

Smartphone Controlled Robotics Car

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1 Document Version History

S.No	Version	Notes
1	1.0	First Version

Table 1: Document Version History

2 Project Description

Objective of this project is to design a robotics car controlled from an Android powered Smartphone over a bluetooth connection.

Building this project provides exposure to multiple design aspects including making a robo car and controlling it using a microcontroller (Arduino is used in this project), adding wireless connectivity to robots, and designing an Android App for sending commands over a bluetooth connection. This project is also super fun to build and play. The concepts used here can easily be extended to design robots for helping with work in homes and offices, etc.

3 Bill of Materials

Below is a list of components, materials and tools required for the project

1. Arduino Uno Rev3 Board
2. L298N Motor Driver Module
3. HC-05 Bluetooth Module
4. Robo Car Materials
 - (a) Robo Car Chassis
 - (b) 2x DC Motors
 - (c) 2x Back Wheels, 1x Front Wheel (Castor Wheel)

- (d) Nuts and Bolts for assembling chassis and attaching different components to it (usually come with the car chassis)
- 5. Breadboard, Resistors - 3x 1.5kOhm, Connecting wires - male-to-male, male-to-female
- 6. Battery(1x or 2x), battery holder and connector

4 Module Level Functionality

4.1 Arduino Uno Rev3 Board

This is the main board containing the microcontroller responsible for system level logic and control flow and interfacing with all the other modules like HC-05 bluetooth module and L298N Motor driver module.

4.2 L298N Motor Driver Module

This module is useful for controlling the motors to which the wheels are attached. In principle, we could also control the motors without L298N module by instead using transistors and diodes. However, using this module makes it easier to control the motors - we don't have to build and test our own transistor circuit. It is sometimes beneficial to use existing modules wherever appropriate so that we could focus on the overall system level product design. This module interfaces with Arduino which sends it commands for controlling the motors.

4.3 HC-05 Bluetooth Module

This module is used for bluetooth connectivity between Arduino and Smartphone. It is a really nice module and includes all the RF components like antenna, etc required for bluetooth communication and provides a very easy to use interface. Communication between Arduino and this module happens over a 2 wire UART Serial Interface.

This module powered by the 5V supply from Arduino in this project. However, the input-output signaling used in the module treats 3.3V as HIGH versus 5V as HIGH signaling used in Arduino UNO. For transmitting data

from HC-05 to Arduino, nothing special needs to be done and a direct connection from TX of HC-05 to RX of Arduino can be used since Arduino also treats 3.3V as HIGH. However, for receiving data from Arduino to HC-05, a simple resistive voltage divider circuit can be used so that when Arduino communicates a 5V high signal, the voltage level is reduced to 3.3V from 5V. This ensures HC-05 circuitry is protected from a high voltage of 5V.

4.4 Battery Power

Power/current requirements for Arduino are low and it can easily be powered for an extended duration from a regular non-rechargeable 9V battery. However, the power/current requirements for DC motors (2 motors in our case) are quite high and the standard 9V battery may get discharged within 30mins or less. Therefore, using a rechargeable battery is better. Below are some battery options which can be considered for this project.

1. Rechargeable 9V Battery
2. Pair of 18650 Lithium-Ion Batteries used in series
3. Non-rechargeable options like non-rechargeable 9V battery or 4x AA/AAA 1.5V cells in series for limited time operation

Also, 2 separate batteries, one for powering the motors and one for powering Arduino (and HC-05 via Arduino's 5V supply) can also be used.

5 High Level System Interface Diagram

Figure 1 shows a high level system interface diagram.

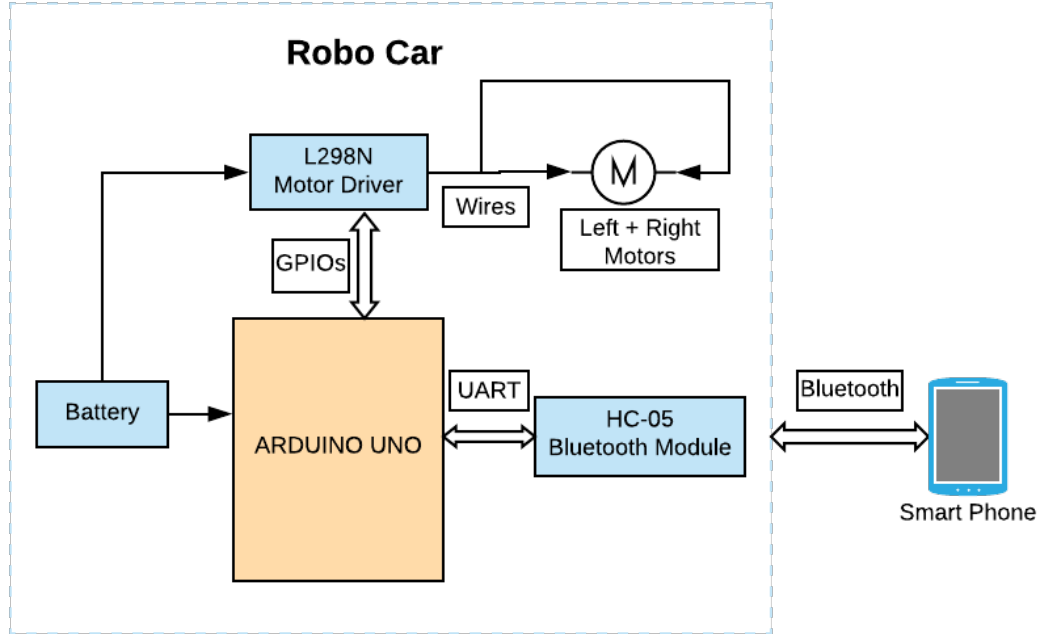


Figure 1: High Level System Interface Diagram

6 Pin Connectivity

Table 2 documents the pin connectivity of Arduino with the different peripherals.

S.No	Arduino	L298N	Hc-05
1	9	IN1	
2	10	IN2	
3	11	IN3	
4	12	IN4	
5	A1		RX
6	A0		TX

Table 2: Pin Connectivity of Arduino with different peripherals

7 Project Demo and Snapshots

Figures 2, 3, 4, 5, 6, 7 show snapshots of the working prototype.

