



Automatic Fire Fighting Robot

¹Anuj Gupta, ²Priyansh Gupta, ³Mehak Hussain, ⁴Aman Jain, ⁵Aparna Gupta

¹⁻⁴ Research Scholar, ⁵ Professor

Department of Electronics & Communication Engineering

Lakshmi Narain College of Technology & Science, Bhopal, Madhya Pradesh, India

Abstract

Fire assumes a significant job in mortal life still alongside that it's dangerous too. Fire circumstance is a catastrophe that can beget the loss of mortal life, property detriment, and lasting incapacity to the told casualty. Firemen are principally entrusted to deal with the fire circumstance, yet regularly they presented to the advanced troubles when quenching fire particularly in dangerous conditions, for illustration, in atomic force plant, oil painting oil treatment installations, and gas tanks. With the development in the field of robotics, mortal intrusion has come less and robots are being considerably used for safety purpose. In our day- to- day lives, fire accidents have come common and sometimes may lead to hazards that make it hard for the firemen to cover mortal life. In analogous cases, a firefighting robot is used to guard mortal lives, wealth and surroundings from the fire accidents. also, we apply two modes of robotic operations-Automatic mode & Homemade mode. In Automatic mode, the robot takes controls by itself grounded on the stoner predefined command. In Homemade mode, the robot can be controlled by the stoner. therefore, this paper presents the advancement of putting out fires using Robots that can quench the fire without the demand for firemen. Fire incident is a disaster that can potentially cause the loss of life, property damage and permanent disability to the affected victim. Major fire accidents do occur in industries like nuclear power plants, petroleum refineries, gas tanks, chemical factories and other large-scale fire industries resulting in quite serious consequences. Thousands of people have lost their lives in such mishaps. Therefore, this project is enhanced to control fire through a robotic vehicle. With the advancement in the field of Robotics, human intervention is becoming less every day and robots are used widely for purpose of safety. In our day-to-day life fire accidents are very common and sometimes it becomes very difficult for fireman to save human life. In such case firefighting robot comes in picture.

