Visvesvaraya National Institute of Technology, Nagpur

Department of Electronics and Communication Engineering

Workshop Project Report

Submitted to: Dr. Ankit Bhurane

Course: Electronic Product Engineering Workshop (ECP 307)

Date: 18/04/2023

Project Title: ***Obstacle Avoiding Robot Car (using Arduino)***

Submitted By:

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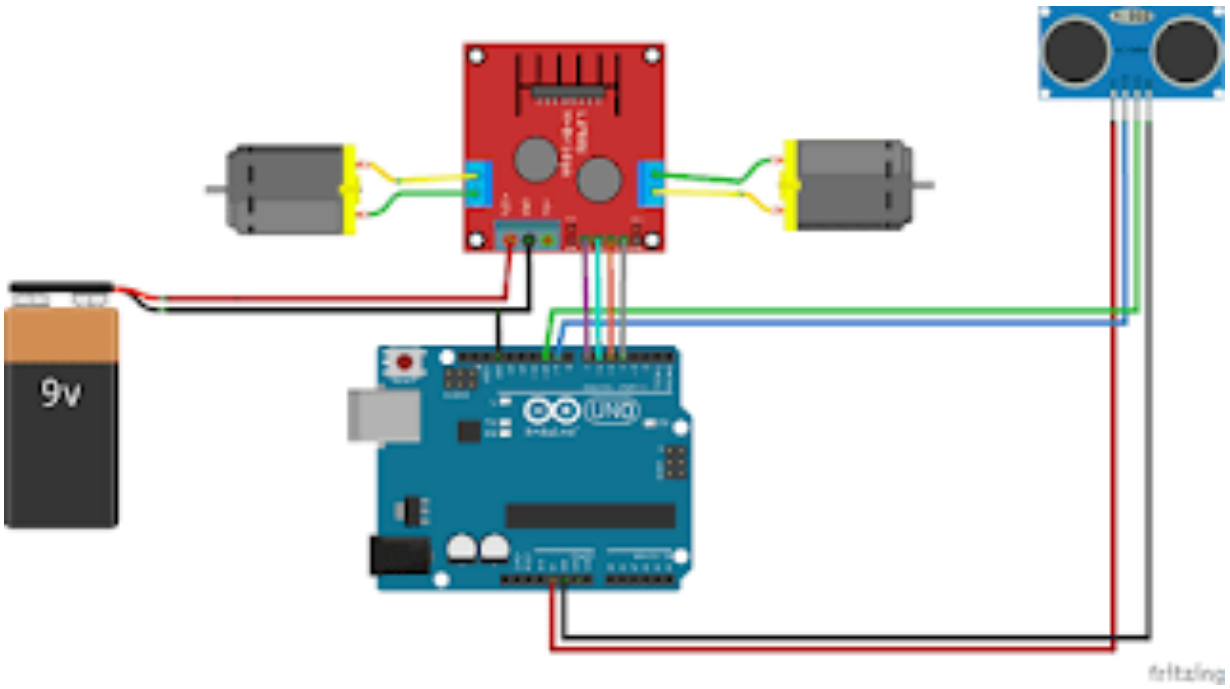
AIM: To make a "obstacle avoiding" robot car which can automatically sense the obstacle in front of it and avoid it by turning itself in another direction.

Components Required:

1. Chassis OR any toy car.
2. Arduino UNO.
3. Ultrasonic sensor HC SR-04.
4. 2 DC motors.
5. 6V to 12V 1A battery.
6. Motor driver module L298N.
7. Jumper wires.
8. Single stranded wires.

