**A**
**PROJECT REPORT**
**ON**

# Revolutionizing Mobility: Unleashing the Power of Obstacle-Avoiding, Bluetooth-Enabled, and Voice-Controlled Cars with Arduino Uno.

**Submitted by**


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Under the guidance of

**Mr. P. U. Dhage**



**DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING**

**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR.**


**2022-23**

# CERTIFICATE

**This is to certify that Mini Project entitled**

**Revolutionizing Mobility: Unleashing the Power of Obstacle-Avoiding, Bluetooth-Enabled, and Voice-Controlled Cars with Arduino Uno.**

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Has been approved as the partial fulfillment for the award of Third year of Electronics and Telecommunication Engineering by PAH Solapur University, Solapur in the academic year 2023-24.

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# ACKNOWLEDGEMENT

The project has certainly enlightened us with the modern era of Technologies and it has boosted our confidence. The project work has certainly rendered us tremendous learning as well as practical experience.

We are thankful to **Dr.V.A.Athavale**, Principal of W.I.T College, **Dr.A.V Thalange** Head of Electronics & Telecommunication Engineering Department for granting permission to undertake this project.

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Last but not least we are thankful to the staff of Electronics & Telecommunication Engineering Department W.I.T. Solapur.

# INDEX

# ABSTRACT

The field of robotics and automation has witnessed remarkable advancements, leading to the development of intelligent and efficient systems. In this report, Present a groundbreaking project centered around an Arduino Uno-based car, equipped with obstacle-avoidance, Bluetooth connectivity, and voice control capabilities. Objective is to enhance the conventional notion of mobility by integrating cutting-edge technologies, enabling seamless navigation, and empowering users with intuitive control options.

The project's core feature is its obstacle-avoidance mechanism, which leverages a combination of ultrasonic sensors and intelligent algorithms. By detecting and analyzing the surrounding environment in real-time, the car autonomously maneuvers around obstacles, ensuring safe and efficient traversal. Furthermore, we integrate Bluetooth technology, enabling wireless communication between the car and a smartphone or other compatible devices. This wireless connectivity unlocks a myriad of possibilities, including remote control, data transmission, and the potential for expansion into larger-scale systems.

Additionally, Introduce a voice control system that adds an extra layer of convenience and interactivity. By employing voice recognition algorithms, users can effortlessly command the car using natural language.The car responds to spoken instructions, making it an ideal choice for individuals with mobility challenges or those seeking a more interactive one.

