A
Project Report
on

Android Controlled Arduino Robot Car

Submitted to

Sant Gadge Baba Amravati University, Amravati

Submitted in partial fulfilment of
the requirements for the Degree of
Bachelor of Engineering in
Electronics and Telecommunication Engineering

Submitted by

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Certificate

This is to certify that the project report entitled "**Android Controlled Arduino Robot Car**" is hereby approved as a creditable study carried out and presented by

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Abstract

The project aims to design an android interface, Arduino bot and to write the program into the Arduino microprocessor. Arduino car contains Arduino UNO microcontroller with basic mobility features. Arduino programs contains instructions mediating between android controller and Arduino car. Android mobile controller uses different mobile sensors to supervise motion. An appropriate program in the Arduino microprocessor to interact with the android controller has to be created. The program has been successfully complied through Arduino IDE & uploaded in to it after proper checking of logic to decrease any loss/damage of hardware. We have to create an android application that will provide user an interface to interact with the Arduino powered car. The interface is easy to use and provide feedback from the Arduino microprocessor through the Bluetooth after giving instruction to Arduino for various actions through interface via Bluetooth module. The android application is to be created with the help of android studio that provide us with more capability & stability. After performing these procedures we have tested this project thoroughly and rectified the maximum no. of errors & wrong logic found in the microcontroller program. The Arduino Car has been designed and tested and found working satisfactorily and we can firmly say that we have been able to create the project as per our goal described.

Acknowledgement

We would like to take this opportunity to express our heartfelt thanks to our guide **Prof. D.L. Bhombe** for his esteemed guidance and encouragement, especially through difficult times. His suggestions broaden our vision and guided us to succeed in this work. We are also very grateful for his guidance and comments while designing part of our project and learnt many things under his leadership. Also we would like to thank to Dr. M. N. Tibdewal, Head of Electronics and Telecommunication Department, all teaching and non-teaching staff of EXTC Department for their encouragement and suggestions for our project.

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Abbreviations

RC   - Remote Control

DC   - Direct Current

SDK   - Software Development Kit

GSM   - Global System for Mobile Communication

Wi-Fi   - Wireless Fidelity

WLAN   - Wireless Local Area Network

PAN   - Personal Area Network

ASCII   - American Standard Code for Information Interchange

ATMEL   - Advanced Technology for Memory and Logic

IDE   - Integrated Development Environment

GUI   - Graphical User Interface

IC   - Integrated Circuit

LED   - Light Emitting Diode

SRAM   - Static Random Access Memory

EEPROM - Electrically Erasable Programmable Read-Only Memory

USB   - Universal Serial Bus

USART   - Universal Synchronous Asynchronous Receiver Transmitter

mAh   - Milli Ampere Hour

RPM   - Rotation Per Minute

PWM   - Pulse Width Modulation

List of Figures

List of Tables

Contents

Chapter 1
INTRODUCTION

This is an Arduino based, Bluetooth controlled RC car. It is controlled by a smart phone application. Bluetooth controlled car is controlled by using Android mobile phone instead of any other method like buttons, gesture etc. Here only needs to touch button in android phone to control the car in forward, backward, left and right directions. So here android phone is used as transmitting device and Bluetooth module placed in car is used as receiver.

Android phone will transmit command using its in-built Bluetooth to car so that it can move in the required direction like moving forward, reverse, turning left, turning right and stop.

Smartphone has quite changed the traditional ways of human to machine interaction. Smartphone is now a vital part of a person's life. Android is a software platform for mobile devices that includes an operating system, middleware and key applications. Android is a safe and secure operating system. All of its essential tools are combined in software called SDK which stands for Software Development Kit. We know that all manual operations have been replaced by automated mechanical operations. Our main objective of writing this paper is to develop an Android app for controlling the robot using Bluetooth. Bluetooth is used for its various advantages over other wireless technologies. Hardware technology utilized in smart phones has also greatly improved. Hence, we can say that Android smartphones will serve a great benefit for industrial, commercial and other general purpose applications.

The DC motors are widely used for providing variable speed drive system in industrial applications resembling automation, electrical traction, military instrumentality, fixed disk drives, thanks to their high potency, noise-free operation, compactness, dependability and low maintenance and cost. Many connection technologies are used nowadays such as GSM, Wi-Fi, WLANs and Bluetooth. Every technique has its own distinctive characteristics and applications.

Among these wireless connections, Bluetooth technology is usually enforced. The system hardware consists of a controller equipped with Bluetooth communication module. It'll be connected to the motors and other alternative components of car. When the robot app is turned on and is connected with the current system via Bluetooth, one

will operate the car by giving wireless commands from the app using the functions already programmed in the app. The vehicle will move all four told directions: left, right, front and back.

For forward movement, movement of both the motors will be in the same direction and for backward motion; movement of the motors will be in opposite direction. For left and right movements, either of the motors will rotate and to stop both the motors will stop. Instructions are given to the motors through the mobile app by the user.

1.1 Purpose of Plan

As most of the work in this area has been done regarding the Arduino & its application, what left out most of the time is the Android controller. In this project we are trying to exploit the android open accessory Bundle so that we can give

a) More realistic experience to the user.

b) Better Connectivity to the Arduino Chip.

c) Increasing the efficiency in controlling of Bot.

1.2 Project Objectives

In this project we will be constructing the android guided Arduino Car by extracting the powers of both the open-source technologies- Android and Arduino Programming.

1.3 Project Goals

- To develop an android application that will provide user an interface to interact with the Arduino powered car.

- To develop an appropriate program in the Arduino microchip to interact with the android controller.

- To compile all the developed modules that we constructed above.

- To produce Arduino car that is controlled by android phone remote which can be used in various fields, like defence, scientific expeditions and so on.

1.4 Scope of Definition

The project is limited to designing an android interface, Arduino bot and write program in to the Arduino microprocessor. Arduino car contains Arduino microcontroller with basic mobility features. Arduino programs contains instructions mediating between android controller and Arduino car. Android mobile controller uses different mobile sensors to supervise motion.

Chapter 2

LITERATURE REVIEW

Wireless control is one of the most important basic needs for all people all over the world. Bluetooth is one of the most used wireless technologies. A Bluetooth control car is such a car that can be controlled wirelessly using a Bluetooth control system and Arduino. With the combination of Arduino, and Bluetooth we can control many other things, like home Lighting, air conditioners, and many more through our cell phones. The Arduino can also contribute at large to the Smart Home system. Nowadays it has made us easier to convert digital signals into physical movements with such microcontrollers.

Today people are using automation in every sector. There are many benefits, for example, it reduces the risk of injury, it is fast, it can work day long, it is reliable, etc. This Bluetooth control car is just an example of automation. This type of car is used in law enforcement and military engagements for some the reasons like Hazard exposure which is controlled from a location of relative safety. Such vehicles are used by many police department bomb squads to defuse or detonate explosives.

These vehicles are also used in space exploration, by using such vehicle NASA. ESA and ROSCOSMOS have explored and collected many data from space, the moon, and mars. In recent days giant companies are using remote control vehicles to deliver their products. And Many of the giant factories have their transportation which is remotely controlled.

Here we have connected this 4-wheeler with Arduino and Bluetooth Module/ There is an Android application that is already installed in the remote device. We send our instruction to the vehicle with that application, that application is connected with the module in the vehicle. Bluetooth module transfer that instruction as a signal to the Arduino, and Arduino works with that signal. In the Arduino, we have installed the code which can work with the signals and convert those instructions to the pre-defined signals. Signals were transferred to the motors, and the car started running.

This car does not have advanced features but we can attach any kind of features like line detecting, or obstacle detecting, even though we can attach the camera to the vehicle and watch it with the remote. This one is just a basic prototype of a remote-

control car, we can add a lot of advanced features and get an armed/especially capable RC Car.

This project aimed to design an automated vehicle prototype built with Arduino and controlled with software developed on Android that can perform manual or automatic paths. Until now research and analyzing the simulation of experiments shown, it is believed that it is feasible to use the prototype designed for cognitive development, for future users can learn to insert custom paths that can process logic issues and more complex mathematics allowing the prototype to perform the desired movements. Analyzing the financial costs of design, it is believed that it is feasible to construct this type of prototype because it presents a low cost of the components used, particularly if they are chosen in a largescale production. It is worth noting that both the Arduino programming language and the language for Arduino in development are free, not burdening additional costs for the development of the project, pointing out that this applies also to the tools used for development. [10]

Chapter 3

HARDWARE REQUIREMENTS AND SPECIFICATIONS

3.1 Components Required

1. Arduino UNO
2. HC – 05 Bluetooth Module
3. Motor Driver L298N
4. Jumper Wire
5. Drilling Machine
6. Soldering Gun
7. 4 X 5V Geared Motors
8. Connecting Wires
9. Battery holder
10. Power Supply
11. Android Phone
12. Bluetooth Controller App

## 3.2 Block diagram and working principle
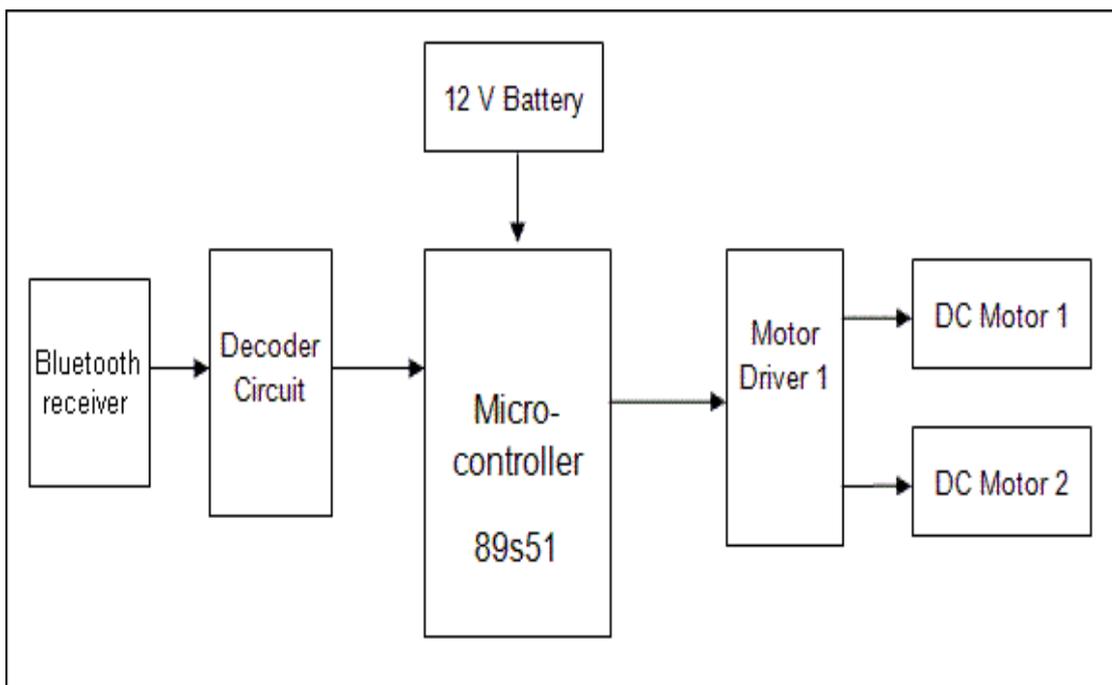
Figure 3.2: Block Diagram

The Block Diagram of our system consists of a Bluetooth module, an Arduino kit and a couple of motors for driving the car.

