Arduino voice controlled Bluetooth car

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A project report as a partial fulfillment of requirement of Microprocessor & Microcontroller Lab

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Chapter 1
Introduction

In this project we have planned a Bluetooth controlled RC vehicle which can assume voice command and it is named as Arduino voice controlled Bluetooth car. The proposed framework will be able to enable the movement as indicated by the distinguishing voice orders and supply them to the vehicle through a wireless system. Identification of speech is also called as "automatic speech recognition (ASR)". The Bluetooth module will get the order and given it to microcontroller, where everything the handling work of the voice is finished also, permit vehicle to move as per voice order; the order will be move forward, move backward, turn left, turn right, and stop. Major elements used in this projects are given below:

1.1 Hardware:

Arduino UNO:

The Arduino Uno is an open-source microcontroller board in light of the Microchip ATmega328P microcontroller and created by Arduino.cc. The board is outfitted with sets of advanced and simple information/yield (I/O) sticks that might be connected to different development sheets (safeguards) and other circuits. The board has 14 advanced I/O pins (six fit for PWM yield), 6 Analog I/O sticks, and is programmable with the Arduino IDE (Integrated Development Environment), through a sort B USB link. It can be fueled by the USB link or by an outside 9-volt battery, however it acknowledges voltages between 7 what's more, 20 volts. The ATmega328 on the board comes pre-modified with a bootloader that permits transferring new code to it without the utilization of an outer equipment developer. Arduino Uno is a famous microcontroller improvement board in view of 8-bit ATmega328P microcontroller. Alongside ATmega328P MCU IC, it comprises different parts like precious stone oscillator, sequential correspondence, voltage controller, and so forth to help the microcontroller.

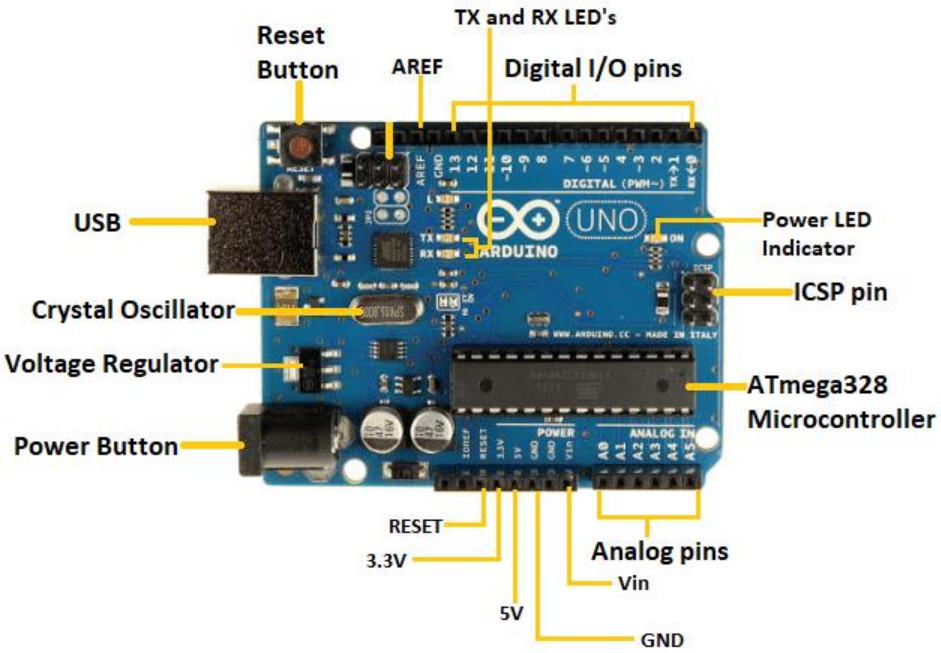

Fig 1.1: Arduino Uno

Arduino Uno Pinout Configuration:

Pin Category	**Pin Name**	**Details**
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.

Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V
Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.

AREF	AREF	To provide reference voltage for input voltage.

