Electronics I
Project #2
H-bridge BB8 design
December 6, 2019

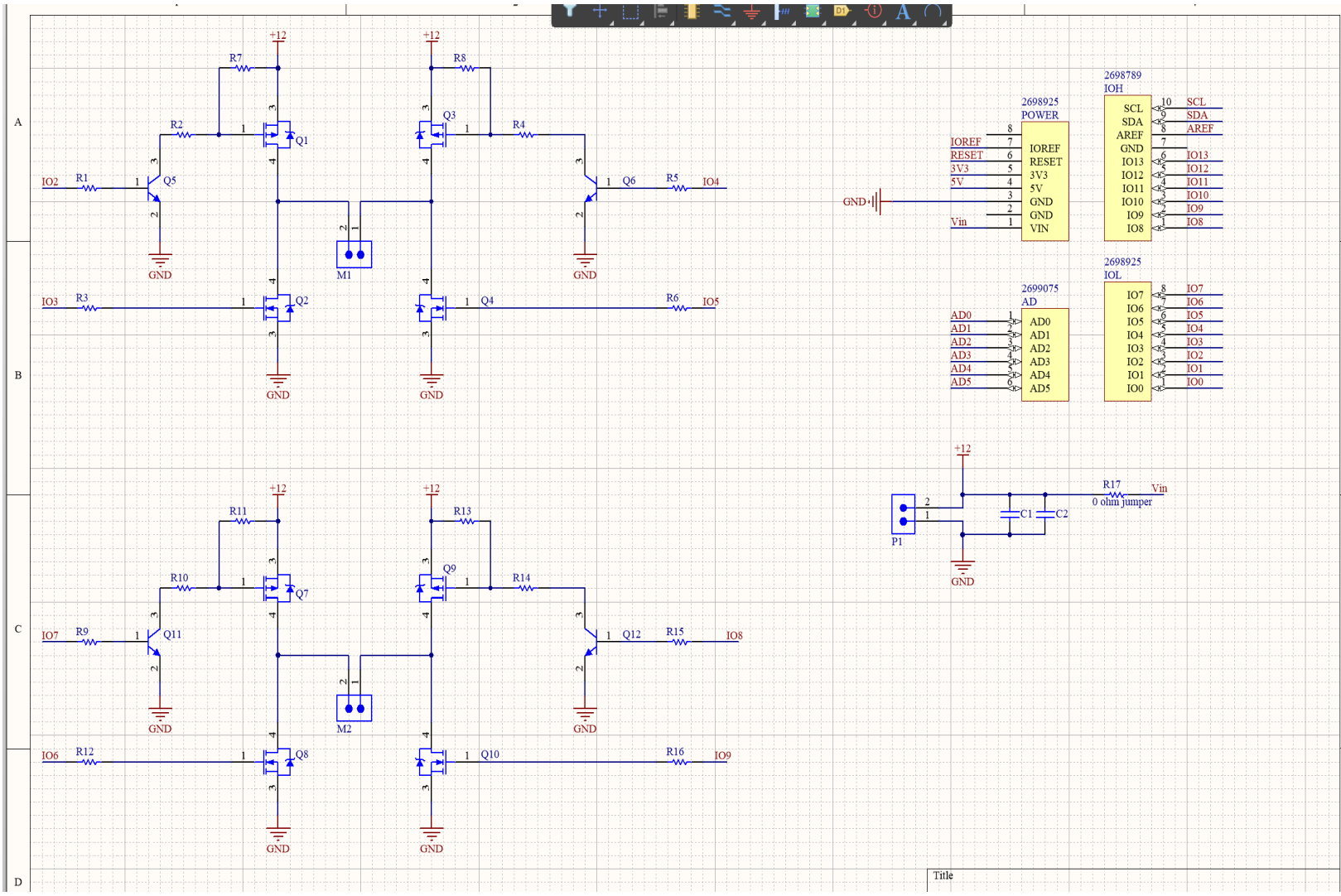
Zain Ahmed, Mohit Patel

Introduction:

