OBSTACLE AVOIDING ROBOT

A MINI PROJECT REPORT

Submitted towards the professional course

15Z610 EMBEDDED SYSTEMS LABORATORY

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MARCH 2020

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INTRODUCTION:

Now a day's many industries are using robots due to their high level of performance and reliability and which is a great help for human beings. Being a branch of engineering, the applications of robotics are increasing with the advancement of technology. The concept of Mobile Robot is fast evolving and the number of mobile robots and their complexities are increasing with different applications. There are many types of mobile robot navigation techniques like path planning, self – localization and map interpreting.

An Obstacle Avoiding Robot is a type of autonomous mobile robot that avoids collision with unexpected obstacles. The design of obstacle avoidance robot requires the integration of many sensors according to their task. The obstacle detection is primary requirement of this autonomous robot. The robot gets the information from surrounding area through mounted sensors on the robot. Some sensing devices used for obstacle detection like bump sensor, infrared sensor, ultrasonic sensor etc. Ultrasonic sensor is most suitable for obstacle detection and it is of low cost and has high ranging capability. A simple project on Obstacle Avoiding Robot is designed here.

The project is aimed to design a basic unmanned vehicle which avoids obstacles by the usage of Ultra-Sonic sensors. This is achieved by using an Arduino UNO. The project proposes a robotic vehicle with an in-built intelligence system which guides the robot whenever an obstacle is ahead of it. This is achieved by using an Ultra-Sonic sensor to send a signal to the Arduino whenever an Obstacle is encountered. Arduino then orders the vehicle to avoid the obstacle.

PROBLEM STATEMENT:

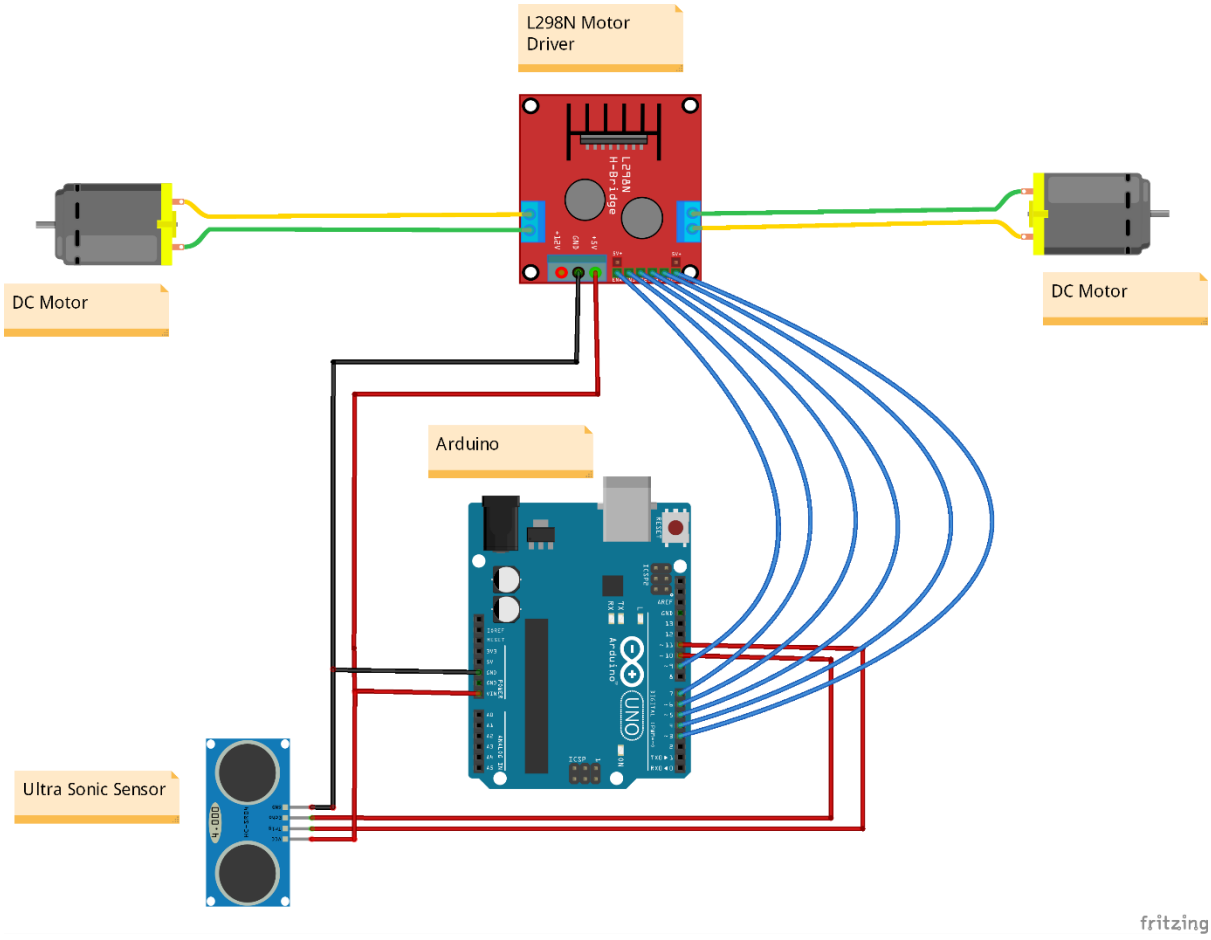
The World Health Organization (WHO) has conducted a survey on road accidents around the world. As per the survey, almost 1.35 million (13.5 lakh) die each year due to road casualties and a good majority of them are aged between five and 29 years. What is even more concerning is that India accounts for around 1.5 lakh road deaths every year. The safety benefits of automated vehicles are paramount. Automated vehicles' potential to save lives and reduce injuries is rooted in one critical and tragic fact: 94% of serious crashes are due to human error. Automated vehicles have the potential to remove human error from the crash equation, which will help protect drivers and passengers, as well as bicyclists and pedestrians. When you consider more than 97,133 people died in motor vehicle-related crashes in the India in 2017, you begin to grasp the lifesaving benefits of driver assistance technologies.

