OBSTACLE AVOIDING ROBOT USING ARDUINO

A PROJECT REPORT

Submitted by

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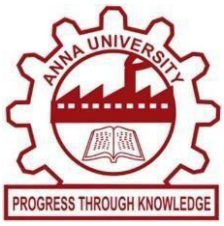
In partial fulfilment for the award of the degree

Of

BACHELOR OF ENGINEERING

IN

ELECTRONICS ENGINEERING



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BONAFIDE CERTIFICATE

Certified that this project **"Obstacle avoiding Robot using Arduino UNO** "is the bonafide work of

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who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other project report on the basis of which a degree was conferred on an earlier occasion on this or any other candidate

SIGNATURE

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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 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 design to build an obstacle avoidance robotic vehicle using ultrasonic sensors for its movement. A micro-controller(Arduino Uno Rev3) 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 microcontroller. Depending on the input signal received, the micro-controller redirects the robot to move in an alternate direction by actuating the motors whichare interfaced to it through a motor driver.

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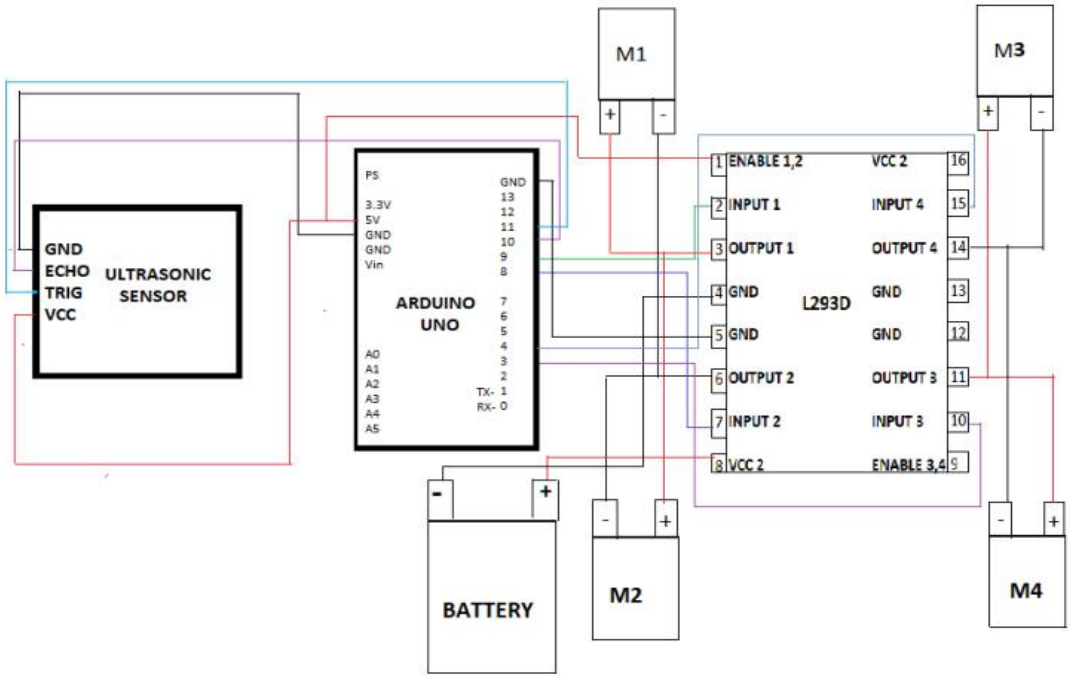
INTRODUCTION:

Obstacle Avoiding Robot is an intelligent device that can automatically sense the obstacle in front of it and avoid them by turning itself in another direction. This design allows the robot to navigate in an unknown environment by avoiding collisions, which is a primary requirement for any autonomous mobile robot. The application of the Obstacle Avoiding robot is not limited and it is used in most of the military organizations now which helps carry out many risky jobs that cannot be done by any soldiers.

Before going to build the robot, it is important to understand how the ultrasonic sensor works because this sensor will have important role in detecting obstacle. The basic principle behind the working of ultrasonic sensor is to note down the time taken by sensor to transmit ultrasonic beams and receiving the ultrasonic beams after hitting the surface. Then further the distance is calculated using the formula.