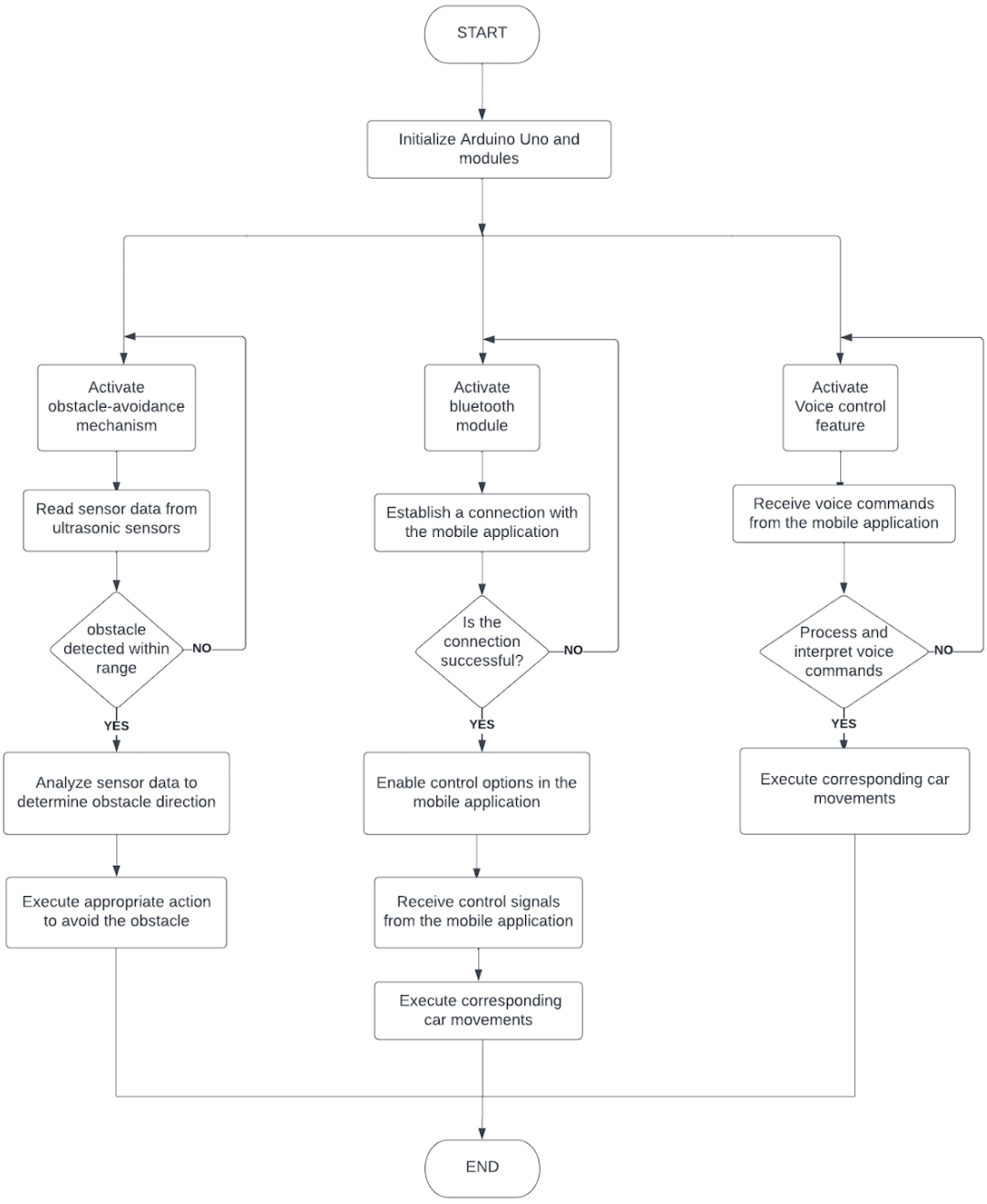
# INTRODUCTION

In an era defined by rapid technological advancements, the fusion of robotics, automation, and intelligent systems has revolutionized various domains. In this report, Present an extraordinary project that embodies innovation and pushes the boundaries of mobility: an Arduino Uno-based car with obstacle-avoidance, Bluetooth connectivity, and voice control capabilities. This groundbreaking endeavor aims to enhance conventional modes of transportation by seamlessly integrating state-of-the-art technologies, empowering users with intuitive control options and unlocking unprecedented levels of convenience and interactivity.

The core focus of this project lies in the implementation of an advanced obstacle-avoidance mechanism. By leveraging ultrasonic sensors and intelligent algorithms, the car adeptly detects and analyzes its surroundings in real-time. This enables the car to autonomously navigate around obstacles, ensuring safe and efficient traversal. The integration of Bluetooth technology takes this project to new heights, enabling wireless communication between the car and external devices such as smartphones. This wireless connectivity offers exciting possibilities, including remote control, data transmission, and the potential for seamless integration into larger-scale systems.

One of the standout features of this project is the incorporation of voice control capabilities. By harnessing the power of sophisticated voice recognition algorithms, users can effortlessly interact with the Arduino Uno-based car using natural language commands. This hands-free control mechanism enhances convenience and accessibility, making it an ideal choice for individuals with mobility challenges and those seeking a more intuitive and interactive experience. The integration of voice control revolutionizes the way interact with robotics and automation, paving the way for a future where machines understand and respond to our spoken instructions seamlessly.Throughout this report, will delve into the intricate details of the hardware architecture, software implementation, and algorithmic logic behind the obstacle-avoiding, Bluetooth-enabled, and voice-controlled car. Exploreing the challenges encountered during the development process and discuss potential avenues for further improvement and expansion. This project serves as a testament to the boundless possibilities that emerge when cutting-edge technologies converge with creative engineering and a vision for redefining mobility.

