A Mini Project Report

On

WIRELESS CAR WITH OBSTRACLE DETECTION

Submitted for partial fulfillment of the requirements for the award of the degree

Of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

BY

Mr. K. PREETHAM GANESH (15641A0496)

Ms. V. NAGASRI (15641A0472)

Ms. D. DEEPTHI (15641A0497)

Mr. K. PRADEEP (15641A0494)

Under the Guidance of

Mr. V. MANOHAR

Assistant professor

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VAAGDEVI COLLEGE OF ENGINEERING

(Autonomous, Affiliated to JNTUH, Accredited By NBA)

BOLLIKUNTA, WARANGAL - 506 005

2015-2019

VAAGDEVI COLLEGE OF ENGINEERING

(Autonomous, Affiliated to JNTUH, Accredited By NBA)

BOLLIKUNTA, WARANGAL - 506 005

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

This is to certify that the project work entitled "**WIRELESS CAR WITH OBSTRACLE DETECTION"** is a bonafide work carried out by **Mr. K. PREETHAM GANESH (15641A0496), Ms. V. NAGASRI (15641A0472), Ms. D. DEEPTHI (15641A0497), Mr. K. PRADEEP (15641A0494)** in partial fulfillment of the requirements for the award of degree of **Bachelor of Technology** in ***Electronics and Communication Engineering*** from Vaagdevi College of Engineering, (Autonomous) during the academic year 2018-2019.

Mr. V. Manohar
Assistant professor
Project guide

Mr. M. Shashidhar
Head of the Department

DECLARATION

We declare that the work reported in the project entitled "**WIRELESS CAR WITH OBSTACLE DETECTION"** is a record of work done by us in the partial fulfillment for the award of the degree of **Bachelor of Technology** in **Electronics & Communication Engineering, VAAGDEVI COLLEGE OF ENGINEERING (Autonomous),** Affiliated to JNTUH, Accredited By NBA, under the guidance of **Mr.V. MANOHAR,** Asst.Prof., We hereby declare that this project work bears no resemblance to any other project submitted at Vaagdevi College of Engineering or any other university/college for the award of the degree.

Mr. K. PREETHAM GANESH (15641A0496)

Ms. V. NAGASRI (15641A0472)

Ms. D. DEEPTHI (15641A0497)

Mr. K. PRADEEP (15641A0494)

ACKNOWLEDGEMENT

The development of the project though it was an arduous task, it has been made by the help of many people. We are pleased to express our thanks to the people whose suggestions, comments, criticisms greatly encouraged us in betterment of the project.

We would like to express my sincere gratitude and indebtedness to my project Guide **Mr.V.Manohar,** Asst.Prof.**,** for his valuable suggestions and interest throughout the course of this project.

We are also thankful to Head of the Department **Mr. M.Shashidhar**, **Associate Professor** for providing excellent infrastructure and a nice atmosphere for completing this project successfully.

We would like to express my sincere thanks and profound gratitude to **Dr. K. Prakash**, principal of **Vaagdevi College of Engineering,** for his support, guidance and encouragement in the course of our project.

We are also thankful to **Project Coordinators,** for their valuable suggestions, encouragement and motivations for completing this project successfully.

We are thankful to all other faculty members for their encouragement

We convey our heartfelt thanks to the lab staff for allowing me to use the required equipment whenever needed.

Finally, we would like to take this opportunity to thank my family for their support through the work. We sincerely acknowledge and thank all those who gave directly or indirectly their support in completion of this work

Mr. K. PREETHAM GANESH (15641A0496)

Ms. V. NAGASRI (15641A0472)

Ms. D. DEEPTHI (15641A0497)

Mr. K. PRADEEP (15641A0494)

LIST OF FIGURES

ABSTRACT

In this project, we will be working on how the Arduino robot car can be controlled using HC-05 Bluetooth module. HC-05 module is an easy to use Bluetooth module (serial port protocol) module, designed for transparent wireless serial connections setup. The HC-05 bluetooth module can be used in master or slave configuration making it a great solution for wireless communication. The role of this module can be configured by only AT commands.

Arduino board which is an open source computer hardware. Arduino plays a vital role in this project.Arduino is connected to L298N motor driver shield which is used to control two motors of up to 2A each in both directions. L298N is ideal for robotic applications and well suited for connections to a microcontroller requiring just a couple lines per motors.

SR-04 is a widely used ultrasonic sensor in miniature projects. We embedded it to Arduino for detection of obstacles in its path. So, that our RC-Car can overcome collisions with the obstacles on its way. A buzzer is placed above the car which can help us with the output (i.e., beep sound) when there is an obstruction in the path.

TABLE OF CONTENTS

CHAPTER 1

Introduction

Smart phones are becoming a basic need in day to day life with massive storage capacities, fortified processors, ample divertissement functions and vast communicating methodologies. Bluetooth is mainly used for exchanging data between different devices be it two smart phones or be it a robot and a smart phone. It mainly performs data transmission and even improve the characteristics of the smart phone, it was developed by telecom vendor Ericsson in 1994, shows its merits by incorporation with smart phones. It has changed the medium of how people uses digital devices at home or offices and has brought wireless devices in existence.

The basic element of a Bluetooth is piconet, which is a collection several slave devices operating together with one master. Maximum of seven slaves can share a common master through a same link. Even several piconet can link together and form scatternet. It is useful in home environments, looking at its range or normal working area be 8 meters. Bluetooth has gradually increased users to prosecute smart phones, which have gingerly turned into a multipurpose portable device and are accessible to people

1.1 ARDUINO UNO BOARD:

UNO is a microcontroller based on ATmega328P. It has 14 digital input-output pins; 6 pins are for PWM outputs, 6 pins act as analog input pins. 16 MHz crystal USB connector power jack is attached, consist of LCSP header and reset button. UNO contains everything needed to support any normal microcontroller (µC). In UNO connections can be established by connecting Arduino to personal computer with a USB cable, power with AC to DC adapter can be provided or battery to get started. Arduino is a firm which design hardware, µC based kits for building digital devices and interactive objects that can percept and control physical devices. It establish a serial communication interface for loading programs from PC through USB.

