International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 9 Issue 5 ǁ 2021 ǁ PP. 10-15

Design and Development of an IoT based Early Warning System for Coalmine safety

[1]Shikha Singh, [2]ParthChaurasia, [3]Prashant Kushwaha, [4]Prashant Chaudhary, [5]Rishabh Sharma,

[1]*Assistant professor, Department of Electronics & Communication Engineering, Noida Institute of Engineering and Technology, Greater Noida, India*
[2]*Student,Department of Electronics & Communication Engineering ,Noida Institute of Engineering and Technology, Greater Noida,India*
[3]*Student,Department of Electronics & Communication Engineering ,Noida Institute of Engineering and Technology, Greater Noida,India*
[4]*Student,Department of Electronics & Communication Engineering ,Noida Institute of Engineering and Technology, Greater Noida,India*
[5]*Student,Department of Electronics & Communication Engineering, Noida Institute of Engineering and Technology, Greater Noida,India*

Abstract
Coal mining sites areamong some of the most unsafe and uncertain places to work with. One of the major cause of accidents resulting in workers losing their lives in mines is lack of communication and partialness description of the mine's environment.In this regard many researchers had suggested devices for early warning systems, but major drawback of these devices is that they are expensive and lack technological advancements. Here an attempt is made to develop an advance Coal Mine Safety System (CMSS) to overcome these drawbacks, providing better safety and monitoring system at low cost for mining industry. The developed CMSS works on IoT based communication, incorporates various sensors to detect temperature, fire alert, gas leakage, humidity and heart rate monitoring. As the CMSS is based on IoT and cloud server, it provides real-time monitoring with precision and data processing gives an early warning for safety.

Keywords: *CMSS, Cloud Server, Safety system, Sensors, Thingspeak, Node MCU.*

Date of Submission: 16-05-2021 Date of acceptance: 31-05-2021

I. Introduction

Industrialization resulted addiction of mankind on coal as fuel in almost every part of the world in spite of one of the most dangerous places to work on, the demand for coal is cumulative making coal mining a more unexpected and hazardous environment to work with. In our work, we have handled the issues by checking all of the data accumulated by the sensors which we have used and the noticing is done using the Thingspeak stage. Underground coal diggers are presented to a wide scope of perils including gas blasts, moving stone, falls, and hardware and versatile gear mishaps. Controlling is conceivable by both consequently and manually. The microcontroller here in the work we have used is NodeMCU. In this design, the detecting framework is acknowledged by different sensors acting like a network. These sensors are utilized to detect and gather subtleties of different boundaries of work space.

1.1.1. Literature Survey

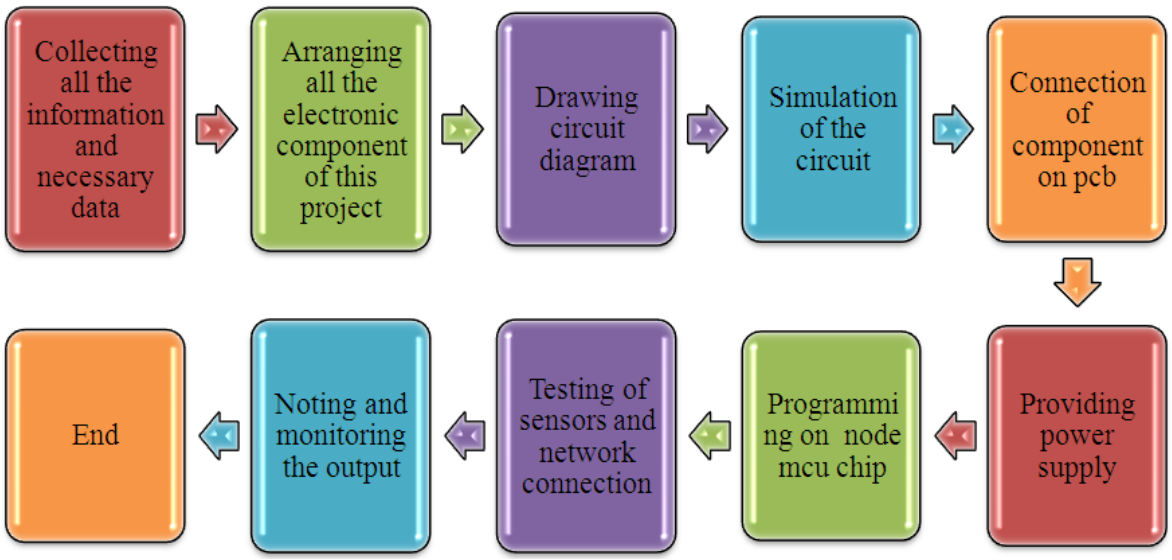
[1].The system is used to measure and monitor toxic gases, fire, temperature and humidity and track the safety of mining and update information to the Iot site.
[2].A better sensing system as well as localization in order to improve the safety of the mine personnel is developed. These can be realized by an appropriate communication scheme. radio frequency technology can be proposed to be a better communication scheme inside underground mines.
[3].The system mainly used to monitor the concentration of dangerous gases in the coal mine.
[4].The proposed design which is built on msp430,in the coal mine various parameters like temperature, humidity, gas, and smoke are monitored. zigbee transceiver is placed at the Centre location and by using the motor climate state is controlled.
[5].This systemcan detectconcentration of gas, temperature,humidity,wind speed, and trace the location of miners in underground mine tunnels.

