SUBMITTED BY

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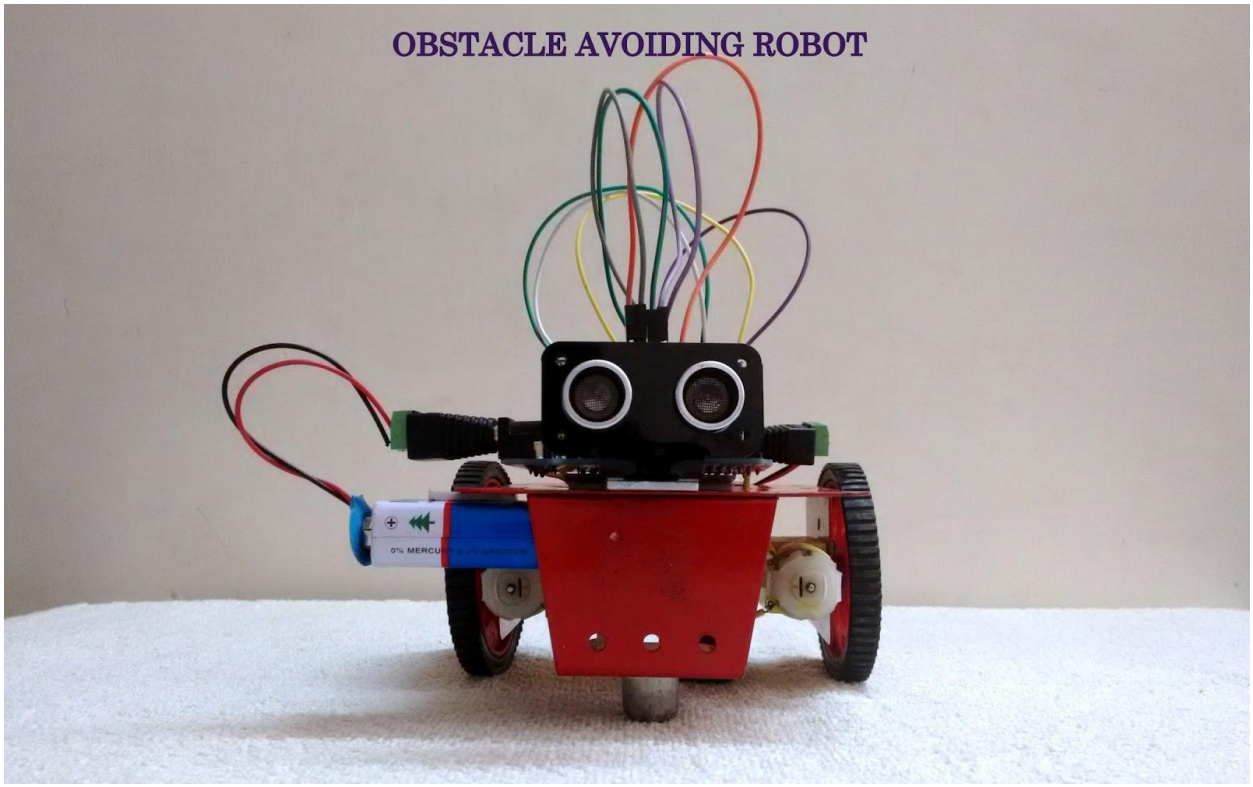
Obstacle Avoidance Robot



Abstract

Obstacle avoidance is one of the most important aspects of mobile robotics. Without it, robot movement would be very restrictive and fragile. This project proposes a robotic vehicle that has an intelligence built in it such that it directs itself whenever an obstacle comes in its path. So, to protect the robot from any physical damages. This can be designed to build an obstacle avoidance robotic vehicle using ultrasonic sensors for its movement. A

microcontroller (AT mega 328P) is used to achieve the desired operation. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the micro-controller. Depending on the input signal received, the micro-controller redirects the robot to move in an alternate direction by actuating the motors which are interfaced to it through a motor driver.

Introduction

Robotics is a set of technologies that requires movement plus intelligence to generate behavior with the goal of simulating or replacing man in the development of daily activities or industrial production.