Since most of the accidents occur due to Human Errors, we have planned to develop a model for Fully-Autonomous Vehicle. This system can be implemented in many of the current vehicles which can be made automated.

Components Required:

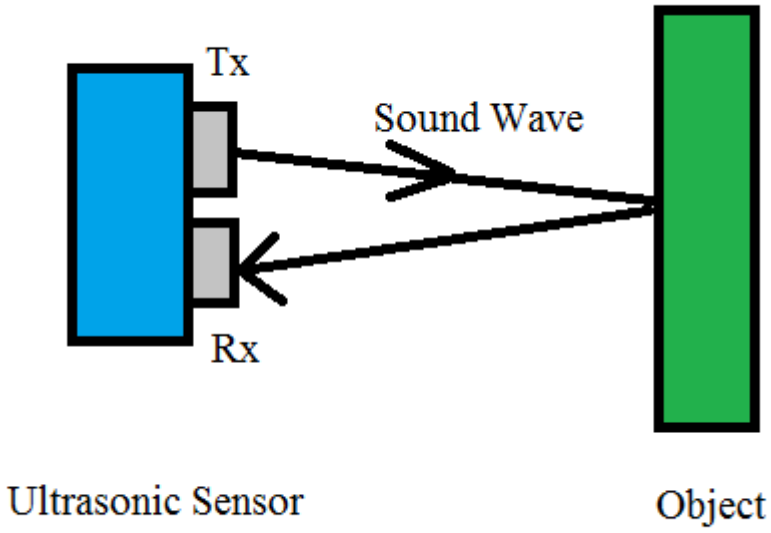
- Arduino UNO
- L293D Motor Driver IC
- Motor Shield
- DC Motors x 2
- Robot Chassis
- Ultra-Sonic Sensor x 1
- Connecting Wires
- Power supply
- Battery Connector
- Battery Holder

Schematic Diagram:



Working Principle:

The ultrasonic sensor emits the short and high frequency signal. These propagate in the air at the velocity of sound. If they hit any object, then they reflect back echo signal to the sensor. The ultrasonic sensor consists of a multi vibrator, fixed to the base. The multi vibrator is combination of a resonator and vibrator. The resonator delivers ultrasonic wave generated by the vibration. The ultrasonic sensor actually consists of two parts; the emitter which produces a 40 kHz sound wave and detector detects 40 kHz sound wave and sends electrical signal back to the microcontroller.