Arduino Uno Pin Mapping:

Of the 32 pins accessible on the UNO board, 22 pins are related with information and result. In that 14 pins (D0 to D13) are valid computerized IO pins, which can be arranged according to you application utilizing pinMode(), digitalWrite() and digitalRead() capacities.Every one of these Digital IO pins are fit for obtaining or sinking 20mA of current (most extreme 40mA is permitted). An extra element of the Digital IO pins is the accessibility of inward draw up resistor.The worth of the inner draw up resistor will be in the scope of 20KΩ to 50KΩ.There are additionally 6 Analog Input Pins (A0 to A5). Every one of the simple information pins give a 10-bit goal ADC highlight, which can be perused utilizing analogRead() work.A significant point about Analog Input pins is that they can be arranged as Digital IO pins, whenever required.Advanced IO pins 3, 5, 6, 9, 10 and 11 are equipped for creating 8-bit PWM Signals. You can utilize analogWrite() work for this.

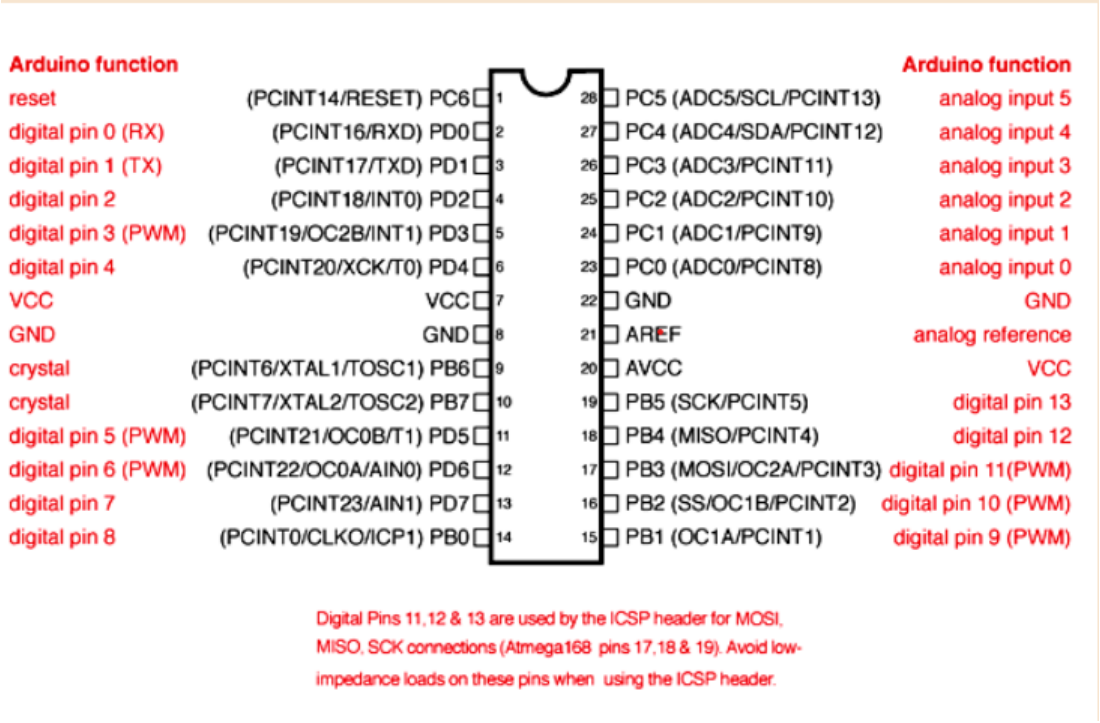

Fig 1.2: Arduino Uno pin mapping

Arduino Uno Technical Specifications:

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB

EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

Motor Driver Module L298N:

This L298N Based Motor Driver Module is a powerful engine driver ideal for driving DC Motors and Stepper Motors. It utilizes the famous L298 engine driver IC and has the locally available 5V controller which it can supply to an outer circuit. It has some control over up to 4 DC engines, or 2 DC engines with directional and speed control this engine driver is ideal for mechanical technology and mechatronics ventures and ideal for controlling engines from microcontrollers, switches, transfers, and so forth. Ideal for driving DC and Stepper engines for miniature mouse, line following robots, robot arms, etc. An H-Bridge is a circuit that can drive a current in one or the other extremity and be constrained by Pulse Width Modulation (PWM). Pulse Width Modulation is a method for controlling the term of an electronic heartbeat. In engines attempt to envision the brush as a water haggle as the streaming beads of water. The voltage would be the water streaming over the wheel at a consistent rate, the more water streaming the higher the voltage. Engines are evaluated at specific voltages and can be harmed assuming that the voltage is applied to vigorously or on the other hand in the event that it is dropped rapidly to dial the engine back. In this manner PWM. Take the water wheel similarity and consider the water hitting it in beats however at a steady stream. The more drawn out the beats the quicker the wheel will turn, the more limited the beats, the more slow the water wheel will turn. Engines will endure significantly longer and be more dependable whenever controlled through PWM.

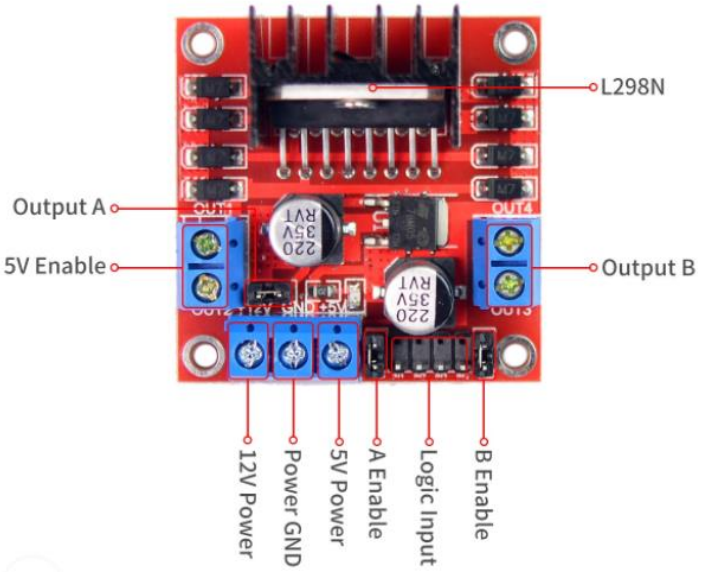

Fig 1.3: Motor Driver

HC-05 Bluetooth Module:

It is a Bluetooth module which is intended for remote correspondence. This module can be utilized in an expert or slave arrangement. Bluetooth sequential modules permit all sequential empowered gadgets to speak with each other utilizing Bluetooth. It has six pins and two modes - Data Mode and Command Mode.

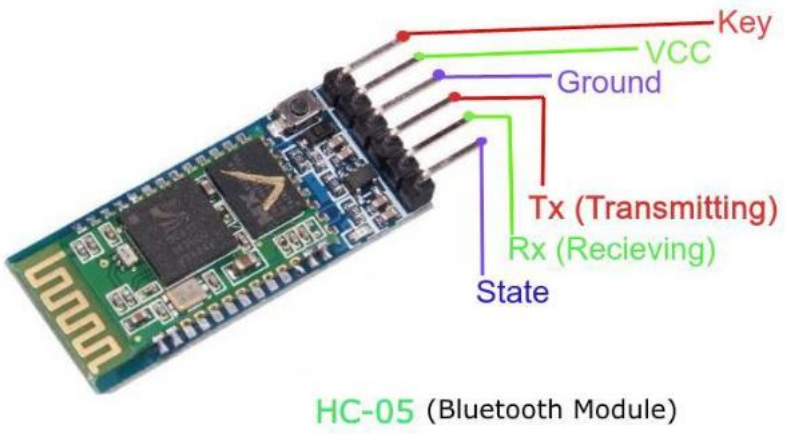

Fig 1.4: Bluetooth Module

1.2 Software:

BT Voice Control for Arduino:

Android Meets Robots: Voice Recognition

Utilizes android mobiles inside voice acknowledgment to pass voice orders to your robot. Matches with Bluetooth Serial Modules and sends in the perceived voice as a string. For instances assuming you make proper acquaintance the android telephone will return a sting *Hello# to your Bluetooth module *and # show the beginning and stop bits. Can Be utilized with any miniature regulator which can deal with strings.

