

SMILE MOBILE ASSEMBLY GUIDE

2021

Bill of Materials

Please refer to the following BOM for all the components needed to assemble the robot:

[BOM link](#)

3D Printing

Mechanical mounts will be 3D printed to give the pre-bought vehicle chassis the ability to mount its required payload (i.e. sensors, computers, batteries, etc.). The following are the necessary parts to be printed:

1. **Base Plates (x4)**: The base plates are 4 flat plates that sit on top of the vehicle for modular mounting
2. **Base Plate Mounts (x12)**: The base plate mounts are used to mount the 4 base plates to the chassis of the vehicle.
3. **BNO055 IMU Mount**: If you plan on using the BNO055 IMU from Adafruit, a base plate mount is available for it.
4. **NVIDIA Jetson TX2 Custom Carrier Board Mount**: If you plan on using the NVIDIA Jetson TX2 with a custom carrier board (shown in the Bill of Materials), we provide a mount to be able to mount it to the base plates.

The printing of these components was done successfully with PLA using a 0.4mm nozzle hotend. It is suggested to use high infill (~40% - 60%) to ensure all the parts are sturdy enough to handle rugged conditions the vehicle may encounter. The .stl files can be downloaded [here](#).

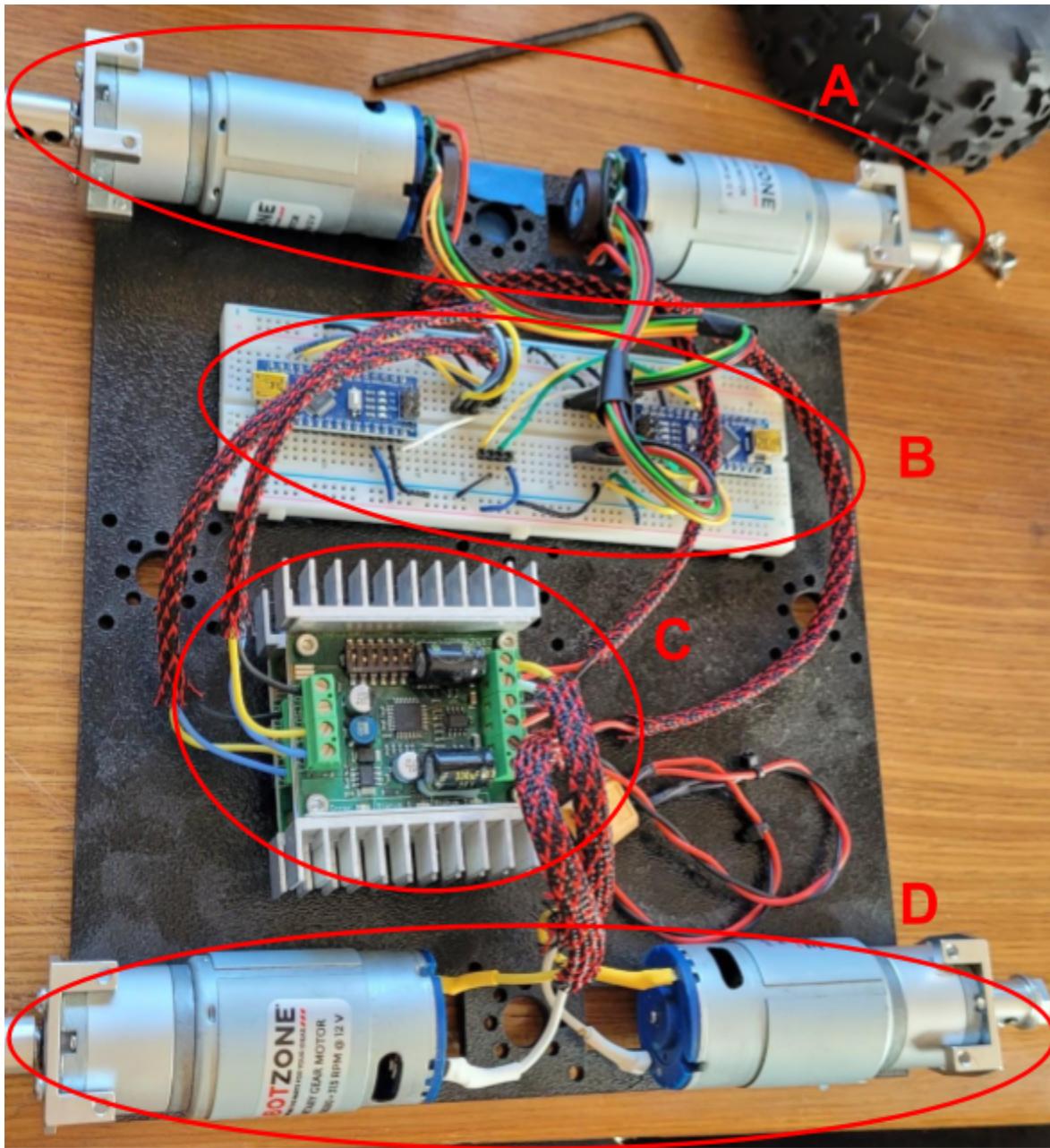
Electrical Wiring

Please refer to the following schematic for all electrical connections:

[Schematic link](#)