The android application controlled robot communicates via Bluetooth to the Bluetooth module present on the robot. While pressing each button on the application, corresponding commands are sent via Bluetooth to the robot.

The commands that are sent are in the form of ASCII. The PIC on the robot then checks the command received with its previously defined commands and controls the DC motors depending on the command received to cause it to move forward, backward, left, right or to stop. Thus allowing us to create an android controlled robot.

3.3 Circuit Diagram

The circuit diagram is shown below :-
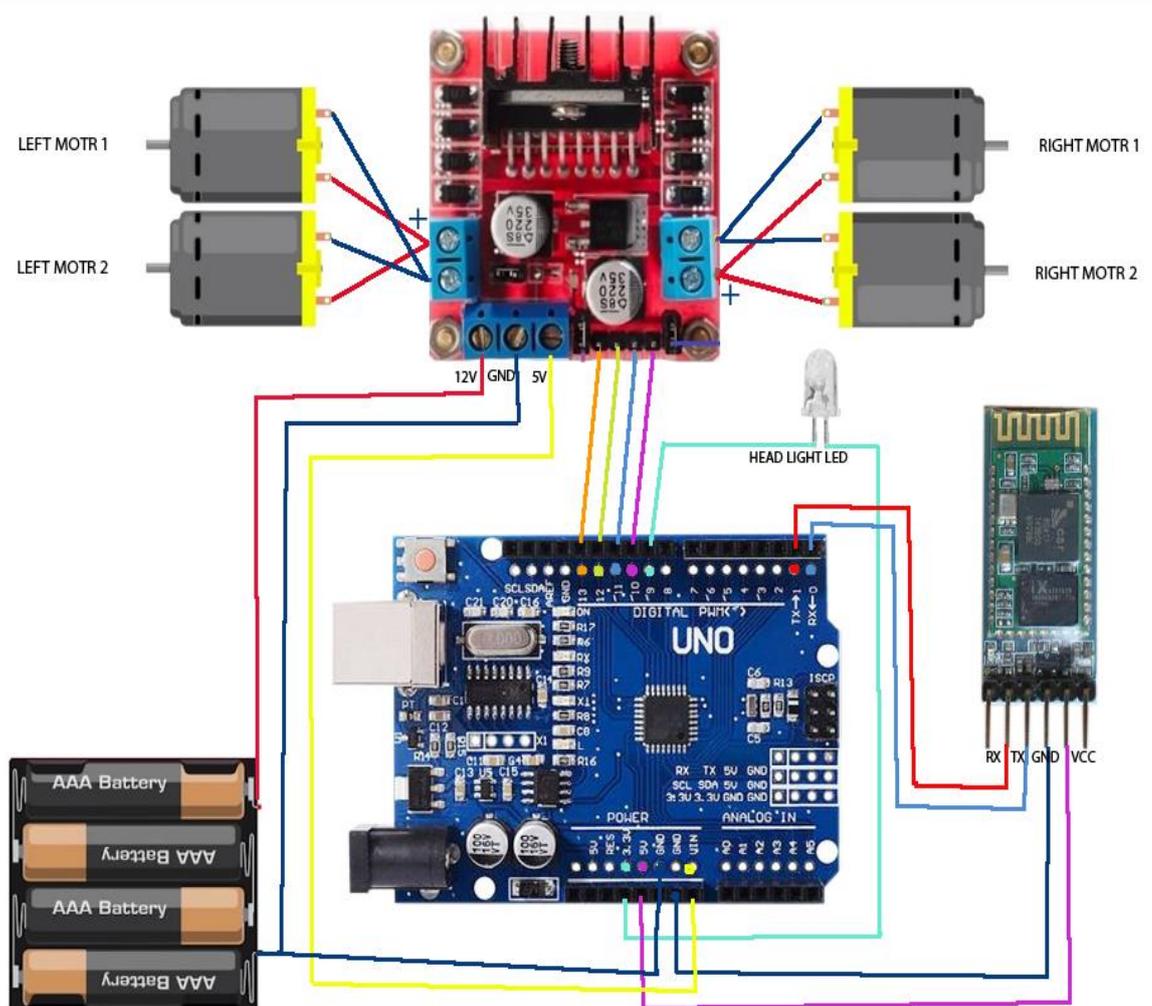
Figure 3.3: Circuit Diagram

Here at first we construct the circuit as shown in Figure 2.3 Then through the data cable we insert the commands in the microcontroller ATMEGA 328P (UNO). These commands help the microcontroller to interface with the Bluetooth module HC05 and also with the motor driver L293D.

Here the Bluetooth module act as a receiver which receives the instruction from the smart phone (remote or transmitter). Then the microcontroller decides the operation for the instruction which is coming from the smart phone. The functions of the given instructions are operated by the microcontroller. The instructions are sent by the smart phone. We can easily control the movements of the dc motor.

3.4 Arduino IDE

The Arduino integrated development environment (IDE) could be a cross-platform application written in Java, and derives from the IDE for the process programing language and also the Wiring projects. It's designed to introduce programming to artists and different newcomers unfamiliar with code development. It includes a code editor with options like syntax highlighting, brace matching, and automatic indentation, and is additionally capable of compilation and uploading programs to the board with one click. A program or code written for Arduino is named a "sketch".

Arduino programs are written in C or C++. The Arduino IDE comes with a code library referred to as "Wiring" from the first Wiring project that makes several common input/output operations a lot of easier. The users would like solely to outline 2 functions to create a possible cyclic government program:

setup (): a function run once at the beginning of a program that may initialize settings

loop (): a function referred to as repeatedly till the board powers off+ programming languages.

Figure 3.4: Arduino IDE

3.5 Arduino Uno

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and Analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. [1]. The board has 14 digital I/O pins (six capable of PWM output), 6 Analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes pre-programmed with a bootloader that allows uploading new code to it without the use of an external hardware programmer. There are many versions of Arduino boards introduced in the market like Arduino Uno, Arduino Due, Arduino Leonardo, Arduino Mega, however, most common versions are Arduino Uno and Arduino Mega.
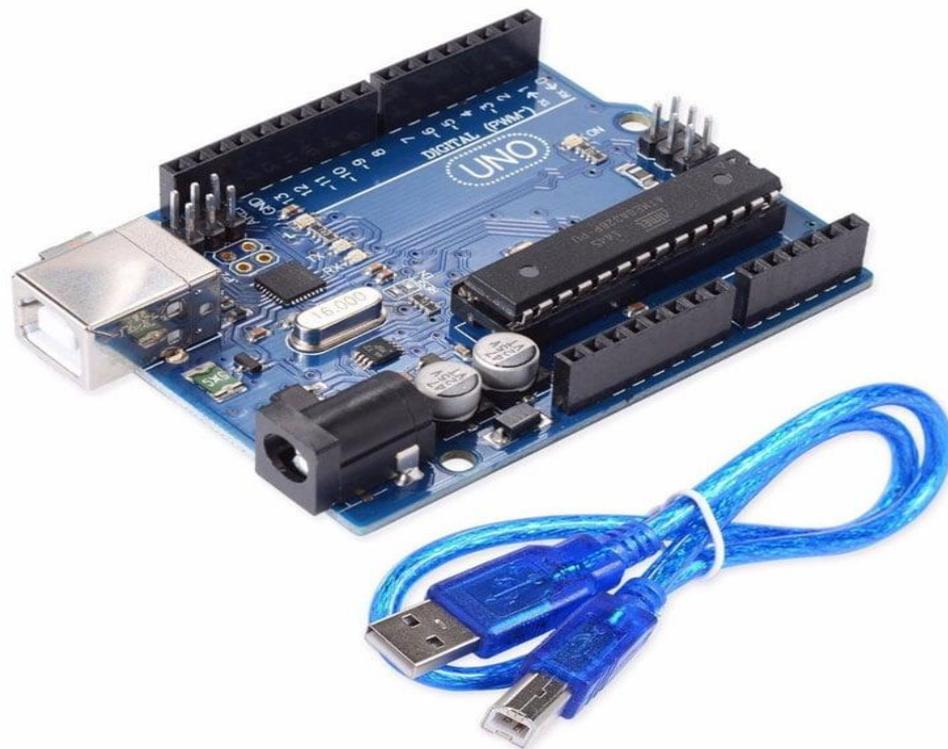
Figure 3.5: Arduino Uno

3.6 Arduino Uno Features and Pin Configuration

Uno means one in Italian, as uno is the first microcontroller of arduino family.

