CERTIFICATE OF APPROVAL

The foregoing is hereby approved as a creditable study of an Engineering study and presented in a manner satisfactory to warrant acceptance as pre requisite to the degree for which it has been submitted. It is understood that the undersigned do not necessary endorse or approve any statement made, opinion expressed or conclusion drawn there in but approve the project report only for which it is submitted.

Board of examiner: _____

ACKNOWLEDGEMENT

We take this opportunity to express our thanks to our project guide MS. Debarchita Mishra Assistant Professor of Department of Electrical Engineering for her invaluable help, guidance and active supervision, judicial criticism and constant encouragement and support without which it would not have been possible for us to give the project report in this shape.

Special thanks are reserved for Prof. (Dr.) Milan Basu Head of the Department, Electrical Engineering for his generous help.

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Abstract

A remote control vehicle is defined as any mobile device that is controlled by a means that does not restrict its motion with an origin external to the device. This is often a radio control device, cable between control and vehicle or an infrared or Bluetooth controller. A remote control vehicle(Also known as RCV) is always controlled by a human and takes no positive action autonomously. It is vital that a vehicle should be capable of proceeding accurately to a target area; maneuvering within that area to fulfill its mission and returning equally accurately and safely to base.

In this project we are using Bluetooth wireless technology to control our robot car which is a very simple communication system. The remote in this project is an android device which has Bluetooth feature built in. The user has to install an application on his/her mobile and turn on the Bluetooth in the mobile phone. User can perform various actions like moving Forward, Backward, move Left and move right using commands that are sent from the android mobile. The Bluetooth is a serial communication medium through which we can connect two devices wirelessly. Here we have used a Bluetooth module in our robot car which gets connected to the phone's Bluetooth, that allows us to communicate and allows to take command over it. The task of controlling the car is done by the Arduino UNO which houses the micro-controller ATMEGA32. Arduino has played a major role in the robotic section and has made it easier to convert digital and analog signal to physical movements. The project is Bluetooth based because it gives us wider range of control and more efficiency. It also gives us the advantage of changing the remote anytime, meaning that we can use any android devices including phones, tablets, computers. Physical barriers like walls, doors, etc. do not effect in controlling the car.

Bluetooth Technology

Bluetooth wireless technology is a short-range radio technology, which is developed for Personal Area Network (PAN). Bluetooth is a standard developed by a group of electronics manufacturers that allows any sort of electronic equipment, from computers and cell phones to keyboards and headphones, to make its own connections, without wires, cables or any direct action from a user. It is an ad hoc type network operable over a small area such as a room. Bluetooth wireless technology makes it possible to transmit signals over short distances between telephones, computers and other devices and thereby simplify communication and synchronization between devices. It is a global standard that eliminates wires and cables between both stationary and mobile devices and facilitates both data and voice communication. Bluetooth offers the possibility of ad hoc networks and delivers the ultimate synchronicity between all your personal devices. Bluetooth is a dynamic standard where devices can automatically find each other, establish connections, and discover what they can do for each other on an ad hoc basis.

Bluetooth is intended to be a standard that works at two levels:

1) It provides agreement at the physical level - Bluetooth is a radio-frequency standard.

2) It also provides agreement at the next level up, where products have to agree on when bits are sent, how many will be sent at a time and how the parties in a conversation can be sure that the message received is the same as the message sent.

It is conceived initially by Ericsson, before being adopted by a myriad of other companies, Bluetooth is a standard for a small, cheap radio chip to be plugged into computers, printers, mobile phones, etc. A Bluetooth chip is designed to replace cables by taking the information normally carried by the cable, and transmitting it at a special frequency to a receiver Bluetooth chip, which will then give the information received to the computer, phone whatever.

Bluetooth topologies:

Bluetooth networks (commonly referred to as Piconets) use a master/slave model to control when and where devices can send data. In this model, a single master device can be connected to up to seven different slave devices as shown in Fig. 1. Any slave device in the Piconet can only be connected to a single master.

The master coordinates communication throughout the Piconet. It can send data to any of its slaves and request data from them as well. Slaves are only allowed to transmit to and receive from their master. They can't talk to other slaves in the Piconet.

