ANDROID CONTROLLED ROBOT USING BLUETOOTH

AN INDUSTRIAL INTERNSHIP TRAINING REPORT

Submitted by

M B V SRI HARSHA
17BEC1195

ECE3099 – INDUSTRIAL INTERNSHIP

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

in

ELECTRONICS AND COMMUNICATION ENGINEERING

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

OCTOBER 2020

School of Electronics Engineering

DECLARATION BY THE CANDIDATE

I hereby declare that the Industrial Internship Report entitled "**ANDROID CONTROLLED ROBOT USING BLUETOOTH MODULE**" submitted by me to VIT, Chennai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Technology** in **Electronics and communication Engineering** is a record of bonafide industrial training undertaken by me under **E.C.I.L , Hyderabad.** I further declare that the work reported in this report has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

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Signature of the Candidate

Date:18-10-2020

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PROJECT / INTERNSHIP COMPLETION CERTIFICATE

Date: 18/06/2019

This is to certify that **Mr. M.B.V SRI HARSHA** bearing **Reg.No:17BEC1195** a student of **VELLORE INSTITUTE OF TECHNOLOGY, CHENNAI** pursuing the Degree of **B.Tech.**, in Electronics and Communication Engineering, has carried out Project work / Internship titled **"ANDROID CONTROLLED ROBOT USING BLUETOOTH"** in **"EMBEDDED SYSTEMS"** under our guidance during the period from **06/05/2019 to 05/06/2019** in partial fulfillment of the requirements for the award of the above mentioned Degree. The student is punctual, hardworking and shown keen interest to produce the project output and results.

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BONAFIDE CERTIFICATE

This is to certify that the Industrial Internship Report entitled "**ANDROID CONTROLLED ROBOT USING BLUETOOTH**" submitted by **M B V SRI HARSHA (17BEC1195)** to VIT University, Chennai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Technology** in **Electronics and communication Engineering** is a record of bonafide internship undertaken by him/her fulfills the requirements as per the regulations of this institute and in my opinion meets the necessary standards for submission. The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Signature of the Examiner
Date:

Head of the Department (B.Tech ECE)

ACKNOWLEDGEMENT

I wish to thank those who were involved in the successful completion of my internship at (E.C.I.L), starting from the deputy general manager, for giving me the opportunity and freedom to learn as per my interests; the head of the team at E.C.I.L, for being a constant support and guidance; the project lead for my internship, Sr.Manager (Electronics), for providing me with the necessary resources; and the entire staff of the company for their support and positivity which made my internship a worthwhile experience.

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M B V SRI HARSHA

ABSTRACT

The purpose of this project is to develop a mobile robot car with an obstacle avoidance capability. The mobile robot will be built with an on-board sensor to get information about the surrounding environment.

The mobile robot is a four wheeled robot platform. The robot has an ultrasonic sensor which is mounted in front of it to scan the front environment. The ultrasonic sensor will trigger a signal to the main controller, which is a Arduino UNO and it is controlled by blue-tooth module HC-05

The direction of the mobile robot will be controlled by one stepper motor that connected to the output of Arduino UNO. The stepper motor will change the direction of mobile robot when an obstacle is detected. The other two wheels are dc motor which is only for motion purpose. The dc motor will be only run forward without influenced by the obstacle senses by ultrasonic sensor.

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1. INTRODUCTION

1.1 OBJECTIVES AND GOALS

The purpose of this project is to develop a mobile robot that is controlled by android and with an obstacle avoidance capability. The mobile robot will be built as a fully autonomous vehicle with onboard sensor to get information about the surrounding environment.

The mobile robot is a three wheeled robot platform. The robot has an ultrasonic sensor which is mounted in front of it to scan the front environment. The ultrasonic sensor will trigger a signal to the main controller, which is a Arduino UNO. The motion of the mobile robot will be controlled by one dc motor. The dc motor will change the direction of the mobile robot. The other two wheels is a dc motor which is only for motion purpose. The stepper motor will be only run forward without influenced by the obstacle senses by ultrasonic sensor.

1.2 BENEFITS

Popular types of sensors for range-based obstacle detection systems includes ultrasonic sensors, laser range finders, radar, stereo vision, optical flow, and depth from focus. How, ever all these sensors have its own defects. Ultrasonic sensors are cheap comparing to other systems. Laser rangefinders and radar provide better resolution but are more complex and more expensive. Most depth from X vision systems require a textured environment to perform properly. Moreover, stereo vision and optical flow are computationally expensive.