# FLOWCHART


START
Initialize Arduino Uno and modules
Activate obstacle-avoidance mechanism
Read sensor data from ultrasonic sensors
obstacle detected within range
NO
YES
Analyze sensor data to determine obstacle direction
Execute appropriate action to avoid the obstacle
Activate bluetooth module
Establish a connection with the mobile application
Is the connection successful?
NO
YES
Enable control options in the mobile application
Receive control signals from the mobile application
Execute corresponding car movements
Activate Voice control feature
Receive voice commands from the mobile application
Process and interpret voice commands
NO
YES
Execute corresponding car movements
END

# COMPONENTS REQUIRED & WORKING OF COMPONENTS

## Components Required

- Arduino Uno
- L293D Motor Shield
- Bluetooth Module
- UltraSonic Sensor
- Servo Motor
- Gear Motor

## Working of Components

### 1.Arduino Uno :

The Arduino UNO is a programmable, open-source microcontroller board from the Arduino series. It contains an ATMega328P microcontroller from Atmel with an 8-bit RISC processing core and 32 KB of flash memory. The board can be powered from a voltage range of 7 to 12 volts, the voltage regulator embedded inside the board will reduce the excess voltage.

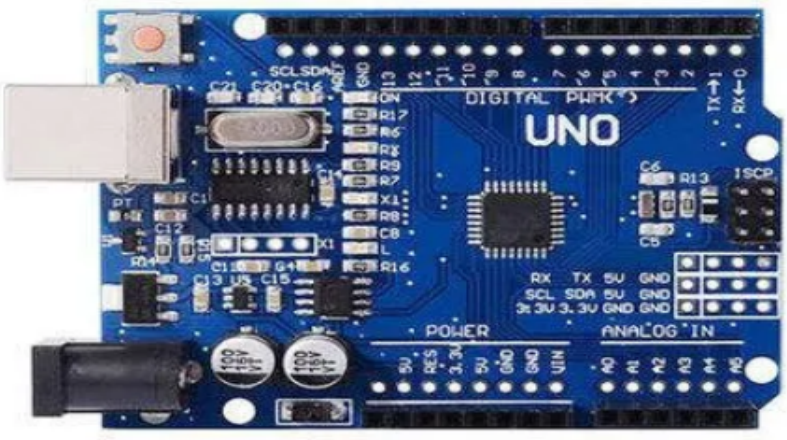



Fig.1 Arduino Uno

## 2.L293D Motor Shield :

- 2 connections for 5V ‘hobby’ servos connected to the Arduino’s high-resolution dedicated timer
- 4 H-Bridges: L293D chipset provides 0.6A per bridge (1.2A peak) with thermal shutdown protection, internal kickback protection diodes. Can run motors on 4.5VDC to 25VDC.
- Up to 4 bi-directional DC motors with individual 8-bit speed selection (so, about 0.5% resolution)
- Up to 2 stepper motors (unipolar or bipolar) with single coil, double coil, or interleaved stepping.
- Pull-down resistors keep motors disabled during power-up
- Big terminal block connectors to easily hook up wires (18-26AWG) and power
- Arduino reset button brought up top
- 2-pin terminal block and jumper to connect external power, for separate logic/motor supplies.

