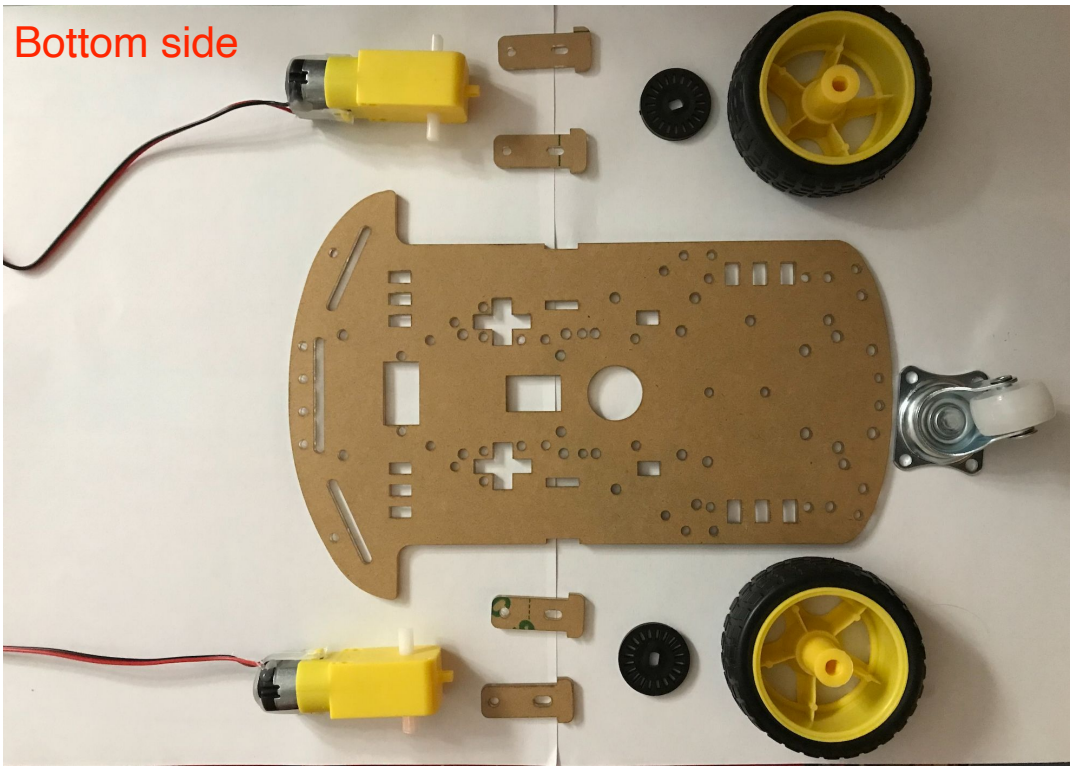
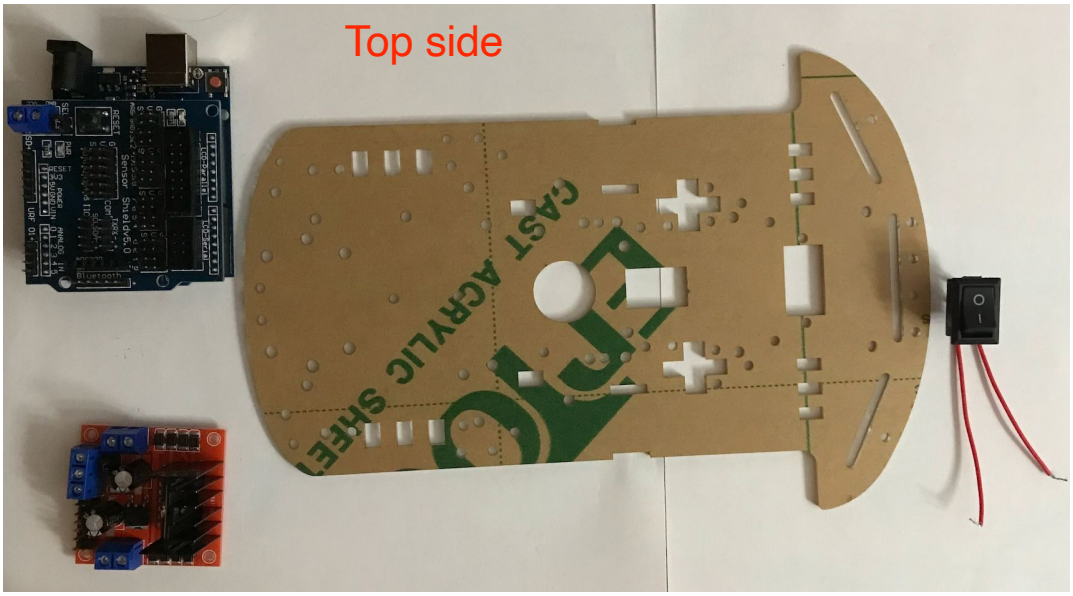
**Pranav Bhounsule**
**Arduino Project: Differential drive car**

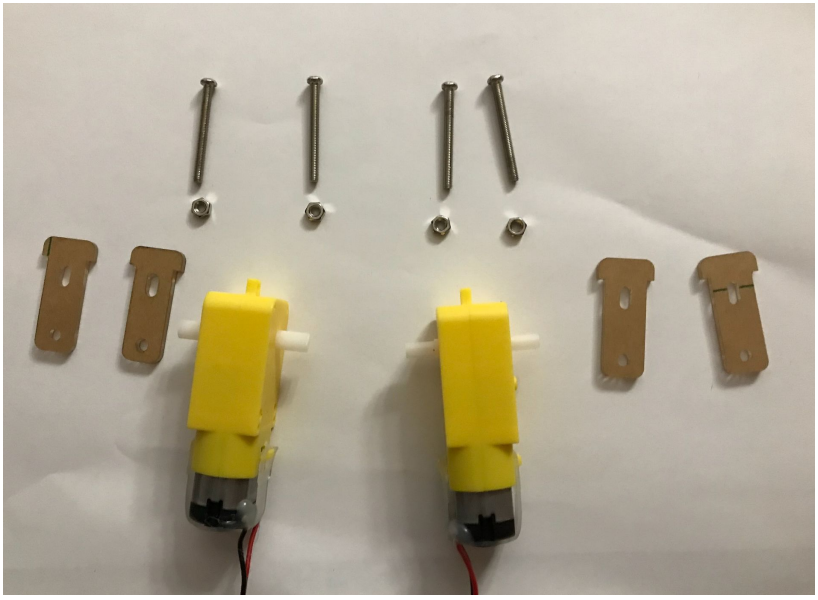
This handout is divided into thee part. First we will assemble the robot chassis, then we will wire it, then write upload Arduino code

