



Fire Fighting Robot For Human Safety

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ABSTRACT

Determining and extinguishing the fire is a dangerous job for a fire extinguisher. To this problem the fire fighter reaches the destination quickly and prevent the fire. Due to this fire fighter are constantly at a risk of losing their life. Technologies has come to rescue this issue. This paper gives you the technical solution to this mentioned problem. These robots are designed to use in extreme condition whereas humans' interruption becomes less and robots are using several works.

An arduino UNO is microcontroller for needed operation. A vessel of water and apparatus for putting out flames organization with pump is got on the machine made to act like man body and its operation is did from microcontroller 1 out-put through right sign put out from sensor. The complete operation is controlled by Arduino UNO microcontroller..

Keyword: -Arduino UNO, DC Gear motor, L293D Motor Driver, and Submersible Pump etc....

1. INTRODUCTION

This advanced firefighting robotic system independently detects and extinguishes fire. In the age of technology, the world is slowly turning towards the automated system and self-travelling vehicles, fire fighters are constantly at a risk of losing their life. Fire spreads rapidly if it is not controlled. In case of a gas leakage there even may be an explosion. So, in order to overcome this issue, safe guard live of our hero, our system comes to the rescue. This firefighting robotic system is powered by Arduino Uno development board it consists of the HC-SR04 ultra-sonic sensor mounted on a servo motor for obstacles detection and free path navigation, it is also equipped with the fire flame sensor for detecting and approaching fire it also makes use of water tank and spray mechanism for extinguishing the fire. Water spraying nozzle is mounted on servo motor to cover maximum area.

1.1 Description of Fire Fighting Robot For Human Safety

According to National Crime Records Bureau (NCRB), it is estimated that more than 1.2 lakh deaths have been caused because of fire accidents in India from 2010-2014. Even though there are a lot of precautions taken for Fire accidents, these natural/man-made disasters do occur now and then. In the event of a fire breakout, to rescue people and to put out the fire we are forced to use human resources which are not safe. With the advancement of technology especially in Robotics it is very much possible to replace humans with robots for fighting the fire This would improve the efficiency of firefighters and would also prevent them from risking human lives. Today we are going to build a *Fire Fighting Robot using Arduino*, which will automatically sense the fire and start the water pump.

In this project, we will learn how to build a *simple robot using Arduino* that could move towards the fire and pump out water around it to put down the fire.

1.2 Necessity of Fire Fighting Robot

Fire is a classical element that has been an equalizer on Earth prior to the start of written history. It has many positive attributes (heat, energy, cleansing, etc.) but it can be extremely dangerous when outside of control. Structure, vehicle, aircraft ship fires and wildfires can wreak havoc and cause serious injury and/or death.

When the fire gets out of control, firefighters are called. But while rescuing people they often get injured because of extreme fire. By using a firefighting robot this kind of accident can be reduced.

Fire fighting is an important job but it is very dangerous occupation. Due to that, Robots are designed to find a fire, before it rages out of control. It could be used to work with fire fighters to reduce the risk of injury to victims and firefighters too.

In this paper, a firefighting robot is proposed. Our robotic firefighting system is designed with certain tasks in mind. It includes analyzing and locating fires, conducting search and rescue, monitoring hazardous variables and the primary task of fire control and suppression. In purpose of rescuing people, the robot monitors the environment thermal state and goes towards the fire location and extracts water from the pump from specific angle to another angle again and again till the fire is blown out. This way it can reduce risk, expand profitability and effectiveness in rescuing.

2. Components and Description

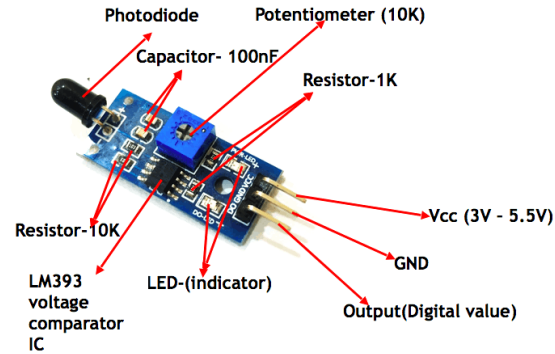
Arduino UNO:

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.



Flame Sensor or Fire Sensor :

The main brain of this project is the Arduino, but in-order to sense fire we use the **Fire sensor module** (flame sensor) that is shown below.



A sensor which is most sensitive to a normal light is known as a flame sensor. That's why this [sensor module](#) is used in flame alarms. This sensor detects flame otherwise wavelength within the range of 760 nm – 1100 nm from the light source. This sensor can be easily damaged to high temperature. So this sensor can be placed at a certain distance from the flame. The flame detection can be done from a 100cm distance and the detection angle will be 60°. The output of this sensor is an analog signal or digital signal. These sensors are used in fire fighting robots like as a flame alarm.