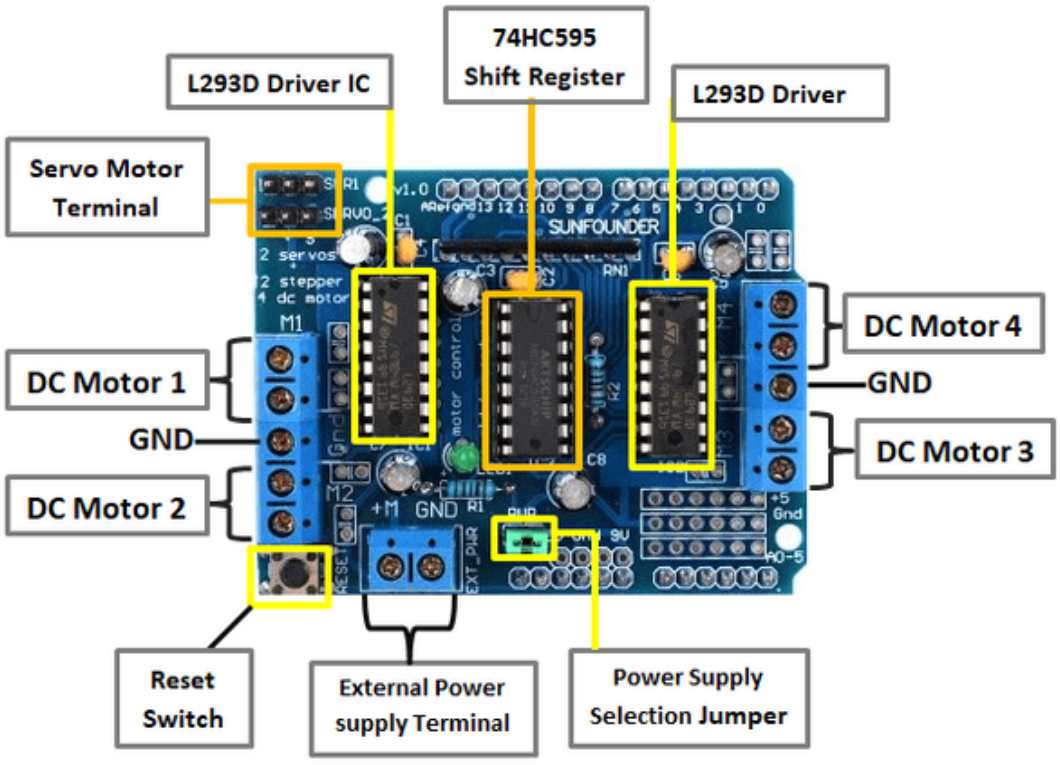



Fig.2 L293D Motor Shield

**3.Bluetooth Module :**

- HC-05 is normally used in embedded projects, where data needs to be transmitted wirelessly over a small distance.
- We can transmit data between two HC-05 modules and can also send data from HC-05 to any Bluetooth appliance i.e. mobile phone, laptop etc.
- In order to do so, first of all, we need to power up our HC-05 module, as shown in below figure:
- As we push the button connected to Key Pin, it will get LOW & HC-05 will start blinking.
- Now, if you check on your mobile phone or laptop, you will be able to find a new Bluetooth device named HC-05.
- Once you connect with this device, you will be able to send and receive data in a serial stream manner.
- This stream is then processed by a microcontroller (i.e. Arduino UNO) attached with HC-05.

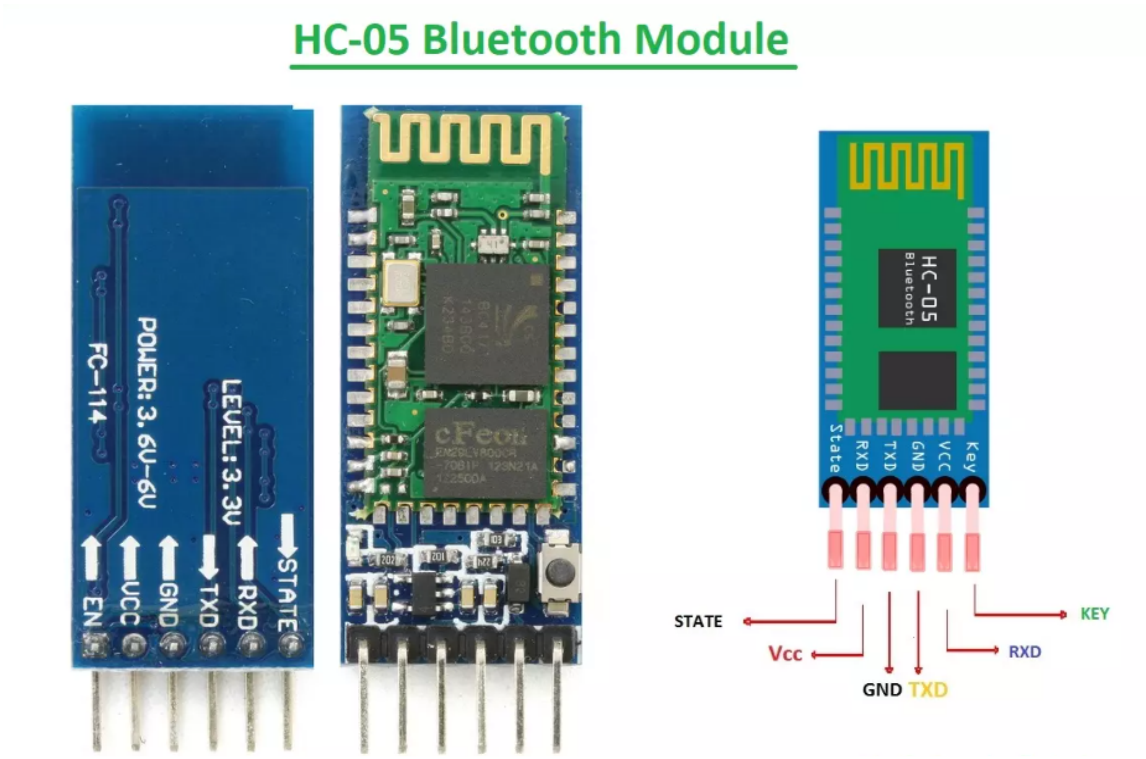



Fig 3.Bluetooth Module

## 4.Ultrasonic Sensor :

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.