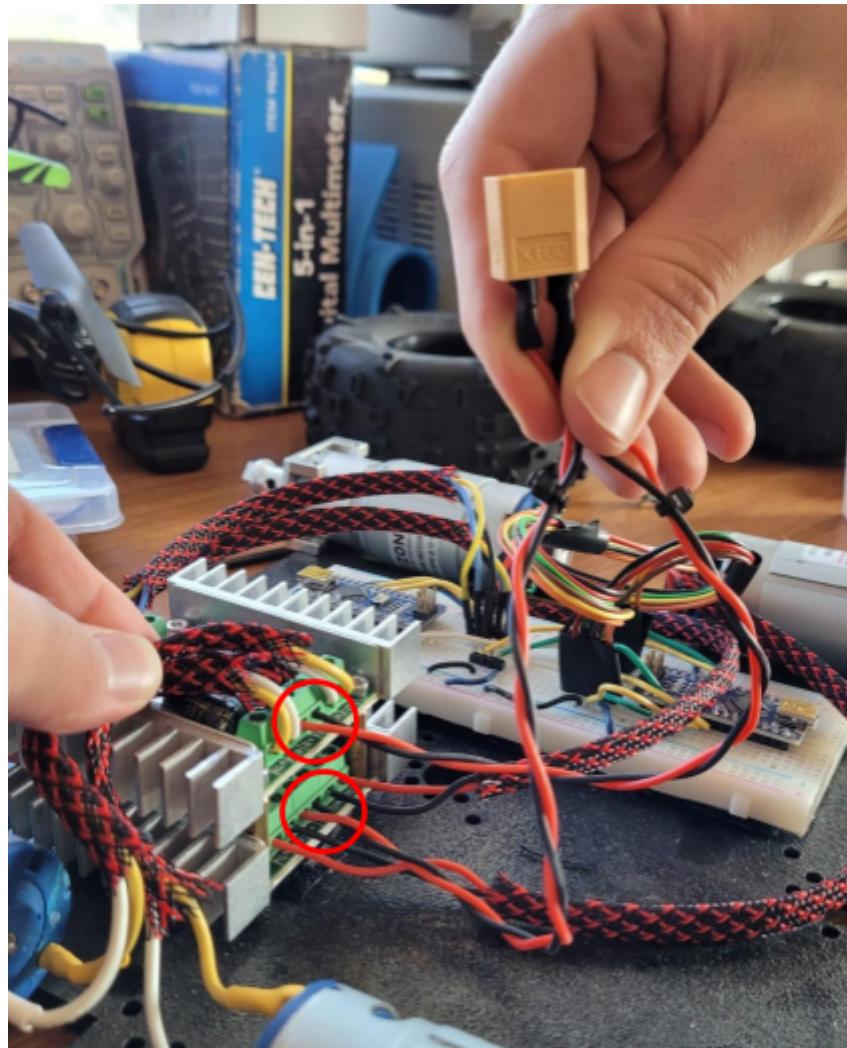
The section will provide notes (and images) to assist in the electrical assembly.

The image below shows the electrical system wired up and mounted to the lower chassis plate of the Prowler robot. Since this design is rapidly prototyped, electrical connections are made using a solderless breadboard. The image highlights the four main subsections of the vehicle's drive train. **(A)** The two rear motors have built-in encoders (critical for odometry estimation). **(B)** Solderless breadboard assembly using two Arduino Nano's. One Nano interfaces with the motor drivers, while the other Nano processes the encoder information. **(C)** Two Sabertooth Dual Motor drivers stacked on-top of each other using standoffs. **(D)** The two front motors which do not have encoders.

