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IOT-ENABLED COAL MINE SAFETY MONITORING AND ALERTING SYSTEM: ENHANCING WORKER SAFETY THROUGH REAL-TIME ENVIRONMENTAL SURVEILLANCE

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ABSTRACT: Safety is the most important part of any industry. Safety and security are critical components of every mining operation. The mining sector employs a number of crucial safety precautions to prevent all types of disasters. Temperature increases, methane gas leaks, and rising water levels remain the leading causes of accidents in underground mines. Here, we assure the safety of our staff. An employee who feels endangered may use the emergency button to contact security. To improve subsurface mine safety, mine personnel must establish a reliable communication link with fixed ground mining systems. A interruption to the communication network is an absolute necessity that will never happen. This proposal describes a zigbee-based wireless mine supervision system that includes early warning information and is designed to be cost effective. The Internet of Things enables the monitoring of employee status.

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

1.INTRODUCTION

Mines are the world's most hazardous workplaces, with thousands of miners killed in explosions. Furthermore, recent research show that, on average, these types of mining disasters claim the lives of approximately 12,000. Coal mine disasters routinely jeopardize miners' lives since coal is a nonrenewable resource that cannot be totally replaced. Unfortunately, fatalities among underground miners occur on occasion. The primary causes of these catastrophes are old machinery and wiring components. Such inadequacies can result in ineffective management, harmful gas escapes in coal mines, and serious risks for excavators working within the mines. In answer to this problem, a coalmine avoidance system was developed. To address the concerns raised in our study, we tested all of the data collected by the sensors. To complete the analysis, we used the Thinger system. The option to adjust manually or automatically is available.

2.LITERATURE SURVEY

Yongping Wu and Guo Feng i

It is possible to monitor coal mines using Bluetooth wireless connection technologies. The basic goal of Bluetooth technology is to create a global standard for unified short-range wireless communication by developing a controlling software operating system and a universal, low-power wireless air interface. This document describes the technical standards, protocol stack architecture, and evolutionary trajectory of Bluetooth technology. Furthermore, Bluetooth host controller interface (HCI) wireless communication methods are proposed as a solution to the complexities involved with Bluetooth technology development

Zhenzhen

Sun proposed the DCS Coal Mine Monitoring System. The RS485 bus configuration allows for two-way and multi-point communication. Therefore, standard 8-bit microcontrollers may be used in the development of such a monitoring system. Its qualities include a low price and a simple circuit structure. Nonetheless, implementing the master-slave design presents a problem in terms of assuring network reliability.

Furthermore, real-time performance is low, and the distance that data can be transmitted is limited

Jingjiang Song, Yingli Zhu

presented a wireless sensor network-based safety monitoring system for coal mines. The aforementioned coal mine safety monitoring system was built with MSP430F and nRF2401. The system's sensor groups closely monitor subterranean mine conditions such as temperature and humidity. The microcontroller transmits the measured data to the wireless communication module. The gathered data is routed to a long-distance monitoring center [4].One potential disadvantage of this solution is that the hardware is vulnerable to damage caused by natural disasters or roof collapses because of its position within coal bunkers. Concurrently, traditional channels of communication lack durability and trustworthiness.Because of the mine's harsh environment, installation and maintenance of the system are extremely difficult. Noisey coal mine operating circumstances may further impair the transmission of relevant messages to miners located at a significant distance from the system.

Yogendra S Dohare and Tanmoy Maity

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3.PROPOSED SYSTEM

Block Diagram Description:

This monitoring system is made up of small electrical components, including LCDs (liquid crystal displays), sensors, PIC boards, Xbee modules, and Zigbee USB interfacing boards. This chapter examines each component in detail and outlines its operation.

The suggested system for coal mine safety includes fixed components such as gas sensor modules, temperature sensors, relays, and water level sensors. Each sensor communicates with the controller. Before we can start, we need to create a ThingSpeak account.The system's important components are the monitoring and control systems. The monitoring system collects a large volume of sensor data.A gas sensor detects gases in a coal mine's environment. When the gas level surpasses the established threshold, a loud siren sounds to inform the miners. Sensor measurements are consistently transferred to the cloud, allowing for extra processing and analysis. Temperature and water level measurements are also relayed by Zigbee to the data control unit from within the coalmine. Figure shows the block diagram for the proposed system.

