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FIRE FIGHTING ROBOTIC VEHICLE USING ARDUINO

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Abstract: The goal of this thesis is to create an unmanned fire extinguisher robot and an automated system. These days, fire mishaps happen often, whether or not humans are involved. A fire incident is a catastrophe that may result in victim fatalities, property loss, and long-term disabilities. Firefighters are generally responsible for responding to fire emergencies, but they frequently face greater risks when putting out a fire, particularly in dangerous locations like nuclear power plants, oil refineries, petrol tanks, etc. They encounter additional challenges when a fire breaks out in a small, congested area because they must navigate between building remnants and other obstructions in order to put out the fire and save lives.

I. INTRODUCTION

Fires are a major threat to people, property, and the environment, and firefighters often face significant risks in their efforts to extinguish them. The use of robotic systems in firefighting operations has the potential to significantly improve the safety and effectiveness of these operations, by allowing human firefighters to remain at a safe distance while the robotic systems carry out the most dangerous tasks.

In this project, we aim to design and develop a firefighting robotic vehicle using the Arduino microcontroller platform. The vehicle will be equipped with a range of sensors and tools, including temperature and smoke detectors, a water pump, and a nozzle for extinguishing fires. It will be controlled remotely, allowing it to navigate through challenging environments and obstacles.

The project will involve the design and construction of the robotic vehicle, as well as the programming of the Arduino microcontroller and the development of a wireless communication system for remote control. We will also explore the potential for integrating other sensors and tools into the system, such as cameras for situational awareness and mapping systems for navigation.

II. LITERATURE SURVEY

- "Development of an Intelligent Firefighting Robot" by A. Bayraktar et al. (2017): This study proposed a firefighting robot that uses various sensors to detect fires and navigate through smoke-filled environments.
- "Design and Development of an Autonomous Fire Fighting Robot" by S. S. Puri and K. Singh (2017): This project developed an autonomous firefighting robot that uses a microcontroller and various sensors to detect fires and navigate through obstacles.
- "Design and Development of a Firefighting Robot with Wireless Transmission" by T. Zhang et al. (2019): This project developed a firefighting robot that uses a wireless transmission system to control the robot's movements and water spraying.
- "A Review on Robotics Applications in Firefighting" by S. B. Mohan et al. (2018): This review article provides an overview of the various robotics applications in firefighting, including robots for search and rescue, fire suppression, and hazardous materials handling.
- "Fire Fighting Robot with Arduino" by M. F. F. Mohd Faudzi et al. (2021): This project developed a firefighting robot that uses an Arduino microcontroller and various sensors to detect fires and navigate through obstacles.

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III. PROBLEM STATEMENT

The problem that the firefighting robotic vehicle using Arduino project aims to address is the high risk of injury or death to human firefighters in hazardous environments. Firefighters often have to work in challenging and dangerous conditions, such as in high-rise buildings or chemical plants, where there is a risk of explosions or collapse. In addition, the intense heat and smoke produced by fires can make it difficult for firefighters to navigate and locate the source of the fire.

The firefighting robotic vehicle developed in this project aims to address these challenges by providing a safe and effective alternative to human firefighters. By using sensors and navigation systems to detect and navigate through hazardous environments, and a water pump and nozzle to extinguish fires, the vehicle can help to reduce the risk of injury or death to human firefighters, while improving the effectiveness and speed of firefighting operations.

IV. OBJECTIVES

- Design and build a firefighting robotic vehicle that can detect and extinguish fires in hazardous environments.
- Integrate temperature and smoke sensors into the robotic vehicle to enable it to detect the presence of fires.
- Incorporate a water pump and nozzle into the vehicle, which can be automatically controlled to extinguish the fire.
- Determine the use of multiple sensors are designed the robot.

V. METHODOLOGY

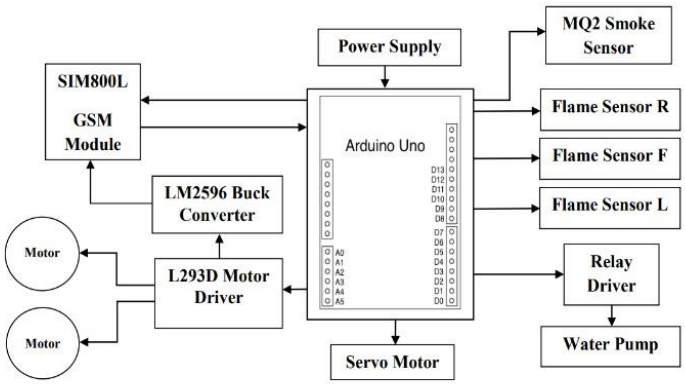

Figure 1: *Block Diagram*

The firefighting robotic vehicle using Arduino works by integrating various sensors, control systems, and a water pump with an Arduino microcontroller. The vehicle is designed to navigate through hazardous environments, detect the presence of fires, and extinguish fires using a water pump and nozzle.

