IoT Based Coal Mine Safety Monitoring and Alerting System

Rajnish Kumar
DEECE
Galgotias University
Greater Noida, India
rajnishkr033@gmail.com

Pratyush Kumar
DEECE
Galgotias University
Greater Noida, India
Pratyushpk1@gmail.com

Dr. D. Gnana Jeba Das
Professor
DEECE
Galgotias University
Greater Noida, India
Jeba.das@galgotiasuniversity.edu.in

Abstract: Coal mine accidents are becoming more common. Many skilled workers and labourers have died. There is no early warning system in place to detect the alarming cause of coal mine accidents and issue an alert. In the mining industry, workplace injuries and illnesses are common. Firedamp and residue blasts, landslips, mine flames, and transport and motorization related specialized disappointments are the most well-known reasons for mishaps in coal mining. As per an investigation of word related mishaps with regards to social and financial variables uncovers the genuine reasons for these mishaps, which are said to happen unavoidably because of specialized blemishes or disappointments. To save and shield the specialists from the risks, a robotized disturbing coal mineshaft mishap discovery framework is utilized. This framework utilizes the consolidated activity of a temperature, tension, and gas sensor, as well as an IOT module, to identify the temperature, strain, and climate in the coal mineshaft, as well as to log all information to the cloud utilizing information logging. Then, at that point, through information obtaining, these information are acknowledged by an administrator controlled server page. The information is handled on a server page, and an alarm is shipped off the gadget, which will streak the alert, as well with respect to the concerned authorities and salvage stations, who will go to safeguard lengths.

Keywords: Arduino, LDR, Gas Sensor, Temperature Sensor, Humidity Sensor, Node MCU.

I. Introduction

The most common way of separating coal starting from the earliest stage known as coal mining. Coal mines have extremely complicated natural conditions, and mining conditions are extremely unpredictable. A coal mine's construction is complicated; branch tunnel space is restricted, and branch tunnel routes are not fixed. Wired transmission frameworks are habitually introduced exclusively in the fundamental passage, restricting organization development altogether. Since no wired organization can be laid out progressively as underground mining advances, observing these risky regions continuously is inconceivable. Moreover, no security observing frameworks are introduced in deserted underground passages because of cost and support limitations, representing a critical danger. Numerous fiascos can happen in mines, expanding the gamble of coal mining and making significant mishaps more probable, making it very challenging to lay out wellbeing. Therefore, there are as yet many blemishes in wired observing and control that should be tended to for coal mineshaft security checking and control. Many coal mineshaft areas, for example, deserted passages and mining segments, make it challenging to introduce wired coal mineshaft wellbeing checking and control frameworks. Our project is an IoT-based coal mine monitoring and alert system. In the coal mine, it can detect all hazardous gases using gas sensors, dust sensors, temperature and humidity sensors. After the gas reaches its threshold value, the buzzer will glow. Hence, this project will be used to provide a rescue system and safety precautions for coal mine workers.

II. Project Idea

People who work in coal mining are exposed to a variety of environmental factors during their work. Methane, carbon monoxide, and temperature all pose a

threat to them. As a result, we must ensure that those who work in coal mining are adequately protected. The goal of this project is to develop a wireless communication and safety monitoring solution for mining. When working in the coal mine, the person must wear a helmet.
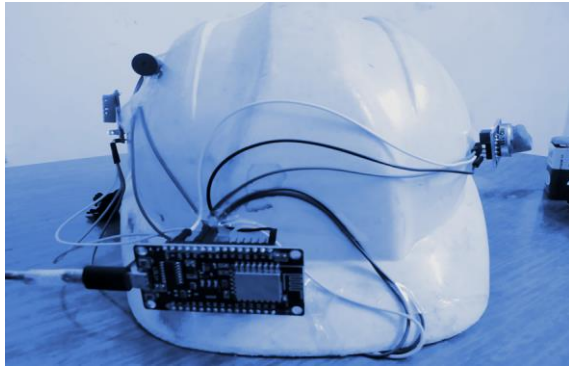
III. Block Diagram
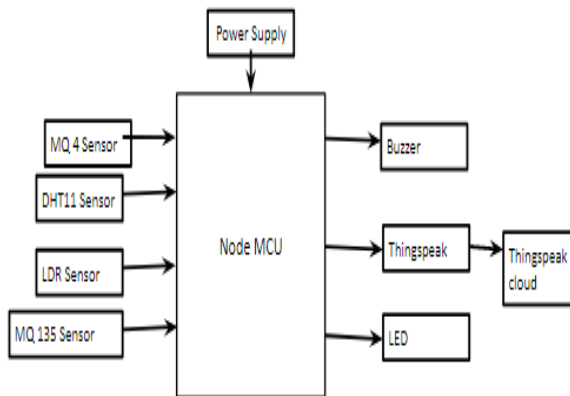
IV. Block Diagram Discriptions

Node MCU: NodeMCU is an open source stage in light of the ESP8266 that permits objects to interface and information to be moved through the Wi-Fi convention. Moreover, it can address a significant number of the undertaking's necessities all alone by giving the absolute most significant highlights of microcontrollers, like GPIO, PWM, ADC, etc.