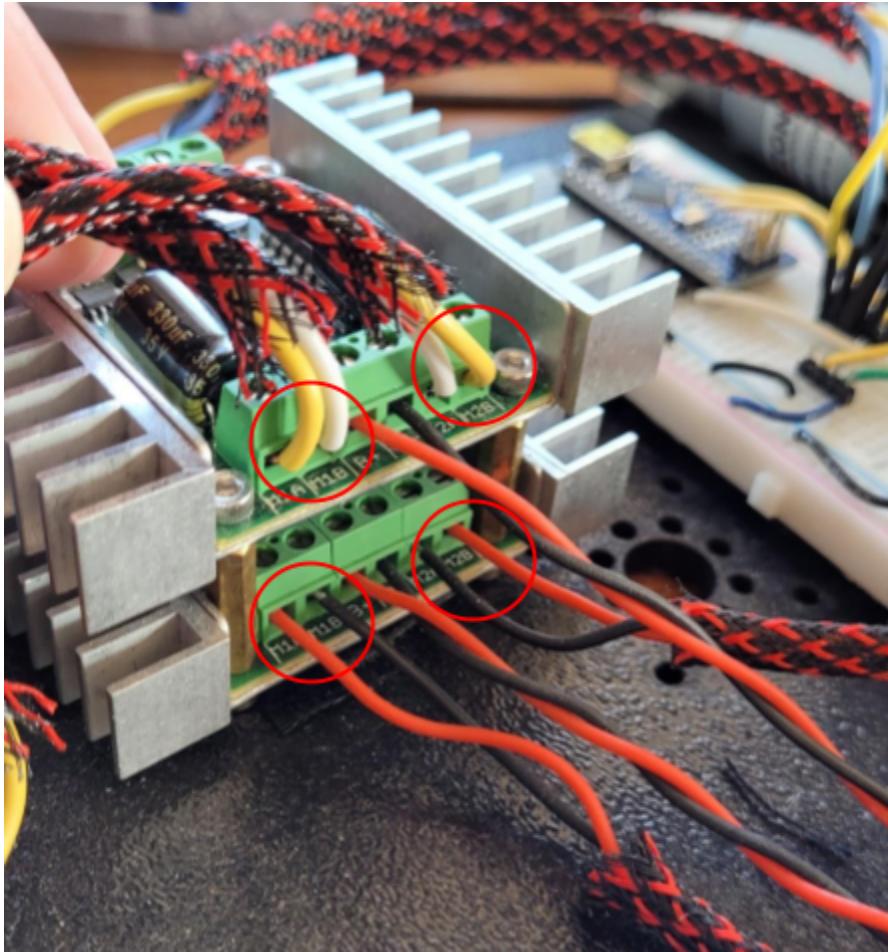


Mechanical Assembly

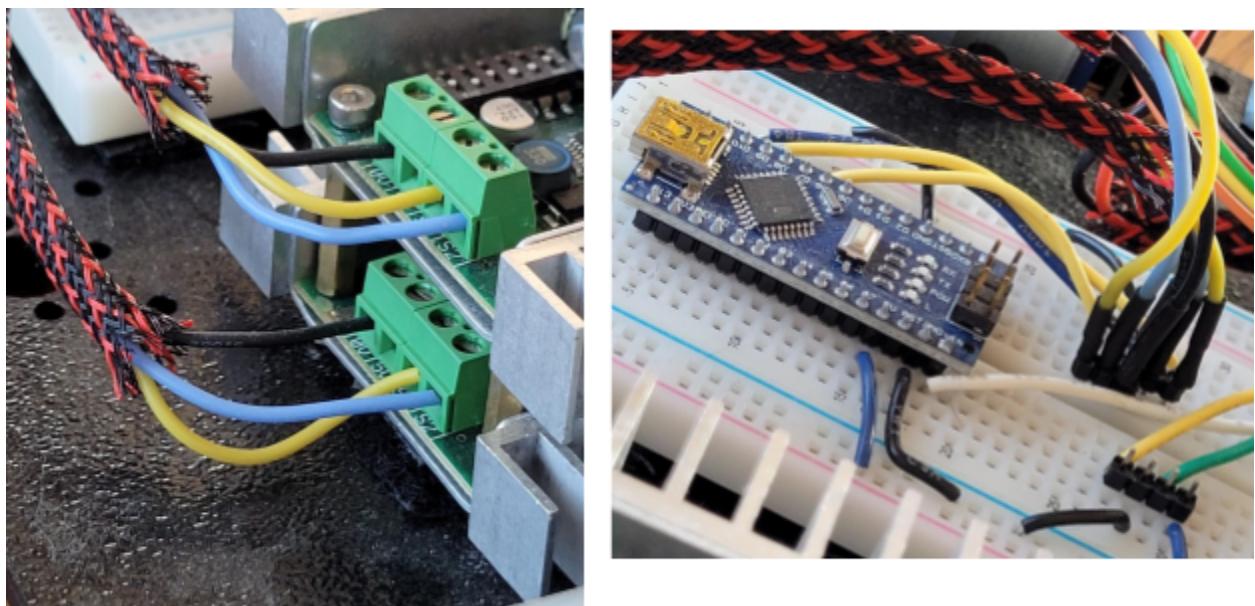
- 1. Battery Power Connector:** The wiring to connect the first battery to the system uses a male XT60 connector. Cut four individual strands of wire (two for power and two for ground). Solder one end of each power wire to the positive side of the XT60 (which is denoted by a “+” symbol). Also solder one end of each ground wire to the negative side of the XT60. This wiring creates a “Y” split to feed the battery into each of the motor drivers individually. See figure below:



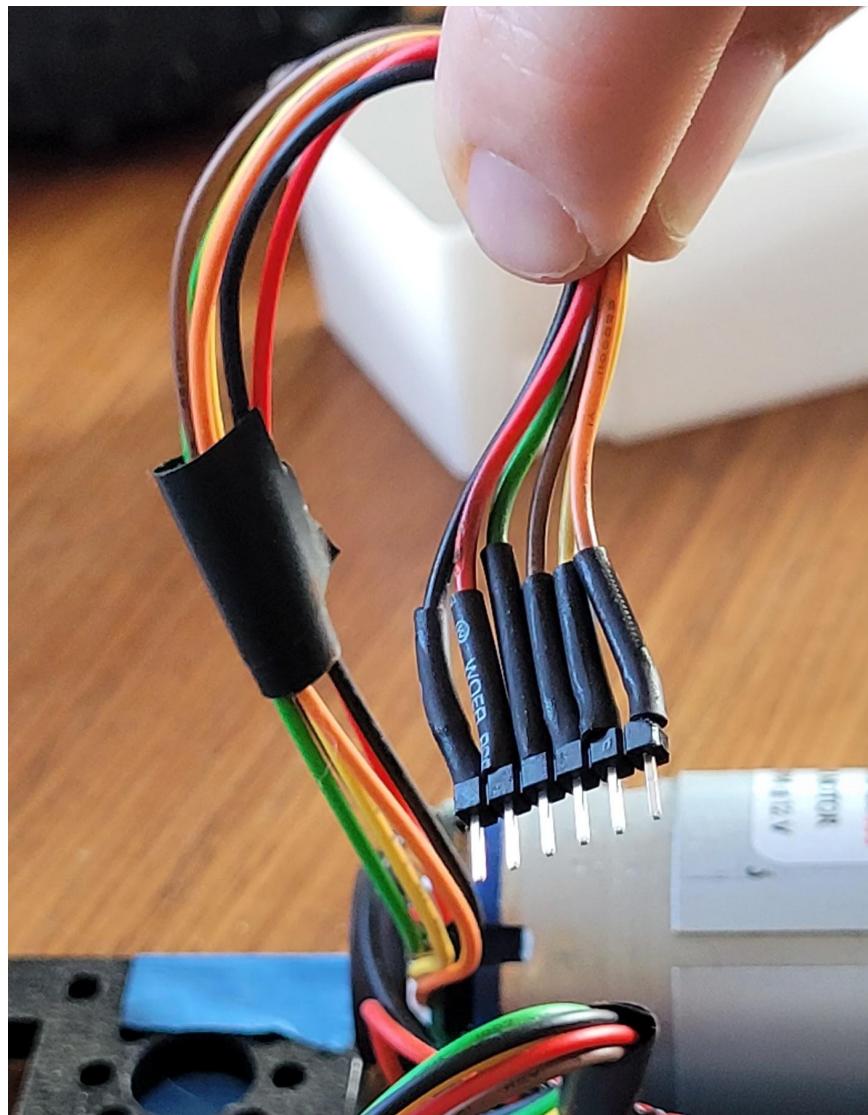
- 2. Motor(s) Connection to Motor Controllers:** Connect wires from the motors to the motor controllers as shown in the figure below. Please refer to the electrical schematic to identify which motor goes to which port of the motor controller.



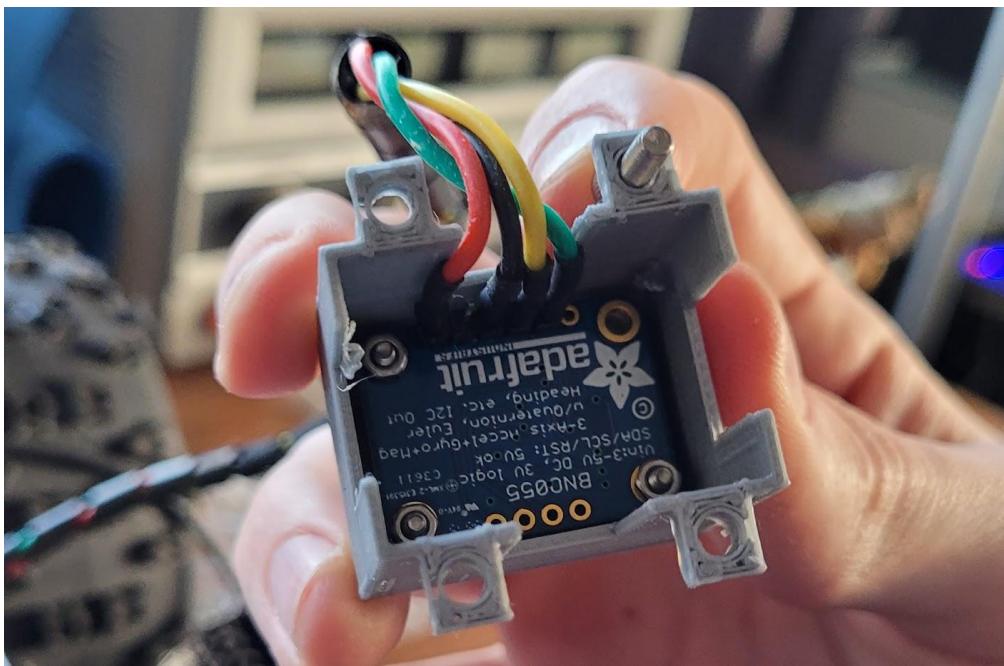
3. Motor Control Inputs: The motors are controlled via PWM commands from one of the Arduino Nanos. Wire the specified PWM motor control signals (as shown in the schematic) to the control inputs of the motor controllers (see figure below).



