

## Robot PCB



### 1 Objectives.

1. Demonstrate the ability to build a robotics system using Electrical and Computer Engineering (ECE) fundamentals such as soldering, assembly, and fabrication.
2. Troubleshoot ECE applications utilizing modern test equipment.

### 2 Materials.

- |   |   |
|---|---|
| 1. Printed Circuit Board (PCB)                | 11. 1 - L7805 5 V voltage regulator (U1)    |
| 2. 1 - 330 Ω resistor (R1)                    | 12. 1 - L78L33 3.3 V voltage regulator (U2) |
| 3. 5 - 10 kΩ resistors (R2 - R6)              | 13. 2 - red LEDs                            |
| 4. 1 - 13 kΩ resistor (R7)                    | 14. Headers                                 |
| 5. 1 - 1 kΩ resistor (R8)                     | (a) 4 - 1x2 male headers (J1-J4)            |
| 6. 3 - 0.1 μF ceramic disc capacitors (C1-C3) | (b) 2 - 1x2 female headers (J5 and J6)      |
| 7. 1 - 10 μF radial capacitor (C4)            | (c) 1 - 2x5 female header (Power Connector) |
| 8. 1 - 33 μF radial capacitor (C5)            | (d) 2 - 8x1 female headers (Motor Driver)   |
| 9. 2 - 2N3904 transistors (Q1-Q2)             | 15. Motor Driver                            |
| 10. 1 - 2N3906 transistor (Q3)                | (a) Motor Driver Board                      |
|   | (b) 2 - 8x1 male headers                    |

### 3 PCB

Your PCB should look like the below figure with all components labeled. This PCB provides power and motor functionality for your robot.

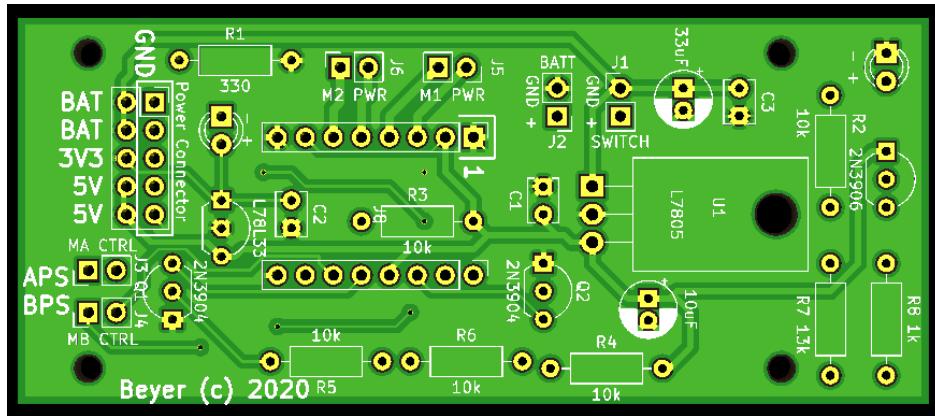


Figure 1: Printed Circuit Board

### 4 Resistors

Gather the 8 resistors. Confirm actual resistance using the digital multimeter (DMM). These are non-directional. Solder each onto the board.

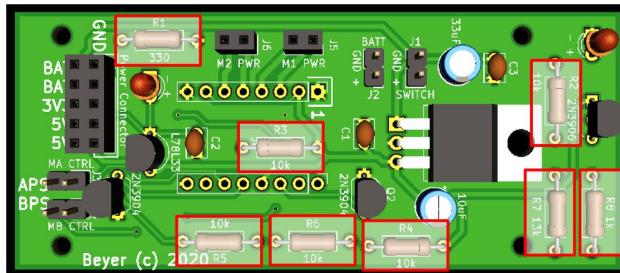


Figure 2: Resistors

### 5 Ceramic Disc Capacitors

Gather the 3 ceramic disc capacitors. These are non-directional. Solder each onto the board.

