Build Robot

1 Objectives.

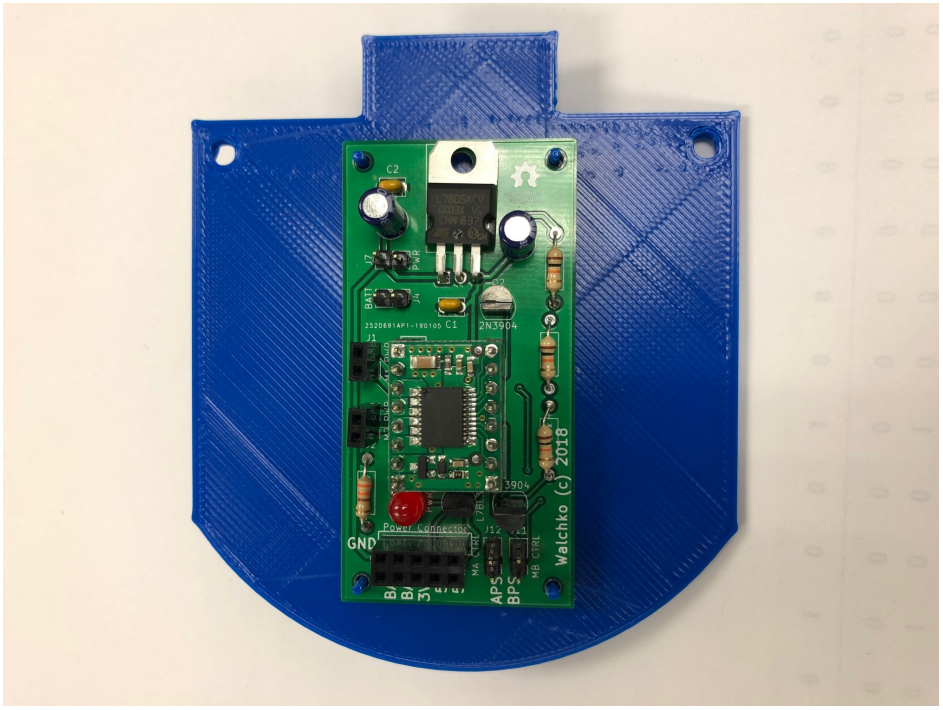
1. Demonstrate the ability to build a robotics system using Electrical and Computer Engineering (ECE) fundamentals such as soldering, assembly, and fabrication.
2. Troubleshoot ECE applications utilizing modern test equipment.

2 Materials.

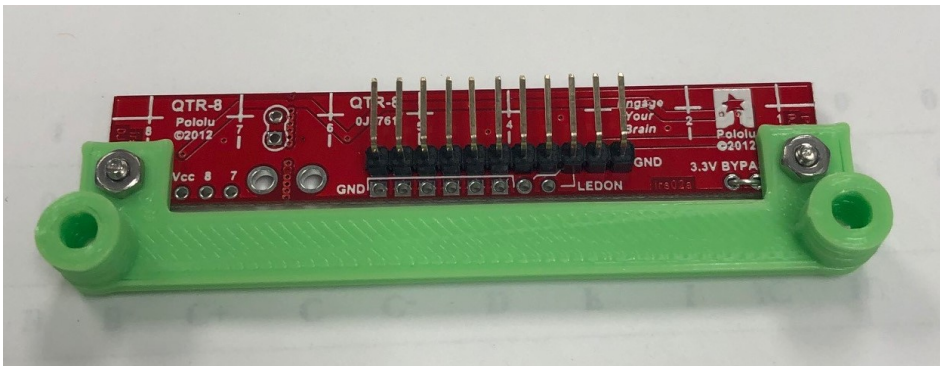
1. Soldered Printed Circuit Board (PCB)
2. Arduino Uno
3. 3D-printed structural pieces (A-D)
4. 2 DC motors
5. 2 wheels
6. 2 tires (note left and right are different)
7. Battery pack
8. Jumper wires
9. Switch
10. 3 IR sensors
11. 1 QTR-8RC Reflectance Sensor Array
12. 1 1 x 11 90^o header
13. 8 hex standoffs (4 short and 4 long)
14. Bolts
    (a) 6 - # 4-40 x 1”
        i. 4 for motors
        ii. 2 for connecting A and B
    (b) 8 - # 4-40 x 1/4”
        i. 8 for connecting standoffs to layers
    (c) 10 - # 2-56 x 1/4”
        i. 2 for line sensors
        ii. 6 for IR sensors
        iii. 2 for wheels
15. Nuts
    (a) 6 - # 4-40
    (b) 8 - # 2-56

