

Fire Detection and Automatic Extinguisher Car System

Dr.R.Poornachandran¹, Jeeva A ², Kubendra S ³, Mithun Maharaj M⁴, Mugesh K ⁵, Mukesh J ⁶

¹Department of Electronics and Communication Engineering, V.S.B .Engineering College, Karur, India.

Email ID : poornachandran6493@gmail.com

²Department of Electronics and Communication Engineering V.S.B .Engineering College, Karur, India.

Email ID : ajeewa712@gmail.com

³Department of Electronics and Communication Engineering, V.S.B .Engineering College, Karur, India.

Email ID : kubendrakubi62@gmail.com

⁴Department of Electronics and Communication Engineering, V.S.B .Engineering College, Karur, India.

Email ID : mithunmaharajecevsb@gmail.com

⁵Department of Electronics and Communication Engineering V.S.B .Engineering College, Karur, India.

Email ID : mugeshkalaimani@gmail.com

⁶Department of Electronics and Communication Engineering, V.S.B .Engineering College, Karur, India.

Email ID : mukeshmass107@gmail.com

ABSTRACT

Fire accidents cause severe damage to life, property, and the environment. This paper presents a fire detection and automatic extinguisher car system that integrates sensors, embedded control, and robotic mobility. The system detects fire using flame, smoke, and temperature sensors and autonomously navigates toward the fire source to extinguish it. Wireless communication enables real-time alerts and monitoring. Experimental evaluation shows that the proposed system achieves fast response, accurate detection, and effective fire suppression while reducing risks to human firefighters.

Keywords: Fire detection, extinguisher car, firefighting robot, IoT, safety system.

1. INTRODUCTION:

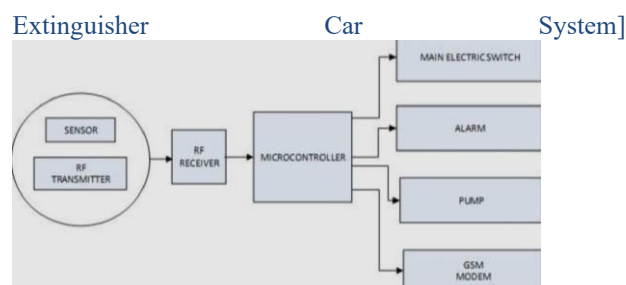
Fire safety is a major concern in industrial, residential, and public environments. Conventional fire detection systems are mostly stationary and rely heavily on human intervention. Delayed response often results in increased damage. With advances in embedded systems, robotics, and IoT, mobile firefighting solutions such as extinguisher cars provide faster response and safer fire control [1].

2. LITERATURE REVIEW

Various fire detection techniques using smoke, heat, and flame sensors have been reported in literature. IoT-based systems provide remote alerts and monitoring [2]. Robotic firefighting systems further improve safety by reducing human exposure. However, high cost and complexity limit adoption. This work focuses on a low-cost, sensor-based extinguisher car suitable for real-world deployment.

3. SYSTEM ARCHITECTURE

The proposed system consists of sensing, control, mobility, communication, and extinguishing modules. Figure 1 illustrates the block diagram of the system. [Figure 1: Block Diagram of Fire Detection and



4. HARDWARE DESIGN

Flame sensors detect infrared radiation, smoke sensors identify combustion particles, and temperature sensors measure ambient heat. A microcontroller processes sensor data and controls DC motors through a motor driver. A relay module activates the extinguisher.

5. SOFTWARE DESIGN AND ALGORITHM

The control algorithm continuously monitors sensor values. When thresholds are exceeded, fire confirmation logic is executed. The extinguisher car navigates toward the fire source using directional sensing. Figure 2 shows the system flowchart. [Figure 2: Flowchart of System Operation]

6. METHODOLOGY

The system operates in four stages: detection, decision-making, navigation, and extinguishing. Sensor fusion improves detection accuracy. Once fire is confirmed, the robot moves toward the fire and activates the extinguisher at a safe distance.

7. RESULTS AND DISCUSSION

Experimental testing under controlled fire conditions demonstrated reliable detection and fast response. The average detection time was significantly lower than manual systems. The extinguisher car effectively suppressed small to medium fires.

8. APPLICATIONS

Applications include industrial plants, warehouses, parking areas, tunnels, residential buildings, and fire extinguisher cars used in hazardous environments.

9. ADVANTAGES AND LIMITATIONS

The system offers fast response, reduced human risk, mobility, and low cost. Limitations include restricted operation in uneven terrain and limited extinguishing capacity.

10. FUTURE SCOPE

Future work includes AI-based fire detection using cameras, GPS-based navigation, cloud integration, and multi-agent firefighting robots.

11. CONCLUSION

The fire detection and automatic extinguisher car system demonstrates an effective approach to modern firefighting. By combining sensing, robotics, and IoT, the system enhances safety and minimizes damage.

REFERENCES

1. J. Smith et al., "Robotic Fire Fighting Systems," IEEE Trans. Safety Eng., 2021.
2. A. Kumar and R. Patel, "IoT-Based Fire Detection," IEEE Conf. Smart Systems, 2022.
3. L. Wang, "Autonomous Fire Extinguisher Robots," IEEE Robotics Conf., 2020