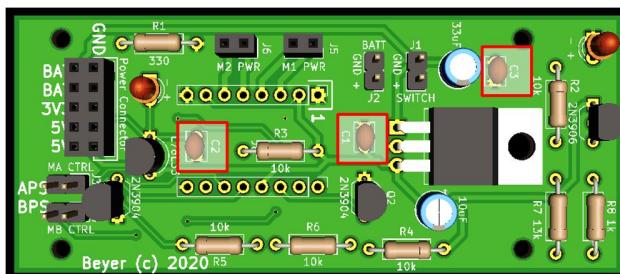


Figure 3: Ceramic Disc Capacitors

## 6 Radial Capacitors

Gather the 2 radial capacitors. These are directional. The negative sign on the capacitor cap should be oriented opposite the positive on the board. Solder each onto the board.

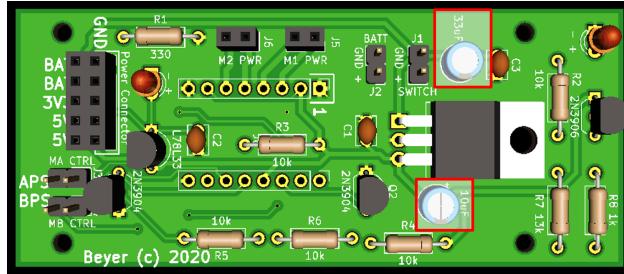


Figure 4: Radial Capacitors

## 7 Transistors

Gather the 3 transistors. These are directional. The flat edge of the transistor should correspond with the board. Solder each onto the board.

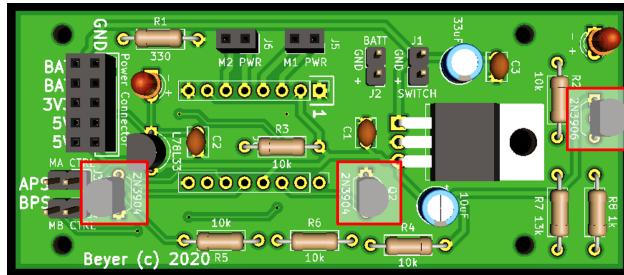


Figure 5: Transistors

## 8 5 V Voltage Regulator

Gather the 5 V voltage regulator. Use pliers to bend the leads 90° towards the back of the regulator (flat side) at the point that the lead thins. Place the regulator so that the flat side lays flat on the top of the PCB. Solder it onto the board.

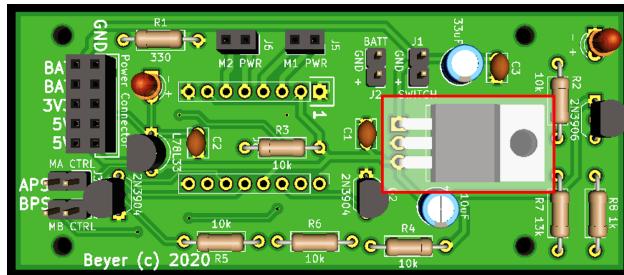


Figure 6: 5 V Voltage Regulator

### 9 3.3 V Voltage Regulator

Gather the 3.3 V voltage regulator. This is directional. The flat edge of the regulator should correspond with the board. Solder it onto the board.

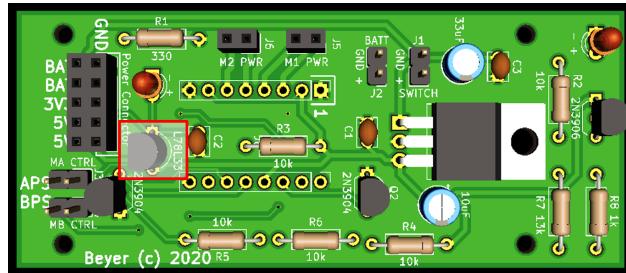


Figure 7: 3.3 V Voltage Regulator

### 10 LEDs

Gather the 2 LEDs. Use the DMM to make sure both are operational. These are directional. The **flat** edge of the LED and the **short** lead should be oriented toward the negative on the board. Solder them onto the board.