A. Mechanical assembly of the robot chassis
The components needed for the bottom and top side are shown.

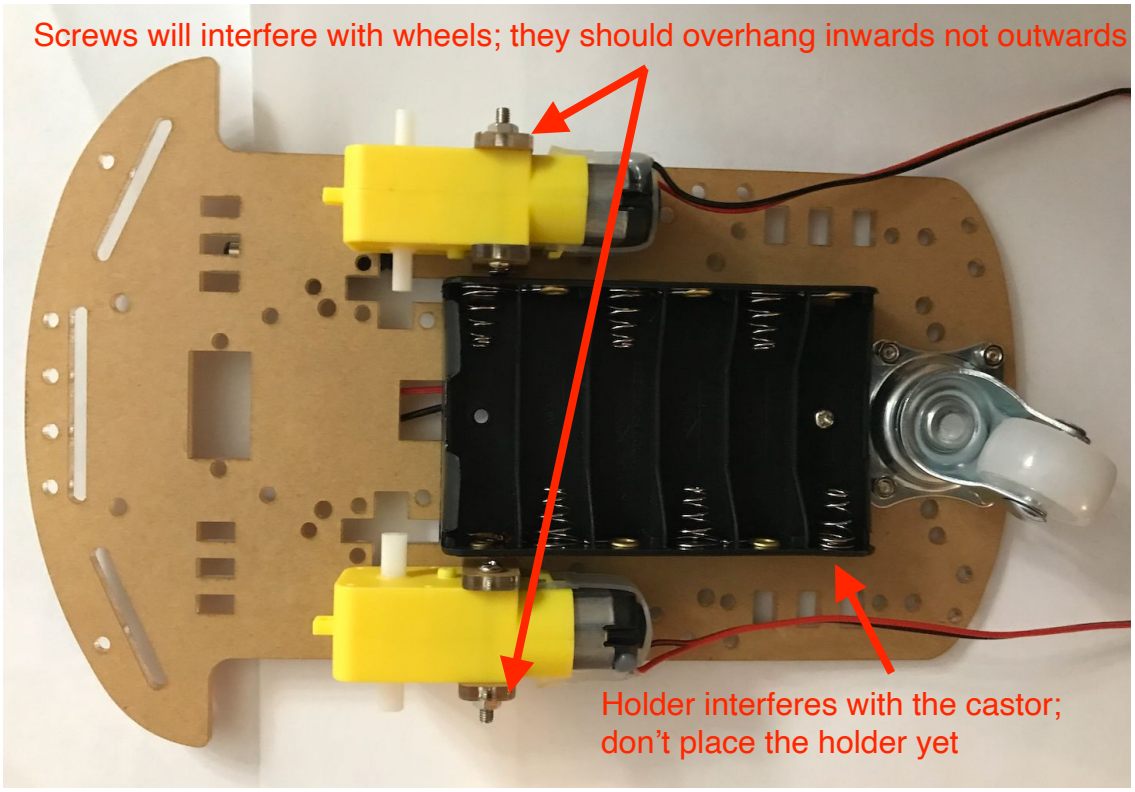


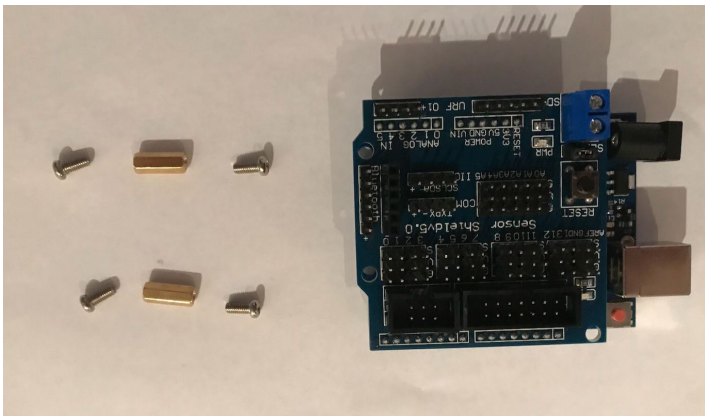
Next, use the following screws for the castor and the motors

