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Automatic Industrial Fault Detection & IOT Based Remote Monitoring

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Abstract: *Industrial environments require continuous monitoring to ensure safety, operational efficiency, and equipment reliability. Traditional monitoring systems often depend on manual inspection, which can lead to delayed fault detection and increased maintenance costs. This paper presents an Automatic Industrial Fault Detection and IoT-Based Remote Monitoring System using ESP32 and multiple environmental sensors. The proposed system integrates an LM35 temperature sensor, MQ-2 gas sensor, LDR, fire sensor, and PIR motion sensor to monitor critical industrial parameters in real time. The ESP32 controller processes sensor data and communicates fault conditions through the SIM800L GSM module and Internet connectivity. A 16×4 LCD display provides local status monitoring, while LEDs and a buzzer generate immediate alerts during abnormal conditions. A DC fan motor is automatically activated when temperature exceeds predefined limits. The collected data can be transmitted remotely for continuous monitoring and predictive maintenance. Experimental results demonstrate that the system effectively detects hazardous conditions such as gas leakage, fire, excessive temperature, unauthorized motion, and abnormal light variations, thereby enhancing industrial safety and reducing operational risks.*

Keywords: Industrial Automation, Internet of Things (IoT), ESP32, Fault Detection, Remote Monitoring, SIM800L, Gas Leakage Detection, Fire Detection, Smart Industry, Predictive Maintenance

INTRODUCTION

The rapid growth of industrial automation has increased the need for intelligent monitoring systems capable of detecting faults and hazardous conditions in real time. Industries such as manufacturing, chemical processing, power generation, and warehousing operate under complex conditions where equipment failures or environmental hazards can lead to production losses, financial damage, and safety risks.Conventional fault detection methods rely heavily on periodic inspections and manual supervision. Such approaches are time-consuming and may fail to identify critical abnormalities promptly. The emergence of the Internet of Things (IoT) has enabled industries to deploy smart monitoring systems capable of collecting, processing, and transmitting data continuously.This research proposes an Automatic Industrial Fault Detection and IoT-Based Remote Monitoring System that utilizes an ESP32 microcontroller along with multiple sensors to monitor industrial conditions. The system detects parameters including temperature, gas concentration, fire occurrence, motion activity, and ambient light intensity. Upon detecting abnormal conditions, the system generates alerts through LEDs, buzzer alarms, LCD notifications, and GSM-based remote messaging using the SIM800L module.The proposed solution enhances industrial safety, minimizes downtime, and enables proactive maintenance through real-time monitoring and fault reporting.

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II. RELATED WORK

Study 1

Researchers developed an IoT-based industrial monitoring system using Arduino and wireless communication technologies. The system enabled remote monitoring of temperature and humidity but lacked multi-parameter fault detection capabilities.

Study 2

Several studies have utilized gas sensors and fire sensors for industrial safety applications. These systems successfully detected hazardous gas leaks but provided limited remote communication features.

Study 3

ESP32-based monitoring systems have gained popularity due to their integrated Wi-Fi capabilities and low power consumption. Such systems allow real-time cloud connectivity and data visualization.

Study 4

Researchers proposed predictive maintenance frameworks that collect sensor data continuously and analyze equipment behavior to identify potential failures before they occur.

Study 5

Recent IoT-enabled industrial solutions integrate GSM communication modules for sending emergency alerts when internet connectivity becomes unavailable. This approach improves reliability in remote industrial environments. Despite these advancements, existing systems often focus on a single parameter. The proposed work combines multiple sensors with IoT and GSM technologies to provide a comprehensive industrial fault detection and monitoring solution.

III. PURPOSE OF THE PROPOSED SYSTEM

The primary purpose of this project is to develop an intelligent industrial monitoring platform capable of detecting multiple fault conditions and providing real-time alerts to operators.

The system aims to:

- Improve industrial safety.
- Detect hazardous conditions at an early stage.
- Reduce equipment downtime.
- Enable remote monitoring through IoT.
- Provide automated responses to abnormal conditions.
- Support predictive maintenance strategies.
- Minimize human intervention in industrial monitoring.

IV. METHODOLOGY

The proposed system follows a layered architecture consisting of Sensor Layer, Controller Layer, Communication Layer, and Application Layer.

