International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 06 | June – 2025 DOI: 10.55041/ISJEM03996
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

INDUSTRIAL ENVIRONMENT MONITORING AND ALERT SYSTEM USING IOT

P.DEV ANAND [*1], Dr. K. Annalakshmi[*2],Ms. S. Sangeetha [*3]

[1]PG Student, Department Of Computer Application, Dr. M.G.R. Educational And Research Institute, Chennai, Tamil Nadu, India.

[*2] Assistant Professor, Department Of Computer Application, Dr. M.G.R. Educational And Research Institute, Chennai, Tamil Nadu, India.

[*3] Assistant Professor, Department Of Computer Application, Dr. M.G.R. Educational And Research Institute, Chennai, Tamil Nadu, India.

ABSTRACT

The Industrial Environment Monitoring and Alert System using IoT is designed to enhance workplace safety and efficiency by integrating gas sensors, heat sensors, and an alarm system. This system continuously monitors industrial environments for potential hazards such as gas leaks and abnormal temperature fluctuations. The gas sensor detects harmful gases (e.g., methane, carbon monoxide), while the heat sensor monitors temperature levels to prevent overheating and fire hazards.If any parameter exceeds predefined safety limits, the system triggers an alarm and can send real-time alerts to concerned authorities via IoT-based communication.

This project leverages IoT technology to enable remote monitoring and data logging, improving real-time decision-making and preventive maintenance. The collected data can be analyzed to predict hazardous conditions, ensuring a safer and more efficient industrial environment. Overall, this smart industrial safety system minimizes risks, enhances automation, and optimizes industrial operations by providing a proactive safety mechanism. Industries involving hazardous gases and high-temperature machinery pose significant safety challenges. Conventional safety measures rely heavily on human supervision, which can be prone to errors and inefficiencies. The integration of Internet of Things (IoT) technology in industrial safety systems offers a real-time, automated, and scalable solution for preventing accidents and ensuring a secure working environment. Several research studies highlight the role of **IoT-based industrial monitoring systems** in enhancing workplace safety. Smart sensors, cloud computing, and data analytics are commonly used to detect environmental anomalies and prevent accidents. Prior studies emphasize **gas detection technologies**, **temperature monitoring**, and **wireless alert mechanisms** for early hazard identification. However, existing systems often lack real-time remote monitoring capabilities and efficient data processing, which this study aims to improve.

I. INTRODUCTION

The advent of the Fourth Industrial Revolution, often referred to as **Industry 4.0**, is redefining the operational frameworks of industries across the globe. This new era is characterized by the integration of smart technologies into traditional manufacturing and industrial practices, creating highly interconnected and intelligent systems. Among the most significant technologies driving this transformation is the **Internet of Things (IoT)**. By connecting sensors, devices, and control systems to a central network, IoT enables real-time data exchange, automation, and remote management—resulting in

© 2025, ISJEM (All Rights Reserved)

increased productivity, safety, and efficiency.

One of the most critical applications of IoT in the industrial sector is in the area of **workplace safety and hazard management**. Industrial workplaces are inherently prone to risks due to the presence of heavy machinery, high temperatures, chemical processes, and flammable or toxic gases. Despite the implementation of various safety protocols and standards, accidents such as gas leaks, fires, and equipment overheating remain common and often catastrophic. These incidents not only endanger human lives but also lead to financial losses, legal liabilities, and environmental damage. Hence, the demand for **intelligent, automated, and proactive safety systems** is more pressing than ever.

II. LITERATURE SURVEY

1. IoT-Based Environmental Monitoring System for Industries

Author: R. Sharma et al. (2018)
Overview:
This study introduced a system using Arduino and various environmental sensors to monitor industrial pollution levels. The data was uploaded to a cloud platform (ThingSpeak), enabling real- time tracking and remote access.
Limitation:
Lack of alert mechanism in case of threshold breach, and no mobile integration.
Contribution to Current Work:
Inspiration to use cloud platforms and real-time dashboards for industrial data monitoring.

2. Smart Industry Pollution Monitoring using IoT

Author: N. Patel et al. (2019)
Overview:
This project utilized MQ series gas sensors along with a GSM module to detect and send SMS alerts during gas leaks. The system was implemented in small-scale chemical industries.
Limitation:
Limited to gas monitoring and lacked multi-parameter support (e.g., temperature, humidity).
Contribution to Current Work:
Highlighting the importance of real-time alerting and the role of GSM/SMS for emergency response.

