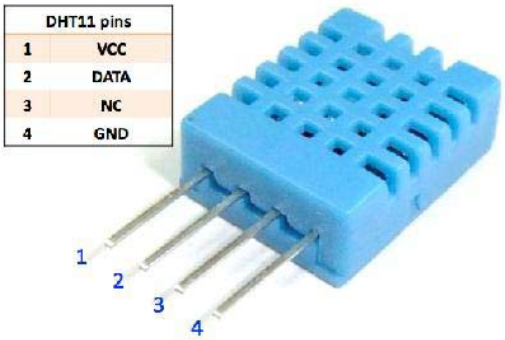

Figure 5: Humidity Sensor (DHT 11)

Humidity Sensor (DHT11) checks humidity in air. The amount of the water presented in the air is nothing but the humidity. Its operating range is 0 to 60 degree. This sensor gives approximation. It is Compatible with automatized assembly processes, including wave soldering reflow and water immersion .Humidity measurement accuracy ±0.3% RH.

Technical specifications:	
Measurement	: 20
Range	: 20%
Operating Temp.	: -40-100 ^{0C}
Storage Temp.	: -40-125 ^{0}C
Supply Voltage	: 10Vac
Accuracy	: 5%

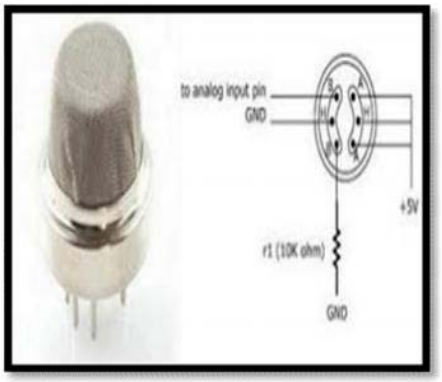

Figure 6: Gas Sensor (MQ6)

Gas sensor is essential to used, because it plays an important role in mining sector [4]. By sensing various gases i.e. hydrogen sulphide, methane etc. and shows approximate percentage of that gases.

The sensor's conductivity is higher along with the gas concentration rising. When high temperature (heated by 5.0V)[3], it cleans the other gases adsorbed under low temperature. Gas sensor (MQ6) it senses the gases which is harmful for the person who are working in mining it is with low cost and suitable for different application.

Figure 7: LCD

This 20x4 LCD is electrically and mechanically interchangeable with 20x4 LCDs from several other vendors which have more accuracy than other LCD [3].LED backlight brightness, voltage and current vary widely, as does the quality of the display [6]. This shows percentage and amount of gases also all the collected data given by the sensor shows with the help of LCD.

Feature

Display format: 20 x 4 characters.
High accuracy
Low power consumption
Easy to operates.
Operating voltage is maximum 5V.
Alpha numeric. 16 pin LCD have 4 rows and 20 columns

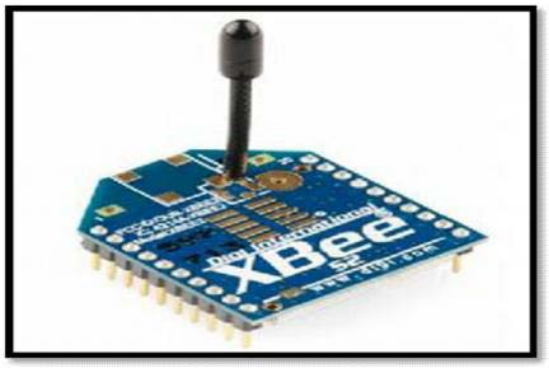

Figure 8: Zig-bee module with antenna used as transmitter.

In recent year wireless technology becomes much forwarded as the use of the wireless technology which also expanded [6]. In the form various applications using this wireless technology we can easily transmit information from one place to another with the secure transmission. Wireless communication enhanced to convey information quickly [10].

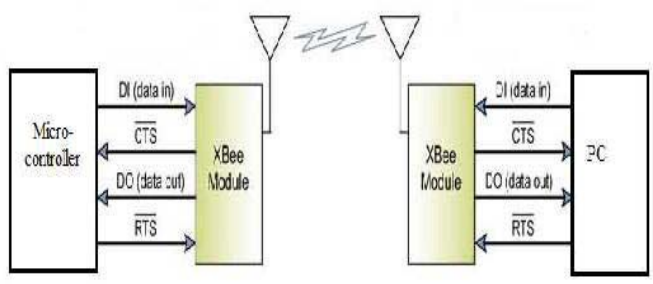

Figure 2: Connections with X-Bee modules

The main characteristics of Zig-Bee network are simple implementation, low power consumption [2],low cost interface, redundancy of devices, high node density per physical layer (PHY) and medium access control layer (MAC).It is the upgraded version of zig bee and its frequency range is 2.4 GHz.

Using zig-bee module (CC-2420) we can transmit all the collected data which is given by Micro-controller and receive by zig-bee module at the control station[15].Wireless communication enhanced to convey information quickly.In Urgent situation of coal mine alert through wireless communication and affected region can be provide help and support with the help of this alert[9].

There are mainly five types of zig-bee module having different ranges and faster transmission and acts as a trans-receiver.

- Zig-bee router (ZR)
- Zig-bee co-ordinator (ZC)
- Zig-bee end device (ZED)
- Zig-bee device object (ZDO)

ADVANTAGES

- Safety monitoring of the environment. Improved Services in coal mining.
- Providing Wireless connection security
- Faster Checked Out/In
- Prevent from the high temperature, humidity and harmful gases
- Quick Searching and can able to give the warning.

CONCLUSION

The main purpose to design this project is safety of person who work in coal mine. We can give assurance about the safety of person who are working in coal mine. In future this person who work in coal mine can easily identify the various gases, temp. Or about sudden short coming natural accidents which happens generally in coal mine. So we overcome this using "zigbee based intelligent helmet for coal miners". This is not only for coal miners, in future we can use this helmet where ever the underground works are done by workers.

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