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# Arduino based, Bluetooth controlled RC Car

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**Abstract:** The project aims to design 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. An appropriate program in the arduino microprocessor to interact with the android controller has to be created. The program has been successfully compiled through arduino IDE to the arduino microprocessor & loaded 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 create with the help of android studio that provide us with more capability & stability. After doing all of this we have test this project thoroughly and find the maximum no. of error & wrong logic in the microprocessor program. After doing this only we can say that we have been able to create as per our goal described.

**Keywords:** Arduino Uno, HC-05 Bluetooth Module, Motor Driver Module L298N, Micromors and Grippy Wheels, Jumper Wires, Bluetooth Controller Car.

## 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.



Figure 1. Arduino Robot Car Wireless Control

## 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.<sup>[1]</sup> 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.

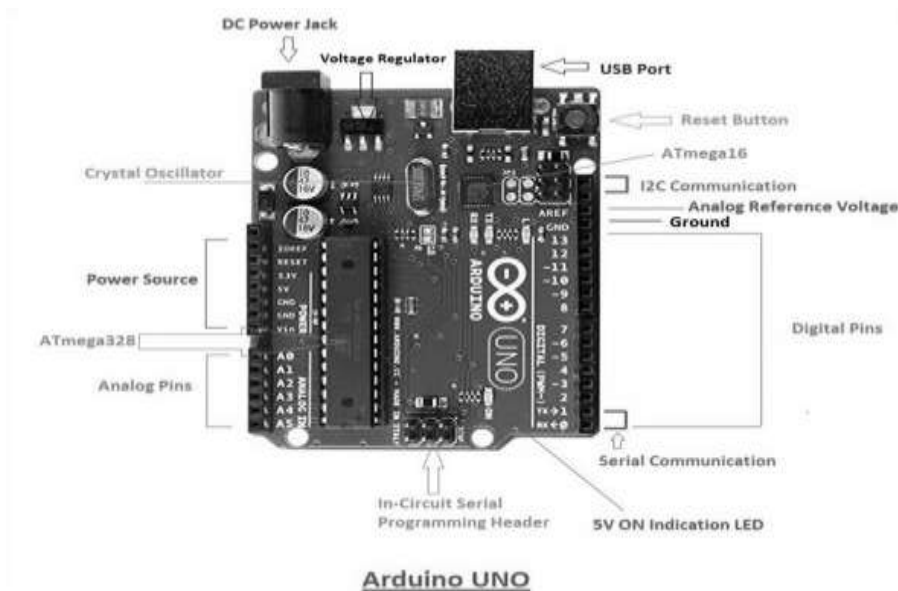


Figure 2. Arduino UNO Kit

### 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 <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 serial port (USART).

