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IOT Based Coal Mine Safety Monitoring and Alerting System

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ABSTRACT: Any sort of industry must prioritise safety. The mining sector places a premium on everyone's safety and security. The mining industry takes a few simple steps to prevent accidents of all kinds. Accidents still happen. owing to a rise in temperature, a rise in water level, and methane gas leakage, in underground mines. We offer worker safety here. When a worker is in danger, he can use the panic button to alert security. A trustworthy communication system between underground mine employees and the fixed ground mine system must be built in order to increase safety in underground mines. There must never be a break in the communication network, under any circumstances. This paper proposes a low-cost wireless mine supervision system based on zigbee with early-warning intelligence.

KEYWORDS: PIC Microcontroller ,wifi / GSM moule ,zigbee ,temperature sensor , gas sensor , water level sensor

I.INTRODUCTION

The world's most hazardous location to work is a mine since explosions there frequently result in thousands of fatalities. And according to a recent report that such mining catastrophes have resulted in an average death toll of 12,000 persons. There are numerous coal mine accidents that occur in the mines, and the miners are putting their lives in danger by working there. Unfortunately, it happens occasionally that miners lose their lives in the coal mines, making them an unsustainable source that cannot be widely replaced by humans. Such catastrophes frequently occur as a direct result of outdated machinery and electrical devices, leading to improper handling, the spilling of toxic gases in coal mines,

II.LITERATURE SURVEY

Yongping Wu and Guo Feng use the Bluetooth wireless transmission technique to execute coal mine monitoring. As a benchmark for a single, worldwide short-range Bluetooth technology will create a standard low-power, low-cost wireless air interface and controlling software opening system for wireless communication.

The Bluetooth host controller interface (HCI) wireless communication problems are addressed in this study, which also discusses the Bluetooth technology's technical characteristics, protocol stack structure, and background in development .The suggested DCS Coal Mine Monitoring System by Zhenzhen Sun The RS485 bus structure, which is based on RS485 Bus, provides multi-point and two-way communication. This means that this kind of monitoring system can be created using standard 8-bit microcontrollers. It benefits from a straightforward circuit design and affordable price.

III.PROPOSED METHOD

This monitoring system includes a number of parts, including boards (such as a PIC board, an Xbee module, and a Zigbee USB interface board), LCDs (liquid crystal displays), and more.various sensors and other tiny electrical parts. Each of these parts is thoroughly discussed in this chapter, along with how it functions.

The suggested system fixes the gas sensor modules, temperature sensor, water level sensor, and relays for the coal mine safety systems. We connect the controller to every sensor. To begin, we must register for a ThingSpeak account. We mostly have monitoring and regulating mechanisms in this system. All of the data from various sensors is monitored by the monitoring system. Gas is discovered by gas sensor in the environment in a coal mine. The bell goes out loudly to alert the mine employees if the gas level rises over the regular level. This sensor's readings arecontinually uploaded to the cloud for use in analysis and other purposes. Inside the coalmine, the temperature and water level measurements are also measured and sent to a data control unit through zigbee. Figure 1 depicts the suggested system block diagram.



IV. BLOCK DIAGRAM

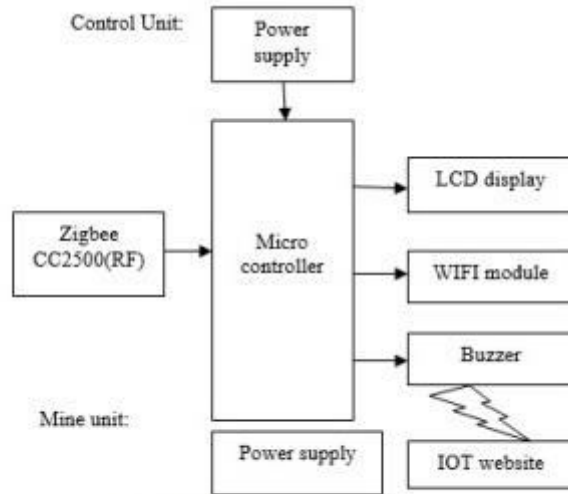


Fig.1. Block Diagram of the System

This monitoring system includes a number of parts, including boards (such as a PIC board, an Xbee module, and a Zigbee USB interface board), LCDs (liquid crystal displays), and more various sensors and other tiny electrical parts.

