

# IoT Based Fire and Smoke Detection using Alarm and App Notification

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**Abstract**—Fire accidents cause serious damage to life and property, especially in residential and industrial areas. Early detection of fire and smoke can help reduce losses. This project presents an IoT-based fire and smoke detection system that continuously monitors environmental conditions using sensors. When fire or smoke is detected, the system triggers an alarm and sends a notification to the user's mobile device. The proposed system is cost-effective, easy to install, and suitable for homes, offices, and small industries. threshold, the system automatically generates alerts to authorities and displays warning messages for users.

**Keywords**—Internet of Things (IoT), Fire Detection System, Smoke Sensor, Temperature Sensor, Smart Alarm System, Mobile Application Notification, Real-Time Monitoring, Wireless Sensor Network, ESP8266/ESP32, Safety Monitoring System, Smart Home Safety, Early Fire Warning System

## I. INTRODUCTION

Fire safety is a critical concern in modern society due to the increased use of electrical appliances, industrial machinery, and flammable materials. Fire incidents often occur unexpectedly and spread rapidly, leading to serious damage. Early detection plays a vital role in minimizing losses and ensuring human safety.

With the advancement of Internet of Things (IoT) technology, physical devices can now be connected to the internet for real-time monitoring and control. IoT enables smart systems that can sense environmental changes and respond automatically. In this project, IoT is used to develop a smart fire and smoke detection system that not only triggers a local alarm but also sends alerts to the user's mobile phone, enabling quick action.

With the advent of the Internet of Things (IoT), fire and smoke detection systems have undergone a transformative evolution. IoT technology enables physical sensors and devices to connect to the

internet, allowing real-time monitoring, automated communication, and intelligent responses to environmental changes. Unlike traditional systems, IoT-based fire safety solutions provide continuous, remote monitoring, instant alerts, and integration with other smart devices and building management systems. These capabilities enhance situational awareness, reduce response times, and empower users to take proactive measures before a fire escalates.

In this project, IoT is leveraged to build a smart fire and smoke detection system that triggers a local alarm and simultaneously sends alerts directly to the user's mobile phone. This dual approach ensures that potential fire hazards are detected early, enabling occupants and safety personnel to act quickly and decisively, ultimately reducing risk and improving overall safety.

Traditional fire detection methods often rely on standalone sensors and manual monitoring, which may delay alerting occupants and emergency responders, especially in large or remote structures. This delay can have devastating consequences, as every second counts when a fire breaks out. Early detection is therefore vital not only for quickly initiating evacuation procedures but also for activating safety measures that limit fire spread and protect valuable assets.

## II. LITERATURE SURVEY

i.) Kumar and Sharma (2021) presented a research paper titled "Smart Fire Detection System Using IoT", published in the International Journal for Research in Applied Science & Engineering Technology (IJRASET).

ii.) Jirapure et al. (2023) published "Real Time IoT Based Smoke, Gas and Fire Detection System Using

Mobile App” in the Journal of Embedded Intelligence and Vision Systems (JEIVS).

iii.) Tarhate et al. (2020) published a review paper titled “A Review on IoT Based Approach for Fire Monitoring System” in the International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSCEIT)

iv.) Gond et al. (2022) presented “Gas Leakage and Fire Detection Using IoT” in the International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET).

### III. METHODOLOGY

The proposed system follows a simple and systematic approach to detect fire and smoke using IoT technology. The main goal is to design a low-cost, easy-to-use system that can be implemented by students and used in small-scale environments such as homes, laboratories, and classrooms.

#### 1. System Overview

The system continuously monitors the surrounding environment using sensors. When smoke, high temperature, or flame is detected beyond a safe limit, the system immediately activates a local alarm and sends an alert to the user’s mobile phone through the internet. This ensures quick awareness and timely action.

#### 2. Sensor Data Collection

Smoke and temperature sensors are placed in the monitoring area to sense changes in the environment. The smoke sensor detects the presence of smoke or harmful gases.

The temperature sensor monitors sudden increases in temperature that may indicate fire.

These sensors continuously send real-time data to the microcontroller for analysis. Such sensor-based fire detection methods are widely used in earlier research due to their reliability and simplicity.

#### 3. Processing Using Microcontroller

An IoT-enabled microcontroller (such as ESP8266 or ESP32) acts as the brain of the system. It reads sensor values, compares them with predefined threshold levels, and decides whether a fire or smoke condition exists. If the readings remain normal, the system continues monitoring. If the values exceed the safe limit, the system immediately triggers alerts.