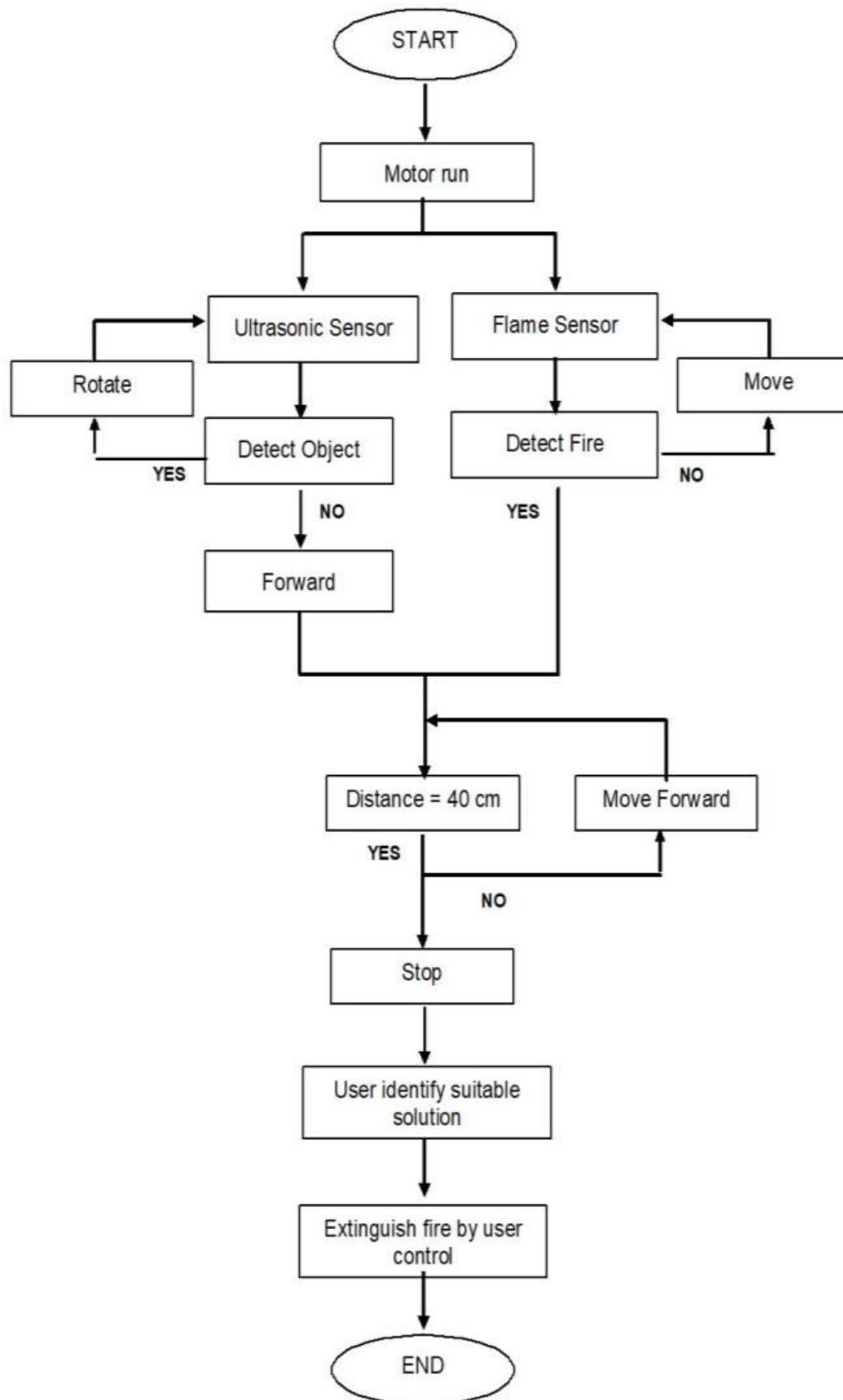
Index Terms - Firefighting robot, compact size robot, ultrasonic sensor, flame sensor, remote control

I. INTRODUCTION:

The design that's being presented is concentrated on a firefighting robot. Robots are able of performing tasks in a more effective, cost-effective, and accurate manner than humans. In the absence of modern hardware and machines, firefighters need to risk their lives to save others' lives in a hazardous situation caused by fire. The firefighting robot is programmed to checkup for and extinguish fires in affected areas. A wireless robot can conduct successful work, allowing the robot to be operated from a distance. As a result of a fire outbreak (or) fire explosion, we're demanding that we use mortal coffers that aren't secure to put out the fire. Its veritably Robots are designed to remove the human factor from Its veritably Robots are designed to remove the human factor from dangerous work and to act in inaccessible environment. The use of robots is more common today. Our task is to design and build a prototype system that could autonomously detect and manually extinguish a fire. This strategy would free firefighters from dangerous tasks, and being jeopardized. The need of Fire extinguisher Robot that can detect and extinguish a fire on its own. Robotics is one of the fastest growing engineering fields of today. Robots are designed to remove the human factor from labour intensive or dangerous work and also to act in inaccessible environment. With the invention of such a device, lives and property can be saved with minimal damage caused by the fire. As an engineer's we have to design a prototype that could autonomously detect the fire and extinguish it. The Fire Fighter Robot is designed to search for a fire in the house or industry for extinguish the fire. The main and only work is to deploy the robot in a fire prone area and the robot will automatically work once it detects a fire breakout. This prototype helps in Rescue operations during fire accidents where the entry of service man is very difficult in the fire prone area. There are several existing types of vehicles for firefighting at home and extinguish forest fires. Our proposed robot is designed to be able to work on its own or be controlled remotely. By using such robots, fire identification and rescue activities can be done with higher security without placing fire fighters at high risk and dangerous conditions. In other words, robots can reduce the need for fire fighters to get into dangerous situations. A recent trend that has become popular is to use robots instead of humans to handle fire hazards. Additionally, the current methods applied in firefighting are inadequate and inefficient relying heavily on humans who are prone to error, no matter how extensively they have been trained. This is mainly because they can be used in situations that are too dangerous for any individual to involve themselves in. In our project, we develop a robot that is able to locate and extinguish fire in a given environment. The robot navigates the area and avoids any obstacles it faces in its excursion. Arduino board acts as a brain of the whole control circuitry. Robot consist of the two sensors that are interfaced in the control circuitry. Sensors are used to detect fire prone area all directions and moves the robot to fire location. When the robot reaches fire zone then a pump extinguisher is attached on the robot comes into action to extinguish the fire.