Fig 1.5:

Arduino IDE:

The Arduino Integrated Development Environment - or Arduino Programming (IDE) - contains a content tool for composing code, a message region, a message console, a toolbar with buttons for normal capacities and a progression of menus. It associates with the Arduino and Genuine equipment to transfer programs and speak with them. A program composed with the IDE for Arduino is called a "sketch".

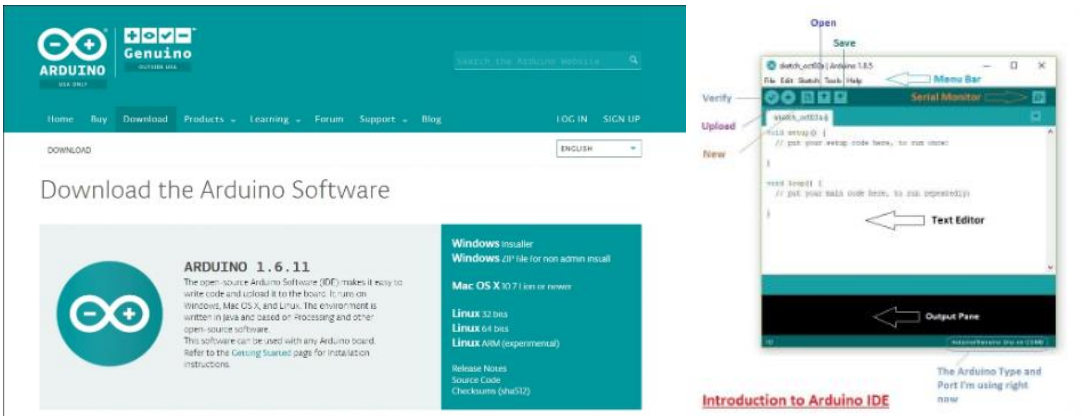

Fig 1.6: Arduino Software

Chapter 2
Literature Review

The primary goal of this proposed work was to foster a mechanical technology vehicle which can be controlled and perform certain activity by human voice or order and this project planned to decrease the parking issue and additionally to use it on the safeguard area. [1]

This project for automated control utilized Android versatile telephone which was extremely modest and effectively accessible. The accessible control orders were more than RF modules. [2]

This paper showed how to control robot controlled vehicle using Wi-Fi module through android application of an android Smart Phone. It also showed that the devices can be controlled even without an android phone by sending a common SMS. [3]

This project of mechanical technology vehicle, which was fit for perceiving the voice order given by the client and play out specific activity as indicated by it. This framework was being executed with two innovation Mel Frequency Cestrum Coefficient (MFCC) which was utilized for separating the element and Hidden Markov Model (HMM) which was utilized for voice order acknowledgment. [4]

It proposed the plan of a robot that can be controlled utilizing an application running on an android telephone. It sends control request through Bluetooth which has specific features like controlling the speed of the motor, identifying and offering the information to mobile about the course. [5]

The robot was moving simply by tapping on the phone with android activity framework. [6]

The project was intended to foster android application based an automated

vehicle for far off activity. This was a sort of robot can be useful for versatility help for older and incapacitated individuals. [7]

This project was comprising of an independent vehicle, which was controlled by utilizing explicit voice orders characterized
for a specific activity. The Alexa was utilized to move voice order to the vehicle. The mechanical technology vehicle would actually want to move as per the order given by the client. [8]

This paper showed how to control a robot using compact through Bluetooth correspondence, a couple features about Bluetooth development, fragments of the flexible and robot. It presented a review of robots compelled
by PDA through moving the robot vertical, converse, left and right side by the android application. [9]

In this paper the objective of Voice Sensor Vehicle was to tune in and follow up on the orders had got from the client. The fundamental goal of the project was when vehicle enters school zone or emergency clinics zone, this will decrease the speed of the vehicle with RF Module. [10]