[6].The paper design a monitoring system for coal mine safety based on zigbee wireless sensor network. The monitoring system collects temperature, humidity and methane values, underground of coal mine through zigbee sensor nodes around themine, and then transmits the data to information processing terminal based on ARM.
[7].Developed a system that monitor temperature ,humidity,methane values in the coal mine and all the values are sent to the ARM9 processor and a using a wi-fi module the values are continuously updated in the webpage.
[8].suggested a sytem that used to monitor the concentarion of dangerous gases in the coal mine.To provide safety the system give the alerts that will be helpful to the worker in the mine to save their lives.

1.1.2. Objectives

1. The proposed system can monitor the process of mining intelligently and warn miners and managers immediately when dangereous issues emerge ,such as gas leakage and water leakage.
2. Detection of different toxic gases within mining environment.
3. Fire detection in mining environment.
4. Moisture and temperature measurement in mining place.
5. Establishment of wireless sensor network .
6. Implementation of real time monitoring system.
7. Oxygen percentage and heart beat rate measurement.

II. Project execution plan



III. Hardware Components

3.1.1. Node MCU kit

The Node Micro Controller Unit (NodeMCU) is utilized as a passage. It has inbuilt Wi-Fi module which is utilized to send the sensor information to cloud for capacity and examination. The primary explanation for choosing NodeMCU is that the sensors utilized in our undertaking utilizes just computerized pins and one simple pins are required. Likewise, it devours less force (3.3v) and is of minimal expense when contrasted with other microcontrollers/processors like Arduino and Raspberry pi. Hub MCU is associated with ultrasonic sensors, gas sensor, temperature sensor, IR sensor. Every one of the qualities are associated and ship off Cloud worker.

3.1.2 Gas sensor

The sensor utilized for identification of unsafe gases is specifically mq2 sensor. It has a high affectability and a quick reaction rate. Gas sensor fundamentally contains four pins, where three pins are utilized A0, GND, VCC,A0 is a simple pin that is associated with the simple pin of Node MCU,GND is associated with GND, VCC supply is 3.3v. It successfully distinguishes gas spillage in ventures and recognize burnable smoke and gases.

3.1.3Fire sensor

Fire sensor is utilized to recognize the fire in the coal mineshafts. Fire sensor principally involves four pins, where three pins are utilized A0,GND, VCC,A0 is simple pin that is associated with simple pin of Node MCU, GND is associated with GND, VCC supply is 3.3v.

3.1.4. **LDR sensor**

A photoresistor is a uninvolved segment that diminishes opposition regarding getting iridescence on the part's touchy surface. The obstruction of a photoresistor diminishes with expansion in episode light power; as such, it displays photoconductivity. Sensor primarily comprises of four pins A0, GND, Digitalpin,The power supply for the sensor is 3.3v and the GND pin of a sensor is associated with GND pin of Node MCU, the advanced pin of LDR sensor to computerized pin of Node MCU.