The ultrasonic sensor enables the robot to virtually see and recognize object, avoid obstacles, measure distance. The operating range of ultrasonic sensor is 10 cm to 30 cm.

Operation of the ultrasonic sensor:

When an electrical pulse of high voltage is applied to the ultrasonic transducer it vibrates across a specific spectrum of frequencies and generates a burst of sound waves. Whenever any obstacle comes ahead of the ultrasonic sensor the sound waves will reflect back in the form of echo and generates an electric pulse. It calculates the time taken between sending sound waves and receiving echo. The echo patterns will be compared with the patterns of sound waves to determine detected signal's condition.

Note: The ultrasonic receiver shall detect signal from the ultrasonic transmitter while the transmit waves hit on the object. The combination of these two sensors will allow the robot to detect the object in its path. The ultrasonic sensor is attached in front of the robot and that sensor will also help the robot navigate through the hall of any building.

Code:

```
int trigger_pin = 11;       // trig pin of HC-SR04
int echo_pin = 10;      // Echo pin of HC-SR04
int EA = 9;             //ENA connected to digital pin 9
int EB = 3;            //ENB connected to digital pin 3
int reverse_A = 7;
int foreward_A = 6;
int reverse_B =5;
int foreward_B = 4;

long dur, dist;

void setup() {

  delay(500);
  Serial.begin(9600);
  pinMode(reverse_A, OUTPUT);     // set Motor pins as output
  pinMode(foreward_A, OUTPUT);
  pinMode(reverse_B, OUTPUT);
  pinMode(foreward_B, OUTPUT);
  pinMode(EA, OUTPUT);     // initialize ENA pin as an output
  pinMode(EB, OUTPUT);     // initialize ENB pin as an output
  pinMode(trigger_pin, OUTPUT);        // set trig pin as output
  pinMode(echo_pin, INPUT);         //set echo pin as input
}

void loop() {

  analogWrite(trigger_pin, LOW);
  delayMicroseconds(2);
  analogWrite(trigger_pin, HIGH);     // send waves for 10 µs
  delayMicroseconds(10);
  dur = pulseIn(echo_pin, HIGH); // receive reflected waves
  dist = dur / 58.2;   // convert to distance
  Serial.println(dist);
  delay(10);
  if (dist > 19)
  {
    analogWrite(EA, 150); // set right motors speed
    analogWrite(EB, 150); // set left motors speed
    digitalWrite(foreward_B, HIGH);                 // move forward
    digitalWrite(reverse_B, LOW);
    digitalWrite(foreward_A, HIGH);
    digitalWrite(reverse_A, LOW);
  }

  if (dist < 18)
  {
    analogWrite(EA, 0); // set right motors speed
    analogWrite(EB, 0); // set left motors speed
    digitalWrite(foreward_B, LOW);  //Stop
```

```
  digitalWrite(reverse_B, LOW);
  digitalWrite(foreward_A, LOW);
  digitalWrite(reverse_A, LOW);
  delay(500);

  analogWrite(EA, 255); // set right motors speed
  analogWrite(EB, 255); // set left motors speed
  digitalWrite(foreward_B, LOW);      //movebackword
  digitalWrite(reverse_B, HIGH);
  digitalWrite(foreward_A, LOW);
  digitalWrite(reverse_A, HIGH);
  delay(500);

  analogWrite(EA, 0); // set right motors speed
  analogWrite(EB, 0); // set left motors speed
  digitalWrite(foreward_B, LOW);  //Stop
  digitalWrite(reverse_B, LOW);
  digitalWrite(foreward_A, LOW);
  digitalWrite(reverse_A, LOW);
  delay(100);

  analogWrite(EA, 0); // set right motors speed
  analogWrite(EB, 150); // set left motors speed
  digitalWrite(foreward_B, HIGH);       //turnleft
  digitalWrite(reverse_B, LOW);
  digitalWrite(reverse_A, LOW);
  digitalWrite(foreward_A, LOW);
  delay(500);
}
```