Working and Circuit Diagram:



Connections:

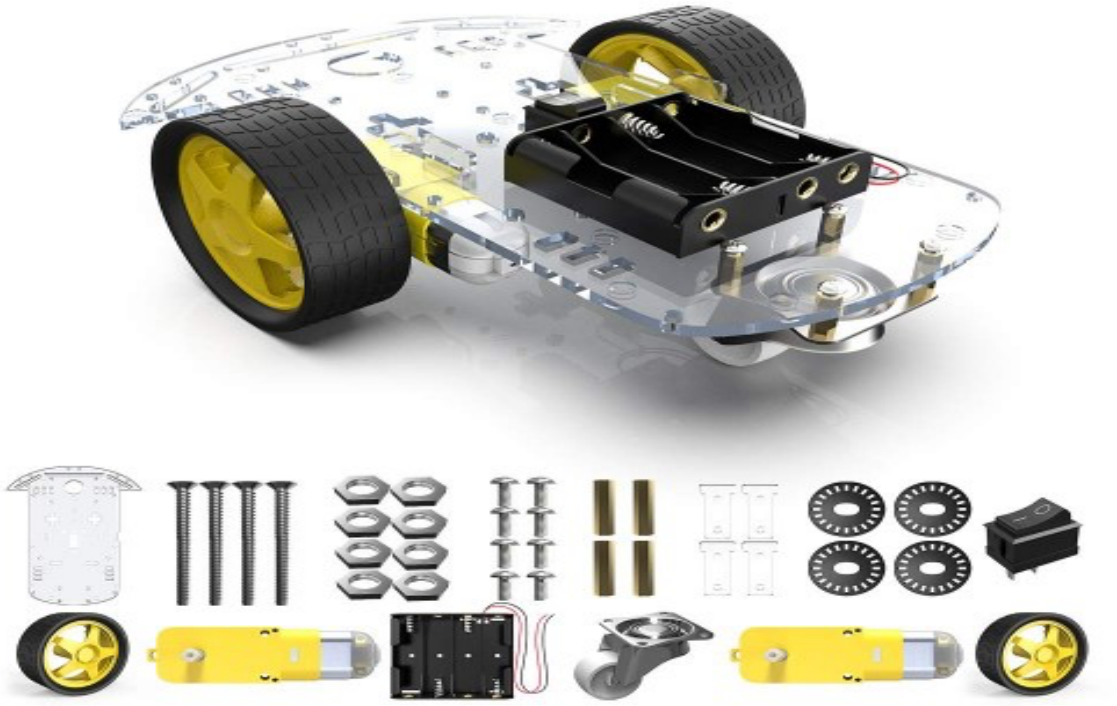
Connections of Ultrasonic sensor

1. VCC – VCC terminal of Arduino.
2. GND – GND terminal of Arduino.
3. Trigpin – digital pin 9 on Arduino.
4. Echo pin – digital pin 10 on Arduino.

Connections of L298N –

1. +12V – Positive terminal of the battery.
2. GND – a)GND of Arduino b)Negative terminal of battery.
3. Input terminal 1 – Pin 4
4. Input terminal 2 – Pin 5
5. Input terminal 3 – Pin 6
6. Input terminal 4 – Pin 7
7. Output terminal 1 – Positive of first motor.
8. Output terminal 2 – Negative of first motor.
9. Output terminal 3 – Positive of second motor.
10. Output terminal 4 – Negative of second motor.

Chassis:



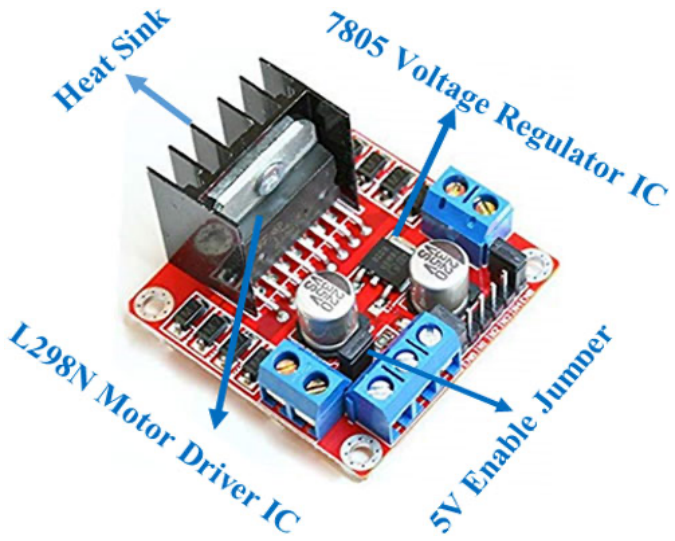
A chassis is the load-bearing framework of an artificial object which structurally supports the object in its construction and function. The main body of the chassis is made of laser-cut clear-acrylic sheet and can hold two gear motors on either side and a supporting universal castor wheel. It also holds a compartment for four AA batteries with battery terminals that protrude through the chassis and can be accessed from the top.