3.1.5. DHT11

DHT11 Sensor is utilized to check the temperature and stickiness esteems inside the coalmines.DHT11 sensor comprises of three pins, power supply of dht11 is 3.3v,Gnd pin is associated with GND pin of NodeMCU, Digital pin of a dht11 sensor is associated with Digital pin of NodeMCU.

3.1.6. MAX30100 sensor

MAX30100 sensor is coordinated heartbeat oximetry and pulse screen module. It speaks with the I2C information line and gives the SpO2 and Pulse data to :the host microcontroller unit. It utilizes photodetectors, optical components where red, green IR LED tweaks the LED beats. The LED current is configurable from 0 to 50mA. The underneath picture is showing the MAX30100 sensor.

IV. Software Component

4.1.1.Thingspeak

It is an open source stage for IoT. It gives versatile cloud framework to interfacing things, devices. To utilize the thingspeak stage initially make a record in the thingspeak stage. In the support a dashboard, it will show the quantity of gadgets associated. It can interface up to 4 gadgets all at once in the stage. In Devices, you can oversee and get to the thingspeak shows the number of gadgets are associated in the venture. A dashboard is made utilizing a dashboard id ,Each dashboard can be associated with various sensors and actuators .Widgets is made in the dashboard for observing the qualities .In Data cans, here we can get to and deal with your pails.

V. Block diagram

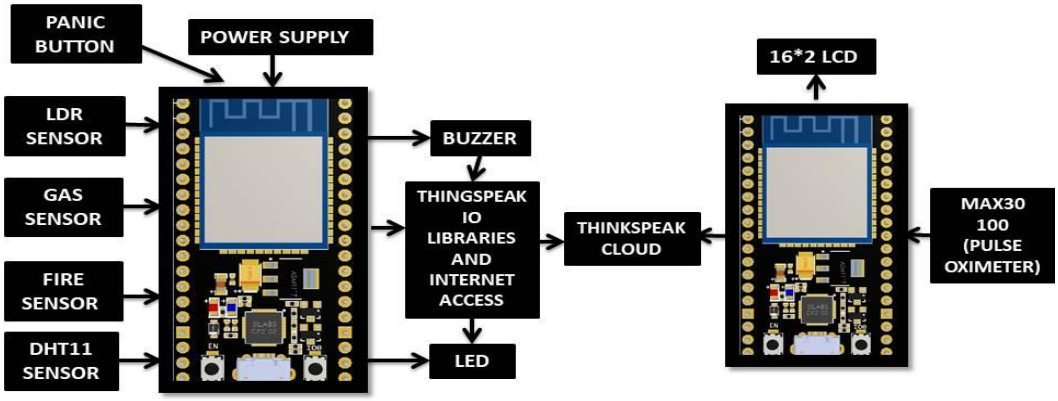


Fig1-block diagram

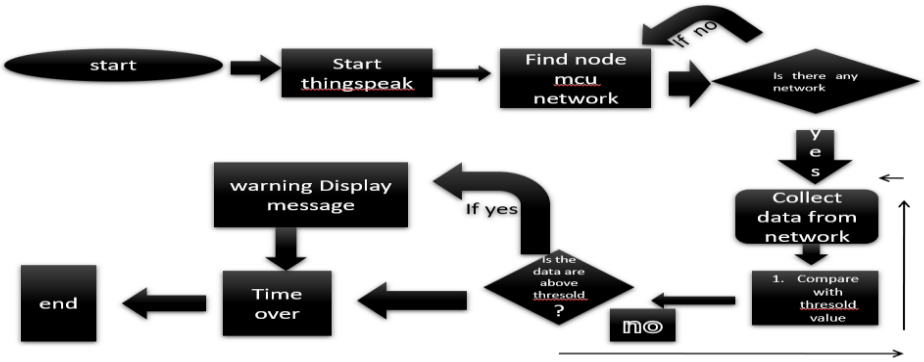
VI. Methodology

6.1.1.The Proposed framework

In our work, we have tackled the issues by checking every one of the information gathered by the sensors which we have utilized and the observing is finished utilizing the Thingspeak platform. Underground coal miners are

exposed to a wide range of hazards including gas explosions, shifting rock, falls, and machinery and mobile equipment accidents. Controlling is possible by both automatically and manually. The microcontroller here in the work we have utilized is NodeMCU. In this design, the sensing system is realized by various sensors acting like a network. These sensors are used to sense and collect details of various parameters of working environment.

