

Fire Fighting Robot Using Arduino Microcontroller

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Abstract- A fire incident is a catastrophe that may result in property damage, fatalities, or long-term disability for the affected person. Gas tanks, chemical factories, nuclear power facilities, and other large-scale fire industries are among the businesses that experience major fire mishaps that can have very catastrophic repercussions. Such accidents have claimed the lives of thousands of people. As a result, the concept is improved to use a robotic vehicle to manage fire. Robotics is advancing at a rapid pace, and more and more, people are using robots for safety-related purposes. In the course of a typical day, fire incidents occur often, and firefighters occasionally face extreme difficulty rescuing lives.

Keywords–Temperature sensor, Smoke sensor, GSM, Relay module, LCD, LED

I. Introduction

It is the duty of cultural property management to safeguard and conserve an institution's infrastructure, holdings, activities, and personnel. To reduce the negative effects of the weather, pollution, theft, vandalism, insects, mould, and fire, constant attention is needed. It is one among the more dangerous because of the intensity and speed of its destructive powers. Structures that have been vandalized or harmed by the environment can be restored, and stolen items can be found. But things destroyed by fire are lost forever. An uncontrolled fire can burn out a structure in a matter of hours or entirely destroy all of the contents in a room in a matter of minutes. Therefore, it is now crucial to contain and put out the fire in order to save lives and expensive property. Robots that are autonomous are capable of acting without the need for a controller. The fundamental concept involves programming the robot to react to external inputs in a specific manner. A excellent example of how this works is the extremely basic bump-and-go robot.

This kind of robot has an obstacle-detection sensor. The robot zips along in a straight line after you switch it on. Upon ultimately encountering an obstruction, the force acts on the sensors, perhaps causing harm to sensors. When the robot

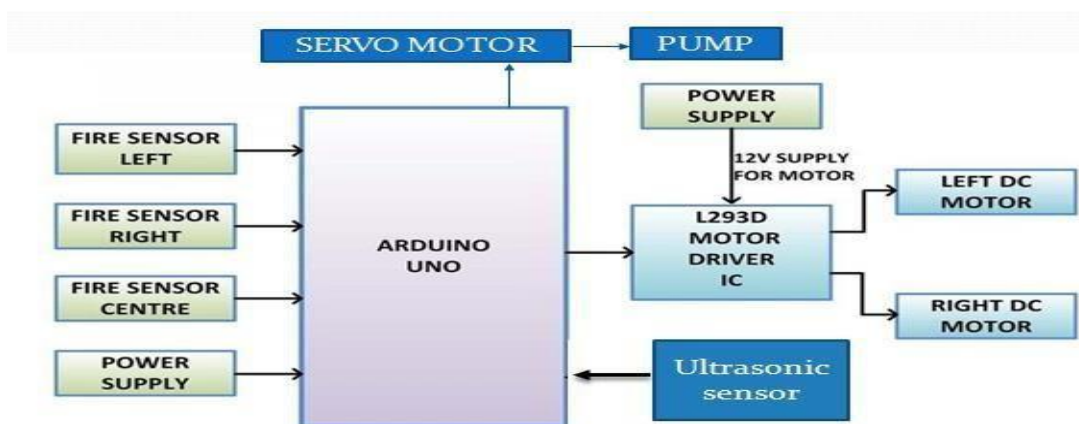
Encounters an impediment, it is directed to turn right and continue forward using an ultrasonic sensor and programming logic. The robot navigates obstacles by changing its direction in this manner. More complex iterations of this concept are employed by sophisticated robots. In order to give robots greater intelligence and perception, robot cists develop new software and sensor technologies. These days, robots are capable of navigating a wide range of surroundings with ease.

Description

The project is designed to develop a fire fighting robot using Arduino. The robotic vehicle is loaded with water pump which is controlled by servos. An AT Mega 328 microcontroller is used for the desired operation. At the transmitting end using commands are sent to the receiver to control the movement of the robot either to move forward, and left or right etc. At the receiving end tow motors are interfaced to the microcontroller where two of them are used for the movement of the vehicle and the one to position the robot. The ultrasonic sensor adequate range with obstacle detection, while the receiver driver module used to drive DC motors via motor driver IC for necessary work. A water tank along with water pump is mounted on the robot body and its operation is carried out from the microcontroller output through appropriate command from the transmitting end. The whole operation is controlled by an AT mega 328 microcontroller. A motor driver IC is interfaced to the microcontroller through which the controller drives the motors, three is flame sensors are fixed on robot chassis to sense the fire and to reach the destination to put off the fire.

Block diagram

L293D Driver module



The Motor Driver is a module for motors that allows you to control the working speed and direction of two motors simultaneously. This Motor Driver is designed and developed based on L293D IC. L293D is a 16 Pin Motor Driver IC. This is designed to provide bidirectional drive currents at voltages from 5 V to 36 V.