L293D Motor Driver :

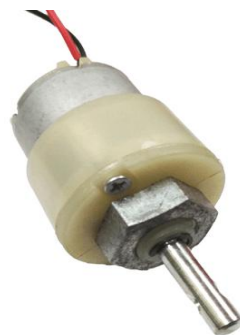
L293D is a basic motor driver integrated chip (IC) that enables us to drive a DC motor in either direction and also control the speed of the motor. The L293D is a 16 pin IC, with 8 pins on each side, allowing us to control the motor. It means that we can use a single L293D to run up to two DC motors. L293D consist of two [H-bridge](#) circuit. H-bridge is the simplest circuit for changing polarity across the load connected to it.

There are 2 OUTPUT pins, 2 INPUT pins, and 1 ENABLE pin for driving each motor. It is designed to drive inductive loads such as solenoids, relays, DC motors, and bipolar stepper motors as well as other high-current/high-voltage loads.

DC Gear Motor :

A Direct Current (DC) motor is a rotating electrical device that converts direct current, of electrical energy, into mechanical energy. An Inductor (coil) inside the DC motor produces a magnetic field that creates rotary motion as DC voltage is applied to its terminal.

The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.



Small Submersible Pump :

A mini submersible water pump is a centrifugal water pump, which means that it uses a motor to power an impeller that is designed to rotate and push water outwards. The motor is located in a waterproof seal and closely connected to the body of the water pump which it powers

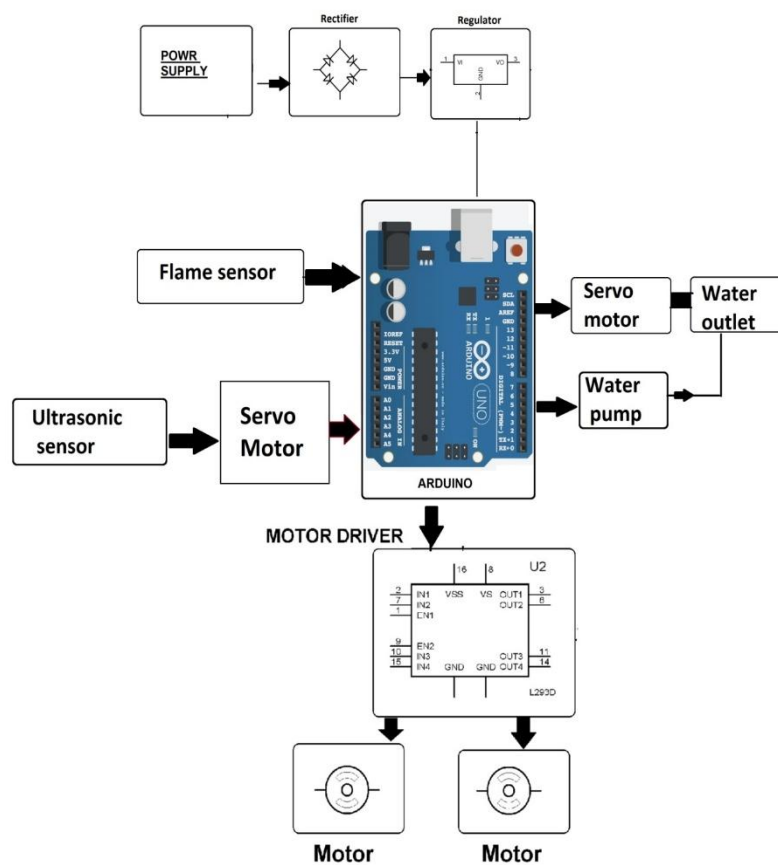
DC solar submersible pumps may often run on several volts of DC power, such as 6V, 12V, 24V, or 32V. There are various advantages to using direct current rather than alternating current (AC).

A submersible pump pushes water to the surface by converting rotary energy into kinetic energy into pressure energy. This is done by the water being pulled into the pump: first in the intake, where the rotation of the impeller pushes the water through the diffuser. From there, it

goes to the surface.



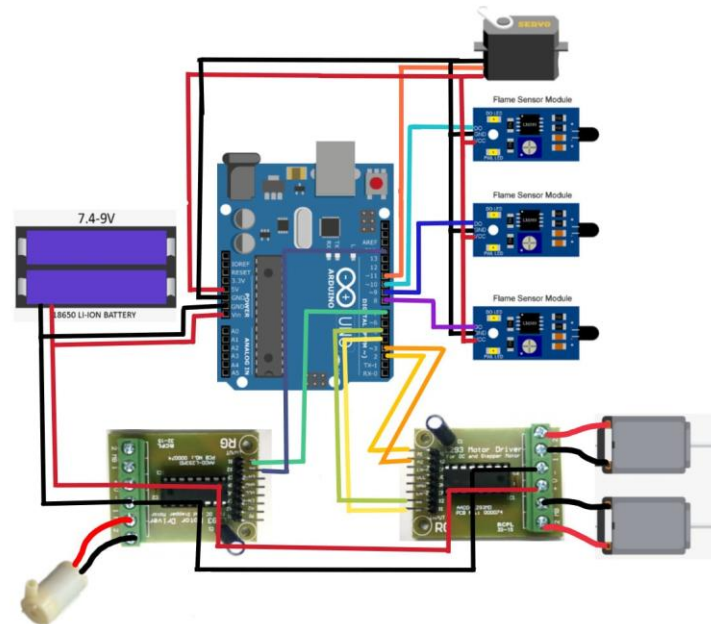
2.1 Block Diagram



- As per block diagram, 12V DC power supply is connected to Arduino UNO and DC gear moto(12V, 500 RPM).
- First of all , when fire is detected flame is is operated and sense the fire and gives signal to Arduino.
- Ultrasonic sensor is used to detect the object.
- When Arduino take signal from flame sensor, it gives gives command to DC motor to move in direction of fire.
- Into the dc motor wheels are attached,which move our robot in given forward,reverse,left, right direction.
- Robot is stop at fire location.
- Submessible pump is connected as a output of Arduino.