Features of Arduino Uno:-

- The operating voltage is 5V
- The recommended input voltage will range from 7v to 12V
- The input voltage ranges from 6v to 20V
- Digital input/output pins are 14
- Analog I/P pins are 6
- DC Current for each input/output pin is 40 mA
- DC Current for 3.3V Pin is 50 mA
- Flash Memory is 32 KB
- SRAM is 2 KB
- EEPROM is 1 KB
- CLK Speed is 16 MHz

Power Supply

The Arduino Uno power supply can be done with the help of a USB cable or an external power supply. The external power supplies mainly include AC to DC adapter otherwise a battery. The adapter can be connected to the Arduino Uno by plugging into the power jack of the Arduino board. Similarly, **the battery** leads can be connected to the Vin pin and the GND pin of the POWER connector. The suggested voltage range will be 7 volts to 12 volts.

Input & Output
The 14 digital pins on the Arduino Uno can be used as input & output with the help of the functions like pinMode(), digitalWrite(), & Digital Read().

Pin1 (TX) & Pin0 (RX) (Serial): This pin is used to transmit & receive TTL serial data, and these are connected to the ATmega8U2 USB to TTL Serial chip equivalent pins.

Pin 2 & Pin 3 (External Interrupts): External pins can be connected to activate an interrupt over a low value, change in value.

Pins 3, 5, 6, 9, 10, & 11 (PWM): This pin gives 8-bit PWM o/p by the function of analogWrite().

SPI Pins (Pin-10 (SS), Pin-11 (MOSI), Pin-12 (MISO), Pin-13 (SCK): These pins maintain SPI-communication, even though offered by the fundamental hardware, is not presently included within the Arduino language.

Pin-13(LED): The inbuilt LED can be connected to pin-13 (digital pin). As the HIGH-value pin, the light emitting diode is activated, whenever the pin is LOW.

Pin-4 (SDA) & Pin-5 (SCL) (I2C): It supports TWI-communication with the help of the Wire library.

AREF (Reference Voltage): The reference voltage is for the analog i/ps with analogReference().

Reset Pin: This pin is used for reset (RST) the microcontroller.

Memory
The memory of this Atmega328 Arduino microcontroller includes flash memory-32 KB for storing code, SRAM-2 KB EEPROM-1 KB.

Communication
The Arduino Uno ATmega328 offers UART TTL-**serial communication**, and it is accessible on digital pins like TX (1) and RX (0). The software of an Arduino has a serial monitor that permits easy data. There are two LEDs on the board like RX & TX which will blink whenever data is being broadcasted through the USB.
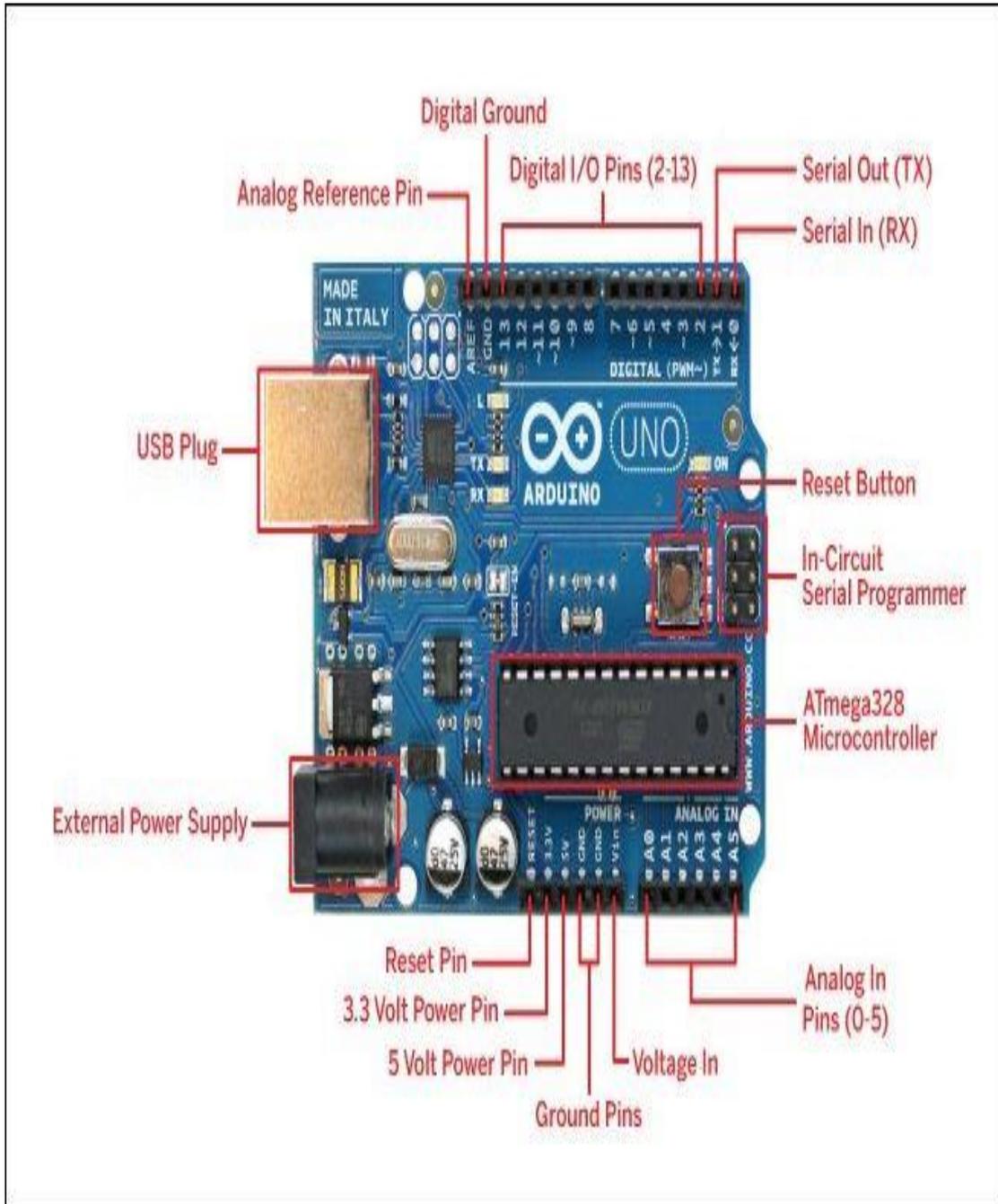
Figure 3.6: Arduino Uno connections

3.7 HC-05 Bluetooth Module

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration. It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications. It has range up to to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency hopping spread spectrum (FHSS) radio technology to send data over air. It uses serial communication to communicate with devices. It communicates with microcontroller using serialport (USART).
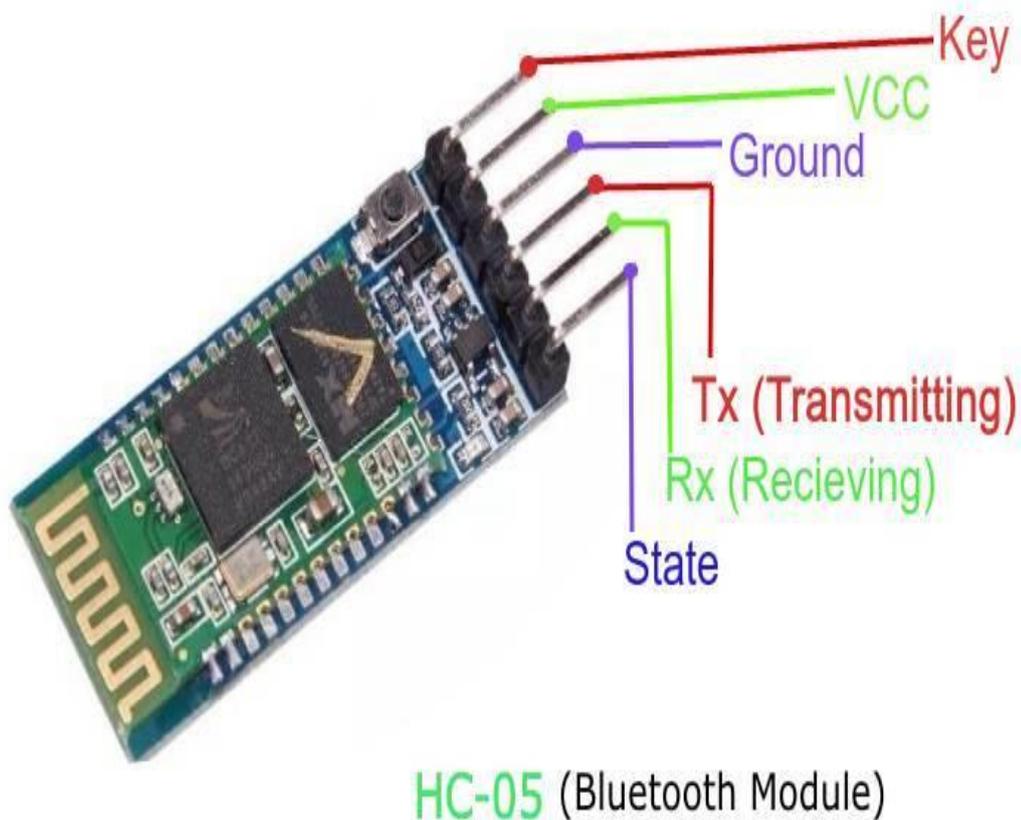