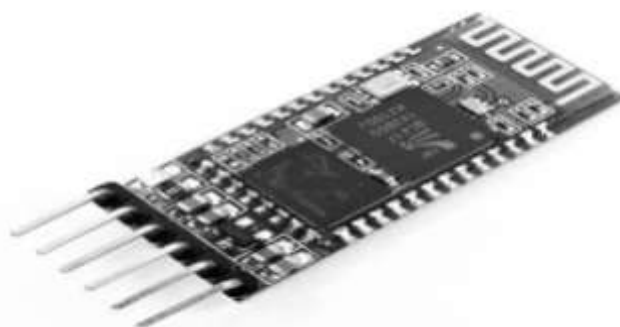


Figure 3: HC-05 Bluetooth Module

#### A. 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.

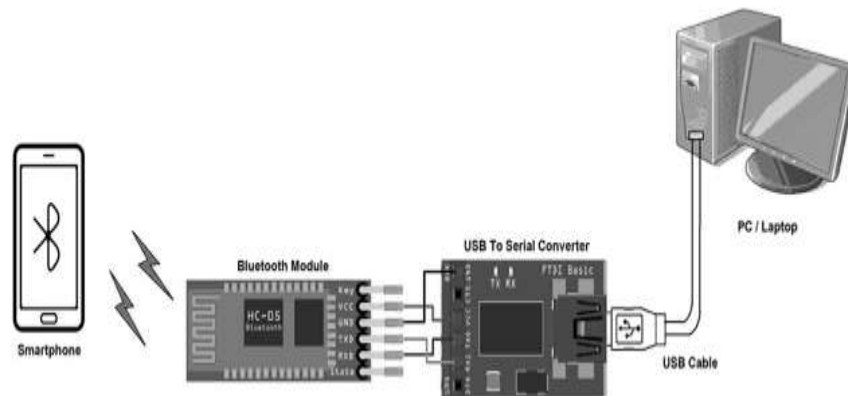


Figure 4. Architecture of Bluetooth Connectivity Module

### Motor Driver Module L298N

This L298N Based Motor Driver Module is a high power motor driver perfect for driving DC Motors and Stepper Motors. It uses the popular L298 motor driver IC and has the onboard 5V regulator which it can supply to an external circuit. It can control up to 4 DC motors, or 2 DC motors with directional and speed control. This motor driver is perfect for robotics and mechatronics projects and perfect for controlling motors from microcontrollers, switches, relays, etc. Perfect for driving DC and Stepper motors for micro mouse, line following robots, robot arms, etc. An H-Bridge is a circuit that can drive a current in either polarity and be controlled by Pulse Width Modulation (PWM). Pulse Width Modulation is a means of controlling the duration of an electronic pulse. In motors try to imagine the brush as a water wheel and electrons as the flowing droplets of water. The voltage would be the water flowing over the wheel at a constant rate, the more water flowing the higher the voltage. Motors are rated at certain voltages and can be damaged if the voltage is applied too heavily or if it is dropped quickly to slow the motor down. Thus PWM. Take the water wheel analogy and think of the water hitting it in pulses but at a constant flow. The longer the pulses the faster the wheel will turn, the shorter the pulses, the slower the water wheel will turn. Motors will last much longer and be more reliable if controlled through PWM.

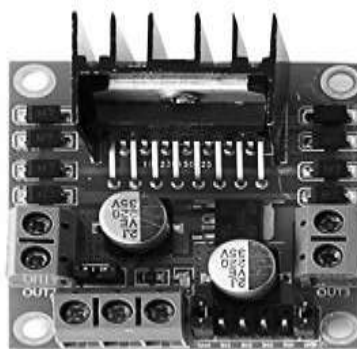


Figure 5: Motore Driver Module L298N

### 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 (rear) 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. Individuals who use an R/C car as a basis for their robot use rack and pinion steering where one motor is connected to a drive train and the other (usually a servo motor) is used for steering. Increasing the number of drive motors helps the robot to climb steeper inclines by increasing the torque. 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. In the image below, the center wheel, chosen mistakenly as the driven wheel, often loses contact with the ground. The way around this is to add suspension.



Figure 6: Micromors and Grippy Wheels for Robotic Control

### Jumper Wires

A jump wire is an electrical wire or group of them in a cable with a connector or pin at each end. Wires are used to connect components to each other on the breadboard or other prototype, internally or with other equipment or components, without soldering. Wire connectors could be male or female. A male connector is commonly referred to as a plug and has a solid pin for a center conductor. A female connector is commonly referred to as a jack and has a center conductor with a hole in it to accept the male pin.



Figure 7: Jumper Wires

### Bluetooth Controlled Car

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.



Figure 8: Bluetooth Controlled Car using Android App

### Software Description

Arduino software is used to put the instruction of whole functions of this system to the microcontroller. Here we use programming language 'C' for coding. The program for executing this project has been written in C language. The program is burnt in the microcontroller using burner software. The program is stored in the EEPROM of the microcontroller, which is present in the NodeMCU ESP8266. By this software we put the data and instruction for forward, backward, left, right operation of this system. In android application when we press a button, a corresponding signal is sent through the Bluetooth to Bluetooth module (HC-05) which is connected with the NodeMCUESP8266. Similarly an android application is been built for Wi-Fi module and when the buttons been pressed through the application the corresponding signal is been sent through the NodeMCU ESP8266 and the motor driver drives the wireless car. When signal data arrives the NodeMCU ESP8266 the pin which corresponds to the particular input is set to high. Now that pin gives the output to the motor driver section. Motor driver switches accordingly the data bit, if the data bit is low then the corresponding pin of the motor driver doesn't work else high bit then the corresponding pin of the motor driver is on. We have used Arduino IDE version 1.8.1 for writing program. There are two steps of the programming. First set up section where we define all the variables. Second loop part where the program runs continuously.



Figure 9: ARDUINO 1.6.8 App

### Resultant 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 HC-05 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.

| Command      | Description                                       | Response |
|--------------|---|----------|
| AT           | Checking communication                            | OK       |
| AT+PSWD=XXXX | Set Password<br>e.g. AT+PSWD=4567                 | OK       |
| AT+NAME=XXXX | Set Bluetooth Device Name<br>e.g. AT+NAME=MyHC-05 | OK       |

|  |  |  |
|--|--|--|
| AT+UART=Baud rate,<br>stop bit, parity bit | Change Baud rate<br>e.g. AT+UART=9600,1,0      | OK   |
| AT+VERSION?                                | Respond version no. of<br>Bluetooth module     | +Version: XX OK<br>e.g. +Version: 2.0 20130107 OK                        |
| AT+ORGL                                    | Send detail of setting done by<br>manufacturer | Parameters: device type, module<br>mode, serial parameter, passkey, etc. |

Table 1: Table of Different Commands used

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<br>Bluetooth controller<br>app | Output for front side<br>motor to give direction |     | Output for rear side motor to<br>move forward or reverse<br>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 2: Table of Different Commands used

## 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 IoT we actually rotate the wheels and give direction to the car. IoT 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 and IOT, we were able to come up with various possibilities that can take place.



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