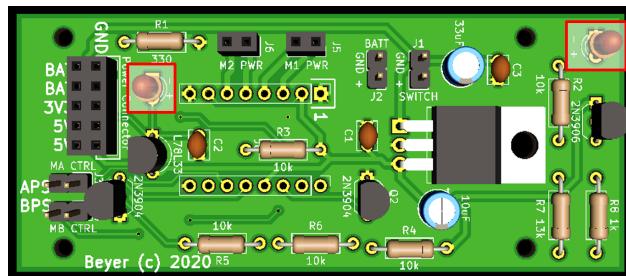


Figure 8: LEDs

### 11 Male Headers

Gather the 4 - 1x2 male headers. The smaller end of the header should go through the board. Solder them onto the board.

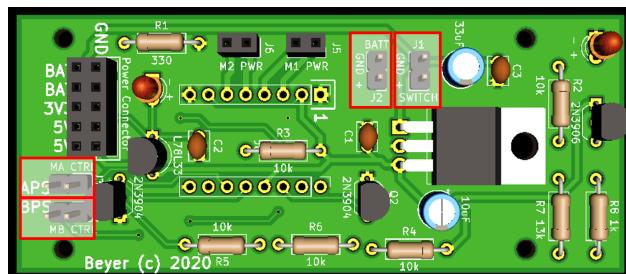


Figure 9: Male Headers

## 12 Female Headers

Gather the 5 female headers. Solder them onto the board.

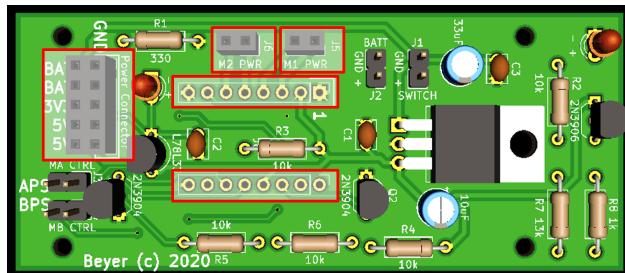


Figure 10: Female Headers

## 13 PCB with No Motor Driver Board

Your board should look like the below figure at this point.

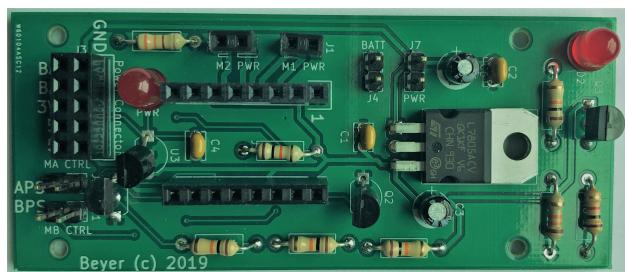


Figure 11: PCB with No Motor Driver Board

## 14 Motor Driver Board

Place the long end of the 2 - 1x8 male headers into the 2 female headers. Orient the motor driver board onto the male headers with the in-line capacitor facing the 5 V voltage regulator. Solder the headers onto the motor driver board.

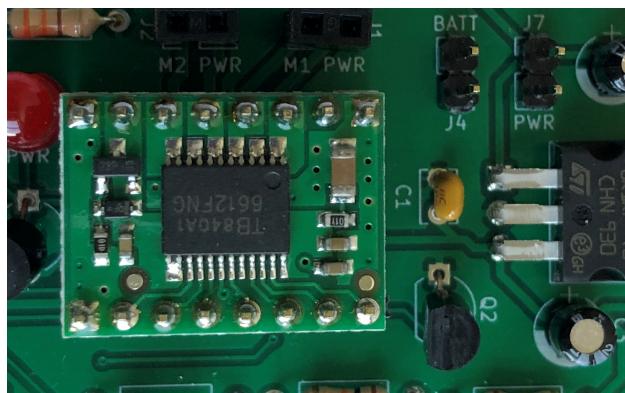


Figure 12: Motor Driver Board

## 15 Completed PCB

Your board is now complete and should look like the below figure.



Figure 13: Completed PCB

## 16 Testing the PCB

Take your board to the instructor to test that it is operational. The Arduino should use your PCB to drive the motors forward, left, right, and backwards.

## 17 Troubleshooting the PCB

If your PCB was not operational it is now time to troubleshoot.

1. Replace your motor driver board with a known operational board from the instructor. Repeat above steps from testing the PCB.
2. Use the schematics on the next page to test connectivity between components. This will help determine if a solder joint is not making connection with the PCB pad.