VII. Flow chart



VIII. Implementation

For the software part we have to integrate our system with the thingspeak cloud server and the integrated device then transmit the date with the help of an inbuilt Wi-Fi module in the Node MCU. for implementation of hardware we had first fixed a node mcu on the board. After that all the sensors added around it with correct pin connection like gas sensor, fire sensor, LDR sensor,Max 30100 sensor.Also a 16*2 display ,buzzer and one panic button.After that we connected the board with a power supply of 5 volt .ThenWi-Fi connection is done with thingspeak cloud that we have already created

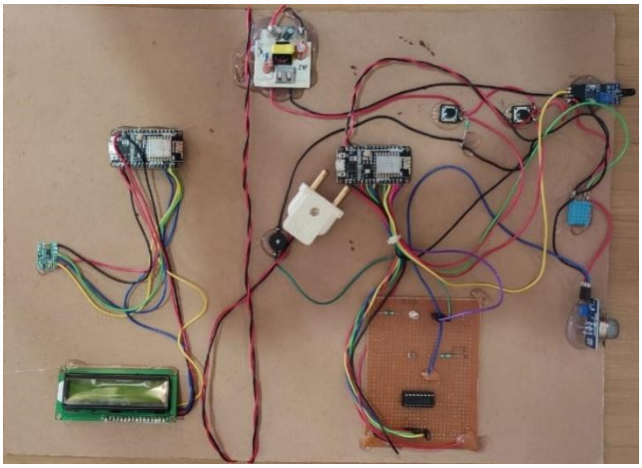


Fig2-working model

IX. Working

In this design, the sensing system is realized by various sensors acting as a network. These sensors are used to sense and collect details of various parameters of a working environment. the system then transmits all the gathered information to the cloud and their real-time monitor in a computer. For working ,first of all we have to give a power supply to the Board. Then we haveto on the node mcu so that it will connect with wireless network i.e. through Wi-Fi with thingspeakcloud. After that all the sensors will start to work and will send the data to cloud continuously so that the cloud will gate updated automatically. Whenever ,the any sensor will cross the threshold value that we have already programmed in node mcu, then warning message will send to the cloud or on the buzzer to alert us. so that we can save lives and equipment.

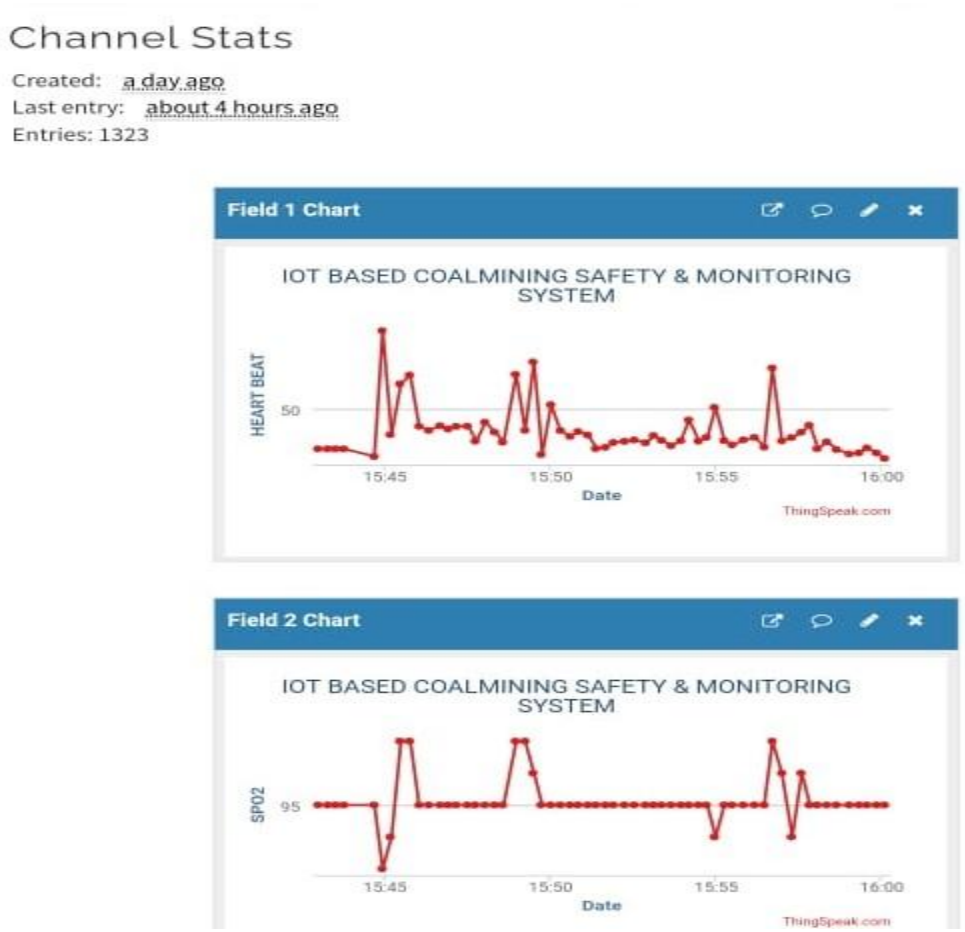


Fig3-output graph

X. Application

1. A mine prosperity head defender is proposed to shield the coal diggers from dangerous gases or hurtful gases.
2. Executive from the room can show the experts with the assistance of a chime if the level of toxic gases increases past a particular level.
3. Customer can perceive the heart setback from sensors and bewray the experts which help in decreasing the danger of lives of laborers.
4. Customers can have this device to save stacks of the stuff which are utilized in mining from a disaster like fire scenes since it has a segment of fireside recognizing.

XI. Conclusion:

This coal mine safety monitoring system based on wireless sensors networks.and hardware and software design of wireless sensor networkare described in detail.wireless sensors networks applied in monitoring coal mine security breaks through the traditional methods and ideas,which improves the practical ability and flexibility of monitoring system.Implementation of coal mine safety system is implemented using fire sensor,gas sensor,humidity and temperature sensor,heart bit rate and oxygen percentage sensor and buzzer also to increase the safety of the workers in the coal mine and to prevent them from danger,by using this system constant checking of coalmine and alerting the worker is done.This system is made in very low cost so it is cost effective also.

Acknowledgement

I Would wish to convey my exceptional thanks of appreciation to the assets of the Noida Institute of Engineering and Technology for permitting me this chance to find and work on this front line development. We are thankful to all or any the those that offer their important direction, heading, and time to us. Without your assistance, it'd not are plausible to organize this endeavor. I might want to loosen up my sincere appreciation to Mrs. Shikha Singh for such uncommon help and bearing. it's our honor to figure on such making development

and glad to have support from our guides. The assistance and responsibility of all people during this endeavor are also perceived.

REFERENCES:

[1]. D.prabhu,"IOT based coal mining saflety for workers using Arduino", *International journal of engineering science and computing(IJESE),2019.*

[2]. C.Shobana Nageswari,"IoT based Smart Mine Monitoring System", *International Journal of Electronics, Electrical and Computational System* ,IJEECS ISSN 2348-117X Volume 7, Issue 4 April 2018.

[3]. S.R. Deokar, "coal mine safety monitoring and alerting system", *International Research Journal of Engineering and Technology(IRJET),*VOLUME:04 ISSUE:03,MARCH 2017.

[4]. Kumarsagar, "Design of Monitoring system for Coal mine safety based on MSP430", *International Journal of Engineering Science Invention(IJESI)* Volume2,Issue 7, July 2013.

[5]. Rajkumar boddu,"zigbee based mine safety monitoring system with GSM",*International journal of computer & communication technology ISSN(PRINT):0975-7449,*volume-3,2012.

[6]. Luihui,"Design of monitoring system based on wireless network",*international conference on mechatronics and embedeed system 2008.*

[7]. Aarthi, "coalmine safety monitoring using wireless sensor network",*International Journal of Scientific Engineering and Technology(IJSET*) volume 2,issue 10,october2013.

[8]. Wakodeetal, "coal mine safety monitoring and alerting system", *International reseach journal on engineering and technology (IRJET) volume 4,*isssue 3,march 2017