Each dual shaft motor has one side holding the wheel while the other is connected to an encoded disk. The chassis has enough holes and openings for mounting sensors, servo, motor drivers, and control modules. This can be used with specific sensors for tracing, obstacle avoidance, distance and speed testing.

Motor driver module L298N:

This **L298N Motor Driver Module** is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator.This L**298N Module** controls 2 DC motors with directional and speed control. The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit. 78M05 Voltage regulator will be enabled only when the jumper is placed. When the power supply is less than or equal to 12V, then the internal circuitry will be powered by the voltage regulator and the 5V pin can be used as an output pin to power the microcontroller. The jumper should not be placed when the power supply is greater than 12V and separate 5V should be given through 5V terminal to power the internal circuitry.

ENA & ENB pins are speed control pins for Motor A and Motor B while IN1& IN2 and IN3 & IN4 are direction control pins for Motor A and Motor B.



L298N Module Pinout Configuration

Pin Name	Description
OUT1 & OUT2	Output pins of Motor A

OUT3 & OUT4	Output pins of Motor B
12V	12V input from DC power Source
5V	Supplies power for the switching logic circuitry inside L298N IC
GND	Ground pin

Features & Specifications

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current:2A
- Logical Current:0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor
- Heatsink for better performance
- Power-On LED indicator

Ultrasonic sensor HC SR04:

Ultrasonic Sensor Pinout Configuration

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

Distance = Speed × Time

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module. The circuitry inbuilt on the module will calculate the time

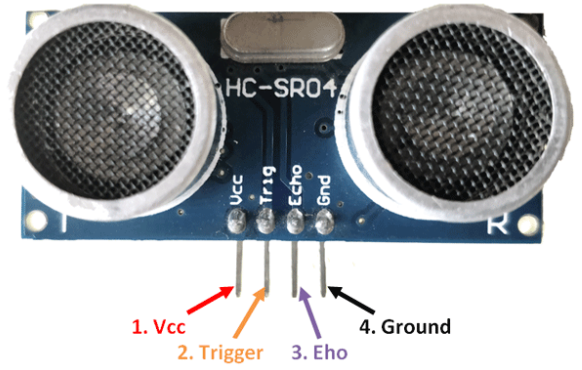
taken for the UltraSonic wave to come back and turns on the echo pin high for that same particular amount of time, this way we can also know the time taken.

Power the Sensor using a regulated +5V through the Vcc ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller. To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

The amount of time during which the Echo pin stays high is measured by the MCU/MPU as it gives the information about the time taken for the wave to return back to the Sensor. Using this information the distance is measured as explained in the above heading.

HC-SR04 Sensor Features

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz



Power Analysis:

Component	Voltage(Measured)	Operating Voltage	Current Output
Power Supply: 1.5 V * 4 AA batteries	4.41 V	6V	4 A
Arduino UNO	5.57 V	5-12V	-
Ultrasonic sensor HC SR-04	5.66 V	5V (DC)	-
L298N Motor Driver Module	4.27 V	3.2V-46V	-
DC Motors	0-4.2V depending on when the motor's axle is rotating (according to the Arduino program)	3V-12V	-

Cost Analysis:

- Arduino UNO: Rs.440
- Ultrasonic Sensor: Rs.192
- Chassis (including 2 DC motors, a wooden frame, battery holder, and 3 wheels): Rs.373
- Type A to Type B USB Cable (for the Arduino to laptop connection): Rs.50
- L298N Motor driver module: Rs.190
- Bread board(small size): Rs.40
- Jumper wires, single strand wires: Rs 50
- Power supply – 4 AA 1.5V batteries: Rs.94

Total Cost: Rs.1429

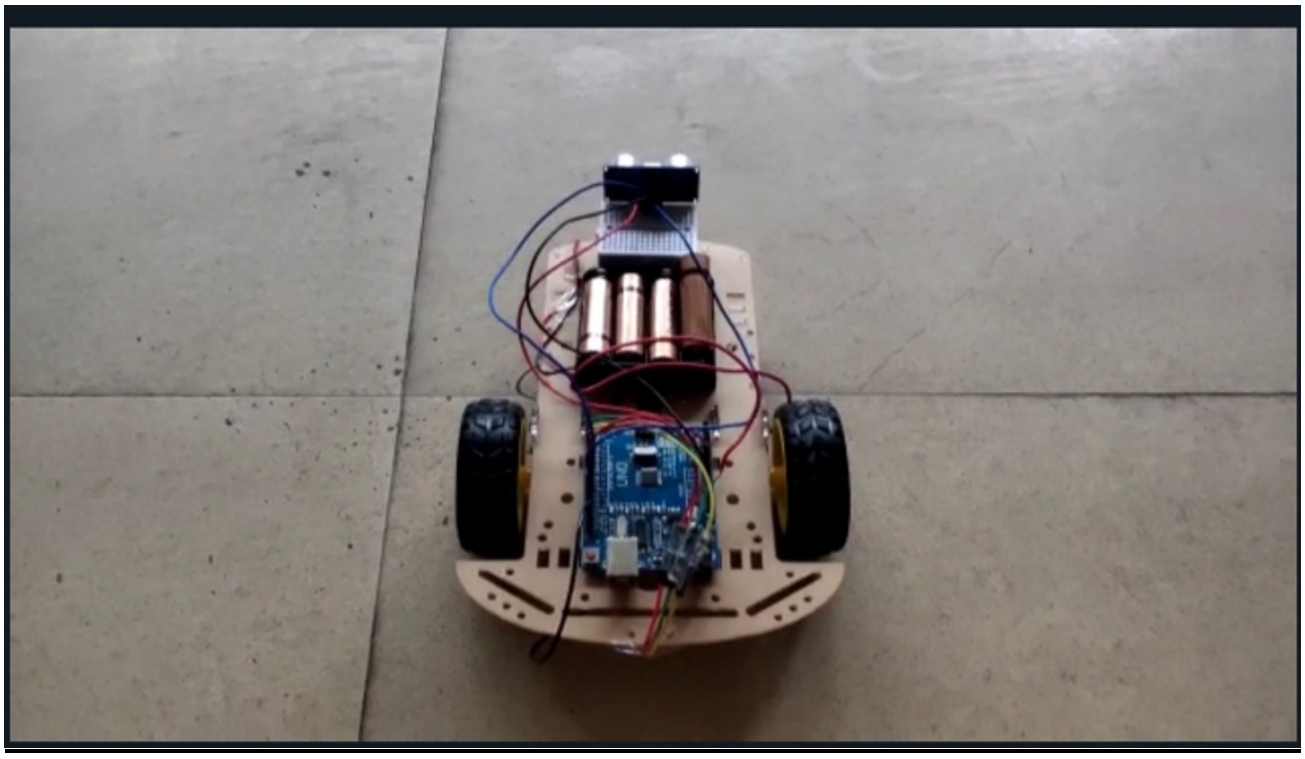
Arduino Code:

```
/* Obstacle Avoiding Robot Using Ultrasonic Sensor and Arduino UNO
 */
int trigPin = 9;      // trig pin of HC-SR04
int echoPin = 10;     // Echo pin of HC-SR04
int revleft4 = 4;       //REVerse motion of Left motor
int fwdleft5 = 5;       //ForWarD motion of Left motor
int revright6 = 6;      //REVerse motion of Right motor
int fwdright7 = 7;      //ForWarD motion of Right motor

long duration, distance;

void setup()
{

  delay(random(500,2000));   // delay for random time
  Serial.begin(9600);
  pinMode(revleft4, OUTPUT);      // set Motor pins as output
  pinMode(fwdleft5, OUTPUT);
  pinMode(revright6, OUTPUT);
  pinMode(fwdright7, OUTPUT);

  pinMode(trigPin, OUTPUT);         // set trig pin as output
  pinMode(echoPin, INPUT);          //set echo pin as input to capture reflected
waves
}

void loop()
{

  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);     // send waves for 10 us
  delayMicroseconds(10);
  duration = pulseIn(echoPin, HIGH); // receive reflected waves
  distance = duration / 58.2;   // convert to distance
  delay(10);

  if (distance > 20)
  {
    digitalWrite(fwdright7, HIGH);                  // move forward
    digitalWrite(revright6, LOW);
```

```
    digitalWrite(fwdleft5, HIGH);
    digitalWrite(revleft4, LOW);
  }

  if (distance < 19)
  {
    digitalWrite(fwdright7, LOW);  //Stop
    digitalWrite(revright6, LOW);
    digitalWrite(fwdleft5, LOW);
    digitalWrite(revleft4, LOW);
    delay(500);
    digitalWrite(fwdright7, LOW);      //movebackword
    digitalWrite(revright6, HIGH);
    digitalWrite(fwdleft5, LOW);
    digitalWrite(revleft4, HIGH);
    delay(500);
    digitalWrite(fwdright7, LOW);  //Stop
    digitalWrite(revright6, LOW);
    digitalWrite(fwdleft5, LOW);
    digitalWrite(revleft4, LOW);
    delay(100);
    digitalWrite(fwdright7, HIGH);
    digitalWrite(revright6, LOW);
    digitalWrite(revleft4, LOW);
    digitalWrite(fwdleft5, LOW);
    delay(500);
  }
}
```