Chapter 3
Methodology

3.1 Design:

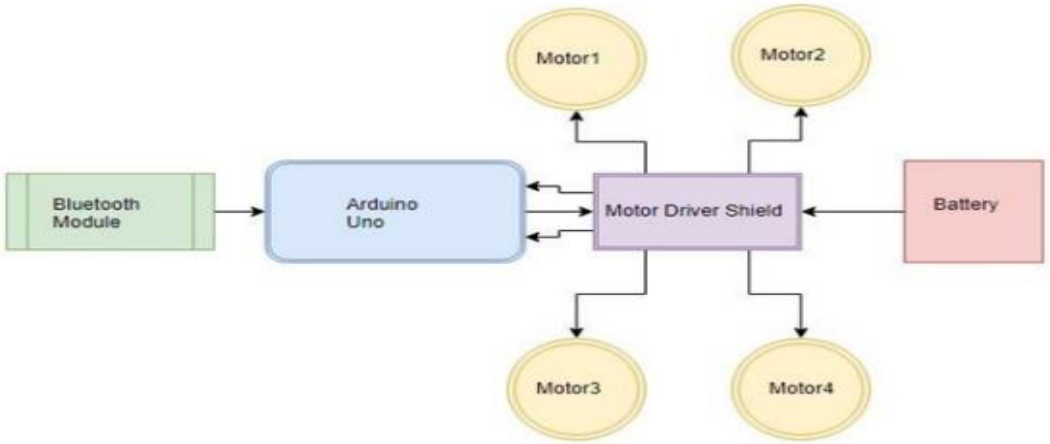

Fig 3.1: Block Diagram

Transmitter Side:

The Mobile application is available in the advanced cell which will get to the voice orders through the Bluetooth module present in the versatile and changes over the voice orders to computerized signals and moves the signs to the Robot.

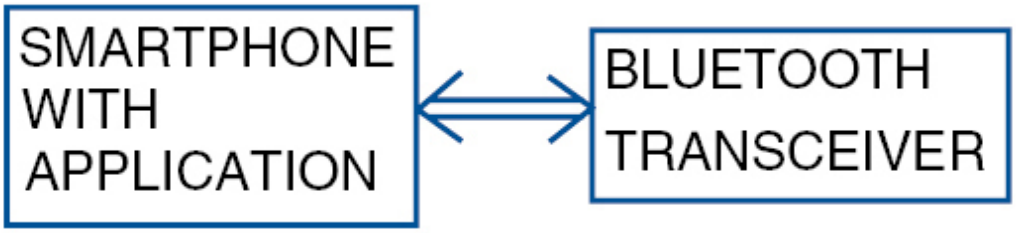

Fig 3.2: Block diagram of transmitter side

Receiver (or) Robot Side:

The computerized signals which are communicated from the transmitter are gotten by the Bluetooth module present in the Robot will get the signal and direct it to the microchip which is available in the Arduino will check with the put away orders and at the execution the DC motors will turn over moving as indicated by the provided order and the motor rotations are constrained by motor driver which is associated with the Arduino.

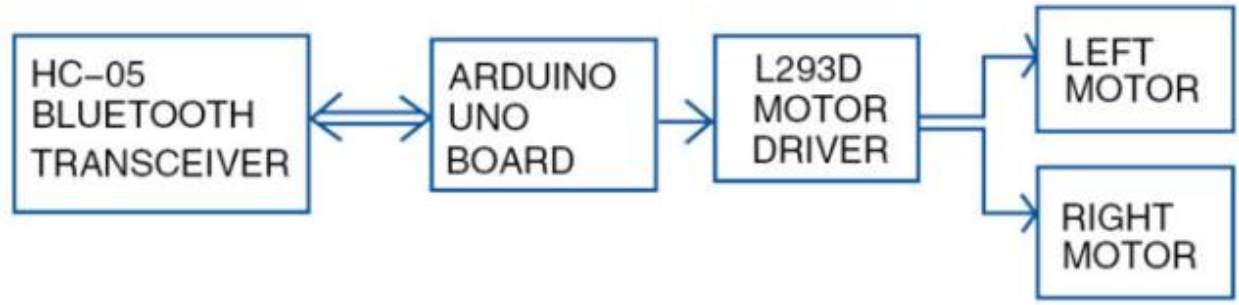

Fig 3.3: Block diagram of the receiver side

3.2 System Specification:

Hardware Specification

- Arduino UNO
- L298 Motor Driver IC
- Bluetooth Device Module
- 4 x 5V Geared Motors
- Connecting Wires
- Robot Chassis
- Battery Holder
- Power Supply
- Battery

