Real-time Monitoring Of AQI In Underground Mines and Remote Intervention Of Ventilation System Using IOT Technology

Mid-Review 1/2/3

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AY 2021-25

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Major Project
Project ID: XX

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Objective and Goals

Objective

- Enhance Worker Safety.
- Real-time Data Collection and Analysis.
- Automate Ventilation Systems.
- Improve Energy Efficiency.
- Minimizing Environmental and Operational Risks.

Goals

Main Goals

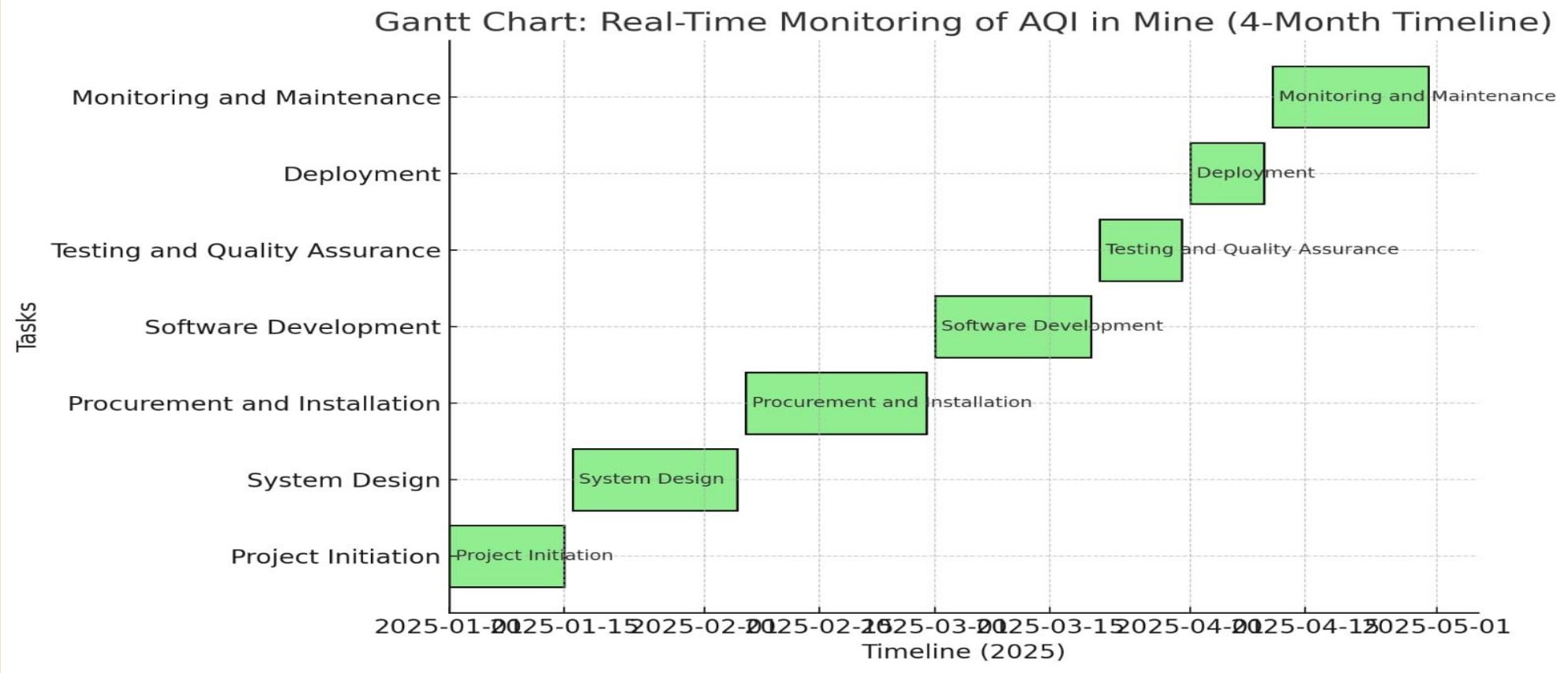
- Ensure Work Safety.
- Automate and Optimize Ventilation Systems.
- Enhance Operational Efficiency.
- Achieve Energy and Cost Efficiency.

