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Fire Fighting Robot

Pranav B Patel [1*], Maulik B Rami [2]
[1] Department of Electronics and Communication, Sankalchand Patel College of Engineering, Sankalchand Patel University, Visnagar, Gujarat, India
[2] Professor, Department of Electronics and Communication, Sankalchand Patel College of Engineering, Sankalchand Patel University, Visnagar, Gujarat, India

* Corresponding Author: **Pranav B Patel**

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Abstract
With developments in the field of robotics, analog sensors have imprecise values of and tend to fluctuate easily. Therefore, the dependence on these sensors in the event of an emergency human intrusion has become less and the robot is getting into situations where it will be ineffective. Automatic robot is widely used for security purposes. In our daily life, developed in the field of uncontrollable fire fighting, fire accidents have become common and can sometimes be extinguished manually when necessary. Manually operated robots require human intervention, leading to dangers that make it difficult for firefighters to work near fires, which can endanger human lives. In such cases, firefighting robots are used to protect human lives, property and the surrounding environment from fire accidents. Here we implement two modes of insufficiently reliable analog sensor values and robot operation: manual mode and automatic mode. Depending on the environment, the manual mode, PHP website is used to control the robotic vehicle. In automatic mode, sometimes the autonomous robot may stray alone from the control field depending on the firefighting command predetermined by the user. For fire detection, we use OpenCV for image processing. The standard light color is determined by the upper and lower operations of the manually operated system within the existing boundaries of the HSV color space of the red, orange, and yellow system. The water spray mechanism is fully automatic in both modes. In PHP website we have control over C. The proposed system to switch between manual and automatic mode is based on, in this project we have implemented both automatic and selective.

Keywords: Arduino Nano, Flame sensor, Web camera, Bluetooth module

1. Introduction
As robotic technologies have improved and become an integral part of our lives, many people have tried to find alternatives to human labour and effort with these further improvements in embedded design technology, especially when humans risk their lives in the event of a flame incident. This allows the robots to reach their full potential and understand complex and difficult post-disaster situations. However, extra effort will be needed if the robot is fighting fire hazards instead of reacting after the hazard has appeared. The need for production system in towns and cities has become imperative and this robot has been built to adapt to the harsh environment of these terrain areas. The basic idea is to deploy located fire alarm sensors by estimating the fire radiation range. Recent developments include distributed fire optics Flame sensors used to extinguish fires. This module uses a wireless sensor structure, the ultrasonic sensor detects obstacles and moves according to the detected obstacle. A digital image processing technique was used with colour video images and was able to detect flames.

2. Importance of Fire Fighting Robot

Safety: Firefighting robots can access hazardous environments, reducing risk to responders. They are equipped to deal with situations where conditions are too dangerous for humans.

24\7 Availability: The robots can operate continuously without rest, ensuring continuous monitoring and control. This ensures rapid response to emerging fire threats, even in situations where human resources are limited.

Remote Operation: - Firefighting robots can be controlled remotely, allowing firefighters to assess and fight fires from a safe distance. This is especially useful in situations where direct human intervention could be dangerous.

Efficiency: - Equipped with sensors and cameras, firefighting robots can collect real-time data on fire developments, helping to make better decisions. They can move over difficult terrain and reach areas that are difficult for humans to reach quickly.

Specialized equipment: - Some firefighting robots are equipped with specialized tools, such as water cannons or foam sprayers that allow them to proactively fight fires. This adds another layer of capability to firefighting efforts.

3. Methodology

- A robot that fights fires is suggested. This robot's primary purpose is to transform into an autonomous assistance vehicle that can find and put out fires. There are many different kinds of vehicles available to put out forest fires and combat flames at home.
- Our suggested robot is built to function independently or under remote control. Such robots can be used to identify fires and perform rescue operations with increased security without putting firefighters in danger or hazardous situations.