Control Unit:

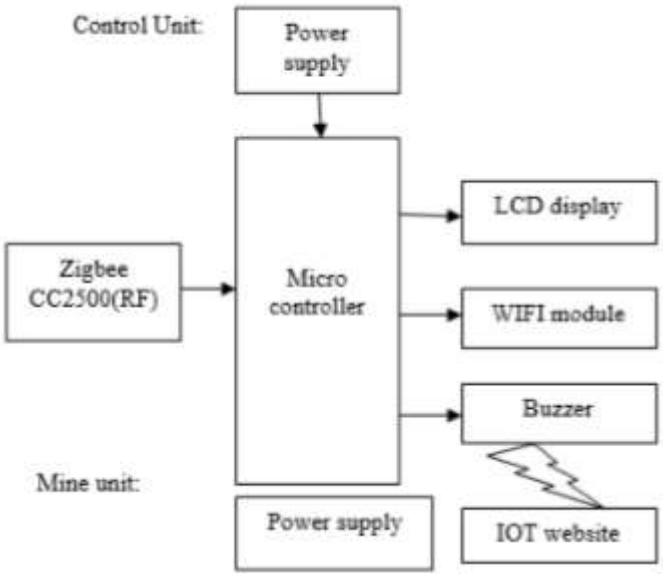

Fig.1.BlockDiagram of the System

This monitoring system is made up of small electrical components, including LCDs (liquid crystal displays), sensors, PIC boards, Xbee modules, and Zigbee USB interfacing boards.

1-PIC 18F4520

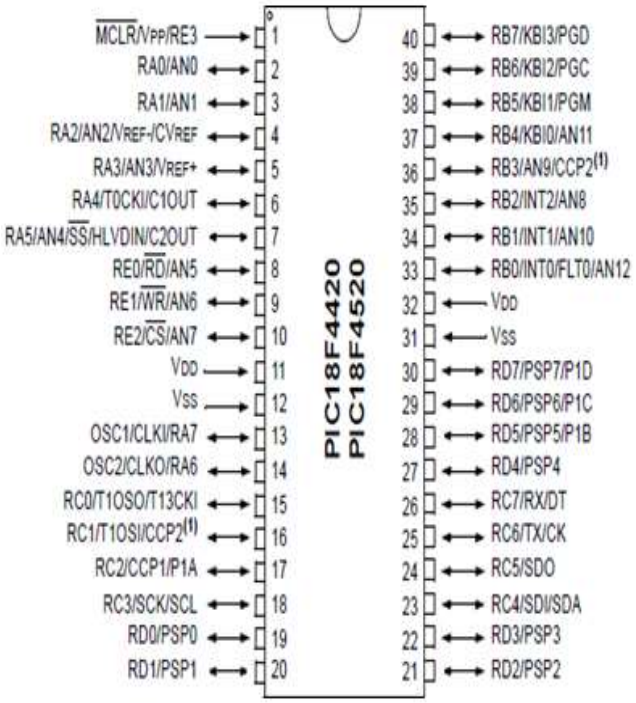

Fig.2.Pin Diagram of PIC18F4520 Operating frequency 20 MHz 40 pins

2-ZIGBEE

The CC2500 is a low-cost 2.4 GHz transceiver designed specifically for extremely low-power wireless applications. The circuit's intended application is within the SRD (Short Range Device) and ISM (Industrial, Scientific, and Medical) frequency bands, which range from 2400 to 2483.5 MHz. The RF transceiver comes with a baseband modem that is easily configurable. The modem supports different modulation methods and has a customizable data rate of 500 k Baud.

Fig-3 Zigbee

3-LM35TEMPERATURESENSOR

Ten millivolts per degree are generated, which can be programmed into a microcontroller or detected using a multimeter. When measured on a linear scale, 300 mV is generated at 30 degrees Celsius.

The LM35 series precision integrated-circuit temperature sensors produce an output voltage that is proportional to the temperature in Celsius. It has an advantage over linear temperature sensors calibrated in degrees Kelvin in that the user does not need to drain a large amount of constant voltage from the LM35 output to get the right 25 degrees Celsius scaling.

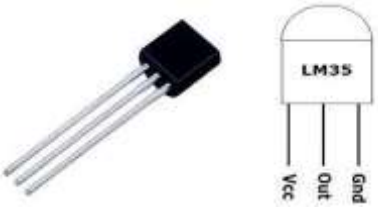

Fig.4-.LM35TemperatureSensor 4 -16*2 LCD DISPLAY

LCD displays are electrical display modules that are extremely versatile. A 16x2 LCD display is a core component found in a wide variety of devices and circuits. These modules perform better than other multi-segment LEDs, particularly those with seven segments. The causes are listed below. LCDs can display bespoke and unusual characters (unlike seven segments), are affordable and simple to program, and can show animations and other data. A 16x2LCD can display 16 characters per line since it consists of two lines, each 16 characters long. This LCD uses a 5x7 pixel matrix to represent each character. There are two registers in this LCD: command and data.

