iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** I **Month of publication:** January 2026

DOI: https://doi.org/10.22214/ijraset.2026.77166

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue I Jan 2026- Available at www.ijraset.com

Review on IOT Based Fire Detection System

Akansha Singh[1], Saloni Maheta[2], Shriyash Ninawe[3], Kahekasha Shaikh[4]
Department of Electronic & Tele-Communication, Polytechnic, Ballarpur Institute of Technology, India

Abstract: ***Fire accidents remain a major threat to human life and property, especially in homes, industries, and public spaces. In many cases, the damage becomes severe because fire is not detected at an early stage. To address this issue, this paper presents an IoT-based fire detection system designed to provide fast and reliable fire alerts. The system continuously monitors environmental conditions using flame, smoke, and temperature sensors connected to a microcontroller. When signs of fire are detected, the system instantly sends an alert to the user through the Internet, allowing quick action to be taken even from a remote location. The real-time data can be viewed through a cloud platform or mobile application for better monitoring. Testing results show that the proposed system responds quickly to fire situations while remaining cost-effective and energy efficient. Due to its simplicity, accuracy, and remote monitoring capability, the system is well suited for smart homes, industrial safety, and other safety-critical environments.***

Keywords: Internet of Things (IoT), Fire Detection System, Real-Time Monitoring, Smoke and Flame Sensors, Smart Safety, Remote Alert System.

I. INTRODUCTION

A. Increasing Fire Accidents and Safety Concerns

Fire accidents are a serious threat to human life, property, and the environment. Incidents in homes, industries, offices, and public places often cause heavy losses because fire is not detected at an early stage. Electrical faults, gas leakage, overheating of machines, and human negligence are some of the common reasons for fire accidents. In many cases, fire spreads rapidly before any help arrives, making the situation more dangerous. Therefore, early fire detection is very important to reduce damage and ensure safety.

B. Limitations of Traditional Fire Detection Systems

Traditional fire detection systems mainly rely on local alarms such as bells or sirens. These systems alert people only within a limited area and fail to provide information when no one is present at the location. Manual monitoring and delayed response further reduce their effectiveness. Also, many conventional systems do not support real-time monitoring or remote alerts. Because of these limitations, fire accidents may go unnoticed for a long time, leading to serious consequences.

C. Need for IoT-Based Fire Detection System

To overcome the drawbacks of traditional systems, an IoT-based fire detection system is required. IoT technology enables continuous monitoring and real-time communication through the internet. By using sensors and IoT platforms, fire-related conditions can be detected early and alert messages can be sent instantly to users, even from remote locations. Such a system improves response time, reduces losses, and enhances overall safety. Hence, IoT-based fire detection systems are highly suitable for smart homes, industries, and modern safety applications.

II. BASIC CONCEPTS OF IOT BASED FIRE DETECTION SYSTEM

A. Overview of Fire Detection System

An IoT-based fire detection system is an automated safety system that monitors environmental conditions to detect fire. It uses sensors to sense smoke, flame, and temperature, and a microcontroller to process the data. The system is connected to the internet for remote monitoring and alert generation.

B. Role of Sensors

Flame sensors detect the presence of fire or flame. Smoke sensors identify smoke particles in the air, while temperature sensors measure sudden rises in temperature. These sensors provide accurate information about fire-related conditions.

C. Role of Microcontroller and IoT

The microcontroller acts as the control unit of the system. It collects data from sensors, analyzes it, and sends alerts using an IoT platform. IoT enables real-time communication with users through mobile applications or cloud services.

III. WORKING PRINCIPLE OF THE SYSTEM

The system continuously monitors the environment using flame, smoke, and temperature sensors. The sensor outputs are sent to the microcontroller, which compares the values with predefined threshold levels. When any sensor detects abnormal conditions indicating fire, the system immediately triggers an alert. The alert is sent to the user through the internet, and a local alarm such as a buzzer or LED is also activated.

The working of the IoT-based fire detection system begins with continuous monitoring of the surrounding environment. Different sensors such as flame, smoke, and temperature sensors are placed in the area to detect fire-related conditions. These sensors constantly sense changes in their surroundings and generate electrical signals based on the intensity of smoke, flame, or temperature rise. This continuous sensing ensures that even small signs of fire are detected at an early stage.