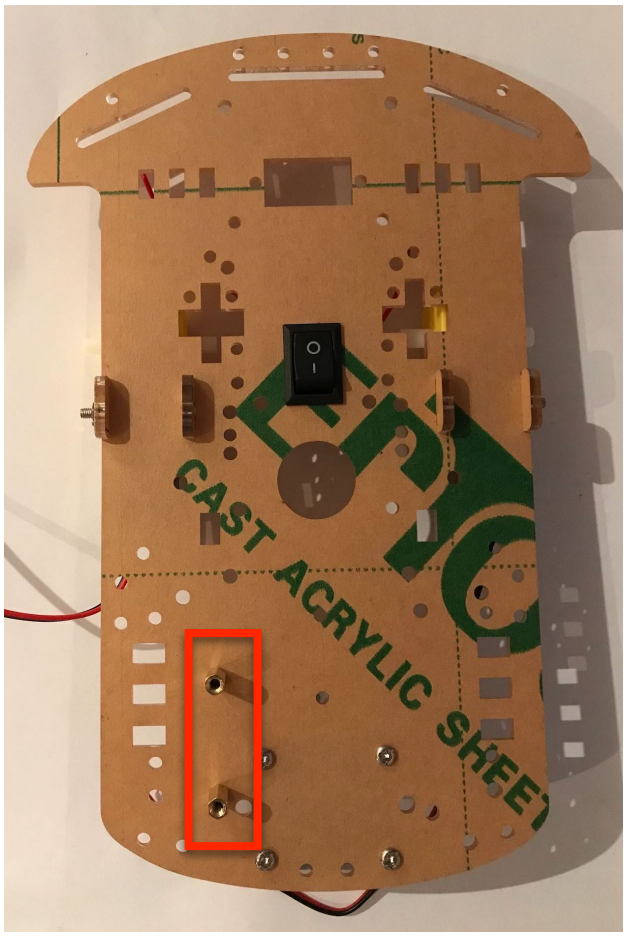


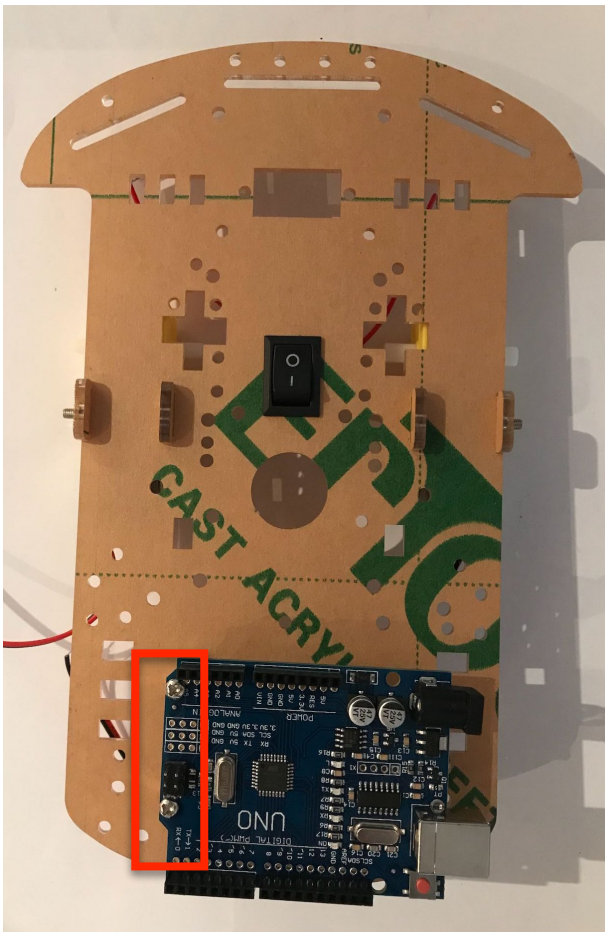
Here is the assembly on the rear end. I made two mistakes that you should avoid which I have addressed in the figure.



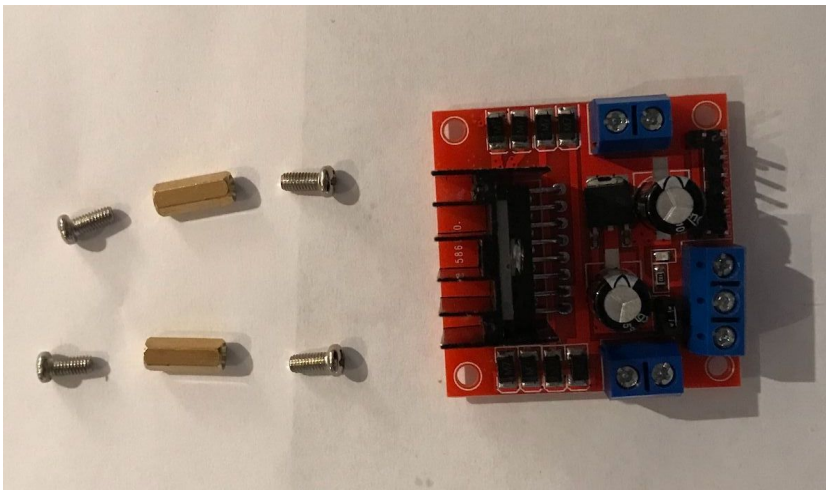
We attach the Arduino using 4 screws and 2 spaces. Because the holes on the plate are not drilled at the right spot, we can only use 2 attachments points for the Arduino.