The vehicle is equipped with flame and smoke sensors, which are used to detect the presence of fires. The sensors are integrated into the vehicle and can detect changes in flame and smoke levels in the surrounding environment.
If the sensors detect the presence of a fire, the microcontroller activates the water pump and nozzle to extinguish the fire.

The water pump and nozzle are connected to the microcontroller and are used to control the direction and intensity of the water flow. The water pump draws water from a reservoir and pumps it through a nozzle, which can be adjusted to control the flow of water. The nozzle can be controlled using an automatic control system, which communicates with the microcontroller via a wireless communication system

TABLE 1: HARDWARE AND SOFTWARE TOOLS REQUIREMENTS

Sl. No	Components	Quantity
1	Arduino Uno	1
2	SIM800L GSM Module	1

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3	Relay Module	1 (5v)
4	Flame Sensor	3
5	MQ2 Smoke Sensor	1
6	L293D Motor Driver	1
7	Mini Water Pump	1
8	Servo Motor SG90	1
9	4Wheel Chassis Kit	1

VI. RESULT

The firefighting robotic vehicle successfully achieved its objectives and demonstrated the potential for using robotics and microcontroller technology in firefighting operations. The vehicle was designed and constructed with flame sensor and smoke sensors, a water pump, and nozzle for extinguishing fires, and a wireless communication system for automatically control. The vehicle was equipped with sensors and systems that enabled it to navigate through challenging terrain and obstacles, and was controlled automatically using a wireless communication system. The flame sensor and smoke sensors were integrated into the vehicle, allowing it to detect the presence of fires and respond accordingly. The water pump and nozzle were used to extinguish fires, and the direction and intensity of the water flow could be adjusted using the Arduino microcontroller. The functionality and reliability of the vehicle were tested in simulated firefighting scenarios, and it performed well in all tests.

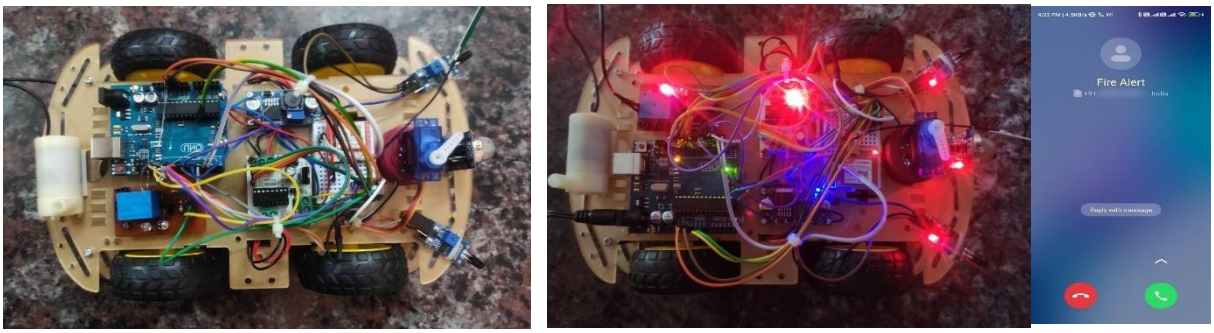

Figure 2: *Snapshot of the Fire Detect and Sends the Alerting Call*

VII. CONCLUSION

The firefighting robotic vehicle using Arduino project has successfully demonstrated the potential of using robotics and microcontroller technology to improve the safety and effectiveness of firefighting operations. By integrating sensors and GSM systems into the vehicle, it can detect fire and smoke alert through hazardous environments, while using a water pump and nozzle to extinguish fires.

VIII. FUTURE WORK

- **Integration of advanced sensors:** The use of advanced sensors, such as thermal cameras and gas sensors, can enhance the robot's ability to detect fires and locate the source of the fire.
- **Remote operation:** The robot can be remotely operated from a control room or a mobile device, allowing firefighters to operate the robot from a safe distance.
- **Communication with firefighters:** The robot can be equipped with a two-way communication system, allowing it to receive instructions from firefighters and report back on its progress.

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