

Presented by: Grp-10

SUBHANKAR KOLAY - 11500321010

SOUMYAJIT DEY - 11500321057

SANTANU BANIK - 11500321041

SOUMYADIP KHATUA - 11500321013

SMART MINER HELMET

SMART MINER HELMET
SMART MINER HELMET



EC-881

Session: 2024-25

Contents:

1. Objectives
2. Key Features
3. Key Components
4. Alert Mechanism
5. Circuit
6. Workflow
7. Working
8. Applications
9. Future Trends
10. Conclusion





Objectives:

- To develop a smart helmet for miners using ESP32 for real-time safety monitoring.
- To enhance miner safety through early detection, alerting, and live situational awareness.
- To detect harmful gases using MQ2, MQ9, and MQ135 sensors.
- To monitor temperature and humidity using a DHT11 sensor.
- To log sensor readings with date and time on an SD card for future analysis.
- To trigger buzzers and LEDs in case of hazardous conditions for immediate alerts.
- To transmit live sensor data to a web page using Wi-Fi (ESP32) for remote monitoring.
- To enable real-time video surveillance using an ESP32-CAM module.



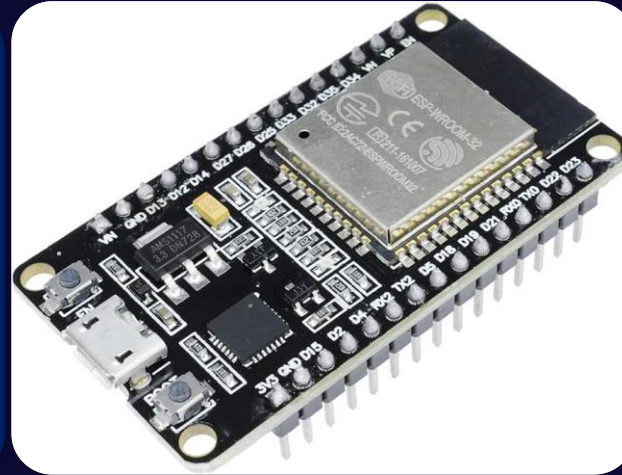
Key Features:

- 1 Multiple Gas Detection System
- 2 Recording Temperature and Humidity
- 3 Audio, Visual & Web based alerts
- 4 Automatic Logging of real time data
- 5 Web Based surveillance system

Key Components:

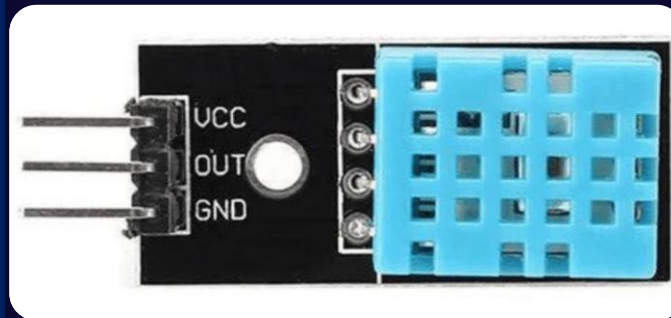
1. ESP-32:

ESP32 is a low-cost, low-power microcontroller with integrated Wi-Fi and Bluetooth capabilities, developed by Espressif Systems.



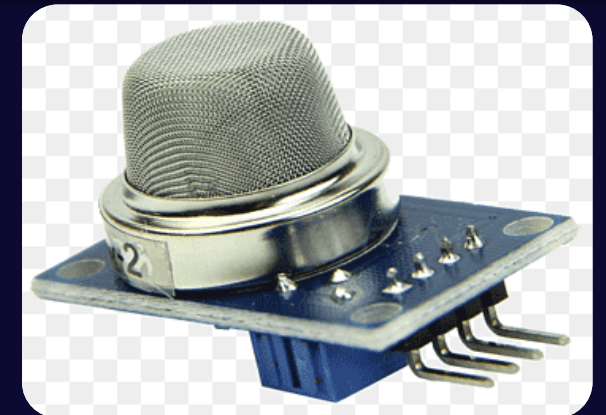
2. DHT11:

DHT11 Sensor is a versatile and affordable device that accurately measures both humidity and temperature. It provides reliable data for improved automation and environmental control.



