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# IOT-Based Underground Workers Safety System

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**ABSTRACT:** The mining industry faces numerous challenges, such as hazardous conditions and remote locations. To prioritize the safety of miners, a Wireless Sensor Network (WSN)-based safety system has been proposed. This system deploys interconnected sensors throughout the mine to monitor environmental parameters like temperature, gas levels, and seismic activity. Miners are provided with wearable devices that collect data on vital signs, body temperature, and location. The collected data is sent to a central control unit in real-time. Advanced data processing and machine learning algorithms analyze the data for anomalies or hazardous conditions. If any such conditions are detected, alarms and alerts are triggered for both the affected worker and the central command center.

**KEYWORDS**: Workers safaty, wireless sensors network (WSN), Health And safety, IOT (Internet of Things).

## I. INTRODUCTION

Ensuring the safety of miners and precious assets is crucial in today's industrial environment.The mining industry, in particular, presents unique challenges and hazards that demand innovative solutions for risk mitigation. This project, an iotbased miner safety monitoring and alerting system, represents a concerted effort to address these challenges head-on. By leveraging advanced sensor technologies and wireless communication, this system aims to revolutionize safety protocols within coal mines, offering real-time monitoring and timely alerts to safeguard the lives of miners. This preface introduces the critical importance of such a system and sets the stage for the comprehensive exploration of its design, implementation, and potential impact on mining safety.

## II. LITERATURE SURVEY

A review of the literature is crucial for identifying the unique approach. Comprehending the analysis conducted by multiple writers on the suggested subject and outlining the approach, along with its advantages and disadvantages, is beneficial.

| Ref. | Key findings |
|---|---|
| 1. | Presents a wireless safety system that employs WSN to monitor vital signs and detect hazards for coal miners. Evaluates the system's performance in real-world conditions |

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| | |
|---|---|
| **2.** | Provides an extensive overview of monitoring systems, including WSN, for worker safety in underground mines. Highlights the importance of early hazard detection |
| **3.** | Describes the design and implementation of a WSN-based safety system for mine workers. Discusses the system's performance and scalability. |
| **4.** | Investigates real-time safety monitoring of mine workers using WSN. Emphasizes the role of WSN in accident prevention and emergency response. |