The signals obtained from the sensors are sent to the microcontroller, which acts as the main control unit of the system. The microcontroller reads the sensor values in real time and compares them with predefined threshold limits stored in its program. These threshold values represent safe environmental conditions. When the sensor readings remain within these limits, the system continues monitoring without any interruption.

If any sensor detects abnormal conditions indicating the presence of fire, such as a sudden increase in temperature, detection of smoke, or flame presence, the microcontroller immediately identifies it as a fire event. At this stage, the system activates local alert devices such as a buzzer or LED to warn people nearby. This immediate local alert helps in quick evacuation and initial fire control.

At the same time, the microcontroller sends the fire detection information to an IoT platform using an internet communication module such as Wi-Fi or GSM. The alert message is delivered to the user's mobile phone or monitoring dashboard in real time. This remote alert feature is highly useful when the user is not physically present at the location.

The system continues monitoring even after the alert is generated. Once the fire condition is cleared and sensor values return to normal levels, the system automatically resets and resumes normal operation. This automated process ensures reliability, reduces human dependency, and provides continuous fire safety monitoring.

IV. SYSTEM DESIGN AND COMPONENT DESCRIPTION

A. Hardware Components

The hardware consists of a microcontroller (such as Arduino or ESP-based board), flame sensor, smoke sensor, temperature sensor, buzzer, LEDs, and an IoT communication module (Wi-Fi or GSM). All components are connected to ensure reliable fire detection and alert generation.

B. Software Design

The system software is developed using embedded programming. The program continuously reads sensor data, compares it with threshold values, and sends alerts through the IoT platform when fire is detected. The software ensures real-time monitoring and quick response.

C. System Integration

Hardware and software components are integrated to work as a complete system. Sensor data processing, alert generation, and internet communication are coordinated efficiently to ensure reliable operation.

V. APPLICATIONS OF IOT BASED FIRE DETECTION SYSTEM

Smart homes and residential buildings
Industrial safety systems
Commercial buildings and offices
Forest fire detection
Hospitals and public infrastructure

VI. ADVANTAGES AND LIMITATIONS

A. *Advantages*

Real-time fire detection
Remote monitoring and alerts
Cost-effective and energy-efficient
Easy installation and maintenance

B. *Limitations*

Internet connectivity is required
Sensor accuracy may vary due to environmental conditions

C. *Possible Improvements*

Integration with automatic fire suppression systems
Use of advanced sensors and AI-based analysis

VII. FUTURE SCOPE

The system can be enhanced by integrating cloud data storage, mobile applications, and smart city platforms. Advanced analytics and machine learning can be used to improve fire prediction and reduce false alarms.

VIII. CONCLUSION

The IoT-based fire detection system provides an efficient and reliable solution for early fire detection and safety management. By combining sensors with IoT technology, the system enables real-time monitoring and instant alerts. This helps in reducing damage, protecting lives, and improving fire safety in various environments.

The IoT-based fire detection system presented in this work provides an effective and reliable solution for early fire detection and safety management. By continuously monitoring fire-related parameters such as smoke, flame, and temperature, the system is capable of identifying fire incidents at an early stage. The integration of IoT technology enables real-time alerts and remote monitoring, which significantly improves response time. This timely detection helps in minimizing damage to life and property and enhances overall safety in residential, industrial, and public environments.