Figure 3.7: HC-05 Bluetooth Module

3.8 Bluetooth Communication Between Devices

First Send data from Smartphone terminal to HC-05 Bluetooth module and see this data on PC serial terminal and vice versa. To communicate smartphone with HC-05 Bluetooth module, smartphone requires Bluetooth terminal application for transmitting and receiving data. You can find Bluetooth terminal applications for android and windows in respective app store. Before establishing communication between two Bluetooth devices, 1st we need to pair HC-05 module to smartphone for communication. First, search for new Bluetooth device from your phone. You will find Bluetooth device with ― HC-05 name. Second, click on connect/pair device option; default pin for HC-05 is 1234 or 0000. In smart phone, open Bluetooth terminal application and connect to paired device HC-05. It is simple to communicate we just have to type in the Bluetooth terminal application of smartphone. Characters will get sent wirelessly to Bluetooth module HC-05.
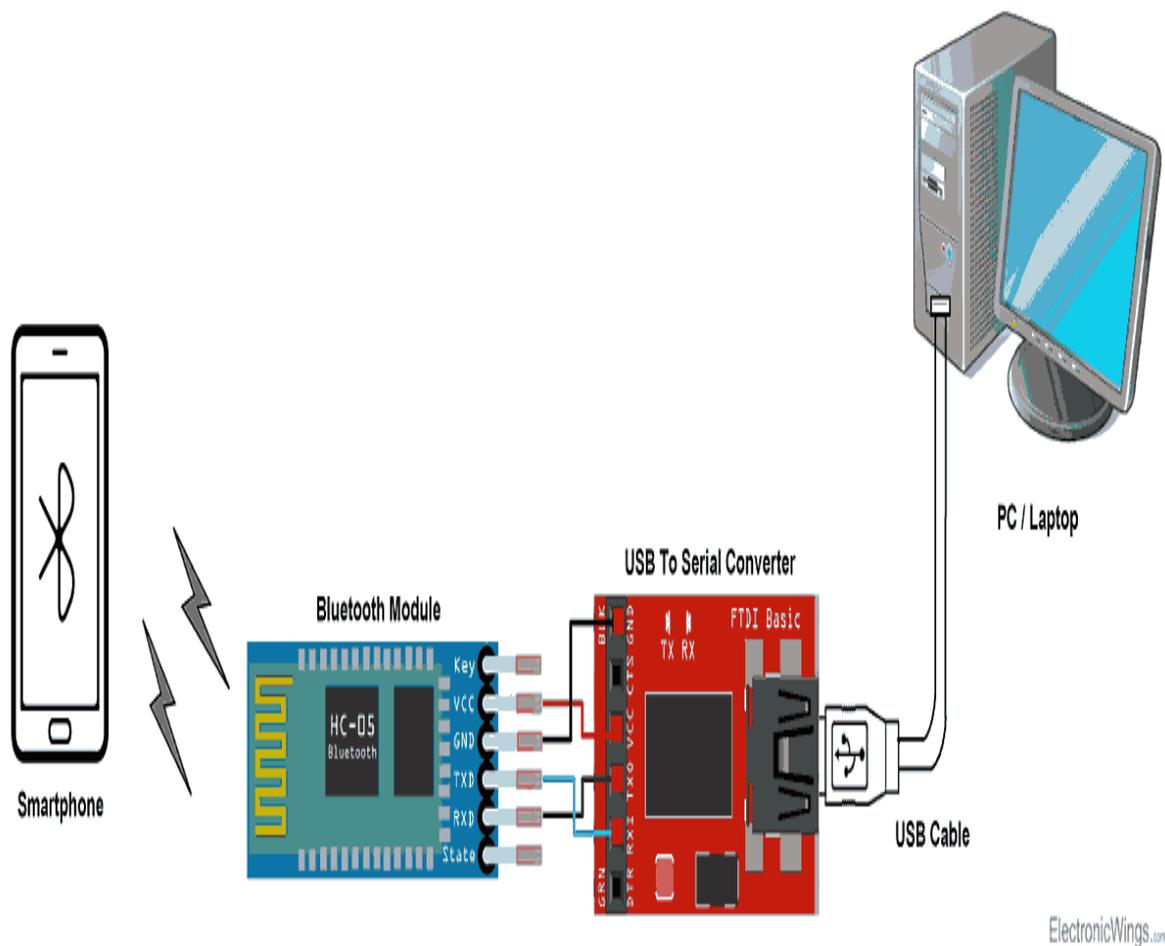
Figure 3.8: Bluetooth communication between devices

3.9 Motor Driver Module L298N

This L298N Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.

I.   Features & Specifications :-

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current:2A
- Logical Current:0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor
- Heatsink for better performance
- Power-On LED indicator

II.   Controlling a DC Motor :-

We can only have full control over a DC motor if we can control its speed and spinning direction. This is possible by combining these two techniques.

1. PWM – to control speed
2. H-Bridge – to control the spinning direction

1. PWM – to control speed

The speed of a DC motor can be controlled by changing its input voltage. A widely used technique to accomplish this is Pulse Width Modulation (PWM).

PWM is a technique in which the average value of the input voltage is adjusted by sending a series of ON-OFF pulses. This average voltage is proportional to the width of the pulses, which is referred to as the Duty Cycle.

The higher the duty cycle, the higher the average voltage applied to the DC motor, resulting in an increase in motor speed. The shorter the duty cycle, the lower the average voltage applied to the DC motor, resulting in a decrease in motor speed.
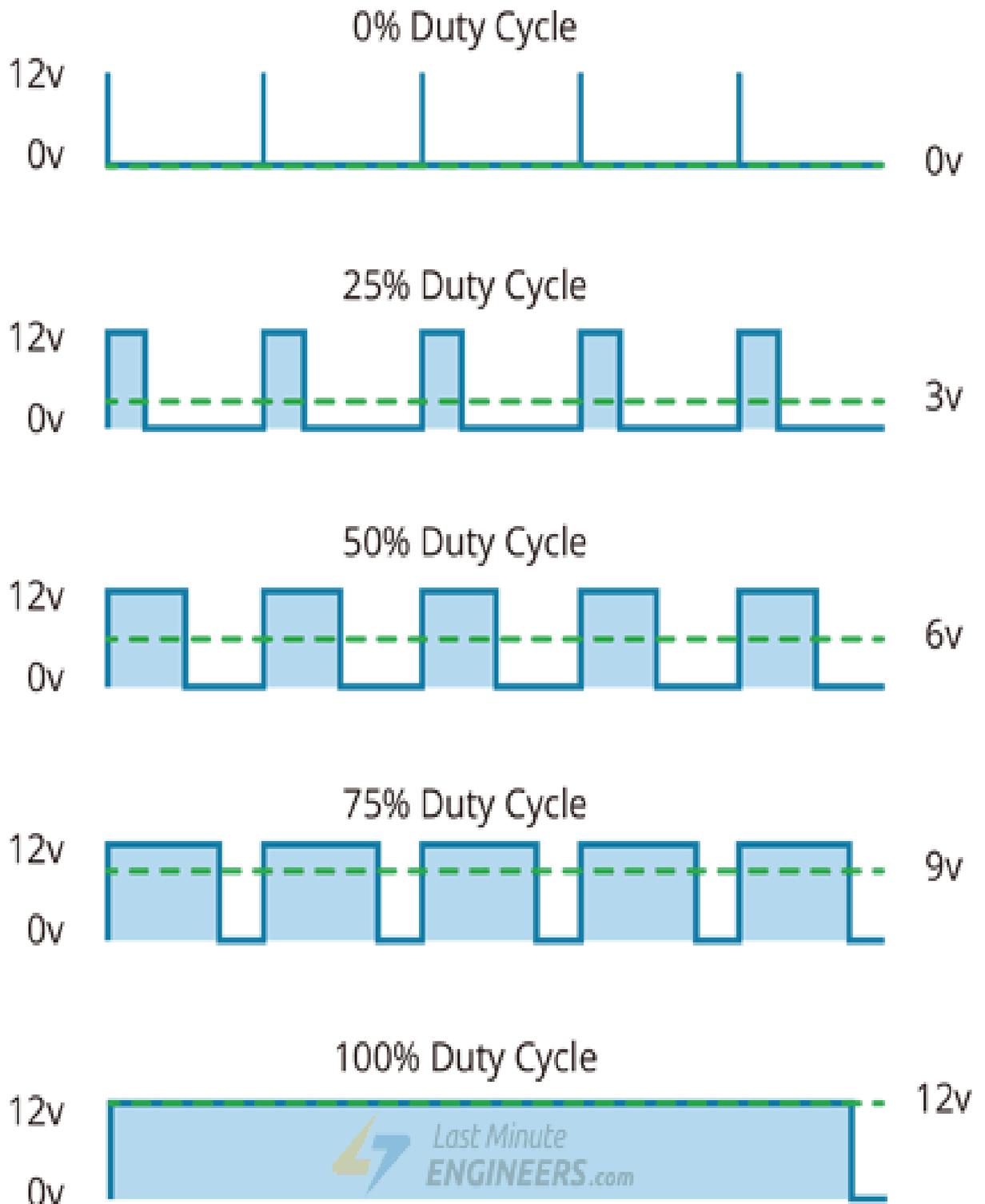
Figure 3.9.1: Pulse Width Modulation(PWM) Technique

2. H-Bridge – to control the spinning direction

The spinning direction of a DC motor can be controlled by changing the polarity of its input voltage. A widely used technique to accomplish this is to use an H-bridge.

An H-bridge circuit is made up of four switches arranged in a H shape, with the motor in the center.