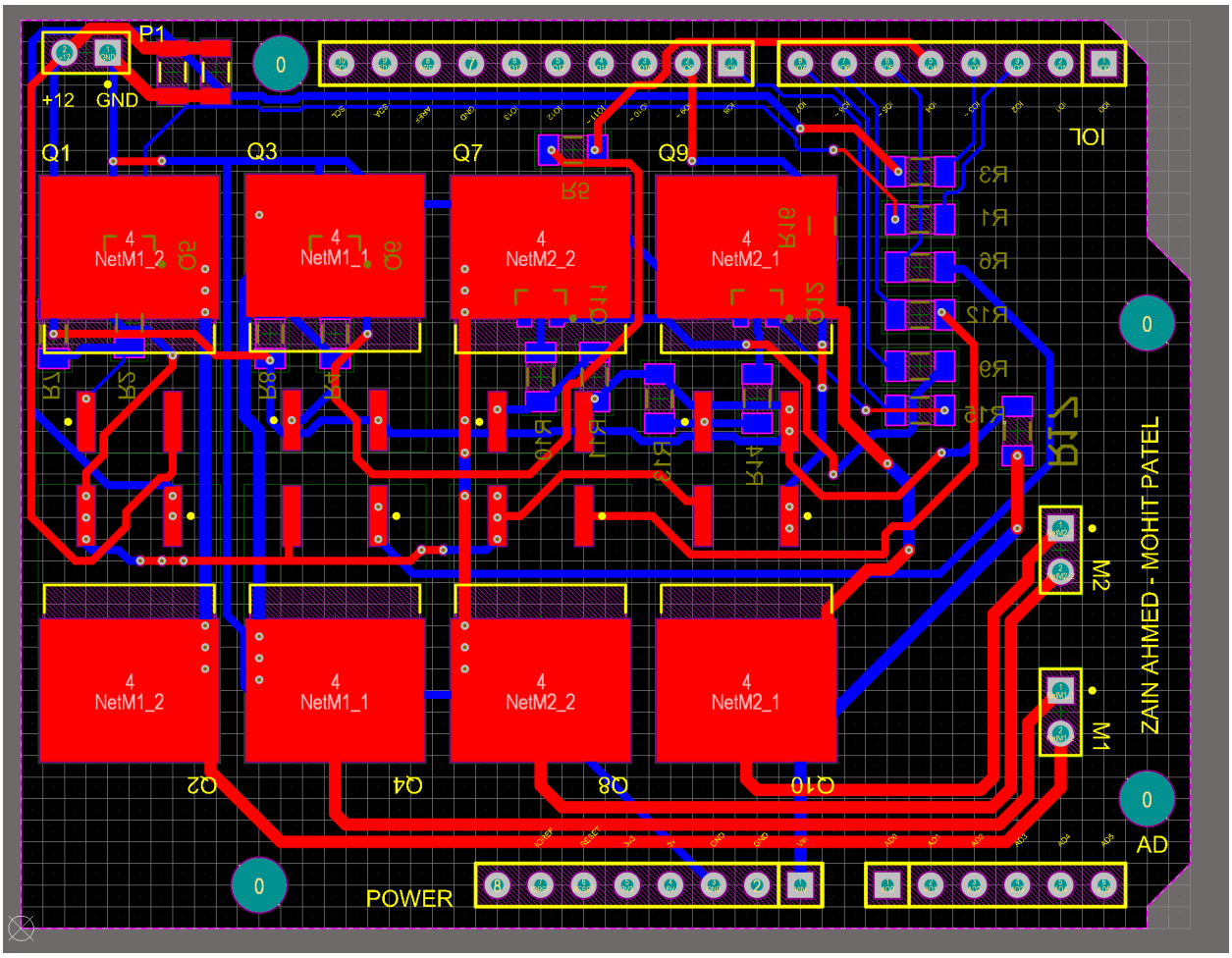
The main purpose of this project is to design and create a printed circuit board that is equivalent to a motor driver and can be used to drive two motors at the same time. This motor driver can be used to control two motors that will act as legs for the BB8. We are given STL files of the 3d printed components that are required for this project. One of the components is called chassis, the chassis hold the arduino unit and the motor controller shield, as well as the two motors with wheels attached to them.