In this we use Arduino board, which is invented for the electronics students to use this in their projects. The Arduino boards are provided as open source that helps the user to build their projects and instruments according to their need. This electronic platform contains microcontrollers, connections, LEDs and many more. There are various types of Arduino boards present in the market that includes Arduino UNO, Red Board, LilyPad Arduino, Arduino Mega, Arduino Leonardo. All these Arduino boards are different in specifications, features and uses and are used in different type of electronics project

DESIGN:



HARDWARE:

1) Arduino Uno Rev3

2) Motor Driver Shield L293D

3) Wheels (4x)

4) TT Gear Motor (4x)

5) Servo Motor

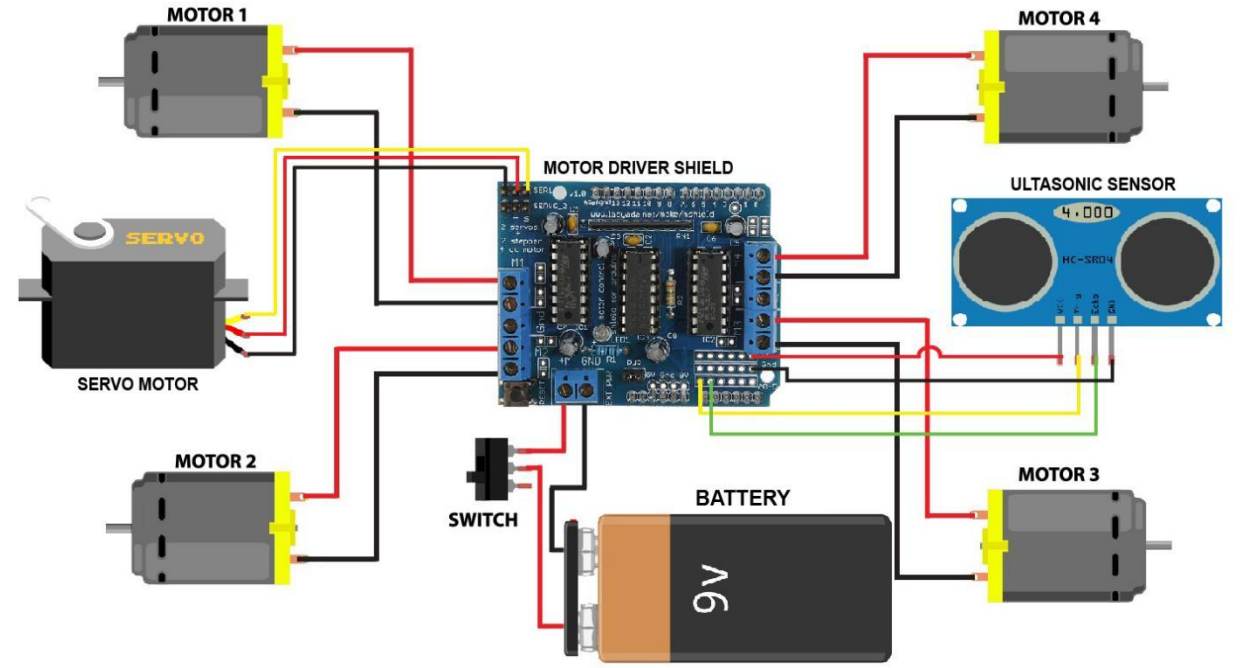
6) Ultrasonic Sensor

7) 18650 Li-on Battery (2x)

8)18650 Battery Holder

9) Male and Female Jumper wire

BLOCK DIAGRAM:



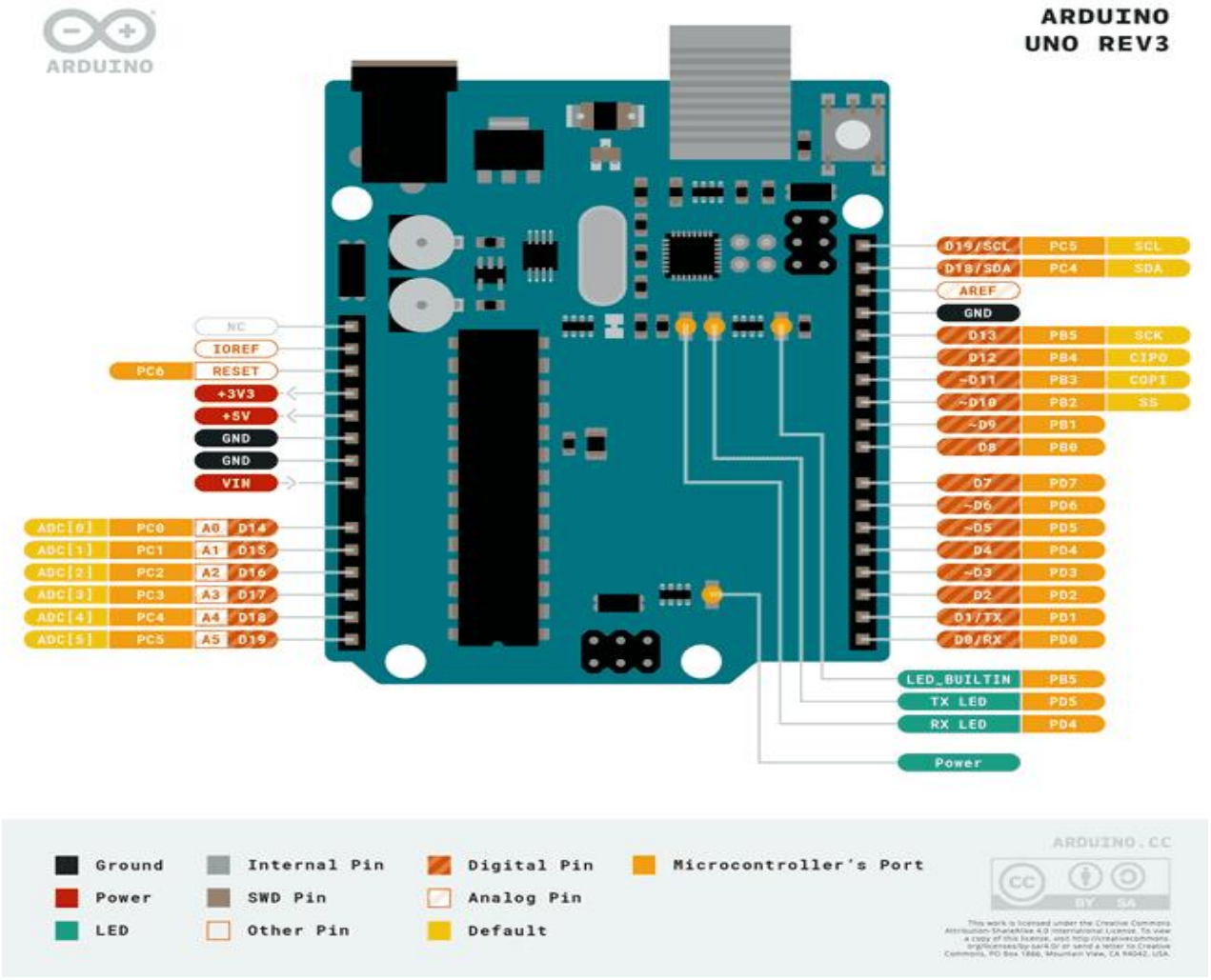
The basic block diagram of the obstacle avoiding car is shown in above figure. Mainly this block diagram consists of the following essential blocks.

a)Arduino Uno Rev3

b)Motor driver (L293D)

c)Ultrasonic Sensor (HC-SR04)