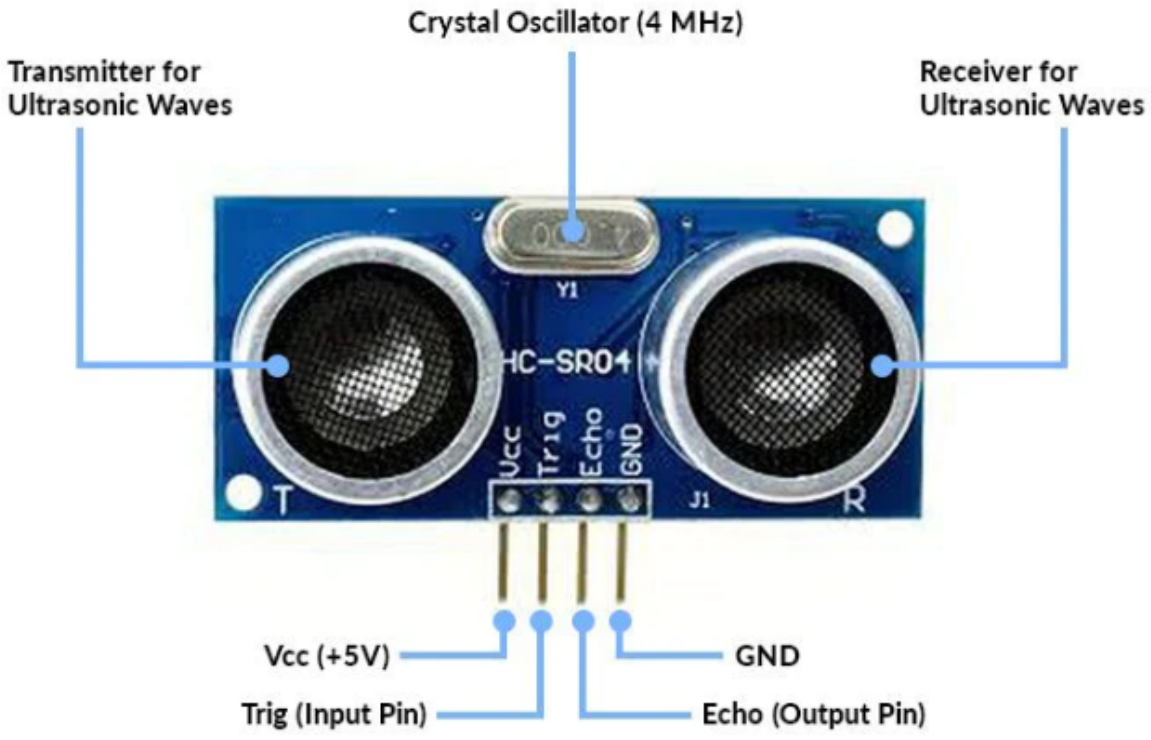



Fig 4.Ultrasonic Sensor

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. From 2cm to 400 cm or 1” to 13 feet. Its operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). It comes complete with an ultrasonic transmitter and receiver module.

## 5.Servo Motor :

You can control the servo motor by sending a series of pulses to it. A typical servo motor expects a pulse every 20 milliseconds (i.e., the signal should be 50Hz).

The length of the pulse determines the position of the servo motor.