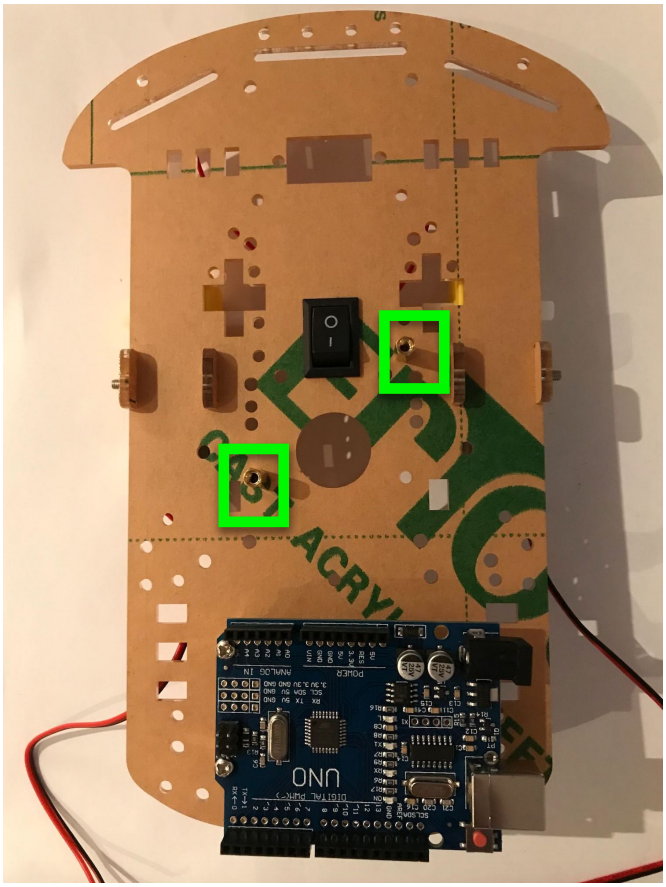


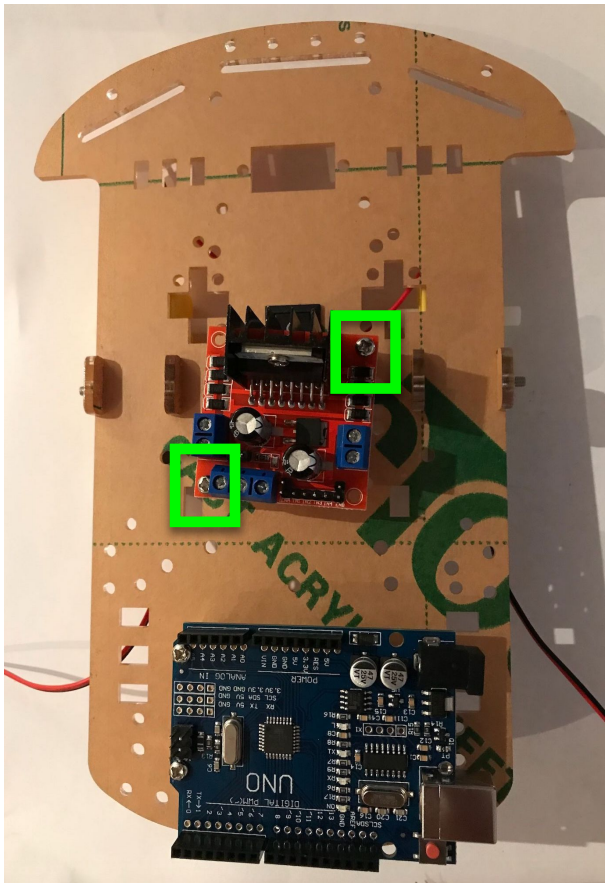


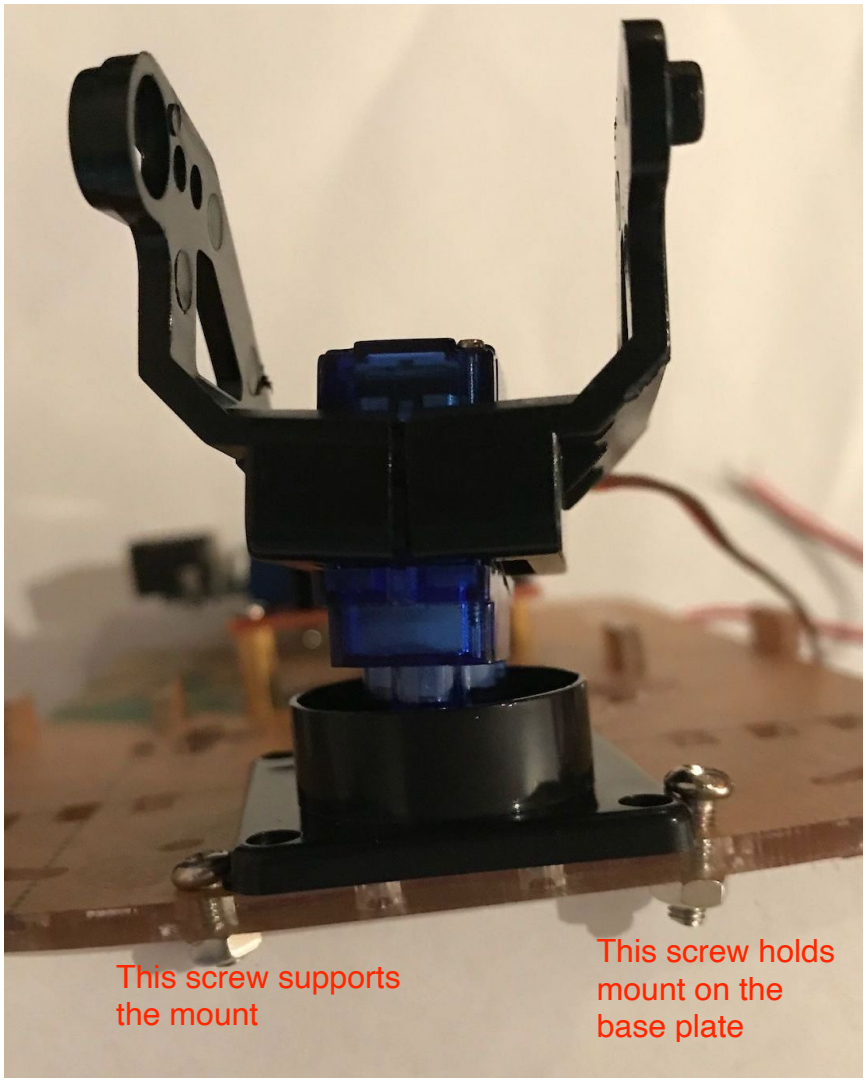
We attach the Motor controller using 4 screws and 2 spaces. Because the holes on the plate are not drilled at the right spot, we can only use 2 attachments points