V. PIC 18F4520

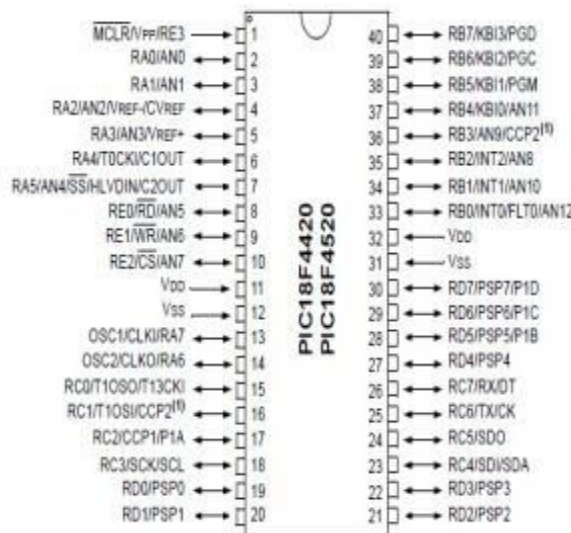


Fig.2. Pin Diagram of PIC 18F4520

Operating frequency 20 MHz 40 pin

VI. ZIGBEE

A cheap 2.4 GHz transceiver made for very low-power wireless applications is the CC2500. The circuit is designed for the ISM at 2400–488.5 MHz. Industrial, Scientific, and Medical) and the SRD (Short Range Device) frequency range. A flexible baseband modem is incorporated with the RF transceiver. The modem offers a customizable data rate of up to 500 k Baud and supports a number of modulation types.



Fig-3 Zigbee

VII.LM35 TEMPERATURE SENSOR

10mV per degree output that may also be easily read on a multimeter or input into a microcontroller. For instance, it will output 300 mV at 30 °C. scaled linearly. Precision integrated-circuit temperature sensors of the LM35 series provide an output voltage that is directly proportional to the temperature in Celsius (Centigrade). Thus, the LM35 is superior than linear temperature sensors calibrated in degrees Kelvin since the user does not need to deduct a significant constant voltage from its output to achieve 25 suitable degrees Centigrade scale.



Fig-3 Zigbee

VIII.16*2 LCD DISPLAY

A LCD (Liquid Crystal Display) screen is a type of electronic display module that has several uses. A 16x2 LCD display is a relatively simple and inexpensive module, widely utilised in many different circuits and gadgets. These modules are preferable over multi-segment LEDs with seven segments and additional segments. The explanations are that LCDs are inexpensive, simply programable, and have no restrictions on showing customised and even customised characters, animations, and other content. A 16x2 LCD has two lines that each have a capacity for 16 characters. Each character on this LCD is presented using a 5x7 pixel matrix. The Command and Data registers on this LCD are its two registers.

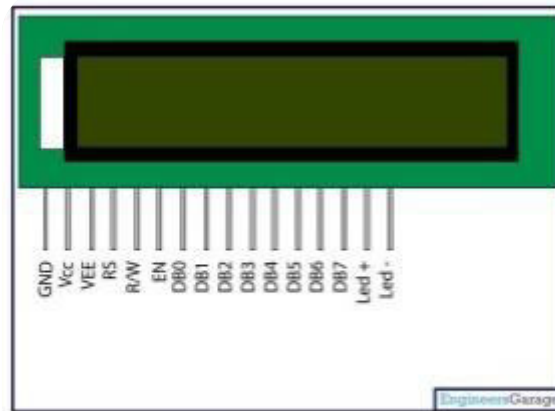


Fig.5 -16*2 Lcd Display

IX. GSM MODULE

Using the USB to Serial adapter, this GSM modem's SIM800A chip and RS232 interface make it simple to connect to a PC or laptop.or via the RS232 to TTL converter to the microcontroller. The right COM port must be identified from the Device Manager of the USB to Serial Adapter once the SIM800 28 modem has been connected via the USB to RS232 adapter. Then, using Putty or any other terminal programme, establish a connection to that COM port at 9600 baud, the modem's default baud rate.You can transmit AT instructions after a serial connection has been established between your microcontroller or PC. When sending AT instructions, such as "ATr," you should