3. Gas Sensors:

A gas sensor is a system that senses the presence or concentration of gases in the atmosphere. Used gas sensors are – MQ-2, MQ-9 and MQ-135, which together can sense upto 9 different gases, found in mines.





1. ESP32 Cam:

The ESP32-CAM is a compact, low-cost development board that combines the capabilities of the ESP32 microcontroller with an onboard camera module. It is used for real time surveillance in a wireless mode.

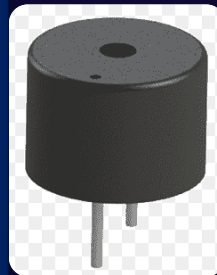
1. OLED:

The OLED Display displays the required sensed parameters.



1. Buzzers & LEDs:

Used to display the alert mechanism in an audio as well as visual way .



1. SD Card Module:

An SD card module is a hardware component that allows a microcontroller or embedded system to read and write data to an SD card. It essentially acts as an interface between the system and the SD card, providing a way to connect the SD card to the system's logic and power.

Alert Mechanisms:



Audio Alarm

A loud siren provides a traditional and effective way to alert occupants of a potential fire.



Visual Alarm

Red LED lights can be used to alert individuals who may be hard of hearing or unable to hear the audio alarm.

Web Based Alerts

The system can send alert notifications in the hosted web platforms, in which the device is connected.