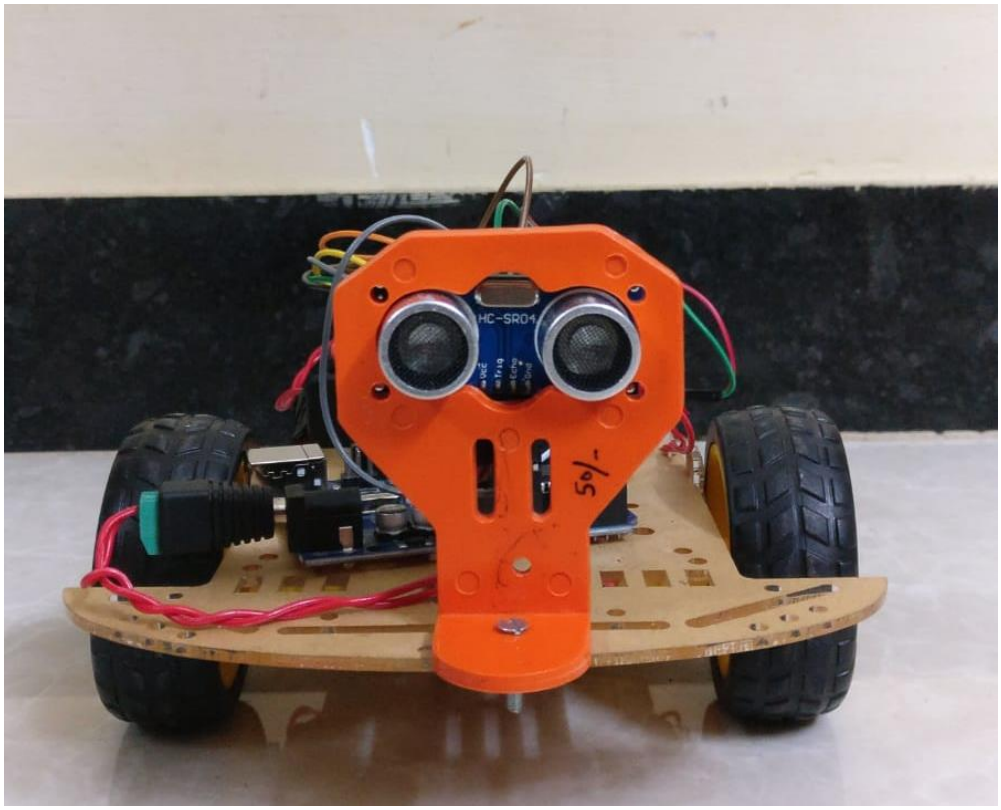
Challenges Faced:

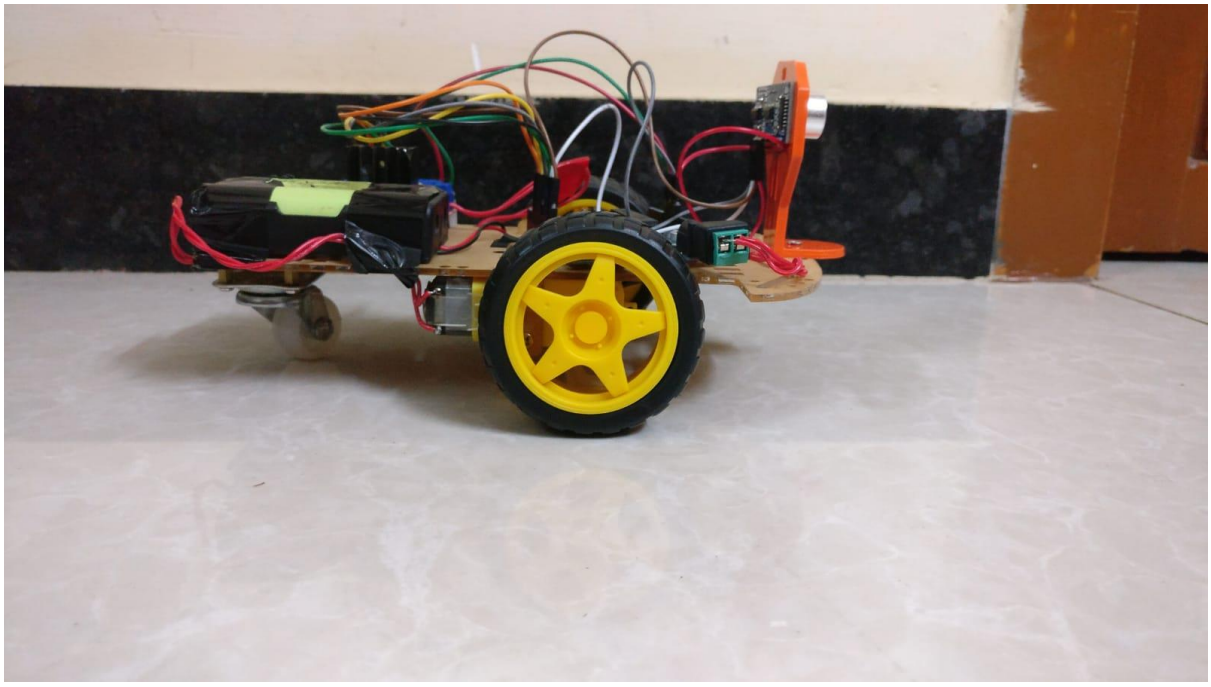
1. Understanding the Working of Ultra-Sonic Sensor
2. Sudden intervention of obstacles leads to a crash.
3. Determining the distance to stop.

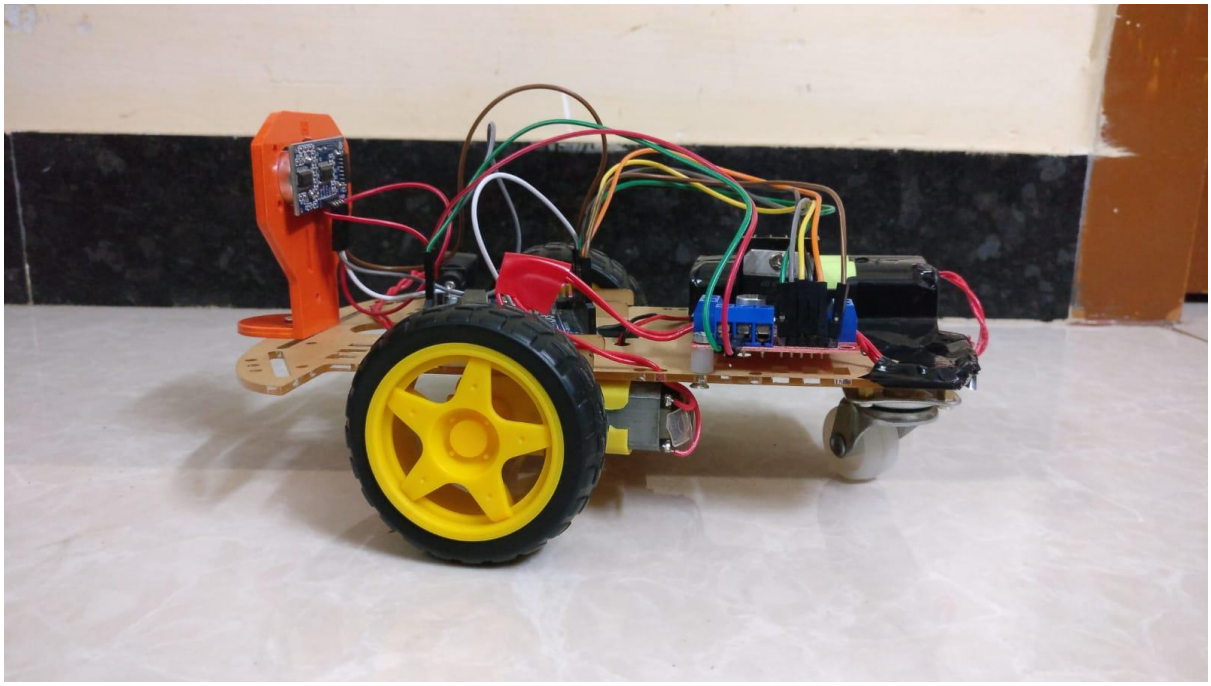
Contribution of Team Members:

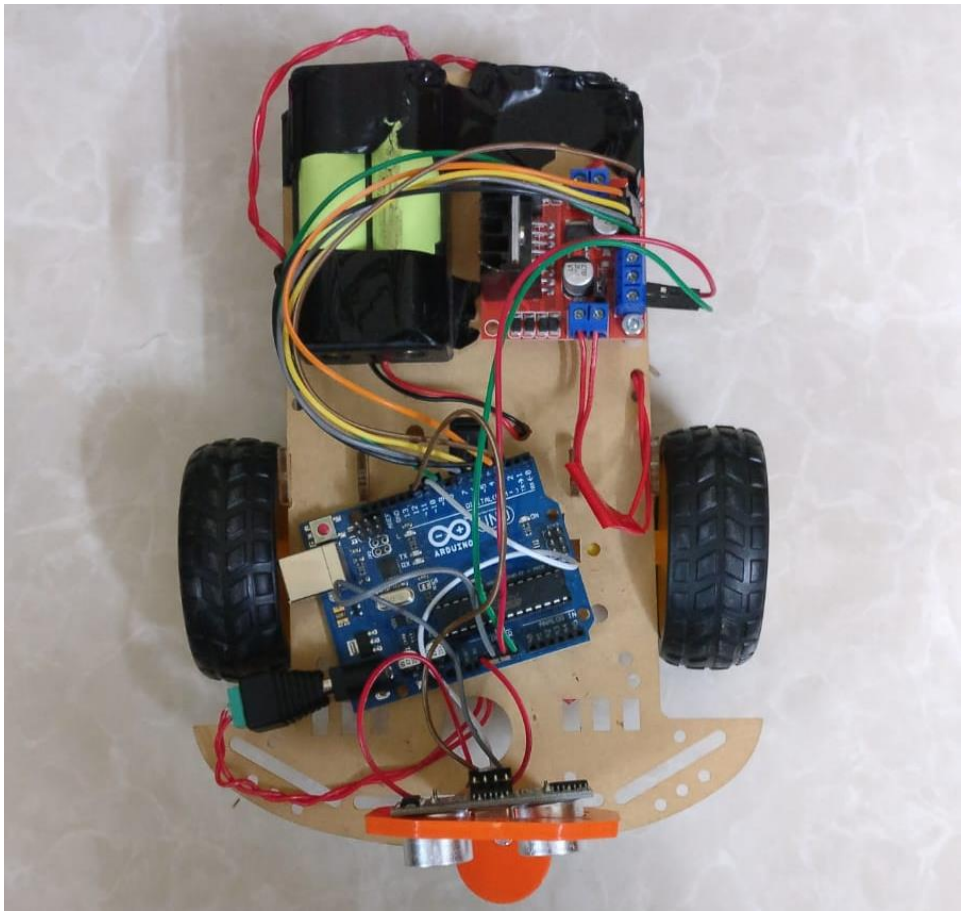
1. Building the Robot – Harhi Varrman and Johann
2. Implementation – Sashwath

Snapshots of Project:









References:

[1] https://www.elprocus.com/obstacle-avoidance-robotic-vehicle/
[2] https://github.com/sashu1999/Obstacle-Avoiding-Bobot