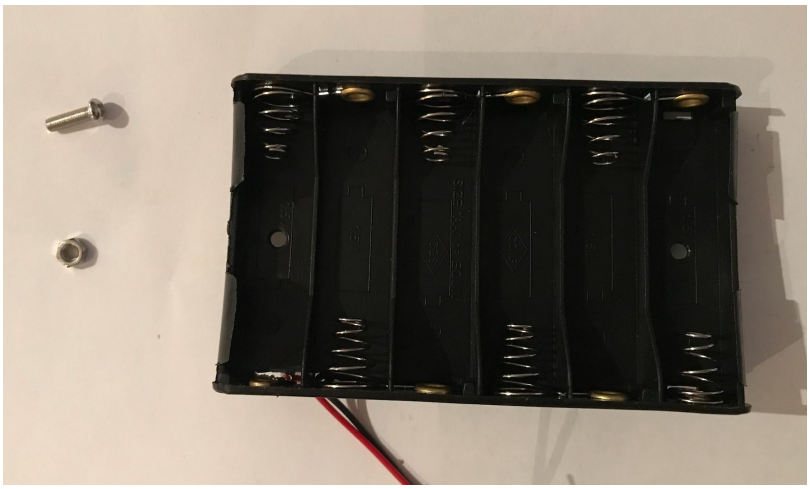


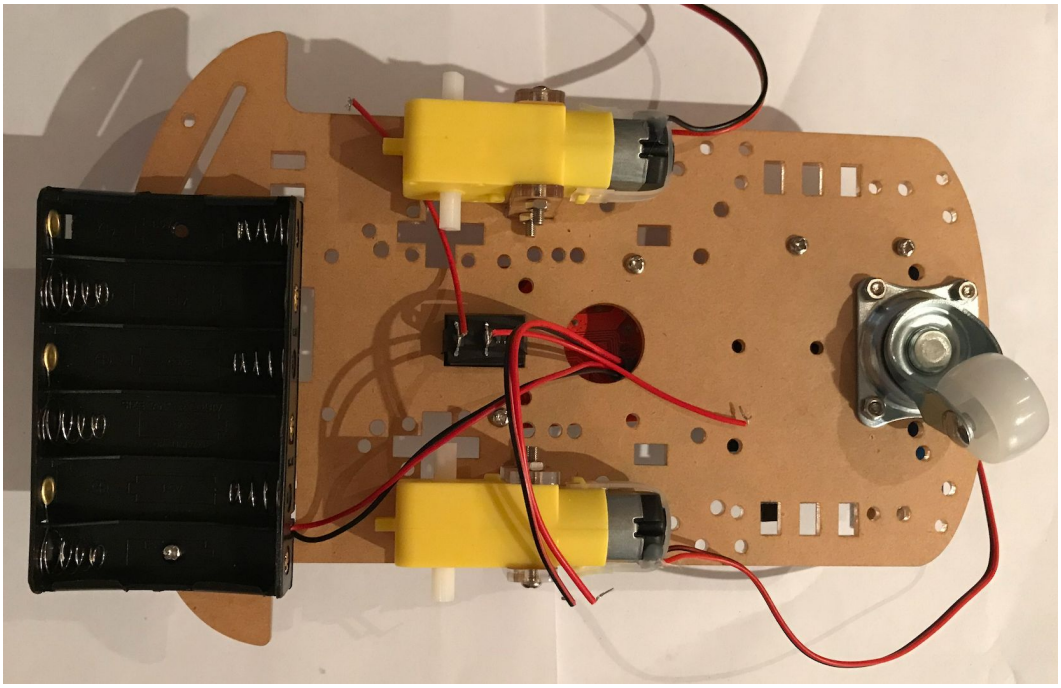


Next, we will mount the ultrasonic sensor and servo motor holder. Unfortunately, there are no holes that align well with the mount so we use two screws to pinch and hold the mount as shown