The design and implementation of a robot able to avoid obstacles and make decisions promotes a lot of interest in the industrial

world that visualize a step forward in terms of technological development based on these applications.

The obstacle avoidance robot is implemented using an ultrasonic sensor which gives input signal to the microcontroller and the motor driver IC L293D is used to control DC gear motors for the motion of the robot.

The obstacle avoidance algorithm needs to steer the robot around the obstacle and resume motion toward the original target. The steering algorithm ensures that the robot does not have to stop in front of an obstacle during its navigation. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the microcontroller.

Parts Used

1. Arduino UNO

2.Ultrasonic sensor HC-SR04

3.Motor Driver IC L293D

4.2x DC Gear Motors

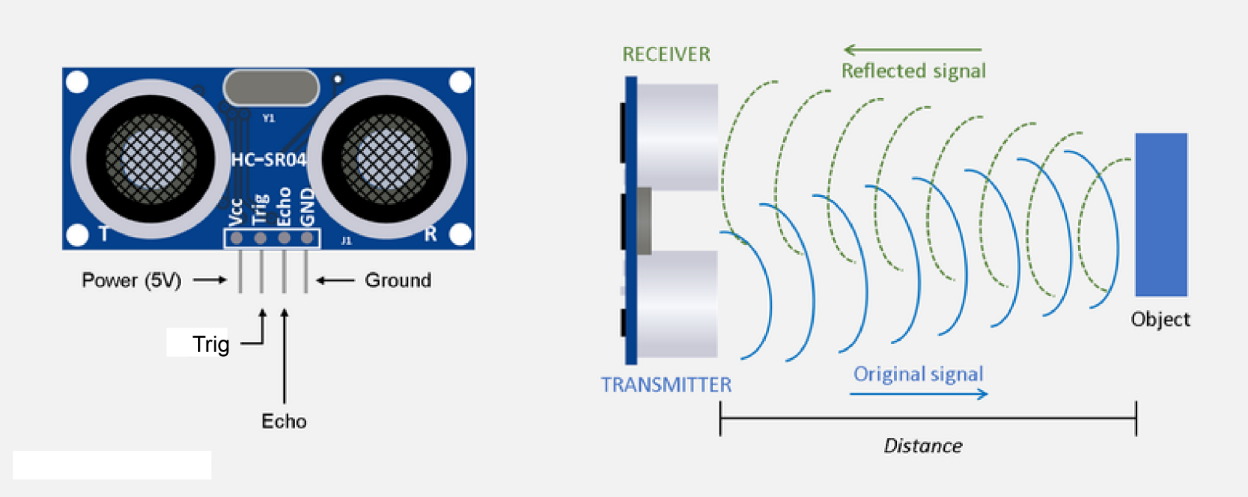
5.Breadboard

Software Used

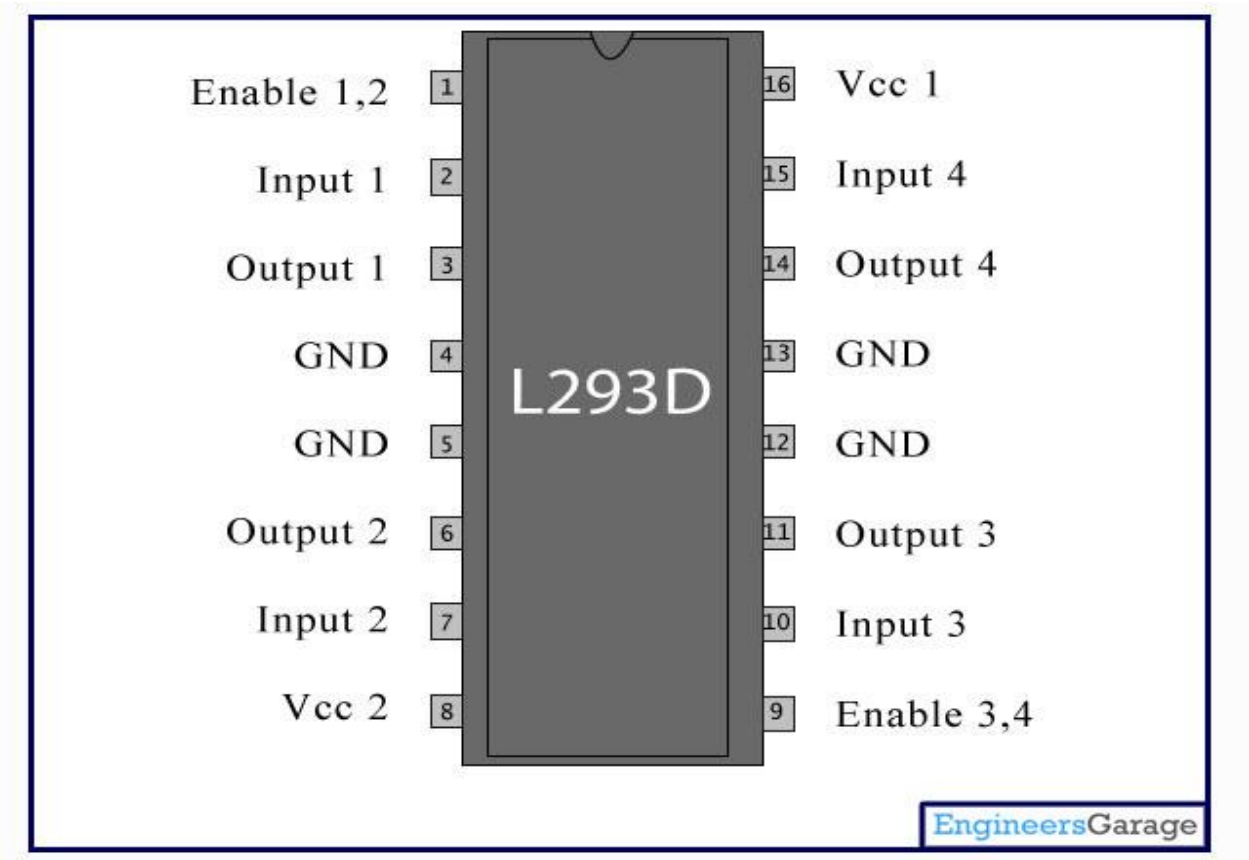
Tinkercad

ARDUINO UNO - The Arduino Uno is an electronic board based on the ATmega328 microcontroller. It has 14 digital inputs / outputs, 6 of which can be used as PWM outputs (Pulse Width Modulation). Another 6 are analog inputs. In addition, it includes a 16 MHz ceramic resonator, a USB connector, a power connector, an ICSP header and a reset button.

ULTRASONIC SENSOR - The ultrasonic sensors continuously emits the frequency signals, when obstacle is detected this signals are reflected back which then considered as input to the sensor.The ultrasonic sensor consists of a multi vibrator, which fixed at its base. The multi vibrator is combination of a resonator and vibrator the ultrasonic waves generated by the vibration are delivers to the resonator. Ultrasonic sensor actually consists of two parts: the emitter which produces a 40 kHz sound wave and detector which detects 40 kHz sound wave and sends electrical signal back to the microcontroller. HC-SR04 ultrasonic sensors are used which consist of 4 pins VCC, Trigger, Echo and GND.