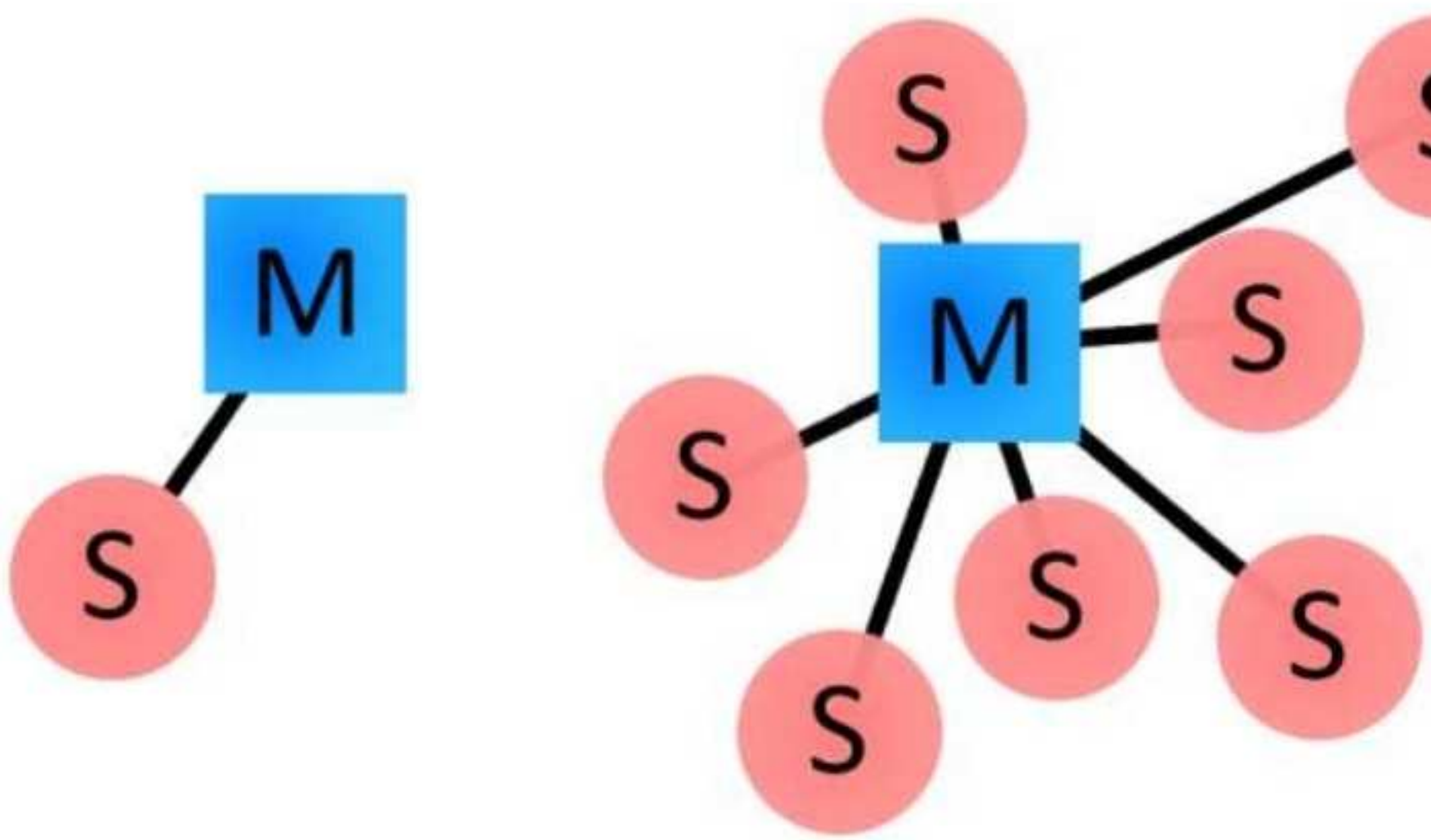


Fig.1.Examples of Bluetooth master/slave Piconet topologies

Analysis

The working of our remote controlled vehicle can be understood easily by observing the block diagram shown below:

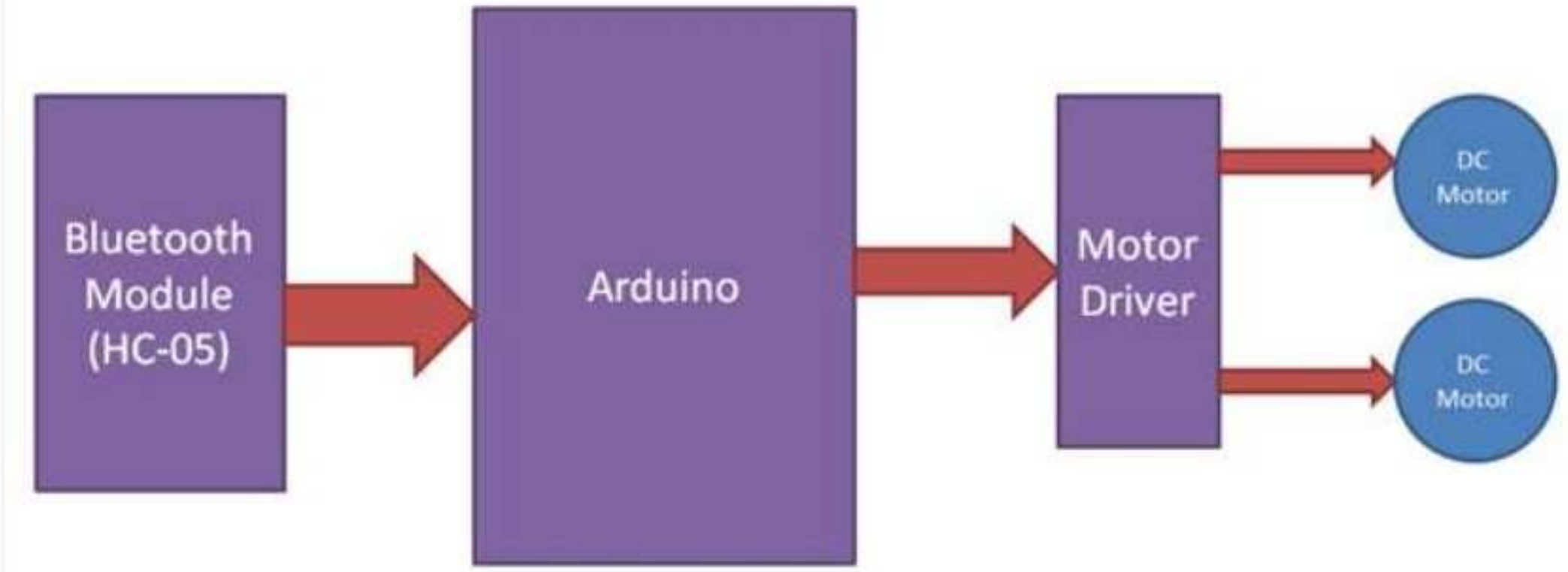


Fig.2. Block diagram of Bluetooth controlled robot car.

Here, the whole system is divided into four principal blocks viz Bluetooth block, microcontroller block, and the motor driver block.

The Bluetooth block comprises of the Bluetooth module present in the mobile phone used along with the Bluetooth module used in our robot car. The mobile phone consists of an application that provides us an interface to send ASCII characters via Bluetooth which is then received by the Bluetooth module on the robot car.

The microcontroller then receives the data from the Bluetooth module and then manipulates the data received into series of digital outputs which run the motor driver section. The data rate of communication is set to 9600 bauds per second. Two BO motors which run at 60 RPM are used.

Design

Hardware: The hardware portion consists of the following principle parts:

1)**Arduino UNO**: Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino consists of both a physical programmable circuit board and a piece of software, or IDE (Integrated Development Environment) that runs on user's computer, used to write and upload computer code to the physical board.

The Arduino Uno microcontroller board(Fig.3) is based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. It can be powered by simply connecting to a computer with a USB cable or with a AC-to-DC adapter or battery to get started.

We have used Arduino because it is an open source device which can be programmed through any operating system like Windows, Mac, Linux, etc. The language used is understandable and easy. Changing of program is also very easy. Various shields and modules that are easily connected to Arduino are available for various purpose like, if we want to connect the Arduino to a network then a Wi-Fi shield is available. For controlling the motor a motor shield is available, and for this project a Bluetooth module is used.

2)**HC 05**: HC-05 module(Fig.4) is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