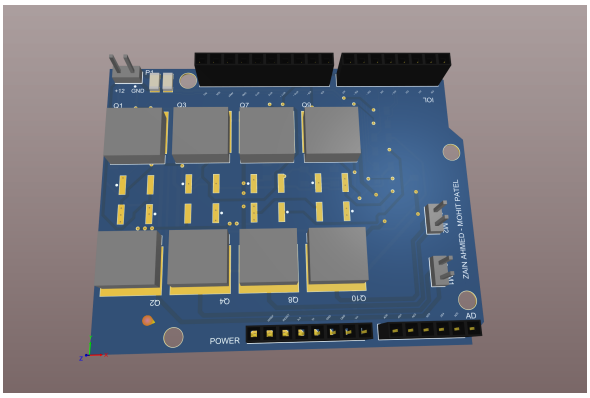
Design:

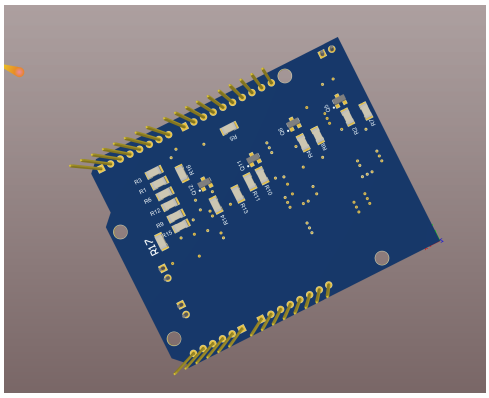
The first step, to get our motor controls shield, is to make a schematic of the H-bridge circuit along with chosen resistors to have the ability to spin the motors in any direction. The picture below shows the general schematic of our design.



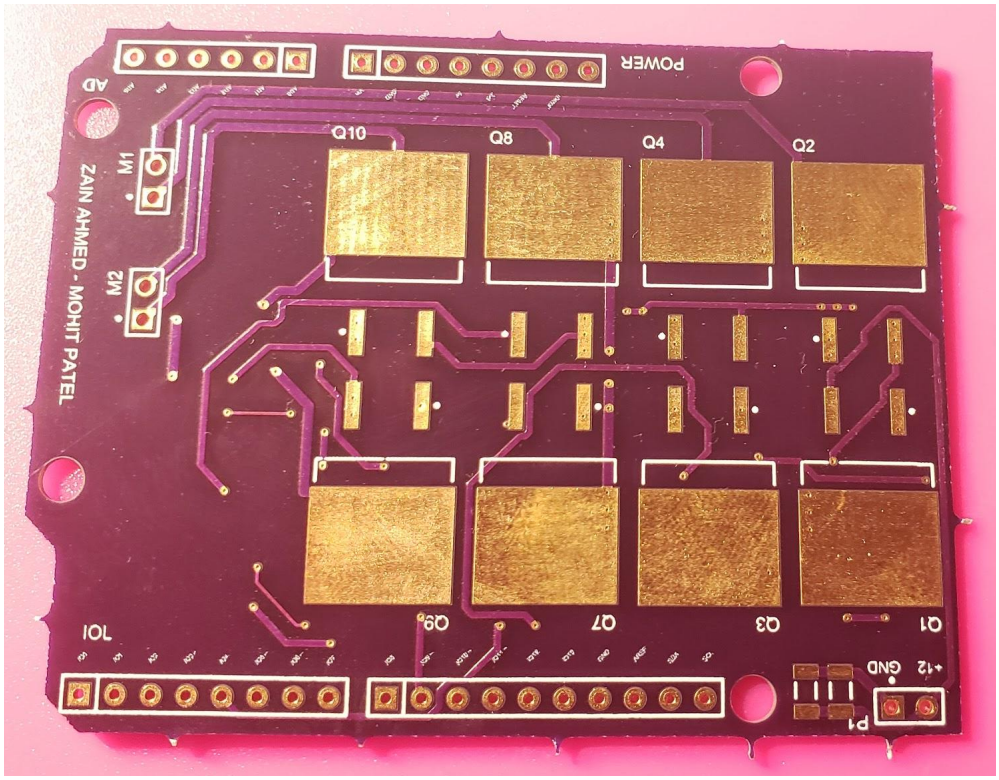
Board Layout:

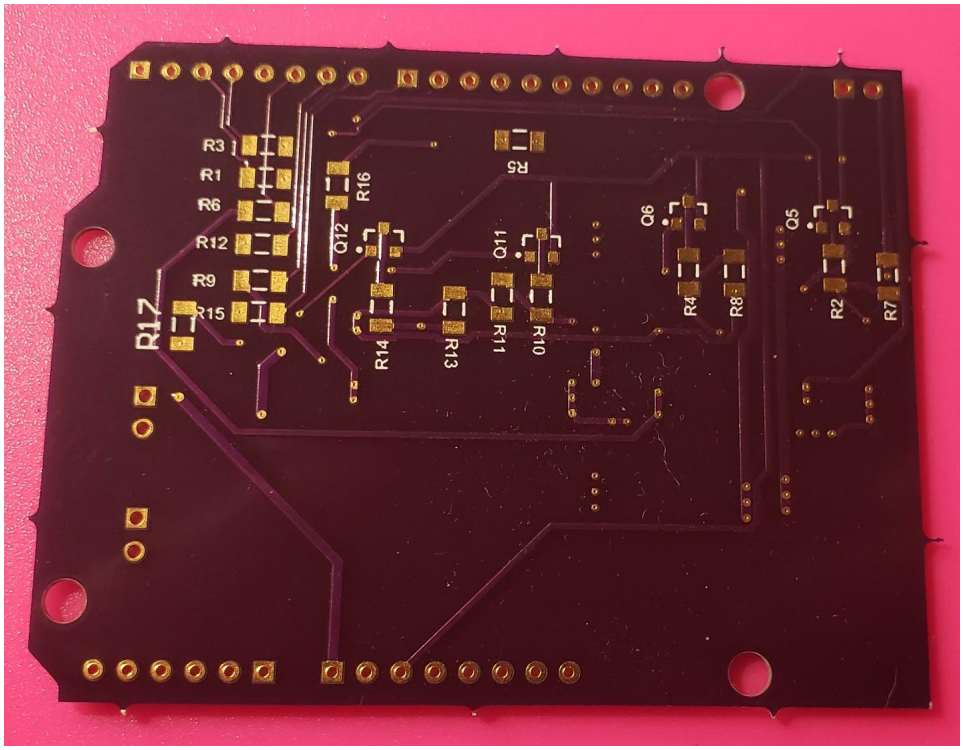


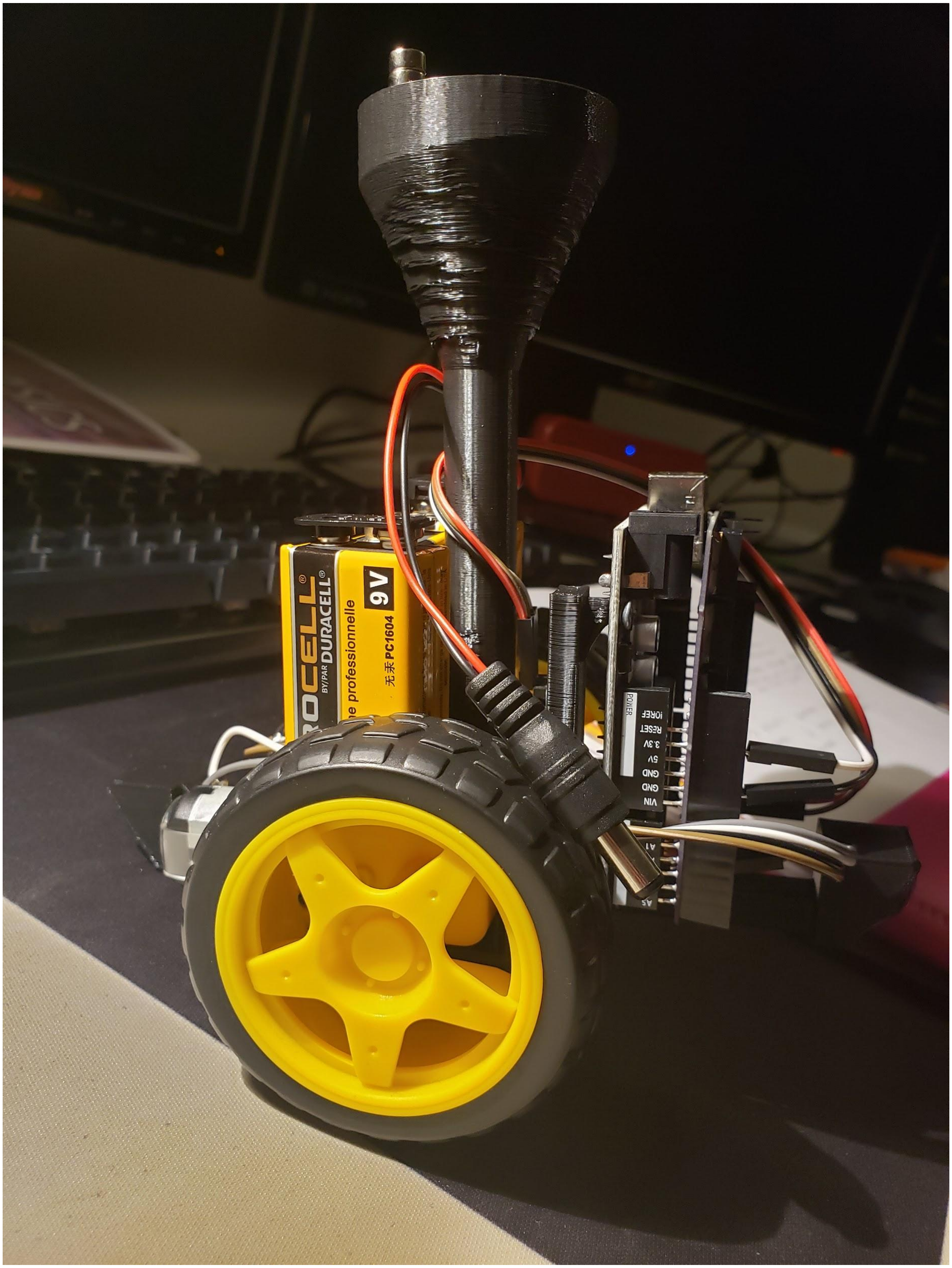


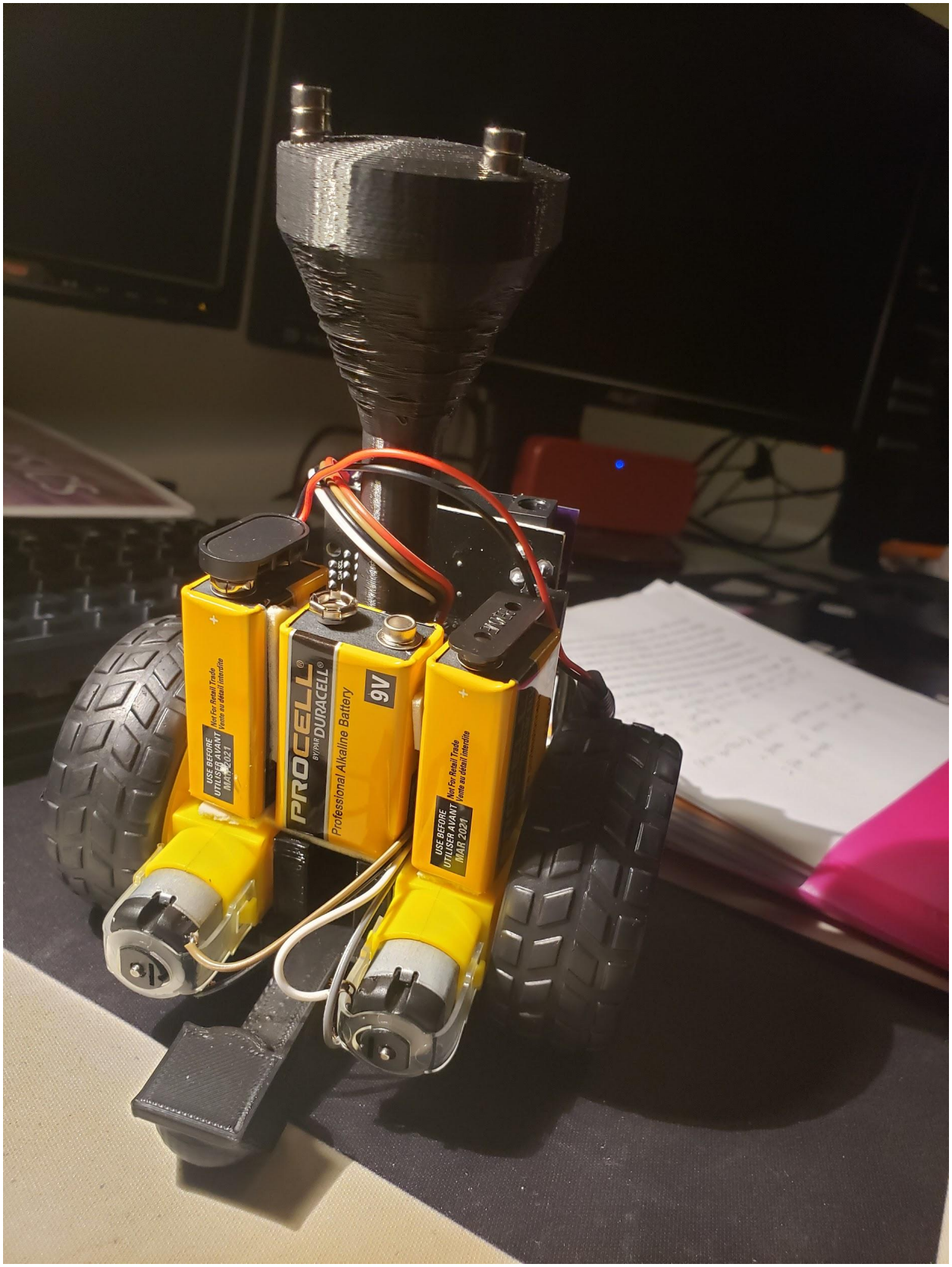


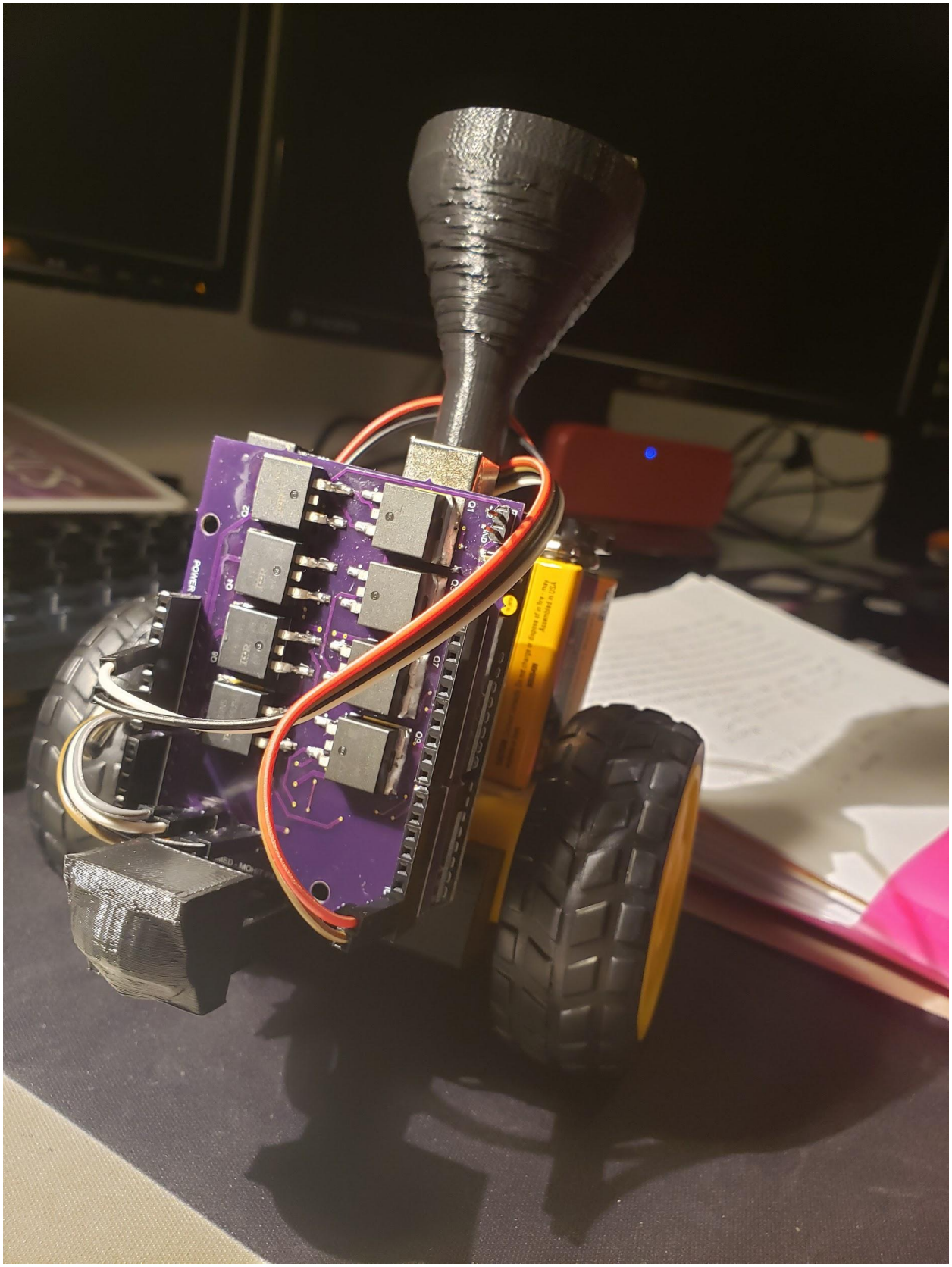
Physical board:






PROCELL
BY/PAR DURACELL
9V
PC1604
professionnelle
POWER
IOREF
RESET
3.3V
5V
GND
GND
VIN


PROCELL
BY/PAR DURACELL
Professional Alkaline Battery
9V
USE BEFORE
UTILISER AVANT
MAR 2021
Not For Retail Trade
Vente au détail interdite


POWER

The board was designed using all surface mount devices for simplicity of assembly and for fitment inside the enclosure. All MOSFETS are mounted on top, and the other components are mounted on the bottom side of the board. The board uses an Arduino Uno layout to snap in as a "shield" on top of the Arduino. There are 3 two pin headers on the board. Two for the motors, and 1 for voltage input. The bottom of the board has a 0 ohm jumper that allows the user to select if the voltage input should be passed into the arduino or not (works if below 12V). The board was designed in Altium Designer.

