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Fire Fighting Robot

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Abstract: ***There is no doubt that firefighting is an important job, but it is also a very dangerous occupation. The absence of human beings in detection of fire usually leads to a huge damage. This project aims to design a firefighting robot that can operate remotely.***
The development of Fire Fighting Robot consists of two elements i.e., hardware and programming. The prototype robot has four 100 rpm Battery Operated motors for driving system. Additionally, ATmega328P microprocessor also interfaces with various sensors namely MQ2 gas sensor, Flame sensor as feedback to the robot. With the assistance of a microcontroller, each guidance for controlling movement is given to the robot, with this assistance the robot can douse the fire. This paper illustrates the working and modelling of an Automated Fire Fighting Robot prototype.
Keywords: Fire Fighting Robot, Flame sensor, Smoke sensor, Safety, Fire Distinguisher

I. INTRODUCTION

Robots can be defined Robots can be defined as machine resembling a human being but capable of performing complex assignments. In hazardous jobs like firefighting robots can be of significant service. Fire Fighting is an imaginary gameplay of firefighter rescuing the victims and stopping the fire as soon as possible. Many of the times wide reaching fire mishaps commence due to small fire flame leading to the much more vandalization.
The stated firefighting robot is competent of detecting the smoke raised in the air due to flame, with the help of smoke sensor MQ2. Likewise, presence of the fire can be detected by the robot with flame sensors intact on anterior of the prototype robot.
Fire detected gets douse with water from water tank mounted on the robot.
The robot firefighter is designed to look for fire in small houses of specific dimensions. An ideal firefighting robot is also capable of warn the service man about the outrage via SMS or a call. Water pump sprays water on the fire to stop it from further spreading. In addition to being able to be installed in homes, laboratories, stores, shops, etc., firefighting robot is easily portable and can be used once installed.

II. LITERATURE REVIEW

The automatic fire fighting robot consists of hardware and software design. The hardware part deals with the mechanical and construction design, electric and electronic circuitry. The software parts deals with the programming [1]. Fire-fighting robots can take many forms, but typically consist of a robotic vehicle with a fire-extinguishing payload, such as a water cannon, foam sprayer, or CO2 gas dispenser.
These robots can be operated remotely or autonomously, and are usually equipped with cameras and sensors to help them navigate and detect fires. Some robots are even capable of performing basic search-and-rescue operations, such as locating victims and carrying them to safety.
This robot integrates the idea of natural fire detection and corresponding engine control. In order for the robot to be controlled bidirectionally, it makes use of the engine driver. With the assistance of a microcontroller, each guidance for controlling movement is given to the robot [2]. The use of fire-fighting robots has several advantages over traditional firefighting techniques. For example, robots can operate in hazardous environments without putting human firefighters at risk. They can also be used to monitor a fire in real-time, allowing firefighters to better contain and extinguish the blaze. Finally, robots can be used in situations where human access is not possible, such as in collapsed buildings or in remote locations. The paper aims to motivate the robotics community to develop a real-world application based on what it can accomplish [3]. In addition to being able to be installed in homes, laboratories, stores, shops, etc., firefighting robot is easily portable and can be used once installed [4].

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III. METHODOLOGY/ EXPERIMENTAL

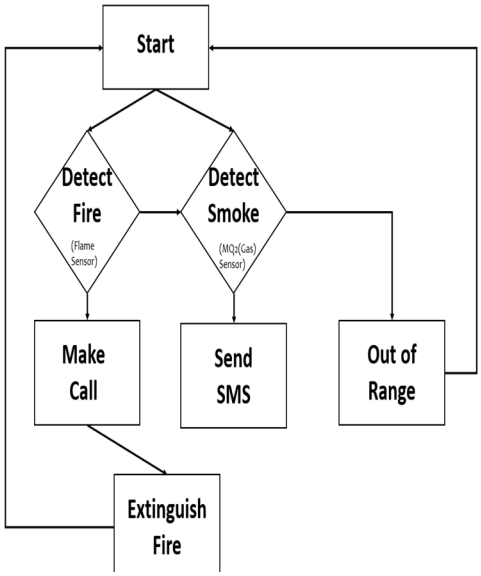

Figure1. Methodology of Working

Firefighting robots are becoming an increasingly important tool in the fight against dangerous fires. Fire robots are designed to replace humans in hazardous environments, allowing firefighters to achieve a greater degree of safety while still providing effective firefighting. Fire robots can be used to navigate dangerous environments and provide assistance in extinguishing fires. This paper will review existing literature on firefighting robots, focusing on the technical aspects of their design and operation, as well as the potential implications for firefighting safety and efficiency. Firefighting robots are typically equipped with sensors and actuators that allow them to detect and respond to fire-related events. Sensors used by fire robots include visual and infrared cameras, temperature sensors, and air quality sensors. These sensors allow the fire robot to detect the presence of smoke or heat, as well as identify the location and intensity of a fire. Actuators allow the robot to navigate the environment and extinguish fires. Common actuators used by fire robots include motors, pumps, and valves. In addition to sensors and actuators, fire robots are also equipped with a fire extinguishing system. This system typically consists of a separate container for each type of extinguishing agent, as well as a nozzle or other delivery system. Common extinguishing agents used by fire robots include water, foam, dry chemicals, wet chemicals, and carbon dioxide.