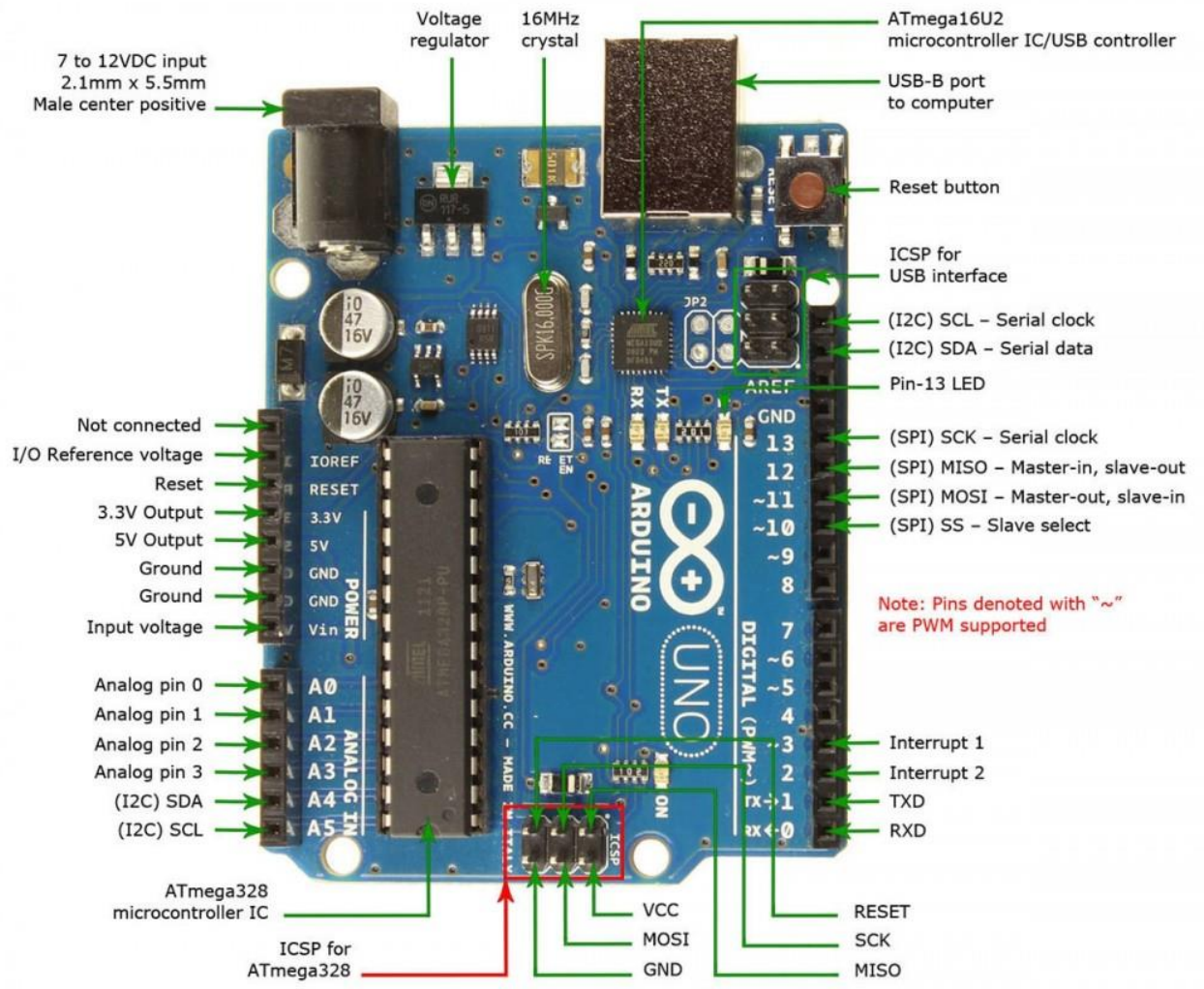

Fig 1: ARDUINO UNO BOARD

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USBto-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means "One" in Italian and is named to mark the upcoming release of Arduino 1.0.

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX).

An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the
board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A SoftwareSerial library allows serial communication on any of the Uno's digital pins.

Rather than requiring a physical press of the reset button before an upload, the Arduino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip.

This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.

Techinal Specifications:

➢ Microcontroller ATmega328
➢ Operating Voltage 5V
➢ Supply Voltage (recommended) 7-12V
➢ Maximum supply voltage (not recommended) 20V
➢ Digital I/O Pins 14 (of which 6 provide PWM output)
➢ Analog Input Pins 6
➢ DC Current per I/O Pin 40 mA
➢ DC Current for 3.3V Pin 50 mA
➢ Flash Memory 32 KB (ATmega328) of which 0.5 KB used by bootloader
➢ SRAM 2 KB (ATmega328)
➢ EEPROM 1 KB (ATmega328)
➢ Clock Speed 16 MH

Android Platform

Android is a mobile operating system developed by Google based on Linus Kernel and is mostly wield with touch screen smart phones .Android platform is reliable for building an android application, android is a common choice of people while they buy any cell phone. Android provides easy accessibility and understandability of different aspects for daily use. They are widely known as mobile computers and are expanding the sale of smartphones worldwide. They are widely accepted as they provide open architecture, platform independent and enormous capabilities. It is built from JAVA programming language and as android uses JAVA, android API provide easy access for hardware components. Android may use USB, Wi-Fi and Bluetooth for connecting with the robot.

Android Studio:

For building an android app android studio is looked for, android studio is an Integrated Development Environment (IDE) for android app development. The first stable build was released in December 2014, starting from version 1.0, based on JetBrains IntelliJ IDEA software, Android Studio is designed specifically for Android app development. It can be downloaded at Windows, Mac and Linux smoothly, and replaced Eclipse Android Development Tools (ADT) which is Google's primary IDE for indigene application development. It has Gradle based build support, Lint tools to catch performance and version compatibility. Android studio is a well-to-do layout editor which allows users to drag-and-drop UI components, and even provide user with option to preview layouts on multiple screens.

1.2 HC-05 BLUETOOTH MODULE:

This is used for establishing Bluetooth connectivity, it is easy to use Bluetooth SPP (special pot protocol) module. It setup a transparent wireless serial connection. HC-05 is a fully qualified Bluetooth supporting V2.0+EDR(enhanced data rate), 3Mbps modulation, 2.4 GHz baseband and use CSR Bluecore 04- External single chip Bluetooth system. Its footprint is very small limiting up to 12.7 mm X 27 mm, its default baud rate is 38400. It underpin master and slave concept, and if the master and slave are paired then red and blue LEDs on the module blinks at 1 time per 2 seconds in interval and if disconnected blue LED blinks for 2 times per second. Its auto pairing pin code is "0000" as default and it automatically reconnect in 30 min when disconnected because of exciding the range of connection.

