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Roborescue: Intelligent Robotics For Pioneering Fire Detection And Extinguishing Using Arduino

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Abstract: In the modern era, fire hazards pose significant threats to human lives and infrastructure. Traditional firefighting methods often expose individuals to dangerous conditions, necessitating intelligent automation to enhance safety and efficiency. RoboRescue is an innovative robotic system designed to detect and extinguish fires using Arduino-based control mechanisms. Leveraging advanced sensors such as flame detectors, temperature sensors, and gas sensors, RoboRescue autonomously identifies fire outbreaks and assesses environmental risks. The system incorporates real-time processing and decision-making algorithms, enabling swift responses and precision in firefighting operations. Equipped with mobility features, the robot can navigate hazardous environments, avoiding obstacles while delivering targeted fire suppression using water or fire-retardant chemicals. The integration of IoT capabilities ensures remote monitoring and control, allowing firefighters to manage operations from a safe distance. This research highlights the potential of intelligent robotics in revolutionizing fire prevention and mitigation strategies, reducing human intervention in life-threatening scenarios, and paving the way for safer and more effective emergency response systems.

I.INTRODUCTION

- Now a day's mobile robots are very useful in construction sites, warehouses and manufacturing plants. Mobile robots can also be used in material handling applications which applications are growing day by day. For analyzing different items and for handling materials mobile robots can be used.
- Wireless navigation is also possible for movements of mobile robot, can be controlled through android. Fuzzy logic control

mechanism is used to control robot. That model does not need any mathematical model controlling. Previously Fire Fighting Robots were controlled by using different electronics devices .

- But this reduces the scope of control of fire fighting robot .However ,with the advanced techniques we can build the same robot by

using android application to control the actions of the robot . With the help of such robots, fireman's work really decreased and

movements of robot are so much effective. By using an android app fireman man detect the fire and can able to extinguish it .

- At the same time robot can detect the obstacles and can avoid them by using ultrasonic sensors . Our project is designed to build an android application which can control operations of the fire fighting robot . Fireman can send commands to robot through Bluetooth module which ISSN:0377-9254 is mounted on robot itself. Smart phones has facility of Bluetooth, through that Bluetooth fireman can

control the movement of firefighting robot . For fire detection it is using two sensors . One is temperature sensor and second is smoke detector. Fire extinguishing system will be get activated when fire detection system detects fire .Sprinkler will start sprinkling water when it detects fire . At the transmitting end android application is used and at receiving end two motors are interface to micro controller.

- With the ever-increasing technology, the developments are increasing in the face of the situations that cause human life. Every day,

the robot industry emerges as a model that is produced as an alternative to human element in a new branch. Flying, robots, wheeled robots legged robots, humandroid robots, underwater robots are just some of them. The growing world population is bringing involuntary problems together. Fires are among the most important of these problems.

- Robot industry has a lot of work in this area. Some of these are fixed mobile robots with different features, which are equipped with

different sensors that detect before the fire is out, mobile rescue robots as fire search and rescue equipment, mobile locating robots used for fire detection, fire extinguishing robots in many different models designed to assist firefighters in the fire. There are many studies on robotics both in the sector and academically.

II. LITERATURE REVIEW

This is mainly a rear wheel drive type of vehicle. The water container has the capacity to contain at least 1L water. It is m ade of

