Zig-Bee Based Intelligent overcoat for Coal Miners

Abinaya. M[1], Chandraleka. D[2], Kalaivani. V[3]

[1,2,3]ECE-III-Year, Mailam Engineering College, Mailam, Tamilnadu

[1]abimohan29@gmail.com, [2]duraileka18@gmail.com, [3]meckalaivaniece@gmail.com

Abstract: This project designs a monitoring and protection system for underground workers based on the wireless network of zigbee. This project addresses an economical, supple, portable continuous monitoring of underground parameter such as high pressure without air gap, collapsing of an atom, chemical reaction of molecules, dirty life cycle, waste management(chemical, nuclear and alcohol factories etc..,) under the earth makes toxic amount of minerals causing toxic gases(CO,SO_2,H_2S,NH_3,CH_4,NOXIOUS etc.,) are detected by gas sensor($MQ135$,$MQ7$ etc., as per the requirement of noxious etc.,) and automating sequence of measuring data using microcontroller and transmit information through digital wireless communication system(zigbee network) to controller. By converting the zigbee protocol to the Ethernet protocol, the controller receives data and sends them information via LCD (PC) with the concept of M2M (Machine to machine - controller room, machine to mobile fire service, mobile to mobile workers and public). The abnormal situation can be projected with high precision, soft controller, reliability, less compatability, less power and large span of battery.

Keywords: Intelligent overcoat, Zigbee Technology, Gas sensor, Humidity sensor, Coal mines, Safety.

1. INTRODUCTION

In earlier days simple overcoat 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.

2. PROBLEMDEFINITION

In their mining, people who work in coal mining have to face different environmental parameters. so to overcome that problem we are using zigbee based intelligent overcoat for coal miners.
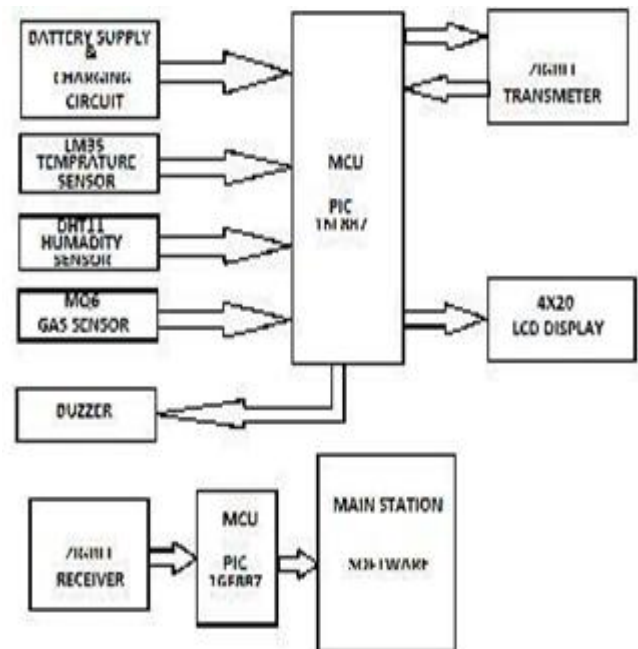

Figure 1. Block Diagram of transmitter and receiver sections

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 [l2].