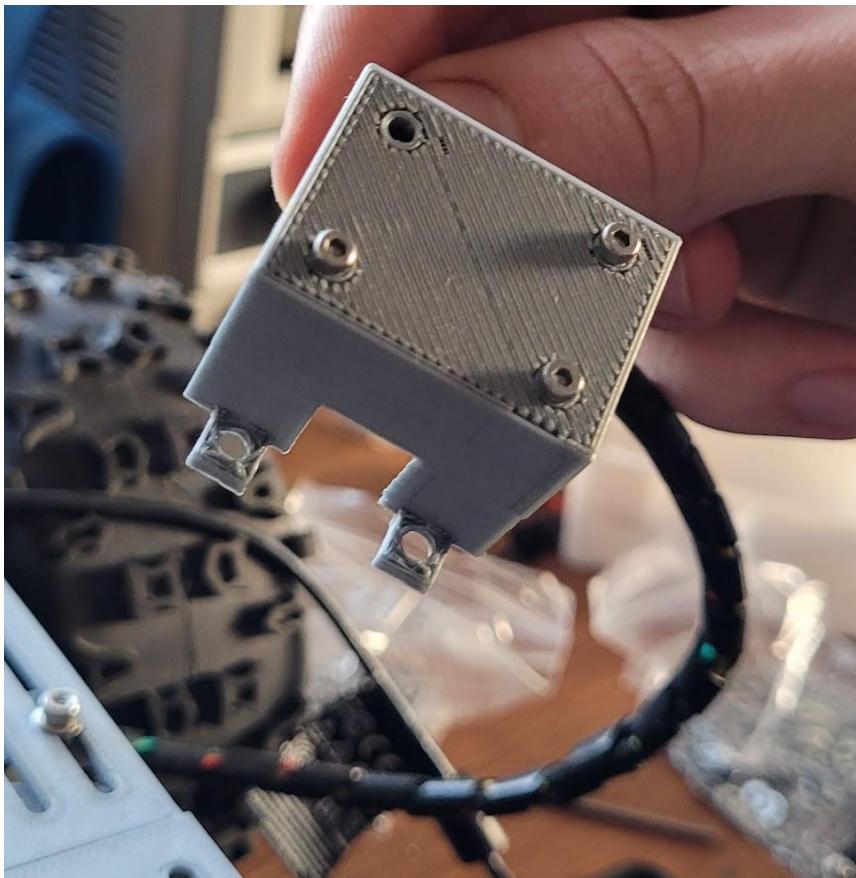
4. Solderless Breadboard Connectors for the Encoders: The encoders on the rear motors originally come with connectors that cannot be connected to the Arduino Nano via the solderless breadboard. Therefore, snip off the original connectors and solder 0.1" male header pins (row of 6) to the wires. Make sure to slide shrink wrap over the wires before soldering the new pins. This needs to be done for both encoders. See the figure below.



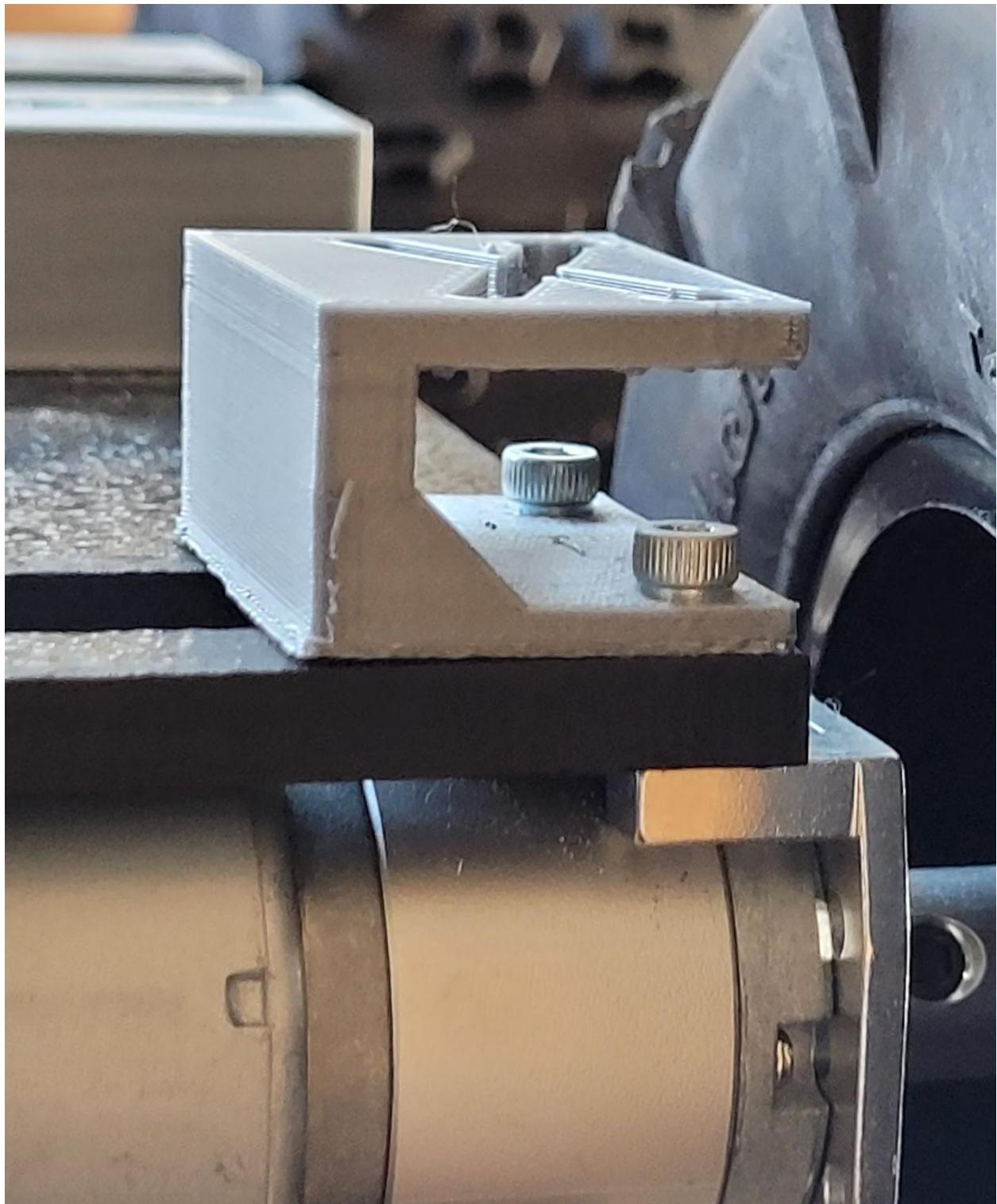
5. **Solder Breadboard connectors to [BNO055 IMU](#).** Then, insert the IMU in the housing and screw it on top of the vehicle away from interference after mounting the base plate.