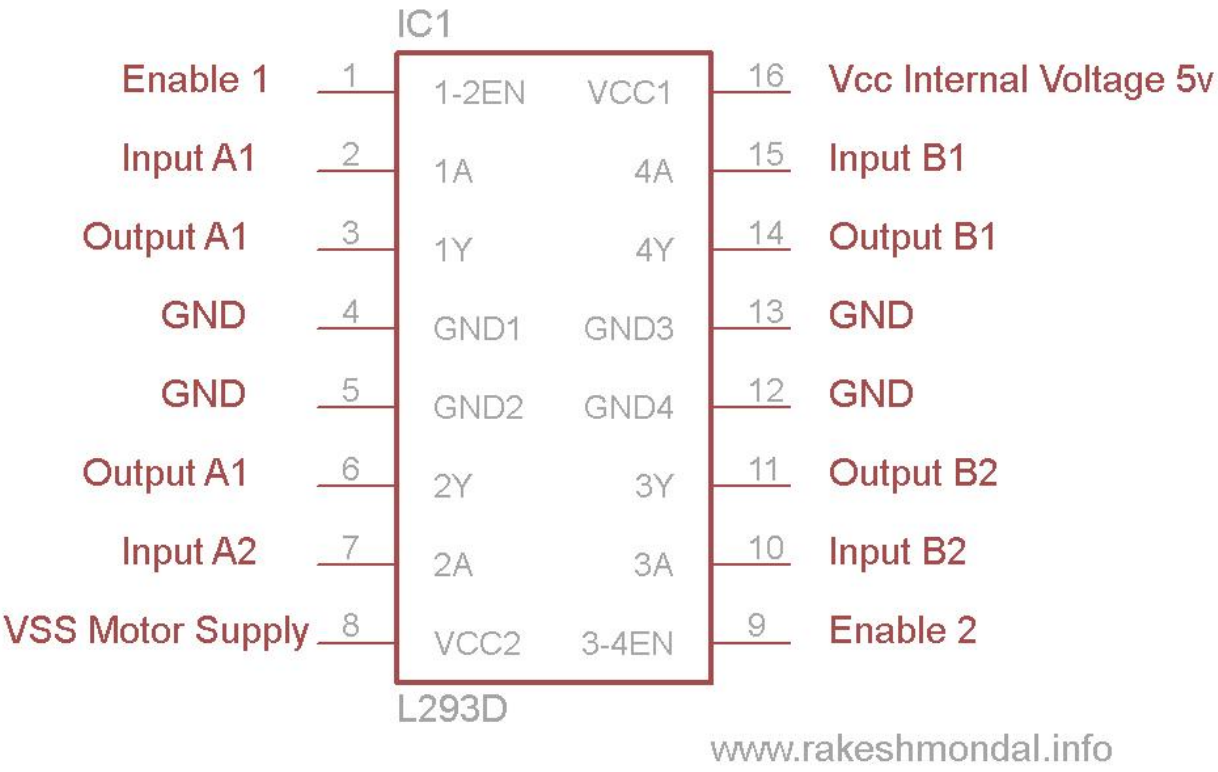
a) ARDUINO UNO REV3:



Arduino/Genuino 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 quartz crystal, 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 worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

b) MOTOR DRIVER (L293D IC):



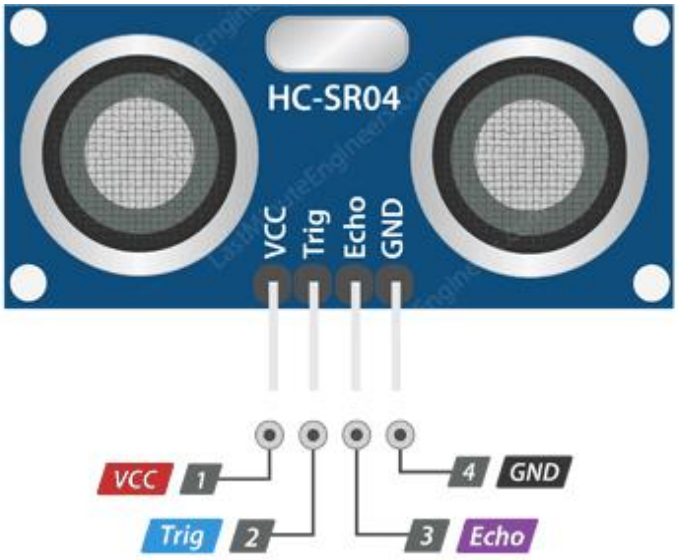
Motor drivers take a low current control signal but provide a higher current signal, thus acting as a current amplifier. The higher current signal drives the motors.