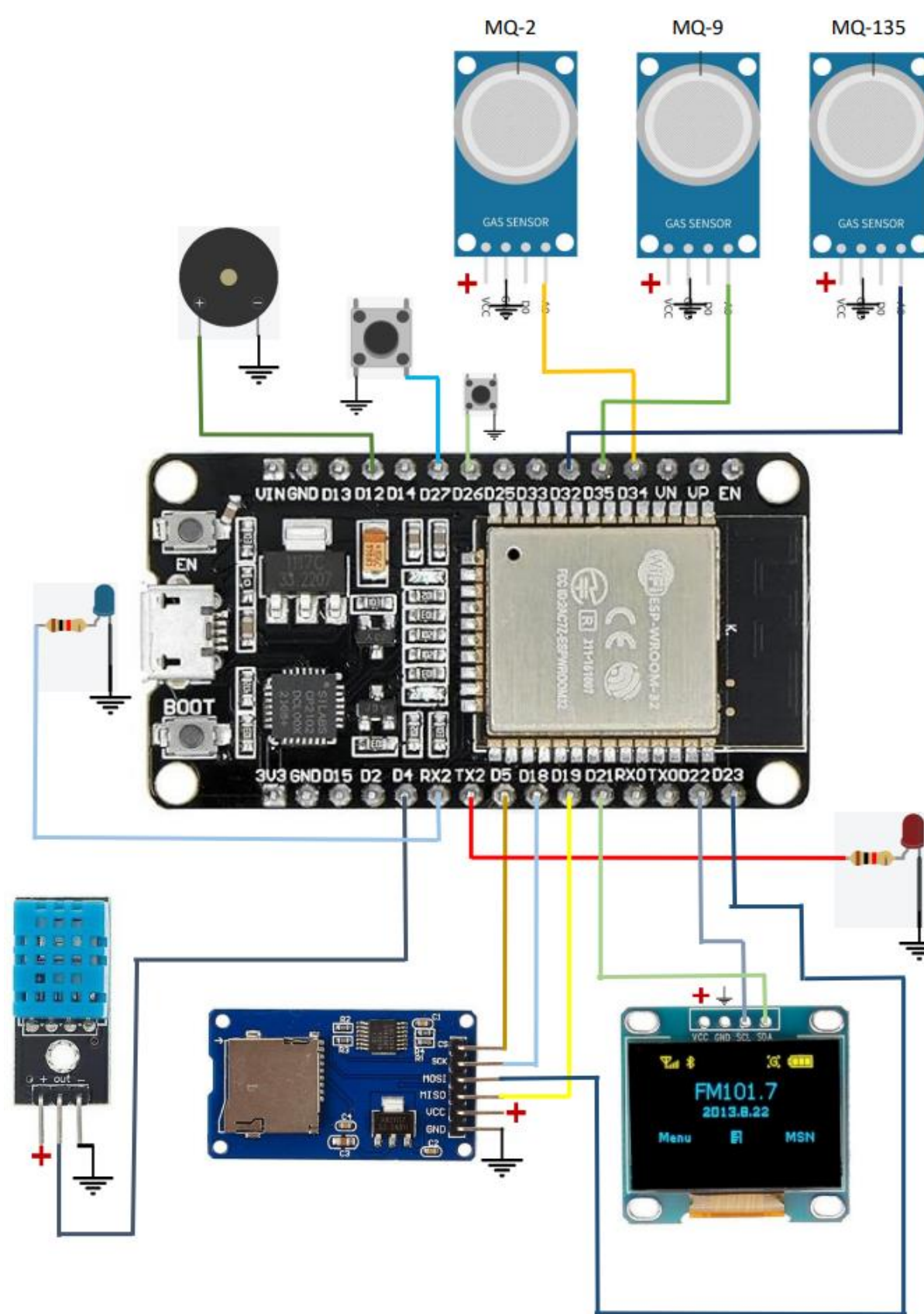


Live Video

The system can send live video footage wirelessly to the outside workstation.