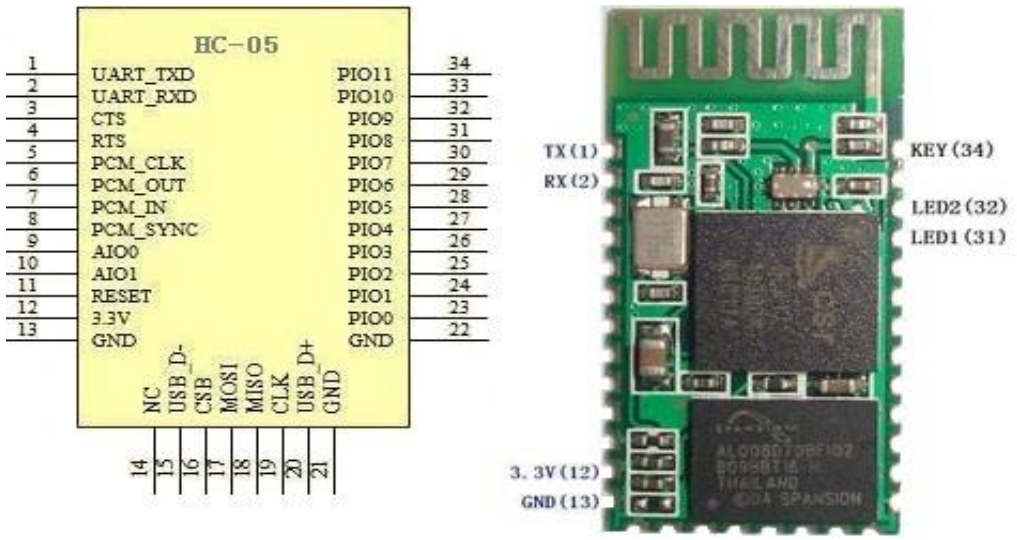

Fig 2: Pin diagram of Bluetooth module

HC-05 Specifications:

- Bluetooth protocol: Bluetooth Specification v2.0+EDR
- Frequency: 2.4GHz ISM band
- Modulation: GFSK(Gaussian Frequency Shift Keying)
- Sensitivity: ≤-84dBm at 0.1% BER
- Speed: Asynchronous: 2.1Mbps(Max) / 160 kbps, Synchronous: 1Mbps/1Mbps
- Security: Authentication and encryption

- Profiles: Bluetooth serial port
- Power supply: +3.3VDC 50mA
- Working temperature: -20 ~ +75Centigrade
- Dimension: 26.9mm x 13mm x 2.2 mm

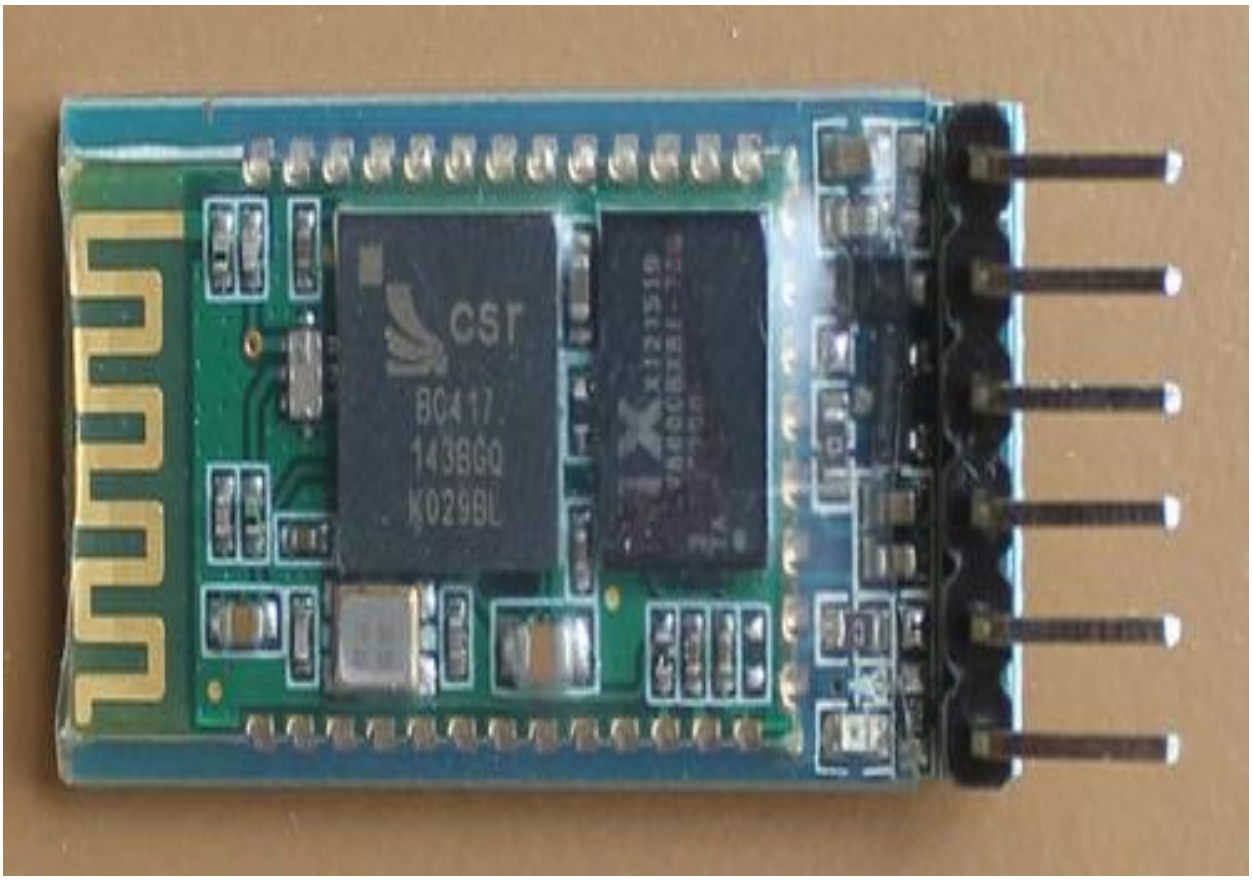

Fig 3: HC- 05 Bluetooth Module

1.3 Ultrasonic Sensor HC-SR04:

This sensor is attached to detect the distance of the obstacle from the robot. It uses sonar to govern distance of an object. It inaugurate non-contact range detection, and provide stable reading in an easy to use package. Its range varies from 2 cm to 400 cm or 1'' to 13 feet. Sensor is not affected by sunlight or black material but it is difficult to detect the distance from any soft material like cloth. It is a combination of both ultrasonic transmitter and receiver module. Its output is greatly perturbed by Echo signal, so the output never goes Low if Echo is not received. Even timeout parameters are needed to alter the output according to the user aspirations. Its resolution is 0.3 cm and trigger input pulse width is 10 μS.