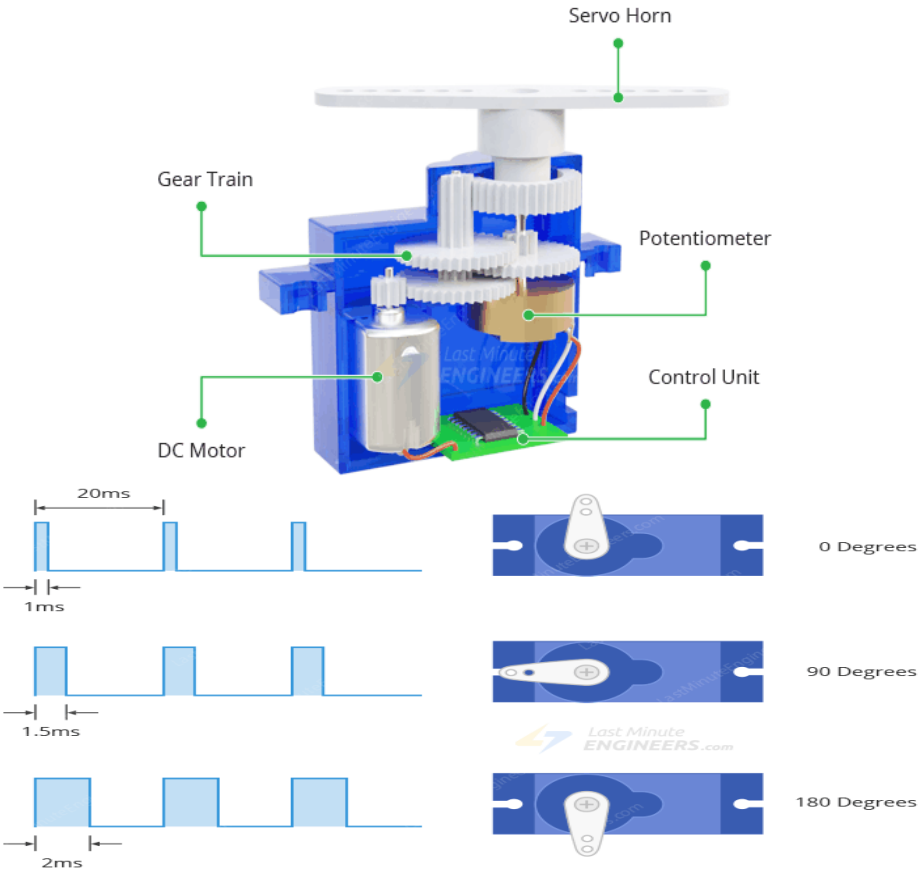



Fig 5.Servo Motor

- A short pulse of 1 ms or less will rotate the servo to 0 degrees (one extreme).
- A pulse duration of 1.5 ms will rotate the servo to 90 degrees (middle position).
- A pulse duration of 2 ms or so will rotate the servo to 180 degrees (other extreme).Pulses ranging from 1ms to 2ms will rotate the servo to a position proportional to the pulse width.

# SOFTWARE USED IN PROJECT

**The libraries Used in the Arduino Code are :**

**1. WiFi.h :**

The WiFi library enables the Bluetooth Module to connect to a Wi-Fi network. It provides functions for connecting, disconnecting, and configuring Wi-Fi connections

**2.Servo.h :**

Allows Arduino boards to control a variety of servomotors,This library can control a great number of servos.It makes careful use of timers: the library can control 12 servos using only 1 timer.

**3.Adafruit Motor Shield library :**

The Adafruit Motor Shield is a hardware module for controlling motors with Arduino. The Adafruit Motor Shield library is a software library that provides functions and classes to control different types of motors. It simplifies motor control and is compatible with Adafruit Motor Shield v1 and v2. Install the library, use example sketches, and refer to Adafruit's documentation for guidance.

# WORKING OF SYSTEM

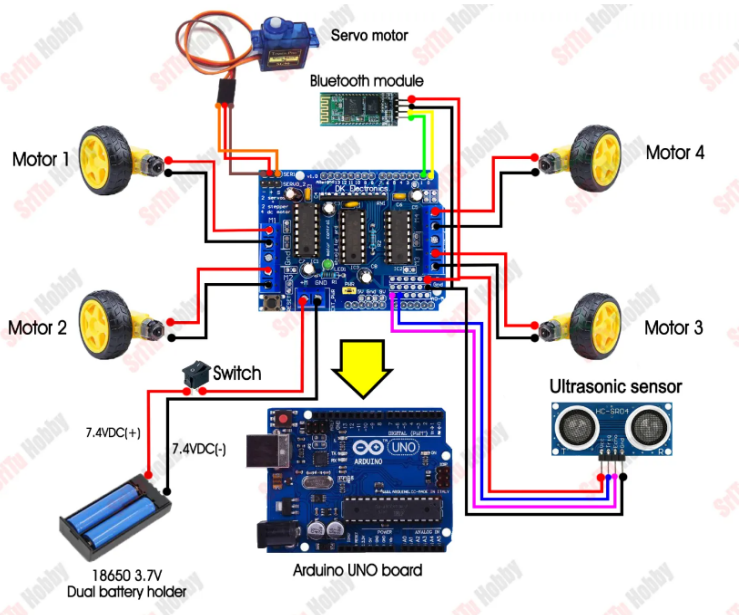
- **Obstacle Avoiding :**

The obstacle-avoidance mechanism implemented in the Arduino Uno-based car is a critical component that enables safe and autonomous navigation through complex environments. This system leverages ultrasonic sensors and intelligent algorithms to detect obstacles in real-time and make informed decisions to avoid potential collisions.

