

# AUTOMATIC OBSTACLE AVOIDANCE ROBOT VEHICLE

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## Abstract

**The automatic obstacle avoidance robot vehicle is designed for detecting the obstacle and avoiding the collision. The design of obstacle avoidance robot requires the ultrasonic sensor (HCSR-04) to detect the obstacle and determine its distance. That sensor module is mounted on a servo motor which is placed in front of the vehicle and turned the direction of the sensor. The robot gets the information from surrounding area through mounted sensors on the robot. The motor driver module (L298N) and four wheel dc motors are used for the movements of vehicle like forward, backward, left, right and stop. A microcontroller Arduino Uno is mainly used to control the vehicle and achieve the desired detection and avoidance operation.**

**Keyword: Arduino Uno, ultrasonic sensor, DC motor, servo motor, motor driver module**

## 1.INTRODUCTION

Nowadays, robots are very popular to control and use in many places where are dangerous for human. And robot can work exactly and automatically depending on the user's control and instructions.

The block diagram of the automatic obstacle avoidance robot vehicle is shown in Fig.1. The obstacle detection is primary requirement of this autonomous robot. An ultrasonic sensor is used to detect any obstacle ahead of it by transmitting trigger pulse every second. When it detects the obstacle by receiving echo signal, it sends a command to the microcontroller Arduino Uno. Depending on the input signal received from ultrasonic sensor, the microcontroller calculates the object's distance and controls the robot to move in an alternate direction and avoid by actuating the DC motors interfaced to it through an H-bridge motor driver

(L298D). Servo motor is used to turn the ultrasonic sensor in three positions (0 degree, 90 degree and 180 degree). Rechargeable 6V battery is used for power supply of all components.

In this project, a robotic vehicle which moves in different directions like forward, backward, left, and right is designed and built to avoid the obstacle when it receives the sensor input that the object is detected.

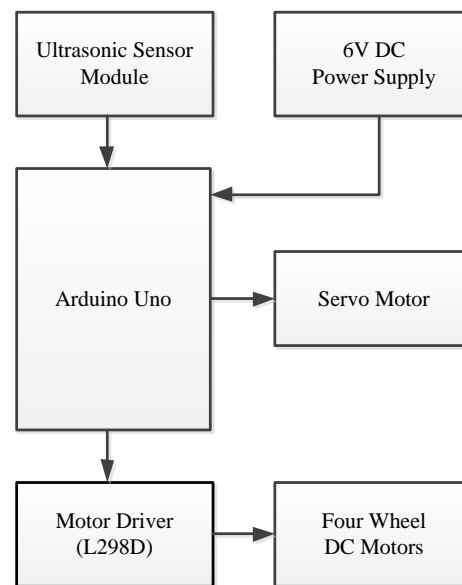


Figure 1. Block Diagram of Automatic Obstacle Avoidance Robot Vehicle

## 2.FUNDAMENTALS OF COMPONENTS

The goal of the project is to create an autonomous robot which intelligently detects the obstacle in its path and avoid the collision. The main components used in this project are presented as follows.

- ✓ Arduino Uno
- ✓ Ultrasonic sensor (HCSR-04)
- ✓ Motor driver module (L298N)

- ✓ DC motor and wheel
- ✓ Servo motor

### 3. OPERATION OF AUTOMATIC OBSTACLE AVOIDANCE ROBOT VEHICLE

Fig.2 shows the flowchart of automatic obstacle detection and avoidance robot vehicle. Firstly, the required inputs and outputs declarations are defined. Servo mounted with ultrasonic sensor is initialized in the middle position (90 degree).

The ultrasonic sensor always senses the obstacle every second. When the sensor detects the obstacle, the distance is calculated in cm and compared with the specified distance. In this project, if the object distance is less than 20cm, the vehicle stops, the servo motor turns to right (0 degree) and the sensor senses the object.

If it is free space, the vehicle turns to right and moves forward. If it has object, the servo turns to left (180 degree) and the sensor senses the object. If it is free space, the vehicle turns to left and moves forward. If it is not free, the vehicle moves backward and the sensor detect the object again. The process is repeated and the robot vehicle is automatically controlled and moved by detection and avoiding the obstacle.