Additional Goals

- Regulatory Compliance.
- Data-Driven Insights
- Remote Monitoring and Control.
- Scalability and Integration.

Project Plan (Clearly mention milestone for objectives under each reviews)

Gant Chart - Milestones and Activities



Literature Survey (Improved post minor project)

Key Publications

- Jing Zhang (2017). “A WiFi -enabled indoor air quality monitoring and control system”.
- Sujuan Liu (2016). “A Low-power real-time air quality monitoring system using LPWAN based on LoRa.
- Chourey, Pet al. (2022). “Designed IoT based air pollution monitoring system using MQ135,MQ7,DHT11 gas sensors.
- Harsh N.shah et al.(2018). " Developed IOT based air pollution monitoring system".
- Monika Singh Et al.(2019)."Proposed an Air Pollution Monitoring System".

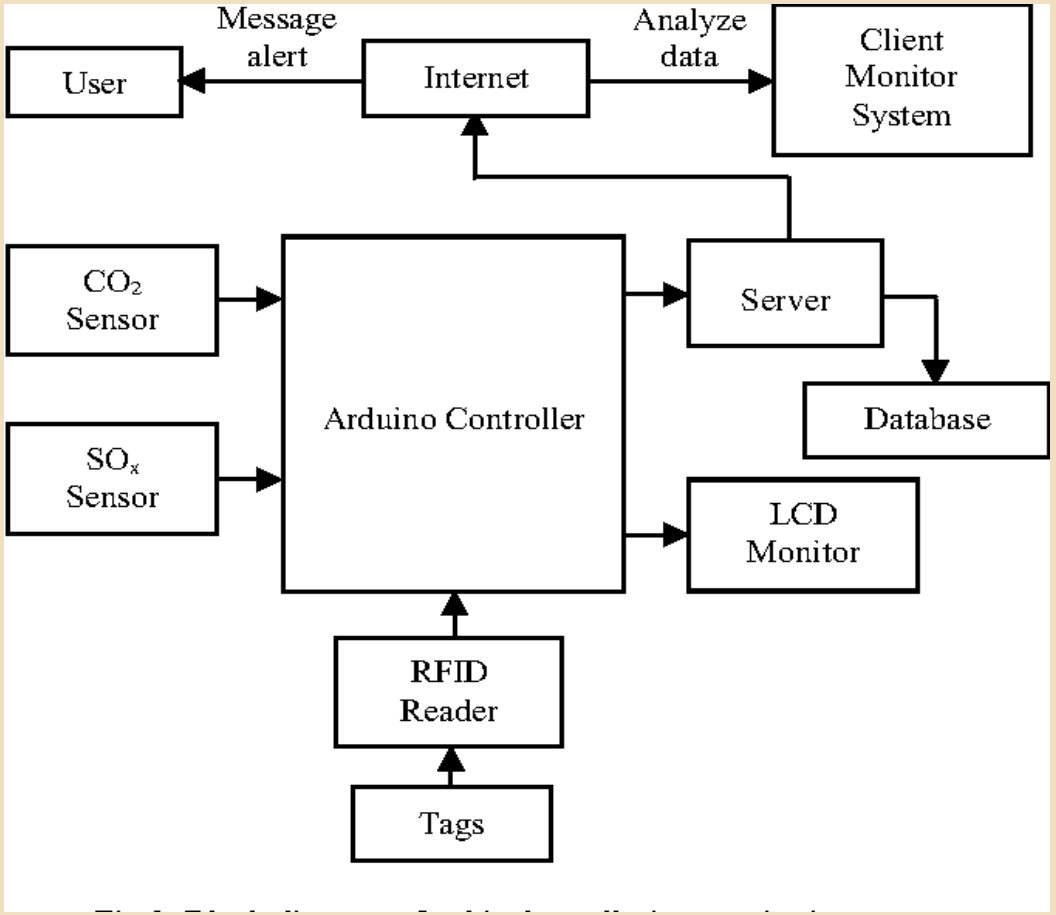
Key Resources – Whitepaper| Application Notes | Datasheet| Others

