

Synopsis: IOT Based Coal Mine Safety Monitoring and Alerting System

Aim

The main aim of this project is to design an IoT-based safety system that monitors coal mine conditions like temperature, water level, and dangerous gases. It helps in preventing accidents by sending real-time alerts to authorities and workers.

Objective

- To ensure the safety of coal mine workers by monitoring environmental conditions.
- To detect harmful gases like methane and CO₂ in underground mines.
- To provide real-time data through wireless communication.
- To send alerts instantly when any unsafe condition is detected.

Working

This system consists of a **master controller** and multiple **slave controllers**. The slave controllers are installed inside the coal mine and are connected to different sensors like temperature, water level, methane, and carbon dioxide. These slave units use RF modules to send data wirelessly to the master controller located at the control room. If any sensor detects abnormal levels, the master controller raises a local alarm and also sends the information to an IoT platform through Wi-Fi. This allows remote monitoring and quick action.

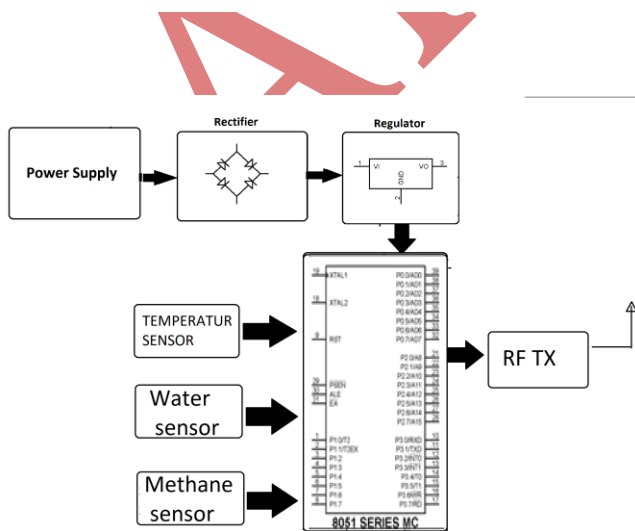
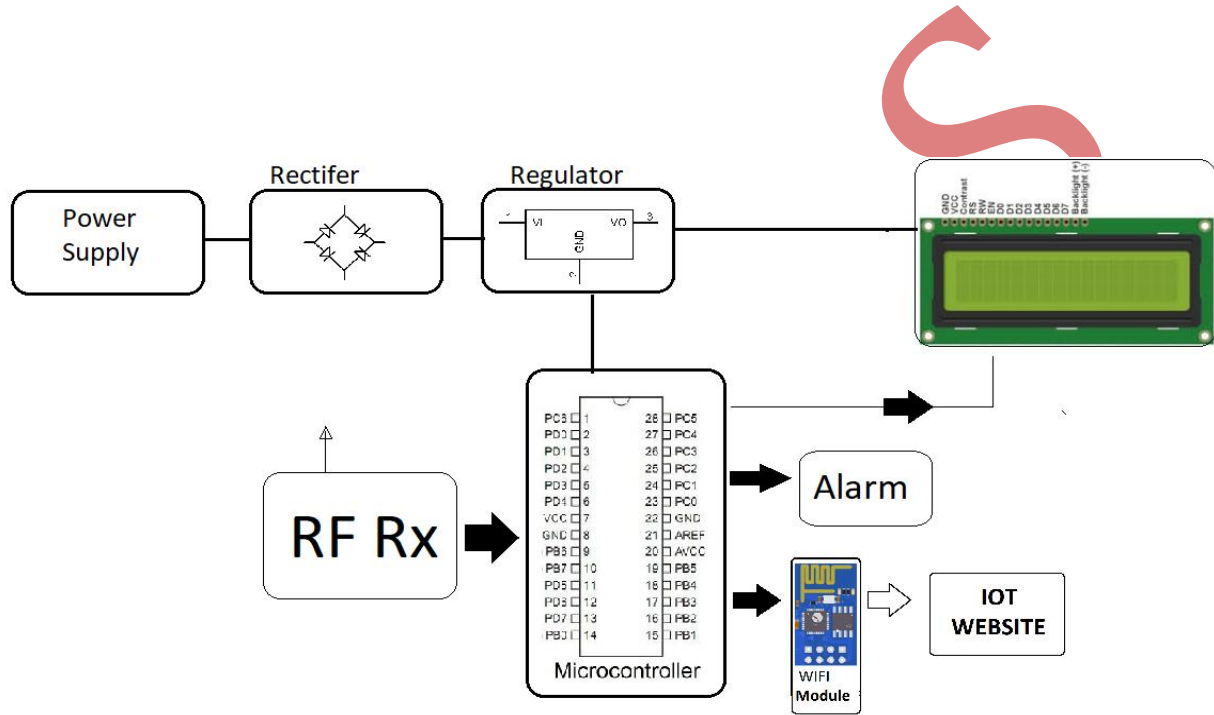
Hardware Components Used

- **Atmega328 Microcontroller** (Master Controller)
- **8051 Microcontroller** (Slave Controllers)
- **RF Module** (for wireless data transfer)
- **Wi-Fi Module** (for IoT connectivity)
- **Temperature Sensor**
- **Water Level Sensor**
- **Gas Sensors (Methane, Carbon Dioxide)**
- **LCD Display** (for showing live data)
- **LEDs, Buzzer, Switches, Push Buttons**
- **Resistors, Capacitors, Diodes, Transistors**
- **PCB or Breadboards, Wires and Connectors**
- **Power Supply (Adapter or Transformer)**

Software Used

- **Arduino IDE** (for writing and uploading code)
- **Programming Language: C**

Block Diagram:



Advantages

- Real-time data helps in quick decision-making.
- Alerts are sent instantly, improving worker safety.
- Wireless system avoids complex wiring.
- Can be accessed remotely through IoT.
- Easy to expand and maintain.

Disadvantages

- RF signals may face interference in deep mines.
- Wi-Fi coverage may be limited underground.
- Sensors need regular calibration and replacement.
- Initial installation cost and training may be required.

Applications

- Coal mining industries
- Other underground mining operations
- Tunnels and construction sites
- Hazardous chemical factories

Future Scope

- Adding GPS to track worker movements inside mines
- Using AI to predict hazardous conditions
- Using LoRa or Zigbee for longer-range communication
- Mobile app integration for instant notifications
- Solar-powered sensors to avoid battery issues

Conclusion

The IoT-based coal mine safety monitoring system is a smart solution to reduce accidents and improve the working environment in coal mines. It ensures real-time monitoring and timely alerts that can help save lives. With further advancements, it can be made even more reliable, efficient, and user-friendly.