Closing two specific switches at the same time reverses the polarity of the voltage applied to the motor. This causes a change in the spinning direction of the motor.
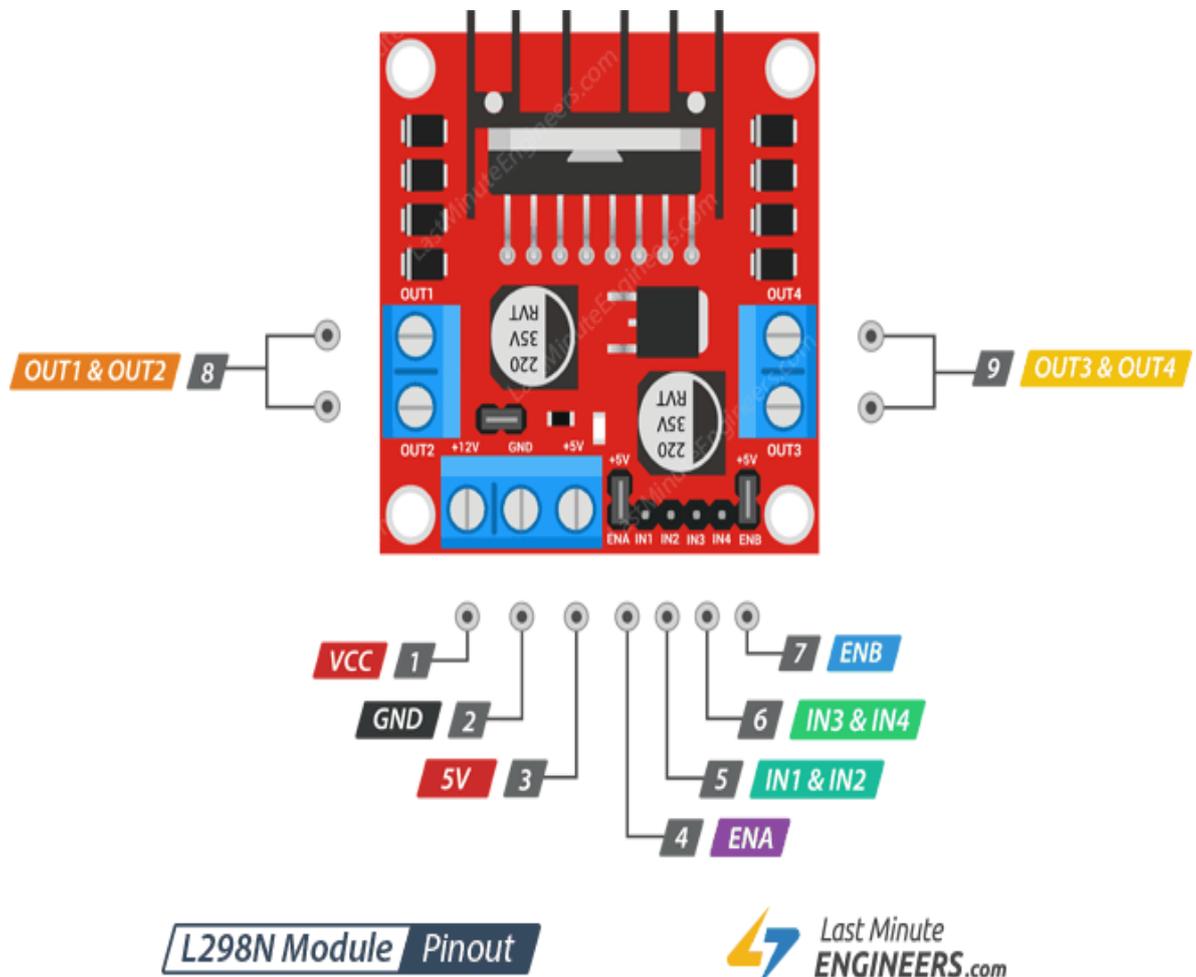

Figure 3.9.2: Motor driver module L298N

3.10 Voltage Drop of L298N

The L298N has a voltage drop of approximately 2V. This is due to the fact that internal switching transistors have a voltage drop of approximately 1V when forward biased, and because an H-Bridge requires the current to pass through two transistors, the total voltage drop is 2V.

So, if you connect 12V to the motor power supply terminal, the motors will receive approximately 10V. This means that a 12V DC motor will never spin at full speed.

In order to get the motor to run at its maximum speed, the motor power supply should have a voltage that is slightly higher (+2V) than the actual voltage requirement of the motor.

Taking into account a voltage drop of 2V, if you are using 5V motors, you will need to provide 7V at the motor power supply terminal. If you have 12V motors then your motor supply voltage should be 14V.
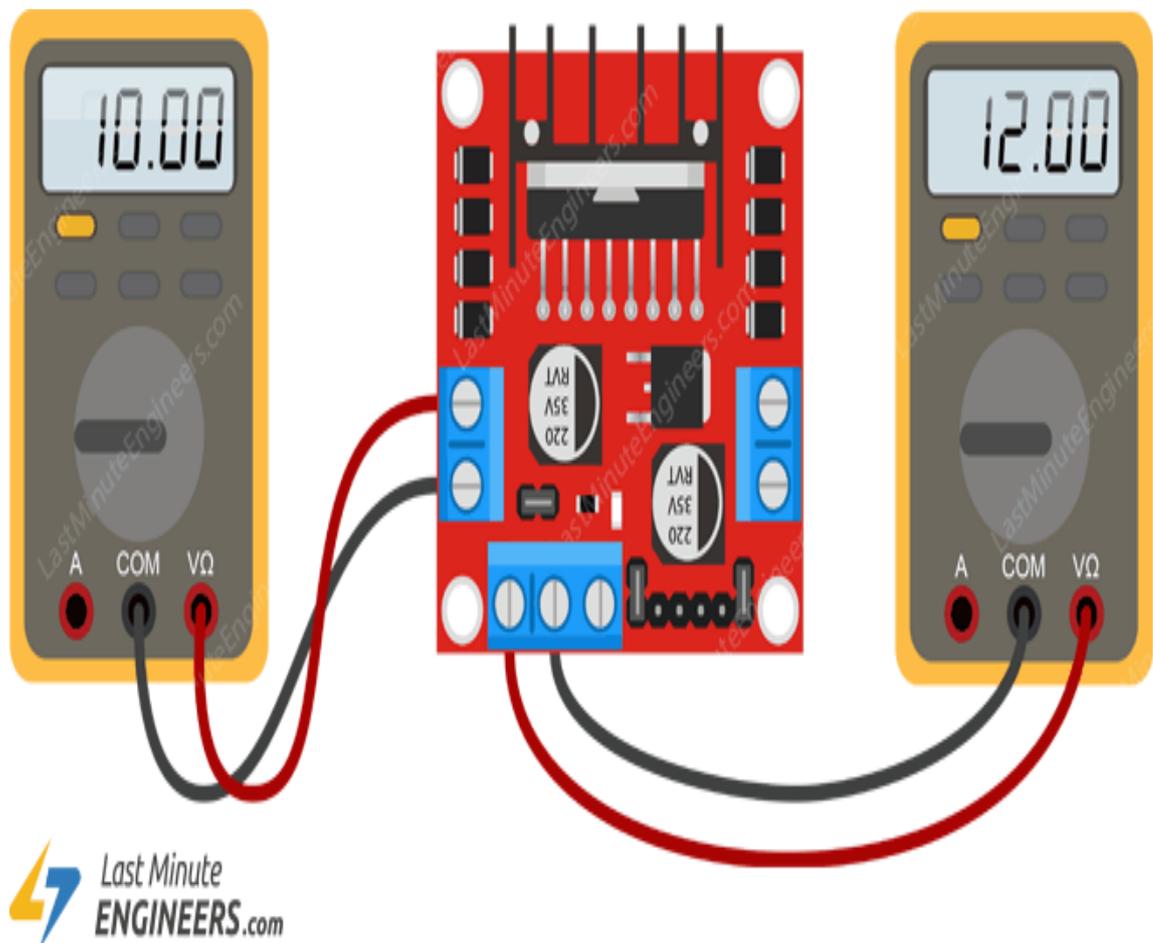
Figure 3.10: Voltage Drop of L298N

3.11 Micromors and Grippy Wheels

Mobile wheeled or tracked robots have a minimum of two motors which are used to propel and steer the robot. Hobbyists tend to choose "skid steering" (like a tank) because of its simplicity to design, incorporate and control. A three wheeled robot's third (front) wheel usually prevents the robot from falling over. Four wheeled robots have either two or four drive motors and use skid steering. Six wheeled robots most commonly have either two, four or six drive motors. Adding ―idle wheels (wheels not connected to a motor) often has the unfortunate consequence of removing weight from the drive wheels resulting in slip and loss of traction, the center wheel often loses contact with the ground.

Figure 3.11: Micromors and Grippy Wheels

3.12 Jumper Wires

A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.
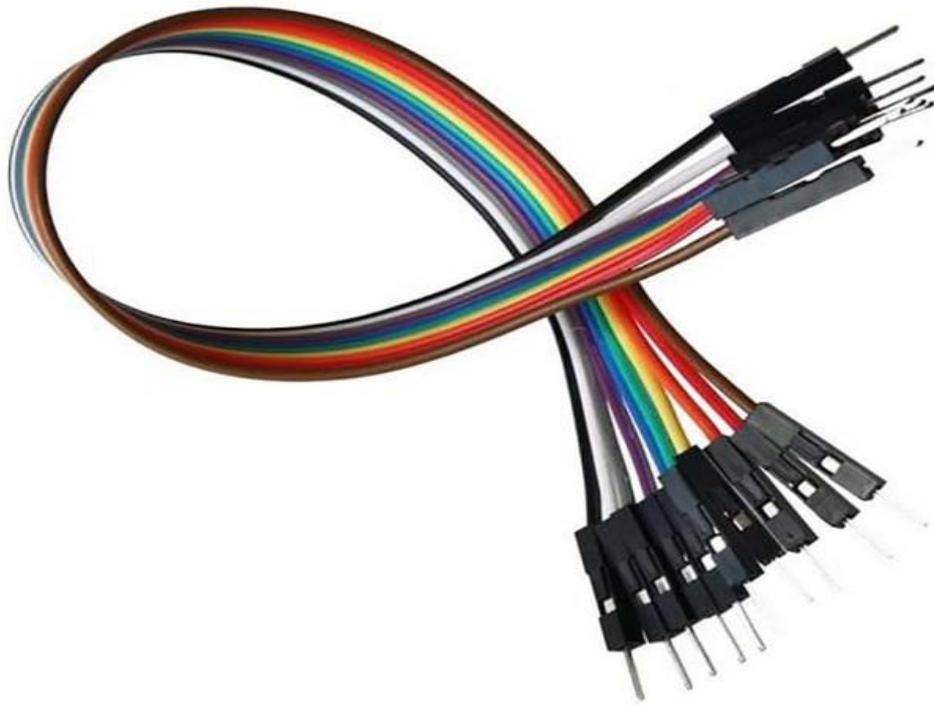
Figure 3.12: Jumper Wires

**3.13 Batteries**

A battery is an energy source consisting of one or more electrochemical cells and terminals on both ends called an anode (-) and a cathode (+). Here for the project, 3 3.7V Lithium-ion batteries has been used.

Figure 3.13: Batteries

3.14 Switch

A switch is used for turning on the power of the vehicle. It controls the battery connection of the vehicle.