Software Specification

- Windows
- Arduino IDE software

- Android Phone
- Bluetooth Controller App

3.3 Circuit Diagram:

The following is the circuit diagram of Bluetooth Controlled Robot using Arduino, L298N and HC-05.

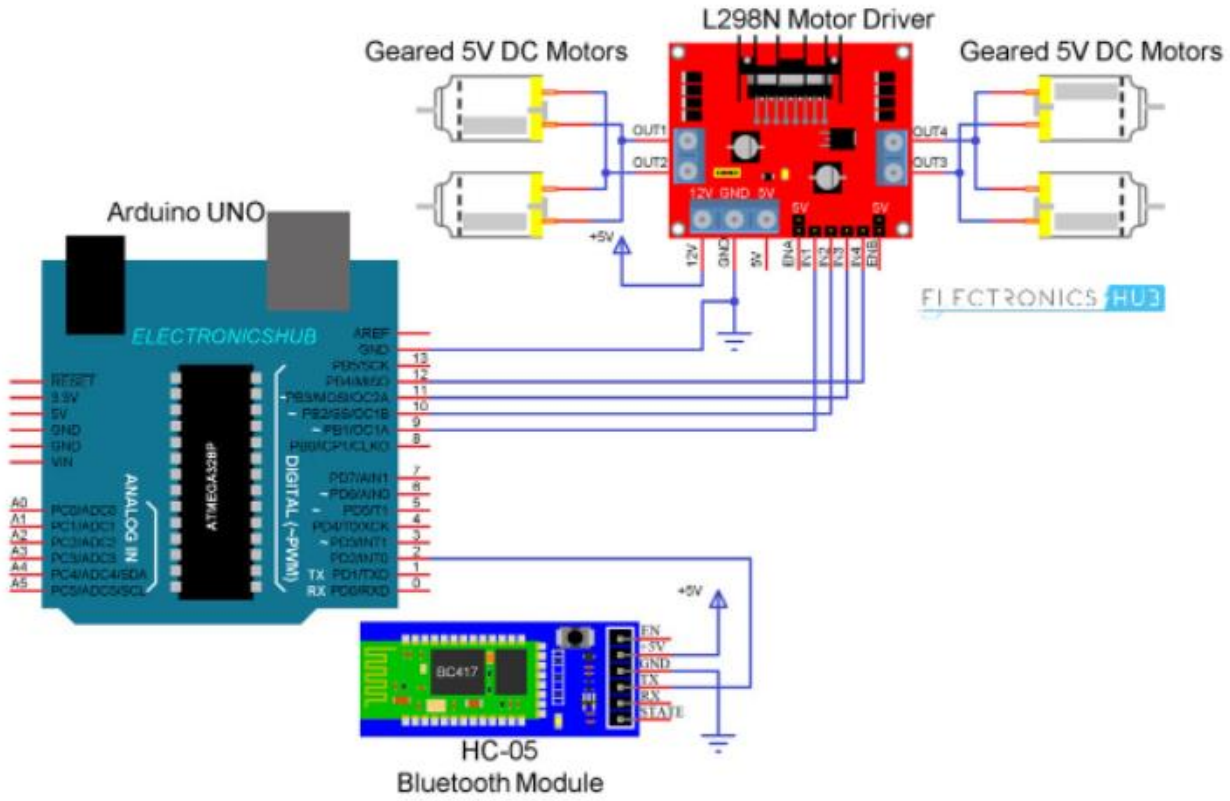

Fig 3.4: Circuit Diagram of Arduino voice controlled Bluetooth car

Coming to the plan of the circuit, first is the Bluetooth Module. The +5V and GND pins of the Bluetooth Module are associated with +5V and GND of Arduino.