HARDWARE COMPONENTS

Fig.3. Arduino Uno

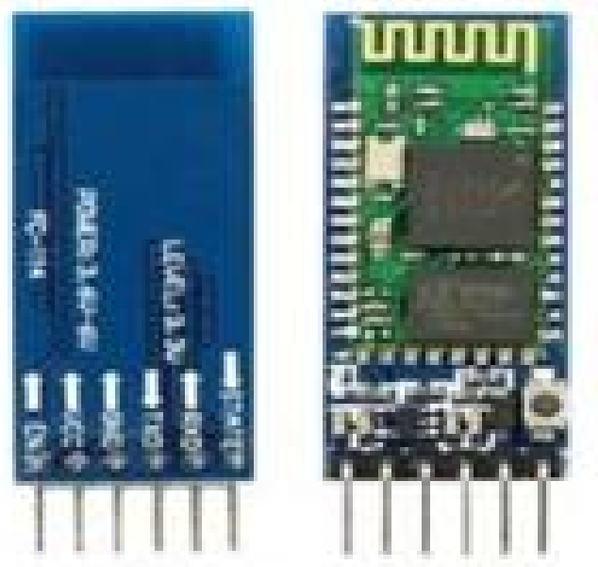


Fig.4. HC05 Bluetooth module

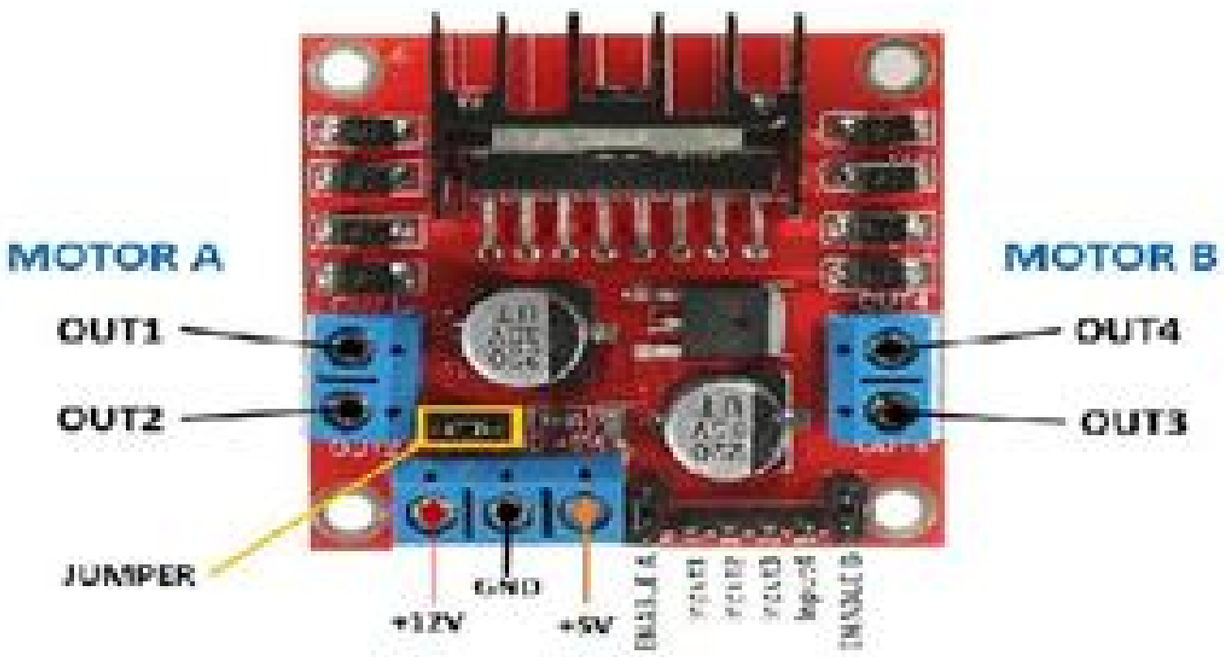


Fig.5 L298N Motor driver IC

Fig.6 BO motor 60 RPM

The HC-05 Bluetooth Module has 6 pins. They are as follows:

1)Enable: When enable is pulled low, the module is disabled which means the module will not turn on and it fails to communicate.

2) Vcc: Supply Voltage 3.3V to 5V

3) GND**:** Ground pin

4) Txd & Rxd: These two pins acts as an UART interface for communication

5) State: It acts as a status indicator. When the module is not connected to / paired with any other Bluetooth device, signal goes Low. At this low state, the led flashes continuously which denotes that the module is not paired with other device. When this module is connected to/paired with any other Bluetooth device, the signal goes High. At this high state, the led blinks with a constant delay say for example 2s delay which indicates that the module is paired.

6) Button Switch: This is used to switch the module into AT command mode. To enable AT command mode, press the button switch for a second. With the help of AT commands, the user can change the parameters of this module but only when the module is not paired with any other BT device. If the module is connected to any other Bluetooth device, it starts to communicate with that device and fails to work in AT command mode.

3)**L293D motor driver:** L293D is a typical Motor driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motors with a single L293D IC.

In a single L293D chip there are two H-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller.

There are two Enable pins on l293d. Pin 1 and pin 9. For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch. Pin no 2, 7, 9 and 11 are used as logic inputs and 4, 5, 12 and 13 are ground.

4) **Motors:**

the motors used are geared L-shaped battery operated dc motors. Gears reduce the speed of the vehicle but increase its torque. This is known as gear reduction. Gear Ratio of motors used is 150:1 and run at 60RPM. The setup assembly helps in increasing the torque and reducing the motor speed.

Software:

Motor driver Logic: The motor driver IC used to control the motors is given the following logic inputs through arduino board:

µC Output	L293D input	Forward	Reverse	Left	Right	Axis1	Axis2
12	2	LOW	HIGH	LOW	LOW	HIGH	LOW
11	7	HIGH	LOW	LOW	HIGH	LOW	HIGH
9	15	LOW	HIGH	LOW	LOW	LOW	HIGH
10	10	HIGH	LOW	HIGH	LOW	HIGH	LOW

Table.1

IDE: The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Verify:

Checks your code for errors compiling it.

Upload:

Compiles your code and uploads it to the configured board.

New:

Creates a new sketch.

Open:

Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.

Save:

Saves your sketch.

Serial Monitor:

Opens the serial monitor.

Additional commands are found within the five menus: File, Edit, Sketch, Tools, Help. The menus are context sensitive, which means only those items relevant to the work currently being carried out are available.

Mobile app: Here we have used Arduino Bluetooth controller application(Fig.7). It provides a Nintendo joystick style interface which is highly convenient for controlling robot cars

and similar projects that utilize Bluetooth as their communication Technology. The buttons can be assigned ASCII Characters that can be sent with the button pressed.