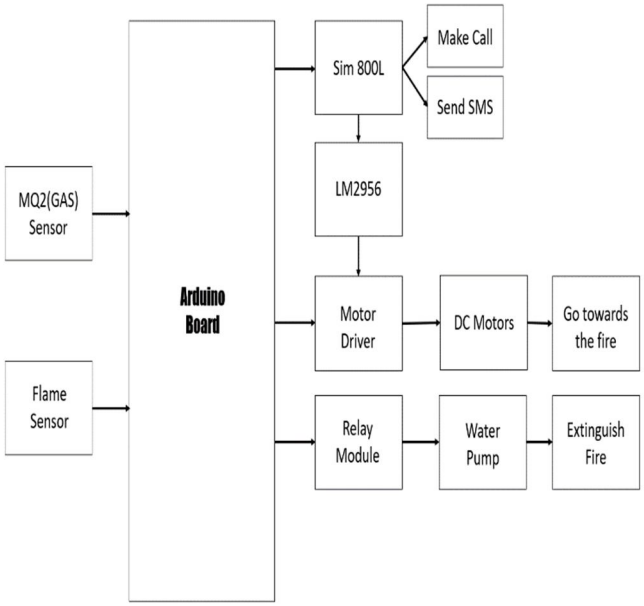

Figure2. Block Diagram

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The firefighting robot uses an Arduino Uno Board as its CPU. When a flame sensor senses a fire, the motor driver is activated, which subsequently engages DC motors, enabling the robot to move closer to the fire.
The system has a fire extinguisher attached. To put out a fire, a relay module is utilized to spray fire extinguisher liquid on it. According to its programming, the cellular module may make a phone call when a fire is detected and send an SMS when a smoke sensor detects smoke.

IV. ADVANTAGES

1) *Faster Response Time:* Firefighting robots are capable of responding to emergency situations faster than human firefighters. This can be especially beneficial in situations where human firefighters may be delayed due to traffic, bad weather, or other factors.
2) *Increased Safety:* Firefighting robots are able to enter dangerous environments that may be too hazardous for human firefighters. This is especially important when dealing with hazardous materials such as chemicals and toxic substances.
3) *Enhanced Mobility:* Firefighting robots are often equipped with powerful motors and can traverse terrain that may be difficult for humans to access. This can be very helpful in situations where the fire is located in an area that is not easily accessible to human firefighters.
4) *Improved Accuracy:* Firefighting robots are typically equipped with sophisticated sensors that can detect fire, heat, and smoke more accurately than the human eye. This helps to ensure that the fire is extinguished quickly and efficiently.
5) *Cost Savings:* Firefighting robots are often cheaper to operate than human firefighters. This can result in significant cost savings in terms of training, equipment, and manpower.

V. LIMITATIONS

1) *Robot's Mobility:* Firefighting robots are typically wheeled, tracked or a combination of both, and they rely on their mobility to move around and reach the fire. However, if the surface is too rough or if there are large obstacles present, the robot may not be able to move around freely.
2) *Limited Reach:* Firefighting robots have limited reach and may not be able to get close enough to put out the fire.
3) Limited Sensors: Firefighting robots have limited sensors and cameras to detect the fire, making it difficult to determine the exact location and size of the fire.
4) *Limited Fire Fighting Capabilities:* Firefighting robots are limited in their firefighting capabilities. They are typically limited to using water, foam, or dry chemical extinguishers, which may not be enough to put out large or intense fires.
5) *High Cost:* Firefighting robots are expensive and may not be affordable for some fire departments.
6) *Safety:* Firefighting robots pose a safety risk to firefighters, as they may not be able to detect hazardous conditions such as smoke or heat.

VI. FUTURE SCOPE

The future of firefighting robots is very promising. In the coming years, it is expected that robots will become increasingly autonomous and will be able to navigate dangerous environments, detect and analyze fires, and take action to extinguish them. Additionally, robots could be used to search and rescue victims, detect hazardous materials, and monitor situations remotely. There is also potential for robots to be equipped with thermal cameras, allowing them to detect hot spots and better direct firefighters on the ground.
Furthermore, the development of artificial intelligence and machine learning could allow robots to make decisions and coordinate with each other in more sophisticated ways. Finally, it is likely that robots will be used in more applications to assist firefighters, such as providing medical aid and helping to contain fires.