Figure 3.14: Switch

3.15 Smartphone with app

The smart phone is the transmitter of this circuit. It sends the data to microcontroller through Bluetooth module. It also helps to send the instruction of forward, backward, left, right to the microcontroller. Actually, the smart phone is used as a remote of this system. Here we operating the Bluetooth RC Controller application as the operating remote of this system. The advantage of this project is that the application software designed for android phones is kept simple but attractive with all necessary built-in functions. The novelty lies in the simplicity of the design and functioning.
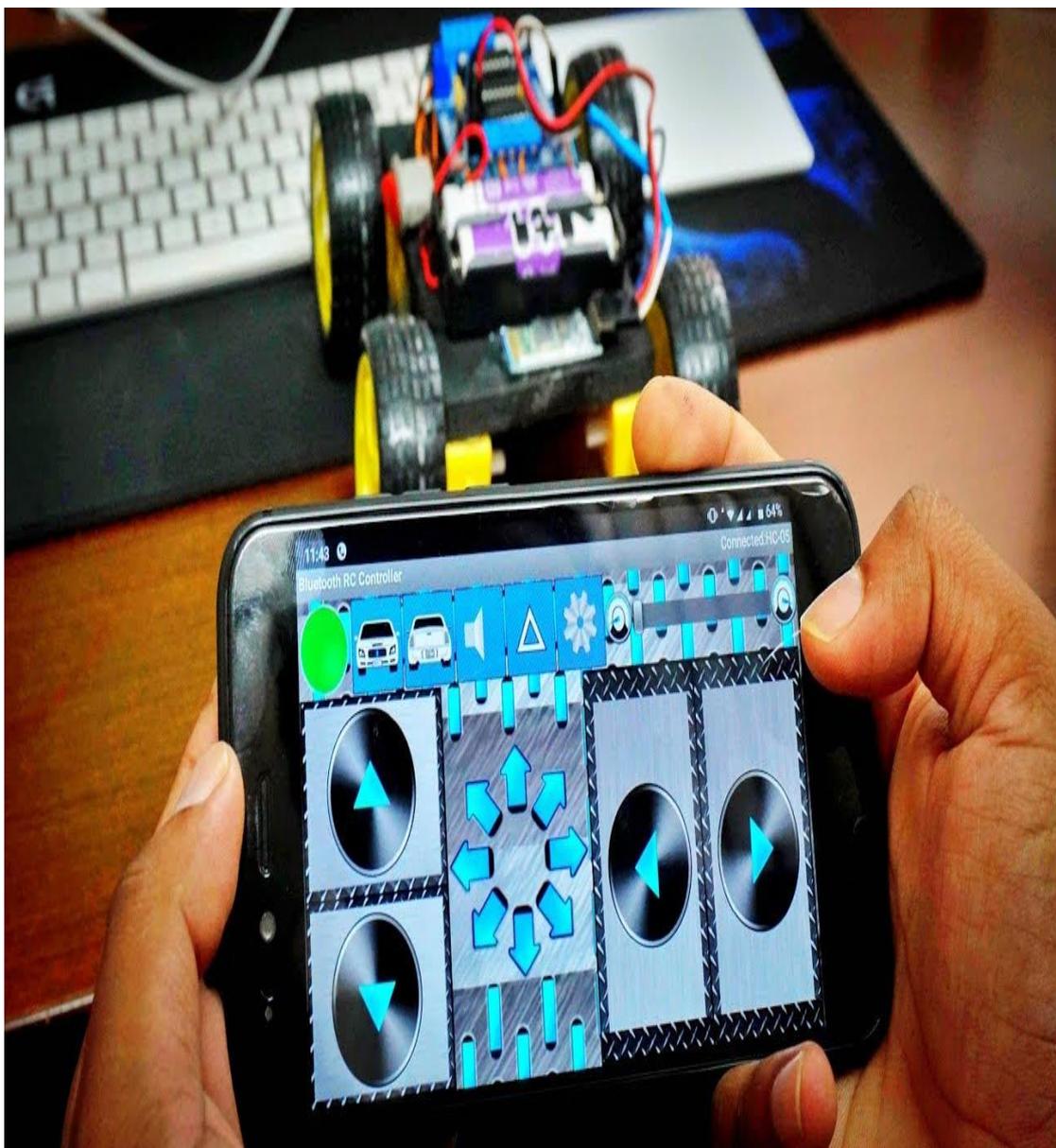

Figure 3.15.1: Smartphone with app

An application was developed in the software Android Studio. App can be installed on an Android smartphone to control the RC unit. The app shows buttons for movement of the car in different directions. These commands are as follows: Left, forward, backward and right. The code for the app is written in java.
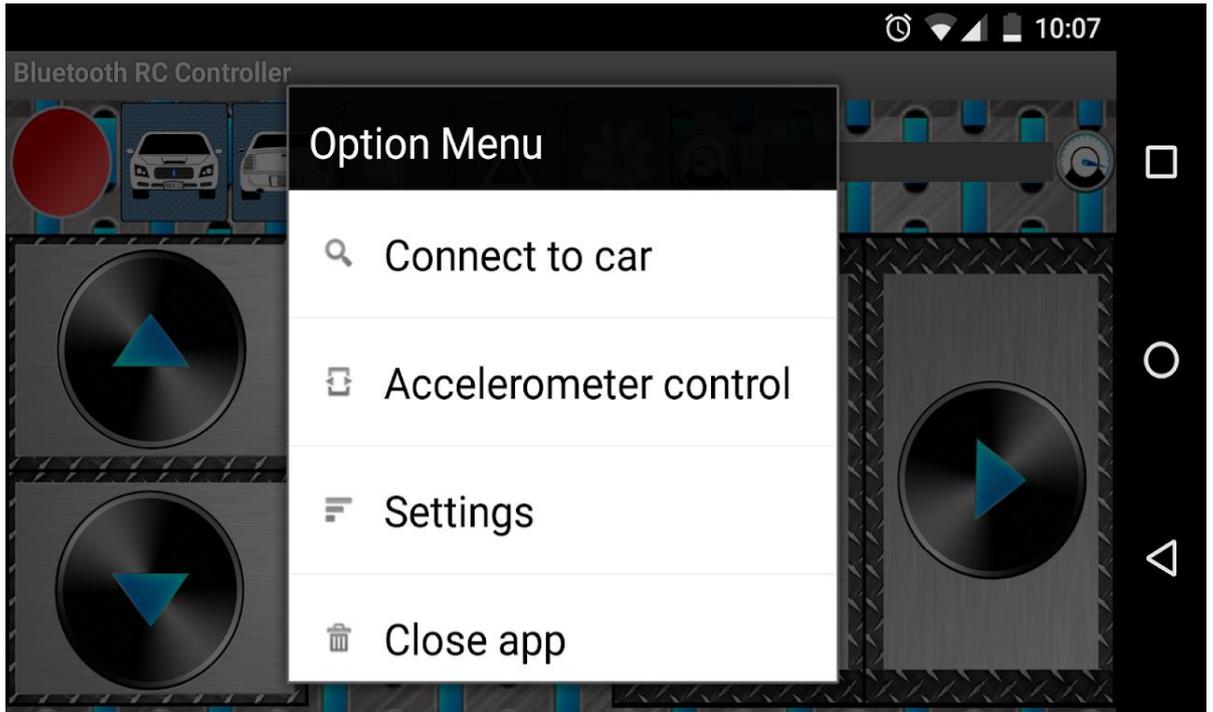
Figure 3.15.2: Application Interface

3.16 RC Module

RC module is the main working unit of this system. This unit consists of the Arduino chip, the two motor drivers, and a Bluetooth module connected to the circuit. Motor drivers are used to control the dc motors. The Arduino Uno, which is a small android chip, resides at the center of the unit. It is responsible for communicating with android smartphone, using the Bluetooth module and controls the motors using the motor driver. The RC unit is powered using 9V battery connected to this Arduino chip. The command for controlling the module is received using Bluetooth module HC-05.

Chapter 4

DESIGN AND IMPLEMENTATION

4.1 Wiring L298N Motor Driver Module to Arduino UNO

Initial procedure is done by connecting the motor power supply. In our experiment, we are using DC gearbox motors, also called "TT" motors, which are often found in two-wheel-drive robots. They are rated for 3 to 12V. We will therefore connect an external 12V power source to the VS terminal. Because L298N has a voltage drop of about 2V, the motors will receive 10V and spin at a slightly lower RPM. But that's okay.

Next, we need to supply 5V to the logic circuitry of the L298N. We'll use the on-board 5V regulator to draw 5V from the motor power supply, so keep the 5V-EN jumper in place.

Now connect the L298N module's Input and Enable pins (ENA, IN1, IN2, IN3, IN4 and ENB) to the six Arduino digital output pins (9, 8, 7, 5, 4 and 3). Note that both Arduino output pins 9 and 3 are PWM-enabled.