II. WORK FLOW:

It is the series of activities that are necessary to complete a task. Each step is a work flow has a specific step before it and specific step after it, except for the first and last step.



III. PRINCIPLE:

The principle of a firefighting robot involves utilizing robotics and automation technology to assist in combating fires, minimizing risks to human firefighters, and enhancing the efficiency of firefighting operations. Here are some key principles typically involved in the design and operation of firefighting robots:

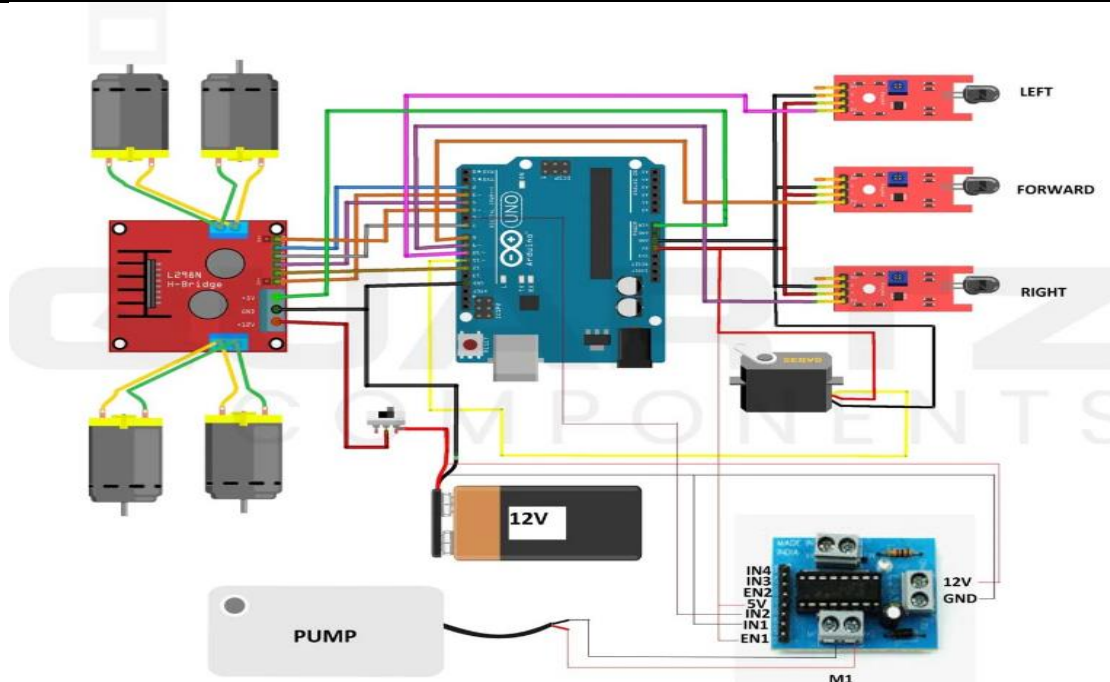
1. **Remote Operation:** Firefighting robots are often designed to be remotely operated by firefighters from a safe distance. This allows firefighters to assess the situation, control the robot's movements, and direct firefighting efforts without directly exposing themselves to danger.
2. **Fire Detection:** Many firefighting robots are equipped with sensors such as thermal cameras and gas detectors to detect the presence of fire, smoke, and hazardous gases. These sensors provide real-time data to firefighters, helping them to locate and assess the extent of the fire.
3. **Fire Suppression:** Firefighting robots may be equipped with various firefighting tools and mechanisms for extinguishing fires. This could include water cannons, foam sprayers, dry chemical dispensers, or even robotic arms capable of manipulating firefighting equipment.
4. **Mobility:** Firefighting robots are designed to be highly mobile and capable of navigating through complex and hazardous environments. They may be equipped with wheels, tracks, or even legs to traverse rough terrain, debris, and obstacles commonly found at fire scenes.
5. **Autonomy:** Some firefighting robots are designed to operate autonomously, using artificial intelligence and advanced algorithms to navigate, detect fires, and suppress them without direct human intervention. Autonomous capabilities can help improve response times and effectiveness, especially in situations where human access is limited or dangerous.
6. **Communication:** Firefighting robots are often equipped with communication systems that allow them to transmit data and receive commands from firefighters and incident commanders. This ensures coordination and collaboration between human firefighters and robotic units during firefighting operations.
7. **Safety Features:** Safety is paramount in firefighting operations, so firefighting robots are typically equipped with features to ensure their safe operation in hazardous environments. This could include heat-resistant materials, redundant systems, and fail-safe mechanisms to prevent malfunctions and accidents.