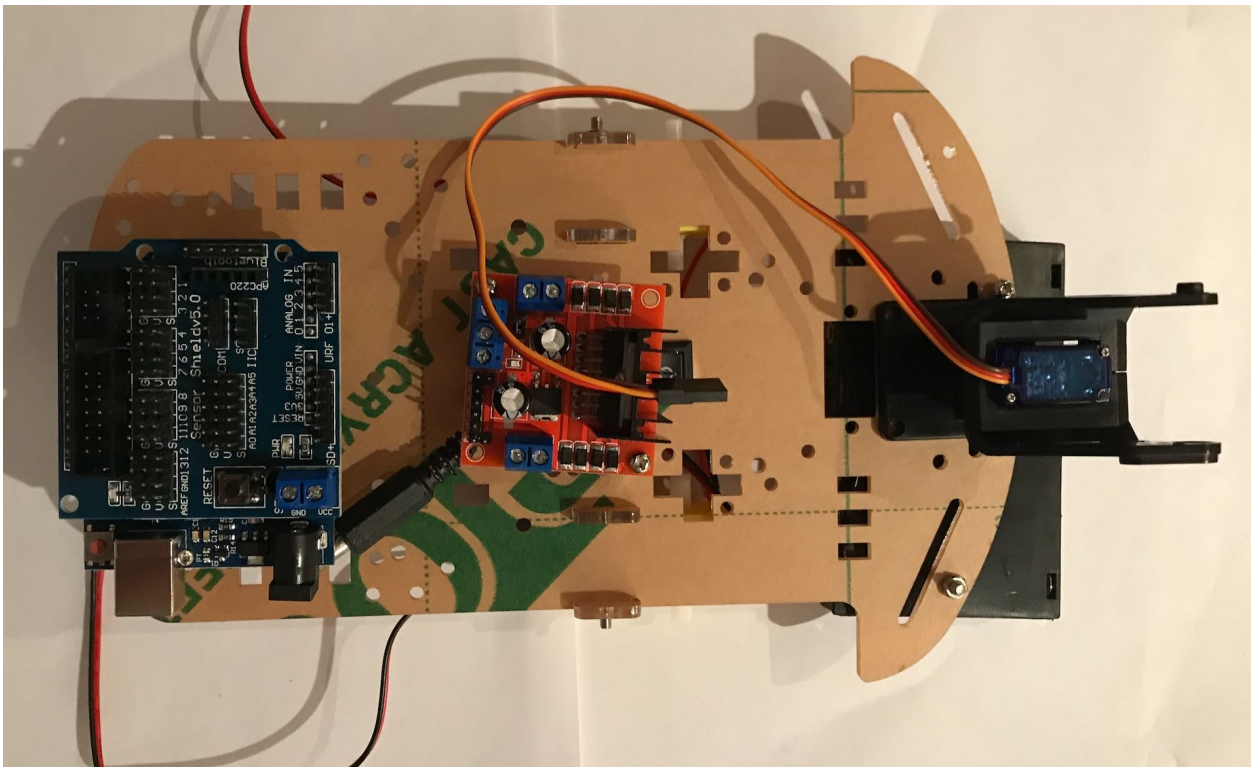


Next, we place the battery holder at the bottom of the base plate

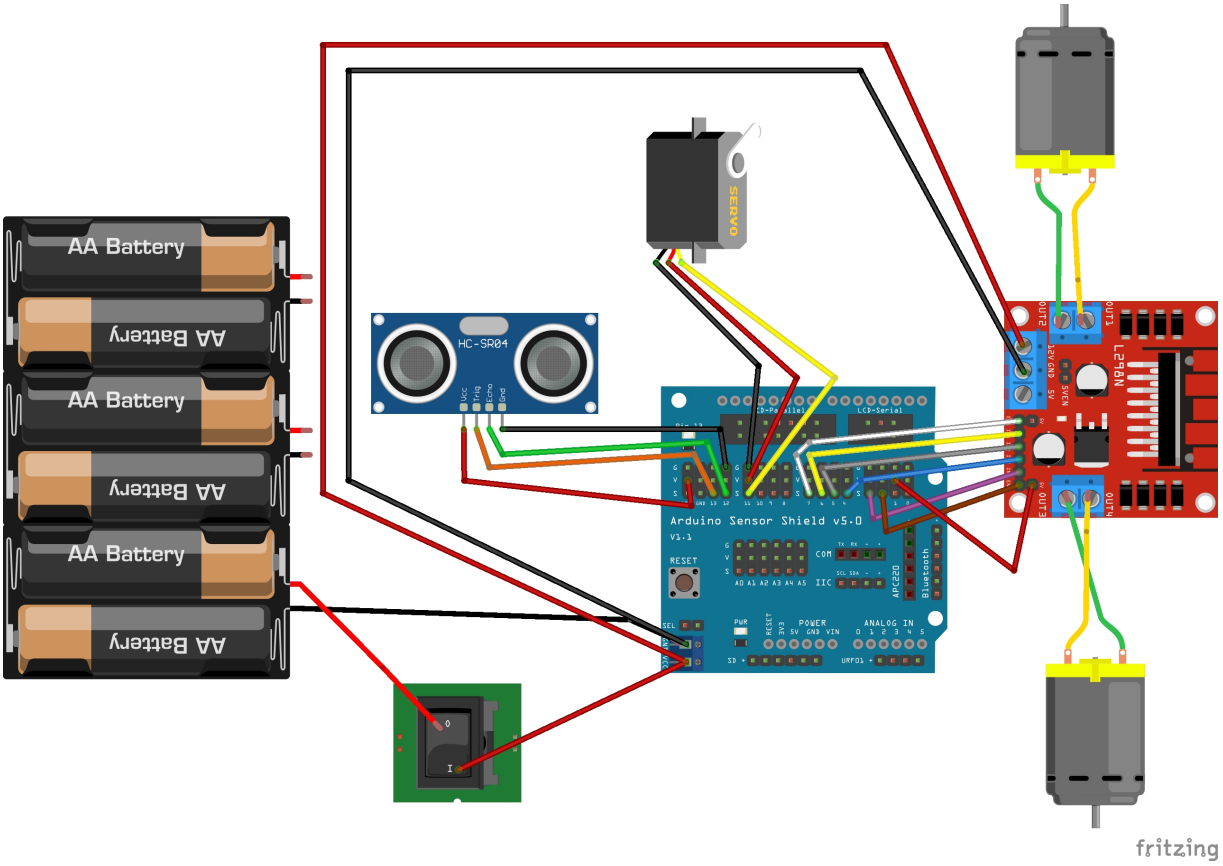




Here is the top view after attaching the mount and the battery holder

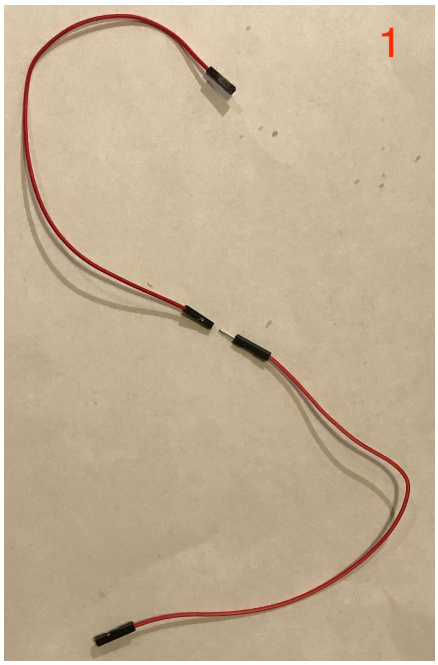


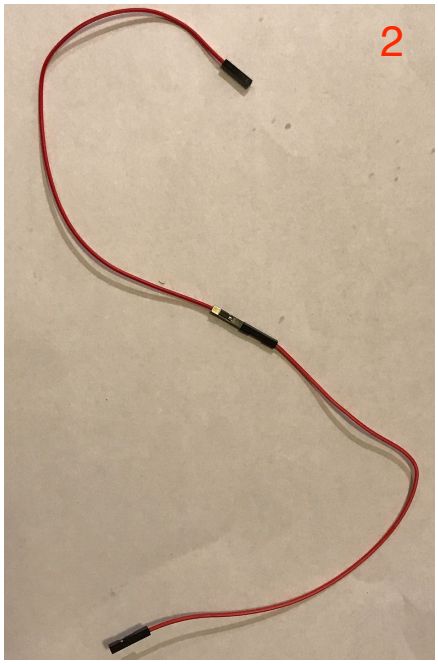
B. Next, we wire the robot together using the circuit diagram shown below.



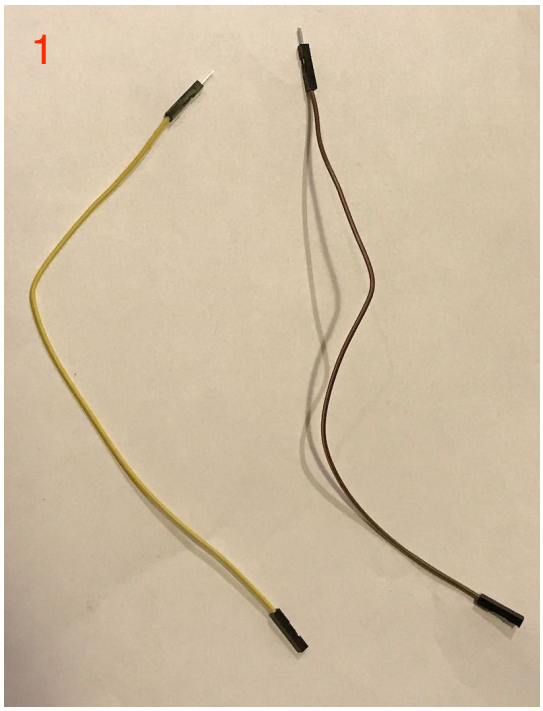
Here are some tips for wiring

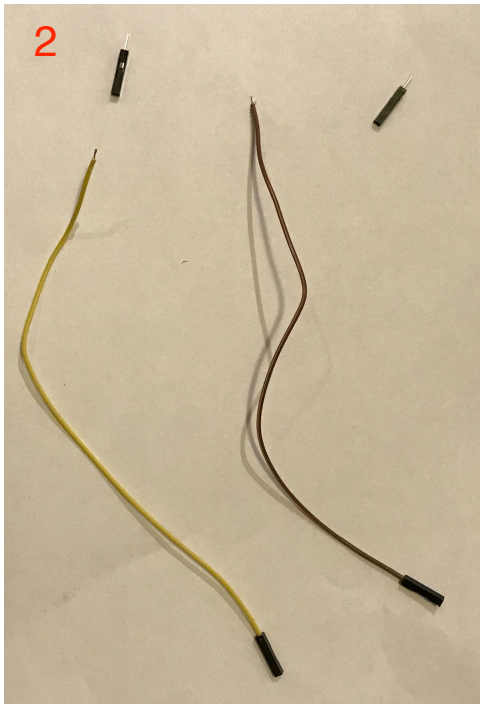
Tip 1: To create lengthy wires to connect the ultrasonic sensor to the sensor shield attach the female/female and male/female wires as shown below

