

Fire Detector Robot

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Abstract: *Fire accidents cause severe damage to life and property. Early detection and quick response are crucial in minimizing losses. This paper presents the design and development of a Fire Detector Robot capable of detecting fire and extinguishing it autonomously. The system integrates sensors, microcontrollers, and actuators to perform efficient fire monitoring and control operations. The proposed robot can be deployed in hazardous environments where human intervention is risky.*

Keywords: Fire Detection, Flame Sensor, Arduino, Robot, Automation, Safety System

I. INTRODUCTION

Fire safety is an essential aspect of industrial and domestic environments. Traditional fire detection systems such as smoke detectors provide limited functionality as they only trigger alarms. The objective of this project is to develop a mobile fire detection robot that not only senses the presence of fire but also navigates towards the source and extinguishes it. This autonomous system enhances safety by preventing fire from spreading and can operate in locations unsafe for humans.

II. LITERATURE REVIEW

Several researchers have proposed fire-detection systems using flame sensors and cameras. Some systems use wireless networks for alerting, while others integrate extinguishing mechanisms. However, many of these models are either stationary or require manual control. This project aims to overcome these limitations by developing a low-cost, autonomous mobile robot that detects and extinguishes fires using sensor integration and microcontroller-based control.

III. METHODOLOGY

3.1 Components Used

- Microcontroller: Arduino Uno
- Sensors: Flame Sensor, Temperature Sensor (LM35)
- Motor Driver: L298N module
- Motors: DC Geared Motors for movement
- Extinguisher System: Mini water pump or DC fan
- Power Supply: 12V battery
- Chassis: Four-wheel robot base

3.2 Working Principle

1. The flame sensor detects infrared radiation emitted by fire.
2. When the sensor output crosses a defined threshold, the microcontroller activates the movement system to approach the fire source.
3. The temperature sensor confirms the heat intensity for better accuracy.
4. Once the robot reaches a safe distance from the fire, it triggers the water pump/fan to extinguish the flame.
5. After the fire is put out, the robot stops and returns to standby mode.



IV. CIRCUIT DESIGN

The circuit connects the flame sensor and LM35 to analog input pins of the Arduino. The L298N driver controls the DC motors for directional movement. The output pin of the Arduino is connected to a relay that activates the water pump or fan. The circuit is powered by a 12V rechargeable battery.

V. RESULTS AND DISCUSSION

The robot successfully detected and extinguished small fires during testing. It was able to sense a flame from up to 80–100 cm away and approach it autonomously. The system worked efficiently on smooth surfaces and responded within 2–3 seconds of fire detection. The response time and accuracy depend on sensor sensitivity and ambient light conditions.

VI. APPLICATIONS

- Fire detection in laboratories, industries, and offices
- Rescue operations in hazardous zones
- Domestic safety in kitchens and electrical rooms
- Use in autonomous surveillance systems

VII. CONCLUSION

The fire detector robot provides an effective, low-cost, and autonomous solution for fire safety. By integrating simple electronic components and sensors, the robot can detect, approach, and extinguish fire without human intervention. Future enhancements may include the addition of a camera module, wireless control, and AI-based navigation for better performance in complex environments.

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