## III.BLOCK DIAGRAM

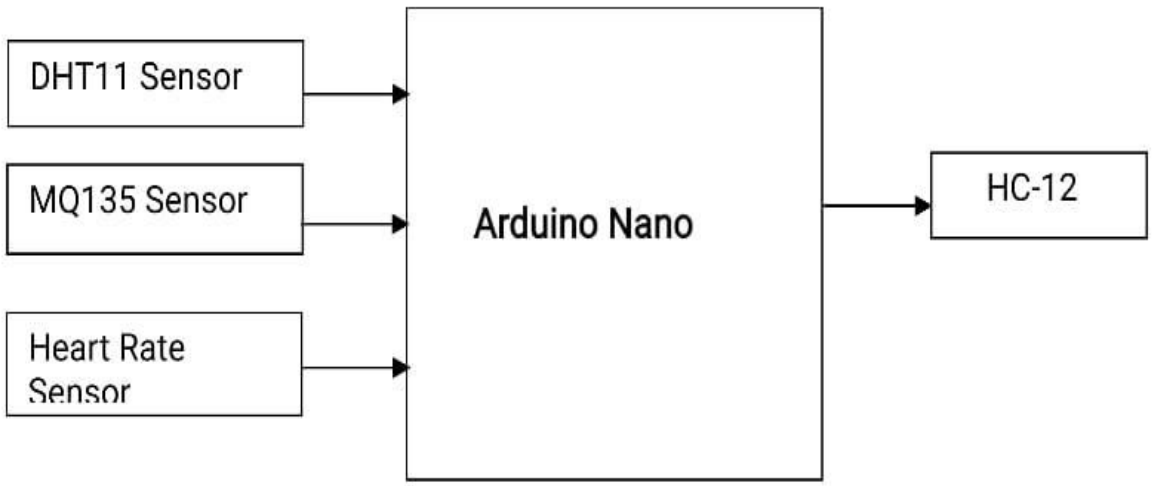


**Fig 1 : shows the block diagram of implemented system Arduino Nano Transmitter side.**

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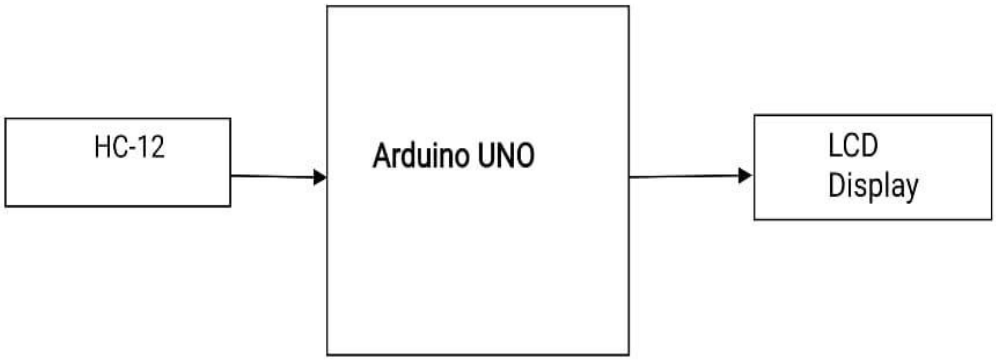


