

A NOVEL DESIGN FOR A FIRE DETECTION SYSTEM BASED ON ARDUINO UNO

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Abstract: This project proposes an automated Fire Detection System using Arduino Uno to enhance fire safety by leveraging flame and smoke sensors for early detection. The system activates an alarm and water pump when fire is detected, providing an affordable and effective solution. Built using an Arduino Uno microcontroller, this system ensures real-time fire detection and rapid response. It is scalable and suitable for various environments.

Keywords: Fire Detection, Arduino Uno, Flame Sensor, Smoke Sensor, Microcontroller, Safety, Early Warning.

1. Introduction

Fires pose significant risks to both life and property, especially when not detected promptly. Traditional fire detection systems require human intervention, causing delays in response times. Automated systems can mitigate this by detecting fire in its early stages and triggering immediate alarms. This project focuses on creating an Arduino-based Fire Detection System using flame and smoke sensors, which promptly detect fire and alert occupants through an alarm system. The Arduino Uno acts as the central processing unit, receiving signals from the sensors and controlling outputs such as alarms and water pumps. Given the simplicity and affordability of the system, it is a viable solution for various settings, including residential and industrial spaces.

2. Methodology

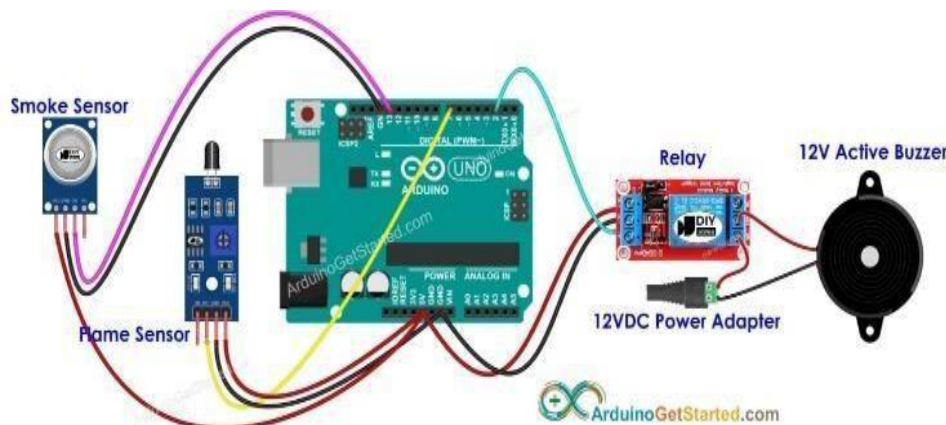


Fig a: Circuit Diagram of Fire Detection System

2.1 Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328P. It includes digital I/O pins,

analog inputs, and a USB interface, allowing it to process sensor data and trigger actions like activating alarms and water pumps when fire is detected.

2.2 Flame and Smoke Sensors

Flame Sensor: The flame sensor detects infrared radiation in the 760nm to 1100nm range, which is typical of flames. It converts this signal into a voltage output that is processed by the Arduino to detect fires.

Smoke Sensor: The smoke sensor detects particulate matter generated by fires. By sensing changes in air quality through a SnO₂ semiconductor, the sensor alerts the Arduino when harmful gases are detected.

3. System Design and Implementation

The core components of the system are:

Arduino Uno Microcontroller: Controls the system by reading sensor inputs and activating alarms.

Flame Sensor: Detects flames and sends signals to the Arduino.

Smoke Sensor: Detects smoke particles in the air. **9V Battery:** Powers the system.

Buzzer: Alerts users with an audible alarm when fire is detected.

Water Pump: Suppresses fire by releasing water when triggered by the Arduino.

4. Results

The system was tested under controlled fire conditions, and it successfully detected both flames and smoke. The system activated the buzzer, providing immediate auditory feedback, and the water pump was triggered, helping to contain the fire.

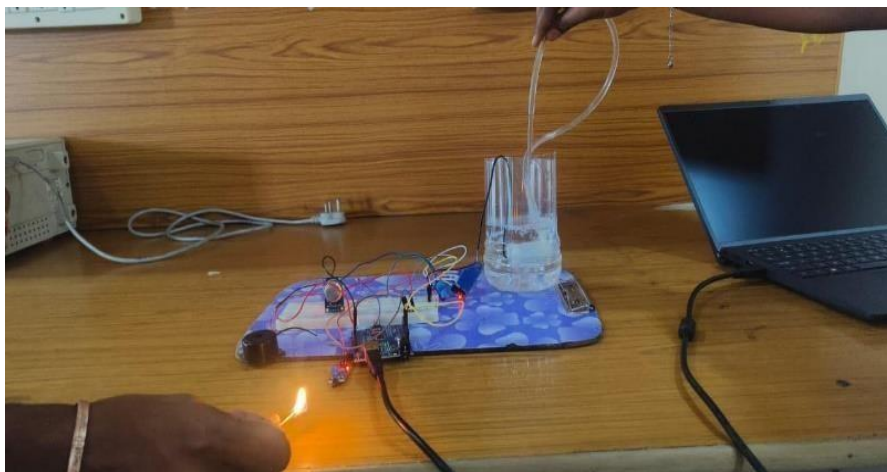


Fig b: Final Output Representation

5. Discussion

The Fire Detection System using Arduino Uno provides a cost-effective alternative to traditional fire detection systems. By integrating flame and smoke sensors with Arduino technology, the system offers rapid response capabilities, ensuring that fires can be detected early. The modular design allows for scalability, and future versions could incorporate IoT for remote monitoring or GSM modules for alerting emergency services.

6. Conclusion

This project successfully developed a fire detection system capable of identifying fire hazards through flame and smoke sensors. The Arduino-based system ensures timely warnings and enables fire suppression, making it suitable for a wide range of environments. Future developments could include the integration of IoT technologies for enhanced functionality.

7. References

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