LDR Sensor: These devices are light-dependent; the resistance reduces when light falls on the LDR, while in dark, it increases. When an LDR is kept in the dark, it has a high resistance, and when it is kept in the light, it has a lower resistance.

DHT-11 Sensor: The DHT11 is an essential advanced Temperature and Humidity sensor with a low sticker price. It estimates the encompassing air with a capacitive humidity sensor and a thermistor and results signal on data pin.

MQ-4 Sensor: Detects the concentration of methane gas within air & its reading is output as an analogue voltage. Leak detection is possible with a concentration sensing range of 300ppm to 10,000ppm. The sensor works in temperatures ranging from -10°C to 50°C and draws less than 150mA at 5V.

MQ-135 Sensor: MQ-135 Gas Sensor can detect harmful gases and smoke such as Ammonia (NH3), Sulphur (S), Benzene (C6H6), CO2, and others.

V. Results

Node MCU collects the sensor values and sends them to ThinkSpeak. The Arduino UNO is connected to a buzzer and a fire sensor, and when the fire sensor senses heat or a high temperature, the buzzer emits an alarm. The gas concentration, temperature, and humidity are all displayed on the monitor.

This will be used to determine temperature in the mining operation. As the temperature rises, the graph's performance will fluctuate.
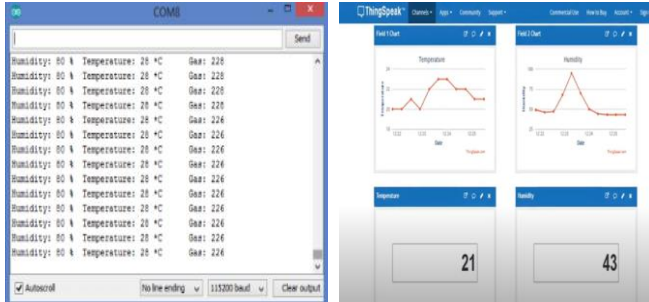
VI. Conclusion

This project can be easily implemented because the system requirements and required components are readily available. It will provide coal miners with safety and change the way they work, as well as a system to monitor and control various environmental changes in mines. It is a trustworthy system that responds quickly and is simple to set up. It is possible to expand the system easily. In the future, it will improve system stability and increase the accuracy of underground miners' positions. The Arduino-based Smart Helmet has been designed to be light in weight and portable. All of the sensors can work in a variety of different environments.

References:

[1] "The study on coal mine monitoring using the Bluetooth wireless transmission system," 2014 IEEE Workshop on Electronics, Computer and Applications, pp. 1016-1018. Yongping Wu and Guo Feng, "The study on coal mine monitoring using the Bluetooth wireless transmission system," 2014 IEEE Workshop on Electronics, Computer and Applications, pp. 1016-1018.

[2] "Wireless Mobile Monitoring System for Tram Rail Transport in Underground Coal Mine Based on WMN," cason, pp.452-455, 2010 International Conference on Computational Aspects of Social Networks, 2010. Xiaolong Feng, Jiansheng Qian, Zhenzhen Sun, Xing Wang, "Wireless Mobile Monitoring System for Tram Rail Transport in Underground Coal Mine Based on WMN," cason, pp.452-455, 2010 International Conference.

[3] "Surveillance and safety system for underground coal mines based on Low Power WSN," Yogendra S Dohare and Tanmoy Maity, IEEE, pp.116-119, 2014.

[4] "Implementation of a safety helmet for coal mine workers," 1st IEEE International Conference on Power Electronics Intelligent Control and Energy Systems, pp. 1-3, 2016. Pranjal Hazarika, "Implementation of a safety helmet for coal mine workers," 1st IEEE International Conference on Power Electronics Intelligent Control and Energy Systems, pp. 1-3, 2016.

[5] " Mine safety system employing wireless sensor network," by Valdo Henriques and Reza Malekian, IEEE, pp. 1-12, 2016.