**Fig 2 : shows the block diagram of Arduino UNO Receiver side.**

## IV.CIRCUIT DIAGRAM

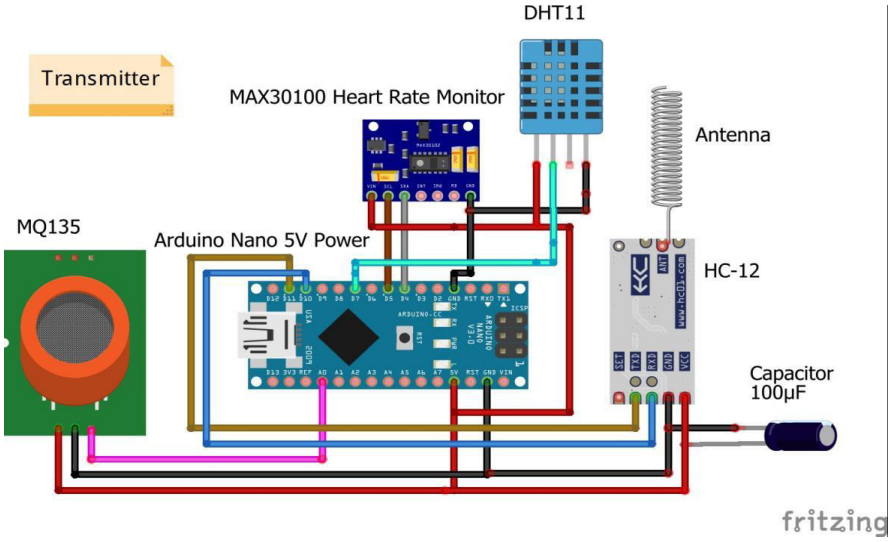


**Fig 3 : Circuit Diagram of Arduino Nano Transmitter side.**

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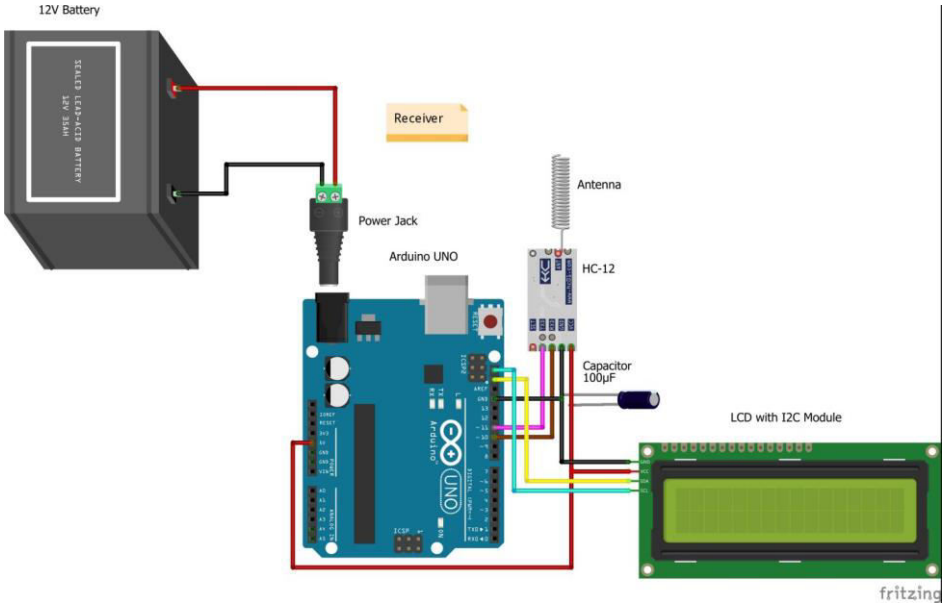


**Fig 4 : Circuit Diagram of Arduino UNO Receiver side**

**The Datails About the Hardware Used for the Implementation Are Provided in the Following Section :**

In this project I have used some of the components like Arduino Nano, Arduino UNO, LCD Display, DHT11 Temperature and Humidity sensor , MQ135 air quality sensor, Max 30100 Heart rate sensor, HC12 Transmitter and Receiver.

**MQ135 air quality sensor:** This component is chosen for its capability to detect a range of gases commonly found in mining environments, aiding in the early detection of potential hazards such as LPG leakages.

**DHT11 Sensor:** Selected for its precise measurement of temperature and humidity, the DHT11 provides vital environmental data necessary for assessing overall safety conditions within the mine.

**Max 30100 Heart rate sensor:** Employing photoplethysmography, this sensor monitors miners' physiological well-being by detecting variations in blood volume in peripheral circulation, aiding in early detection of stress or distress.

**HC12 Transmitter:** Facilitates wireless communication by transmitting sensor data to the receiver module located outside the hazardous area, ensuring seamless data transmission between modules.

**HC12 Receiver:** Receives transmitted data from the transmitter, enabling real-time monitoring of environmental conditions and vital signs within the mine.

**LCD Display:** Connected to the receiver module, the LCD serves as the primary interface for visualizing real-time data, providing immediate insights into environmental conditions and miners' well-being.

**Arduino Nano (Transmitter side ):** Connect sensors to Arduino Nano. Write code to read data and transmit wirelessly.

**Arduino UNO (Receiver side):** Connect HC12 receiver and LCD to Arduino Uno. Write code to receive data and display on LCD.