Finally, wire one motor to terminal A (OUT1 and OUT2) and the other to terminal B (OUT3 and OUT4). You can swap out your motor's connections. There is technically no right or wrong way.
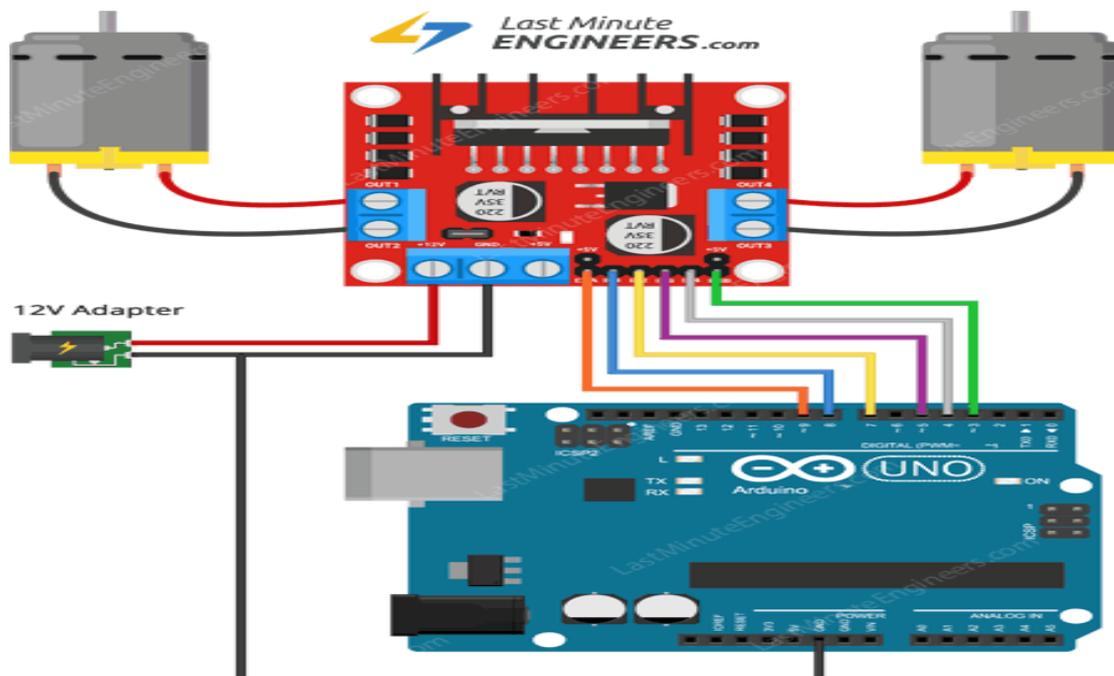

Figure 4.1: Connecting Motor Driver Module to an Arduino

4.2 Flow diagram to control robot car with mobile-application
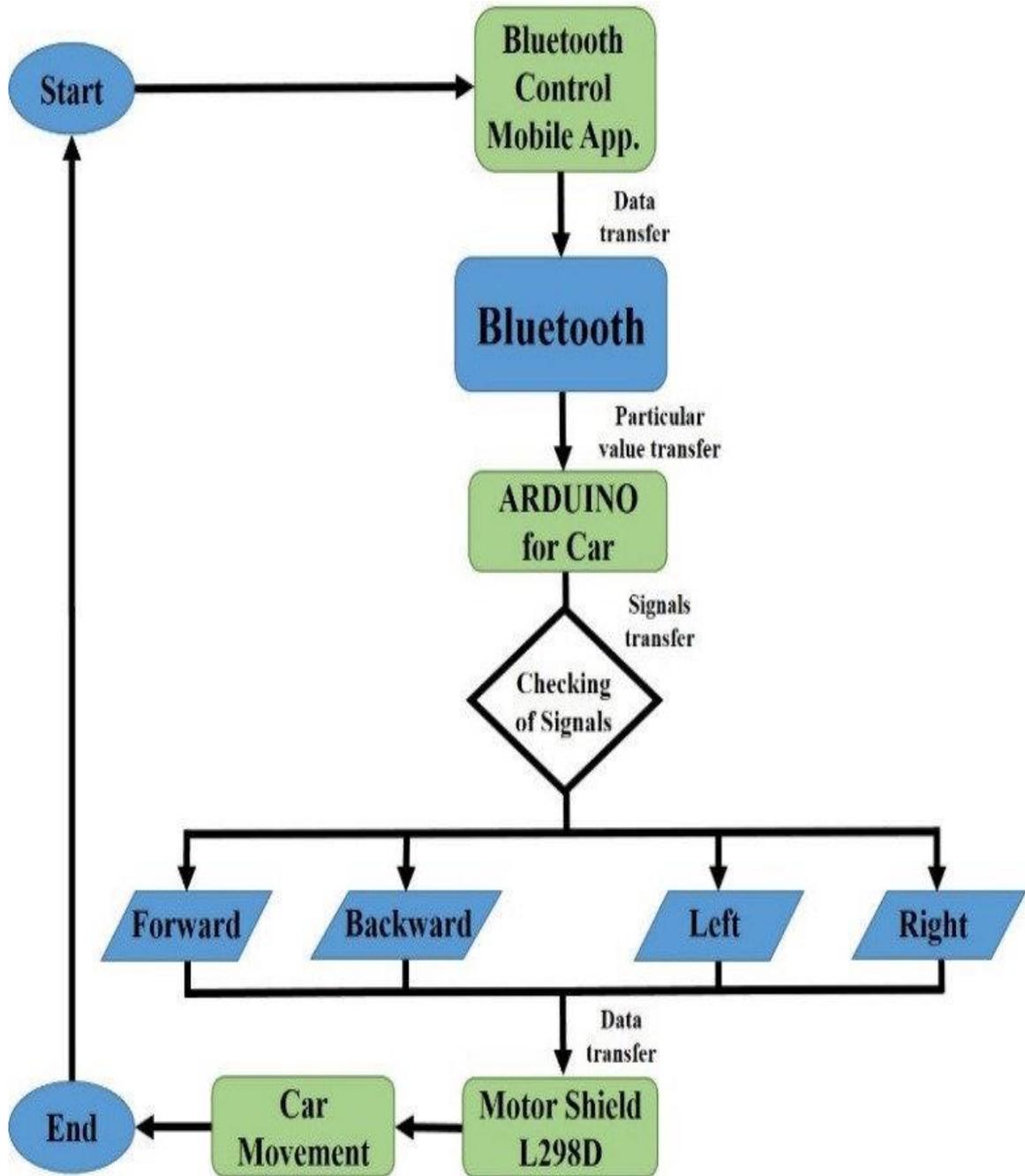
Figure 4.2: Flow diagram to control robot car with mobile-application

Chapter 5

SOURCE CODE OF ARDUINO CAR

5.1 Source Code for Arduino UNO

```
// Starting of Program
int m1a = 9;
int m1b = 10;
int m2a = 11;
int m2b = 12;
char val;

void setup()
{
pinMode(m1a, OUTPUT);   // Digital pin 10 set as output Pin
pinMode(m1b, OUTPUT);   // Digital pin 11 set as output Pin
pinMode(m2a, OUTPUT);   // Digital pin 12 set as output Pin
pinMode(m2b, OUTPUT);   // Digital pin 13 set as output Pin
Serial.begin(9600);
}

void loop()
{
  while (Serial.available() > 0)
  {
  val = Serial.read();
  Serial.println(val);
  }

  if( val == 'F') // Forward
    {
      digitalWrite(m1a, HIGH);
      digitalWrite(m1b, LOW);
      digitalWrite(m2a, HIGH);
      digitalWrite(m2b, LOW);
    }
  else if(val == 'B') // Backward
    {
      digitalWrite(m1a, LOW);
      digitalWrite(m1b, HIGH);
      digitalWrite(m2a, LOW);
      digitalWrite(m2b, HIGH);
    }
```

```
else if(val == 'L') //Left
  {
    digitalWrite(m1a, HIGH);
    digitalWrite(m1b, LOW);
    digitalWrite(m2a, LOW);
    digitalWrite(m2b, LOW);
  }
else if(val == 'R') //Right
  {
    digitalWrite(m1a, LOW);
    digitalWrite(m1b, LOW);
    digitalWrite(m2a, HIGH);
    digitalWrite(m2b, LOW);
  }
else if(val == 'S') //Stop
  {
    digitalWrite(m1a, LOW);
    digitalWrite(m1b, LOW);
    digitalWrite(m2a, LOW);
    digitalWrite(m2b, LOW);
  }
else if(val == 'I') //Forward Right
  {
    digitalWrite(m1a, LOW);
    digitalWrite(m1b, LOW);
    digitalWrite(m2a, HIGH);
    digitalWrite(m2b, LOW);
  }
else if(val == 'J') //Backward Right
  {
    digitalWrite(m1a, LOW);
    digitalWrite(m1b, LOW);
    digitalWrite(m2a, LOW);
    digitalWrite(m2b, HIGH);
  }
else if(val == 'G') //Forward Left
  {
    digitalWrite(m1a, HIGH);
    digitalWrite(m1b, LOW);
    digitalWrite(m2a, LOW);
    digitalWrite(m2b, LOW);
  }
```

```
  else if(val == 'H') //Backward Left
    {
      digitalWrite(m1a, LOW);
      digitalWrite(m1b, HIGH);
      digitalWrite(m2a, LOW);
      digitalWrite(m2b, LOW);
    }
}
```

Chapter 6

RESULT & ANALYSIS

6.1 Resultant and Analysis

Here we work on common mode and when we want to change settings of HC-05 Bluetooth module like change password for connection, baud rate, Bluetooth device's name etc. To do this, HC-05 has AT commands. To use HC-05 Bluetooth module in AT command mode, connect ―Key‖ pin to High (VCC). Default Baud rate of HC05 in command mode is 38400bps. Following are some AT command generally used to change setting of Bluetooth module. To send these commands, we have to connect HC-05 Bluetooth module to the PC via serial to USB converter and transmit these command through serial terminal of PC.

You can directly use the Bluetooth module after purchasing from market, because there is no need to change any setting of Bluetooth module. Default baud rate of new Bluetooth module is 9600 bps. You just need to connect rx and tx to controller or serial converter and give 5 volt dc regulated power supply to module.

Bluetooth module has two modes one is master mode and second one is slave mode. User can set either mode by using some AT commands. Even user can set module's setting by using AT command. Here is some commands uses are given:

First of all user need to enter AT mode with 38400 bps baud rate by pressing EN button at Bluetooth module or by giving HIGH level at EN pin. Note: all commands should ends with \r\n (0x0d and 0x0a) or ENTER KEY from keyboard.

After it if you send AT to module then module will respond with OK

AT → Test Command

AT+ROLE = 0 → Slave Mode select

AT+ROLE = 1 → Master Mode select

AT+NAME = xyz → Set Bluetooth Name

AT+PSWD = xyz → Set Password

AT+UART =< value1>,<value2>,<value3> → set Baud rate

Eg. AT+UART = 9600,0,0

Pin Description of accelerometer

1. STATE → Open
2. Rx → Serial receiving pin
3. Tx → Serial transmitting pin
4. GND → ground
5. Vcc → +5volt dc
6. EN → to enter in AT mode

6.2 Working Explanation

Bluetooth controlled car moves according to button touched in the android Bluetooth mobile app. To run this project first we need to download Bluetooth app form Google play store. We can use any Bluetooth app that supporting or can send data. Here are some apps' name that might work correctly.