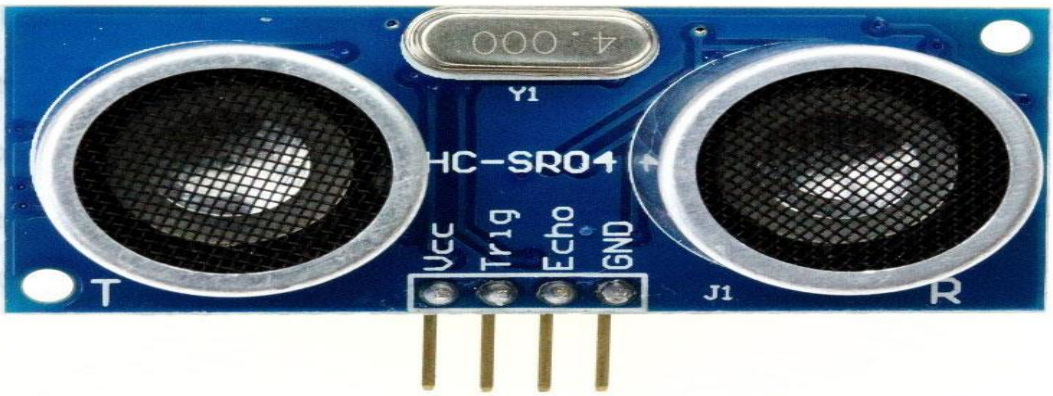

Fig 4 :Ultrasonic sensor HC-SR04

1.4. L298 MOTOR DRIVER:

This dual bidirectional motor driver is based on the very popular L298 Dual H-Bridge Motor Driver IC. This module will allow you to easily and independently control two motors of up to 2A each in both directions.It is ideal for robotic applications and well suited for connection to a microcontroller requiring just a couple of control lines per motor.