3 Layer A - Base Layer.

1. Remove the support from Layer A.
2. Place the PCB on the printed spacers with the “Beyer” printed text towards the rounded edge.



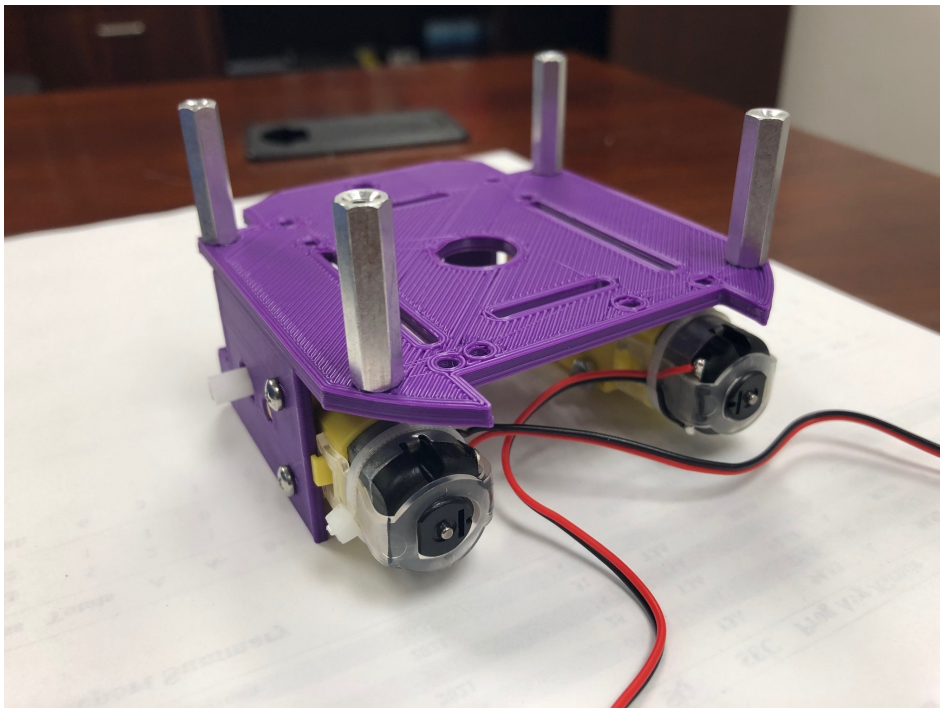
3. Solder the 1 x 11 90^o header to the reflectance sensor array with the bent header opposite of the line sensors
4. Secure the reflectance sensor array to the line sensor mount using 2 - #2-56 x 1/4” bolts and nuts.



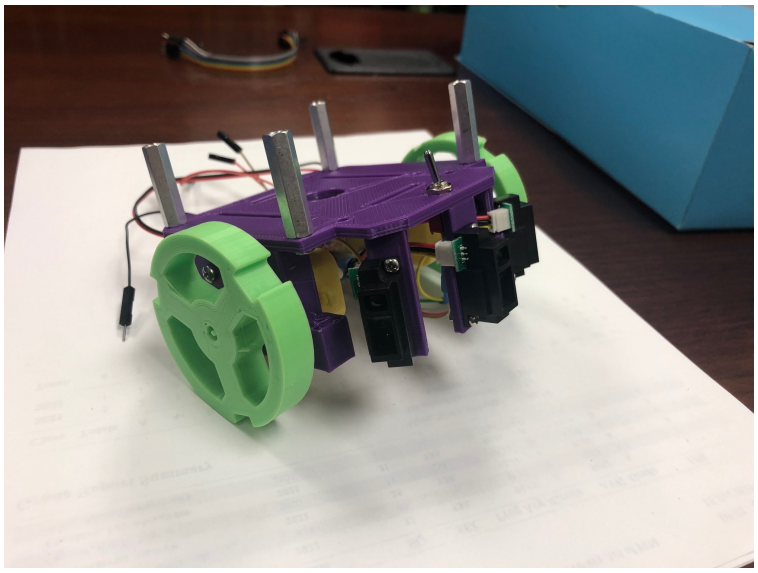
4 Layer B - Motor Layer.