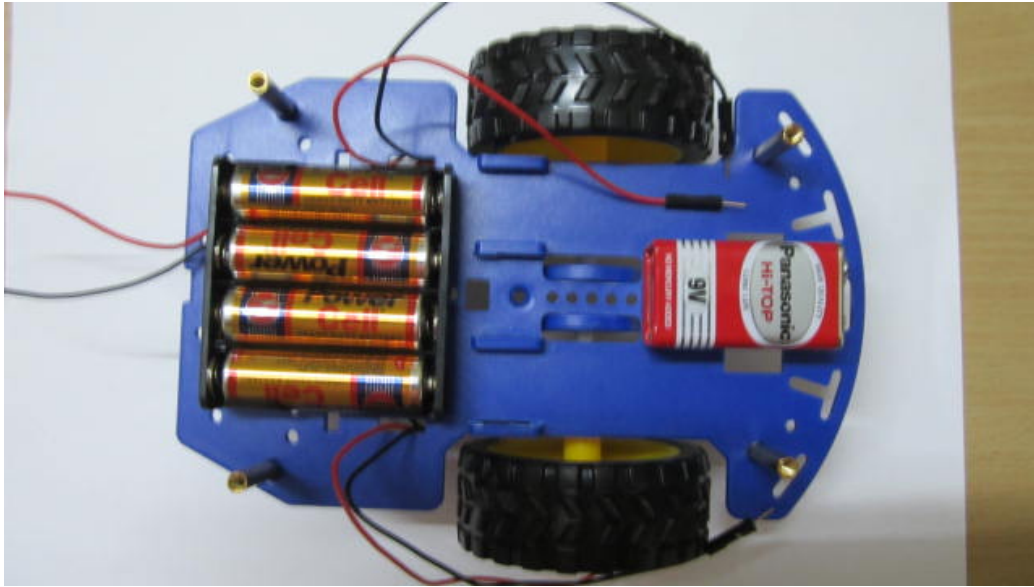


Figure 2: RoboCar Snapshot 1

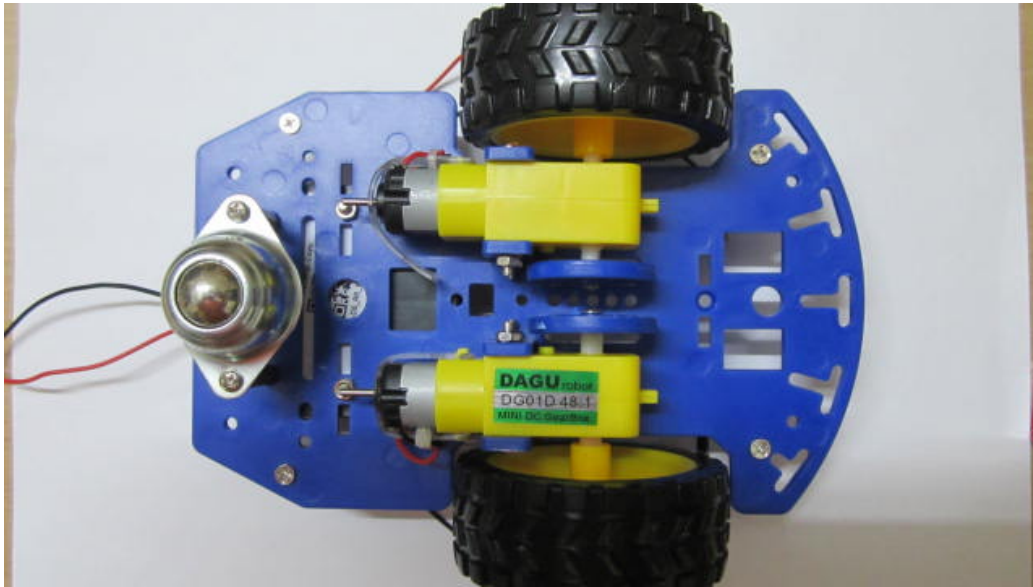


Figure 3: RoboCar Snapshot 2

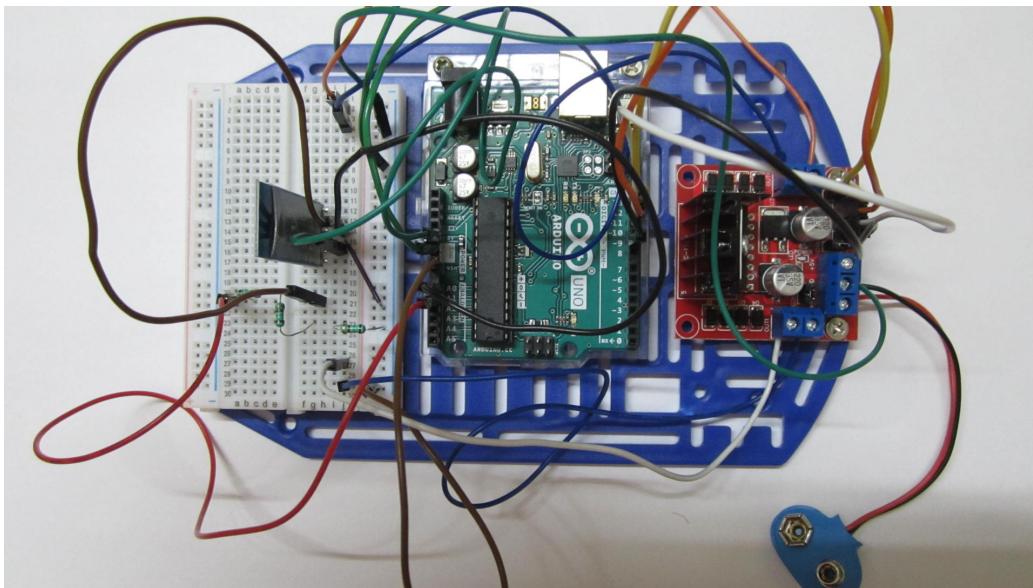


Figure 4: RoboCar Snapshot 3

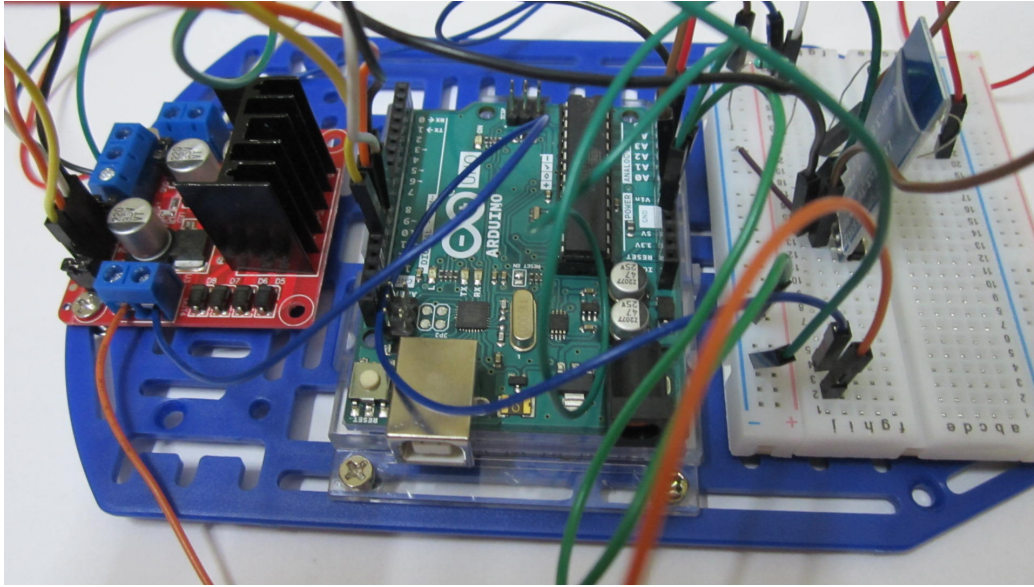


Figure 5: RoboCar Snapshot 4

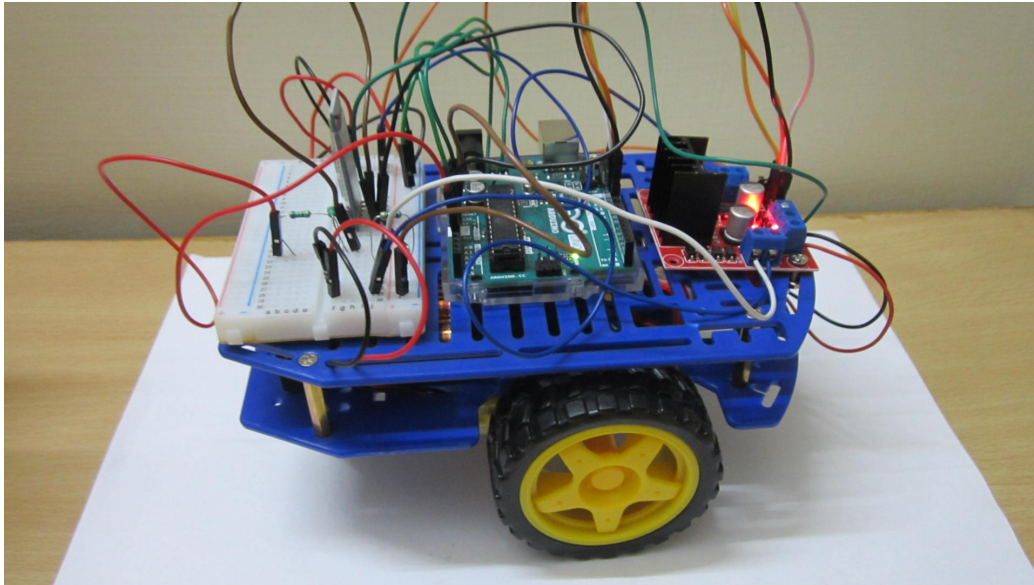


Figure 6: RoboCar Snapshot 5

8 Important Notes and Learnings

Important notes and learnings from the project are captured in this section.

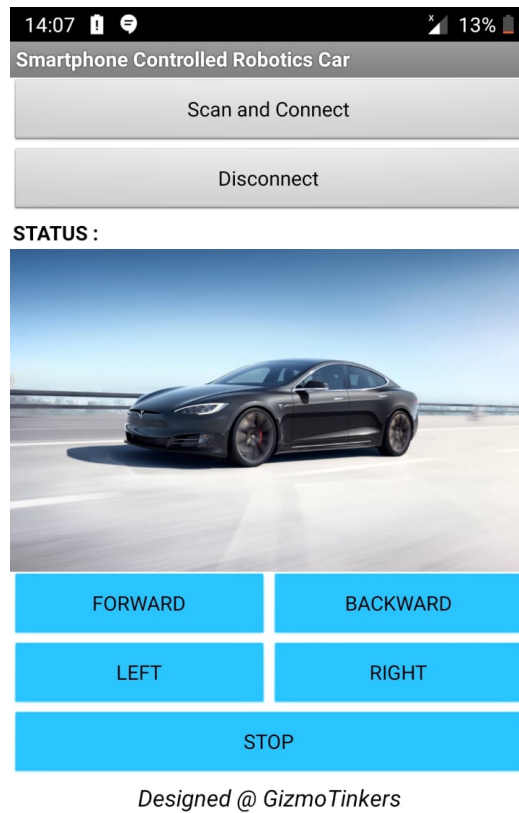


Figure 7: Android App for Controlling the Car

1. It is better to use rechargeable batteries for powering the motors since unlike Arduino, motors draw much higher current and drain batteries much quicker. A pair of rechargeable 3.7V 18650 Lithium-Ion Batteries used in series is a good option.

We however used non-rechargeable batteries in this project but will upgrade to rechargeable batteries for future car projects.

9 Contact Information

If you have any questions or need help in building this project, please feel free to reach out by sending me an email at vasu.gupta9@gmail.com