With many of the things involving physical components being out of my field, I had to get help from our amazing lab coordinator, Steve. In many parts of the project, I had help from him with things such as wiring the cart, design aspects of the bracket, bracing the batteries, securely mounting the wheels, along with other things.

In order to create the bracket right the first time, many 3d prints were used to verify the spacing and positioning of the holes. So, I would recommend first starting small and making a 3d printed part. Both my teammate Dyanna and I have created multiple 3d printable parts using tinkercad. It is simple to use for just creating a printed part. After measuring out the required holes and making a 3d part on tinkercad, they are saved as .stl files. Depending on the printer you will have to configure your print, to do this I used CURA Ultimaker. Then after printing, the part can be measured, and any adjustments can be made. After finalizing the measurements, I used librecad in order to make the .dxf file. This file is the actual file that is used to get the custom part made. You can get the part from sendcutsend and they can do things such as creating a 90-degree bend. In this case, a thickness of ¼ inch (6.35 mm) was used. The bracket was designed to also allow for a brace to run from one side to the other. This can be done by getting a piece of aluminum extrusion and cutting it to length, as well as threading the ends to screw into place. In our case we used m8 bolts to hold the bracket to the cart, and m6 to hold the bracket to the motor.

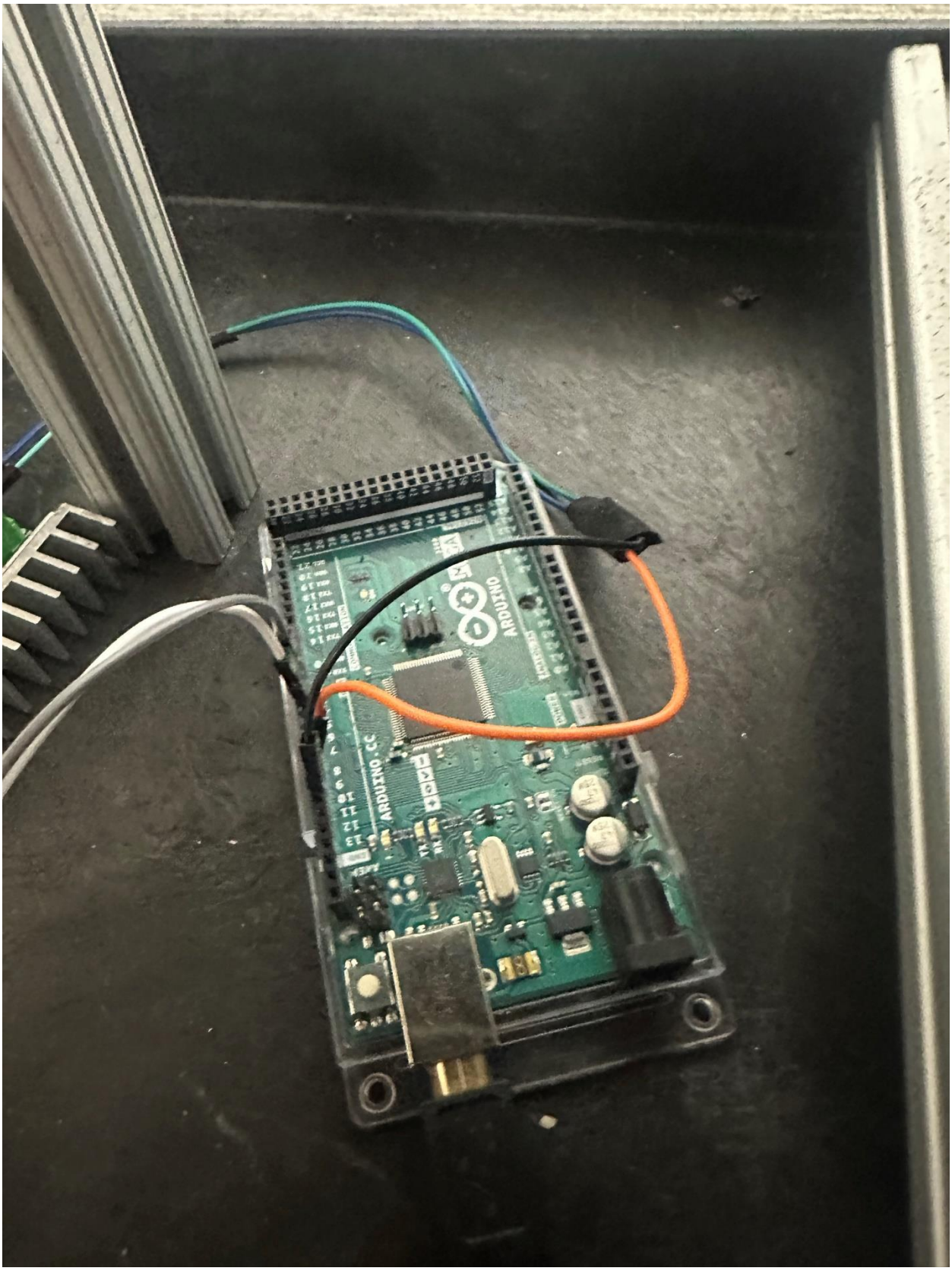
Wiring is done through the batteries, to a 'toggle circuit breaker' then to the two motor control boards. The motor control boards are able to provide power to the raspberry pi, which then provides power to the lidar and Arduino. The batteries are 12v.

