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FIRE FIGHTING ROBOT

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ABSTRACT:

The goal of this project is to create a remote-operating firefighting robot. The two components of the Fire Fighting Robot development process are hardware and programming. Four 100 rpm battery-operated motors power the drive system of the prototype robot. In addition, the ATmega328P microcontroller communicates with a number of sensors, including the MQ2 gas sensor and the flame sensor, to provide feedback to the robot. A microcontroller provides the robot with all the instructions it needs to govern its movements, enabling it to put out the fire. This study presents the operation and modelling of a prototype automated firefighting robot.

Key Components: Arduino UNO, Flame sensor, Servo motor and Water Pump, Gear Motor, Wheels etc.

INTRODUCTION

These days, technology is developing daily. The improved version of the fire extinguisher vehicle is called the Fire Fighting Robot. The equipment is self-sufficient and detects the fire immediately. It has a microcontroller attached to it that has been programmed with computer code and responds to commands. The robot fireman is made to search for fire in compact homes with particular measurements. An ideal firefighting robot can also send a call or send an SMS to the service worker alerting him to the outrage. In order to prevent the fire from spreading, a water pump squirts water upon it.

Key Components: Arduino UNO, Flame sensor, Servo motor and Water Pump, Gear Motor, Wheels etc.

EXISTING HARDWARE

In a fire fighting robot system using an Arduino Uno and vehicles gear motor, several hardware components as servo motor water pump and Gas sensor, Flame sensor. Here are the existing hardware components commonly found in such a system:

1. Arduino Uno:

Arduino Uno is an open-source microcontroller board which is based on MCU. We can use the coding programs and working according to the coding.

2. SERVO MOTOR:

- A servo motor is designed to rotate or move in many directions so it is called the rotational motor. These are two types of current flow in these motors AC and DC. Servo motor is used to rotate in all direction so that we put the water in many directions.

3. Moter Driver:

- Motor Drivers are a vital part of any robotics or automation project.
- It provides the power needed to control motors and other components within an application.

4. Power Supply:
 - It provides electrical power to Arduino Uno system and other components.
 - Power supply needed to proper working of the system. In this system we are using the 12th volt external battery principle of working
5. Relay Modules:
 - Relay modules is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low power signal from a micro controller.
6. Flame Sensor:
 - A flame sensor is a sensor designed to detect and respond the presence of a flame or fire. It is compulsory to perform the fire extinguisher task.
7. Water Pump:
 - Water pump is very useful in this project because it will put the water in the fire when it needed.
8. Connectivity Module (Optional):
 - It is autonomous modules system so it capable to self-decision-making system.

WORKING METHODOLOGY

A fire fighting robot is proto type of the fire extinguisher vehicles by attaching the small fire extinguisher robot the fire detection and controls are automatic.

1. Initialization:
 - The firefighting robot is hardware and software based robotic which is based on fire detection and put on water from spreading water.
2. Fire Detection:
 - Flame sensor detect the fire and put the water on it. until it finished.
 - Detect the fire and servo motor, water pump work together and finish the fire.
3. Motor driver:
 - Motor driver is useful to perform the whole task completion.
 - It drives the motor according to the programming and move right or left due to working principle.
4. Water Pump:
 - Water Pump is necessary for all functioning of firefighting Robot. When flame sensor detect the fire the water pump starts and put off the fire from spreading it.