- Bluetooth RC controller

After installing app you need to open it and then search Bluetooth device and select desired Bluetooth device. And then configure keys. Here in this project we have used Bluetooth controller app.

1. Download and install Bluetooth Controller.
2. Turned ON mobile Bluetooth.
3. Now open Bluetooth controller app
4. Press scan
5. Select desired Bluetooth device

When we touch forward button in Bluetooth controller app then car start moving in forward direction and moving continues forward until next command comes.

When we touch backward button in Bluetooth controller app then car start moving in reverse direction and moving continues reverse until next command comes.

When we touch left button in Bluetooth controller app then car start moving in left direction and moving continues left until next command comes. In this condition front side motor turns front side wheels in left direction and rear motor runs in forward direction.

When we touch right button in Bluetooth controller app then car start moving in right direction and moving continues right until next command comes. In this condition front side motor turns front side wheels in right direction and rear motor runs in forward direction and by touching stop button we can stop the car.

Bluetooth module's rx and tx pins are directly connected at tx and rx of Arduino. And vcc and ground pin of Bluetooth module is connected at +5 volt and gnd of Arduino. And a 9 volt battery is used for power the circuit at Arduino's Vin pin.

Then we have created functions for different directions of car.

There are five conditions for this Bluetooth controlled car which are used to give the directions:

Touched button in Bluetooth controller app	Output for front side motor to give direction		Output for rear side motor to move forward or reverse direction		
Button	M11	M12	M21	M22	Direction
Stop	0	0	0	0	Stop
Forward	0	0	0	1	Forward
Backward	0	0	1	0	Backward
Right	1	0	0	1	Right
left	0	1	0	1	Left

Table 6.2: Table of 5 conditions for directions
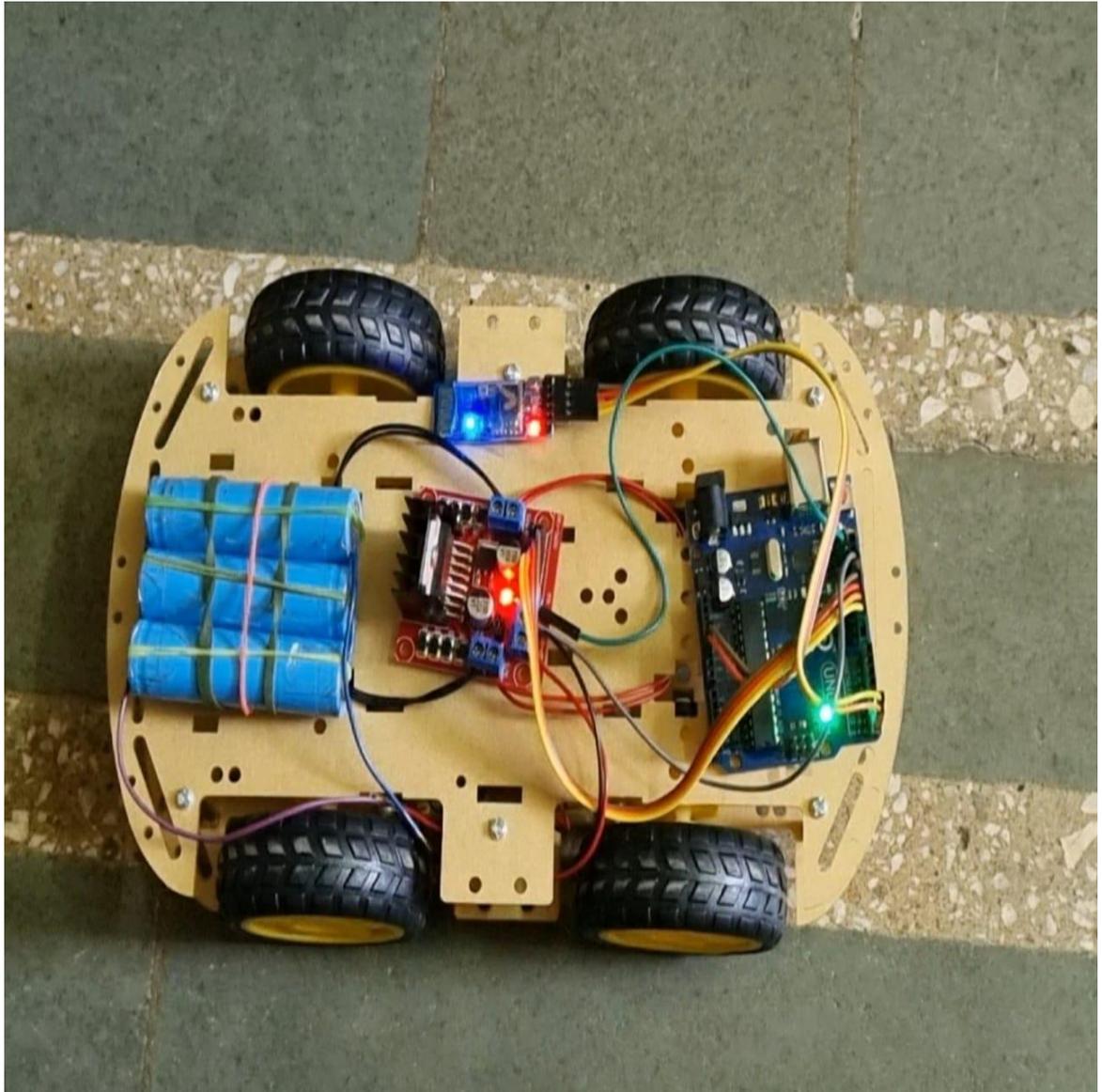
Figure 6.2: Working Explanation

6.3 Limitations

As the range of the Bluetooth Communication is limited (a maximum of 60 meters for class 2 devices for example) the control range of Bluetooth Controlled Robot is also limited. Make sure that sufficient power is provided to all the modules especially the Bluetooth Module. If the power is not sufficient, even though the Bluetooth Module powers on, it cannot transmit data or cannot be paired with other Bluetooth devices.

6.4 Applications

- Low range Mobile Surveillance Devices
- Military Applications (no human intervention)
- Assistive devices (like wheelchairs)
- Home automation

6.5 Advantages

- Easy to install and low cost.
- Manually operate.

Chapter 7
CONCLUSION & FUTURE SCOPE

7.1 Conclusion

To us the need of internet and the things which are internet based are very much important nowadays. IOT or internet of things is the very important part in both computer and our daily lives. The above model describes how the arduino programs the car motor module and by this we actually rotate the wheels and give direction to the car. It gives us the opportunity to work with different platforms and it helps us to create various interesting modules to work on. We also tested the applications used to drive the car. Due to the new concept of Wireless Controlled Car using Bluetooth, Wifi we were able to come up with various possibilities that can take place.

Thus, in this project, we designed an Android App in the software Android Studio to control the RC module. We have programmed Arduino and designed the RC car as shown in the diagram previously. The car will receive the commands via Bluetooth and move accordingly.

The Arduino is an open source device that has been the brain for numerous projects. The Arduino has everything that is required by the user which includes its inbuilt converter, i/o pins etc. With the combination of Arduino, and the Bluetooth Shield we can control over many other things, like home Lightings, air conditioner and many more through our cell phones. The Arduino can also contribute at large for the Smart Home system. By doing this Project we found out a lot about the Arduino, and how it has made us easier to convert digital signals into physical movements. One more advantage of Arduino is that once a program is burned we don't need to worry about the program getting erased as long as it is not RESET. Arduino has also over all other microcontroller because of its efficiency and user friendly property.

This project consists of a basic prototype of a Bluetooth control car above stated. The prototype car can recognize commands from users and can turn the car left, right, and

stop with great accuracy. It can be further improved by using different sensors like ultrasonic or infrared and with various levels of coding.

Our Bluetooth control car has a range of 10-20 meter with the mobile Bluetooth controlling system. The range mostly depends on the receivers transmission level.

In the future, we could use rechargeable batteries like Ni-Cd Battery or Li-ion batteries that could avoid the present disadvantage. Also, we could make use of this RC Motor Car as a surveillance system or rovers by adding a few more sensors and updating the code. This would make them into robots. These robots could self-monitor under any human supervision, thereby reducing manpower. These are just the alternatives, on which this project could be improvised and updated.

IoT or the internet of things is a very important part of both computers and our daily lives. The above model describes how the Arduino programs the car motor module and by IoT, we rotate the wheels and give direction to the car. IoT allows us to work with different platforms and it helps us to create various interesting modules to work on.

With the ever-increasing problems, our knowledge has to expand to adapt better to the changes all around us. In the same way, it is hoped that this activity is a small step that would lead us to further enhancements and goals.

7.2 Future Scope

What the Arduino platform has done is to take what was once a fragmented and expensive market for robotics and microprocessors and become the major platform, largely by virtue of much lower cost and ease of use, leading to higher volume and popularity, and community support behind it. Arduino has made it simple to program their boards with any computer via USB and simple to integrate with a wide array of sensors and devices. The Arduino is great for hobbyists, prototypes, and people just starting out in robotics because of its low cost, ease of use, and large following online. It's easy to learn and teach people to be able to do basic things with the Arduino, yet it's capable enough to do fairly sophisticated things if you as a developer have the capability to take advantage of it. It's allowing people to develop projects inexpensively to build and control their own devices, such as sensors that send data to the Internet and control systems for all kinds of things. It's also reducing the cost of development by allowing companies to develop prototypes much more quickly and with less initial investment.

The Future Prospects are as follows:

- Mobile application of this project can be brought on other mobile operating system like iOS & windows phone.
- Using of Wi-Fi direct/cellular network instead of bluetooth module, so that the range of the arduino car be increased to larger scale.
- Application the project concept of guiding through mobile device to quadcopter, so that we can cover the aerial view of the surrounding.
- With the help of DIP we can install a camera on the car which will provide us the view of camera on the mobile device.
- Due to time & resource constraints these ideas where not brought to light in the project
- With the ever increasing problems, our knowledge has to expand to adapt better to the changes all around us. In the same way it is hoped that this activity is a small step that would lead us to further enhancements and goals

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