The L298 is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

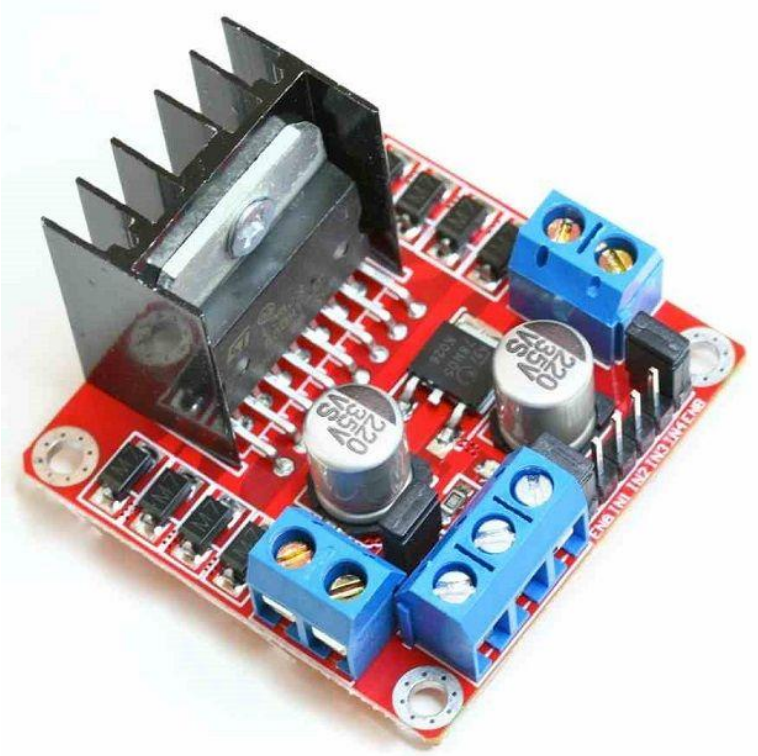

Fig 5 :L298 Motor Driver

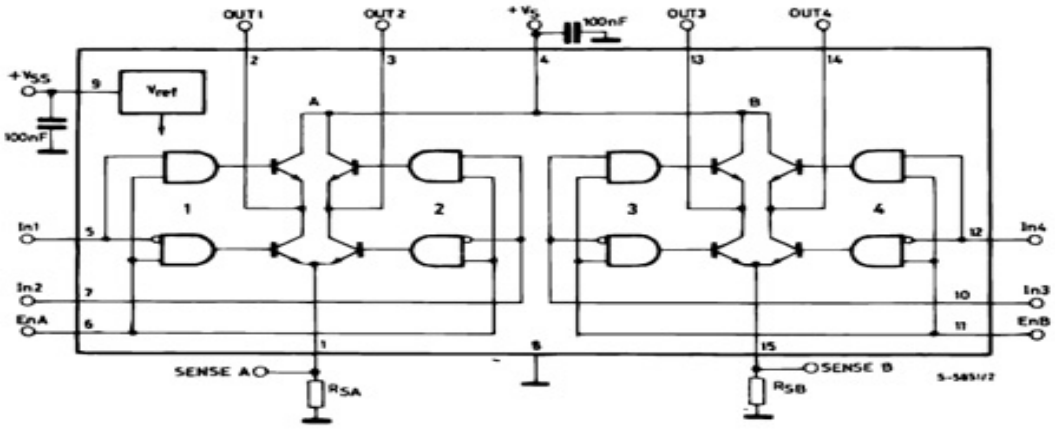

Fig 6: Circuit Diagram of Motor Driver

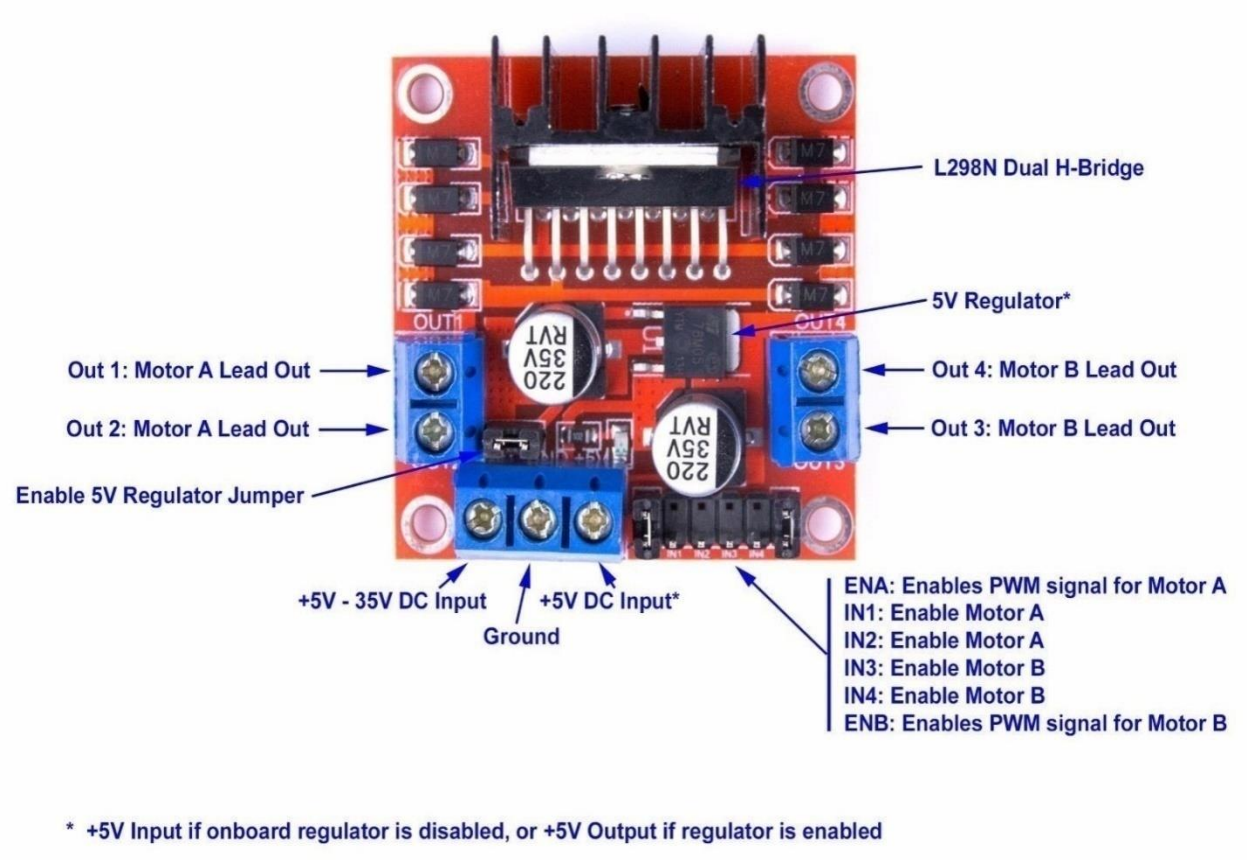

Fig 7: Pin description of L298 Motor Driver

POWER OUTPUT STAGE

The L298 integrates two power output stages (A ; B).The power output stage is a bridge configurationand its outputs can drive an inductive load in common or differenzial mode, depending on the state ofthe inputs. The current that flows through the loadcomes out from the bridge at the sense output : anexternal resistor (RSA; RSB.) allows to detect the in-tensity of this current.

INPUT STAGE

Each bridge is driven by means of four gates the in-put of which are In1 ; In2 ; EnA and In3 ; In4 ; EnB.The In inputs set the bridge state when The En inputis high ; a low state of the En input inhibits the bridge.All the inputs are TTL compatible.

SUGGESTIONS

A non inductive capacitor, usually of 100 nF, must be foreseen between both Vs and Vss, to ground,as near as possible to GND pin. When the large ca-pacitor of the power supply is too far from the IC, a
second smaller one must be foreseen near theL298.The sense resistor, not of a wire wound type, mustbe grounded near the negative pole of Vs that mustbe near the GND pin of the I.CEach input must be connected to the source of thedriving signals by means of a very short path.Turn-On and Turn-Off : Before to Turn-ON the Sup-ply Voltage and before to Turn it OFF, the Enable in-put must be driven to the Low state.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Power Supply	50	V
V_{SS}	Logic Supply Voltage	7	V
V_I, V_{en}	Input and Enable Voltage	–0.3 to 7	V
I_O	Peak Output Current (each Channel) – Non Repetitive (t = 100µs) –Repetitive (80% on –20% off; t_{on} = 10ms) –DC Operation	 3 2.5 2	 A A A
V_{sens}	Sensing Voltage	–1 to 2.3	V
P_{tot}	Total Power Dissipation (T_{case} = 75°C)	25	W
T_{op}	Junction Operating Temperature	–25 to 130	°C
T_{stg}, T_j	Storage and Junction Temperature	–40 to 150	°C

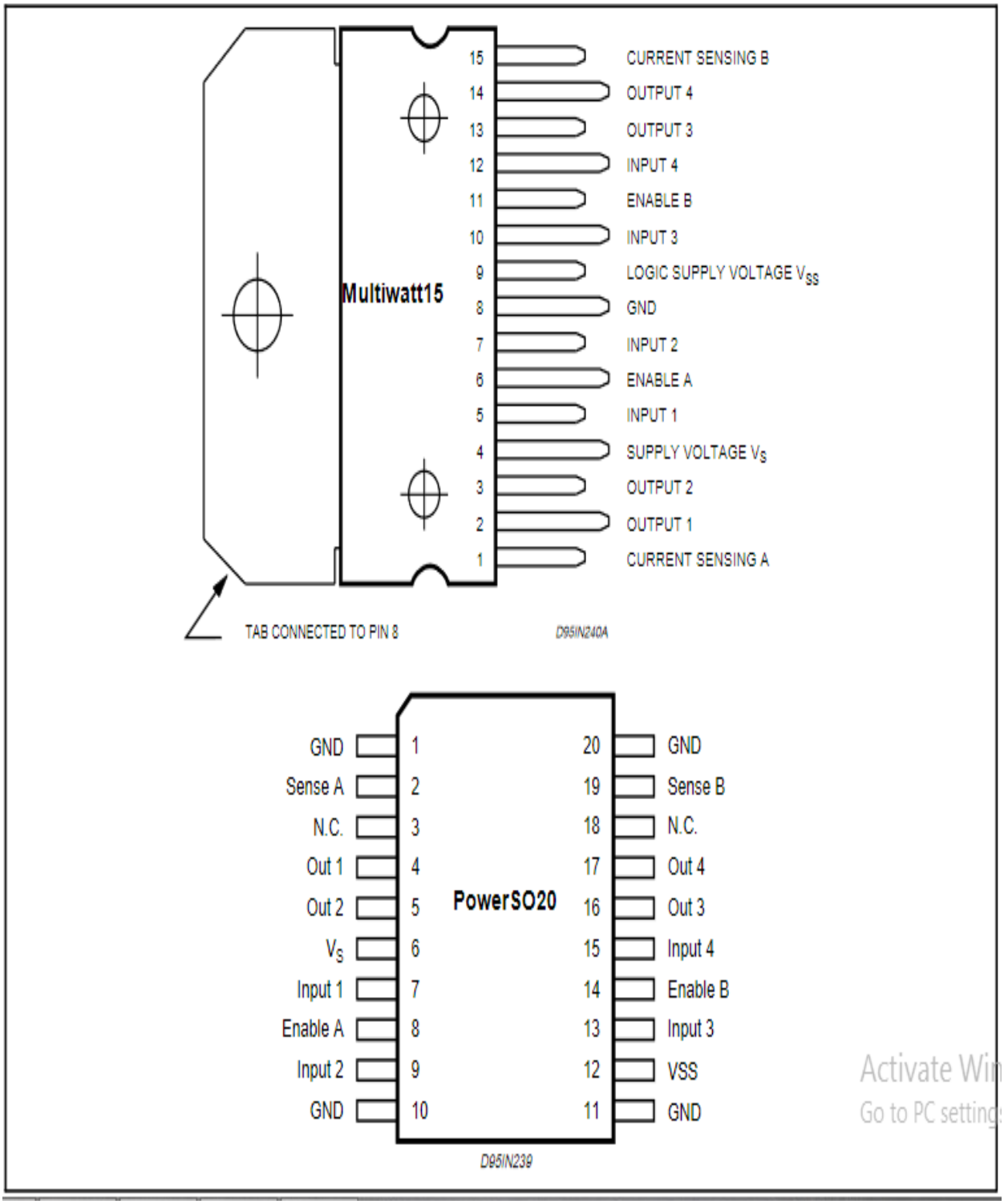

Fig 8: Pin Diagram of Multiwatt15 and Power SO20

1.5 12v HIGH TORQUE DC MOTOR:

Direct current motor is an electric motor which is capable of handling mechanical movements by converting conventional energy. DC motor takes electrical energy and produces mechanical energy. Dc motors are usually referred to as power devices, which are specifically used in auto mobiles, food blenders and so in robots. It is an electrical machine convertor which converts DC electric power to mechanical power and basically rely on the forces composed by magnetic field. It have either electro mechanical or electronics as internal mechanism to periodically change the direction of the current flow, mostly produces rotatory motion while some produce force directly and motion in the straight line.

