DESIGN WITH MICROPROCESSORS

Bluetooth-Controlled Car Robot

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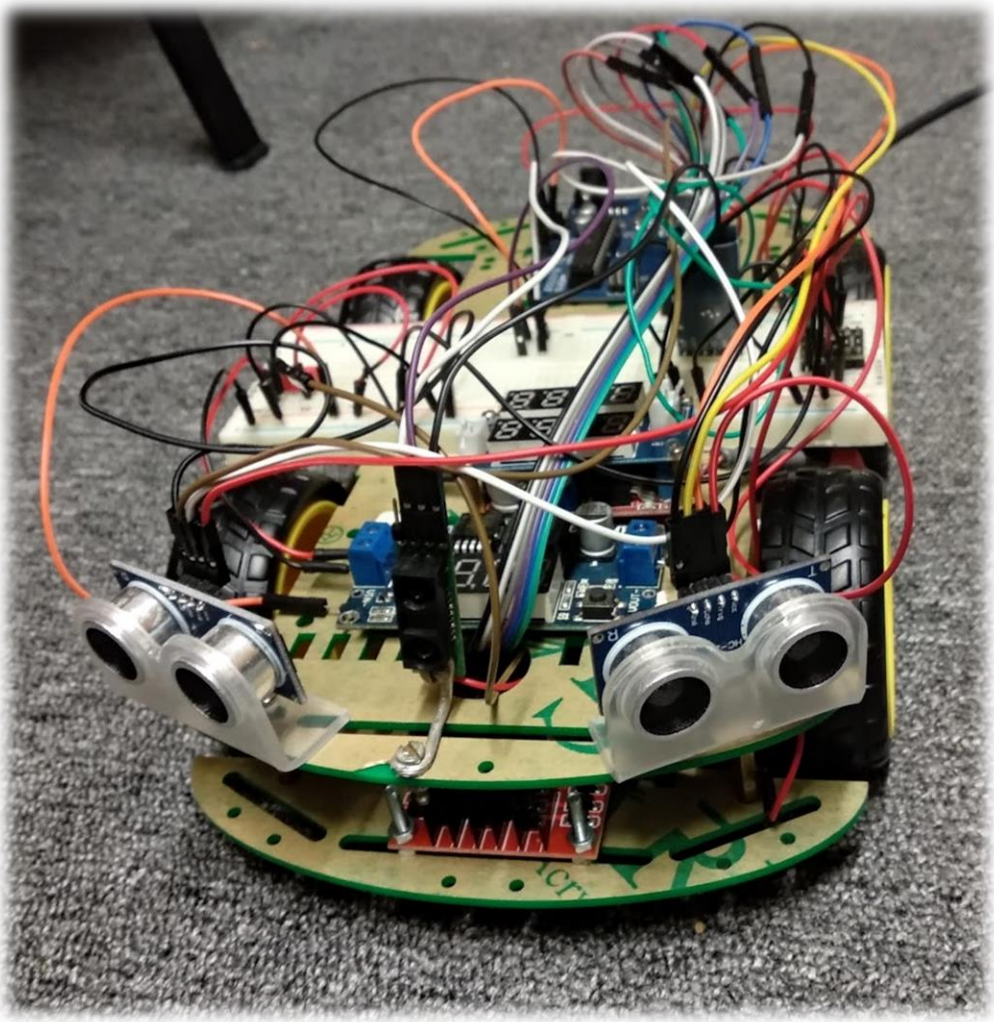
The main circuit consists of:

- Arduino UNO Rev3
- L298N Dual Motor Controller Module 2A (H-Bridge)
- 4 DC Motors 3V-6V
- 2 Ultrasonic Ranging Modules HC - SR04
- HC-05 Bluetooth Module
- Optical Distance Sensor
- 20V to 12V DC Converter
- 12V to 3.3V DC Converter



The components are assembled on a chassis together with 4 wheels and a breadboard, using jumper wires.

