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A Review Paper on Automatic Fire Fighting Robot Using Arduino

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A B S T R A C T

The project's goal is to use Arduino to build and create a firefighting robot. The robot will have sensors to identify any fire and will be able to navigate within a designated region in order to put out the fire. An Arduino microcontroller will be used to drive the robot, which will be designed to move on its own and carry out firefighting duties. To spray water on the fire, the robot will be outfitted with a water tank, a pump, and a nozzle. In order to navigate towards the fire and sense its heat, it will also be equipped with infrared sensors. The robot's mobility and firefighting will be managed by the Arduino microcontroller, which will also handle the sensor data. Designing the mechanical structure of the project will entail.

Keywords: Arduino UNO, Robot, Flame Sensor, Fire Extinguisher, Water Pump.

1. Introduction

Fire emergencies may be deadly and destructive, requiring prompt response and efficient solutions. We'll look at using Arduino to create an automated firefighting robot in this project. Because it can detect and extinguish fires on its own, this robot is an essential tool for fire safety and prevention. This robot uses a combination of sensors, motors, and intelligent control to detect flames and act swiftly to put them out.

Controlling the fire can be done with a firefighting robot. This robot is capable of autonomous fire detection and water cannon control. Robots can move to the location of the fire to put it out thanks to certain sensors we use. The fire-flying robot's construction is identical to that of an RC vehicle controlled by Bluetooth. Three sensors are on the robot. One sensor on the robot's front side detects objects in front of it, and two other sensors at either front corner look for fire as well. The robot will sense and approach any spot where a sensor picks up fire. With four wheels, three sensors, a single water tank, a single nozzle.

1.1 Structure

- One of the riskiest issues that can cause significant financial loss as well as loss of life is a fire disaster.
- Firefighters may find it challenging to get to the scene of a fire due to volatile chemicals, smoke, and high temperatures.
- Firefighters are also at danger for injury in such circumstances. Robots that combat fires can be helpful in these kinds of settings.
- The IOT technology underpins this fire extinguishing robot.

1.2 Objectives

- To find fire in the region vulnerable to disasters.
- When fire is detected, it is put out.
- Lowers the amount of devastation and labor effort put out by humans, as well as the harm done to human life.
- To utilize flame sensors to detect fire.
- To automatically put out a fire when one is detected

2. Literature Review

A model of a firefighting robot was put out by M. A. Rashid Sarkar and Tawfiqur Rakib. It includes a base platform made of "Kerosene wood," temperature and flame sensors, an LM35 sensor for temperature sensing, and a one-liter water container made of durable, water-resistant cardboard. The robot has two wheels on which it may move.

"Design and Implementation of app controlled firefighting robot," Hira Beenish and Usra Sami, 2019's Fourth International.The Electrical Engineering Conference (IEEC 2019) will take place in January at the IEP Center in Karachi, Pakistan.[2] Mohd Aliff, MI Yusof, Nor Samsiah Sani, and Azavitra Zainal, "Development of Fire Fighting Robot (Q Rob)", International Journal of Advanced Computer Science and Applications, Vol. 10, No. 1, 2019.

The article titled "Design and Implementation of Flame Sensor and Obstacle Detection for Automatic Fire Fighting Robot" was released in February 2018 (ISSN 2319-8885) by the International Journal of Scientific Engineering and Research.

[4] Abdul Haleem Abro, Juan Du, Moazzam Ali Bhutto, Sharmeen Iftikhar Shah2.In the present world, being a firefighter is a serious and dangerous profession. Several authors are creating autonomous firefighting robots in response to this problem.

Athulya Balan, Mariya Simon, and Sindhu TV developed a 'Virtual Reality Simulation of Fire Fighting Robot' system at MATLAB using the 'Virtual Reality Toolbox'. And testing control methods is its first objective. It's crucial to keep in mind that a robot cannot work at a level appropriate if there is not a sufficient formalization environment. This robot model could only operate in corridors and rooms that were empty of extraterrestrial objects It looks like it was only going to aim at one source of fire based on the marks on the floor.[1] Norway's Ayuni Binti Abd Majid produced.