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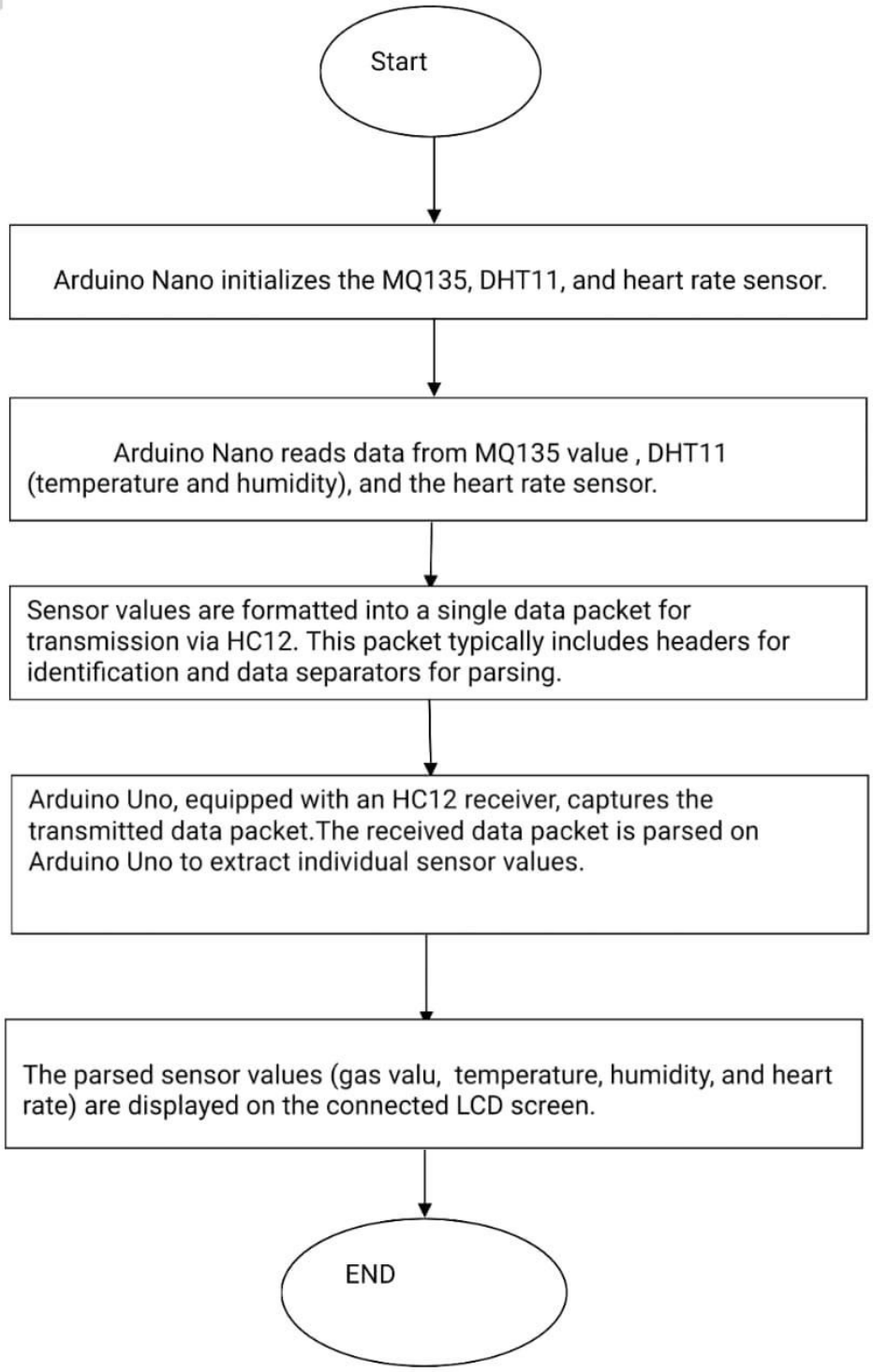
## V. FLOW CHART




## VI. RESULT

The implementation of the miner underground safety monitoring system utilizing the MQ135 gas sensor, DHT11 sensor, heart rate sensor, HC12 transmitter, HC12 receiver, and LCD display has proven to be highly effective in enhancing safety measures within mining environments.

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**Fig 5 : safety monitoring system**

Through continuous monitoring of gas concentrations, temperature, humidity, and miners' vital signs, the system provides real-time insights into environmental conditions and potential hazards. The MQ135 gas sensor enables early detection of gas leakages, while the DHT11 sensor ensures accurate measurement of temperature and humidity levels, essential for maintaining optimal working conditions.

The heart rate sensor plays a critical role in monitoring miners' physiological well-being, allowing for prompt intervention in case of health emergencies or distress. The HC12 transmitter and receiver facilitate seamless wireless communication, enabling data transmission over long distances within the mine.

## VII. CONCLUSION

The IoT-based underground miners safety monitoring and alerting system presented here offers a comprehensive solution for enhancing safety and security in mining operations. By integrating advanced sensor technologies, wireless communication, and user-friendly interfaces, the system enables real-time monitoring of environmental conditions and miners' vital signs. Despite some limitations such as range constraints and power consumption considerations, the system's advantages in terms of enhanced safety, real-time monitoring, and cost-effectiveness make it a valuable tool for ensuring the well-being of miners and improving overall safety protocols in coal mines. With further refinement and deployment, this system holds the potential to significantly mitigate risks and prevent accidents in mining environments.

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