By adhering to these principles, firefighting robots can play a crucial role in enhancing the effectiveness, safety, and efficiency of firefighting operations, ultimately helping to save lives and protect property.

IV. CIRCUIT OPERATION:

The main goal of this project is to develop a robotic vehicle which is used to extinguish fire in an event of any major fire hazard particularly. Major fire accidents do occur in industries like nuclear power plants, petroleum refineries, gas tanks, chemical factories and other large-scale industries resulting in quite serious consequences. Occasionally its observed that its insolvable for fire- fighting labor force to pierce the point of the fire, indeed as the fire causes tremendous property damage and lose of mortal life, due to high temperatures or the presence of explosive accoutrements. In similar surroundings, fire- fighting robots can be useful for extinguishing a fire. therefore, fire- fighting robot are operated in places where firefighters are unfit to work. Besides that, firefighting robots can be used for guarding fire fighters from extreme peril in Petro- chemical, chemical dangerous product, toxin or explored fire accidents. thus, it also can reduce the mortal injury from environment (IDE), which is common to all Arduino boards and running both online and offline.

1. **Power Supply:** As with manual firefighting robots, an automatic firefighting robot requires a reliable power source. This could be a battery pack, possibly supplemented by alternative power sources like solar panels or fuel cells for extended operation.
2. **Sensor Suite:** The heart of the automatic firefighting robot's circuitry is its sensor suite, which typically includes:
3. **Water Pump:** An electric pump or motorized valve controls the flow of water from the robot's reservoir to the firefighting nozzle.
4. **Nozzle Control:** Servo motors or solenoid valves control the orientation and flow rate of the firefighting nozzle, allowing precise targeting of the fire.
5. **Movement Motors:** If the robot is mobile, motor controllers regulate the movement of wheels, tracks, or legs to navigate towards the fire.
6. **Safety Features:** Safety is paramount in automatic firefighting operations. The circuitry includes safety features such as temperature monitoring to prevent overheating, emergency stop mechanisms in case of malfunctions, and fail-safe systems to ensure safe operation.