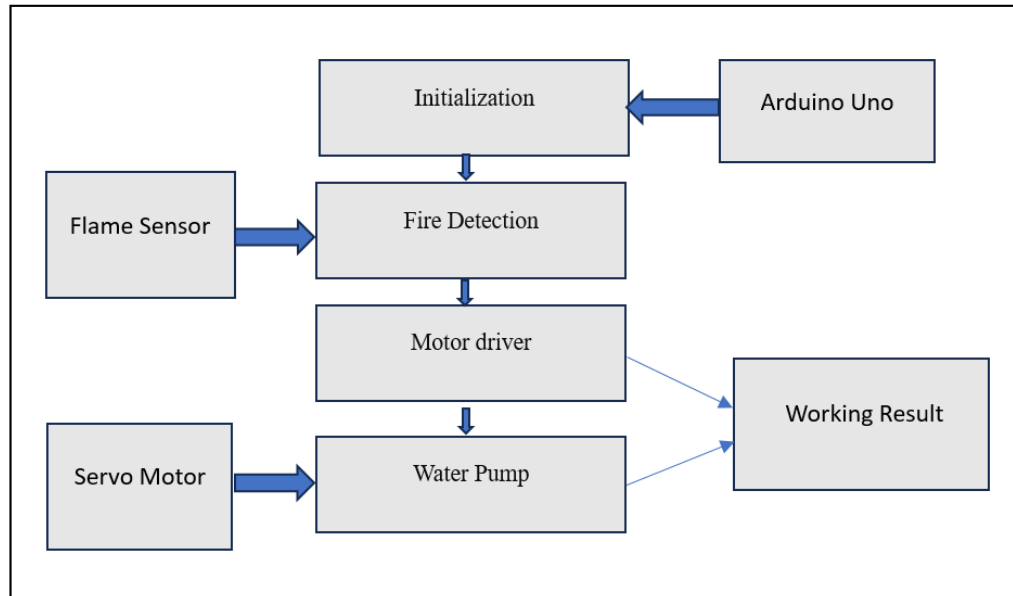


Figure 1. Block Diagram

HARDWARE COMPONENT

Flame sensor is a useful sensor. Flame Detection Sensor Module is sensitive to the flame, but also can detect ordinary light.

The flame sensor can be used to detect fire or other light source with wavelength of 760 nm ~ 1100 nm light. Flame sensor probe angle of 60 degrees, the special sensitivity of the flame spectrum. The flame sensor's operating temperature is -25 degrees Celsius to 85 degrees Celsius.

- The flame sensor is multipurpose sensor. It is used in many applications and it detect the fire in a certain area and send the message through the sim800L.
- The fire detection is totally depended on the sensor capability
- It is required in many industrial area and Hospitals also.

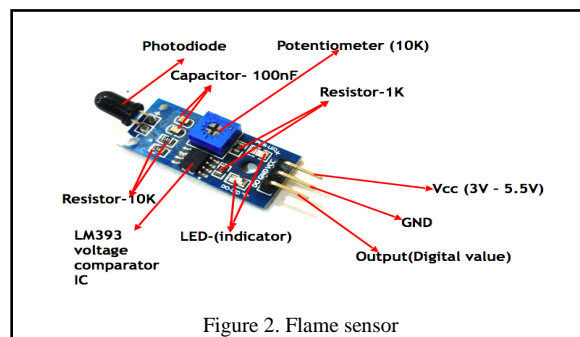


Figure 2. Flame sensor

Arduino Uno R3:

The Arduino Uno is a popular microcontroller board that is widely used for various electronic projects, prototyping, and DIY applications. It's part of the Arduino ecosystem, which includes a range of development boards, software IDE, and a supportive community. Here are some key features and aspects of the Arduino Uno:

- The Arduino Uno is based on the Atmega328P microcontroller, which is an 8-bit AVR microcontroller. This microcontroller provides a good balance of performance and features for many projects.
- The Uno has a total of 14 digital input/output pins, of which 6 can be used as PWM (Pulse Width Modulation) outputs. It also has 6 analog input pins, which can be used to read analog sensors or signals.
- The Arduino Uno can be powered via a USB connection or an external power supply. It has a built-in voltage regulator that allows it to be powered from a wide range of sources (typically 7-12V DC).

- Arduino Uno can be programmed using the Arduino Integrated Development Environment (IDE), which is based on the C and C++ programming languages. It's relatively easy to get started with Arduino programming.



Figure 2. Arduino Uno R3 Diagram

iii. Motor Driver(L239D):

To rotate the motor on working condition we use the motor driver. The motor is the important electronics component. It is used in many applications. For Example, Electronic toy or Gadgets.

A motor Driver is basically a current amplifier which takes a low-current signal from the microcontroller and gives out a proportionally higher current signal which can control and drive a motor. In most case, a transistor can act as a switch and perform this task which drives the motor in a single direction.