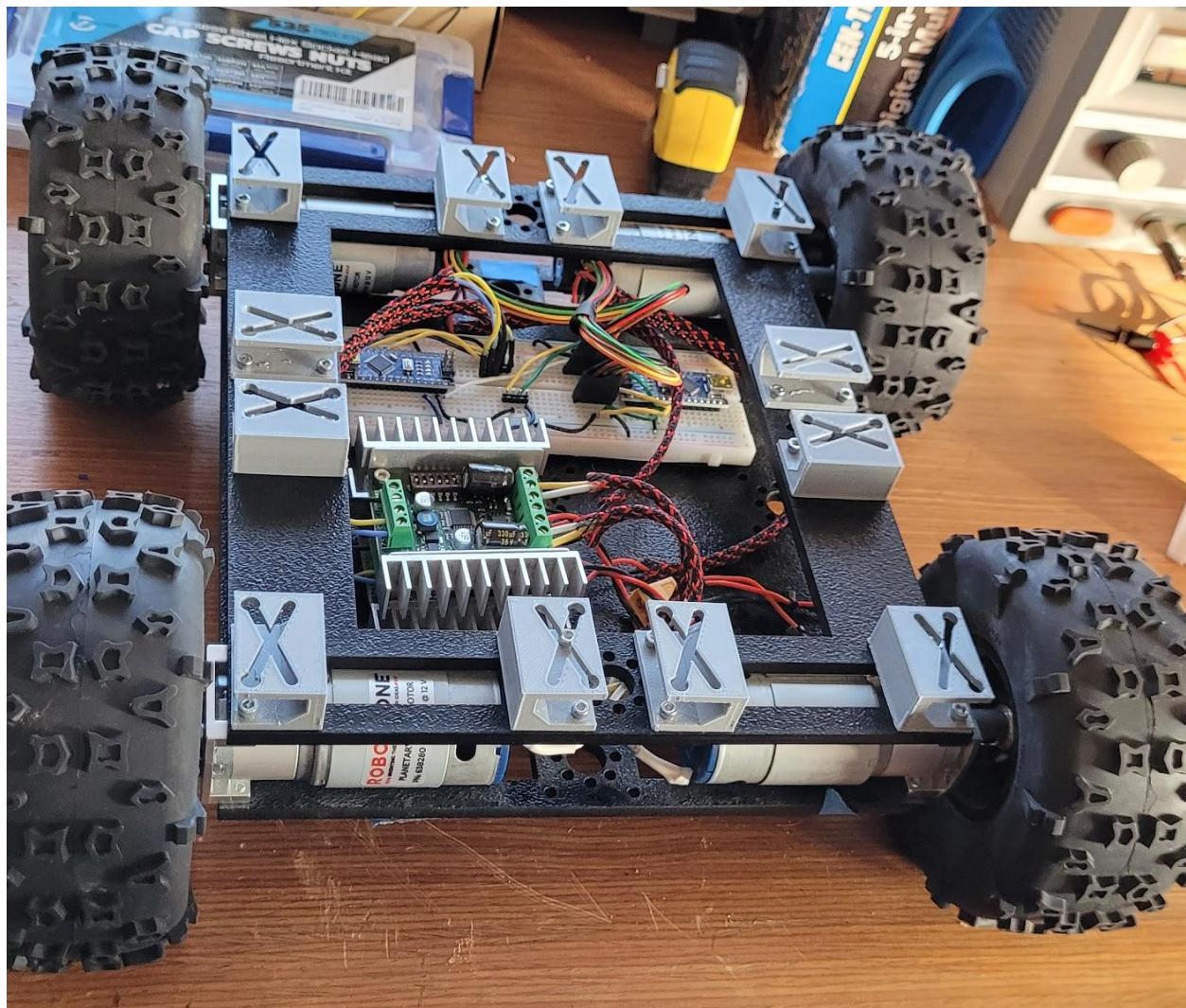
Screw in IMU into the housing.



