

# IoT-Based Fire & Smoke Detecting Sensor with Smart Sprinkler

Aryan Padaye, Rithwik Saggam, Payal Kadam, Pranay Shigam

*Electronics and Telecommunication, Vidyalankar Polytechnic*

*Electronics and Telecommunication, Vidyalankar Polytechnic*

*Electronics and Telecommunication, Vidyalankar Polytechnic*

*Electronics and Telecommunication, Vidyalankar Polytechnic*

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**Abstract** - Fire accidents cause serious damage to human life and property, especially when detection and response are delayed. Traditional fire alarm systems mainly provide sound alerts and depend on manual intervention to control fire hazards. This paper proposes an IIoT-based fire detection and automated sprinkler system to enhance safety and reduce response time. The system uses smoke, temperature, and flame sensors to continuously monitor environmental conditions. When fire-related parameters exceed predefined thresholds, an alarm is triggered, alert notifications are sent to users, and an automated sprinkler system is activated to control the fire. The system also supports remote monitoring through a web or mobile platform, allowing users to receive real-time updates from any location. The proposed solution is cost-effective, reliable, and suitable for residential, commercial, and industrial applications.

**Key Words:** Fire detection, Automated sprinkler system, Sensors, Safety system, Remote monitoring, IIoT.

## 1. INTRODUCTION

Fire accidents are a serious threat to human life and property. Many incidents become dangerous due to delayed detection and slow response. Traditional fire alarm systems mainly provide sound alerts and depend on manual action to control the fire, which may not be effective in critical situations.

With the advancement of technology, smart fire detection systems can continuously monitor environmental conditions using multiple sensors. These systems are capable of detecting smoke, temperature rise, and flame presence, and can quickly send alerts to users. In addition, automated sprinkler systems can be used to control fire by activating water spray without human intervention.

This paper presents an IIoT-based fire detection and automated sprinkler system that improves safety, reduces response time, and minimizes damage during fire emergencies. The proposed system is reliable, cost-effective, and suitable for residential, commercial, and industrial applications.

## 2. Body of Paper

### 2.1 System Architecture

The proposed system consists of an ESP32 microcontroller integrated with multiple sensors such as the MQ135 gas sensor, flame sensor, and DHT11 temperature sensor. The MQ135 sensor is used to detect smoke and harmful gases present in the environment. The flame sensor detects the presence of fire by sensing infrared radiation, while the DHT11 sensor monitors temperature and humidity levels.

All sensors are connected to the ESP32, which acts as the central processing unit of the system. It continuously collects and analyzes sensor data in real time. When abnormal conditions are detected, the system activates an alarm, sends notifications to users, and triggers an automated sprinkler system to control the fire. The system also supports real-time monitoring through IoT-based platforms, allowing users to access system status remotely.

### 2.2 Working Principle

The system continuously monitors environmental conditions using different sensors. The MQ135 detects smoke or gas leakage, the flame sensor identifies fire, and the DHT11 measures temperature changes. These sensors work together to provide accurate detection of fire hazards.

The sensor readings are compared with predefined threshold values stored in the ESP32. If any value exceeds the set limit, the ESP32 processes the signal and performs necessary actions such as activating a buzzer, sending alert notifications, and turning on the sprinkler system. This ensures early detection, quick response, and effective control of fire, thereby minimizing damage and improving safety.

### 2.3 Components Used

ESP32 Microcontroller  
MQ135 Gas Sensor  
Flame Sensor  
DHT11 Sensor  
Buzzer  
Water Pump / Sprinkler  
Power Supply

Table -1:

**Components & Their Functions**

Component	Function
MQ135 Sensor	Detects smoke and harmful gases.
Flame Sensor	Detects fire
DHT11 Sensor	Measures temperature & humidity
ESP32	Controls the system
Buzzer	Gives alert
Sprinkler	Sprays water to control fire

**Sensor Specifications**

Sensor	Parameter	Range	Output
MQ135	Gas/Smoke	10-1000 ppm	Analog
Flame Sensor	IR Detection	760-1100 nm	Digital
DHT11	Temp & Humidity	0-50°C, 20-90% RH	Digital

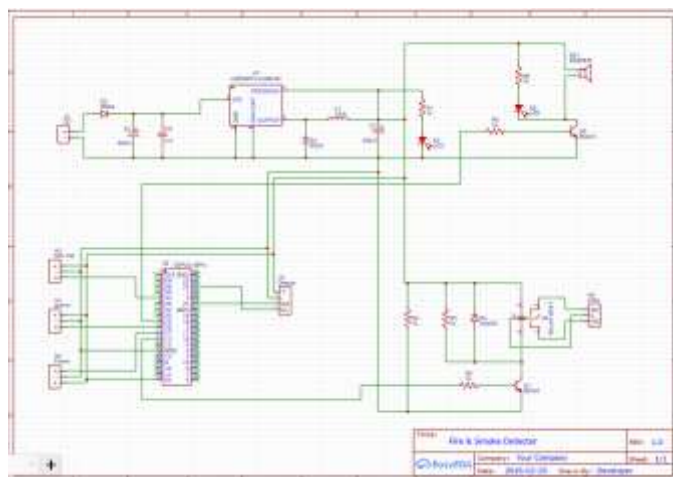


Fig -1: Circuit diagram of IIoT-based Fire & Smoke Detecting Sensor with Smart Sprinkler

**3. CONCLUSIONS**

Fire detection and automated sprinkler systems play an important role in improving safety and reducing damage caused by fire accidents. By using sensors for early detection and automatic sprinkler activation, the system can respond quickly without human intervention. Real-time alerts and remote monitoring further help users take immediate action during emergency situations.

Overall, the proposed system provides a reliable, efficient, and cost-effective solution for fire safety in residential, commercial, and industrial environments.

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**REFERENCES**

[1] A. Barua and A. Hossain, "Design of fire detector with water sprinkler based on Internet of Things (IoT)," HANIF Journal of Information Systems, vol. 2, no. 2, pp. 01-08, 2025.

[2] N. Arora, S. Yadav, Y. R. Singh, and K. Mishra, "IoT & AI enabled fire detection system," International Journal of Research in Advanced Science and Engineering Technology, vol. 11, no. 4, pp. 676-681, 2025.

[3] Y.-J. Kim, H. Kim, S. Lee, and W.-T. Kim, "Trustworthy Building Fire Detection Framework With Simulation-Based Learning," IEEE Access, vol. 9, pp. 55777-55791, Apr. 2021.

[4] J. Desikan, S. K. Singh, A. Jayanthiladevi, S. Singh, and B. Yoon, "Dempster Shafer-Empowered Machine Learning-Based Scheme for Reducing Fire Risks in IoT-Enabled Industrial Environments," IEEE Access, vol. 13, pp. 46546-46560, Mar. 2025.

[5] A. O. M. Shamsuddoha, S. Sadman, M. H. Anik, and M. Rahman, "Smoke Detection System," SlideShare Presentation, 2017.

[6] R. Divya, B. Kalyan Kumar, G. Vishnu Yadav, and M. Mudassir, "IoT Based Fire Department Alerting System," SlideShare Presentation, 2025.