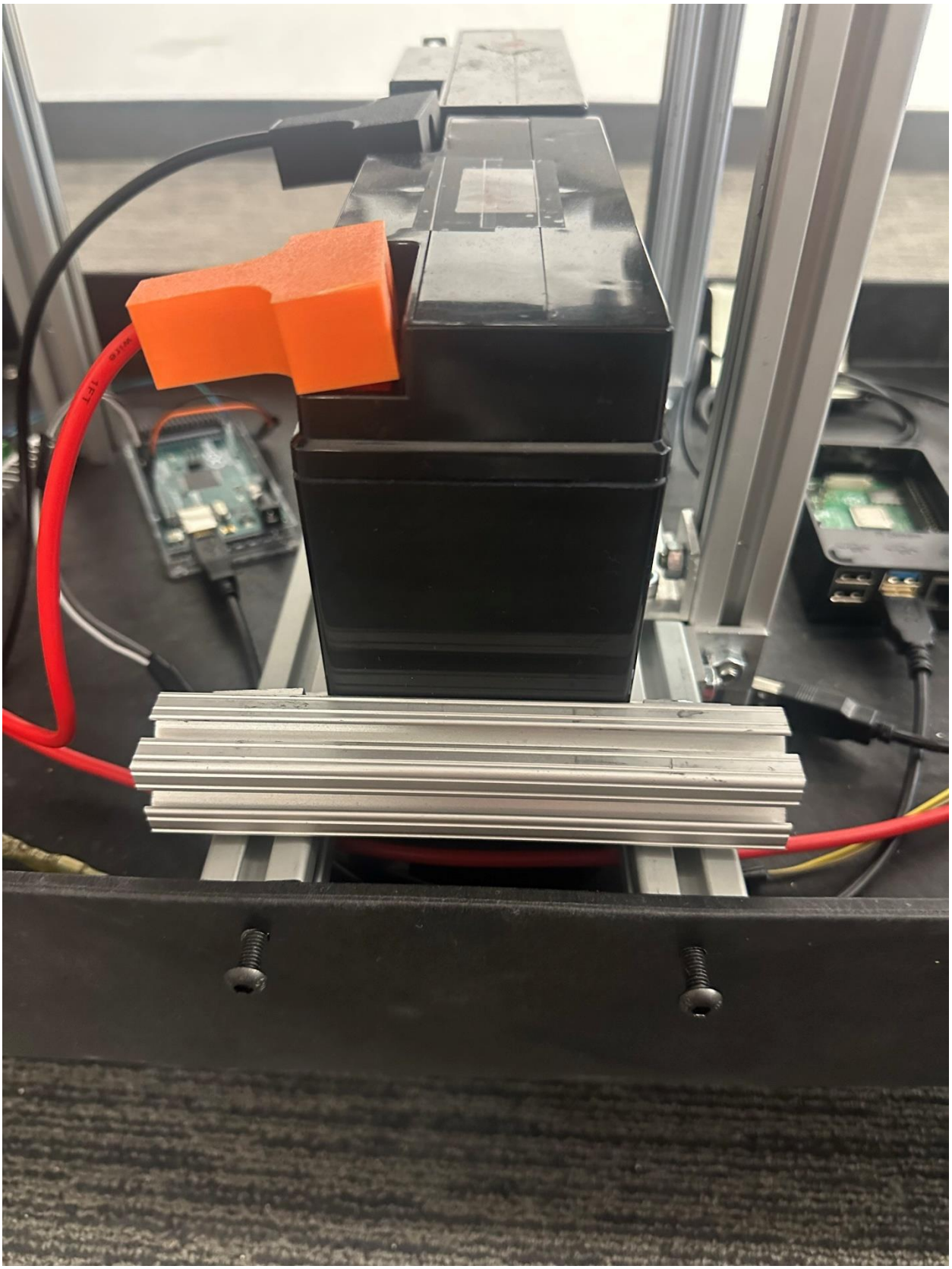
We use a sabertooth 2x12 for each pair of motors (one for the front, the other for the rear). We also have a raspberry pi 4, this acts as both a hub for wireless communication as well as what does all processing. There is also a lidar attached as a way to detect obstacles. The Arduino is attached to the pi, and has the code in order to get the motors to spin in the way we want. The actual motors are unknown of what they are and are thought to be windshield wiper motors, but there are many other possible things it could be.