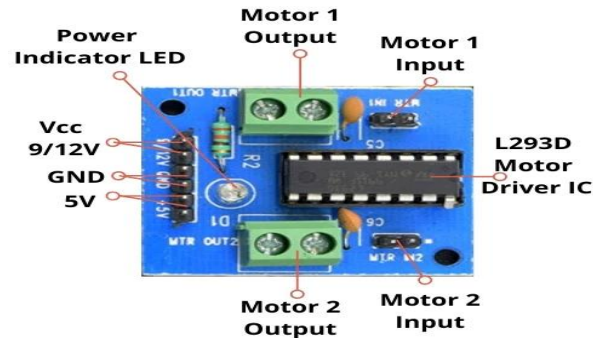


Figure 3.L239D Motor Driver

iii. Water Pump:

Water pump is very useful electronic device that are used in this project. When the Flame sensor detect the fire. It started and spreading the water on the fire.

- Brushless Mini DC water Pump refers to a machine that uses DC 4.5V ~ 24V to drive a brushless motor to run, and the brushless motor rotation drives the impeller to rotate, thereby increasing the pressure of the liquid to achieve the effect of transferring liquid.
- The water pump is generally composed of pump body, motor stator, shaft, bearing, rotor (magnets and impellers) and so on. There are one inlet and one outlet on the pump body, water enters from water inlet, and exits through the outlet. Any water pump that adopts this form and in small size is called brushless DC mini water pump.

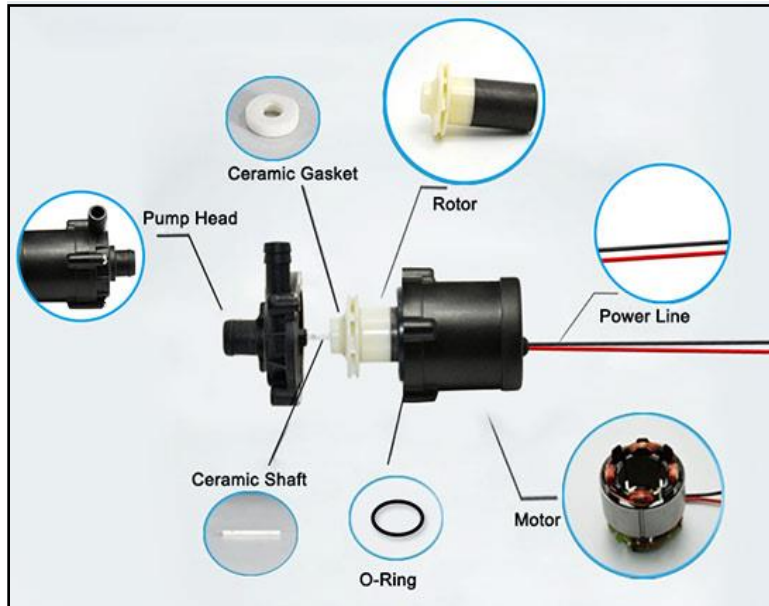


Figure 4. Water Pump

Servo motor:

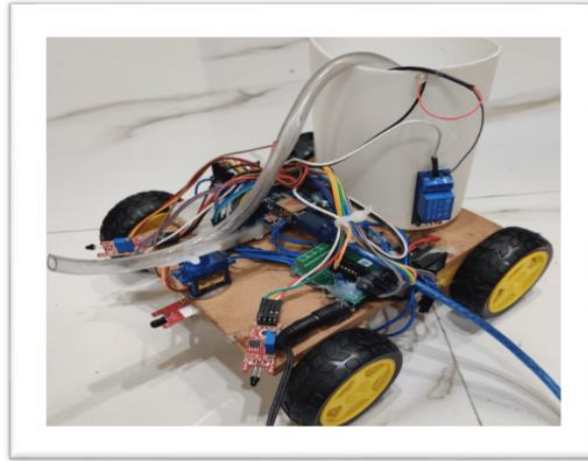
In a fire fighting robot system, the servo motor is a rotatory and self-contained, high efficiency electrical Device.

Then function of servo motor is convert the control signal of the controller into the rotational angular displacement. It rotates the 0 to 180 degrees in the direction.



Figure 5: Servo Motor

FINAL HARDWARE RESULT



CONCLUSION

This Fire Extinguishing Robot model helps distribute the workload of firefighters during firefighting operations. Our research intends to construct a real-time, speed-consistent firefighting robot that can locate fires and use a pumping mechanism to put them out. Fundamental hardware components that were attached to the robot assisted in the detecting and extinguishing processes. First, fire is detected using infrared flame sensors. Second, the robot is guided to the fireplace by rubber wheels and BO Motors. Ultimately, the robot uses servo motors and a submersible water pump to put out the fire.

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