Durgesh Sharma, Harshala Gaikwad, Kartavya Verma developed "Fire Fighting Robot Using Arduino ". This firefighter robot model helps to reduce the burden of firefighters in firefighting tasks. The goal of this project is to build a firefighting robot model that navigates at a stable speed, identifies a fire, and then extinguishes it using a pumping mechanism. Detecting and extinguishing of fire was performed utilizing primary hardware components mounted on the robot. First, Infrared sensors are used for obstacle detection. Flame sensors are utilized for fire detection. Second, Battery operated wheels and gear motors are used for navigation of the robot to relocate the fire accident place. Finally, the robot quenches the fire using a submersible water pump and servo motors [3]. K. Anuradha,Dr. R. Prema,Dr. N.

The fire extinguishing robot that Nagesh MS, Deepika T V, Stafford Michahial, and Dr. M Shivakumar proposed uses DTMF (Dual Tone Multi Frequency Tones) technology for navigation and a flame sensor for fire detection that can detect flames with a wavelength range of 760 to 1100 nm and a sensitivity that varies from 10 cm to 1.5 feet. [4]

Abhideep Bhatti, Varenyam Sharma, Sushrut Khajuria, and Rakesh Johar suggested an Arduino-based firefighting robot that uses radio frequency (RF) remote control to run both the robot and the water pump.The user may operate the robot up to seven meters away. Additionally, it has a wireless camera that assists the operator in directing the robot in the desired direction.

3. Problem Defination

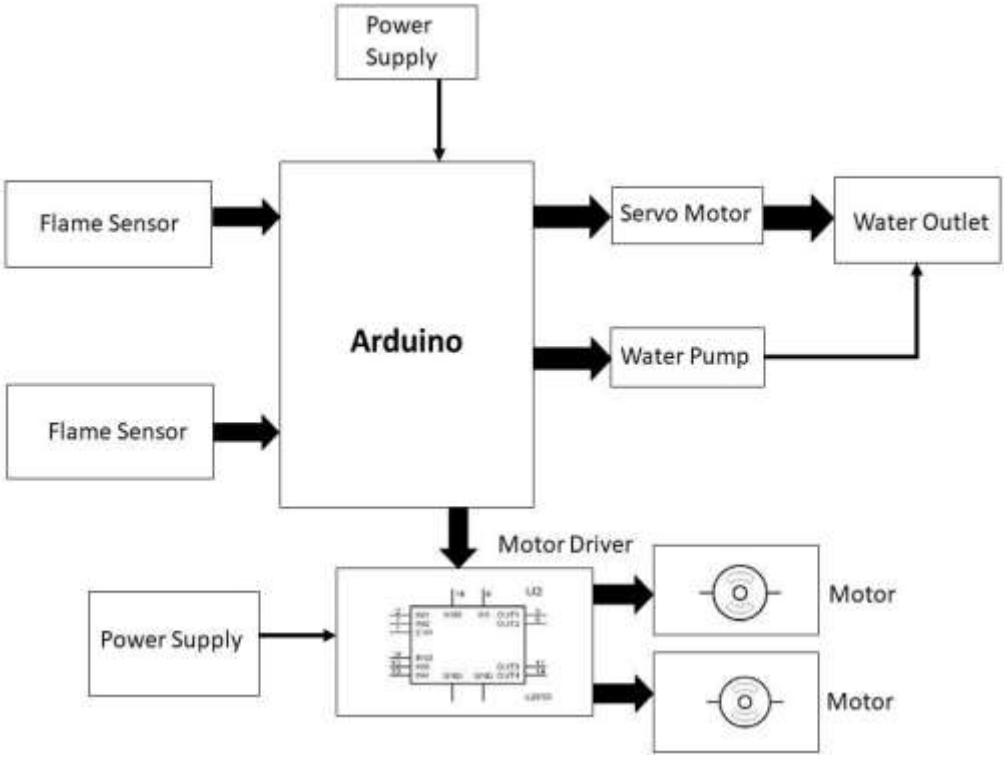
The goal of this project is to develop a Fire Fighter Robot that can autonomously find and extinguish indoor flames using Arduino. The robot must be equipped with a range of sensors, such as temperature and flame sensors, in order to properly detect the presence of fire. It should also be able to quickly go past obstacles and reach the fire's origin. The robot should be able to put out the fire if it has the proper equipment, like a water spray or fire extinguisher. Wireless communication is also necessary for the robot to allow firefighters to watch and control it from a distance. The main objective is to enhance the capacity to combat flames by utilizing self-governing robots.