Fig 9: DC Motor 12V

1.6 ROBOTIC CHASSIS:

Fig 10 :Robotic Chassis

This robotic chassis kit contains of an acrylic base with two gear motors, two compatible wheels, a ball caster, and other accessories.

Package Contains:

- 2 x Deceleration motors
- 16 2 x Aluminum fasteners
- 1 x Nylon all-direction wheel
- 1 x Chassis
- 1 x Battery box (4 x AA batteries, not included)
- 1 x Screwdriver

DC motor specification:

- Unloaded speed: 120 RPM
- Load current: 190 mA (250 mA MAX) .
- Maximum torque: 800 g. Cm min

Chassis Specification:

- Dimensions: 7.72 in x 4.13 in x 0.12 in (19.6 cm x 10.5 cm x 0.3 cm)
- Weight: 14.29 oz (405 g)

Wheel specification

- Width: 30mm
- Diameter: 65mm.

CHAPTER 2

2.1 PROBLEM DEFINITION

The problem definition that our project deals by is using the Bluetooth communication to produce an effective and high range transmitter circuit which can drive several motors. The main aim of the project is to produce small scale controllable circuits like electronics wheel chairs and RC cars etc.

2.2 PROBLEM SPECIFICATION

Problem specifications plays a major role in every project that is designed and developed. So, choosing a perfect problem statement is necessary as we are going to develop a project to overcome that problem statement. In our project we took few of the below problems that we want to overcome after the completion of project.

1. The main thing we considered was to make a low-cost wireless control which can be used everywhere and also in remote locations where there is no perfect network.
2. The second thing we gave a thought about was easy to use design. Every one doesn't have enough knowledge to use complex controls so we need to make it simple.
3. The next main thing we have in our mind was the project should have many applications. Multiple applications are considered mainly during the design of our project
4. We also thought about making it look simply. Simple in the sense it shouldn't have lot of complex circuitry. The coding for this project is also should be simply understand by people who have minimum knowledge. Basically, an Easy to assemble project.

CHAPTER 3

3.0 SYSTEM DESIGN

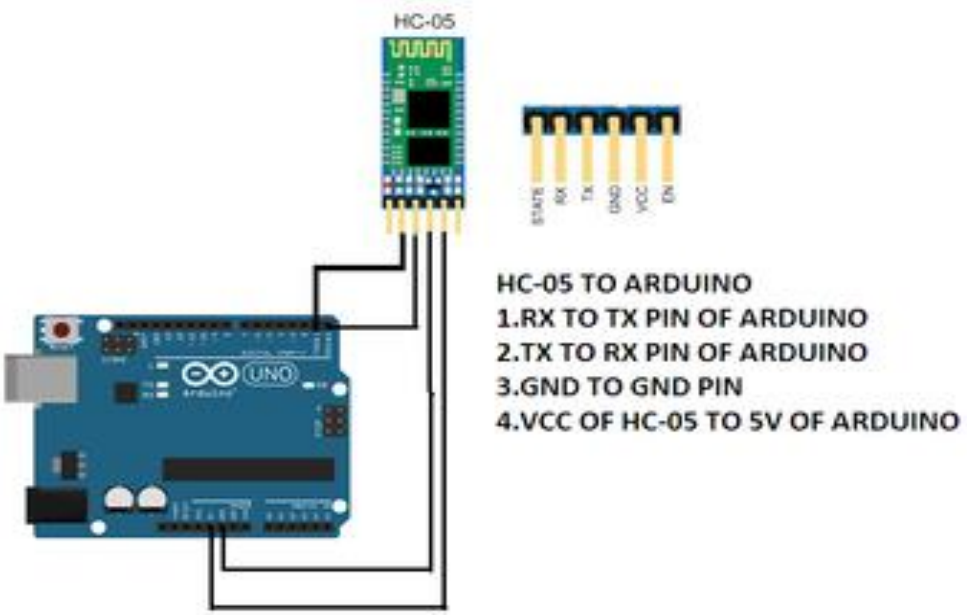

Fig 11 : CONNECTION OF HC-05 TO ARDUINO

1. CONNECT RX PIN OF HC-05 TO TX PIN OF ARDUINO
2.CONNECT TX PIN OF HC-05 TO RX PIN OF ARDUINO
3 .CONNECT GND PIN OF HC-05 TO GND PIN OF ARDUINO
4. CONNECT VCC PIN OF HC-05 TO 5V PIN OF ARDUINO

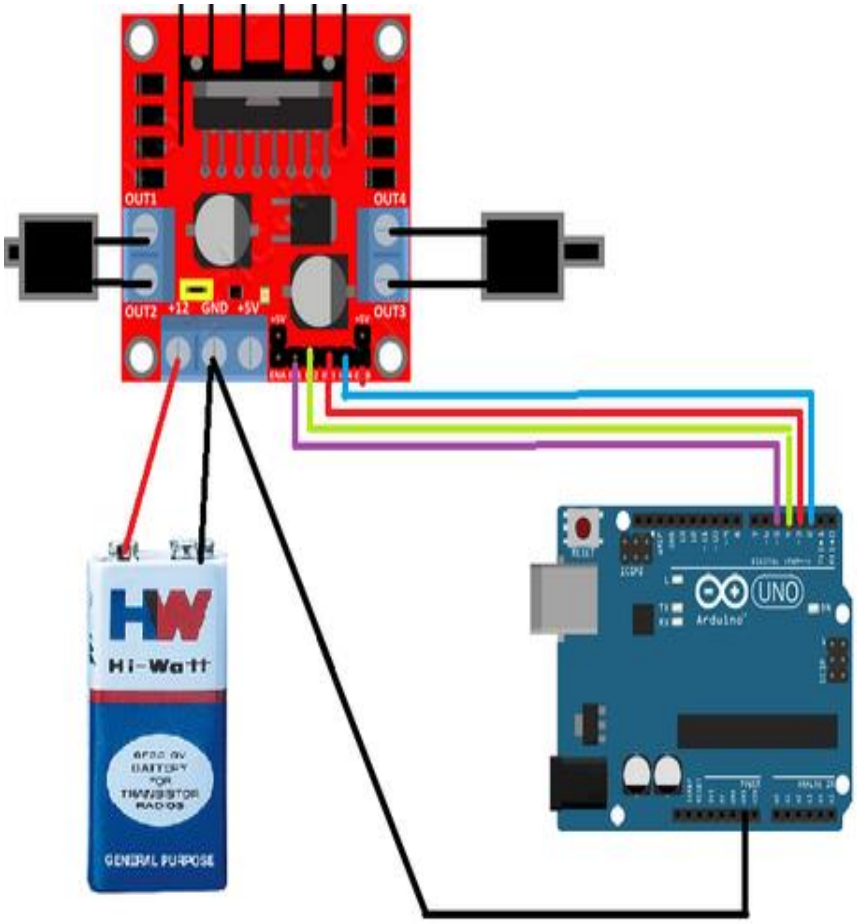

Fig 12 : Connection of l298n motor driver to Arduino

1.Connect n1 pin of l298n to arduino 2 pin
2.Connect n2 pin of l298n to arduino 3 pin
3.Connect n3 pin of l298n to arduino 4 pin
4 Connect n4 pin of l298n to arduino 5 pin
5.Connect gnd pin of l298n to arduino gnd pin