#### 4. Decision Making and Alert Generation

Once abnormal conditions are detected: A buzzer and LED are activated to alert people nearby. At the same time, the microcontroller sends a warning message to the user’s mobile phone via the internet. This dual alert mechanism ensures safety even if the user is not physically present at the location.

#### 5. Mobile Notification and Remote Monitoring

The system uses Wi-Fi connectivity to send real-time notifications through cloud services or mobile applications. This allows users to receive alerts instantly, regardless of their location. Remote monitoring significantly reduces response time and helps prevent major damage.

#### 6. Testing and Validation

The system is tested under controlled conditions by introducing smoke and heat to verify sensor accuracy and response time. Threshold values are adjusted to reduce false alarms and improve reliability. Proper testing ensures the system works efficiently in real world situations.

#### 7. Deployment

After successful testing, the system can be installed in the desired area. Due to its simple design and low cost, it is suitable for student projects, small buildings, and basic safety applications.

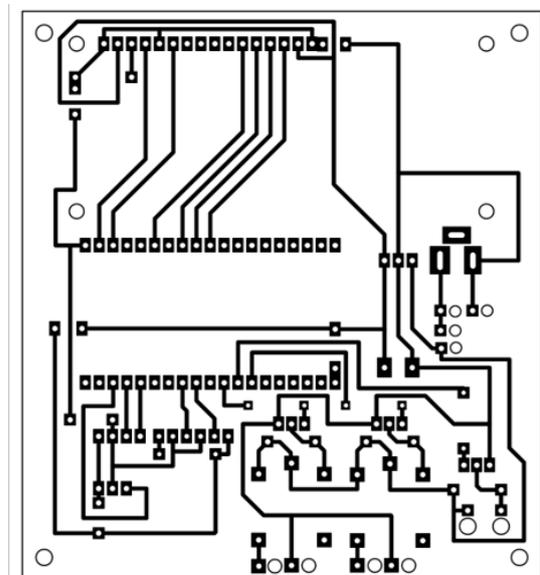


Fig.PCB BLOCK DIAGRAM

### IV. RESULT

After building and testing the IoT-based fire and smoke detection system, the outcomes showed that

the system works effectively in detecting hazardous conditions. When smoke or a sudden rise in temperature was introduced in the testing area, the sensors responded quickly, and the microcontroller was able to identify the abnormal values. As soon as the sensor readings crossed the predefined safety limits, the system activated the local alarm (buzzer and LED), immediately alerting anyone nearby.

At the same time, the IoT connection successfully sent alerts to the user's mobile phone. This real-time notification allowed the user to receive information about the possible fire condition instantly, even when they were away from the location. The remote alert feature worked reliably via Wi-Fi, making it useful for real emergency situations where quick response is critical.

Overall, the system demonstrated that it can accurately detect signs of fire and smoke and generate timely alerts locally as well as remotely. The results confirm that this IoT-based approach enhances traditional fire detection by enabling early warning and real-time monitoring, which are key to preventing loss and ensuring safety. Systems like this have been shown in research to improve responsiveness and awareness compared to traditional smoke detectors alone.

## V. CONCLUSION

In this project, a smart IoT-based fire and smoke detection system was developed to provide early warning of potential fire hazards. By integrating sensors with an internet-connected microcontroller, the system was able to continuously monitor environmental conditions, detect abnormal smoke and temperature levels, and respond promptly. The dual alert mechanism — a local buzzer/LED alarm and remote mobile notifications — ensured that both occupants on site and users away from the location were informed immediately when danger was detected. This approach addresses key limitations of traditional fire detectors, such as lack of real-time remote alerts and dependence solely on local alarms.

The results demonstrated that the system reliably detected fire conditions and delivered alerts in real time, making it suitable for small-scale and low-cost applications such as residential rooms, laboratories, and educational projects. The use of IoT increased the responsiveness and accessibility of fire monitoring,

confirming that smart systems can significantly enhance safety over conventional standalone sensors. Future improvements could include cloud data logging, enhanced sensor fusion for better accuracy, and integration with wider smart building systems.

Overall, the project highlights how affordable IoT technology can be effectively applied to real-world safety challenges, making fire detection more responsive, connected, and user-centric. This aligns with broader trends in research showing that IoT solutions improve early hazard detection and help reduce potential losses.

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