The ultrasonic sensors emit high-frequency sound waves and measure the time it takes for the waves to bounce back after hitting an obstacle. By analyzing the time delay, the distance between the car and the obstacle can be accurately calculated. This distance information serves as crucial input for the obstacle-avoidance algorithm.

The Arduino Uno continuously reads and processes the data from the ultrasonic sensors, allowing for real-time obstacle detection. Upon detecting an obstacle within a specified range, the intelligent algorithm analyzes the sensor readings and determines the appropriate course of action to avoid the obstacle.

The decision-making process takes into account various factors, including the proximity and direction of the obstacle. Depending on the scenario, the system may instruct the car to stop, change direction, or execute a predefined maneuver. These decisions are made swiftly and efficiently to ensure the car can navigate its environment while maintaining a safe distance from potential obstructions.



- **Bluetooth Control :**

The Bluetooth control functionality in the Arduino Uno-based car revolutionizes the way it is operated. Through the HC-05 Bluetooth module and a ready-made mobile application, users can wirelessly control the car's movements and functions. The mobile app provides an intuitive interface with directional buttons, sliders, or virtual joystick controls, enabling easy interaction. With a simple installation process and a reliable Bluetooth connection, users can instantly control the car from their smartphones. This wireless control feature enhances flexibility and convenience, making the car suitable for various applications such as exploration, surveillance, and interactive demonstrations. The seamless communication between the car and mobile application, facilitated by the HC-05 module, offers enhanced control capabilities and a user-friendly experience.

- **Voice Control :**

The voice control functionality in the Arduino Uno-based car introduces a cutting-edge feature that allows control through a ready-made mobile application. By integrating a dedicated mobile app with voice recognition capabilities, users can effortlessly operate the car using natural language commands.

The mobile application, specifically designed for this project, offers an intuitive interface that captures and processes voice commands. Users can simply speak their instructions into the app, which then translates the spoken words into control signals for the Arduino Uno-based car.

The ready-made nature of the app eliminates the need for extensive programming or custom app development, making it accessible to a wide range of users. Once installed on a compatible smartphone, users can establish a connection with the car and initiate voice control instantly.

This voice control feature adds a new level of convenience and interactivity to the Arduino Uno-based car. Users can navigate, change directions, or perform specific actions by simply speaking their desired commands. The hands-free nature of voice control opens up possibilities for applications such as home automation, accessibility for individuals with mobility challenges, and creating immersive user experiences.

By combining the power of a ready-made mobile application with voice recognition capabilities, the Arduino Uno-based car demonstrates an advanced level of control and interaction.