1. Remove the support from Layer B.
2. Use 4 - # 4-40 x 1/4” bolts and attach the 4 short hex standoffs to Layer B (outermost holes and opposite of the printed B).
3. Install the 2 DC motors to Layer B with wires facing inwards. The motors have yellow plastic cases that should be oriented towards the front of Layer B. The white plastic drive shafts should be protruding

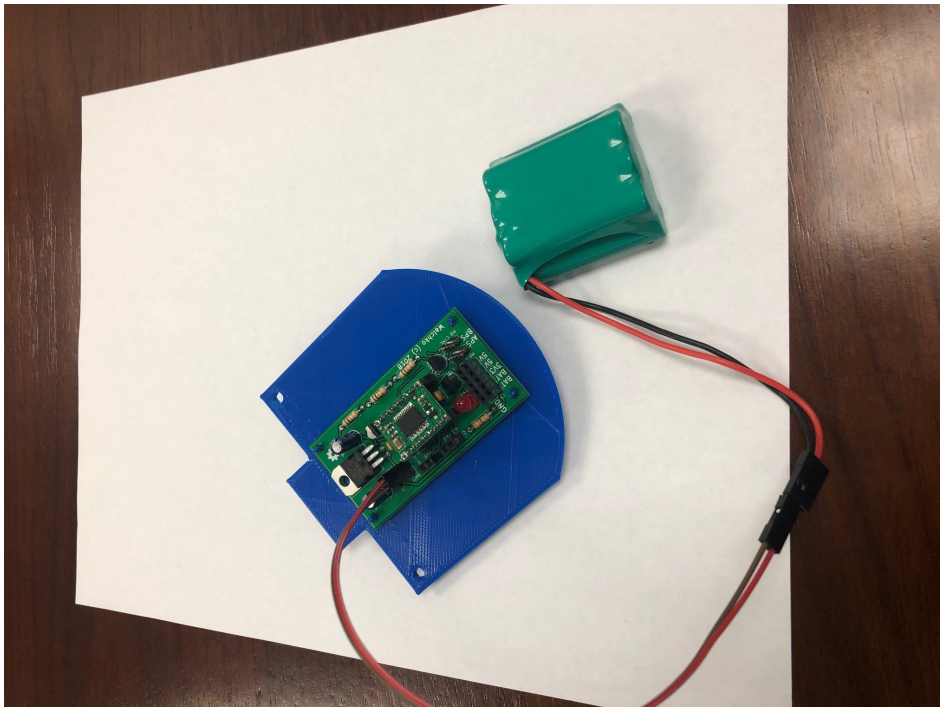
through the side holes of Layer B. Use 4 - # 4-40 x 1" bolts and nuts to secure each motor (Ensure the screw heads are to the outside of Layer B).