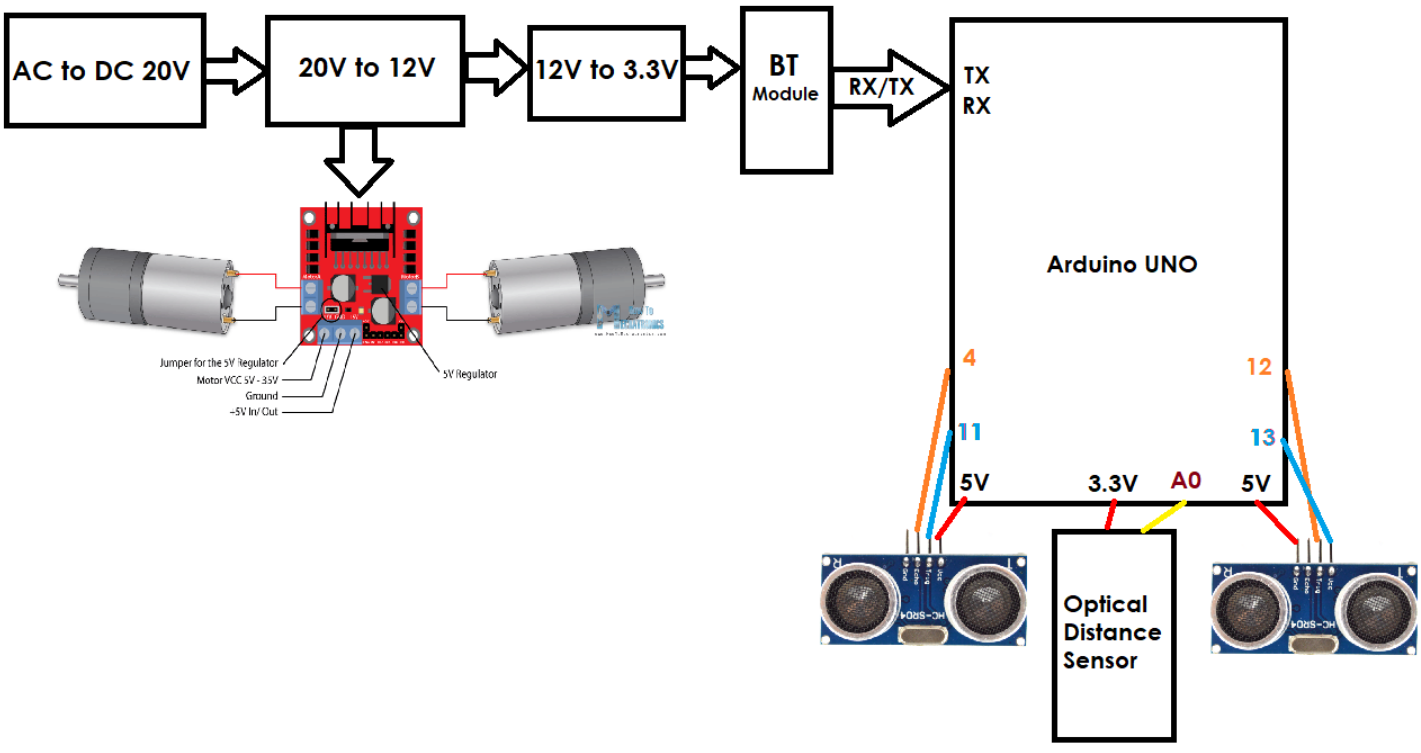
There is a main AC/DC converter which outputs a value of 20V. This component is connected to another converter on-board which outputs 12V for the motors. The last convertor receives this value and converts it to 3.3V, powering the Bluetooth module.

All the sensors are connected to VCC on the breadboard (5V coming from the Arduino Board).