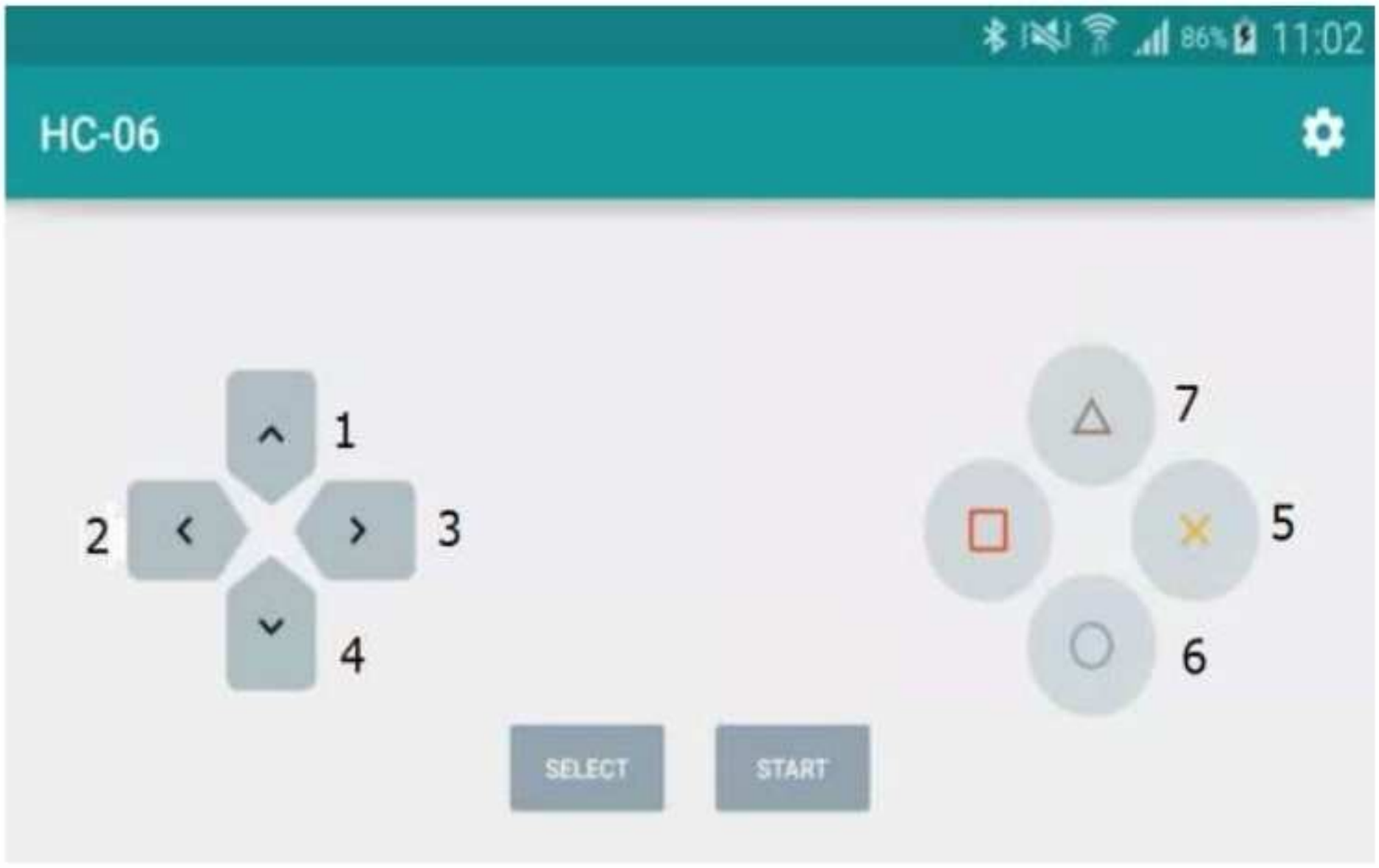


Fig.7. User interface of Bluetooth remote controller application

In the figure shown above, the values assigned to the different buttons on the joystick interface are shown. When a button is pressed the respective ASCII character assigned to the button is sent by the mobile phone via Bluetooth.

Arduino sketch:

We have used hardware serial in this project in order to set up communication between the Bluetooth module and Arduino board. The ASCII characters received by the Bluetooth module are fed to the Arduino board using Serial communication. In the sketch the received data can be used with the help of Serial.read() function. Data received from Serial.read() is assigned to a variable which is then used to be compared with different values in series of if loops. The if loops then call different functions that are used to drive the vehicle Forward, Backward, Left or Right. the following is the flow chart of our arduino sketch.