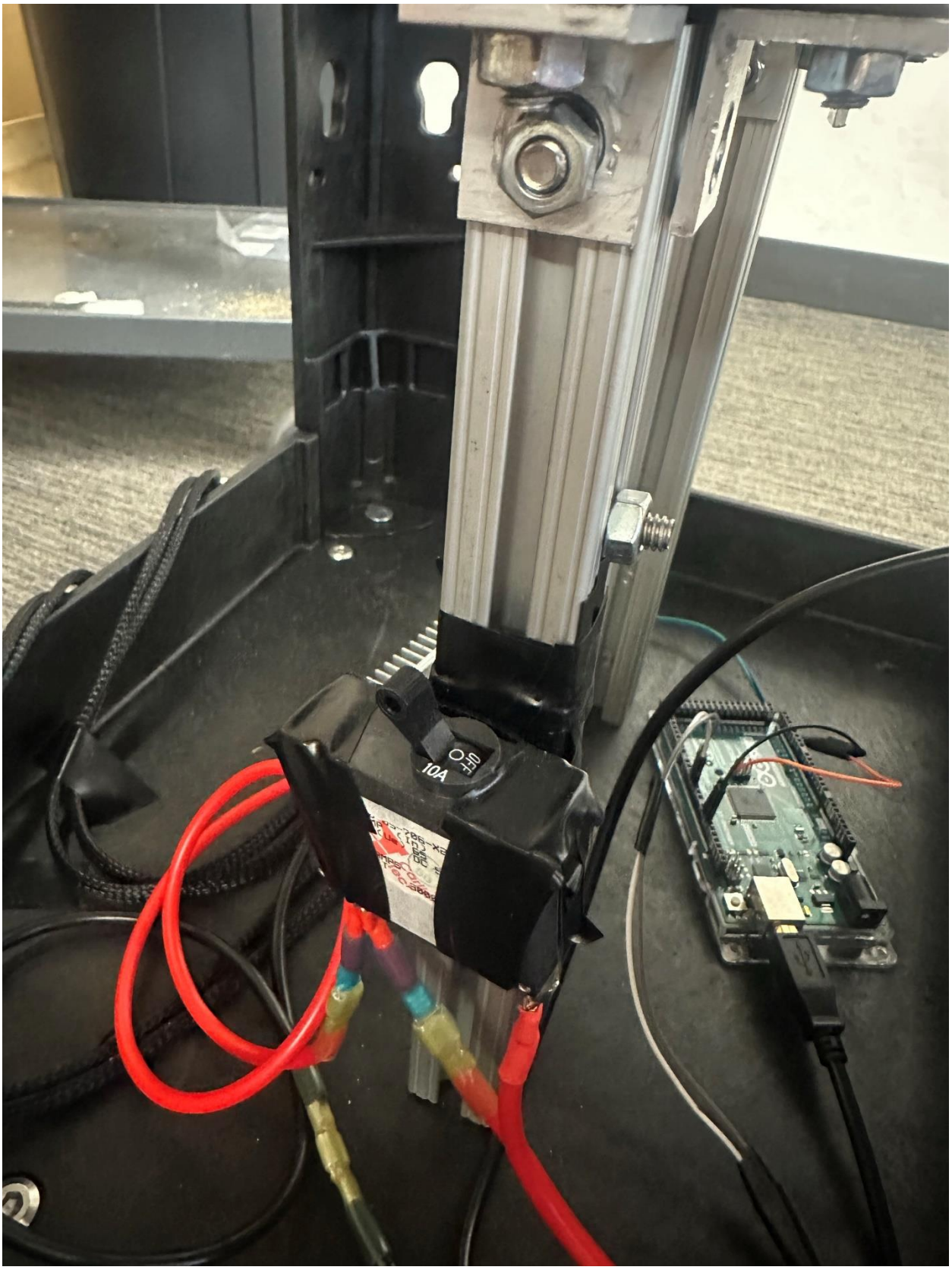
The main focus of the mounting system is to secure the batteries since they are so dense and it is important that nothing ill happens to them. To do this two pieces of aluminum extrusion were cut to length and threaded to screw into the sides of the cart. The batteries are held in from sliding side to side with a short piece of aluminum extrusion connected to the two pieces that prevent them from shifting forwards and backwards. In addition to that, in order to mount the lidar, I assembled a frame of aluminum extrusion to hold up the 3d printed part I designed. This allowed the lidar to not be blocked by the aluminum extrusion.