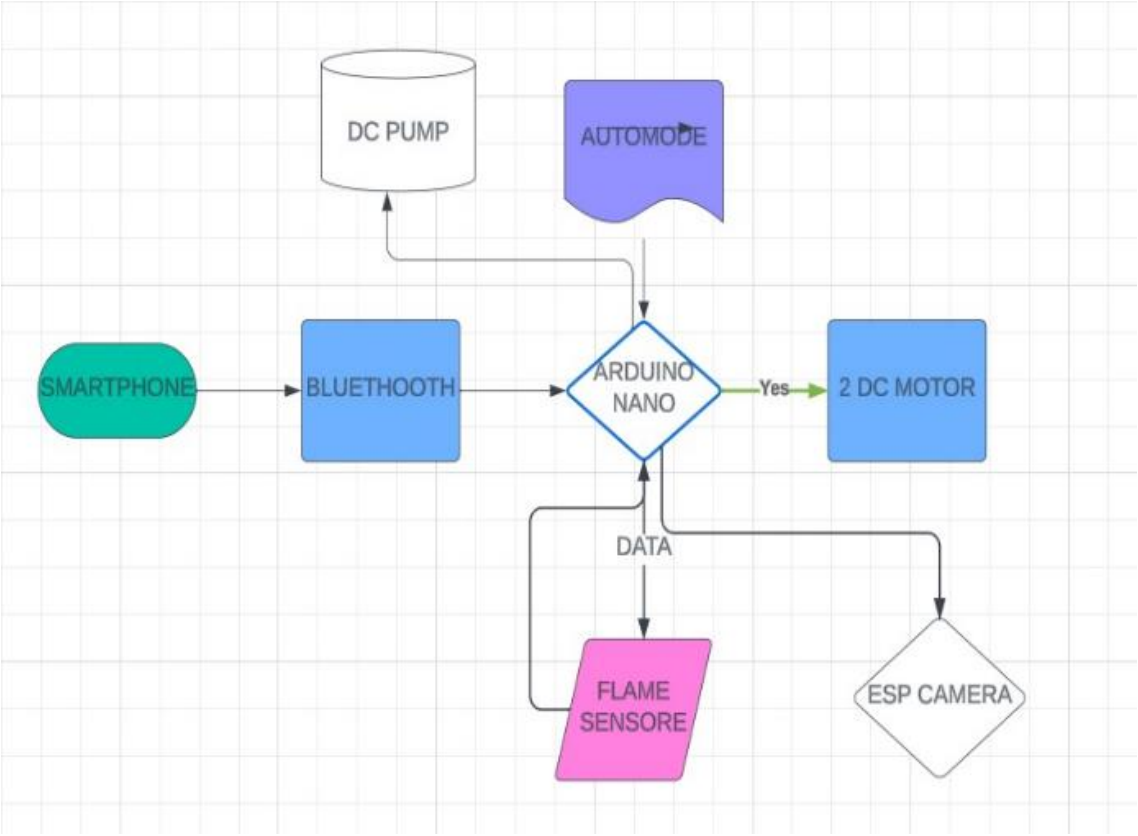

Fig 1: Block diagram of Fire Fighting Robot

- Alternatively said, firefighters may not need to enter as many hazardous situations when there are robots around. In addition, the robot's small size and autonomous control make it suitable for employment in dangerous environments like tunnels or nuclear power facilities where fires frequently occur in tight spaces.
- A small and compact firefighting robot has been built in this study. Rescue Robot is the short form for this robot's name, Fire Fighting Robot. This robot can search, avoid obstacles, and put out fires. Additionally, this robot can improve the task's quality, safety, productivity, and efficiency. When compared to Thermite and FireRob robots, the fire fighting robot is more flexible and smaller. The capacity of the firefighting robot to penetrate places with tiny openings or tight spaces is another benefit.
- Robots designed to battle fires have the ability to locate and put out fires. Robots that battle fires can locate a target by utilizing ultrasonic and flame sensors. While the ultrasonic sensor is used to identify objects nearby the firefighting robot, the flame sensor locates the source of the fire. The Arduino NENO, which was connected to both sensors, managed the DC motor's movement.
- When the DC motor detects a fire, it will halt 30 centimeters away from the source of flames. The operator will use a remote control to put out the fire from a distance. Additionally, the operator can keep an eye on the firefighting robot via a camera linked to a smartphone.

Fig 2: Snapshot of Module

4. Advantages

Quick response: The speedy deployment of firefighting robots to the fire scene shortens the response time. This quick action is essential to preventing the fire from becoming worse and reducing the amount of damage.

Resource optimization: Allocating human resources more efficiently can be achieved by using robots to fight fires. Whereas robots handle some parts of battling fires, human firefighters are better able to concentrate on making intricate decisions and developing strategic plans.

Data collection and analysis: Real-time data collection from fire sites by firefighting robots improves situational awareness. The analysis of this data can lead to improvements in emergency response plans, equipment, and firefighting tactics.

Advanced sensors: Firefighting robots, with their sophisticated sensors, are able to identify a number of characteristics, including temperature, gas concentration, and even human presence. This information aids in determining the extent of the fire and developing successful plans.

Improved safety: - By deploying firefighting robots in dangerous situations, firefighters' dangers are decreased. They can go through regions with intense heat, smoke, or poisonous fumes that could be fatal to people.

5. Disadvantages

Limited adaptability: Compared to human firemen, they can find it difficult to manage unforeseen obstructions or negotiate complicated environments.

High initial cost: Certain fire departments can be discouraged from investing in firefighting robots due to the high cost of developing and deploying them.

Maintenance requirements: Regular maintenance is necessary for firefighting robots to ensure optimal performance, hence increasing their overall cost and posing logistical issues.

Limited capabilities: The current generation of firefighting robots might not be as capable as human firefighters in many areas, including the capacity to carry out difficult jobs and make deft choices in fast-paced environments.

Dependence on technology: Because they depend on technology, firefighting robots may not be as effective in emergency situations due to failures, hacking, or interference.

6. Conclusion

The firefighting robot was constructed from materials that could be found nearby, and testing were conducted to determine how successful it was in various scenarios. We will be able to develop a better model with the aid of this performance test, as the firefighting robot must manage many scenarios. Robots designed to fight fires can effectively put out small-scale fires. In darker areas, it is more effective at spotting fire flames. It is intended to be a prophylactic robot because it has the ability to quickly detect fires and put them out before they spread. There may be a solution to all fire concerns with this multisensory robot. In addition to having a larger reserve capacity than the, this robot design can fight huge flames with sufficient financing and accessibility. An upgraded detecting unit can even provide detection capabilities in all circumstances, extinguish fires sooner.

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