- IOT Sensors
- Soft Ware Resources
- Net Working and Communication

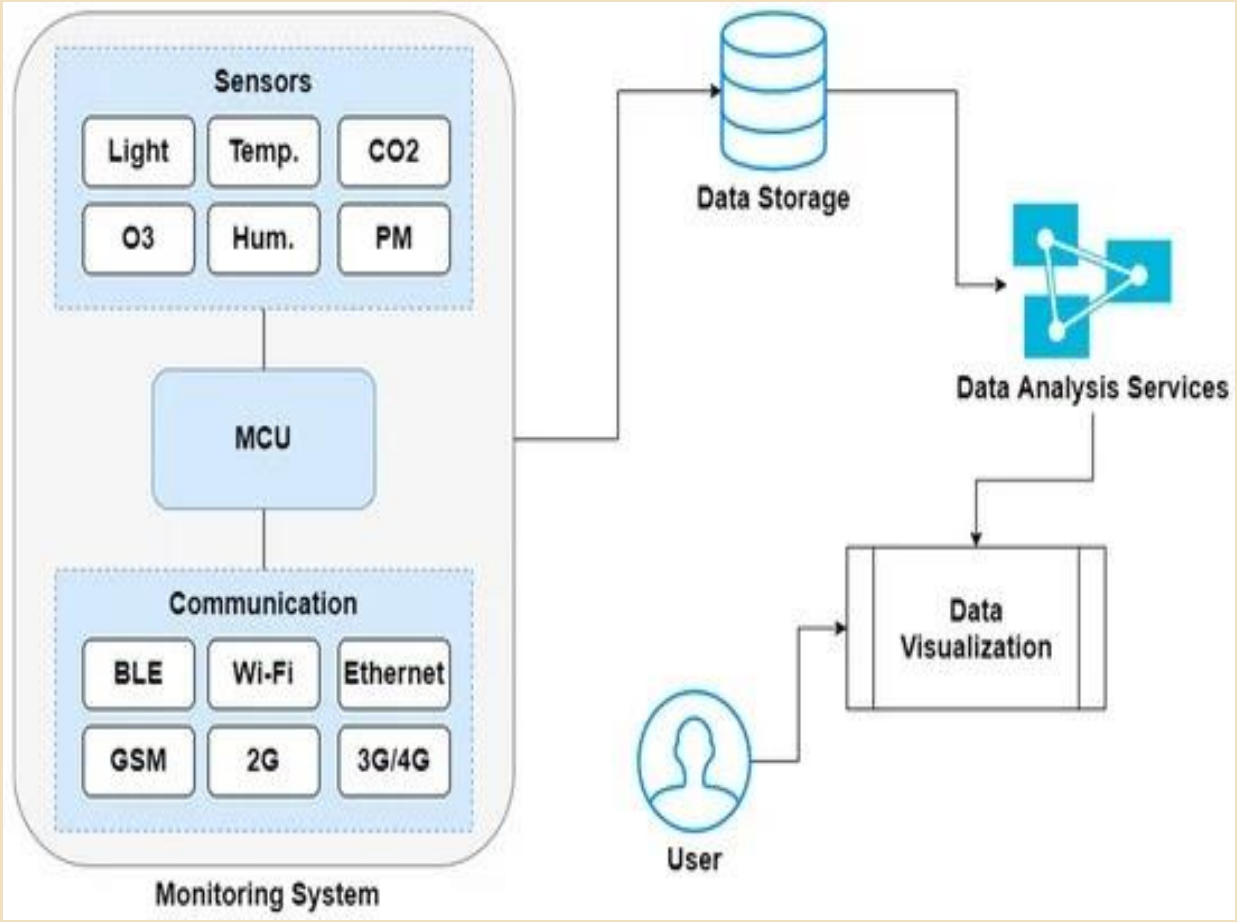
- **Existing Implementations – Products| Opensource| GitHub etc**
- IOT-Based Gas Detection Systems.
- Ventilation on Demand(VoD) Systems.
- Wireless Sensor Networks(WSNs).
- Cloud-Based Monitoring Platforms.