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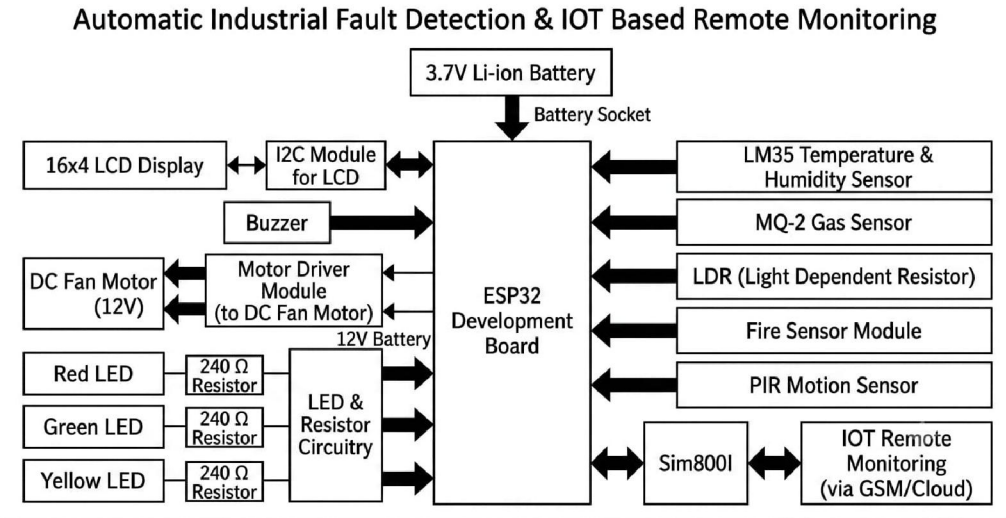
4.1 System Architecture



4.2 Component Function

ESP32	Main controller
LM35 Sensor	Temperature monitoring
MQ-2 Sensor	Gas leakage detection
LDR	Light intensity measurement
Fire Sensor	Flame detection
PIR Sensor	Motion detection
LCD 16×4	Local display
SIM800L	GSM communication
DC Fan	Cooling operation
LEDs	Status indication
Buzzer	Emergency alert

4.3 Sensor Layer

The sensor layer collects real-time environmental and operational data.

LM35 Temperature Sensor

Monitors industrial temperature levels and detects overheating conditions.

MQ-2 Gas Sensor

Detects combustible gases such as LPG, methane, propane, and smoke.

Fire Sensor Module

Identifies flame presence and fire hazards within industrial environments.

PIR Motion Sensor

Detects unauthorized human movement in restricted industrial zones.

LDR Sensor

Measures ambient light intensity and identifies abnormal lighting conditions.

The sensor layer serves as the primary source of information for fault detection.

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4.4 Controller Layer

The controller layer is implemented using the ESP32 Development Board.

Functions include:

- Reading sensor data.
- Comparing readings with predefined threshold values.
- Executing fault detection algorithms.
- Activating alarms and indicators.
- Controlling the DC cooling fan.
- Sending data to communication modules.

Advantages of ESP32:

- Built-in Wi-Fi and Bluetooth.
- High processing capability.
- Low power consumption.
- Multiple GPIO interfaces.

4.5 Communication Layer

The communication layer enables data transmission and alert generation.

Wi-Fi Communication

- The ESP32 transmits sensor readings to cloud platforms or IoT dashboards for remote monitoring.

GSM Communication (SIM800L)

When a fault occurs:

- SMS alerts are sent to authorized personnel.
- Emergency notifications are generated.
- Communication remains available even when internet connectivity fails.

Example alert:

- "Warning! Gas leakage detected in Industrial Zone A. Immediate inspection required."

4.6 Application Layer

The application layer provides visualization and user interaction.

Functions include:

- Real-time monitoring dashboard.
- Historical data analysis.
- Fault notifications.
- Remote status tracking.
- Maintenance decision support.

Outputs:

- LCD status display.
- Mobile notifications.
- SMS alerts.
- LED indicators.
- Audible buzzer alerts.