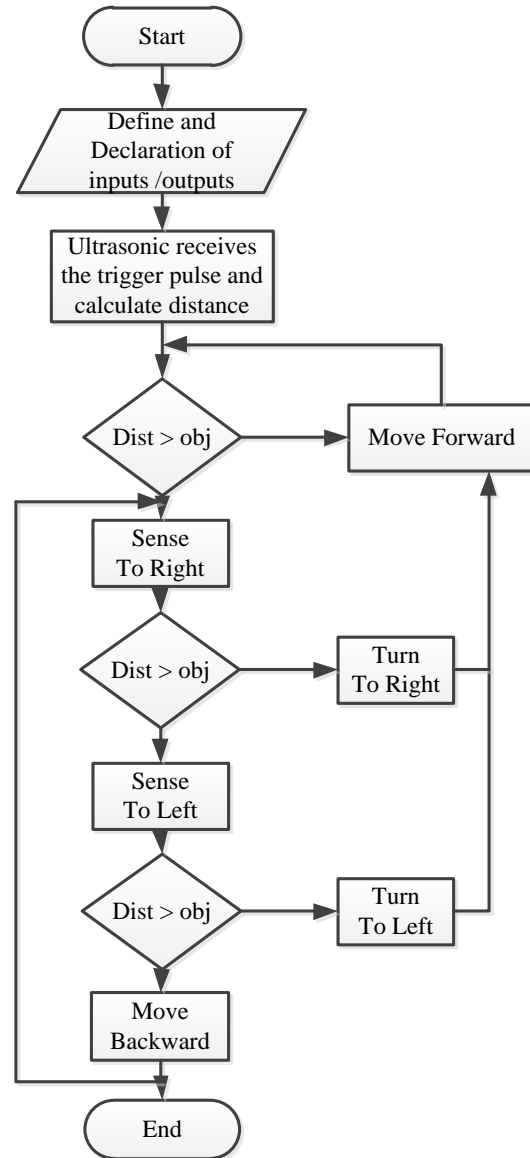


Figure 9. Flowchart of Automatic Obstacle Avoidance Robot Vehicle

### 4. IMPLEMENTATION OF AUTOMATIC OBSTACLE AVOIDANCE ROBOT VEHICLE

There are two portions in the Arduino sketch; void setup() and void loop(). The initializations and declaration for inputs and outputs are done in the setup program. All processes of automatic avoidance robot vehicle are instructed in the main program.

Initially, the servo motor is at 90 degree position and the vehicle (DC motors and wheels) is in forward direction. In this project, the L298N motor driver module act as an

interface between Arduino and the motors. It receives the PWM pulses from Arduino to drive the four DC motors (MA1, MA2, MB1 and MB2) and move the direction. And then the vehicle automatically changes direction and avoid the objects depending on the detection of the ultrasonic sensor

```

File Edit Sketch Tools Help
final $
#include <Servo.h>
Servo myservo;
#define echopin 8 // echo pin
#define trigpin 9 // Trigger pin
int Object1 = 20; //Object detected distance #20cm
//int Object2 = 2; // Object detected distance #2.5cm
long duration, distance; // Duration used to calculate
int MA2=5; //Speed control for motor1
int MB2=4; //Direction control for motor1
int MA1=6; //Speed control for motor2
int MB1=7; // Direction control for motor2
void setup() {
  Serial.begin (9600);
  myservo.attach(3);
  pinMode (trigpin, OUTPUT);
  pinMode (echopin, INPUT );
  pinMode (MA1, OUTPUT);
  pinMode (MB1, OUTPUT);
  pinMode (3, OUTPUT);
  pinMode (MA2 ,OUTPUT);
  pinMode (MB2, OUTPUT);
}
void loop ()
{
  distance = ping();
  if (distance > Object1) // if path is clear
  
```

Figure 8. Initialization of Program

Table 1. DC Motor Control in Program

Vehicle	MA1	MA2	MB1	MB2
Direction	IN1	IN2	IN3	IN4
Forward	Low	High	Low	High
Backward	High	Low	High	Low
Right	Low	High	High	Low
Left	High	Low	Low	High
Stop	High	High	High	High

### 5.HARDWARE DESIGN OF AUTOMATIC OBSTACLE AVOIDANCE ROBOT VEHICLE

Arduino is the main processing unit of the robot vehicle. Fig.10 describes circuit diagram of automatic obstacle detection and avoidance robot vehicle. The ultrasonic sensor has 4 pins: Vcc, Trig, Echo and Gnd. Vcc and Gnd are connected to the supply and ground pins of the Arduino. Trig is connected to the pin9 and Echo is connected to pin8 of the Arduino.