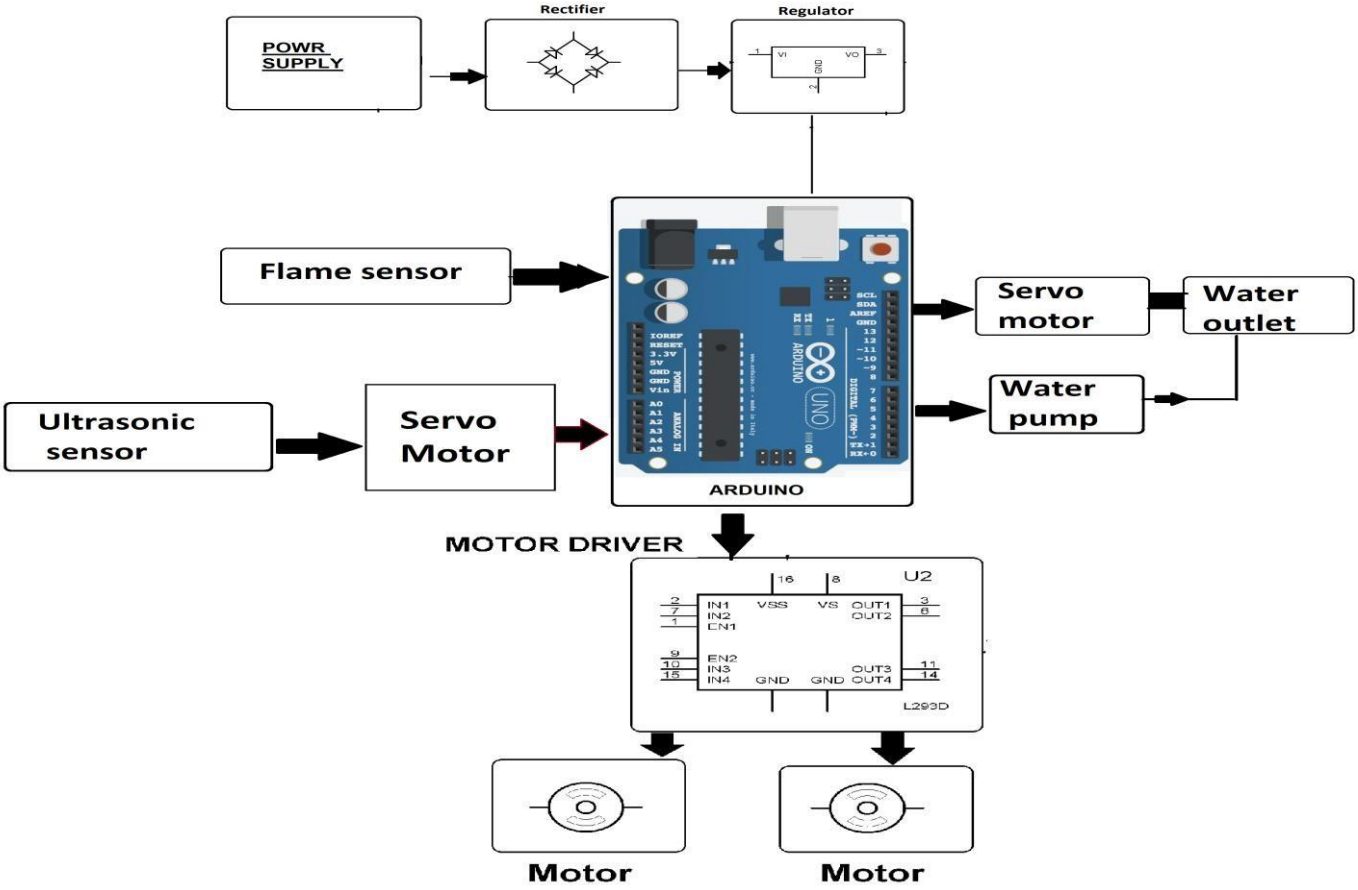
strong cardboard which has water resistant property.

- Fire detection system.
- Communication system.
- The Locomotion system.

It is used for obstacle detection and four ultrasonic range finder to find the distance between obstacle and system.

- **III. OBJECTIVES:**
- Find Fire: To detect fire quickly using sensors.
- Move on Its Own: To let the robot move automatically and avoid obstacles.
- Keep People Safe: To reduce the risk to humans by fighting fires in dangerous areas.

IV. BLOCKDIAGRAM & METHODOLOGY



- Initialization: Power up the robot and initialize all components, including sensors, motors, and the control system.
- Navigation: The robot moves autonomously, scanning its surroundings using sensors to avoid obstacles and identify fire locations.Fire Detection: Once a fire is detected, the robot stops and positions itself to face the fire source.
- Fire Extinguishing: The robot activates the water pump and targets the fire accurately, extinguishing it using the mounted water outlet.Monitoring and Repositioning: The robot continuously monitors the area for remaining flames or obstacles, adjusting its position as needed to ensure complete firefighting coverage

Working Flow:

- This robot is loaded with a water tanker and a pump controlled through wireless communication to sprinkle water. For the desi red operation, an Arduino microcontroller is used.
- At the transmitter end, push buttons are used to send commands to the receiver end to control the robotic movement, either in forward, backward, right or left direction. while the decoder decode before feeding it to another microcontroller to drive DC motors via motor driver IC for necessary work.