4. Methodology

As a means of battling flames in hazardous or unreachable areas, firefighting robots are growing in popularity. These remotely controlled robots are safer for firefighters to work with since they may be outfitted with a range of sensors and instruments to aid in the detection and extinguishment of flames.

The Arduino is one of the most widely used platforms for robotic firefighting. The Arduino microcontroller is an excellent option for both engineers and enthusiasts since it is user-friendly and reasonably priced. For the Arduino, there are several libraries that may be used to control sensors, motors, and other devices. The Arduino is used in many different types of robots that battle fires.

5. Block Diagram



6. Component Required

6.1. Arduino UNO –

Fig (1). Arduino UNO

The open-source electronics platform Arduino is built on user-friendly hardware and software. Arduino boards have the ability to take inputs, such as a light from a sensor, a finger pressing a button, or a message from Twitter, and convert them into outputs, such as starting a motor, turning on an LED, or posting content to the internet.

6.2. Flame Sensor –

Fig (2). Flame Sensor

The flame sensor module is equipped with a photodiode for light detection and an op-amp for sensitivity adjustment. Its purpose is to detect fire and, upon detection, to emit a HIGH signal. After interpreting the signal, Arduino activates the LED and buzzer to send an alarm. The signal processing circuit evaluates the input and ascertains if a flame is there after the sensor element records the pertinent radiation released by the flame. After that, the output interface offers a signal or output voltage that may be utilized to communicate with other control systems, sound an alarm, or engage a safety feature.

6.3 Servo Motor –

Fig (3). Servo Motor

The servo motor is a closed-loop device that uses positional feedback to regulate both position and rotational or linear speed. An electric signal, either digital or analog, controls the motor by dictating how much movement corresponds to the shaft's ultimate command position. A servo or error-sensing feedback control can improve a system's performance. In addition, a very complex controller is needed; this is often a separate module made especially for servomotor operation. DC motors with accurate angular position control are known as servo motors. These DC motors' gears gradually reduce their speed. The typical rotating cutoff angle of servo motors is between 90° and 180°. Additionally, some servo motors have a 360-degree rotational cutoff .

6.4 L298 Motor Driver –

Fig (4). L298 Motor Driver

DC and stepper motors may be driven by this high power motor driver module, the L298N. An L298 motor driver integrated circuit and a 78M05 5V regulator make up this module. Up to four DC motors or two DC motors with directional and speed control can be operated by the L298N Module. High voltage, high current twin full-bridge motor driver integrated circuit L298. It manages inductive loads like relays, solenoids, DC, and stepper motors and takes typical TTL logic levels (Control Logic). This IC has fifteen pins. The operational voltage range for the L298 datasheet is +5 to +46V, and the maximum current that may be drawn through each output is 3A. The two enable inputs on this integrated circuit allow you to turn the gadget on or off without relying on the input signals.

6.5 12V DC Water Pump –

Fig (5). 12V Water Pump

A 12V direct current power source power the DC electric water pump motor in a 12 Volt water pump. In order to boost, transfer, elevate, or circulate liquids such as water, oil, or coolant for sprayers, cars, fountains, showers, gardens, etc., it uses centrifugal force produced by a high-speed rotating impeller. The industry and customers alike strongly value the 12V water pump because of its small size, long operating life, and low cost. As a result, 12volt pumps are widely used in cars for a wide range of applications, such as circulation water pumps, hot water boosters, aquariums, fish tanks, agriculture, tabletop fountains, garden solar fountains, PC cooling systems, and car washing.

7. Benefits of Project-

- It pinpoints the precise location of the fire's origin.
- It offers capable of detecting correctly with Increased flexibility.
- It is cost-effective and dependable.
- It lessens the work that humans do.

8. Conclusion-

The Automatic Fighting Robot is a significant technology that has the potential to significantly increase fire and catastrophe safety. It recognizes and extinguishes fires on its own using a number of components, such as flame sensors, motors, and Arduino control. This research on the potential applications of technology to safeguard individuals and their belongings while offering practical solutions to fire emergencies.

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