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V. OBJECTIVES

The major objectives of the proposed system are:

- To develop an automated industrial fault detection system.
- To continuously monitor environmental and operational parameters.
- To detect temperature abnormalities and overheating conditions.
- To identify gas leakage and fire hazards.
- To monitor unauthorized movement in industrial areas.
- To provide real-time fault alerts through GSM and IoT communication.
- To reduce equipment failure and production downtime.
- To improve industrial safety and reliability.
- To enable remote monitoring and control.
- To support predictive maintenance practices.

Simulation RESULT

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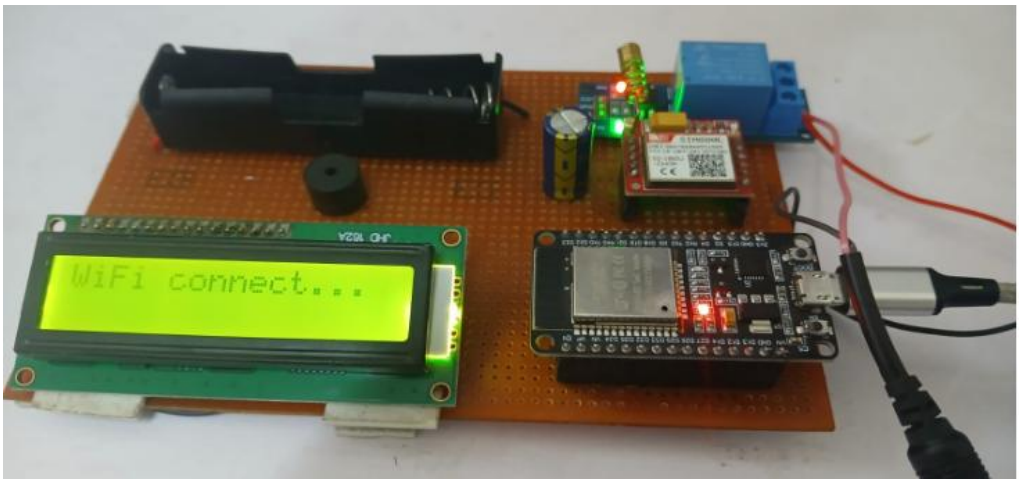

VII. CONCLUSION

This paper presented an Automatic Industrial Fault Detection and IoT-Based Remote Monitoring System utilizing ESP32 and multiple sensing technologies. The system continuously monitors temperature, gas concentration, fire hazards, motion activity, and ambient light conditions. Through real-time data acquisition, fault analysis, and remote communication, the proposed solution enhances industrial safety and operational reliability. The integration of GSM and IoT technologies ensures that critical alerts are delivered promptly to responsible personnel, enabling timely intervention. The developed system offers a cost-effective, scalable, and intelligent approach to industrial fault management and represents a significant step toward Industry 4.0-based smart manufacturing environments.

FUTURE WORK

Several enhancements can be incorporated into future versions of the system:
Integration of Artificial Intelligence (AI) for predictive fault analysis.
Cloud-based data storage and analytics.

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Mobile application development for real-time monitoring.
Machine Learning algorithms for anomaly detection.
Integration with SCADA systems.
Energy consumption monitoring.
Industrial equipment vibration analysis.
Digital twin implementation for smart factories.
Voice-assisted monitoring systems.
Support for large-scale industrial deployments using LoRaWAN and 5G technologies.

REFERENCES

[1]. L. Da Xu, W. He, and S. Li, "Internet of Things in Industries: A Survey," IEEE Transactions on Industrial Informatics, vol. 10, no. 4, pp. 2233-2243, 2014.
[2]. K. Ashton, "That Internet of Things Thing," RFID Journal, 2009.
[3]. Al-Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash, "Internet of Things: A Survey on Enabling Technologies," IEEE Communications Surveys & Tutorials, 2015.
[4]. V. Madisetti and S. K. Ucisik, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Pearson Education, 2017.
[5]. M. Collotta and G. Pau, "A Novel Energy Management Approach for Smart Homes Using Bluetooth Low Energy," IEEE Journal, 2015.
[6]. N. Kumar and J. Rodrigues, "Industrial Internet of Things: Vision, Challenges and Future Directions," Future Generation Computer Systems, 2017.
[7]. Espressif Systems, ESP32 Technical Reference Manual, 2024 Edition.
[8]. Hanwei Electronics, MQ-2 Gas Sensor Datasheet, 2023