L293D is a motor driver that allows direct current (DC) motor to drive on either direction. It contains two inbuilt H-bridge driver circuits.

To rotate the motor in clockwise or anticlockwise direction, voltage need to change its direction. H-bridge is a circuit that allows voltage to be flown in either direction. Hence H-bridge IC are ideal for driving a DC motor.

Here are 4 input pins for L293d, pin 2,7 on the left and pin 15 ,10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1. For rotating the motor in clockwise direction the input pins has to be provided with Logic 1 and Logic 0. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

c) ULTRASONIC SENSOR (HC-SR04):



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 emits an ultrasound at 40 000 Hz which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance

The HC-SR04 Ultrasonic Module has 4 pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the Arduino Board respectively and the trig and echo pins to any Digital I/O pin on the Arduino Board.

In order to generate the ultrasound you need to set the Trig on a High State for 10 µs. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo pin. The Echo pin will output the time in microseconds the sound wave traveled.

METHODOLOGY:

The obstacle avoidance robotic vehicle uses ultrasonic sensors for its movements. Arduino is used to achieve the desired operation. The motors are connected through motor driver IC to Arduino. The ultrasonic sensor is attached in front of the robot.

Whenever the robot is going on the desired path the ultrasonic sensor transmits the ultrasonic waves continuously from its sensor head. Whenever an obstacle comes ahead of it the ultrasonic waves are reflected back from an object and that information is passed to the arduino. The arduino controls the motors left, right, back, front, based on ultrasonic signals. In order to control the speed of each motor pulse width modulation is used (PWM).

When ultrasonic sensor detect the object which is kept inside the path it will send the signal toward the arduino uno and according to that it will it will rotate the motor M3 & M4 in forward direction and rotate the motor M1 & M2 in reverse direction such way that the car get moving in left direction. Similarly in every time whenever an obstacle in found to be in path of car it will detect it and rotate the car in left direction to avoid the obstacle

SOFTWARE USED:

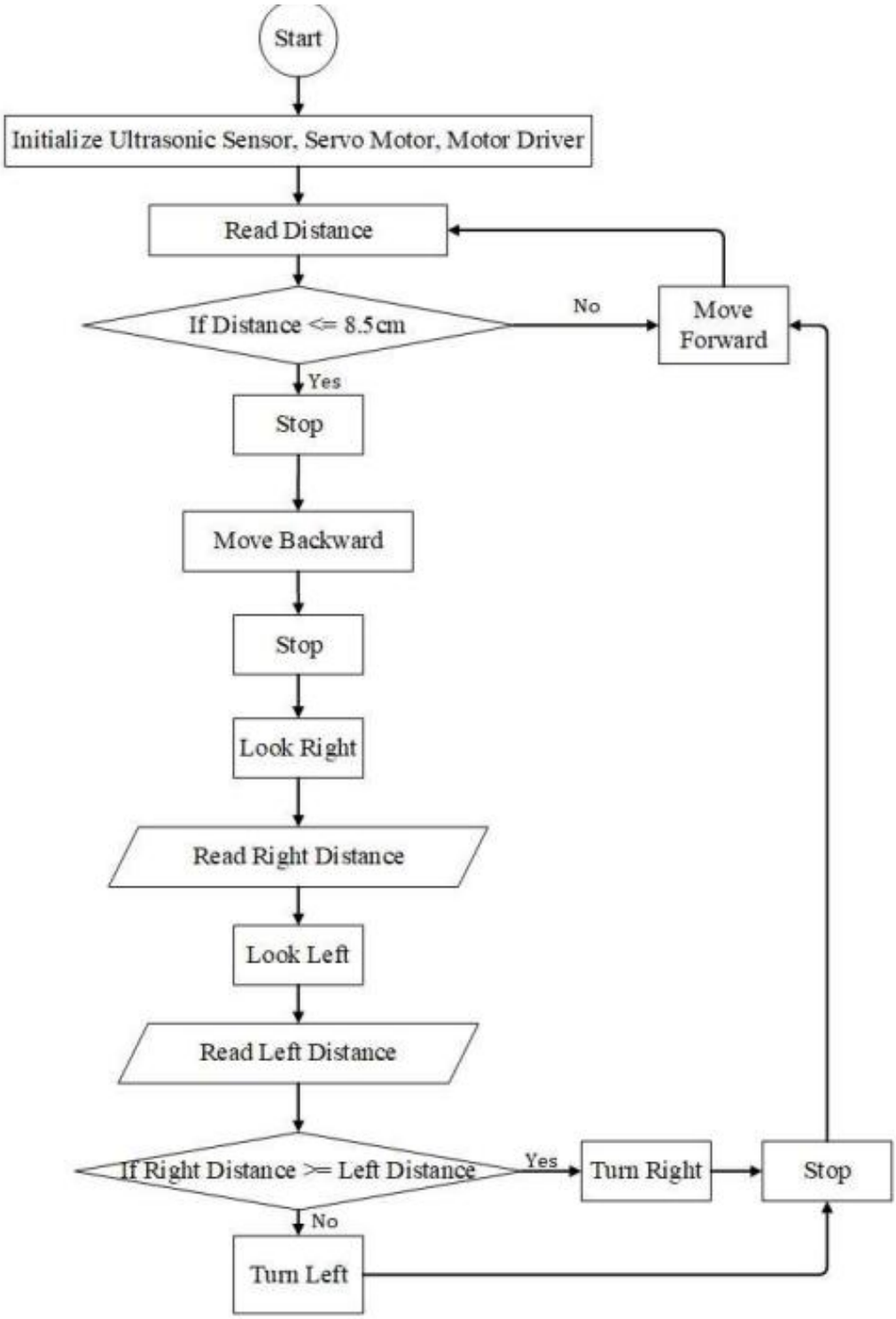
a) ARDUINO IDE:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

The Arduino IDE is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as **Windows, Mac OS X, and Linux**. It supports the programming languages C and C++. Here, IDE stands for **Integrated Development Environment**.

The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.'

FLOW CHART OF THE PROGRAM:



SOURCE CODE:

```
#include <AFMotor.h>
#include <Servo.h>
#define Speed 220
#define Trig A1
#define Echo A0
#define spoint 90
int distance;
int Left;
int Right;
int L = 0;
int R = 0;
Servo servo;
AF_DCMotor M1(1);
AF_DCMotor M2(2);
AF_DCMotor M3(3);
AF_DCMotor M4(4);

void setup() {
  pinMode(Trig, OUTPUT);
  pinMode(Echo, INPUT);
  servo.attach(10);
  start();
  M1.setSpeed(Speed);
  M2.setSpeed(Speed);
  M3.setSpeed(Speed);
  M4.setSpeed(Speed);

}

void loop() {
  distance = ultrasonic();
  if (distance <= 16) {
    Stop();
    backward();
    delay(100);
    Stop();
    L = leftsee();
```

```
    servo.write(spoint);
    delay(800);
    R = rightsee();
    servo.write(spoint);
    if (L < R) {
      turnleft();
      delay(500);
      Stop();
      delay(200);
    } else if (L > R) {
      turnright();
      delay(500);
      Stop();
      delay(200);
    }
  } else {
    forward();
  }
}

void forward() {
  M1.run(FORWARD);
  M2.run(FORWARD);
  M3.run(FORWARD);
  M4.run(FORWARD);
}
void backward() {
  M1.run(BACKWARD);
  M2.run(BACKWARD);
  M3.run(BACKWARD);
  M4.run(BACKWARD);
}
void turnleft() {
  M1.run(BACKWARD);
  M2.run(BACKWARD);
  M3.run(FORWARD);
  M4.run(FORWARD);
}
void turnright() {
  M1.run(FORWARD);
```

```
  M2.run(FORWARD);
  M3.run(BACKWARD);
  M4.run(BACKWARD);
}
void Stop() {
  M1.run(RELEASE);
  M2.run(RELEASE);
  M3.run(RELEASE);
  M4.run(RELEASE);
}
int leftsee() {
   servo.write(20);
  delay(800);
  Left = ultrasonic();
  return Left;
}

int rightsee() {
  servo.write(150);
  delay(800);
  Right = ultrasonic();
  return Right;
}

int ultrasonic() {
  digitalWrite(Trig, LOW);
  delayMicroseconds(4);
  digitalWrite(Trig, HIGH);
  delayMicroseconds(10);
  digitalWrite(Trig, LOW);
  long t = pulseIn(Echo, HIGH);
  long cm = t / 29 / 2; //time convert distance
  return cm;
}
void start() {
  delay(3000);
  for (int a = 0; a < 4; a++) {
    servo.write(spoint);
    delay(50);
    servo.write(40);
```

```
    delay(50);
    servo.write(90);
    delay(50);
    servo.write(spoint);
  }
}
```