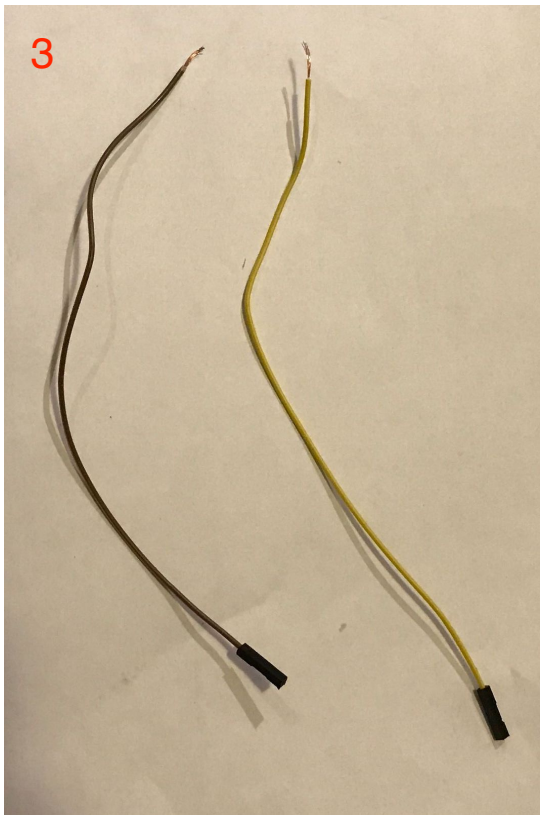


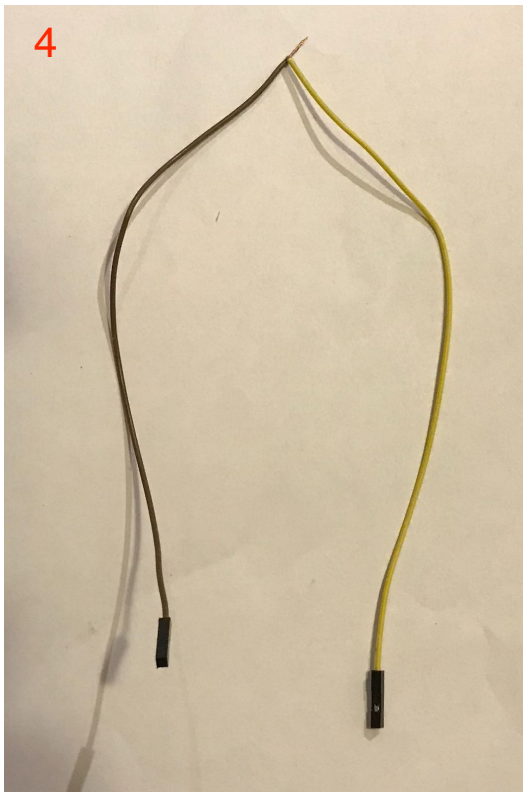



Tip 2: If you are out of wires with female/female connectors then you can combine two wires with female/male to create a female/female wire as shown below