Since we will be just sending information connected with the Robot's development from Android Phone to Bluetooth Module and don't plan to get any information from Arduino, we will associate just the TX pin of the Bluetooth Module to RX Pin of Arduino.

This RX pin of Arduino depends on SoftwareSerial library (Pin 2 and Pin 3 are arranged as RX and TX on Arduino). The RX pin of the Bluetooth is left open.

Then, the L298N Motor Driver Module. Advanced I/O Pins 8 through 11 of Arduino are designed as Input pins of the Motor Driver and are associated with IN1 through IN4 of the L298N Motor Driver Module. Both the Enable Pins are associated with 5V through the given jumper.

The robot case which I am utilizing in this Bluetooth Controlled Robot Car project is provided with four geared motor. Since L298N has openings for just two engines, I have joined the left side engines as one set and the right side engines as other set and associated both these sets to the result of L298N Module.

3.4: Working:

Voice orders are handled by smartphone, and speech to-text recognition is done inside the application utilizing Google speech-recognition technology. Message is then shipped off the beneficiary side through Bluetooth. Text got by means of Bluetooth is sent to Arduino utilizing UART serial communication protocol. Arduino code checks the text got. At the point when the text is a matching string, Arduino controls the developments of the robot likewise in forward, in reverse, Turning Right, Turning Left and Stop.

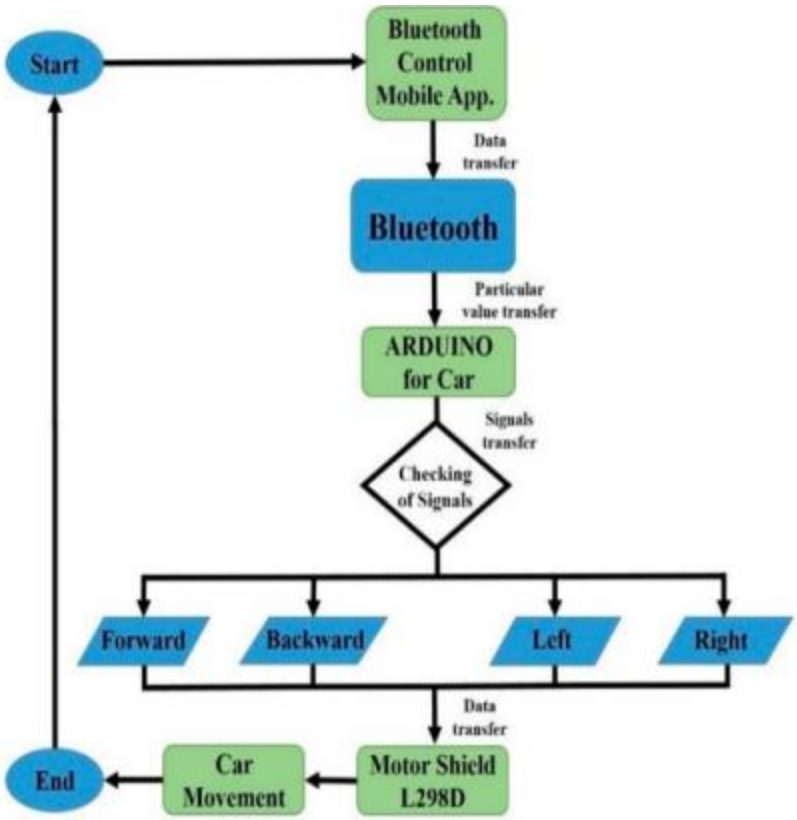

Fig3.5: Flowchart of Arduino voice controlled Bluetooth car

Steps to control the automated car:

- Download the application " BT Voice Control for Arduino " from Google play store and introduce it.
- After establishment, turn on the Bluetooth of cell phone and Bluetooth module.
- Then pair your cell phone Bluetooth with Bluetooth module and the default secret key for matching is "0000" or "1234".
- Then the application and robot is prepared to play out the activity.
- Then click on the "MIC" of the application and provide explicit order to the robot.
- Robot will play out the provided explicit order.
- For example, when we express forward through the application to the robot, this order is given to Bluetooth module of robot which is associated with the Arduino.