APPLICATIONS:

This device has application in surveying different landscapes and mapping them. It can alsobe used in commercial devices like

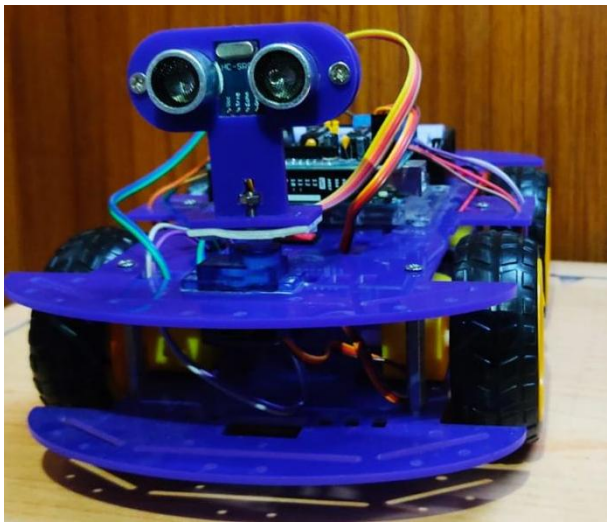
- Automated lawn mover
- Smart room cleaner
- Obstacle avoiding robots can be used in al
- most all mobile robot navigation systems.
- They can also be used in dangerous environments, where human penetration could befatal.
- Unmanned vehicle driving
- Mining Vehicle that uses Obstacle Detection

RESULT:

The result is obtained for obstacle avoidance robot using Arduino, if the robot moves forward if any obstacle detect it check for other directions and moves where there is no obstacles it moves in forward direction, to sense the obstacle ultrasonic sensor is used.

We used servo motor to rotate the ultrasonic sensor. The working principle of the robot is transmitting sensed signal to the microcontroller to control the DC motors for obstacle avoidance. The direction of the motors to move either clockwise or anticlockwise directions as provided by the microcontroller.

Ultrasonic sensor detect a moving object, the robot will move backward (motor 1 and motor 2 counter clockwise). The sensor also detects object, the robot will stop (motor 1 and motor 2 OFF). After 50 ms, motor 1 will move clockwise and the robot will turn left. After 500 ms, the robot will move forward (motor 1 and motor 2 clockwise) and after 1000ms, both motors will stop.



CONCLUSION:

The goal of our project is to create a autonomous robot which intelligently detects the obstacle in his path and navigate according to the actions we set for it. The above Arduino controller and ultrasonic sensor were studied and the HcSR-04 ultrasonic sensor was selected, as the controlling result are satisfying for its use in the automobile prototype system bring developed. It was used to sense the obstacle and avoidance them.

Obstacle avoidance is a very good application to be used in vehicle preventing many accidents and loss of life. 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, the ultrasonic distance sensors were used that provided a field of detection.

The robot is fully autonomous and after the initial loading of the code, it requires no user intervention during its operation. When placed in unknown environment with obstacles, it moved while avoiding all obstacles with considerable accuracy.

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