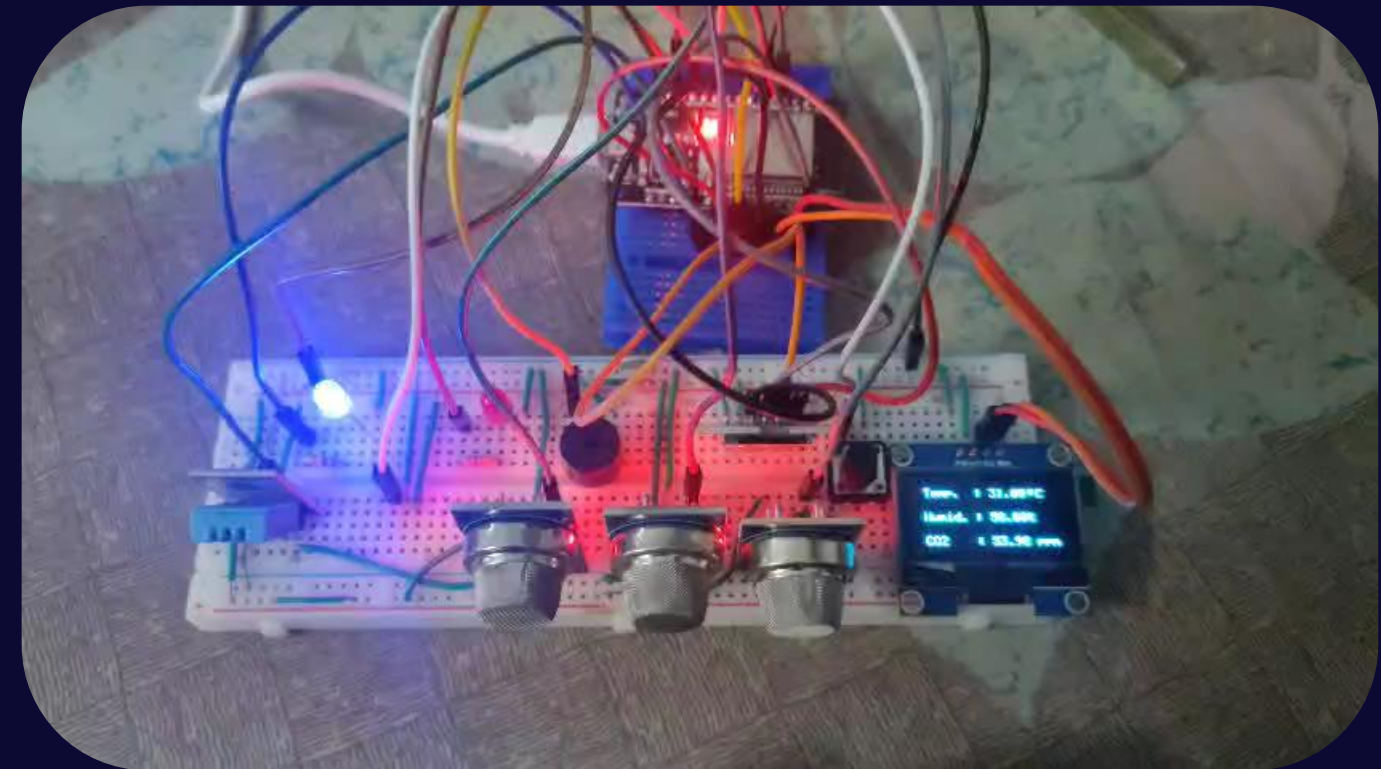


Circuit:

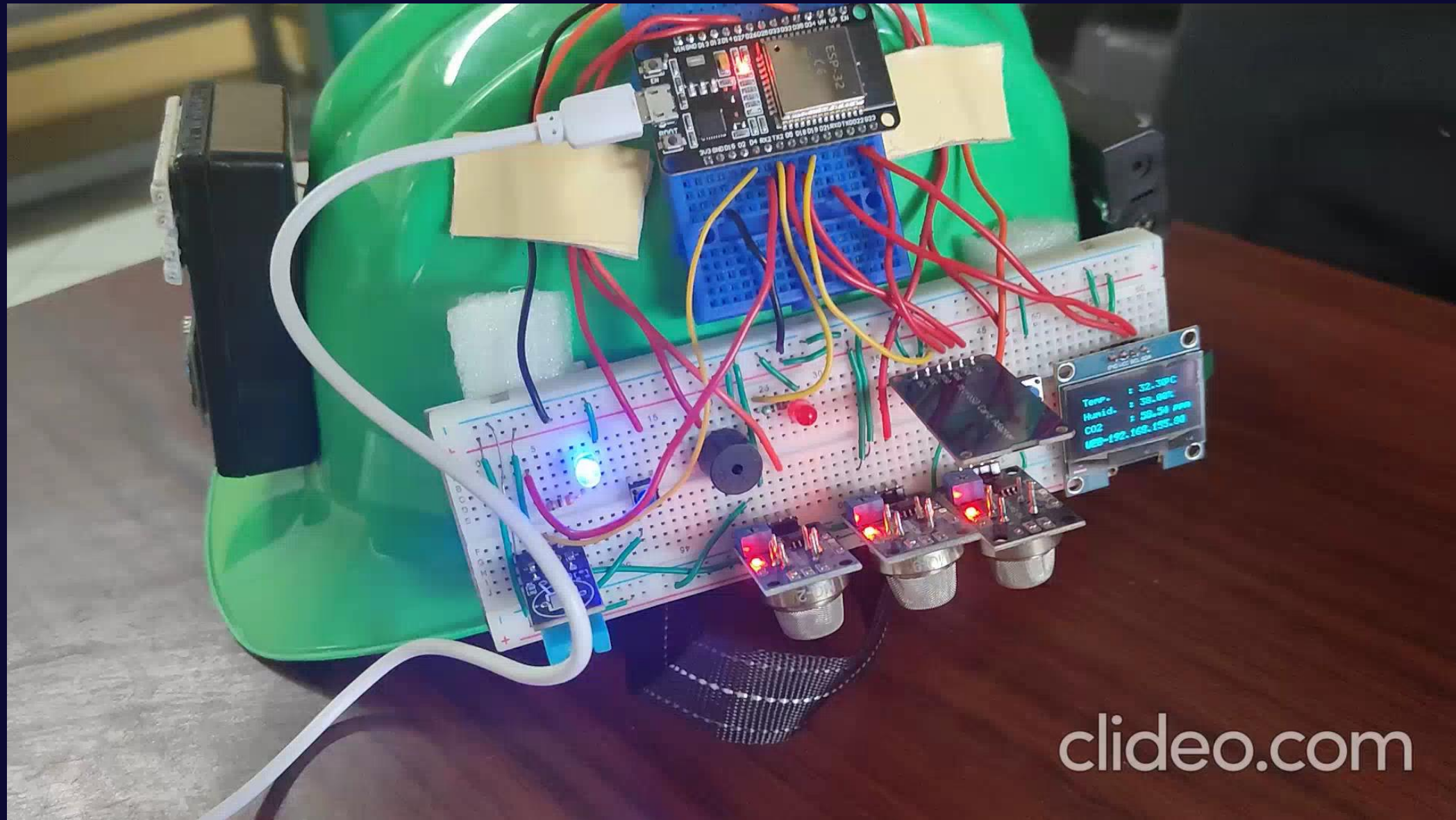


Workflow:

- **Step 1:** Calibrating the Gas Sensors (MQ-2, MQ-9, MQ-135).
- **Step 2:** Connecting the sensors, buzzer and Leds with ESP32.
- **Step 3:** Interfacing the OLED with the sensor real time readings.
- **Step 4:** Logging the data using the SD Card Module.
- **Step 5:** Adding a SOS Button to detect emergency.
- **Step 6:** Establishing a separate circuit for ESP32-Cam.
- **Step 7:** Activating the Web functionalities using Built in WIFI.
- **Step 8:** Creating a Power Circuit to generate 5V power supply.
- **Step 9:** Adding all the components in a strip board.
- **Step 10:** Running and Testing the prototype.



Working:



clideo.com

Applications:

1

Mine Worker Safety

Detects hazardous gases, extreme temperatures, alerting workers in real time through buzzers, LEDs, and web-based messages to prevent accidents.

2

Industrial & Research Applications

Can be adapted for use in tunnels, mines, oil refineries, chemical plants, and other hazardous environments where real-time monitoring and alerting are crucial.

3

Disaster Prevention & Early Warning

Identifies dangerous environmental changes early, such as gas leaks or fire outbreaks, allowing prompt evacuation and risk mitigation.

4

Remote Monitoring & Surveillance

The camera provides live video transmission to external workstations, enabling remote monitoring of mine conditions and enhancing safety oversight.



Future Trends:

1. Integration with AI & ML:

AI models can detect unusual behavior or faulty sensor readings automatically.

Use ML to predict hazardous conditions based on sensor trends (e.g., rising gas levels, temperature spikes).

2. GPS Live - Tracking:

Inclusion of a GPS System, that can perform in underground covered areas, can help in tracking the miners from the outstations.

3. Long Range (LoRa) Communication:

LoRa is a low-power wireless technology that enables long distance data transmission, even in deep underground tunnels. It works reliably without internet and consumes minimal power.

4. Advanced Sensor Suite:

Integrating Barometric Sensors to detect collapse prone low-pressure zones. Also adding a system that can keep track record of the miner's health system with the help of the helmet.





Conclusion:

The Smart Miner Helmet project demonstrates a practical and innovative approach to enhancing miner safety through real-time environmental monitoring and alert systems. This project not only addresses real-time hazard detection but also emphasizes early warning and emergency management, which are crucial for saving lives during critical situations. By leveraging low-cost, low-power IoT components, the helmet is also designed to be affordable and scalable, making it suitable for widespread deployment in the mining industry.

Overall, the Smart Miner Helmet project reflects how the integration of embedded systems, sensor networks, and wireless technologies can contribute to building a safer and more responsive mining environment. It serves as a promising prototype for future smart safety equipment in industrial settings.

THANK
YOU