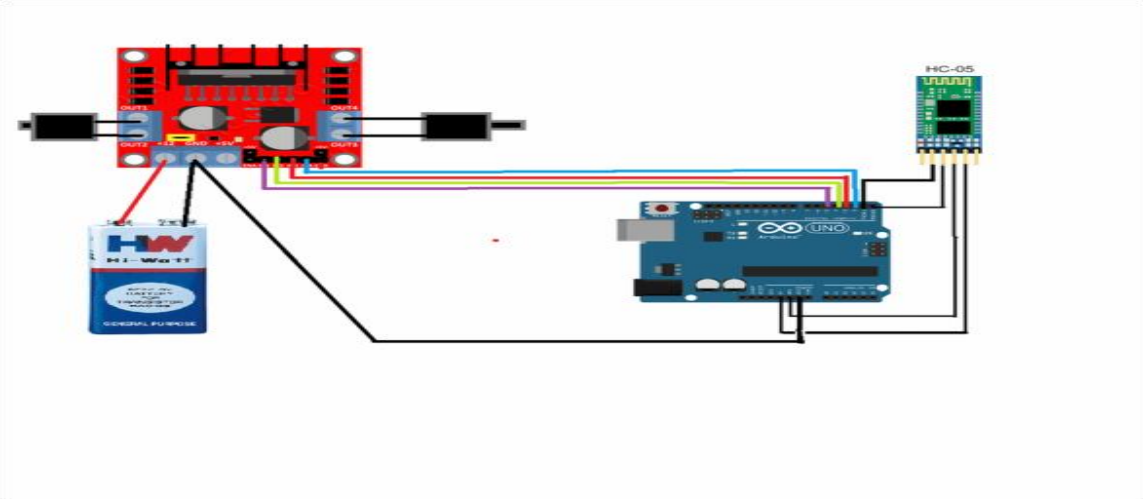

Fig 13: Entire Connections of Project

The controlling device of whole system are microcontrollers. Bluetooth module, DC Motors are interfaced to the microcontroller the data received by the Bluetooth module from Android smart phone is fed as input to the controller. The controller acts accordingly on the DC motor of the Robot. The Robot in this project can be made to move in all four directions using Android phone. The code is written in C Language first we need to make sure your HC-05 Bluetooth module is paired with your mobile. The default password for pairing is 1234 or 0000.

Click on "SELECT DEVICE" icon to select paired Bluetooth module when press "UP ARROW" it sends the data "F" to Bluetooth module connected with the circuit. When microcontroller detects "F" the Robot car moves FORWARD. When press "DOWN ARROW" it sends the data "B" to Bluetooth module connected to the circuit. When microcontroller detects the "B" the Robot car moves REVERSE. When press "RIGHT ARROW" it sends the data "R" to Bluetooth module connected to the circuit. When microcontroller detects the "R" the Robot car moves RIGHT SIDE. When press "LEFT ARROW" it sends the data "L" to Bluetooth module connected to the circuit. When microcontroller detects the "L" the Robot car moves LEFT SIDE.

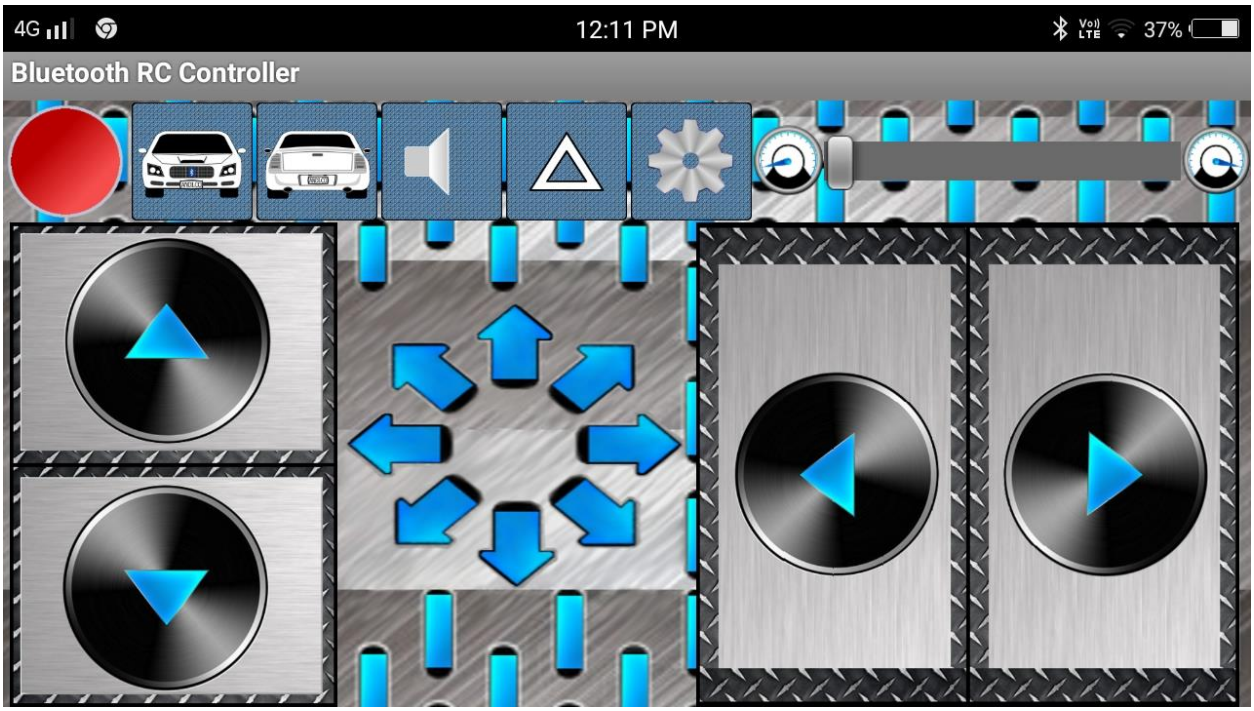

Fig 14: Application that we use to Control Robot

CHAPTER 4

IMPLEMENTATION ISSUES

- We have added a new element to this project that makes us find an obstacle (if any) present in the path of car.
- For that we have used a sensor (SR ULTRA SONIC SENSOR) which is connected to Arduino
- The Ultrasonic sensor sends out a high frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has two openings on its front. One opening transmit ultrasonic waves (like a tiny particles), the other receives them (like a tiny micro phones).
- So whenever an obstacle comes in the path of the car the ultrasonic sensor sends sound pulses that hit the obstacles and return to the sensor and the receiver scans the echo message.
- Then the sensor raises an alarm indicating obstacle in its path, helping us to divert the direction and for a smooth navigation.
- In this way with the help of sensor we have added an extra feature to vehicle for easy operation.