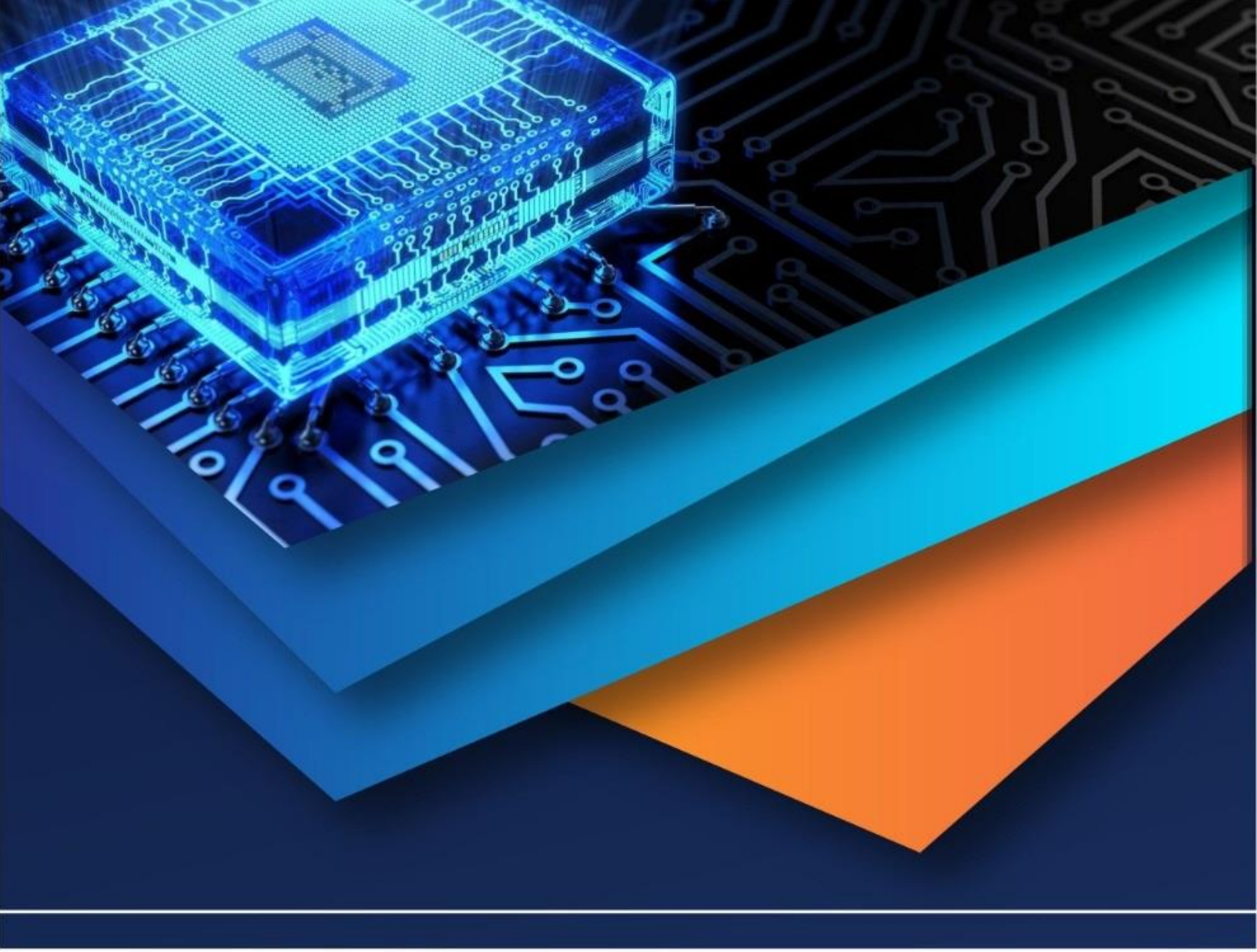
IX. ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my project guide Ms. Sandhya Meshram and faculty members for their guidance and support throughout the completion of this project. I am also thankful to my team members and family for their encouragement and cooperation.

Their technical knowledge and support helped me understand the concepts clearly and complete the work successfully. I am also thankful to the Head of the Department Mr. Balvir Chand and all the faculty members for providing the necessary facilities, academic support, and a positive learning environment.

REFERENCES

[1] Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education, India.
[2] Muhammad Ali Mazidi, Sarmad Naimi, and Sepehr Naimi, The AVR Microcontroller and Embedded Systems, Pearson Education.
[3] Douglas V. Hall, Microprocessors and Interfacing: Programming and Hardware, McGraw-Hill Education.
[4] Arduino Uno Technical Documentation and Hardware Reference Manual.
[5] ESP8266 / ESP32 Wi-Fi Module Datasheet and Technical Specifications.
[6] Smoke Sensor (MQ-2 / MQ-135) Datasheet and Application Notes.
[7] Flame Sensor Module Technical Specifications and Working Principles.
[8] Temperature Sensor (LM35 / DHT11) Datasheet and User Guide.
[9] Internet of Things (IoT): Architecture, Applications, and Security Concepts, Reference Notes.
[10] Fire Safety Standards and Guidelines, Government and Safety Authority Publications.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY