

Collision Avoidance Robotics Car (Doc Version 1.0)

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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 which can autonomously move around an area while avoiding collisions.

Project uses the Arduino microcontroller along with sensors like ultrasonic distance sensor, servo motor and L298N motor driver module. Ultrasonic distance sensor is mounted on top of the servo motor and by programmatically rotating the servo motor in different directions, distances to obstacles around the car can be obtained.

This project is 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. Robots for serving food in functions and parties can also be designed using these concepts.

3 Bill of Materials

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

1. Arduino Uno Rev3 Board
2. Motor Driver Module L298N
3. Micro Servo Motor
4. Ultrasonic Sensor Module HC-SR04
5. 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)
6. Breadboard, Connecting wires - male-to-male, male-to-female
 7. Battery (2x 18650 cells in series) and battery holder

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 Micro Servo Motor

A micro servo motor is useful for a controlled rotation/movement. This project uses a micro servo motor for rotating the ultrasonic sensor module mounted on top of the servo motor. This enables sensing distances to obstacles in front, left and right side of the car using a single ultrasonic module by rotating it in different directions.

4.4 Ultrasonic Sensor Module

Ultrasonic Sensor Module HC-SR04 is used in this project and helps provide distances to obstacles in front of it. It is also very easy to use and interface with Arduino. NewPing API library is used in this project for finding distances using the HC-SR04 module. Figure 1 shows the interface connections between Arduino and Ultrasonic module used in this project.

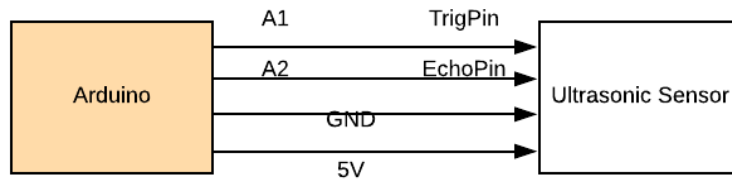


Figure 1: Interface Connections between Arduino and Ultrasonic Sensor Module HC-SR04

4.5 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. This project uses a pair of rechargeable 18650 Lithium-Ion Batteries connected in series to power the complete system.

5 High Level System Interface Diagram

Figure 2 shows a high level system interface diagram.

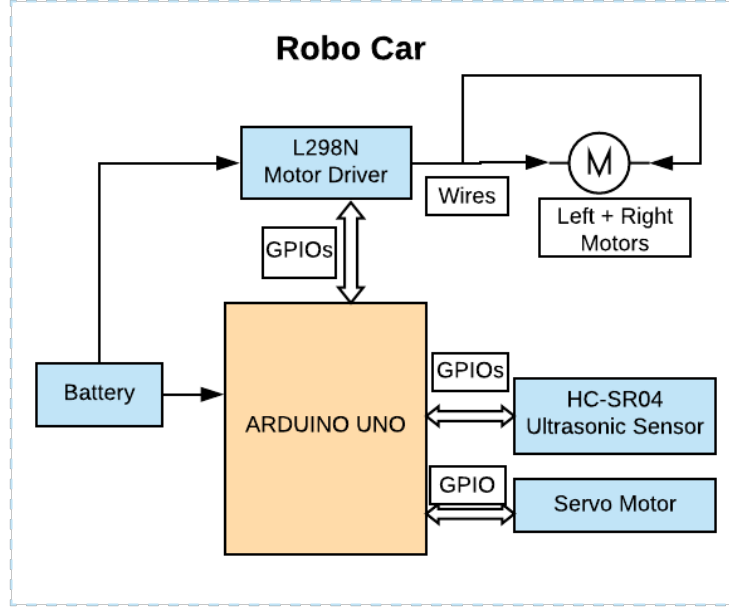


Figure 2: High Level System Interface Diagram

6 Pin Connectivity

Table 2 documents the pin connectivity of Arduino with the different peripherals. L298N refers to the motor driver module. HC-SR04 refers to the ultrasonic sensor module.

S.No	Arduino	L298N	HC-SR04	Servo Motor
1	9	IN1		
2	10	IN2		
3	11	IN3		
4	12	IN4		
5	A0			SIG
6	A1		Trig Pin	
7	A2		Echo Pin	

Table 2: Pin Connectivity of Arduino with different peripherals

7 Project Demo and Snapshots

Figures 3, 4, 5, 6, 7 show snapshots of the working prototype. [Link to Demo Video - \(LINK\)](#) .