V. PROPOSED SYSTEM:

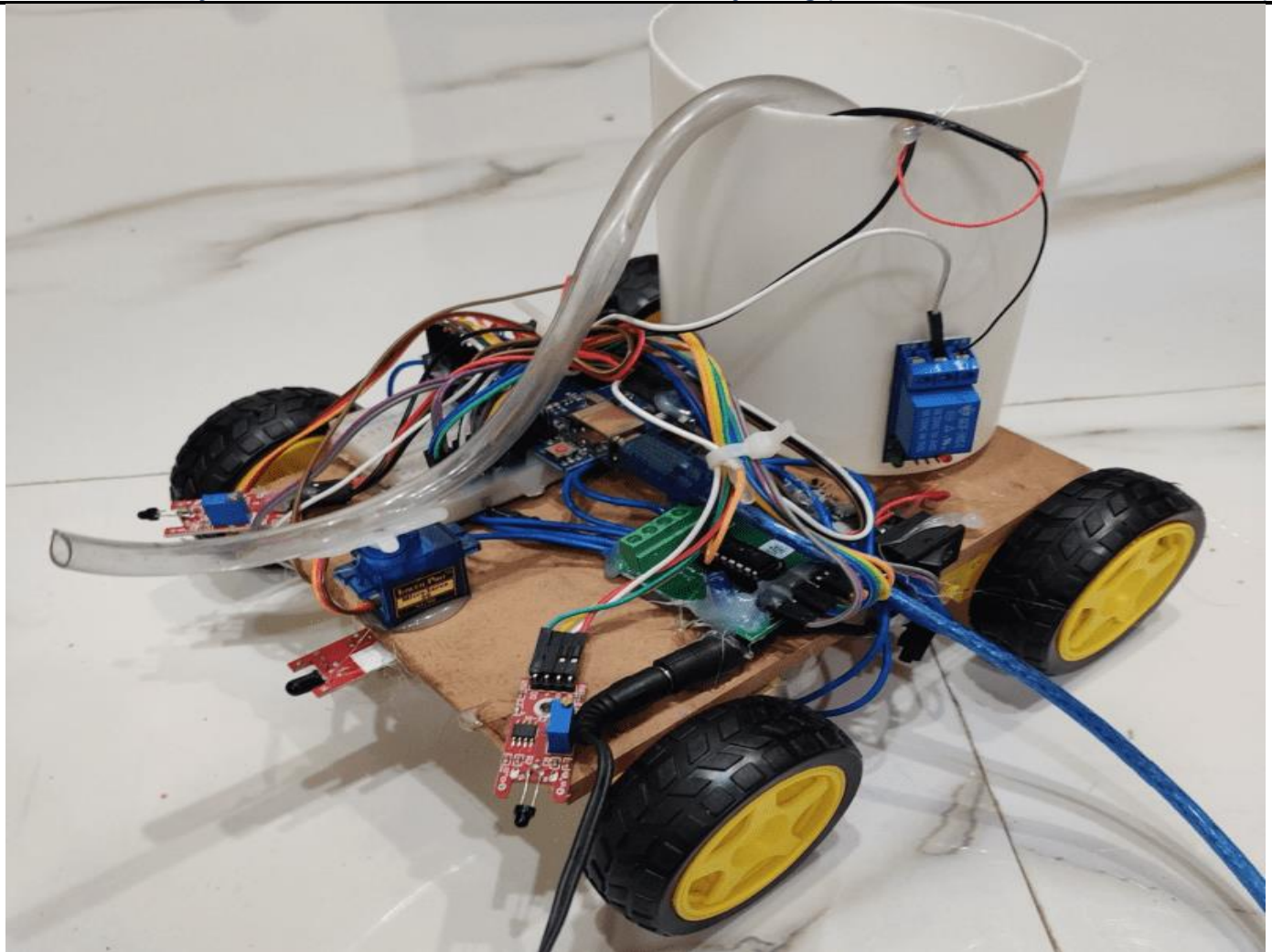
The proposed model is able to detect presence of fire using flame sensor and calculates object distance using ultrasonic sensor and moves the robot to fire accident location. It contains gear motors and motor driver to control the movement of robot. When it detects fire, it communicates with microcontroller (Arduino MEGA) and the robot will move towards the fire affected area. The fire extinguisher is mounted on the robotic vehicle which is then controlled over the wireless communication so that it extinguishes the fire automatically.