3. Wireless Sensor Networks for Industrial Environmental Monitoring

Author: A. Gupta and M. Verma (2017)
Overview:
This paper focused on WSN-based architecture for factory floor monitoring. It proposed deploying multiple nodes wirelessly to collect and transmit environmental data.
Limitation:
WSN modules faced connectivity and power consumption issues over long distances.
Contribution to Current Work:
Laid the groundwork for distributed monitoring systems and inspired the inclusion of multiple sensors with low power microcontrollers like ESP32.

4. Cloud-based Industrial Monitoring using Blynk and IoT

Author: P. Srinivasan et al. (2020)
Overview:
Implemented a user-friendly mobile app using Blynk to visualize industrial parameters. It showed how real-time data can be easily accessed on smartphones.
Limitation:
Data security and access control were not adequately addressed.
Contribution to Current Work:
Motivated the use of mobile dashboards and cloud-based alerting for industrial monitoring.

5. Design of a Gas Detection and Alert System using Arduino and GSM

Author: S. Mehta et al. (2016)
Overview:
Focused on gas leak detection and sending SMS alerts via GSM. Demonstrated low-cost implementation in hazardous environments.
Limitation:
Did not support Wi-Fi/cloud connectivity for remote access.
Contribution to Current Work:
Introduced reliable SMS-based alerts, leading to inclusion of both cloud and GSM-based notifications in modern systems.

III. PROPOSED SYSTEM

To address the limitations of traditional industrial safety systems, the proposed solution is a smart, IoT- based **Industry Management System** that integrates gas sensors, temperature sensors, and real-time communication technology to ensure continuous monitoring, faster response, and improved workplace safety. This system is designed to detect hazardous gas concentrations and abnormal temperature fluctuations and to immediately alert concerned authorities, both locally and remotely, through connected digital platforms. 7

The core idea behind this system is **automation and remote accessibility**. Unlike traditional systems, which depend on manual inspection or localized alarms, this solution leverages the Internet of Things (IoT) to deliver an integrated safety network that can be monitored in real time from anywhere in the world. The system is built around a microcontroller or embedded platform (e.g., Arduino, ESP32, or Raspberry Pi), which collects input from various environmental sensors and processes the data in real-time.
The main components of the system include:

 Gas Sensor Module: Responsible for detecting dangerous gases such as methane, carbon monoxide, and LPG. These sensors continuously check for gas concentration levels and pass the data to the microcontroller.

 Temperature Sensor: Measures ambient temperature or heat from equipment. Any unexpected rise in temperature could indicate equipment failure or potential fire hazards.

International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 06 | June – 2025 DOI: 10.55041/ISJEM03996
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

 Microcontroller Unit: Acts as the system's brain. It reads sensor data, compares values against safety thresholds, and determines whether an alert condition has been met.

 Alert System: Comprises a buzzer and LED indicators for immediate, on-site warning. This ensures nearby personnel are informed without delay.

 IoT Communication Module: Uses Wi-Fi, GSM, or other wireless protocols to send real-time alerts via SMS, email, or cloud-based applications. This ensures that off-site supervisors and emergency teams can react promptly.

 Cloud Platform and Dashboard: Sensor data is uploaded to the cloud for storage, analysis, and visualization. A user-friendly dashboard allows stakeholders to monitor system performance, view historical data, and analyze trends for predictive maintenance.