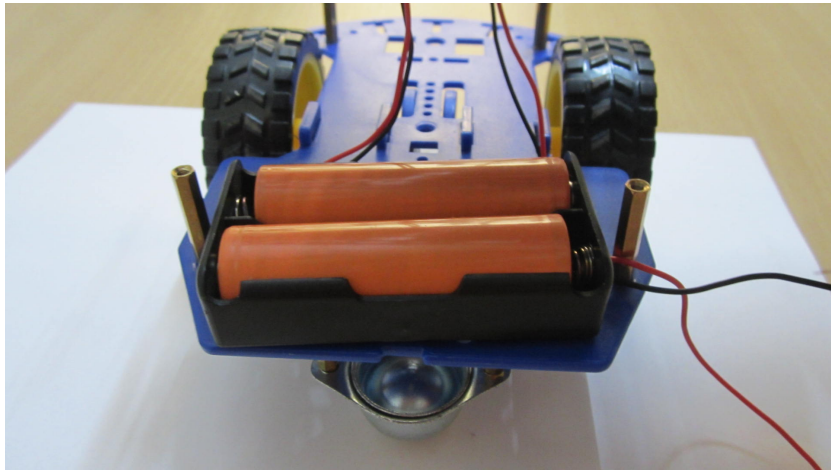


Figure 3: RoboCar Snapshot 1

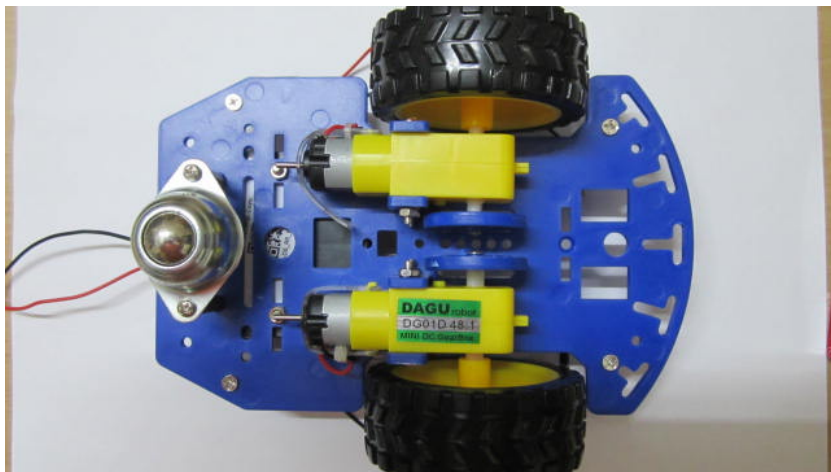


Figure 4: RoboCar Snapshot 2

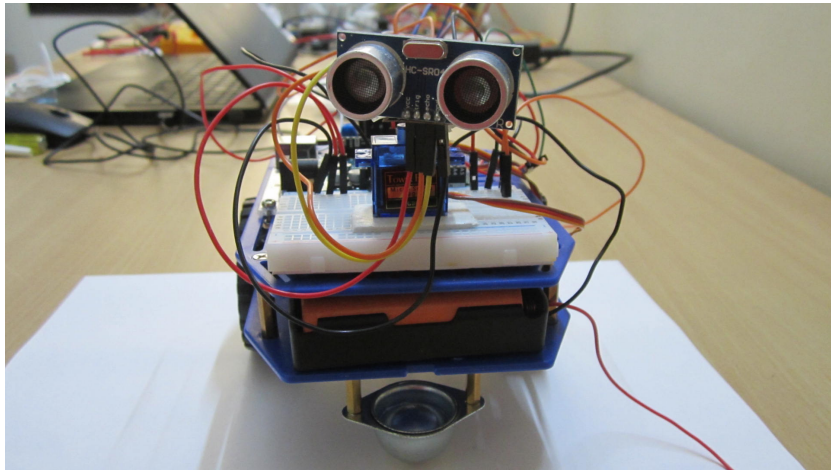


Figure 5: RoboCar Snapshot 3

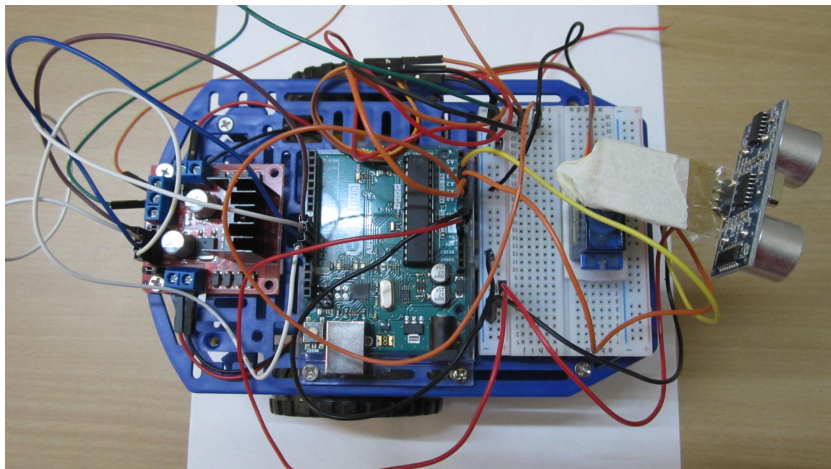


Figure 6: RoboCar Snapshot 4

8 Important Notes and Learnings

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

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.

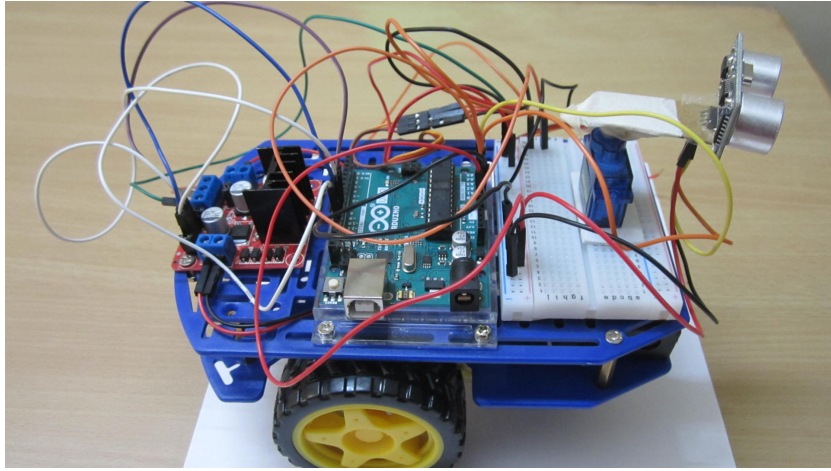


Figure 7: RoboCar Snapshot 5

2. An ultrasonic sensor mount for attaching the ultrasonic sensor to servo motor is useful in making the system more sturdy.

9 Contact Information

If you have any questions or need help in building this project, please feel free to reach out to us by messaging us on Facebook ([LINK](#)), or through the message option on our website ([LINK](#)) or sending me an email at vasu.gupta9@gmail.com