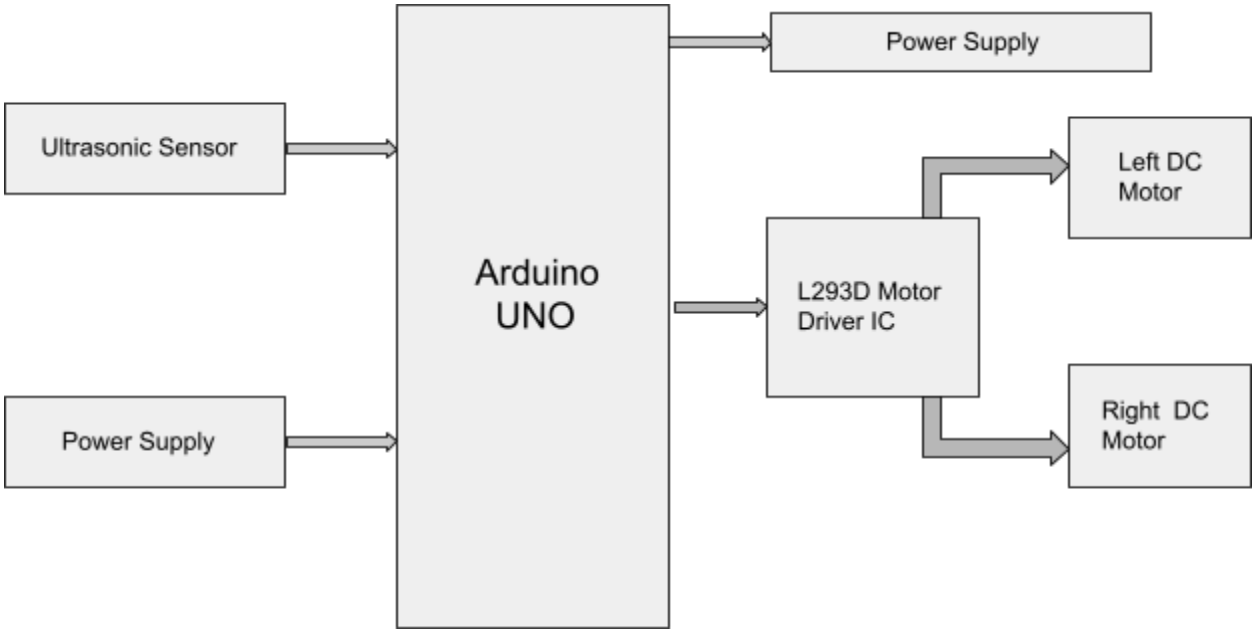


MOTOR DRIVER IC L293D - L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive in either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motors with a single L293D IC.It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction.



PIN DIAGRAM OF L293D

Methodology-



BLOCK DIAGRAM OF SYSTEM

Connections-

ULTRASONIC SENSOR :

Vcc pin of sensor is connected to 5v channel of Arduino UNO for power supply.

Trig pin is connected to D13 pin of Arduino UNO to transmit waves.

Echo Pin is connected to D12 pin of Arduino UNO to receive reflected waves.

GND pin is connected to GND channel of Arduino UNO.

L293D :

Enable pins 1 and 9 are connected to 5V channel of Arduino UNO.

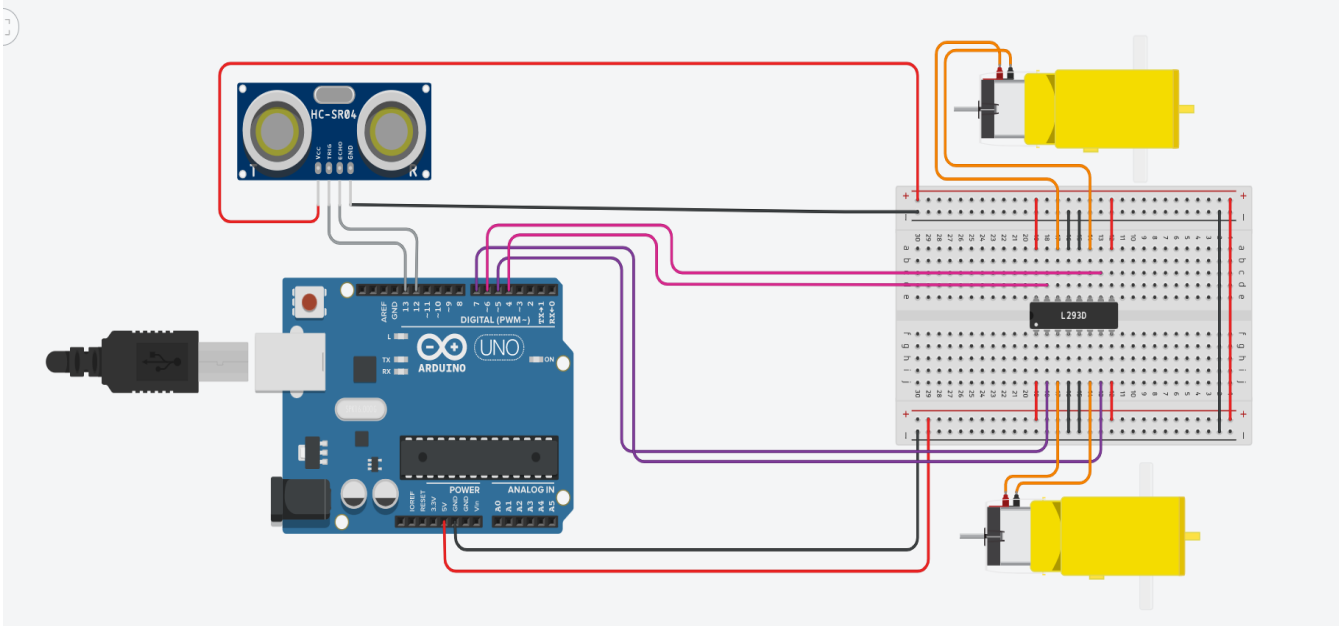
VCC pins 8 and 16 are also connected to 5V channel of Arduino UNO for power supply.