Here we are designing a low cost obstacle detection robot that uses ultrasonic waves. The system basically comprises a transmitter

section and a receiver section. Sounds up to 20kHz are audible for human, sounds above 20kHz are inaudible and are called Ultrasonic sound.

It can be used in vehicles. So, that the sensor detects the obstacle and reduces the car speed and further deviates from the direction it is going mainly this is to decrease number of accidents. It can be used in military weapons so as to detect the target and can change its direction so as not to be effected from the target. For example brahmos missile.

1.3 FEATURES

- Compact and light weight
- High sensitivity and high pressure
- High reliability
- Power consumption of 20mA
- Internally frequency compensation Wide output voltage swing 1.5 V Common mode input voltage range includes supply voltage range 30 V (Single) 15 V (Split) Output short circuit protection
- Wide Supply-Voltage Range: 4.5 V to 36 V
- Separate Input-Logic Supply
- Blue-tooth Controlled

2.1 CIRCUIT ANALYSIS

It mainly consists of Transmitter section and a receiver section. Receiver section is an IC .

Basic principle of operation of ULTRASONIC sensor:

An ultrasonic sensor typically utilizes a transducer that produces an electrical

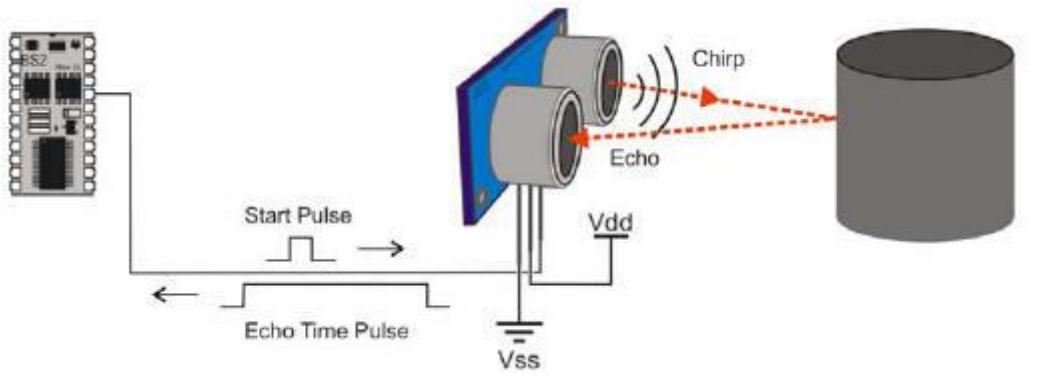
Output in response to received ultrasonic energy. The normal frequency range for human hearing is roughly 20 to 20,000 hertz.

Ultrasonic sound waves are sound waves that are above the range of human hearing and, thus, have a frequency above about 20,000 hertz.

Any frequency above 20,000 hertz may be considered ultrasonic.
Most industrial processes, including almost all sources of friction, create some
Ultrasonic noise. The ultrasonic transducer produces ultrasonic signals. These signals are propagated through a sensing medium and the same transducer can be used to detect returning signals.

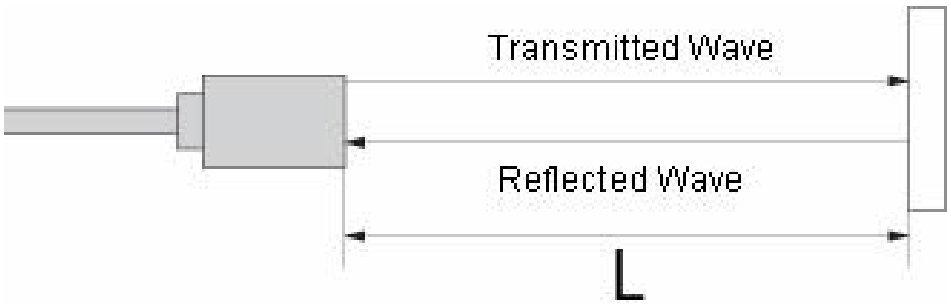
Ultrasonic sensors typically have a piezoelectric ceramic transducer that converts an excitation electrical signal into ultrasonic energy bursts. The energy bursts travel from the ultrasonic sensor, bounce off objects, and are returned toward the sensor as echoes. Transducers are devices that convert electrical energy to mechanical energy, or vice versa. The transducer converts received echoes into analog electrical signals that are output from the transducer.

Ultrasonic transducers operate to radiate ultrasonic waves through a medium
such as air. Transducers generally create ultrasonic vibrations through the use of
piezoelectric materials such as certain forms of crystals or ceramic polymers.



Measurement Principle / Effective Use of Ultrasonic Sensor:

Ultrasonic sensors transmit ultrasonic waves from its sensor head and again receive the ultrasonic
waves reflected from an object. By measuring the length of time from the transmission to reception of the
sonic wave, it detects the position of the object.



The advantages of Ultrasonic sensor

Ultrasonic sensor has some advantages which are;

i. Measures and detects distances to moving objects.

ii. Impervious to target materials, surface and color.

iii. Solid-state units have virtually unlimited, maintenance-free lifespan.
iv. Detects small objects over long operating distances.
v. Resistant to external disturbances such as vibration, infrared radiation, ambient noise and EMI
radiation.

vi. Ultrasonic sensors are not affected by dust, dirt or high-moisture environments.
vii. Discrete distances to moving objects can be detected and measured.
viii. Less affected by target materials and surfaces, and not affected by color. Solid-state units have
virtually unlimited, maintenance free life. Can detect small objects over long operating distances.

The disadvantages of Ultrasonic sensor

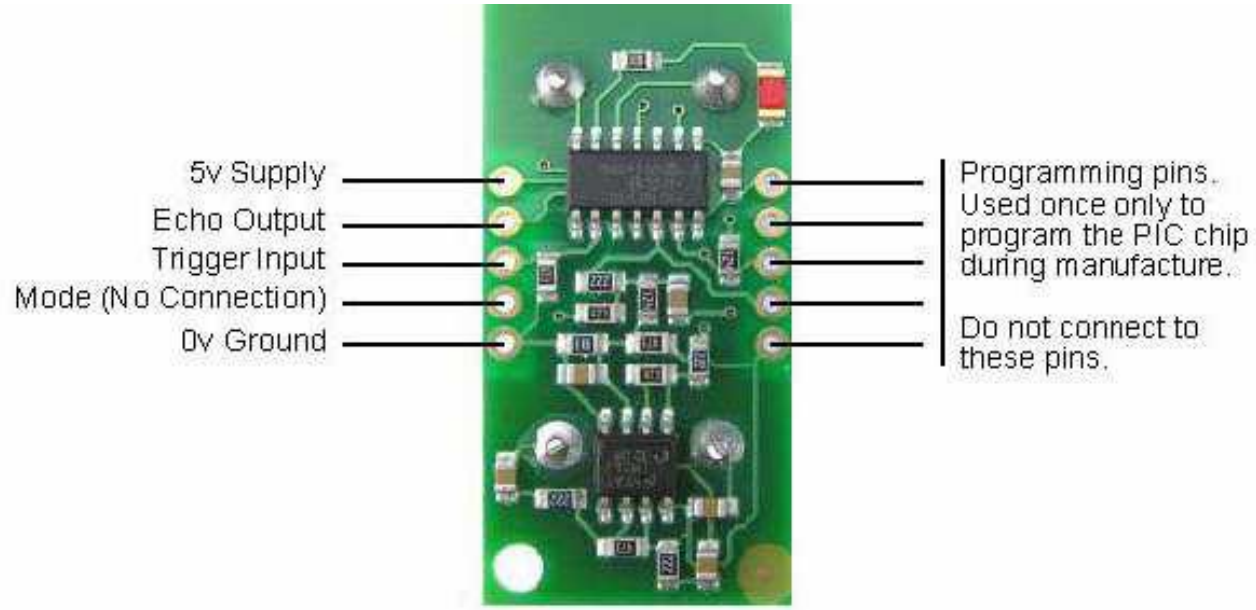
Some disadvantages of ultrasonic sensor are;

i. Overheating of a wave emitter precludes the energy of ultrasonic waves emitted there from being enhanced to a practical level.

ii. Interference between the projected waves and the reflected waves takes place, and development of standing waves provides adverse effects.

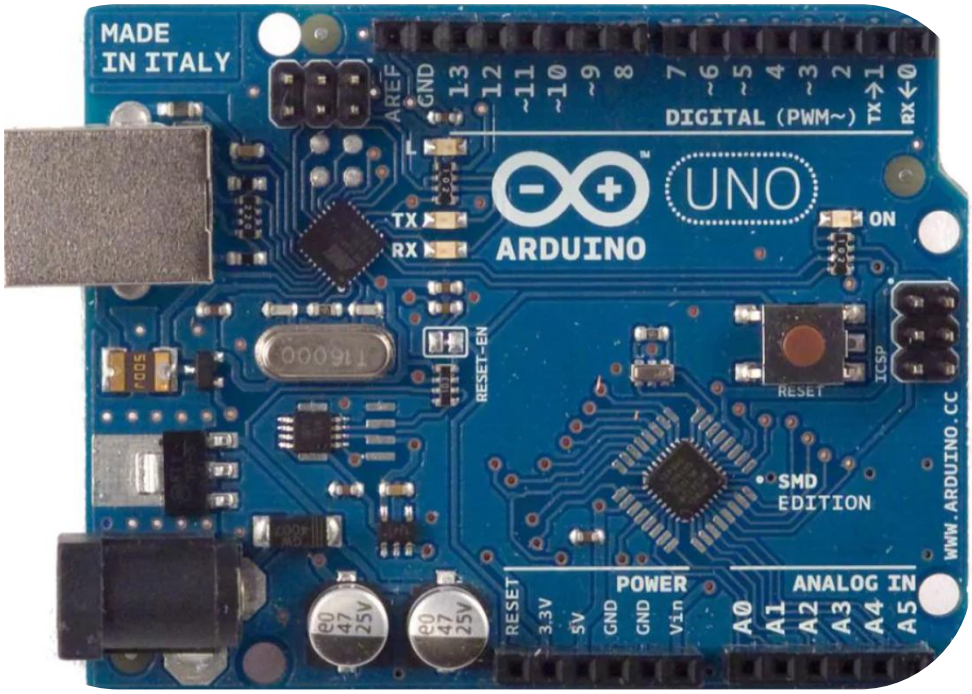
iii. It is impossible to discern between reflected waves from the road surface and reflected waves from
other places or objects.

iv. There is no effective measure for removing the influences of factors other than road surface irregularities such as, for example, winds, temperature variations, etc., which can change the intensity of reflected waves.



Connections for 2-pin Trigger/Echo Moce (SRF04 compatible)

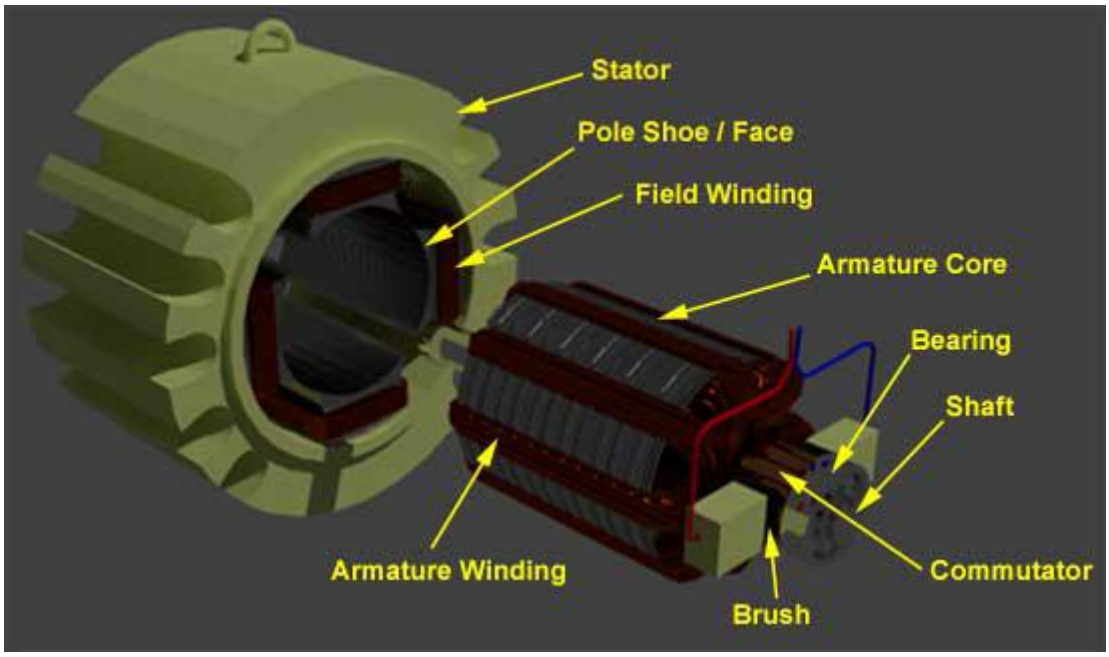
ARDUINO UNO:



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 ceramic resonator, 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 USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Revision 3 of the board has the following new features: 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new

pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin, that is reserved for future purposes. Stronger RESET circuit. Atmega 16U2 replace the 8U2. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

DC Motor:



An **electric motor** converts electrical energy into mechanical energy. The
reverse process that of converting mechanical energy into electrical energy is
accomplished by a generator or dynamo. Traction motors used on locomotives often perform both tasks if the locomotive is equipped with dynamic brakes. Electric motors are found in household appliances such as fans, refrigerators, washing machines, pool pumps, floor vacuums, and fan-forced ovens.

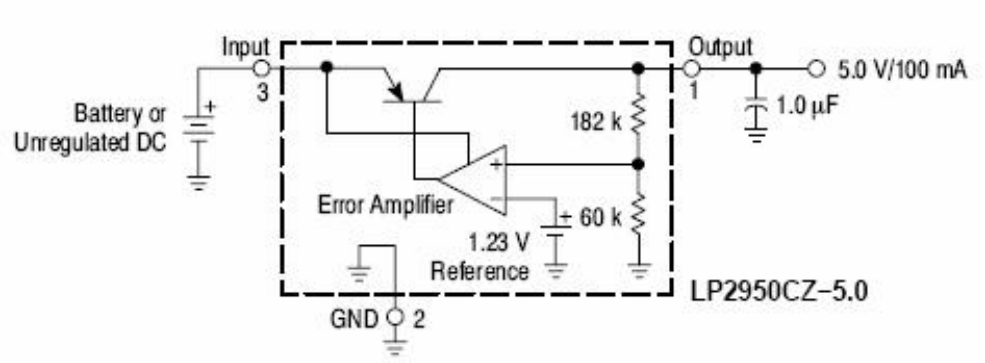
Most electric motors work by electromagnetism, but motors based on other
electromechanical phenomena, such as electrostatic forces and the piezoelectric effect, also exist. The fundamental principle upon which electromagnetic motors are based is that there is a mechanical force on any current-carrying wire contained within a magnetic field. The force is described by the Lorentz force law and is perpendicular to both the wire and the magnetic field. Most magnetic motors are rotary, but linear motors also exist. In a rotary motor, the rotating

part (usually on the inside) is called the rotor, and the stationary part is called the stator. The rotor rotates because the wires and magnetic field are arranged so that a torque is developed about the rotor′ s axis. The motor contains electromagnets that are wound on a frame. Though this frame is often called the armature, that term is often erroneously applied. Correctly, the armature is that
part of the motor across which the input voltage is supplied. Depending upon the design of the machine, either the rotor or the stator can serve as the armature.

The principle of conversion of electrical energy into mechanical energy by
electromagnetic means was demonstrated by the British scientist Michael Faraday in 1821 and consisted of a free-hanging wire dipping into a pool of mercury. A permanent magnet was placed in the middle of the pool of mercury. When a current was passed through the wire, the wire rotated around the magnet, showing that the current gave rise to a circular magnetic field around the wire. This motor is often demonstrated in school physics classes, but brine (salt water) is sometimes used in place of the toxic mercury. This is the simplest form of a class of electric motors called homopolar motors. A later refinement is the Barlow′ s Wheel. These were demonstration devices, unsuited to practical applications due to limited power.

Voltage Regulator:

Referring to the figure , voltage regulator is used to provide regulated 5V to power the PIC16F877A microcontroller. This is very essential since the microcontroller will blow if the voltage supplied to it is exceeding its voltage rating.



Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device and overload protection all in a single IC. Although the internal construction of the IC is somewhat different from that described for discrete voltage regulator circuits, the external

operation is much the same. IC unit provide regulation of a fixed positive voltage, a fixed negative voltage or an adjustably set voltage.

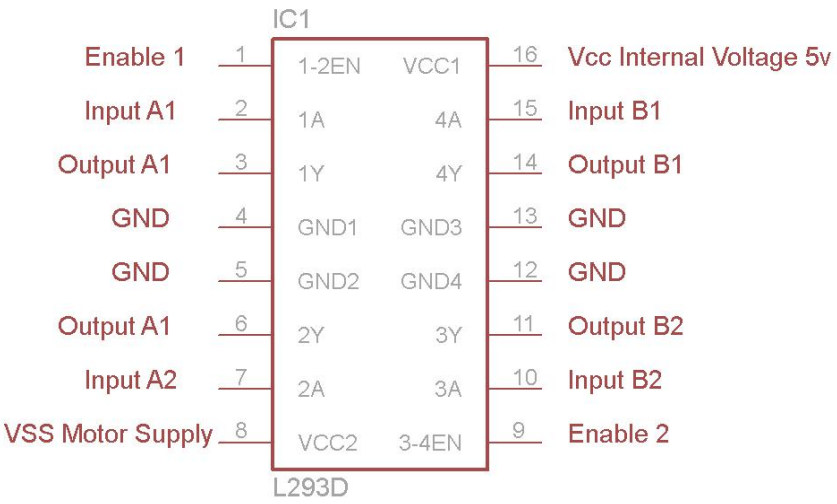
A power supply can be built using a transformer connected to the ac supply line to step the ac voltage to desired amplitude, then rectifying that ac voltage, filtering with a capacitor and RC filter, if desired, and finally regulating the dc voltage using an IC regulator. The regulators can be selected for operation with load currents from hundreds of mill amperes to tens of amperes, corresponding to power ratings from milliwats to tens of watts.

L293D

L293D is a typical Motor driver or 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 motor with a single L293D IC.
The l293d can drive small and quiet big motors as well.

It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence, H-bridge IC are ideal for driving a DC motor.

In a single l293d chip there 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, as shown in figure 5, for being able to drive the motor, the pin 1 and 9 need to be high. 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.

There are 4 input pins for this l293d, pin 2.7 on the left and pin 15 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1.

In simple you need to provide Logic 0 or 1 across the input pins for rotating the motor.

Let' s consider a Motor connected on left side output pins (pin 3.6).

For rotating the motor in clockwise direction, the input pins have to be provided with Logic 1 and Logic 0.

• Pin 2 = Logic 1 and Pin 7 = Logic 0 | Clockwise Direction

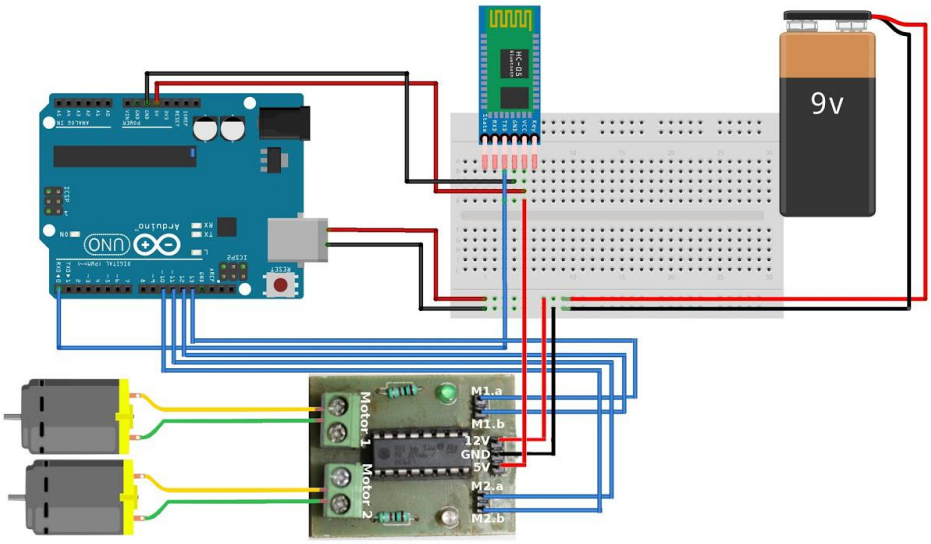
• Pin 2 = Logic 0 and Pin 7 = Logic 1 | Anticlockwise Direction

• Pin 2 = Logic 0 and Pin 7 = Logic 0 | Idle [No rotation] [Hi-Impedance state]

• Pin 2 = Logic 1 and Pin 7 = Logic 1 | Idle [No rotation]

In a very similar way the motor can also operate across input pin 15 for motor on the right-hand side.

CIRCUIT DIAGRAM



BLUETOOTH MODULE(HC-05):

The HC-05 is a very cool module which can add two-way (full-duplex) wireless functionality to your projects. You can use this module to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop. There are many android applications that are already

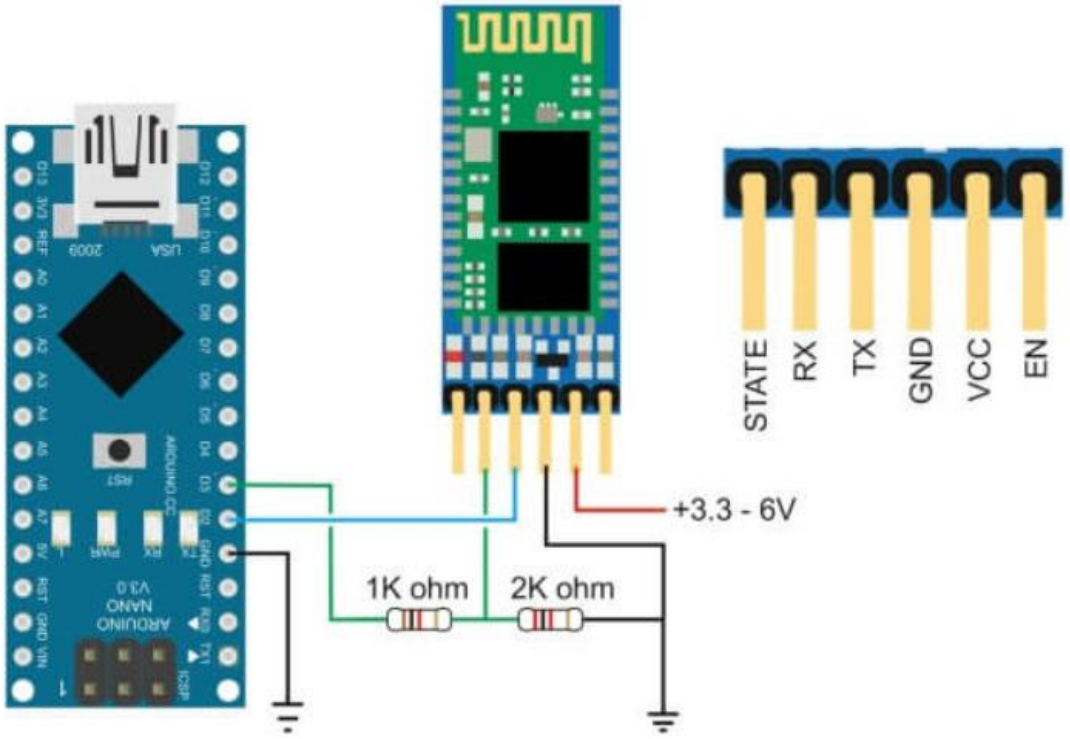
available which makes this process a lot easier. The module communicates with the help of USART at 9600 baud rate hence it is easy to interface with any microcontroller that supports USART. We can also configure the default values of the module by using the command mode. So if you looking for a Wireless module that could transfer data from your computer or mobile phone to microcontroller or vice versa then this module might be the right choice for you. However do not expect this module to transfer multimedia like photos or songs; you might have to look into the CSR8645 module for that.

How to Use the HC-05 Bluetooth module

The **HC-05** has two operating modes, one is the Data mode in which it can send and receive data from other Bluetooth devices and the other is the AT Command mode where the default device settings can be changed. We can operate the device in either of these two modes by using the key pin as explained in the pin description.

It is very easy to pair the HC-05 module with microcontrollers because it operates using the Serial Port Protocol (SPP). Simply power the module with +5V and connect the Rx pin of the module to the Tx of MCU and Tx pin of module to Rx of MCU as shown in the figure below.

HC-05 BASIC SET UP



During power up the key pin can be grounded to enter into Command mode, if left free it will by default enter into the data mode. As soon as the module is powered you should be able to discover the Bluetooth device as "HC-05" then connect with it using the default password 1234 and start communicating with it.

2.3 PROGRAM:

```
// Starting of Program
int m1a = 10;
int m1b = 11;
int m2a = 12;
int m2b = 13;
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);
```

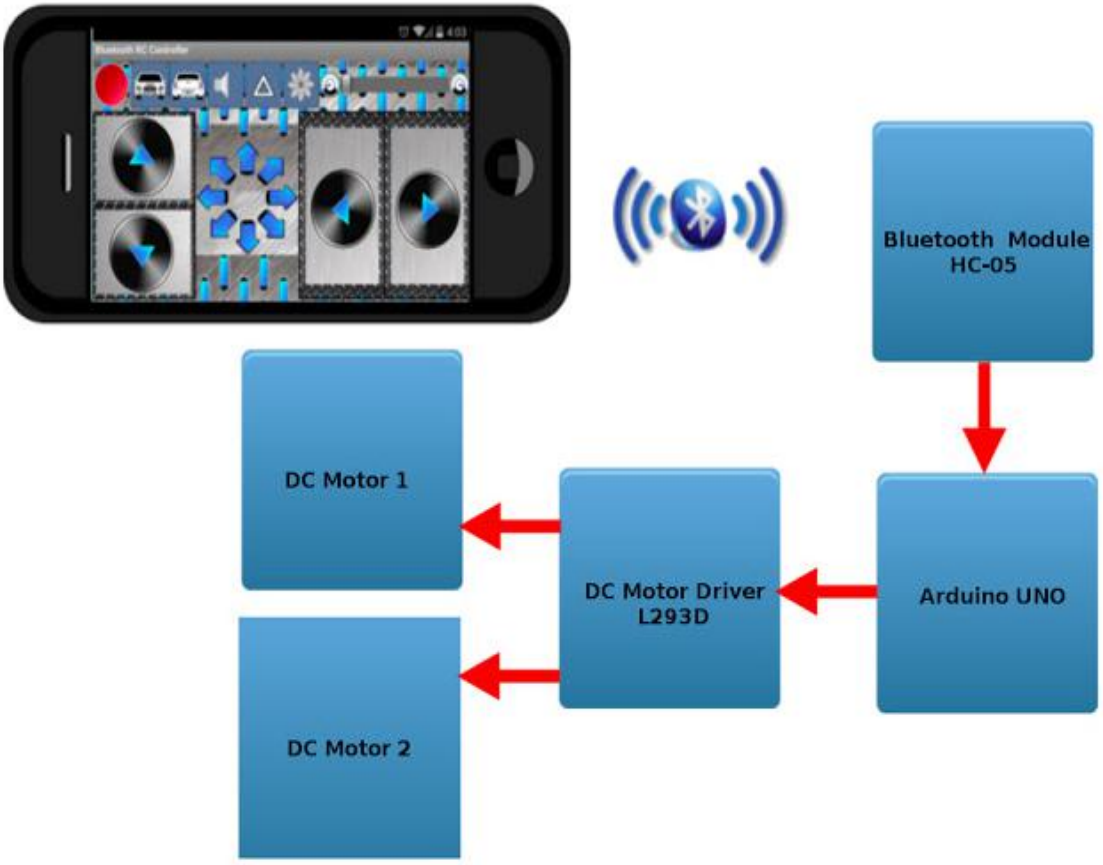
```
    digitalWrite(m1b, HIGH);
    digitalWrite(m2a, LOW);
    digitalWrite(m2b, LOW);
    }
   else if(val == 'G') //Forward Left
    {
    digitalWrite(m1a, LOW);
    digitalWrite(m1b, LOW);
    digitalWrite(m2a, HIGH);
    digitalWrite(m2b, LOW);
    }
  else if(val == 'H') //Backward Left
    {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

// End of program
```

2.4 WORKING PROCESS:

The Android Application that we are going to use for this project. This Application can be downloaded from the Android Playstore.

The Name of the Application is: **Arduino Bluetooth RC Car**
we are not going to use the full features of this App. We will try to do it in some other project.



Now let me try to explain the working of this project. The Circuit will get ready to receive commands once the Android Application is successfully paired with the Bluetooth Module HC-05.
When a button is pressed(Suppose Forward Button) a value will be sent(Value "F") and it will be received by the Bluetooth Module. This Value again will be sent to Arduino UNO by the Bluetooth Module. Once Arduino receives the Value it will check what action need to be taken according to the value received. In this case Arduino will set digital pins 10 to 13 in such a way that the DC Motor will rotate in forward direction. The digital pins 10-13 of Arduino UNO is connected to the input pins of DC Motor Driver M1.a,M1.b,M2.a and M2.b respectively. Output pins of DC Motor driver will be

connected to the DC Motors. This way Arduino will start to control the DC Motors using their Digital pins 10-13
The Table shown below explains the Value and action that are used for this project.

Value	**Action**
F	Forward
B	Backward
S	Stop
R	Right
L	Left
I	Forward Right
J	Backward Right
G	Forward Left
H	Backward Left

Hence DC Motor 1 & DC Motor 2,These two DC motors will decide the direction of the Car. This car can move to the following directions.
1.Forward Direction
2.Reverse Direction
3.Forward Right
4.Forward Left
5.Reverse Right
6.Reverse Left

3. CONCLUSION AND FUTURE WORK

CONCLUSION

- Obstacle detection robot using blue-tooth was built and implemented.
- The system is targeted at obstacles.
- The robot developed can detect obstacles at a certain range.
- The robot detects the obstacle and deviates from its path.

FUTURE WORK

- The Ultrasonic sensor can also be used in such a way that if a missile is locked on any car by using ultrasonic sensor the car can move away from the obstacle.
- By using more ultrasonic sensors we can cover the detection the obstacles around the object.
- Ultrasonic waves are less diffused and it can pass through high density substances so it can be used in detecting the targets by submarine or ships.

4. REFERENCES

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