# PROJECT CODE

```
//obstacle avoiding, Bluetooth control, voice control robot car.
#include <Servo.h>
#include <AFMotor.h>
#define Echo A0
#define Trig A1
#define motor 10
#define Speed 170
#define spoint 103
char value;
int distance;
int Left;
int Right;
int L = 0;
int R = 0;
int L1 = 0;
int R1 = 0;
Servo servo;
AF_DCMotor M1(1);
AF_DCMotor M2(2);
AF_DCMotor M3(3);
AF_DCMotor M4(4);
void setup() {
 Serial.begin(9600);
 pinMode(Trig, OUTPUT);
 pinMode(Echo, INPUT);
 servo.attach(motor);
 M1.setSpeed(Speed);
 M2.setSpeed(Speed);
 M3.setSpeed(Speed);
 M4.setSpeed(Speed);
}
void loop() {
 Obstacle();
 //Bluetoothcontrol();
```

```
  //voicecontrol();
}
void Bluetoothcontrol() {
  if (Serial.available() > 0) {
    value = Serial.read();
    Serial.println(value);
  }
  if (value == 'F') {
    forward();
  } else if (value == 'B') {
    backward();
  } else if (value == 'R') {
    left();
  } else if (value == 'L') {
    right();
  } else if (value == 'S') {
    Stop();
  }
}
void Obstacle() {
  distance = ultrasonic();
  if (distance <= 12) {
    Stop();
    backward();
    delay(100);
    Stop();
    L = leftsee();
    servo.write(spoint);
    delay(800);
    R = rightsee();
    servo.write(spoint);
    if (L < R) {
      right();
      delay(500);
      Stop();
      delay(200);
    } else if (L > R) {
```

```
    left();
    delay(500);
    Stop();
    delay(200);
   }
  } else {
   forward();
  }
}
void voicecontrol() {
 if (Serial.available() > 0) {
   value = Serial.read();
   Serial.println(value);
   if (value == '^') {
    forward();
   } else if (value == '-') {
    backward();
   } else if (value == '<') {
    L = leftsee();
    servo.write(spoint);
    if (L >= 10 ) {
     left();
     delay(500);
     Stop();
    } else if (L < 10) {
     Stop();
    }
   } else if (value == '>') {
    R = rightsee();
    servo.write(spoint);
    if (R >= 10 ) {
     right();
     delay(500);
     Stop();
    } else if (R < 10) {
     Stop();
    }
```

```
   } else if (value == '*') {
     Stop();
   }
  }
}
// Ultrasonic sensor distance reading function
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 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 right() {
  M1.run(BACKWARD);
  M2.run(BACKWARD);
  M3.run(FORWARD);
  M4.run(FORWARD);
}
void left() {
  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(180);
  delay(800);
  Right = ultrasonic();
  return Right;
}
```

# ADVANTAGES AND LIMITATIONS

## Advantages

**1. Enhanced Safety:** The obstacle-avoidance mechanism ensures safe navigation by detecting and avoiding obstacles in real-time, minimizing the risk of collisions and accidents.

**2. Convenience and Accessibility:** Bluetooth and voice control functionalities offer intuitive and hands-free control options, making it easier for users to interact with the car without the need for complex manual controls or physical connections.

**3. Wireless Connectivity:** The integration of Bluetooth technology enables wireless communication between the car and external devices, providing flexibility in controlling the car from a distance.

**4. User-Friendly Interface:** The dedicated mobile application provides a user-friendly interface, allowing users to control the car's movements and functions with ease using intuitive controls or voice commands.

**5. Versatility:** The Arduino Uno-based car can be used for various applications, including exploration, surveillance, and interactive demonstrations, thanks to its adaptable control mechanisms and advanced features.

- **Limitations**

**1. Limited Range:** The Bluetooth control functionality has a limited range, typically up to a few tens of meters. Users need to be within this range to establish a connection and control the car.

**2. Dependency on Mobile Application:** The functionality and compatibility of the car's control system rely on the specific mobile application. Any limitations or issues with the app may affect the overall user experience.

**3. Voice Recognition Accuracy:** Voice control accuracy can vary based on factors such as background noise, accent, and pronunciation. Inaccurate voice recognition may result in unintended commands or require repeated attempts to achieve the desired actions.

**4. Complexity of Setup:** Setting up the Bluetooth connection and configuring the mobile application to communicate with the car may require some technical knowledge and troubleshooting, which can be challenging for inexperienced users.

**5. Reliance on Power Source:** The car's operation depends on a reliable power source, whether it's a battery or a wired power supply. Limited battery life or power interruptions can impact the car's performance and control capabilities.

# CONCLUSION

In conclusion, the Arduino Uno-based car equipped with obstacle-avoidance, Bluetooth, and voice control features represents a significant advancement in the field of autonomous vehicles and robotics. The integration of these functionalities offers numerous advantages, including enhanced safety, convenience, wireless connectivity, and a user-friendly interface.

The obstacle-avoidance mechanism ensures safe navigation by detecting and avoiding obstacles in real-time, minimizing the risk of collisions and accidents. The Bluetooth control functionality allows for seamless wireless communication between the car and external devices, providing flexibility and convenience in controlling the car from a distance. Additionally, the voice control feature offers a hands-free and intuitive method of operation, further enhancing the user experience.

# REFERENCES


- **Arduino Website:**
  **(https://www.arduino.cc/)**
- **Multifunctional Robot:**
  **(https://srituhobby.com/how-to-make-a-multi-function-arduino-robot/)**
- **Adafruit Learning System:**
  **(https://learn.adafruit.com/)**