A. pin diagram of 40 pin PDIP
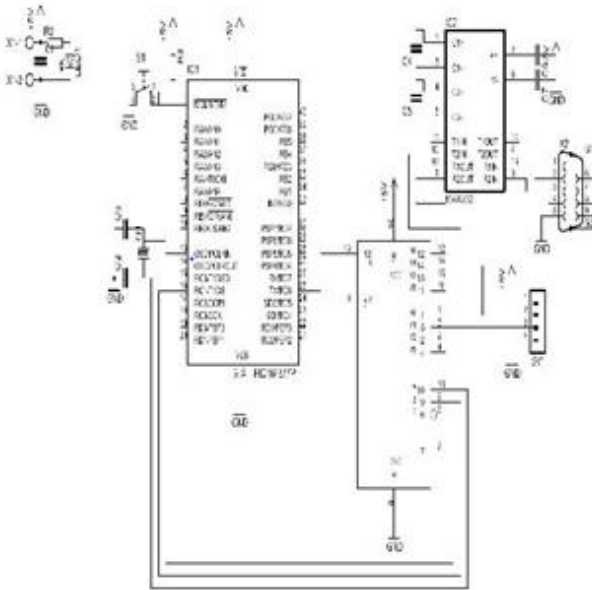

Figure 2. Circuit diagram of transmitter Section

Figure 3. Circuit diagram of receiver section

3. HARDWAREUNITS

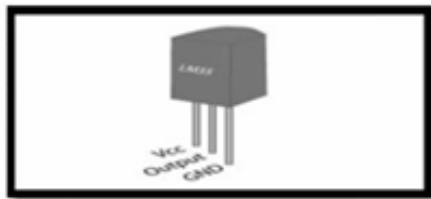Temperature and Humidity sensor Unit

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.
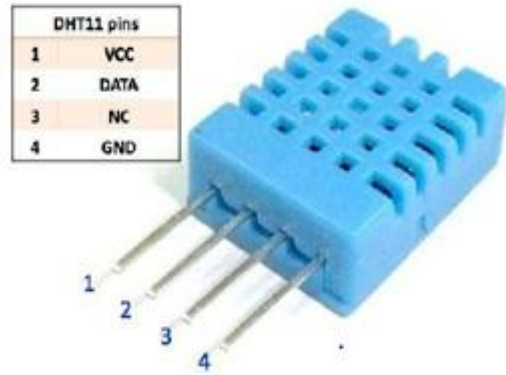

Figure 5. Humidity Sensor (DHT ll)

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

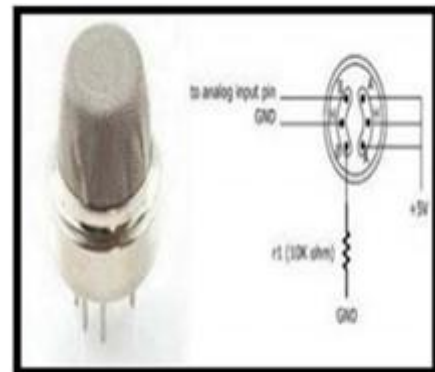| Technical specifications:	
Measurement	: 20
Range	: 20%
Operating Temp.	: -40-l00 ^{0}C
Storage Temp.	: -40-l25 ^{0}C
Supply Voltage	: l0Vac
Accuracy	: 5%

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. Gassensor (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 can be interchanged electrically and mechanically with 20x4 LCDs from several other suppliers that are more accurate than other LCDs [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

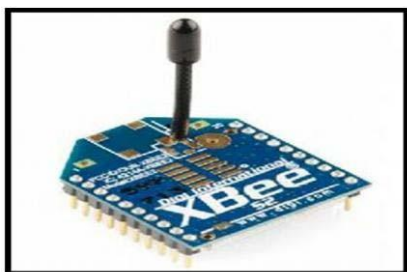| Display format: 20 x 4 characters. |
| --- |
| High accuracy |
| Low power consumption |
| Easy to operates. |
| Operating voltage is maximum 5V. |
| Alpha numeric. l6 pin LCD have 4 rows and 20 columns |

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 [l0].
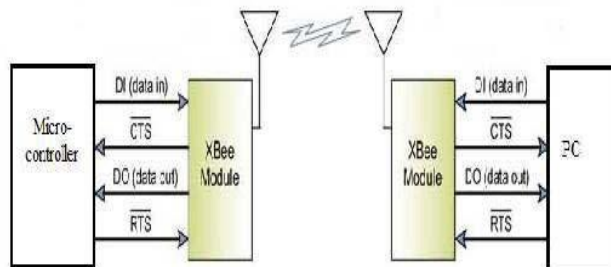

Figure 2. Connections with X-Bee modules

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[l5].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)

4. ADVANTAGES

- Safety monitoring ofthe environment. Improved Services in coalmining.
- ProvidingWirelessconnectionsecurity
- Faster CheckedOut/In
- Prevent from the hightemperature, humidity and harmfulgases
- Quick Searching and can able to give the warning.

5. CONCLUSION

The main application 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 overcoat for coal miners". This is not only for coal miners, in future we can use this overcoat where ever the underground works are done by workers.

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