Fig-6 GSM Module

X. MQ- GAS SENSOR

Using a MQ sensor it detect a gas is very easy. You can either use the digital pin or the analog pin to accomplish this. Simply power the module with 5V and you should notice the power LED on the module to glow and when no gas it detected the output LED will remain turned off meaning the digital output pin will be 0V. Remember that these sensors have to be kept on for pre-heating time (mentioned in features above) before you can actually work with it. Now, introduce the sensor to the gas you want to detect and you should see the output LED to go high along with the digital pin, if not use the potentiometer until the output gets high. Now every time your sensor gets introduced to this gas at this particular concentration the digital pin will go high (5V) else will remain low (0V). You can also use the analog pin to achieve the same thing. Read the analog values (0-5V) using a microcontroller, this value will be directly proportional to the concentration of the gas to which the sensor detects. You can experiment with this values and check how the sensor reacts to different concentration of gas and develop your program accordingly.

X. RESULT

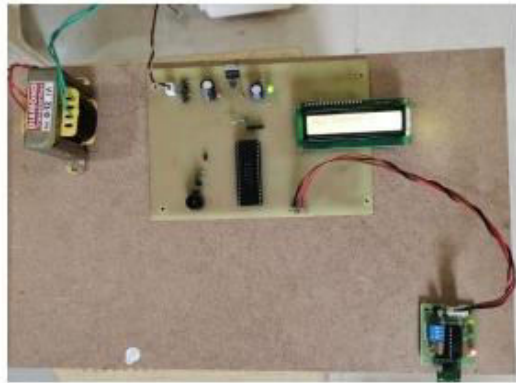


Fig.14 Control unit

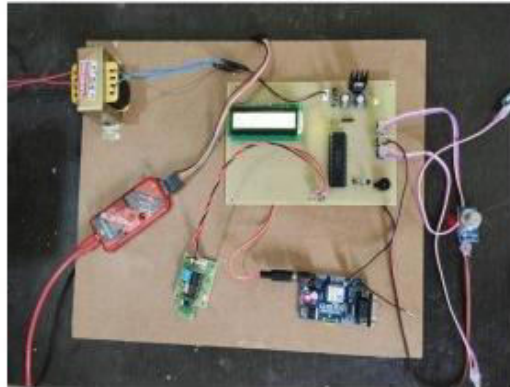


Fig.15 Mine unit

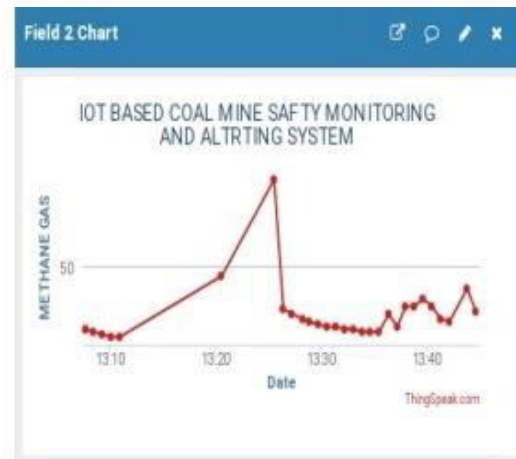


Fig.16 Output on IOT website

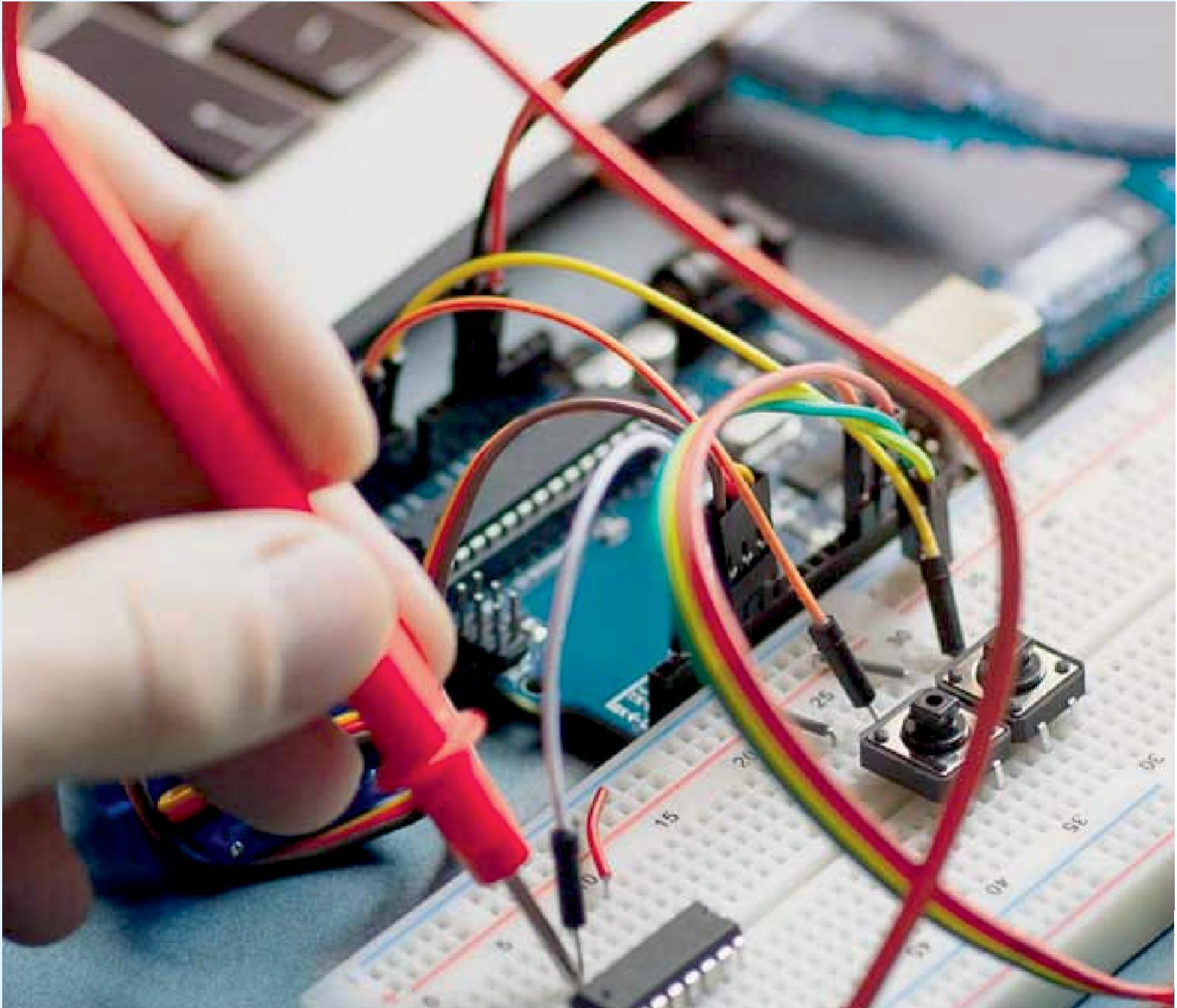
From above graph it is seen that whenever the parameters exceeds the preset limit i.e. when temperature is more than 500C , gas concentration is more than 50 and humidity is more than 250 then the designed system will show alert message on lcd display and buzzer will sound. Also, IOT website gives this information to distant person hence it helps to prevent dangerous hazard .

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