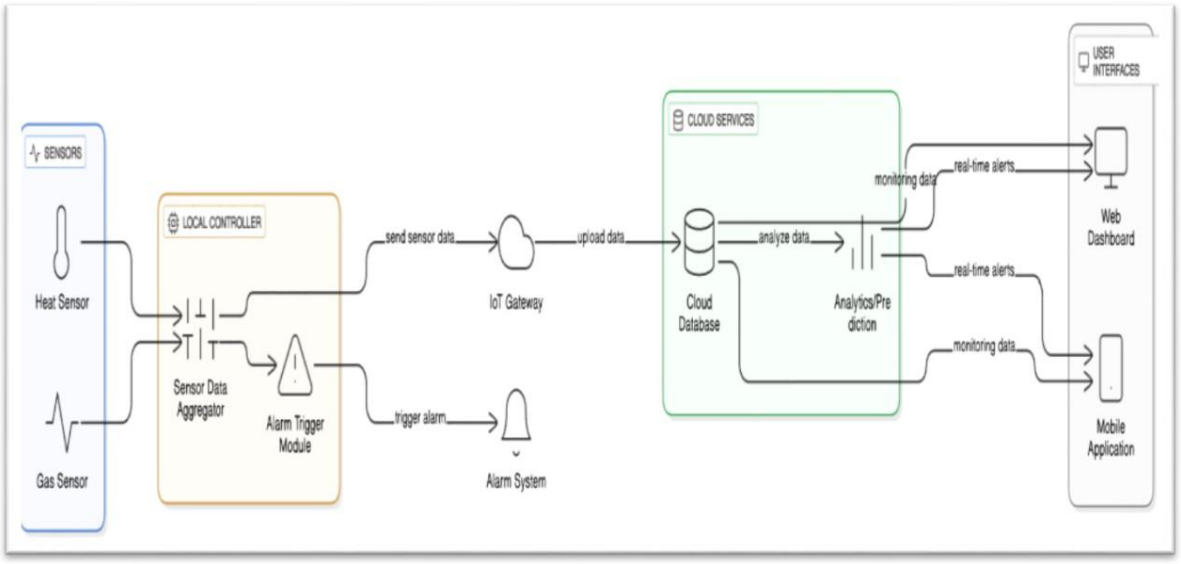

Figure 1: Architecture

IV.ALGORITHM

1. **Start the system** and initialize all sensors and Wi-Fi connection.
2. **Set safety threshold values** for gas, temperature, and humidity.
3. **Read sensor data** continuously in a loop.
4. **Compare** each reading with its threshold:
    - If any value exceeds the limit, **trigger an alert** (buzzer, LED, notification).
5. **Send data to the cloud** for remote monitoring.
6. **Repeat** the process continuously.

International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 06 | June – 2025 DOI: 10.55041/ISJEM03996
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

Sequence Diagram

This sequence diagram elaborates on the interactions between different components of an IoT- based Industry Management System, providing a temporal view of data flow, monitoring, alerting, and maintenance scheduling. It highlights the roles of the ESP32, Sensors, Cloud Platform, User, and Maintenance System in a more dynamic and sequential manner