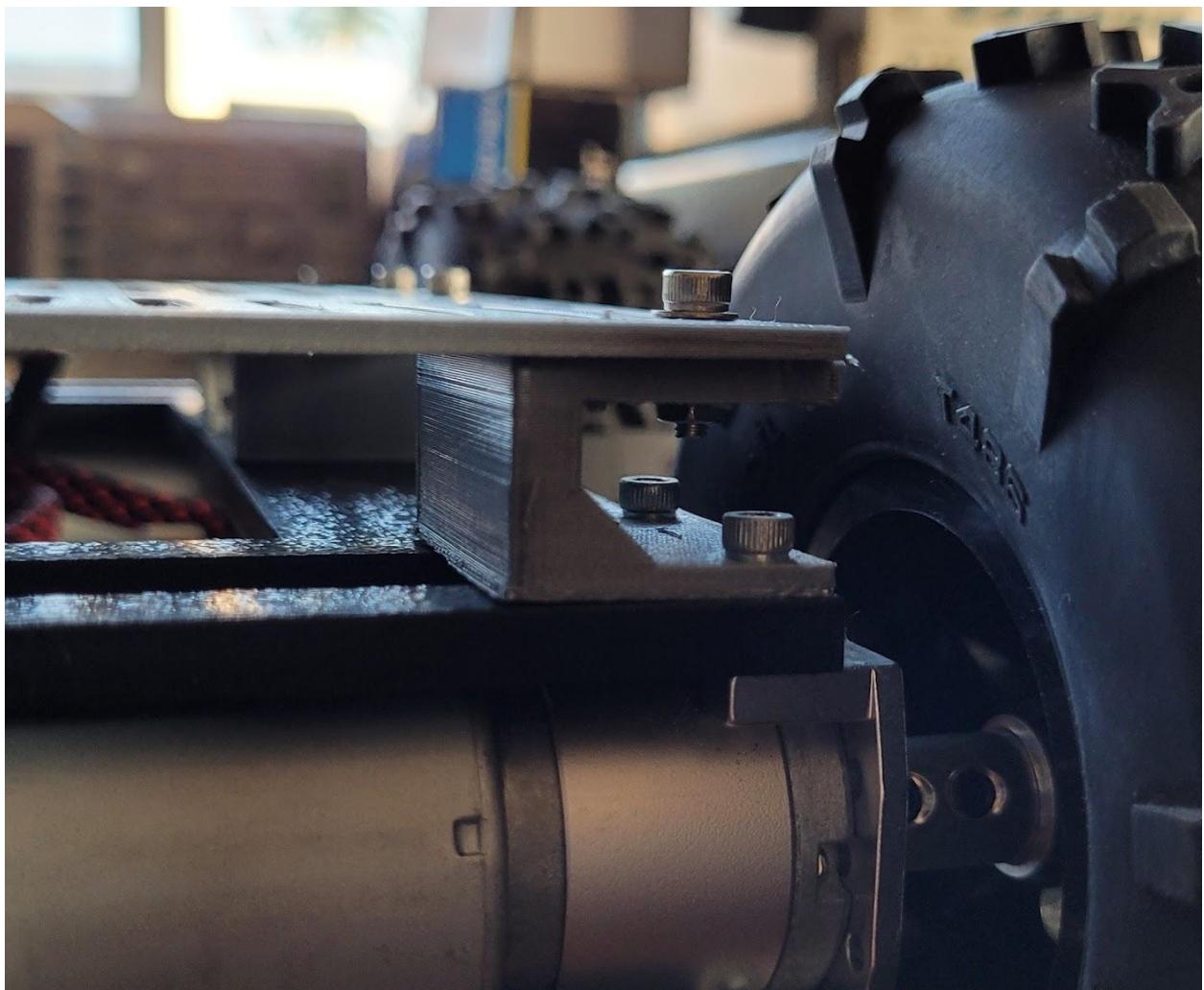
6. Screw in the custom stand off brackets (bracket specs) on the car's top frame using m3 x 16mm socket head cap screws.