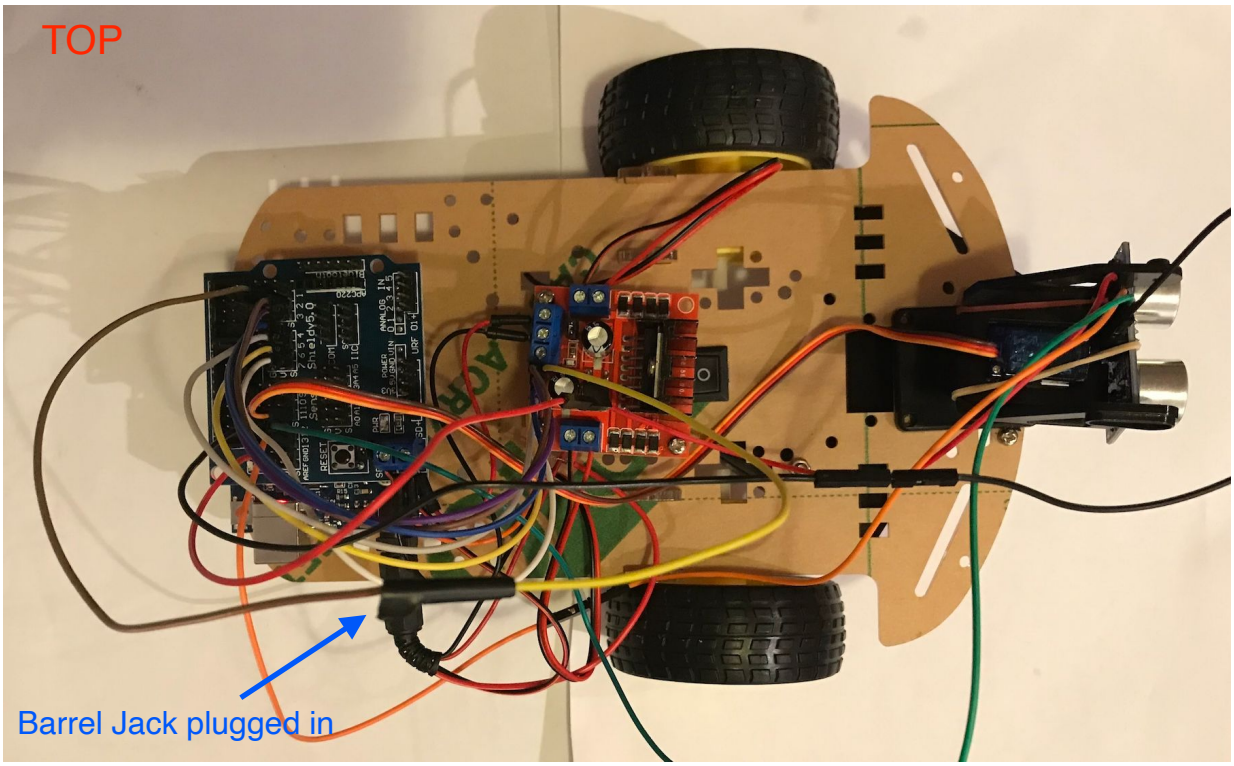


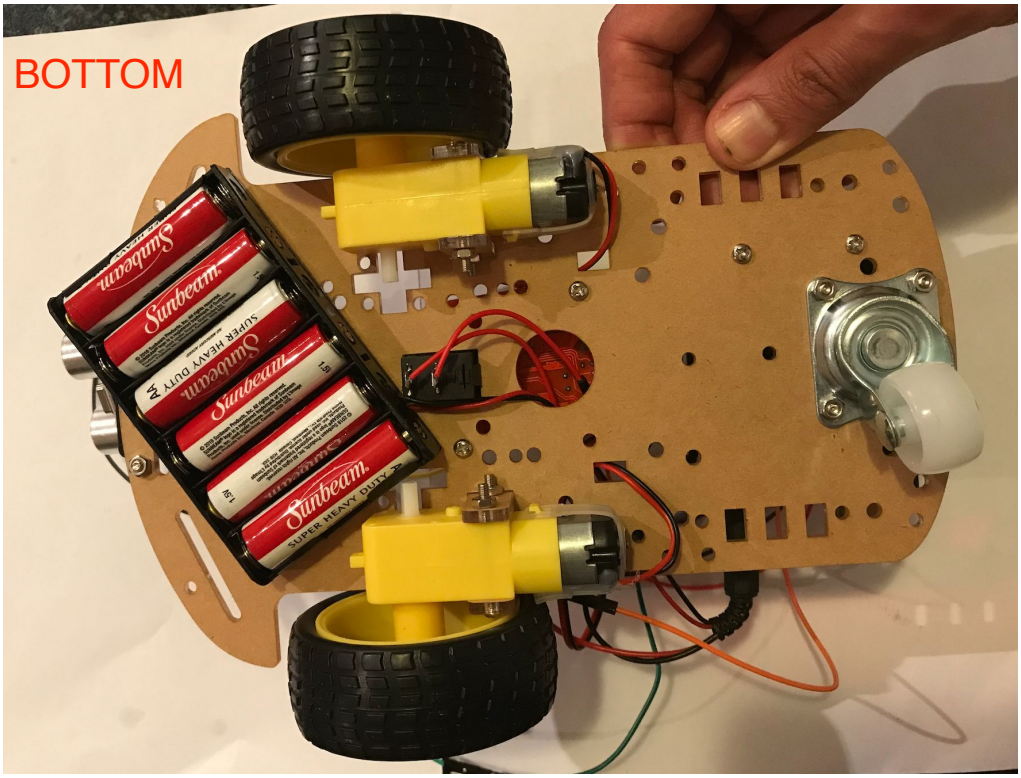



After wiring, putting the batteries in the holder, and attaching the tires, the robot looks like this.



C. Finally, we program the robot using the code below. The code causes the robot motors to spin and the ultrasonic sensor to rotate. It does not do anything intelligent yet. I provide this code as car_basic.ino

```
#include <Servo.h>

// servo stuff
int servoPin = 11;
int pos = 90;    // variable to store the servo position
int dpos = 2;  // increments
int servoDir = 1; //increment
Servo myservo;  // create servo object to control a servo

//ultrasonic stuff
const int trigPin = 13;
const int echoPin = 12;
long duration;
int distance;


// Motor control pins: L298N H bridge
const int enAPin = 2; // Left motor PWM speed control
const int in1Pin = 3; // Left motor Direction 1
const int in2Pin = 4; // Left motor Direction 2
const int in3Pin = 5; // Right motor Direction 1
const int in4Pin = 6; // Right motor Direction 2
const int enBPin = 7; // Right motor PWM speed control

void check_obstacles()
{
  pos+=servoDir*dpos;
  myservo.write(pos);
  delay(15);
  if (pos>=180)
  {
   servoDir = -1;
  }
  else if(pos<=0)
  {
   servoDir = +1;
  }
  distance = read_distance();
  Serial.print("Distance: ");
  Serial.println(distance);
}
```

```
long read_distance()
{
  // Clears the trigPin
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);

  // Sets the trigPin on HIGH state for 10 micro seconds
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Reads the echoPin, returns the sound wave travel time in microseconds
  duration = pulseIn(echoPin, HIGH);

  // Calculating the distance
  distance= duration*0.034/2;

  // Prints the distance on the Serial Monitor
//  Serial.print("Distance: ");
//  Serial.println(distance);

  return distance; //returns the distance
}

void motorLeft(int dir, int speed)
{
  if (dir==1)
  {
  digitalWrite(in1Pin,HIGH);
  digitalWrite(in2Pin,LOW);
  }
  else
  {
  digitalWrite(in1Pin,LOW);
  digitalWrite(in2Pin,HIGH);
  }
  analogWrite(enAPin,speed); //needs more than 150 to work
}

void motorRight(int dir, int speed)
{
  if (dir==1)
  {
  digitalWrite(in3Pin,HIGH);
  digitalWrite(in4Pin,LOW);
  }
```

```
  else
  {
  digitalWrite(in3Pin,LOW);
  digitalWrite(in4Pin,HIGH);
  }
  analogWrite(enBPin,speed); //needs more than 150 to work
}

void setup() {
  //servo stuff
  myservo.attach(servoPin);
  myservo.write(pos); //might need calibration

  //ultrasonic stuff
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input

  Serial.begin(9600); // Starts the serial communication

  //motor stuff
  pinMode(enAPin, OUTPUT);
  pinMode(in1Pin, OUTPUT);
  pinMode(in2Pin, OUTPUT);
  pinMode(in3Pin, OUTPUT);
  pinMode(in4Pin, OUTPUT);
  pinMode(enBPin, OUTPUT);

}

void loop() {
  check_obstacles();

  //go forward
  motorLeft(-1,150);
  motorRight(-1,150);
  delay(500);

   //stop
  motorLeft(1,0);
  motorRight(1,0);
   delay(500);

  //go backward
  motorLeft(1,150);
  motorRight(1,150);
   delay(500);
```

```
    //stop
  motorLeft(1,0);
  motorRight(1,0);
   delay(500);

  //go left
  motorLeft(1,150);
  motorRight(-1,150);
   delay(500);

    //stop
  motorLeft(1,0);
  motorRight(1,0);
   delay(500);

  //go right
  motorLeft(-1,150);
  motorRight(1,150);
   delay(500);

 //stop
  motorLeft(1,0);
  motorRight(1,0);
   delay(500);

}
```

Here is a video of the robot
https://youtu.be/69PimkwdvYA

**Exercise:**
Create an obstacle avoidance car.
Here is a video of what that might look like
https://youtu.be/gTemenSm1XQ (10 seconds)
https://youtu.be/l2PdLCVFFyo (30 seconds)