



Coal Mine Safety Monitoring and Warning Device

A.Srinivas, Meghana.K, Sri Vivek.G, Bhanu Prakash.A, Alekhya.T

Department of Computer Science and Engineering - Artificial Intelligence, Chalapathi Institute of Technology, Guntur, India.

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ABSTRACT

Ensuring safety in coal mines requires continuous monitoring of environmental conditions, including temperature, humidity, and gas levels. This project introduces an "IoT-based Coal Mine Safety Monitoring System" that utilizes the DHT11 temperature and humidity sensor, a gas sensor, a buzzer, and ThingSpeak for data visualization. The system aims to provide real-time data on environmental parameters and gas concentrations within the coal mine. In case of unsafe conditions, the buzzer alerts miners, and the data is sent to ThingSpeak for remote monitoring and analysis. This integration of IoT technologies enhances safety measures, contributes to accident prevention, and ensures a secure working environment in coal mines.

Keywords:DHT11 Temperature and Humidity Sensor,Gas sensor,Buzzer,Real-Time data transmission to ThingSpeak,Alert System

1. INTRODUCTION

In recent years, the integration of Internet of Things (IoT) technology has revolutionized various industries, and the mining sector is no exception. The coal mining industry, known for its inherent risks, has embraced IoT to enhance safety measures through real-time monitoring and warning systems. This article explores the significance of IoT-based coal mine safety solutions, their components, and the potential impact on minimizing risks and ensuring the well-being of miners.

2. LITERATURE REVIEW

This system uses a low energy consumption, cost-efficient controller, Arduino UNO R3 board, a Temperature and Humidity sensor DHT11, IR sensors, Harmful gas sensor, an LDR sensor for noticing the

changes in mine climate, and Wi-Fi for remote logging of data. A temperature sensor, a methane and carbon dioxide sensor, and a microcontroller that gathers temperature, humidity, and methane values.

3.COMPONENTS

Functioning of the System:

The sensor nodes are deployed in various locations in the mines and connected to the gateway node through wireless communication.

The gateway node collects the data from all the sensors and sends it to the cloud, where it is analysed.

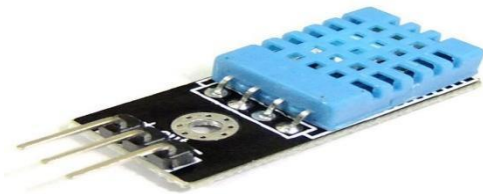
If the data exceeds the safe limit, the cloud sends an alert to the miner through the mobile application.

The miner can take necessary precautions based on the alert.

Gas sensor: It help us understand the amount of gas in the environment and the natural state of its movement



Temperature Sensor: It a device that detects and measures hotness and coolness and converts it into an electrical signal.



Fault Sensor: t a malfunction or deviation of a sensor from its normal operation, resulting in inaccurate or unreliable measurements of the physical variables of a system.

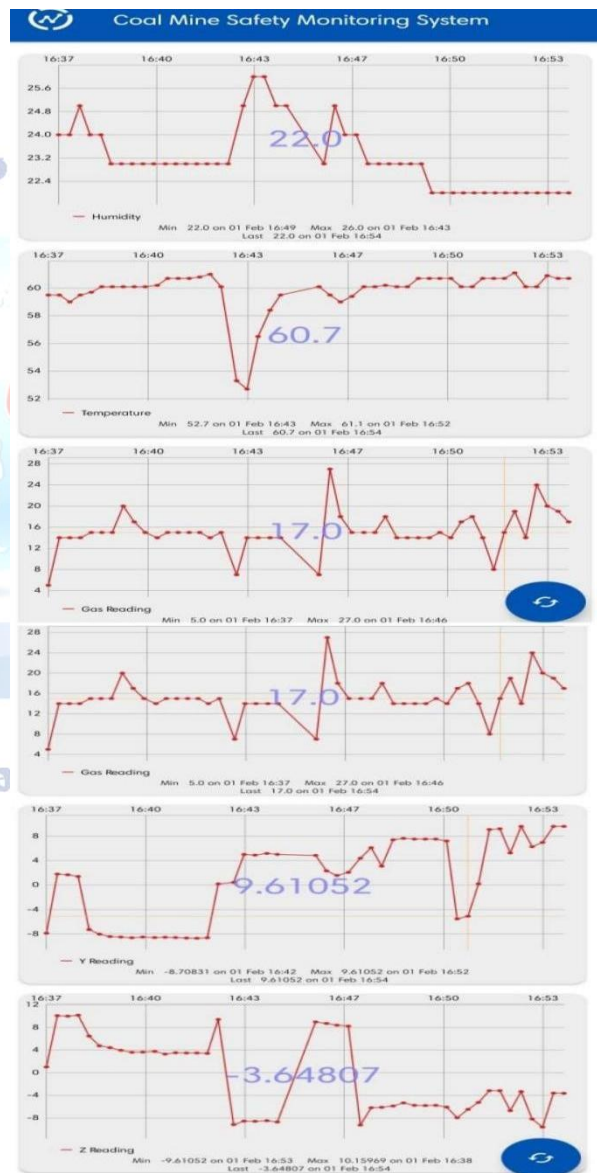


Buzzer: It is an audible alerting mechanism that operates through mechanical, electromechanical.



Node of MCU: It is an extensively employed development board in IoT applications, providing a versatile and cost effective approach to connect devices to the internet. It features Wi-Fi and programming capabilities, facilitating speedy prototyping and deployment of IoT solutions.

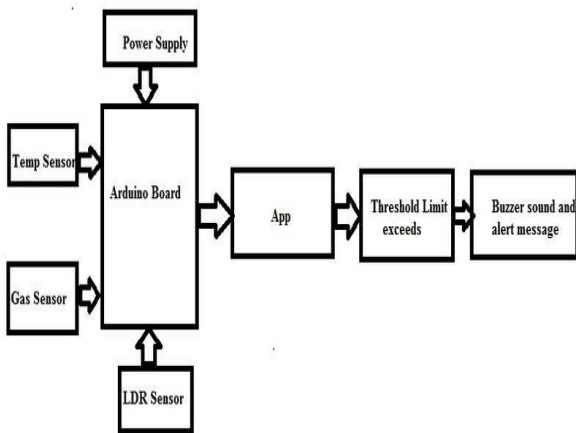
Thingspeak Integration: ThingSpeak is an open-source software written in Ruby which allows users to communicate with internet enabled devices.



4. TESTING & RESULTS

The Arduino microcontroller is used to detect and monitor variables in a coal mine. Live readings are provided by the temperature sensor, humidity sensor, IR

flame sensor, and gas sensor. A microcontroller and a transceiver are connected to all of these sensors. The data is sent to the microcontroller, and communication between the gateway and the specific node is done



A smart helmet is also computed with a microcontroller which simply has a push button connected to it. The microcontroller is also comprised of a ZigBee transceiver. This measure has been taken to maximize the safety of workers in coalfield. Whenever a worker needs medical attention or has any discomfort, a panic button can be used, which transmits a message in the control room about an emergency so that medical attention can be given to that worker.



Arduino Uno is the central component, and it sends the information on the internet via the Zigbee module. DC power supply is used for supplying voltage to the circuit. This is the circuit diagram for the smart helmet's monitoring and alerting system. This system will be built using Arduino, ZigBee modules, and sensors such as the DTH11 humidity sensor and the IR flame sensor, among others. The sensors we'll use will detect changes in the coal miner's environment, and variables like temperature, gas concentration, and fire detection will be continuously monitored. It will also have an extension that will connect to an LCD display, which will be placed at the entrance to the coal minefield. Also, the data which will be recorded by sensors will be transmitted via the Zigbee module to

the control room so that proper actions can be taken effectively in minimum time.

Conclusion:

This paper presents a Zigbee-based coal mine monitoring system. The proposed system is used to monitor the subsurface characteristics of a coal mine and will aid in the prevention of mine disasters. Additionally, the proposed system addresses all of the problems associated with wired connections. As a result, this is an advancement above the traditional coal mine safety system. Furthermore, a distress signal from the smart helmet is useful in abnormal environmental conditions or when a person needs medical attention. This system has applications in securities of industries as well. It is easy to upgrade and modify further as innovations arise.

5. CONCLUSION

The literature review highlights the importance of coal mine safety monitoring and warning devices in ensuring the well-being of workers in the mining industry. The review discusses the components of coal mine safety monitoring systems, the integration of IoT technology, and the development of proximity detection and collision warning systems. Ongoing research efforts aim to enhance the performance and efficiency of these devices for improved mining safety. Overall, Coal Mine Safety Monitoring and Warning Devices play a vital role in protecting the lives of miners and improving the safety of coal mining operations. As technology continues to advance, these devices will become even more sophisticated and effective, further reducing risks and ensuring the well-being of miners.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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