

TEMPRATURE, HUMIDITY & FIRE EXTINGUISHER MONITORING USING ESP32 WEBSERVER

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Abstract: Industrial environments such as warehouses, chemical plants, and manufacturing units require continuous monitoring to prevent fire accidents and ensure safety. Traditional fire detection systems often provide limited real-time monitoring and lack remote accessibility. This research proposes an IoT-based industrial fire safety monitoring system using the ESP32 microcontroller. The system integrates multiple sensors including a DHT11 temperature and humidity sensor, flame detection sensor, and infrared (IR) sensors for monitoring fire extinguisher status at different pillars. The ESP32 processes sensor data and hosts an embedded web server that displays real-time environmental conditions through a browser-based dashboard.

When abnormal temperature or flame detection occurs, the system activates a buzzer alarm and generates visual alerts on the monitoring interface. The proposed system offers a low-cost, scalable, and real-time monitoring solution that improves industrial safety and enables early fire detection.

I. INTRODUCTION

Fire hazards in industrial environments pose significant risks to equipment, infrastructure, and human safety. Conventional fire alarm systems generally depend on standalone detectors and centralized panels that provide limited environmental monitoring and remote accessibility.

Recent advancements in Internet of Things (IoT) technology enable intelligent monitoring systems using microcontrollers and sensors. The ESP32 microcontroller provides built-in WinFi capability, making it suitable for real-time data monitoring and remote access applications.

This study presents an ESP32-based fire safety monitoring system capable of detecting fire conditions, monitoring environmental parameters, and verifying the operational status of fire extinguisher points. The system also provides a web-based dashboard for real-time monitoring.

II. METHODOLOGY

The proposed system consists of an ESP32 microcontroller, DHT11 sensor, flame sensor, IR sensors, and a buzzer alarm. The DHT11 sensor measures temperature and humidity conditions within the monitored environment. The flame sensor detects fire intensity, while the IR sensors monitor the availability and status of fire extinguishers installed at different locations.

The ESP32 collects sensor data and processes it continuously. When the flame sensor detects fire beyond a threshold value, the controller activates a buzzer alarm and displays a warning message on the dashboard. A web server hosted on the ESP32 allows users to monitor system data in real time through any web browser connected to the same WinFi network.

III. RESULT AND DISCUSSION

The system was tested under various simulated environmental conditions. Experimental results show that the system successfully detects flame presence, monitors environmental parameters, and provides real-time visualization through the web interface.

The alarm system activates immediately when fire is detected, ensuring early warning and quick response. The dashboard provides clear graphical information about temperature, humidity, and extinguisher status.

IV. CONCLUSION

The proposed IoT-based industrial fire safety monitoring system using ESP32 provides an efficient solution for real-time safety monitoring. The system integrates environmental sensing, fire detection, and web-based visualization into a compact and cost-effective platform.

The solution improves situational awareness, reduces response time in emergency situations, and enhances industrial safety management.

V. FUTURE SCOPE

- Integration with cloud-based data storage
- Mobile application monitoring
- SMS and email alert systems
- Additional sensors such as smoke and gas detectors

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