VII. CONCLUSION

The firefighting robot is a promising new technology that has the potential to revolutionize the way fire fighters operate. It is capable of navigating through a burning building and locating the source of the fire and extinguishing it quickly and accurately.
Its main advantage is that it can be used in hazardous environments where it would be too dangerous for humans to enter.
It also has the potential to save lives, as it is capable of responding to fires more quickly than human firefighters. Therefore, the firefighting robot is an excellent tool to have in the firefighting arsenal.

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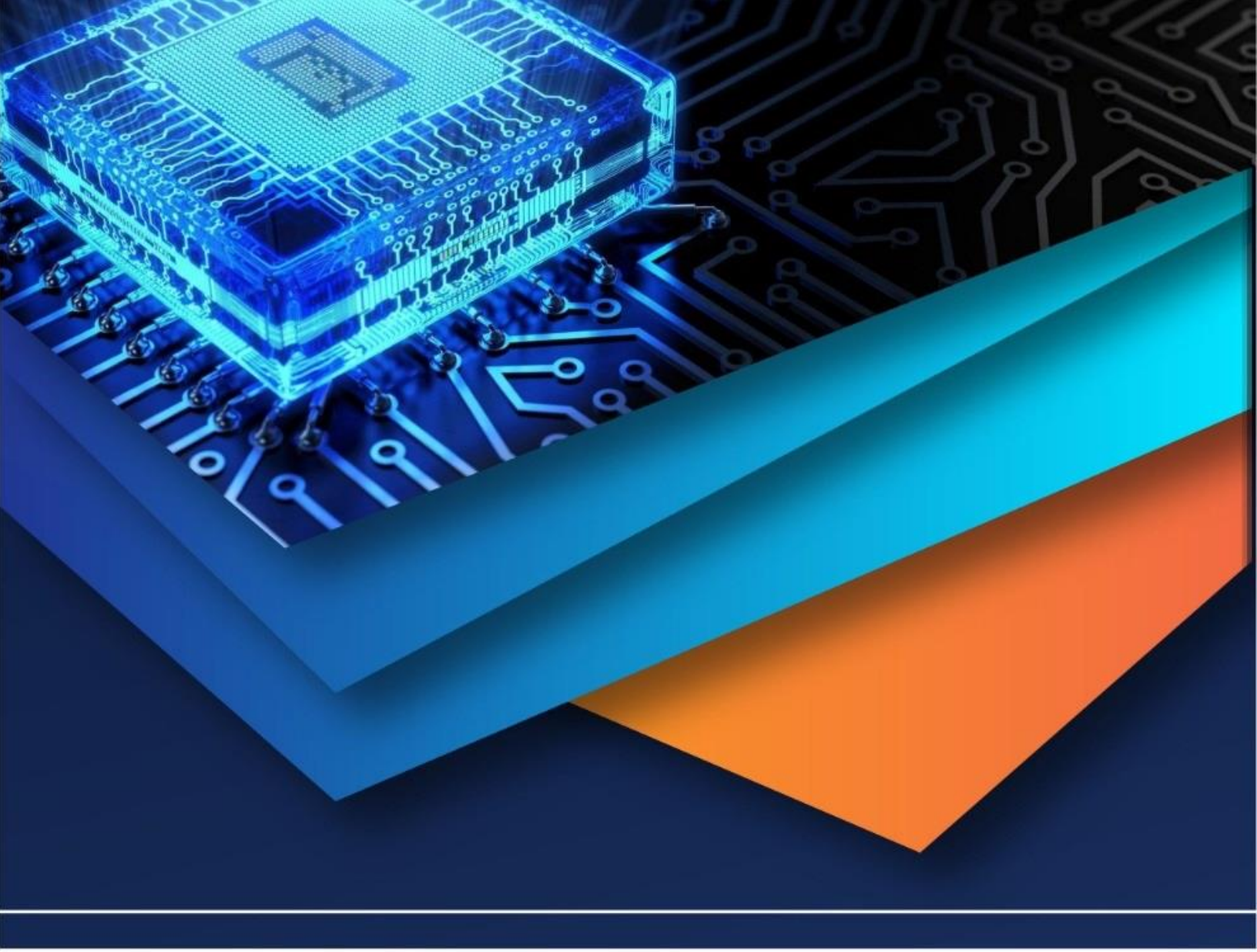

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