Architecture

Structural Diagram
Block Diagram/Pin Diagram



Behaviour Diagram
Flow chart/ State machine



Use Cases & Testing

Use Cases

- Real-Time AQI Monitoring.
- Remote Ventilation System Control.
- Worker Safety and Compliance.
- Energy Optimization.
- Emergency Response.

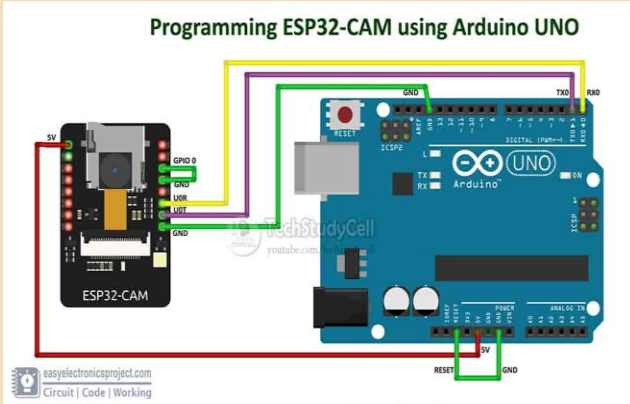
Test Cases

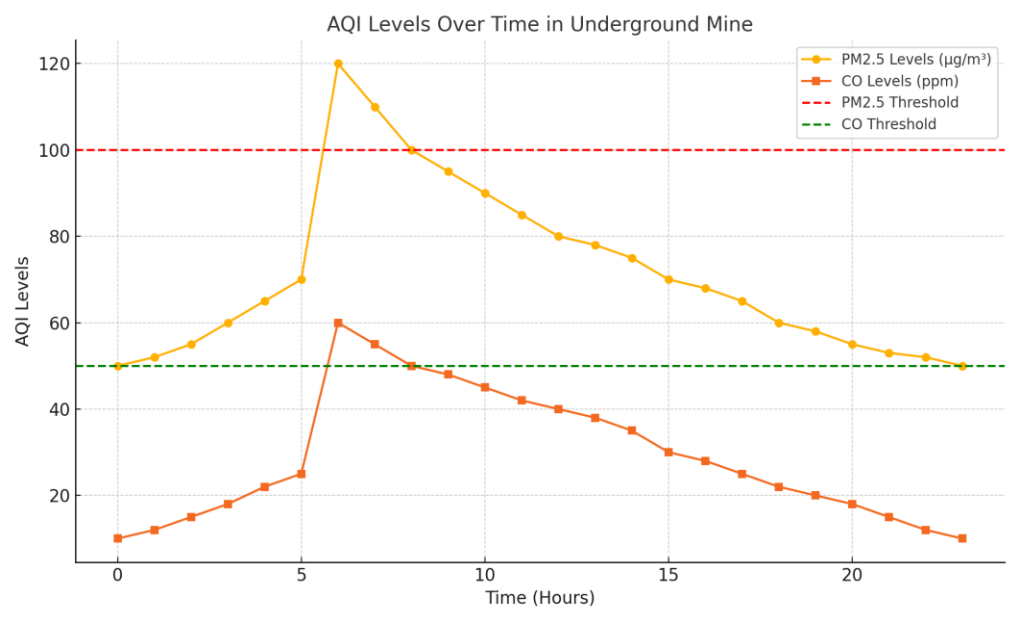
- AQI Sensor Monitoring.
- Alerts and Notifications.
- Remote Ventilation Control.
- System Reliability and Uptime.
- Security and Access Control.

Implementation and Results – Iteration 1

Iteration 1 : Results

- Identify parameters to monitor Particulate matter (PM2.5,PM10),Toxic gases(CO2,Co,Methane,SO2,NO2),Temperature, Humidity sensor(DTH11).
- IOT sensors for AQI measurement.
- Cloud/server for data storage analysis, and visualization.
- Develop a cloud-based platform to monitor AQI in real-time.
- Use low-power communication protocols for seamless data transfer(ESP32/Arduino UNO).
- Calibrate sensor for accuracy under underground conditions.
- Test communication, data integrity, and ventilation system responsiveness.
- The microcontrollers automatically triggers ventilation when AQI exceeds safe thresholds.
- Establish a maintenance schedule for sensors, gateway, and software.