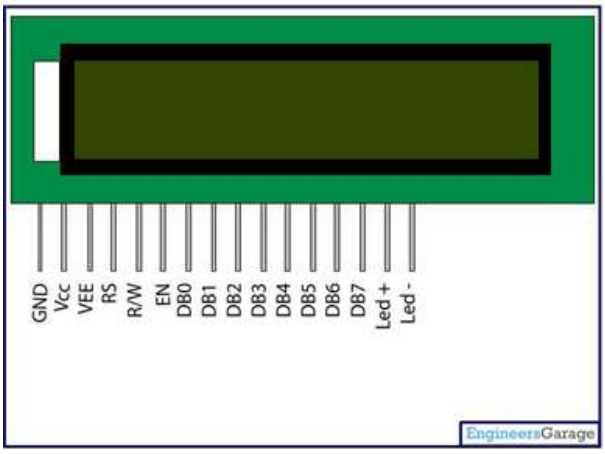

Fig.5-16*2LcdDisplay 5 -GSM MODULE

This GSM modem is easily compatible with a desktop computer, laptop, or microcontroller via the RS232 interface, USB to Serial adapter, or RS232 to TTL converter. Once the SIM800 28 modem has been attached to the USB to RS232 connector, use the USB to Serial Adapter's Device Manager to select the proper COM port. Connect to the COM port with Putty or similar terminal application, making sure the modem's default baud rate of 9600 is used.After establishing a serial connection, the computer or microcontroller can start transmitting AT commands. In response to AT instructions, such as "AT^r," the SIM800 modem should show "OK" or an other response, depending on the command transmitted.

6-PIEZOELECTRICBUZZER

Features

0 sealed: yes

0operatingpower:3-6VDC/ 25mA

0 extremely compact, ultrathin construction

0 no electrical noise

0low current consumption yet high sound pressure level

Fig.11Piezoelectric Buzzer

7 -MQ- GAS SENSOR

Using a MQ sensor to detect a gas is a simple process. This can be achieved using either the digital or analog ports. A mere 5V is sufficient to activate the module's power LED. In the absence of gas detection, the output LED will remain dormant, resulting in a digital output pin of zero voltage. It is crucial to note that these sensors require pre-heating before usage. Insert the sensor into the gas to be measured, and if the digital pin does not rise, raise the output with the potentiometer until it does. If the sensor is exposed to this gas at this concentration, the digital pin will go high (5V); otherwise, it will stay low (0V). The same result can be achieved by using the analog pin. A microcontroller should be used to read analog values (0-5V), which correspond precisely to the gas concentration reported by the sensor. By adjusting these values, one may see how the sensor reacts to different gas concentrations and then adapt the application.

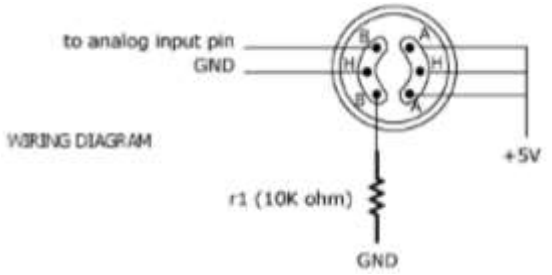

Fig.12DiagramOfGasSensor 8 - WATER LEVEL SENSOR

Fig.13-WaterLevel Sensor

A float switch is a liquid level detecting device that can activate a variety of devices, including an alarm, indicator, pump, or other apparatus. Float switches are used to monitor the amount of liquid in a vessel. The switch may operate another device, such as a pump, indicator, or alarm. Hydroponics, gardening, freshwater and saltwater tanks, power head control aquariums, filtration, heating, pumps, ponds, basement alarms, boats, air conditioning drain pans, pressure washers, carpet cleaning machines, reef aquariums, fluid control, ice makers, coffee makers, marine, automotive, and vehicle applications, evaporator coils, condensation lines, and relays are just a few of the uses for these. By modifying the float, it can be changed from frequently opened to

typically closed.

ADVANTAGES:

- Cost is less
- Provide wireless connection security
- Improved services in coal mine.

AP PLICATIONS

- For Underground Mine System

4.RESULT:

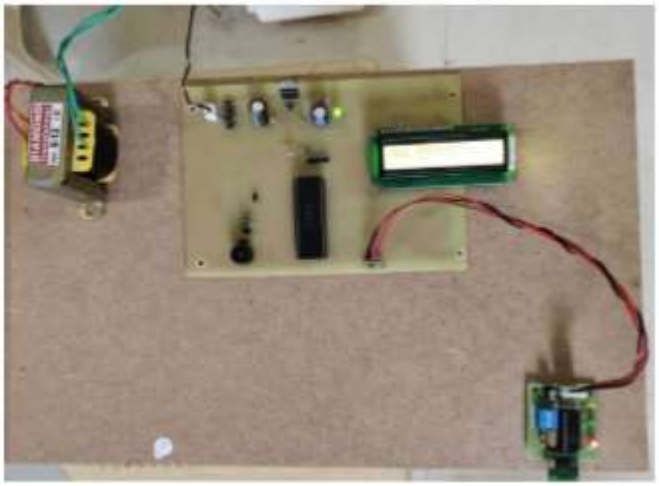

Fig.14Controlunit

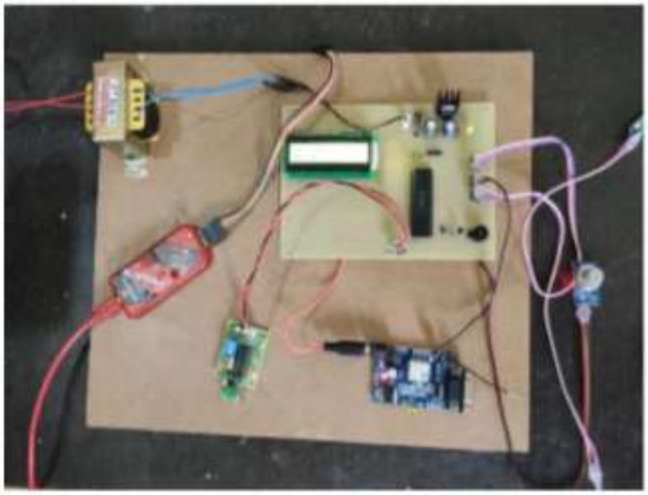

Fig.15Mineunit

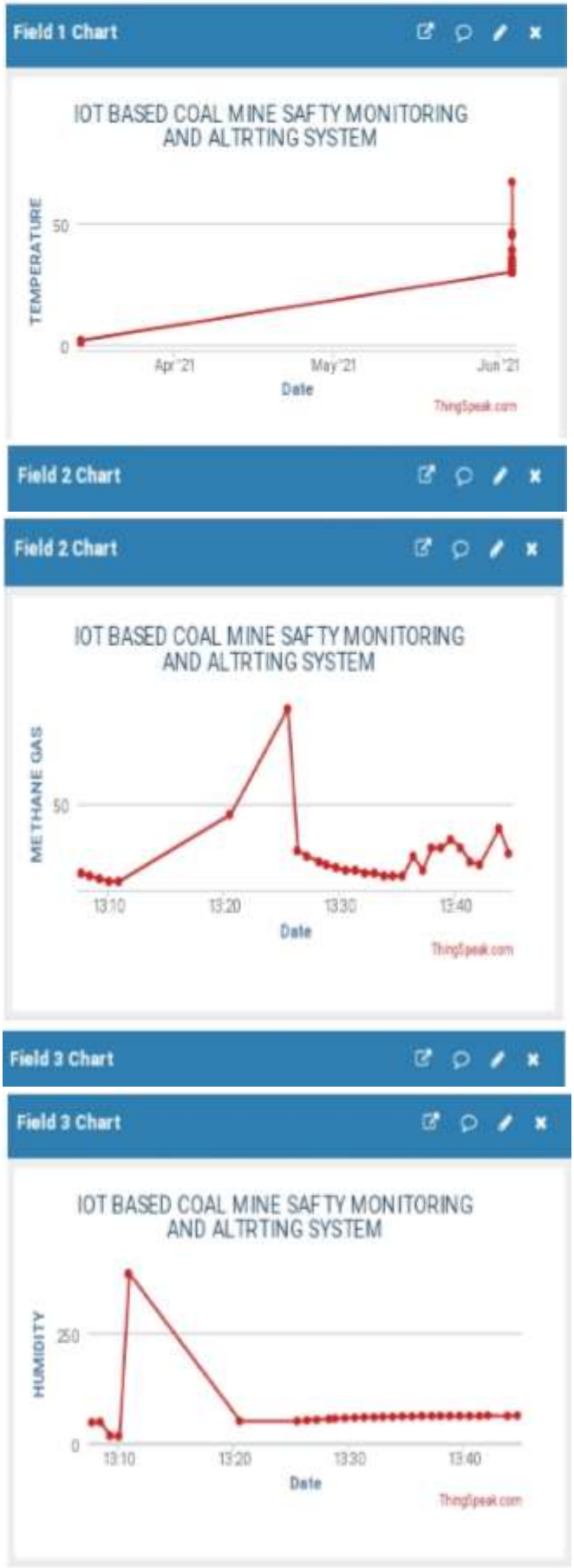

Fig.16Output on IOT website

The graph above demonstrates how the intended system responds to any parameter that exceeds the predetermined threshold. An warning message

will be shown on the LCD screen, and a buzzer will ring if the temperature increases above 500 degrees Celsius, the gas concentration exceeds 50, or the humidity exceeds 250 percent. Furthermore, the IOT website makes the information available to remote entities, assisting in the prevention of potential problems.

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