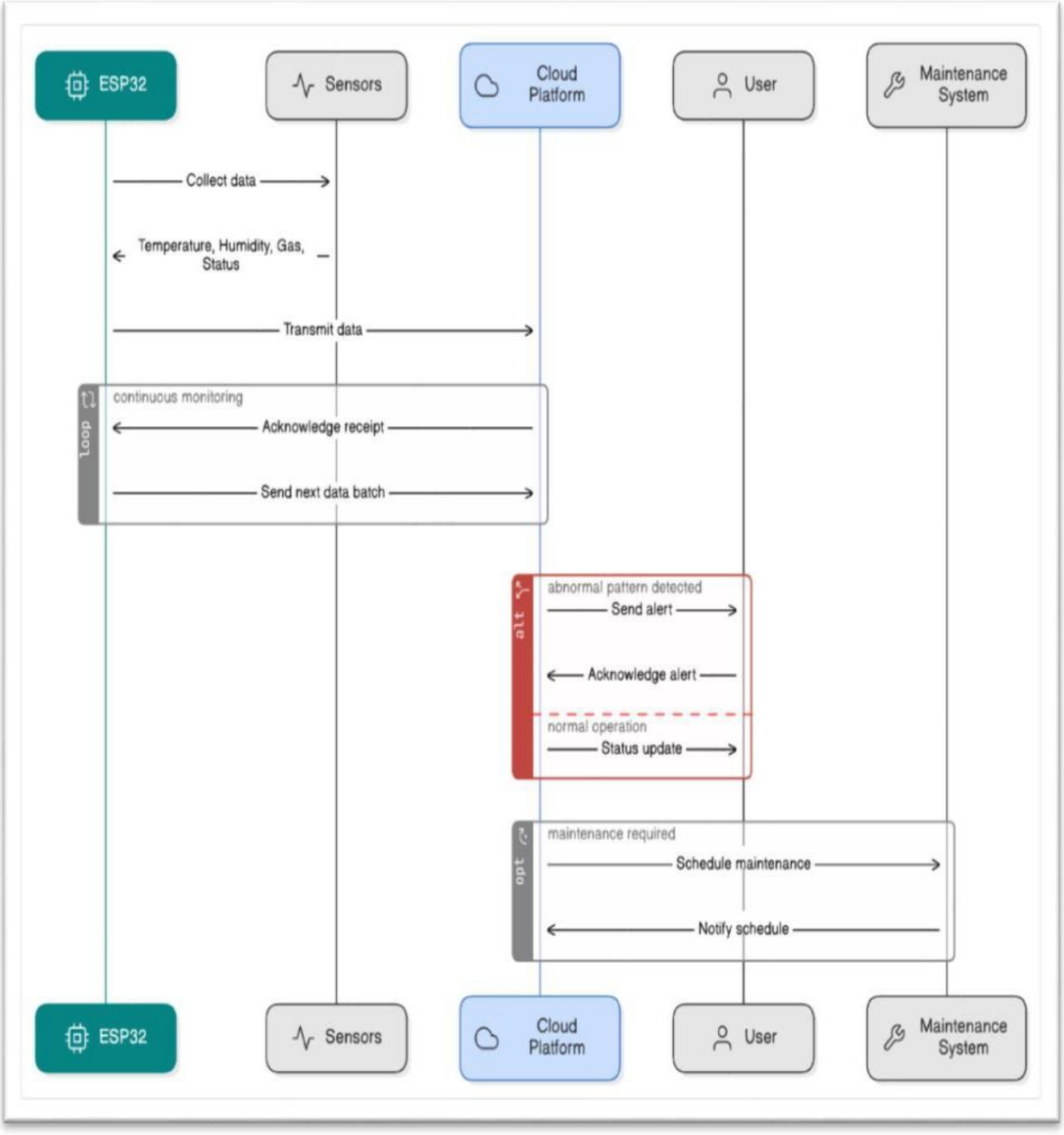

Figure 2: Sequence Diagram

© 2025, ISJEM (All Rights Reserved)

V.CONCLUSION AND FUTURE ENHANCEMENT

In modern industrial settings, safety and efficiency are non-negotiable priorities. The **Industrial Environment Monitoring and Alert System using IoT** addresses both of these critical needs by delivering a smart, real-time monitoring solution capable of detecting hazardous gases and extreme temperatures that could pose risks to personnel, equipment, and infrastructure.

The successful implementation of this project showcases how low-cost, widely available technologies such as **microcontrollers, gas sensors, temperature sensors, Wi-Fi modules, and cloud platforms** can be effectively combined to create an intelligent safety ecosystem. The project's primary goals—to detect gas leaks, monitor temperature anomalies, raise alarms, and communicate alerts via IoT—have been met with considerable success, forming the foundation for a scalable, reliable, and responsive industrial safety monitoring tool.

To evolve the **Industrial Environment Monitoring and Alert System using IoT** into a more powerful, scalable, and intelligent solution, several enhancements are proposed:

Offline Data Buffering and Syncing

By implementing **local data storage** using EEPROM, SD card modules, or SPIFFS (for ESP8266), the system can temporarily hold sensor data when the internet is unavailable. Once connectivity is restored, the data can be synced with the cloud.

Dynamic Threshold Adjustment

Instead of fixed thresholds, future iterations can implement **adaptive or environment-specific thresholding**. By learning from historical data or operator inputs, the system can determine safe operational ranges based on context, improving its **intelligence and relevance across industries**.

Sensor Fusion and Redundancy

Adding multiple sensors for the same parameter and averaging their outputs (sensor fusion) would improve **accuracy and fault tolerance**. Also, using redundant microcontrollers with failover mechanisms would **ensure uninterrupted monitoring** in critical environments.

Machine Learning for Predictive Safety

Integrating **machine learning models** could allow the system to identify patterns leading up to hazardous events. For instance, if a gas leak is often preceded by a specific rise in temperature or humidity, the system could learn this and **predict risks before they escalate**, making it **truly proactive**.

Mobile Application Integration

Developing a cross-platform **mobile application** (Android/iOS) would enable real-time push notifications, remote alarm deactivation, and portable dashboard access, enhancing **user** engagement and responsiveness**.**

Integration with Actuator Systems

In future versions, the system could be connected to **automated actuators**

REFERENCE

1. A. Ray and S. Saha, "IoT Based Industrial Safety Monitoring System Using Gas Sensor and Temperature Sensor," International Journal of Engineering Research & Technology (IJERT), vol. 9, no. 5, pp. 1002–1006, 2020.

2. M. R. Palattella et al., "Internet of Things in the 5G Era: Enablers, Architecture, and Business Models," IEEE Journal on Selected Areas in Communications, vol. 34, no. 3, pp. 510–527, 2016.

3. R. Kumar and M. P. Singh, "Real-Time Industrial Monitoring Using IoT for Safety and Maintenance," International Journal of Innovative Technology and Exploring Engineering (IJITEE), vol. 8, no. 12, pp. 193–198, 2019.

4. S. Patel and P. Shah, "Smart Industrial Safety and Automation System Using IoT," International Journal of Science and Research (IJSR), vol. 8, no. 6, pp. 1055–1059, 2019.

5. P. Kamble and S. B. Rathod, "IoT Based Smart Gas Monitoring System," International Research Journal of Engineering and Technology (IRJET), vol. 6, no. 3, pp. 7210–7214, 2019.

6. A. Jain and A. Agrawal, "IoT-Based Industrial Environment Safety Monitoring System," Proceedings of the 2020 International Conference on Smart Technologies in Computing, Electrical and Electronics (ICSTCEE), pp. 367–372, 2020.

7. L. Atzori, A. Iera, and G. Morabito, "The Internet of Things: A Survey," Computer Networks, vol. 54, no. 15, pp. 2787–2805, 2010.