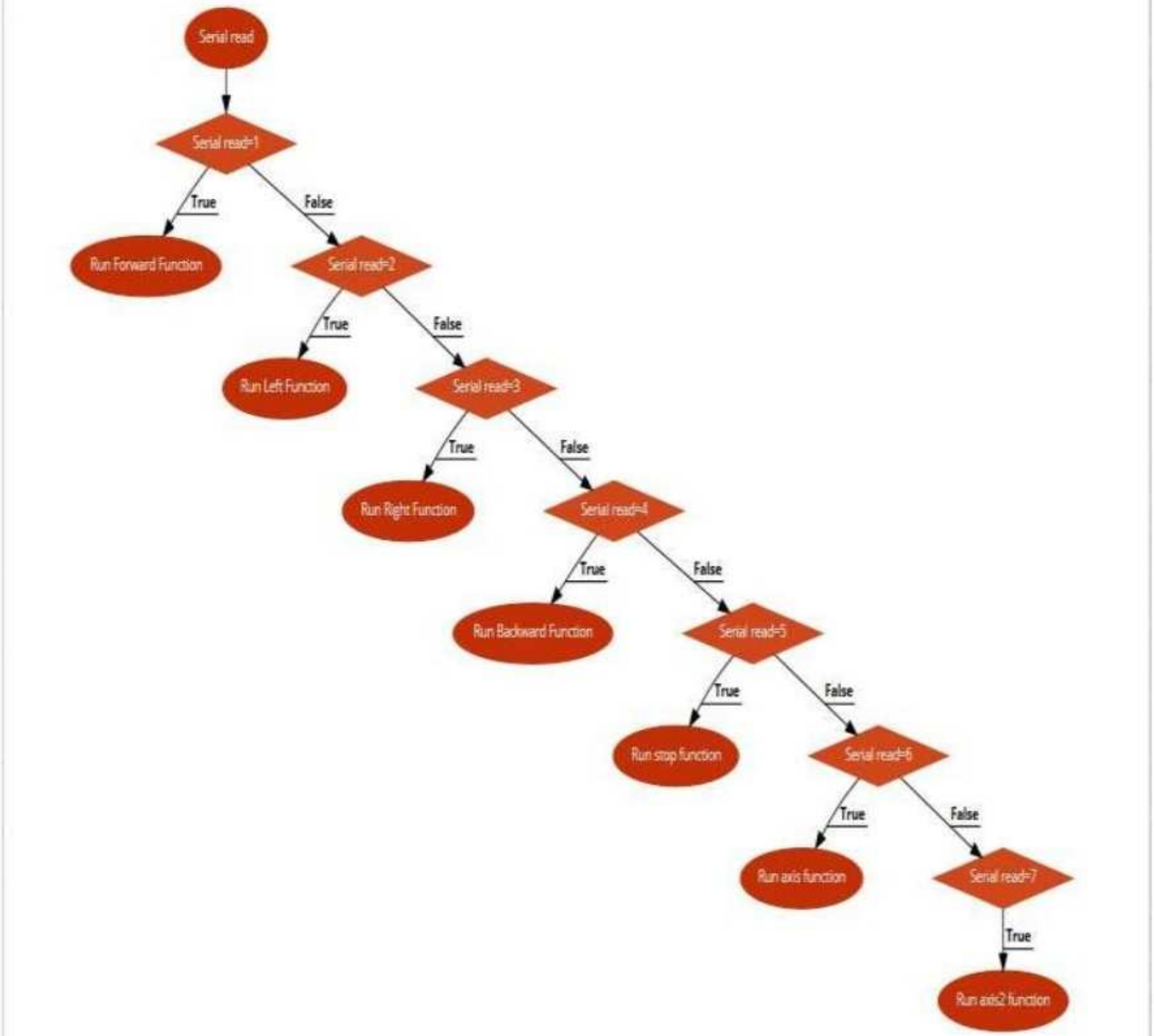


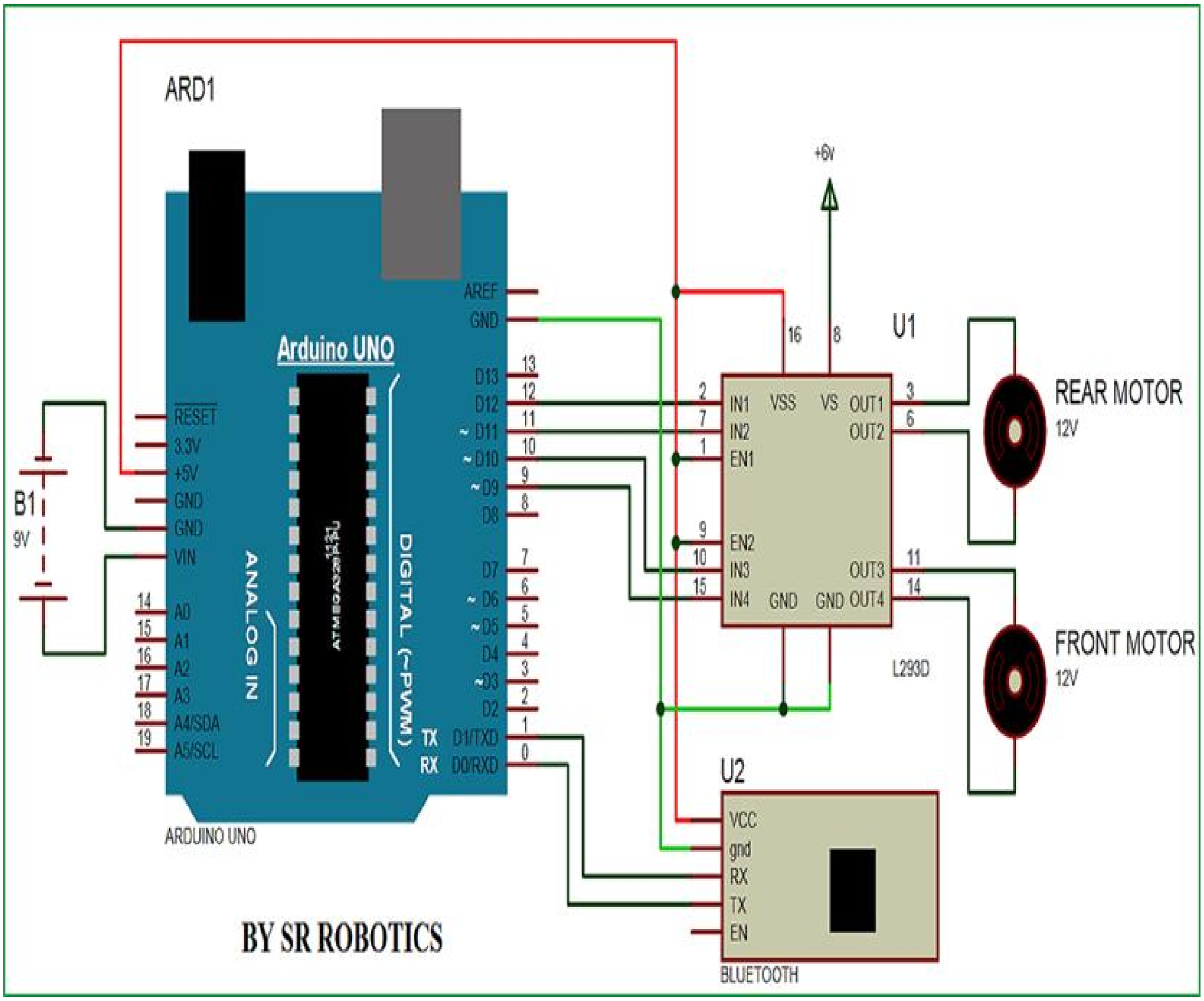
Fig.8. Sketch Flowchart

Implementation:

The project is implemented on beadboard and the breadboard itself is used as the chassis for the robot car as shown in Fig.11. The Bluetooth module HC05 is connected to the Arduino board through simple single strand wires. The transmission pin of the Bluetooth module is connected to the receiver pin of Arduino and the receiver pin of the Bluetooth module is connected to the transmission pin of the Arduino. The Digital output pins 9, 10, 11 and 12 of Arduino board are connected to the pins 4, 10, 7 and 2 of the L298N motor driver IC respectively.

Two rechargeable batteries as supply is used which is connected to motor driver and Arduino respectively. When the circuit is energized, we will have to first pair the android phone with the Bluetooth module through the phones Bluetooth setting. The default password of the Bluetooth module will be 1234. Once the phone gets paired open the application 'Bluetooth Remote Controller" which we can downloaded from Google play store. After connecting the mobile to HC05, four options will appear on the application-Controller mode, Switch mode, Dimmer mode and Terminal mode. We have to select the Controller mode from it. The controller mode will provide us a joystick interface. We will send ASCII values from the application to the Bluetooth module. As the user presses any control buttons, the controller will run programs move forward, backward, right, left, depending on the data sent by the mobile and the car moves likewise. The Arduino also stores the program in its memory so it does not require re uploading of Program. The IN1, IN2, IN3 and IN4 are the inputs for the motor driver that receives command from the Arduino for the two motors respectively. The motor driver should be grounded with the Arduino ground pin(GND). The motor driver requires minimum of 6v and above to run, any voltage below 6v the motor remains off.The RXD pin of the Bluetooth module is for receiving commands from the Android devices and sends to Arduino through this pin and the TXD is for transmitting or sending datesor information‘s It is supplied with a 5v dc source from the arduino 5v pin. The main part of the above circuit diagram is arduino UNO. The power supply section is very Important. It should provide constant voltage to the devices for successful working of the project.