- This pump used to pump water from can or water tank and flow it towards servo motor through pipeline.
- Servomotor sprinkle the water in 180 degree directed (it sprinkle water in direction where flame sensor sense the actual fire).
- And fire is defuse.

2.2 Circuit Diagram



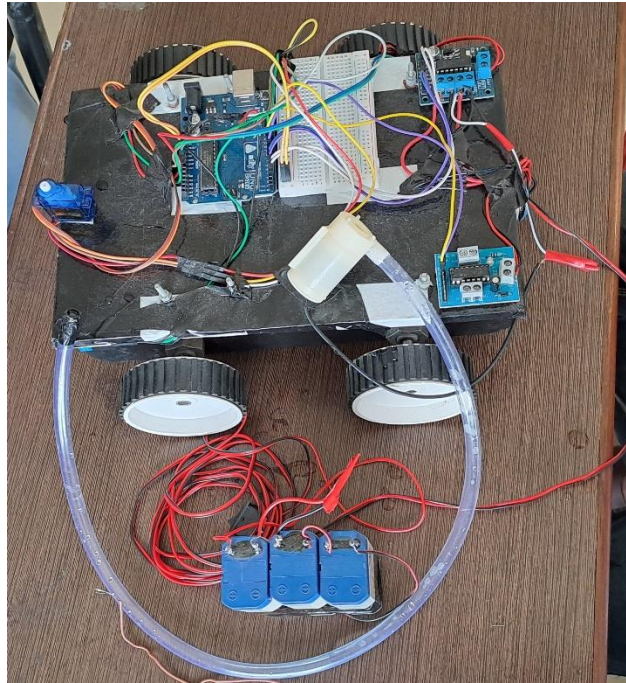
- Connect the all flame sensors D0 at point 8 , 9 and 10 of arduino.
- Short the ground terminal of both sensors and connect it with ground terminal of servo motor and finally connect it to ground terminal of arduino as shown in circuit.
- As shown in circuit short the VCC terminal of all sensors and sevo and connect it to 5V terminal of arduino.
- Connect both two dc motor to M1 and M2 terminal of L293D and take input from point 1 and 2 terminal from arduino as shown in figure .
- Connect the motor pump at terminal M1 and M2 of another L293D and take input from point 7 and GND of arduino.
- Supply both L293D motor driver using battery.
- Supply arduino from dc battery at terminal Vin and GND .

3. Working of Fire Fighting Robot

There are several possibilities of fire in any remote area or in an industry. For instance, in garments godowns, cotton mills, and fuel storage tanks, electric leakages may result in immense fire & harm. In the worst of cases & scenarios, fire causes heavy losses both financially and by taking lives. Robotics is the best possible way to guard human lives, wealth and surroundings. A Firefighting robot is designed and built with an embedded system. It is capable of navigating alone on a modeled floor while actively scanning the flames of fire. The robot could be used as a path guide in a fireplace device or, in normal case, as an emergency device. This robot is designed in such a way that it searches a fire, & douses it before the fire could spread out of range & control.

This type of firefighting robot will sooner or later work with firefighters, thus greatly reducing the danger of injury to victims. Apart from this, this Firefighting robotic project will also help generate interest along with the innovations in the field of robotics while operating towards a sensible and obtainable solution to save lives and mitigate the danger to property.

3.1 Result



Application:

- 1) Can be used in record maintaining rooms where fire can cause lose of valuable data.
 - 2) Can be used in Server rooms for immediate action in case of fire
 - 3) Can be used in extinguishing fire where probability of explosion is high. For eg. Hotel kitchens, LPG/CNG gas stores, etc.
 - 4) Every working environment requiring permanent operator's attention.
- At power plant control rooms.
 - At captain bridges.
 - At flight control center

4. CONCLUSIONS

Fire-fighting robot can be easily and conveniently used and operated automatically when any fire incident occurs in educational, industrial and hospital areas to save human life. Fire-fighting Robot comprises of numerous sensors and motors, and has small in size, less in weight, with rechargeable batteries, in result it requires less space.

Prototype provides us greater efficiency to detect the flame, temperature and gas presented in the affected area. The extinguisher robot effectively extinguishes fire before it becomes uncontrollable and gives threat to life.

Fire-fighting robot also successfully removes obstacle from the path to another location by using a robotic arm to clear the way. Hence, the robot can play a crucial role in our society.

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