CHAPTER 5

5.1 CONCLUSION

Almost all navigation robot demands the same sort of obstacle detection, hence obstacle avoidance strategy is of utter importance. Obstacle avoidance robot has a vast field of application. They can be used as services robots, for the purpose of household work and so many other indoor applications. In those challenging environments, the robots need to gather information about their surroundings to avoid obstacles. Now a days, even in ordinary environments, people also require that robots can detect and avoid obstacles.

Various techniques have emerged to develope the science of robotics and robots. One method is evolutionary robotics, in which a number of differing robots are submitted to tests like obstacle avoidance system. Those which perform best are used as a model to create a subsequent "generation" of robots. There are concerns about the increasing use of robots and their role in society. Additional features can be easily incorporated into this module if required, long range sensors can be used. The speed of the robot can be controlled.

5.2 FUTURE SCOPE

The future scope for this project mainly depends on how its used and also for which application it is being used. The wireless control obstacle detection that we have made is a Bluetooth control car which uses buzzer sound when it detects an obstacle in front of its way.

The various ways it can be used in the future as up to our knowledge is, it can be used everywhere where there is no perfect Wi-fi network available because Bluetooth is freely available in every low-cost mobile phone. So, we can expect the usage in remote villages also.

Due to its cheaper price and easy to use nature, people slightly above the poverty line can also use this in future as it shows a cheapest way of controlling wheels wirelessly. This Bluetooth tech can also be used in any wireless controlling methods.

Lastly coming to obstacle detection, it is already widely used in many technologies in which some of them are Surveillances, Security, even in robots that are going to be sent outer space. Because live videos and pictures are always not an option where there is no signal strength which is needed when reporting back those videos and pictures to us. So, people are using inbuilt obstacle detection sensors so as to automatically detect the obstacle and avoid it without any instruction form the user.

CHAPTER 6

CODING

```
//Declare the arduino pins
int lm1 = 11;
int lm2 = 10;
int rm1 = 9;
int rm2 = 8;
int horn = 4;
int fl = 3;
int bl = 2;
void setup()
{
  //initlize the mode of the pins
pinMode(lm1,OUTPUT);
// Pin lm1 is assigned as OUTPUT
pinMode(lm2,OUTPUT);
// Pin lm2 is assigned as OUTPUT

pinMode(rm1,OUTPUT);
// Pin rm1 is assigned as OUTPUT

pinMode(rm2,OUTPUT);
```

```
// Pin rm2 is assigned as OUTPUT

pinMode(horn,OUTPUT);
pinMode(fl,OUTPUT);
// Pin f1 is assigned as OUTPUT

pinMode(bl,OUTPUT);
// Pin b1 is assigned as OUTPUT

   //set the serial communication rate
Serial.begin(9600);
}
void loop()
{
  //check whether arduino is reciving signal or not
while(Serial.available() == 0);
  char val = Serial.read() ;
//reads the signal
Serial.print(val);

  /*********For Forward motion*********/
  if (val == 'F')
  {
Serial.println("FORWARD");
digitalWrite(lm1,HIGH);
```

```
digitalWrite(rm1,HIGH);
digitalWrite(lm2,LOW);
digitalWrite(rm2,LOW);
  }

    /**********For Backward Motion**********/
  else if(val == 'B')
  {
Serial.println("BACK");
digitalWrite(lm2,HIGH);
digitalWrite(rm2,HIGH);
digitalWrite(lm1,LOW);
digitalWrite(rm1,LOW);
  }
   /**********Right**********/
  else if(val == 'R')
  {
Serial.println("RIGHT");
digitalWrite(lm1,HIGH);
digitalWrite(rm2,HIGH);
digitalWrite(lm2,LOW);
digitalWrite(rm1,LOW);
  }
```

```
   /*********Left*********/
  else if(val == 'L')
  {
Serial.println("LEFT");
digitalWrite(lm2,HIGH);
digitalWrite(rm1,HIGH);
digitalWrite(lm1,LOW);
digitalWrite(rm2,LOW);
  }
   /*********Horn*********/
 else if(val == 'V')
  {
digitalWrite(horn,HIGH);
  }
else if(val == 'v')
  {
digitalWrite(horn,LOW);
  }
  /*********Front Lights*********/
  else if(val == 'W')
  {
digitalWrite(fl,HIGH);
  }
```

```
  else if(val == 'w')
  {
digitalWrite(fl,LOW);
  }
  /*********Back Lights*********/
  else if(val == 'U')
  {
digitalWrite(bl,HIGH);
  }
  else if(val == 'u')
  {
digitalWrite(bl,LOW);
  }
  /*********STOP*********/
Else
  {
Serial.println("Invalid!!!");
digitalWrite(lm1,LOW);
digitalWrite(rm1,LOW);
digitalWrite(lm2,LOW);
digitalWrite(rm2,LOW);
  }
}
```

CHAPTER 7

REFERENCES

1. Gobel, S., Jubeh, R., Raesch, S. L., and Z¨undorf A., “Using the Android Platform to control Robots”, Kassel University Germany.

2. HarshavardhanB.Patil, Prof.V.M.Umale ―Arduino Based Wireless Biomedical Parameter Monitoring System Using Zigbee.‖ IJETT, Volume 28 Number 7 - October 2015.

3. V. Naga phanindra, B. Suresh Ram ― Wireless Remote Control Car Based on ARM7.‖ IJETT, Volume 5 Number 5 - Nov 2013.

4. Pradip det and Manas ghosh,2ndEd,Oxford University press,2013 ― used for programming

5. R.L Boylestad and louis Nashelsky,9Ed,2006 PEI/PHI ― used to study on electronics and devices of circuit

6. Iyer and k.satya prasad 2009,2Ed ― related signals and systems

7. B.L Thereja,A.K Thereja,"Electronics Technology",S.Chand and company vol 1 and vol 2 Ltd 2005 education ― used for dc motors

8. Fredraic J.hill,Gerald R.peterson,3rd Ed-John Wiley and sona Inc. ― Used for switching theory and logic design

9. Dennis Roddy and John coolen,4th edition 2004 "Analog communication" ― used for sensors ,recivers,transmittors