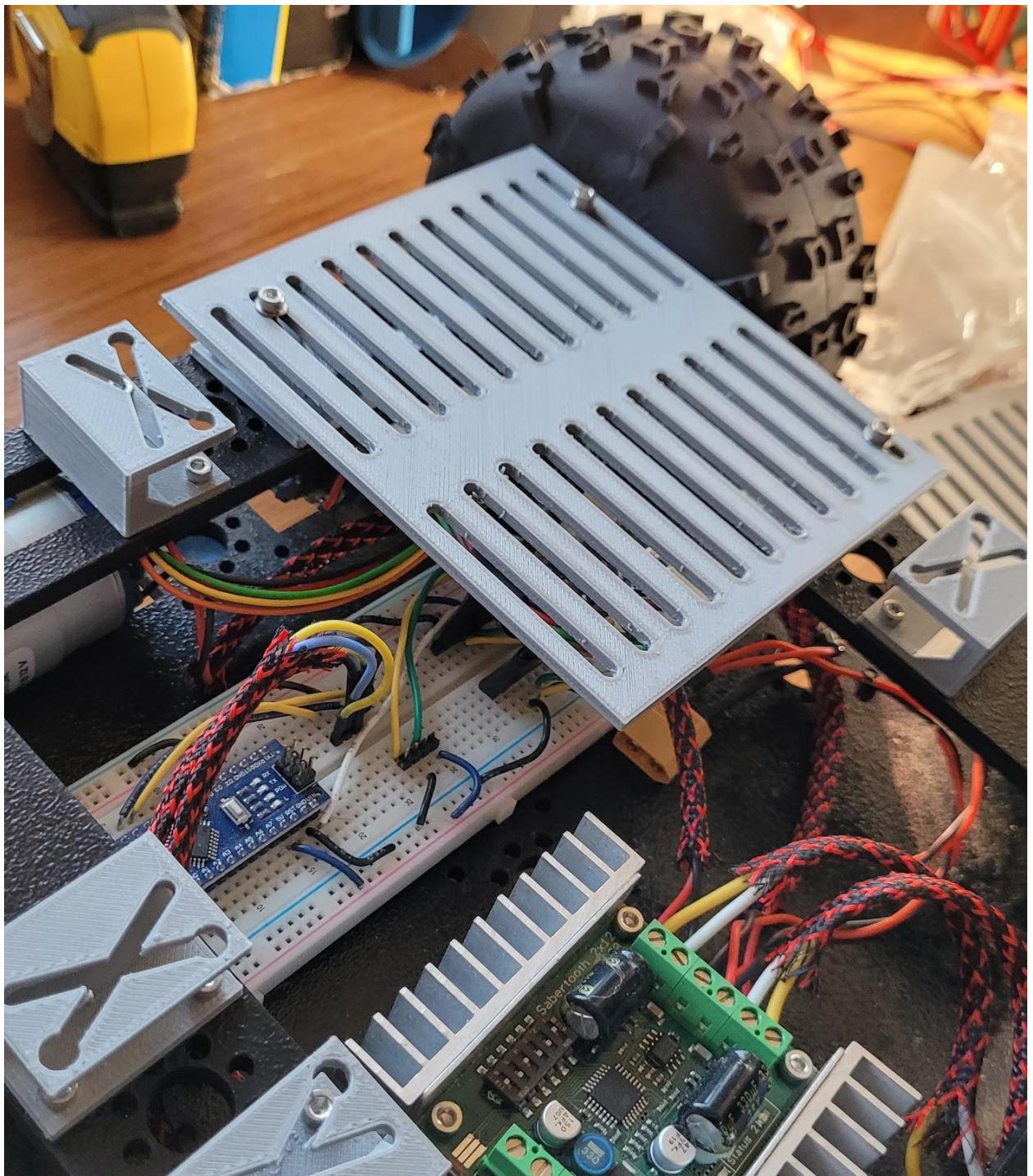


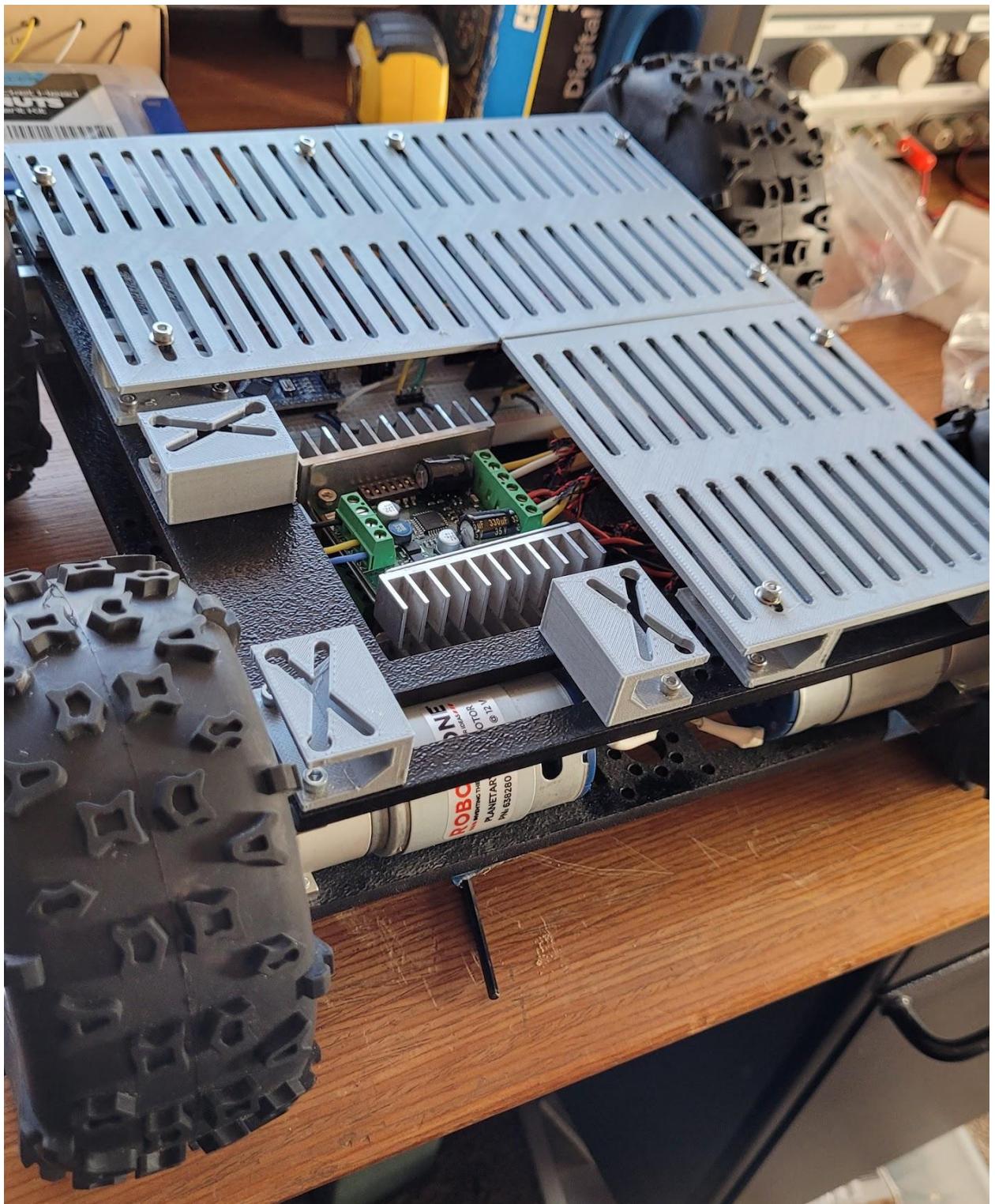
7. Mount all 12 of the brackets as shown:



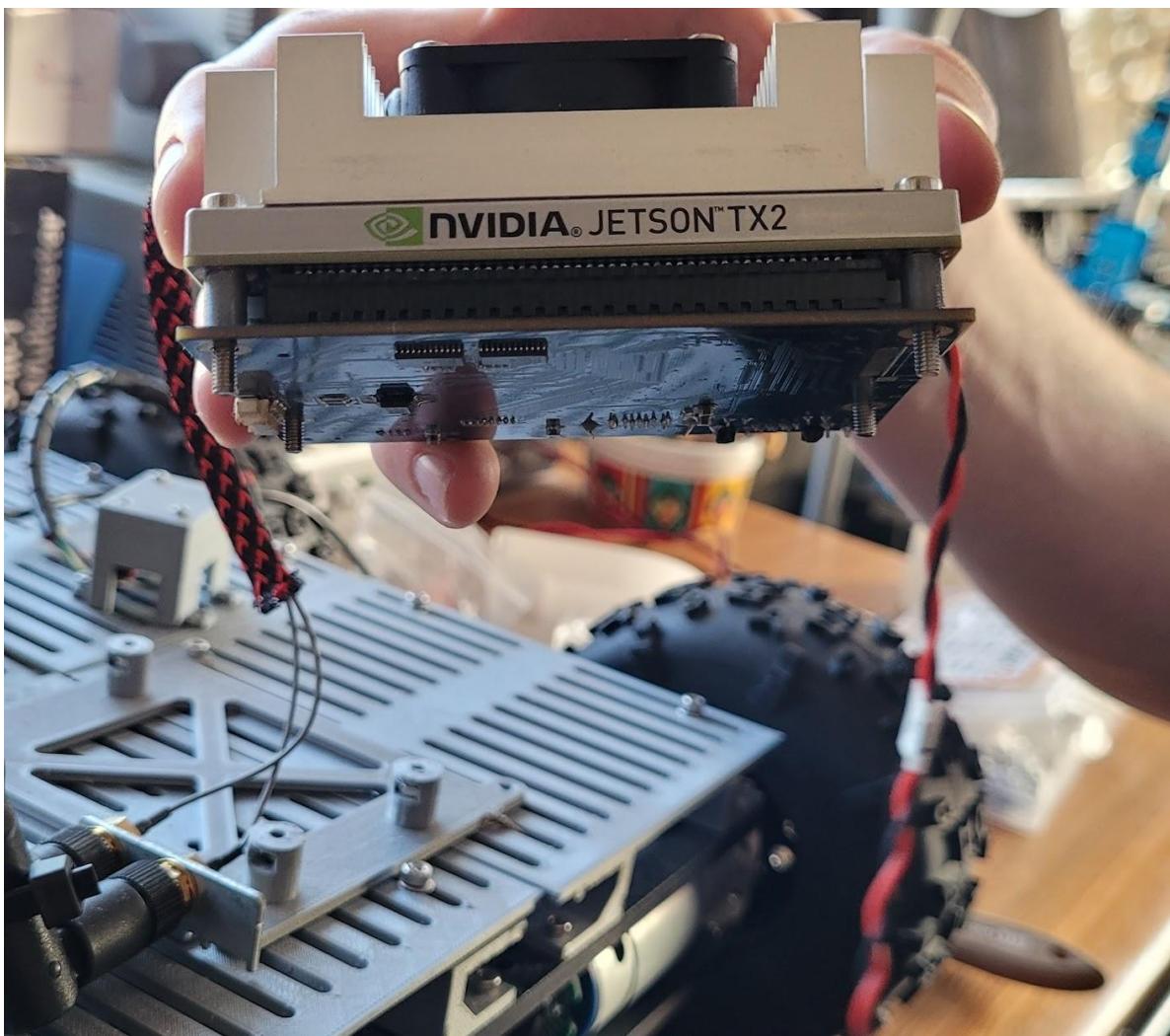
8. Next, screw in each of the 4 base plate pieces on each corner of the car as shown.