There are three wires in DC servo motor; two pins are positive and negative supply and other one is for the signal that is to be sent from the Arduino. Servo motor is connected to pin3 and ultrasonic sensor is placed on its shaft.

5V and 12V pins of L298N are connected to Vcc of Arduino and 6V battery respectively. Output pins 5 and 6 of Arduino are connected to input pins IN1 and IN2 of L298N to control the motorA (MA2, MA1). Output pins 4 and 7 of Arduino are connected to input pins IN3 and IN4 of L298N to control the motorB (MB2, MB1). Driver's input pins 1 and 3 are direction controls and pins 2 and 4 are speed controls for motors.

For required power supply, 6V rechargeable battery is used for arduino and motors.

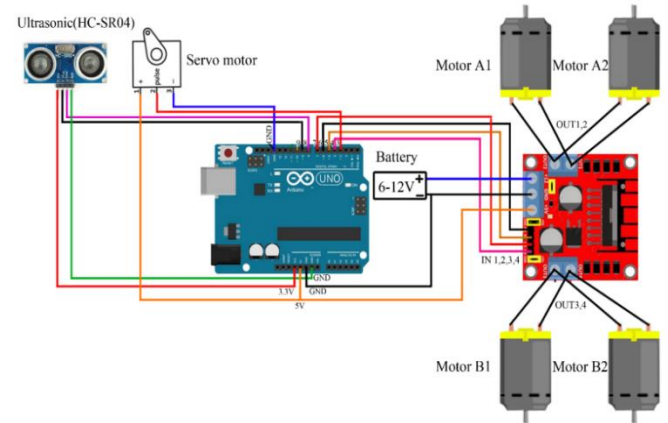


Figure 10. Circuit Diagram of Automatic Obstacle Avoidance Robot Vehicle

### 6.TEST AND RESULTS OF AUTOMATIC OBSTACLE AVOIDANCE ROBOT VEHICLE

After connecting the circuit diagram and assembling the vehicle frame, the automatic obstacle detection and avoidance robot vehicle can be seen in Fig.11(a), (b) and (c).

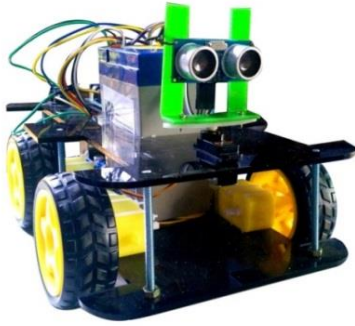


Figure 11(a). Front View of Vehicle

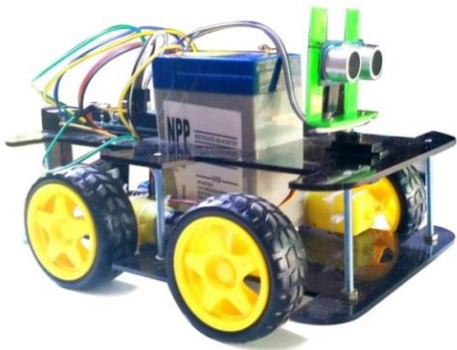


Figure 11(b). Side View of Vehicle



Figure 11(c). Top View of Vehicle

Testing and results of the automatic avoidance robot vehicle are shown in from Fig.11(d) to (j)



Figure 11(d). Vehicle Moves Forward and Detects Obstacle



Figure 11(e). Vehicle Senses To Right and Detects Obstacle



Figure 11(f). Vehicle Senses To Left



Figure 11(g). Vehicle Turns Left



Figure 11(h). Vehicle Detects Obstacle



Figure 11(i). Vehicle Senses Right



Figure 11(j). Vehicle Turns Right

## 7.CONCLUSION AND DISCUSSIONS

This project is very simple but very effective and useful. The automatic detection and avoidance technology is also popular and is required in unmanned vehicle. This project can be extended to line following and object avoidance robot vehicle. It also can be modified by adding various types of sensors such as flame sensor module, camera module for various applications.

## REFERENCES

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