CIRCUIT DIAGRAM



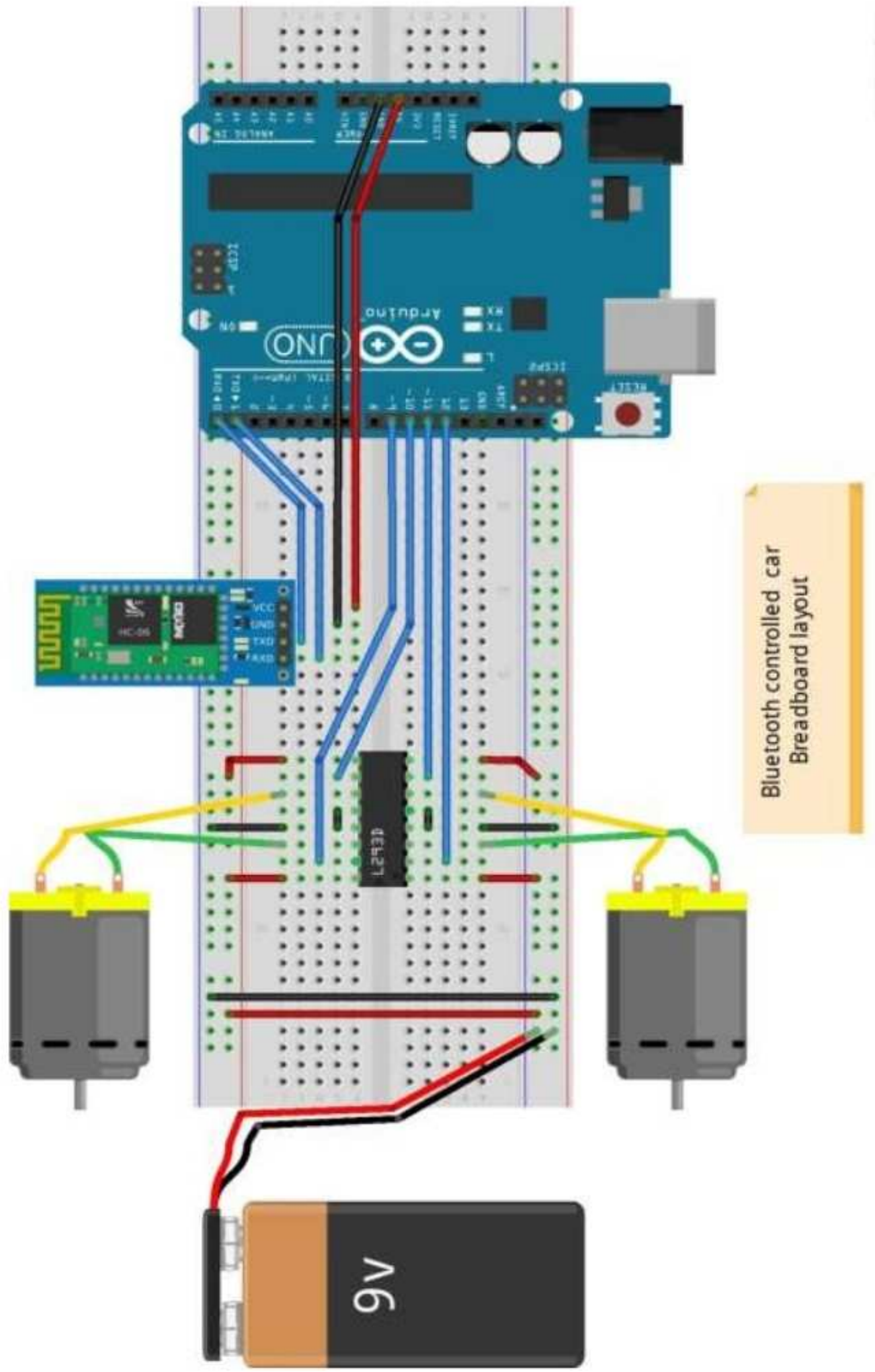


Fig.11 Breadboard layout of Bluetooth controlled robot car

FUTURE SCOPE IN INDIA

The knowledge is ever expanding and so are the problems which the mankind strive to solve. In this spirit, it is hoped that the current activity will lead to further enhancements. For example: work on future for military purpose by the robot. After having implemented this Intelligent System, what remains the scope for improvements. Firstly, we could directly go for Wireless Power Transmission which would further reduce the maintenance costs and power thefts of the system, as cable breaking is one of the problems faced today In addition to this, controlling the Traffic Signal lights would be another feature that we could look into after successful implementation of our system. Depending on the amount of traffic in a particular direction, necessary controlling actions could be taken. Also emergency vehicles and VIP convoys can be passed efficiently.

The world is quickly adopting to electric vehicles and in the next couple of decades, EVs are going to be more mainstream than internal combustion vehicles. More automotive manufacturers are now devoting a rather large chunk of their resources towards the research and development of electric vehicles. This begs a question though! Where does India fit in the overall scheme of electric vehicles globally? The government of India had a plan of converting the entire fleet of vehicles to fully electric by 2030, which is barely 12 years away. But in January, 2018, it was sort of scrapped. If this actually happens, then India will be one of the largest markets for electric vehicles in the world, possibly only behind China.

EXPERIMENTS IN KOLKATA

The government of WEST BENGAL is currently running three such buses in New Town; with an aim to curb pollution and promote a ‘green city’ mission, the West Bengal Housing Infrastructure Development Corporation Limited (WBHIDCO) launched three electric buses through a collaboration with Coal India on May 1 2018.

Electric buses are no longer unique to New Town, though. The state government has also launched similar buses in the city. On February 20 2019, the West Bengal Transport Corporation (WBTC) rolled out 40 buses phase-wise to re-shape the urban mobility scene. The new 31-seater electric buses, bought under the FAME I scheme and operated/managed by the Corporation itself, run on 11 routes in the city.

WEST BENGAL TRANSPORT CORPORATION
Paribahan Bhaban
12, R.N. Mukharjee Road, Kolkata : 700 001.
Phone : 2213-1212-15, FAX – 2262-8277
E-mail : cstc.traffic@gmail.com

Details of Electric Bus Operation

Sl. No.	Route No.	Origin - Destination	No. of Bus
1	EB - 1	Nabanna - Rathtala	10
2	V - 1	Kundghat - Airport	5
3	AC - 31	Janakalyan - Jadavpur	1
4	AC – 4B	Joka - New Town	5
5	AC – 24	Patuli - Howrah	5
6	AC – 12D	Thakurpukur - Howrah	3
7	AC – 34	Ariadaha - Howrah	2
8	AC – 54	Rathtala - Howrah	5
9	AC – 15	Howrah - Bantala IT Park	1
10	AC – 48	Kundghat - Bantala IT Park	1
11	AC-16	Janakalyan - Tollygunge Metro Stn.	2
		TOTAL :	**40**

27-06-2019

SOURCE CODE

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

Conclusion

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.

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