- As indicated by the programming of the Arduino the robot will play out the assignment or order. Subsequently the robot will move to advance.
- According to the given command the robot can perform other operation or command like Backward, Left, Right, Stop and Rotation of robot.

3.5: Code:

```
#include<SoftwareSerial.h>
#include <Wire.h>
int LF = 8;
int LB = 9;
int RF = 10;
int RB = 11;
void setup()
{
  Serial.begin(9600);
  pinMode(LF, OUTPUT);
  pinMode(RF, OUTPUT);
  pinMode(LB, OUTPUT);
  pinMode(RB, OUTPUT);

}

void loop()
{
  if (Serial.available())
  {
    String a = Serial.readString();
    Serial.print("The command is ");
    Serial.println(a);
    if (a == "go forward")
```

```
      Forward();
    if (a == "go back")
      Backward();
    if (a == "right" || a == "turn right")
      Right();
    if (a == "left" || a == "turn left")
      Left();
    if (a == "stop")
      Stop();
  }
}
void Forward()
{
  digitalWrite(LF, HIGH);
  digitalWrite(RF, HIGH);
  digitalWrite(RB, LOW);
  digitalWrite(LB, LOW);
}
void Backward()
{
  digitalWrite(LB, HIGH);
  digitalWrite(RB, HIGH);
  digitalWrite(RF, LOW);
  digitalWrite(LF, LOW);
}
void Right()
{
  digitalWrite(LF, HIGH);
  digitalWrite(RF, LOW);
  digitalWrite(RB, HIGH);
  digitalWrite(LB, LOW);
```

```
}
void Left()
{
  digitalWrite(LF, LOW);
  digitalWrite(RF, HIGH);
  digitalWrite(RB, LOW);
  digitalWrite(LB, HIGH);
}
void Stop()
{
  digitalWrite(LF, LOW);
  digitalWrite(RF, LOW);
  digitalWrite(RB, LOW);
  digitalWrite(LB, LOW);
}
```

Chapter 4
Results and Discussion

4.1 Result:

Through our Design and implementation of our proposed work, we can accomplish the results given below:

- Robot is controlled through voice orders given by the client who is working the project.
- These voice order should be given through an android application which is installed on the client's android phone.
- Voice recognition is done inside the android application and afterward a separate order is given to the voice-controlled robot car.
- Microcontroller fitted on the car translates these orders and provides a suitable order to the motor associated with the car.

4.2 Restrictions:

- As the scope of the Bluetooth Communication is restricted (a limit of 10 meters for class 2 gadgets for instance) the control scope of Bluetooth Controlled Robot is likewise restricted.
- Ensure that adequate power is given to every one of the modules particularly the Bluetooth Module. On the off chance that the power isn't adequate, despite the fact that the Bluetooth Module powers on, it can't send information or can't be matched with other Bluetooth gadgets.

4.3 Applications:

- Low reach Mobile Surveillance Devices
- Military Applications (no human intercession)
- Assistive gadgets (like wheelchairs)

- Home automation

Chapter 5
Conclusion

The proposed structure of our work shows that how a robot can be control using Bluetooth. The voice is sent through the Bluetooth innovation and the ideal working actually occurs. This assignment reduces human undertakings at spots or conditions where human interventions are inconvenient. Such systems can be brought into usage at spots, for model, business organizations, home automation, military and gatekeeper, investigation purposes, etc.

5.1 Future scope:

- Here we have used Bluetooth module that has a limitation of range. In future we can add WIFI module to it for preventing the range limitation.
- Internet of Things - Will permit the client to control the vehicle from anyplace in the world.
- Artificial Intelligence - Will permit the vehicle to be prepared or to advance without anyone else so it turns out to be genuinely independent and can work without human intercession of any sorts.
- We can also use Global Positioning System(GPS) & Global Monitoring System(GMS) so that we can track our automated device from home.

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