ADVANTAGES OF PROPOSED SYSTEM

1. The robot will be used at places where it is dangerous for humans to enter.
2. Capability of sensing accurately with increased flexibility.
3. Reduce human effort.
4. Reliable and economical.
5. It reduces the time delay in reaching fire affected area.
6. It reduces the errors and the limitations that are faced by human fire fighters.
7. Sensors have long life time and less cost.:

VI. RESULT

The development of automatic firefighting robots represents a significant advancement in fire response technology, promising improved safety, efficiency, and effectiveness in combating fires across various scenarios. These robots autonomously detect fires, swiftly analyze the situation, and initiate suppression measures without human intervention. By navigating hazardous environments and suppressing flames rapidly, they minimize risks to human firefighters and mitigate property damage. Their 24/7 availability ensures readiness to respond to fires at any time, while remote operation capabilities allow for safe control from a distance. Automatic firefighting robots can be scaled and customized for different applications, including industrial settings, urban areas, and maritime environments, making them versatile assets in fire response efforts. With their ability to provide rapid, autonomous firefighting assistance, these robots have the potential to revolutionize fire response capabilities, ultimately saving lives and protecting communities from the devastating effects of fire incidents. The integration of artificial intelligence and advanced sensor technologies in automatic firefighting robots offers additional layers of sophistication to their operations. These robots not only detect fires but also analyze environmental conditions in real-time, allowing for adaptive firefighting strategies tailored to the specific characteristics of each fire. Furthermore, their ability to communicate with central command centers and other firefighting units facilitates seamless coordination and collaboration in multi-agency response scenarios. Additionally, automatic firefighting robots contribute to environmental sustainability by reducing the use of water and firefighting agents through targeted and efficient suppression methods. As these robots continue to evolve and become more prevalent, they hold the potential to transform firefighting practices on a global scale, ushering in a new era of enhanced fire response capabilities and ultimately saving more lives and protecting valuable assets in the face of fire emergencies.



VII. CONCLUSIONS

We've enforced an automatic Fire Fighting Robot using detectors and wireless communication. Fire causes tremendous damage and loss of mortal life and property. It is occasionally insolvable for the fire fighter labor force to pierce the sight of fire because of explosive accoutrements, bank and high temperature. Through this we can conclude that robot can be placed where mortal lives are at threat. The robot can operate in the terrain which is out of mortal reach in veritably short time. In similar surroundings, Fire Fighting robots can be useful for extinguishing fire.

The robot directly and efficiently finds the fire within minimal time after the fire is detected. This design presents the design and the perpetration of a firefighting robot that moves towards the fire and pump out water to extinguish the fire. This project describes about the real time firefighting robot which moves in a constant speed, identify the fire and then extinguish it with the help of pumping mechanism. It has advantageous features such as ability to detect location of fire automatically besides having a compact body and lightweight structure.

The robot can be used at a place that has a small entrance or in small spaces because it has a compact structure. The system can potentially be useful to accompany fire fighters and prevent an outbreak. The operator is able to extinguish fire using remote control from longer distance. Operators can also monitor the environmental conditions during the process of firefighting by using the camera. From the experimental results, the robot can sense smokes and fire accurately in a short time.

With their scalability, versatility, and potential for continuous improvement, automatic firefighting robots are poised to revolutionize fire response practices globally. As research and development in this field progress, these robots hold the promise of further advancements, ultimately saving more lives and safeguarding communities against the devastating effects of fire emergencies. In this rapidly evolving landscape, automatic firefighting robots stand as a beacon of hope for more resilient, efficient, and effective firefighting operations in the future.

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