RESULT AND ANALYSIS:

- DC Supply of 4-12V is given to TP4056A module.
- Two 3.7V,2000mAh batteries are connected in series due to which a total of 7.32 V is generated
- LM7805 was fed with the above Voltage and it gave an Output of 4.87V and 1.8A which is sufficient to charge a Mobile Phone.



ADVANTAGES AND APPLICATIONS:

1. The application of Obstacle Avoiding robot is not limited and it is used in most of the military organization now which helps carry out many risky jobs that cannot be done by any soldiers.
2. Method on a floor cleaning robot for long hallways.
3. Obstacle avoiding robots can be used in almost all mobile robot navigation systems.

LIMITATIONS:

A disadvantage with obstacle avoidance based on edge detecting is the need of the robot to stop in front of an obstacle in order to provide a more accurate measurement. All mobile robots feature some kind of collision avoidance, ranging from primitive algorithms that detect an obstacle and stop the robot in order to avoid a collision, using some sophisticated algorithms that enable the robot to detour obstacles. The latter algorithms are more complex, since they involve detection of an obstacle as well as some kind of quantitative measurements concerning the obstacle's dimensions.

FUTURE SCOPE:

Adding a camera:
If the current project is interfaced with camera (e.g a Webcam) robot can be driven beyond line-of-sight & range can be becomes practically unlimited as networks have a very large range.

Use as a fire fighting robot:

By adding temperature sensor,water tank and making some changes in programming we can use this robot as fire fighting robot.

REFERENCES:

https://www.blackkeyhole.com/2020/03/2-wheel-obstacle-avoiding-roboticcar-car.html?m=1
(For Arduino Code)

https://components101.com/sensors/ultrasonic-sensor-working-pinout-datasheet
(For Description of Ultrasonic sensor HC SR04)

https://components101.com/modules/l293n-motor-driver-module
(For Description of L298 Motor Module)