Code:

The code reads in serial input from a bluetooth module. The software checks for "FBLRS" for forward, backward, left, right, and stop respectively. This uses the hardware serial port on the uno, which means that a USB device can also command the car at the same time.

ElectronicsProject

```
char command;

// Motor A
int AH1 = 2;
int AH2 = 4;
int AL1 = 3;
int AL2 = 5;

// Motor B
int BH1 = 7;
int BH2 = 8;
int BL1 = 6;
int BL2 = 9;

void setup()
{
  Serial.begin(9600);  //Set the baud rate to your Bluetooth module.

  // Set all the motor control pins to outputs
  pinMode(AH1, OUTPUT);
  pinMode(AH2, OUTPUT);
  pinMode(AL1, OUTPUT);
  pinMode(AL2, OUTPUT);

  digitalWrite(AH1, LOW);
  digitalWrite(AH2, LOW);
  digitalWrite(AL1, LOW);
  digitalWrite(AL2, LOW);

  pinMode(BH1, OUTPUT);
  pinMode(BH2, OUTPUT);
  pinMode(BL1, OUTPUT);
  pinMode(BL2, OUTPUT);

  digitalWrite(BH1, LOW);
  digitalWrite(BH2, LOW);
  digitalWrite(BL1, LOW);
  digitalWrite(BL2, LOW);
}
```

```
void loop(){
  if(Serial.available() > 0){
    command = Serial.read();

    //Change pin mode only if new command is different from previous.
    //Serial.println(command);
    switch(command){
    case 'F':
      forward();
      break;
    case 'B':
       back();
      break;
    case 'L':
      left();
      break;
    case 'R':
      right();
      break;
    case 'S':
      Stop();
      break;
     default:
//    Stop();
      break;
    }
  }
}
```

```
void allOff() {
  digitalWrite(AH1, LOW);
  digitalWrite(AH2, LOW);
  digitalWrite(AL1, LOW);
  digitalWrite(AL2, LOW);

  digitalWrite(BH1, LOW);
  digitalWrite(BH2, LOW);
  digitalWrite(BL1, LOW);
  digitalWrite(BL2, LOW);
}
void forward()
{
  allOff();
  digitalWrite(BH2, 1);
  digitalWrite(BL1, 1);
  digitalWrite(AH1, 1);
  digitalWrite(AL2, 1);
}
void back()
{
  allOff();
  digitalWrite(BH1, 1);
  digitalWrite(BL2, 1);
  digitalWrite(AH2, 1);
  digitalWrite(AL1, 1);
}
void left()
{
  allOff();
  digitalWrite(BH1, 1);
  digitalWrite(BL2, 1);
  digitalWrite(AH1, 1);
  digitalWrite(AL2, 1);
}
void right()
{
  allOff();
  digitalWrite(BH2, 1);
  digitalWrite(BL1, 1);
  digitalWrite(AH2, 1);
  digitalWrite(AL1, 1);
}
void Stop()
{
 allOff();
}
```

Budget Summary Table:

Item	Quantity	Price($)
MOSFET N-CH 200V 9.3A D2PAK	4	4.84
MOSFET P-CH 200V 6.5A D2PAK	4	11.40
RES SMD 1K OHM 5% 1/4W 1206	20	1.22
RES 2M OHM 1% 1/4W 1206	10	.49
CONN HEADER VERT 36POS 2.54MM	1	2.27
TRANS NPN 45V 0.5A SOT23	8	1.12
CAP CER 1UF 10V X5R 0603	10	.36
SPRAY PAINT	1	3.98
MOTORS AND WHEELS	2	7.5
BATTERY CASE	1	3.0
MAGNETS	12	3.5
BLUETOOTH MODULE	1	10.0
BATTERY	3	5.0
PCB	3	28.5
TOTAL	-	83.18