9. Unscrew the Jetson TX2 off the development board and mount it on the custom carrier board





Note: the battery uses a XT-60 connector. Prepare and solder a power cable with the XT-60 connector to the terminals of the carrier board.

* **The carrier board schematic can be found here:**

https://www.uta.edu/utari/_images/research/airborne/TX2.pdf

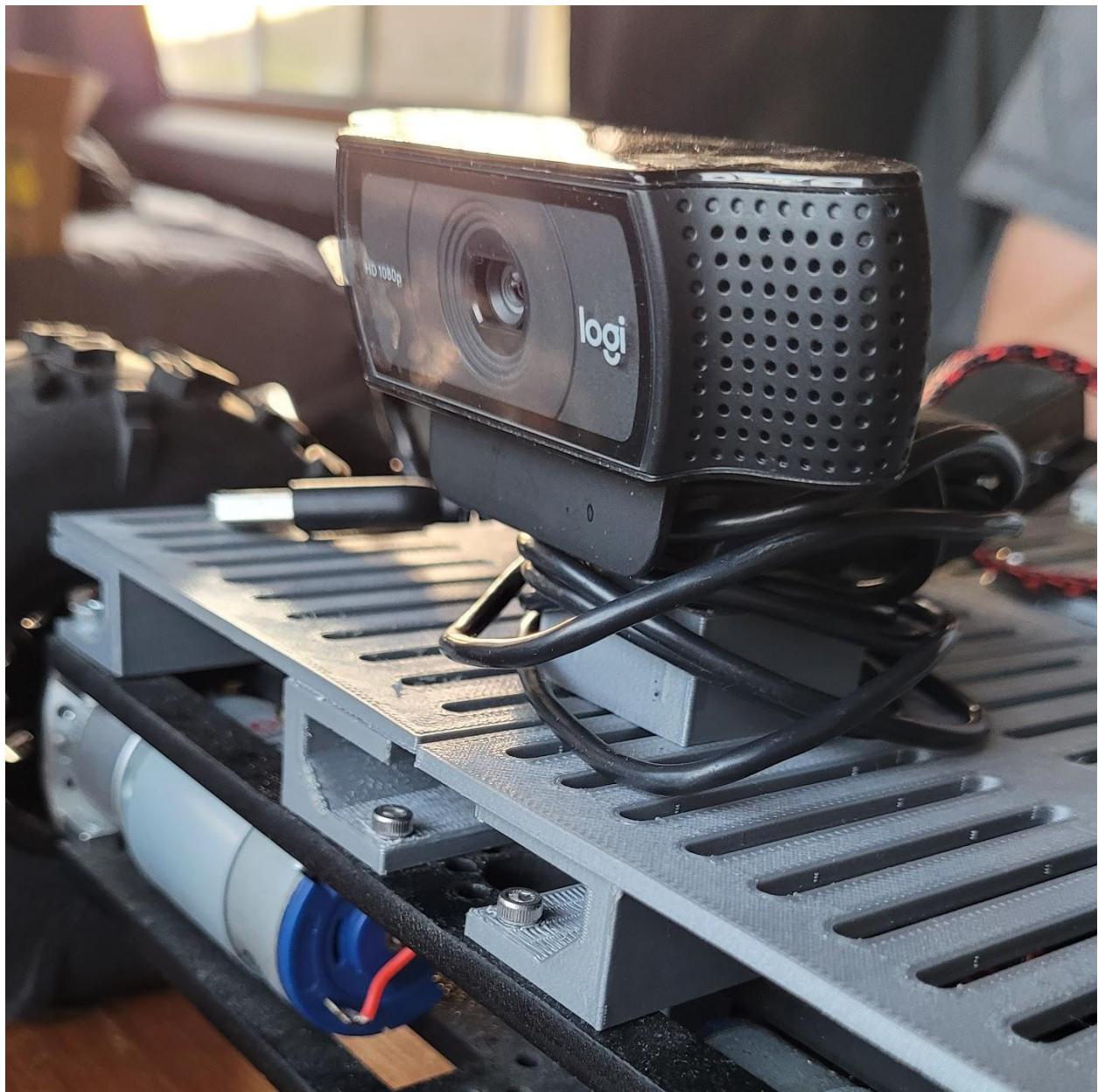
10. Screw in the wifi/bluetooth antenna mounts on the base plate





11. Screw in the camera mount and then mount the camera on top of it facing forward.





Running the SMILE Mobile:

Once all components have been mounted and power is connected, power on the Jetson TX2 and follow the guide provided on the github for setting up and repository and running some tests.

<https://github.com/RamizHanan/smile-mobile/blob/development/README.md>