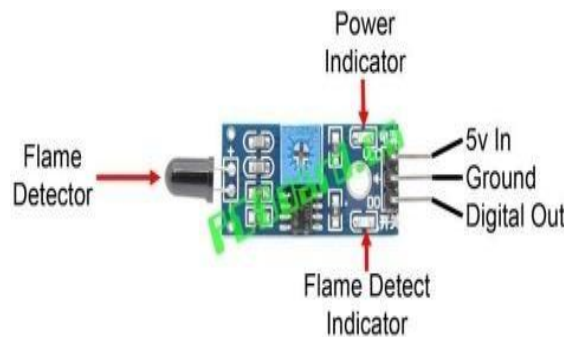
A. Features of L293D driver module

- Can be used to run Two DC motors with the same IC.
- Speed and Direction control is possible
- Motor voltage V_{cc2} (Vs): 4.5V to 36V
- Maximum Peak motor current: 1.2A
- Maximum Continuous Motor Current: 600mA
- Supply Voltage to V_{cc1} (vss): 4.5V to 7V
- Transition time: 300ns (at 5V and 24V)
- Automatic Thermal shut down is available
- Available in 16-pin DIP, TSSOP, SOIC packages

B. Flame Sensor Module:

A flame sensor module that consists of a flame sensor (IR receiver), resistor, capacitor, potentiometer, and comparator LM393 in an integrated circuit. It can detect infrared light with a wavelength ranging from 700nm to 1000nm. The far-infrared flame probe converts the light detected in the form of infrared light into current changes. Sensitivity is adjusted through the onboard variable resistor with a detection angle of 60 degrees.

Working voltage is between 3.3v and 5.2v DC, with a digital output to indicate the presence of a signal. Sensing is conditioned by an LM393 comparator.



C. Ultrasonic Sensor

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.

It is important to understand that some objects might not be detected by ultrasonic sensors. This is because some objects are shaped or positioned in such a way that the sound wave bounces off the object, but are deflected away from the Ultrasonic sensor. It is also possible for the object to be too small to reflect enough of the sound wave back to the sensor to be detected. Other objects can absorb the sound wave all together (cloth, carpeting, etc), which means that there is no way for the sensor to detect them accurately. These are important factors to consider when designing and programming a robot using an ultrasonic sensor. The distance can be calculated with the following formula

Distance $L = \frac{1}{2} \times T \times C$



VCC- Connects to 5V of positive voltage for power
Trig- A pulse is sent here for the sensor to go into ranging mode for object detection
Echo- The echo sends a signal back if an object has been detected or not. If a signal is returned, an object has been detected. If not, no object has been detected.
GND- Completes electrical pathway of the power.

C. Arduino UNO board

The Atmel 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughputs approaching 1 MIPS.

D. Arduino

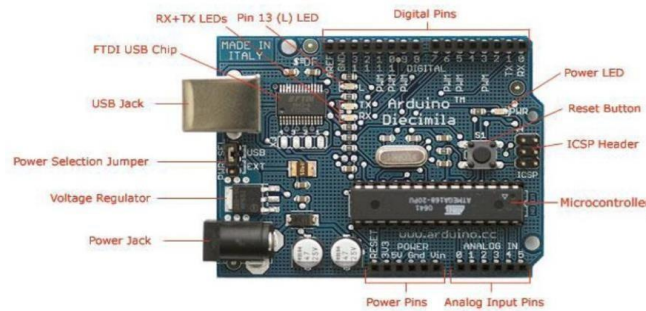


Figure: Arduino UNO board

Final Output in Hardware

```

#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
String sentence;

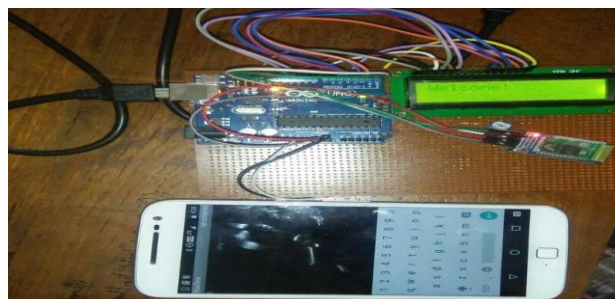
void setup() {
  Serial.begin(9600);
  lcd.begin(16, 2);
  lcd.print("Welcome!");
  delay(3000);
  lcd.clear();
}

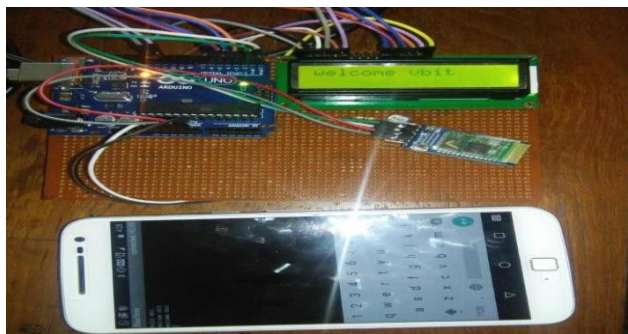
void loop() {
  int i=0;
  char commandBuffer[100];
  if(Serial.available() > 0) {
    delay(100);
    while(Serial.available() > 0) {
      commandBuffer[i++] = Serial.read();
    }
    commandBuffer[i] = '\0';
    i = 0;
    Serial.print((char*)commandBuffer);
    lcd.print((char*)commandBuffer);
    delay(100);
    lcd.clear();
  }
}

```

Done compiling.

Sketch uses 4286 bytes (33%) of program storage space. Maximum is 32256 bytes.
Global variables use 240 bytes (12%) of dynamic memory, leaving 1000 bytes for local variables. Maximum is 2048 bytes.





II. Conclusion

The prototype fireman robot has a useful design. Thanks to its features, this prototype can progress by combining with different sensors. The toolkit sends a signal to the controller after using a photo diode to identify the infrared light that the fire emits. We intend to expand this work to include a keypad that can be programmed to enable the robot to travel in the correct direction with the aid of a motor driver module and extinguish the flames using a water tank that is spun 180 degrees with the assistance of a servo in order to achieve a quicker outcome. This next endeavor, in addition to the characters, will look into the use of a long-range sensor in conjunction with suitable technology to give faster and better.

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