GND pins, 4,5,12,&13 are connected to GND channel of Arduino UNO.

Input Pins 2,7,10,14 are connected to D5,D7,D6,D4 pins of Arduino UNO respectively.

Output Pins 3 and 6 are connected to Left motor.

Output Pins 11 and 14 are connected to Right motor.



CIRCUIT DIAGRAM

Working -

The ultrasonic sensor emits the short and high frequency signal. If they detect any object, then they reflect back echo signal which is taken as input to the sensor through Echo pin .Firstly user initialize Trigger and Echo pin as low and push the robot in forward direction. When obstacle is detected Echo pin will give input as high to microcontroller. Pulse In function is used for calculating the time of distance from the obstacle.

After determining the time, it converts into a distance. If the distance of object is less than 50 the robot will first stop for 1sec, then it will move back and stop for 1 sec and finally will move towards right changing its direction to avoid the obstacle.

Arduino board is connected with DC Motor through Motor driver board (pin10, pin11, pin12, pin13) which provides power to the actuators. Actuators are used to move robot in Forward, Backward, Left and Right directions. The movement of robot will be stop whenever there is an obstacle is present on its path which can be detected by ultrasonic sensors. Ultrasonic sensors give time in length to the microcontroller as an input for further actions.

Code -

```
const int trigPin=13;              //initialize Trig Pin
const int echoPin=12;            //initialize Echo Pins
const int input1=5;               //initialize Motor Pins
const int input2=7;
const int input3=6;
const int input4=4;

void setup(){
            pinMode(trigPin,OUTPUT);  //Set Trig pin as output
            pinMode(echoPin, INPUT);  //Set echo pin as input
            pinMode(input1, OUTPUT);  //Set  Motor pins as output
            pinMode(input2, OUTPUT);
            pinMode(input3, OUTPUT);
            pinMode(input4, OUTPUT);

           Serial.begin(9600);
}
long duration;
int distance;

void loop(){
            digitalWrite(trigPin, LOW);
            delay(2);
            digitalWrite(trigPin, HIGH);          // transmit waves for 10µ sec
            delay(10);
            digitalWrite(trigPin, LOW);
            duration=pulseIn(echoPin, HIGH);           //receive reflected waves
            distance=duration*0.034/2;                  // distance calculation
```