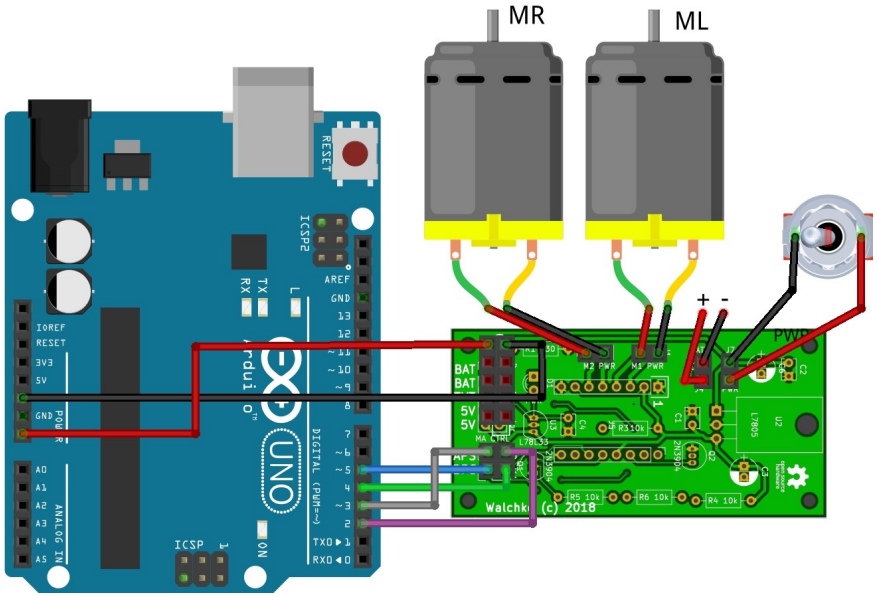
4. **IR Sensor:** Connect three IR sensors to the sensor mounts on the front of the bot using 6 - #2-56 x 1/4" bolts and nuts.
5. **Switch:** Solder the male ends of two male-to-female jumper wires to the connectors on the switch.
6. Remove the two nuts and lock washer that came attached to the switch and use one nut to attach it to Layer B in the same direction as the standoffs.
7. **Wheels:** Attach the wheels by sliding them onto the axles. Use 2 - # 2-56 x 1/4" bolts to secure the wheels onto the axles.



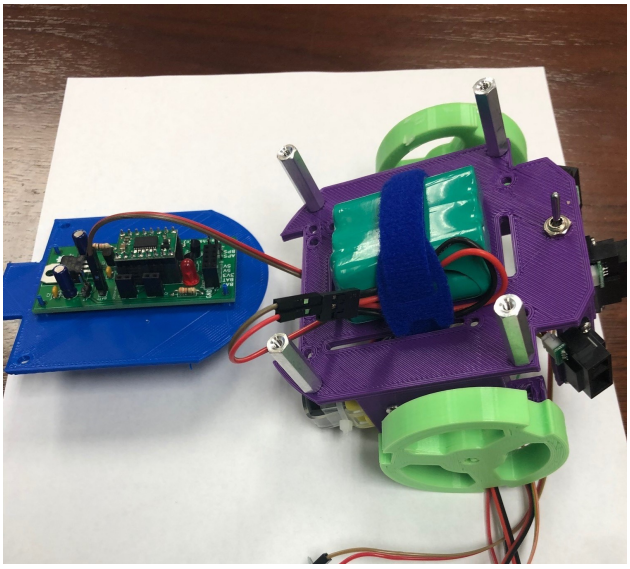
8. **Battery:** Connect a male to female jumper to the *BATT* headers on the PCB and feed through a slot in Layer B. These wires will connect to the battery and enable the removal of the battery without taking apart the bot.



9. **Testing PCB:** Wire the motors, Arduino, battery, and switch to the PCB as shown in Figure. Download the `robot_pcb` folder from **Teams** (`Labs/robot_pcb`). Create the following folder: `C:Program Files (x86)/Arduino/libraries/Motor` and move the *Motor.h* file into it. Open the `robot_pcb.ino` file. Compile and upload to the Arduino. If working correctly, the tires should go forward for 1 second, then left for 1 second, then right for 1 second, then backwards for 1 second. Disconnect the PCB from the Arduino.