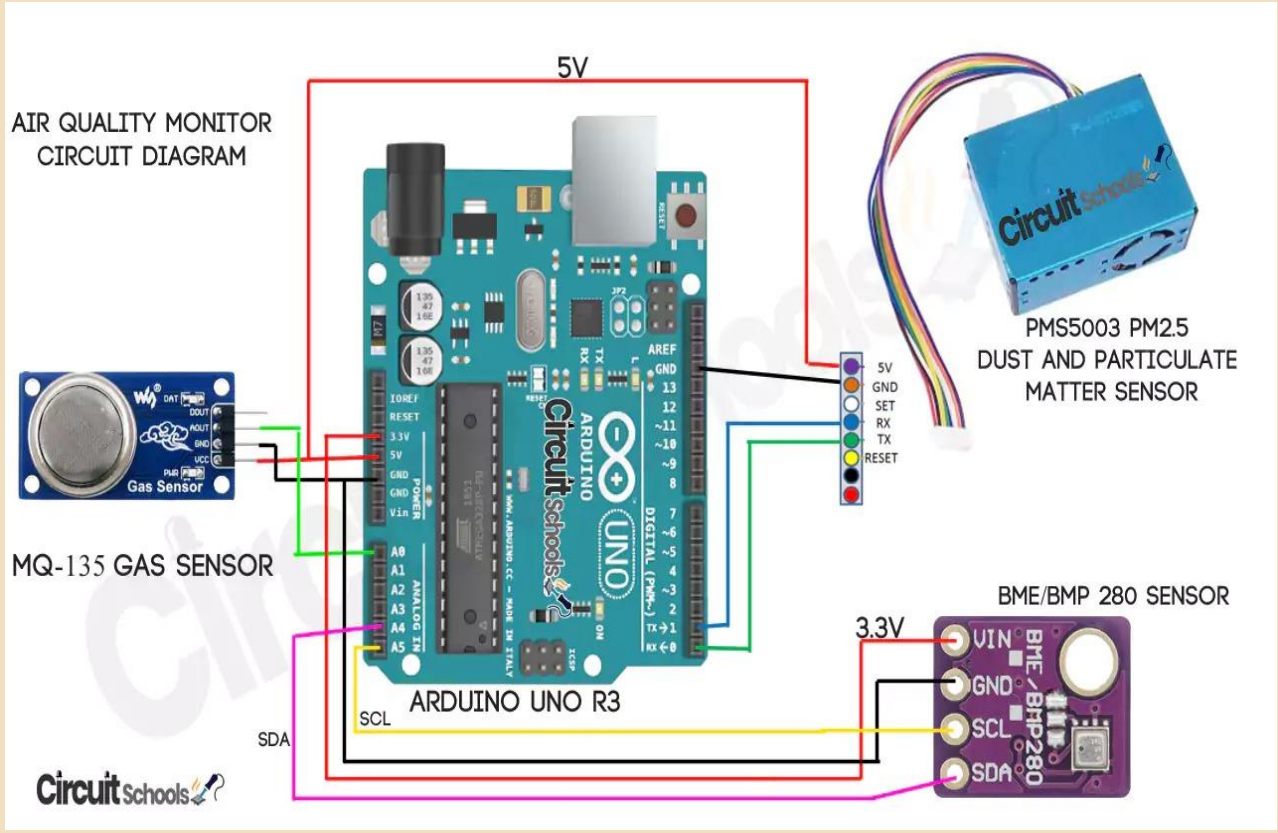


Implementation and Results – Iteration 2 (Optional)

Iteration : Results + Validation against the use cases and test cases

Results

- Improved Worker Safety.
- Optimized Ventilation System Performance.
- Increased Operational Efficiency.
- Compliance with Regulations.
- Predictive Maintenance.



Validation against the use cases and test cases

- Gas Leak Detection.
- Oxygen Level Monitoring.
- Energy Optimization.
- Emergency Response to Toxic Gas Release.
- Ensure sensor readings are within 5% accuracy.
- Achieve a response time of <10 seconds
- Maintain >95% data delivery reliability.
- Reduce hazardous gas concentration to safe levels within 5min .

THANK YOU

Have a Great Day !