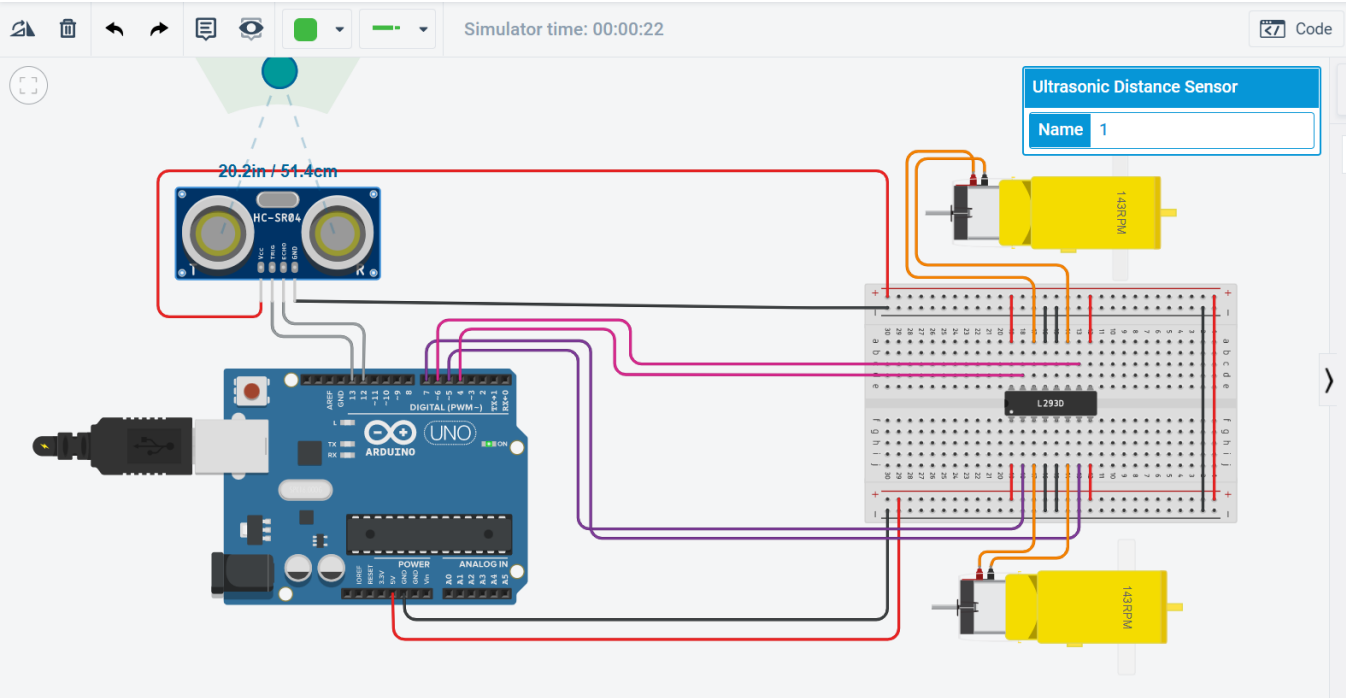
```
Serial.println(distance);
if(distance<50){                    // condition for presence of obstacle
        digitalWrite(input1, LOW);      // stop
        digitalWrite(input2, LOW);
        digitalWrite(input3, LOW);
        digitalWrite(input4, LOW);
        delay(1000);

        digitalWrite(input1, LOW);      //move back
        digitalWrite(input2, HIGH);
        digitalWrite(input3, HIGH);
        digitalWrite(input4, LOW);
        delay(2000);

        digitalWrite(input1, LOW);      // stop
        digitalWrite(input2, LOW);
        digitalWrite(input3, LOW);
        digitalWrite(input4, LOW);
        delay(1000);

        digitalWrite(input1, LOW);    //move right
        digitalWrite(input2, HIGH);
        digitalWrite(input3, HIGH);
        digitalWrite(input4, HIGH);
}
else{
        digitalWrite(input1, HIGH);    //move forward
        digitalWrite(input2, LOW);
        digitalWrite(input3, LOW);
```

```
                digitalWrite(input4, HIGH);
        }
        delay(500);
}
```



Sample simulation when Distance>50

Conclusion-

This project developed an obstacle avoiding robot to detect and avoid obstacles in its path. The robot is built on the Arduino platform for data processing and its software counterpart helped to communicate with the robot to send parameters for guiding movement. For obstacle detection,more ultrasonic distance sensors can be used so that they provide a wider field of detection. The robot is fully autonomous and after the initial loading of the code, it requires no user intervention during its operation.

Applications-

o The modification of this logic code is used in vacuum cleaners.

o This robot can be used for avoiding concealed paths, such as an industrial robot in a factory is expected to avoid workers so that it won't hurt them

o It will be very useful in parking system.

o They have great importance in scientific exploration and emergency rescue, there may be places that are dangerous for humans or even impossible for humans to reach directly, then we should use robots to help us gather information to about their surrounding challenging environments.