V. ADVANTAGES

1. Enhanced Accessibility and Navigation:

- Navigates hazardous areas:The robot can access areas where humans cannot safely or easily reach, such as narrow passages, high floors, or smoky environments.
- Equipped with sensors like ultrasonic and IR sensors, the robot can avoid obstacles and navigate complex environments.

2. Improved Fire Detection and Response:

- Advanced sensors, including flame, temperature, and smoke detectors, enable quick and accurate fire detection.
- The robot's ability to detect fires early on allows for faster responses and potentially prevents fires from escalating into larger, more dangerous situations.

3. Enhanced Safety and Efficiency:

- The robot can perform dangerous tasks that firefighters would otherwise have to perform, reducing the risk of injury or exposure to hazardous conditions.
- The robot can be remotely controlled and monitored, allowing firefighters to stay at a safe distance while assessing the situation and directing the robot.

4. Cost-Effective Solution:

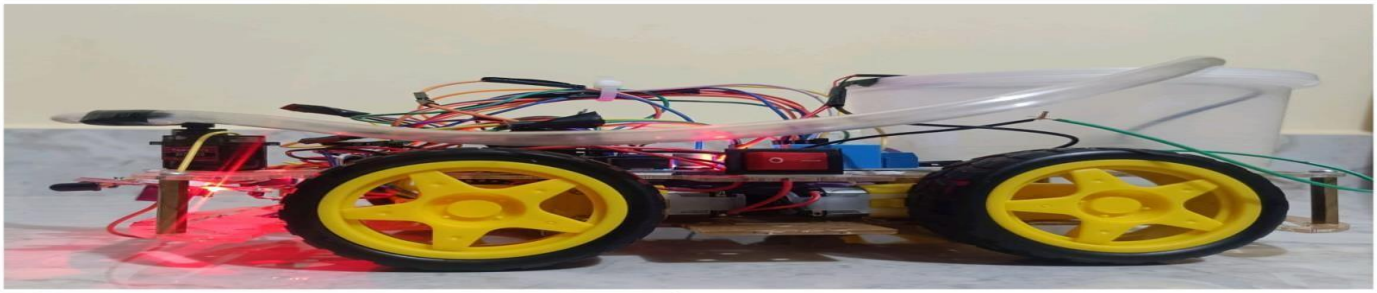
- Compared to traditional firefighting methods, the robot can be a more cost-effective solution in the long run, reducing the need for extensive manpower and equipment.

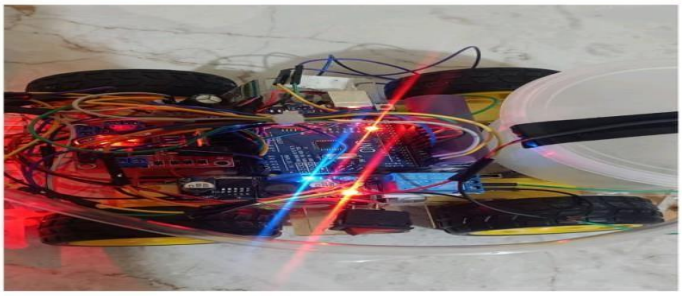
VI. APPLICATIONS

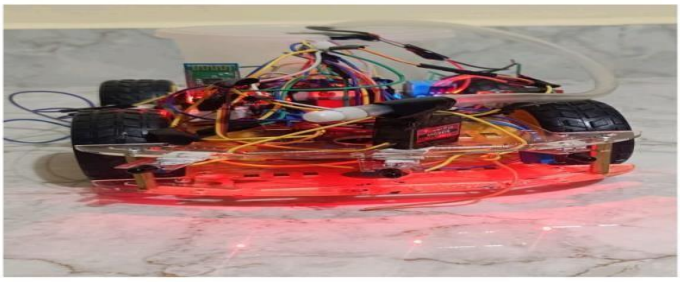
- Firefighting in small spaces.
- Operating in hazardous environments.
- Assisting in rescue missions.
- Educational and research purposes.

VII RESULTS AND CONCLUSION:

- The robot will autonomously detect and extinguish fires while navigating obstacles. By reducing human involvement, it enhances safety in dangerous environments.
- It is expected to function effectively in various settings, including industrial and hazardous areas.
- The robot will provide a reliable firefighting solution in challenging conditionsAs the Fire Fighter Robot has to endure different situation, this effectiveness test will help us to make a better model. The Fire Fighting Robot is effective enough to fight against fire on a small scale. It can sense fire flame better at darker places. It is made as a preventer robot.







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