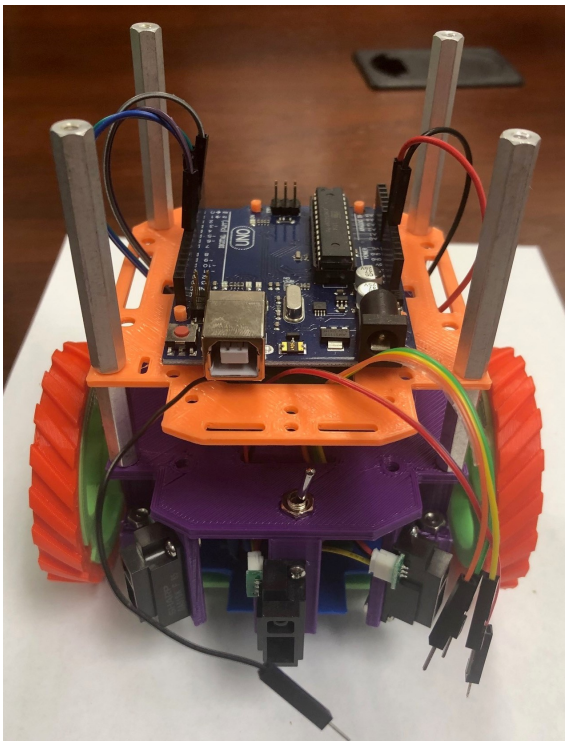


10. Secure the battery to Layer B using velcro.



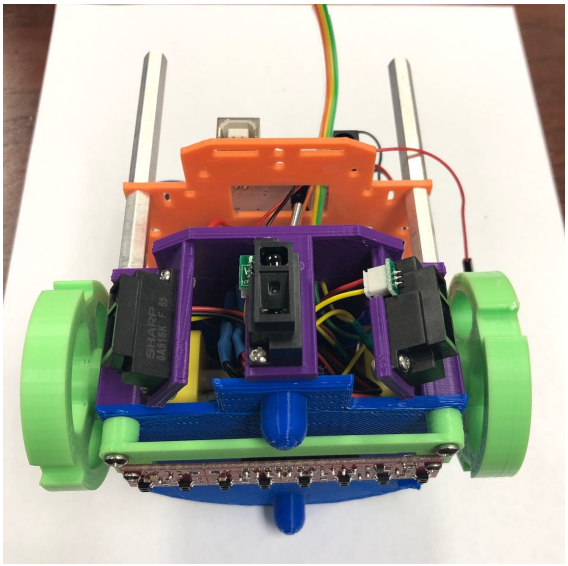
5 Layer C - Arduino Layer.

1. Connect Layer C to Layer B using the larger standoffs.
2. Place the Arduino on the printed spacers (will only go one direction).
3. Wire the Arduino to the PCB going through the slots in Layer C and B.
4. Feed the wires from the IR sensors through the slots at the front of Layer B and C.

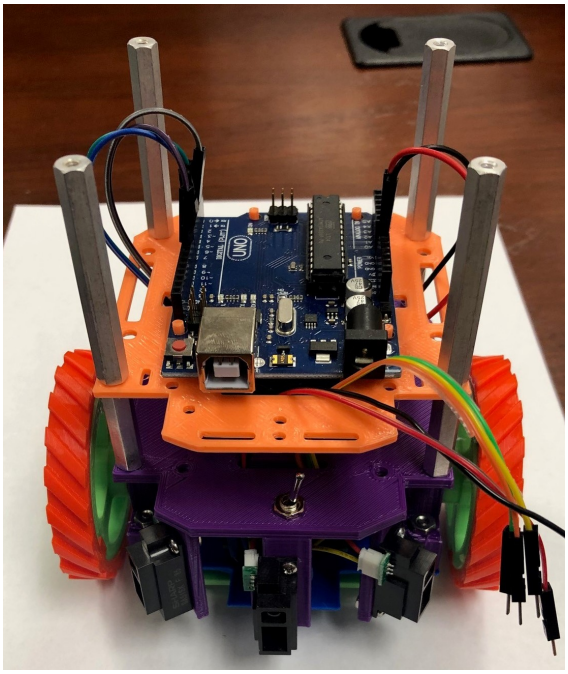


6 Connect Layer A to Layer B/C.

1. Connect the three layers using the line sensor mount and 2 - # 4-40 x 1" bolts and nuts.



2. Put the tires on the wheels.



7 Testing.

1. Connect the battery to the jumper and turn on the PCB. The robot should drive in the same pattern as before.