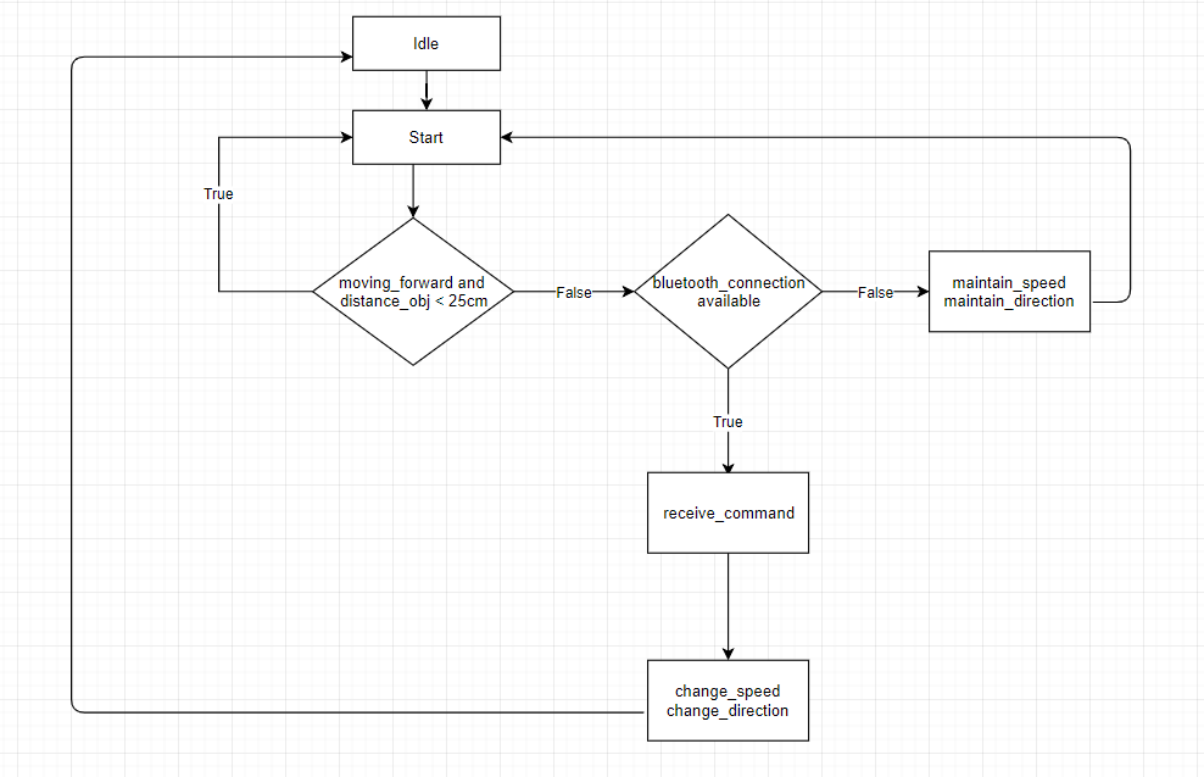
The motors are controlled through the L298N Dual Motor Controller Module 2A.

The distance read by the optical sensor comes out as an analogue signal read by the A0 pin.

Top-Level View



State Machine Flowchart



Description

```
#include <SoftwareSerial.h>
#define rx 3
#define tx 2

#define trigPinR 11
#define echoPinR 4
#define trigPinL 13
#define echoPinL 12

#define dirPin A0
```

The SoftwareSerial library, along with the rx and tx pins, are used in communication with the Bluetooth module. The next 4 bits are used for the HC-SR04 sensors, and A0 is used as input pin for the optical distance sensor.

Function *engineA,* along with its counterpart *engineB*, makes the motor move by writing to the analog pin the motor is connected to, the desired speed which is given as parameter. The *way* variable is a Boolean which represents the direction of movement. When *way* is true, the robot moves forward, and when *way* is false, the robot moves backwards.

long readDistance(bool side)

This function is used to compute the distance a the HC-SR04 reads. The *side* parameter chooses between the left and the right sensor on the robot. The transmitter (trig pin) sends a signal: a high-frequency sound. When the signal finds an object, it is reflected and the receiver (echo pin) receives it. The time between the transmission and reception of the signal allows us to know the distance to an object. This is possible because we know the sound's velocity in the air.

```
if (way && currSpeed != 0 && (readDistance(true) < 25 || readDistance(false) <
25 || dist < 25))
 {
  delay(25);
  currSpeed = 0;
  currSpeedA = currSpeedB = currSpeed;
 }
```

As we enter the loop function, we check if any of the three sensor detect any object in a range smaller than 25cm. If so, the robot is not allowed to move forward.

Next, we check if we have received a command through the Bluetooth module. We can receive 5 commands: forward, back, left, right and stop. We use the *way* and *newWay* variables in order to respond smoothly to sudden changes in movement. For example, if the robot is moving forward and we send a *back* signal, the robot will stop instead of starting to move backwards. This results in a more intuitive approach. *wayA* and *wayB* are directly commanding the right and left motors.