The making of the physical cart can be done without experience in similar things if you are willing to ask for help and learn.

There are images below on some of the parts mentioned here.


ARDUINO
ARDUINO.CC

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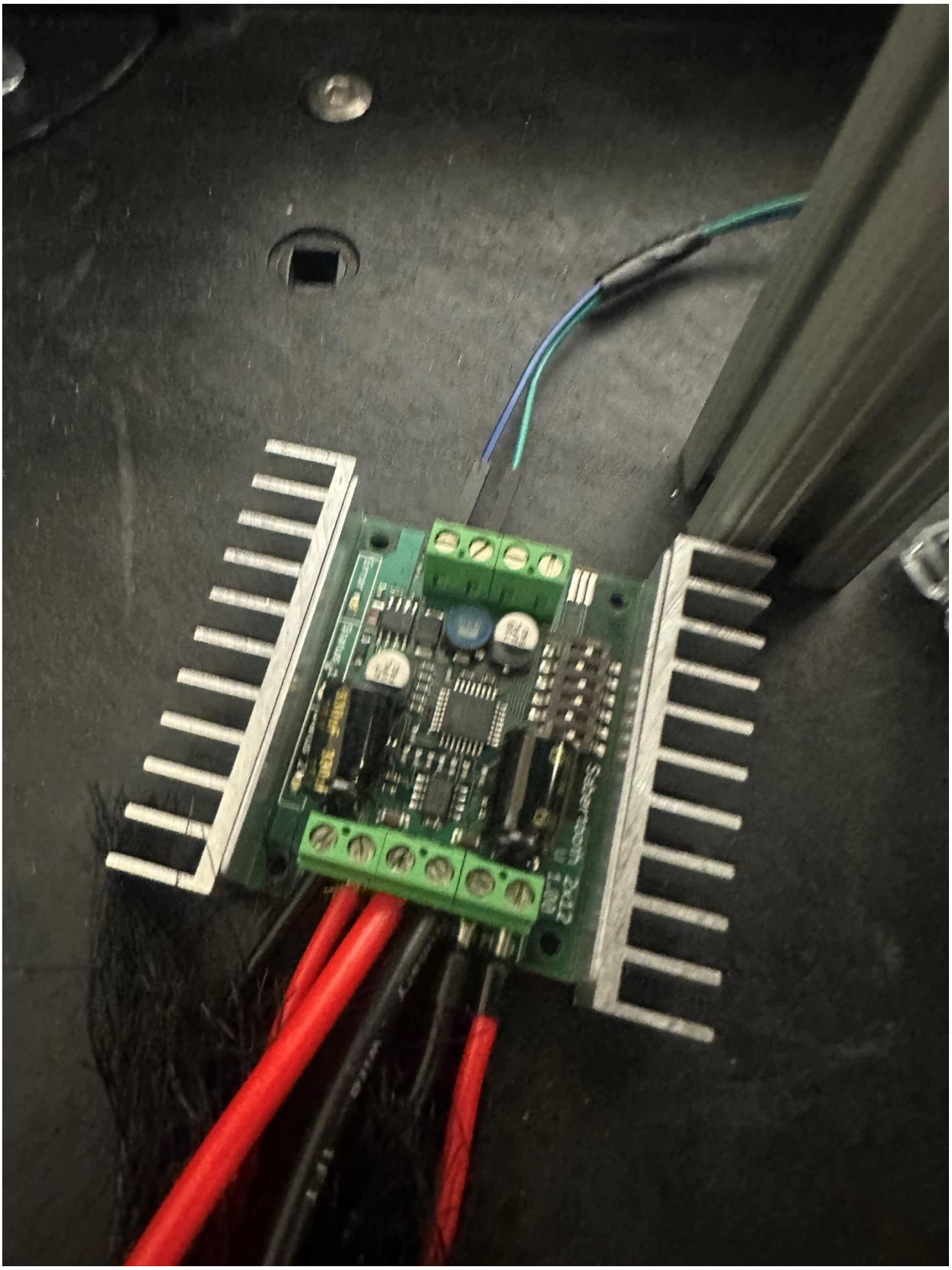
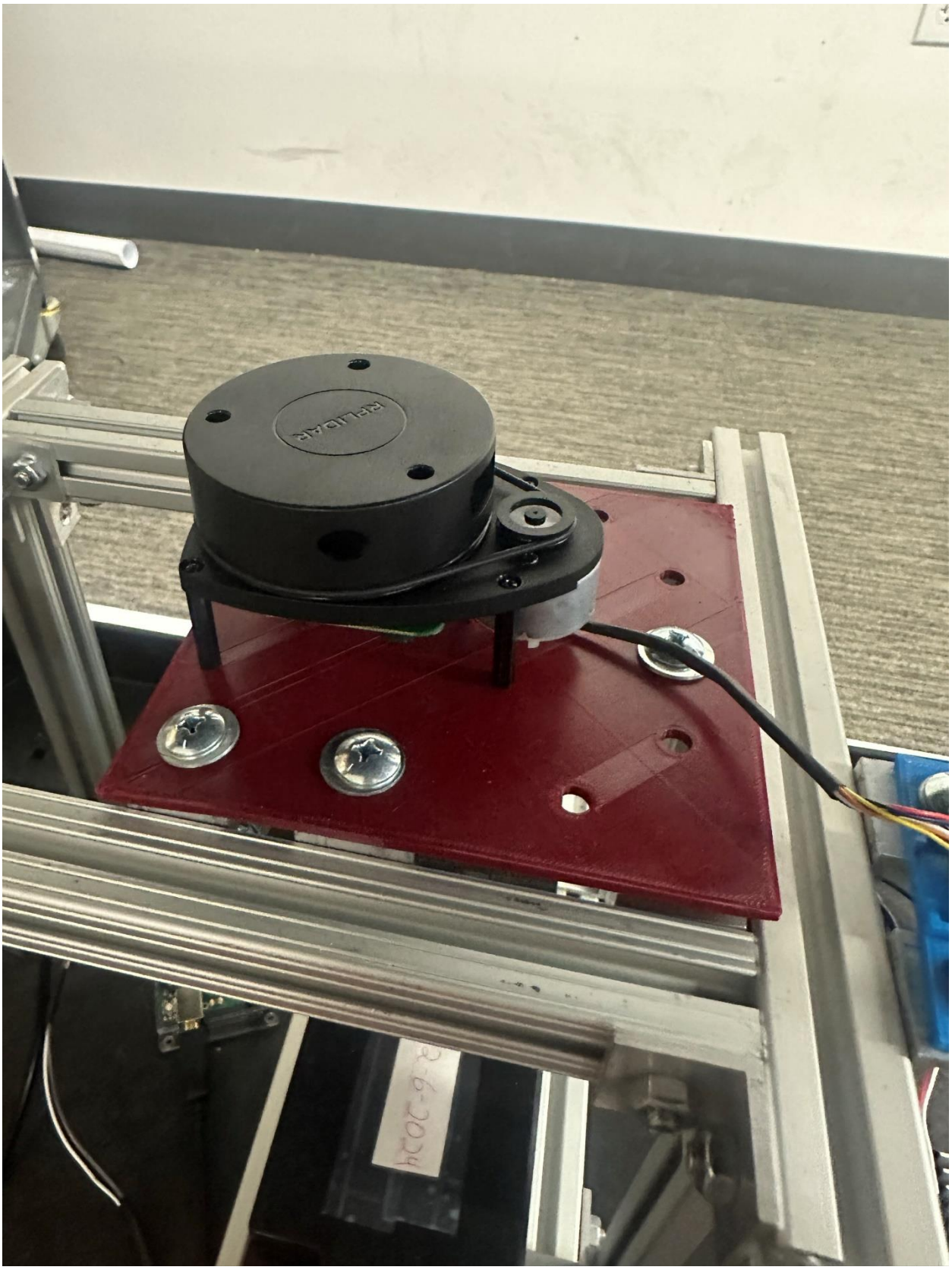
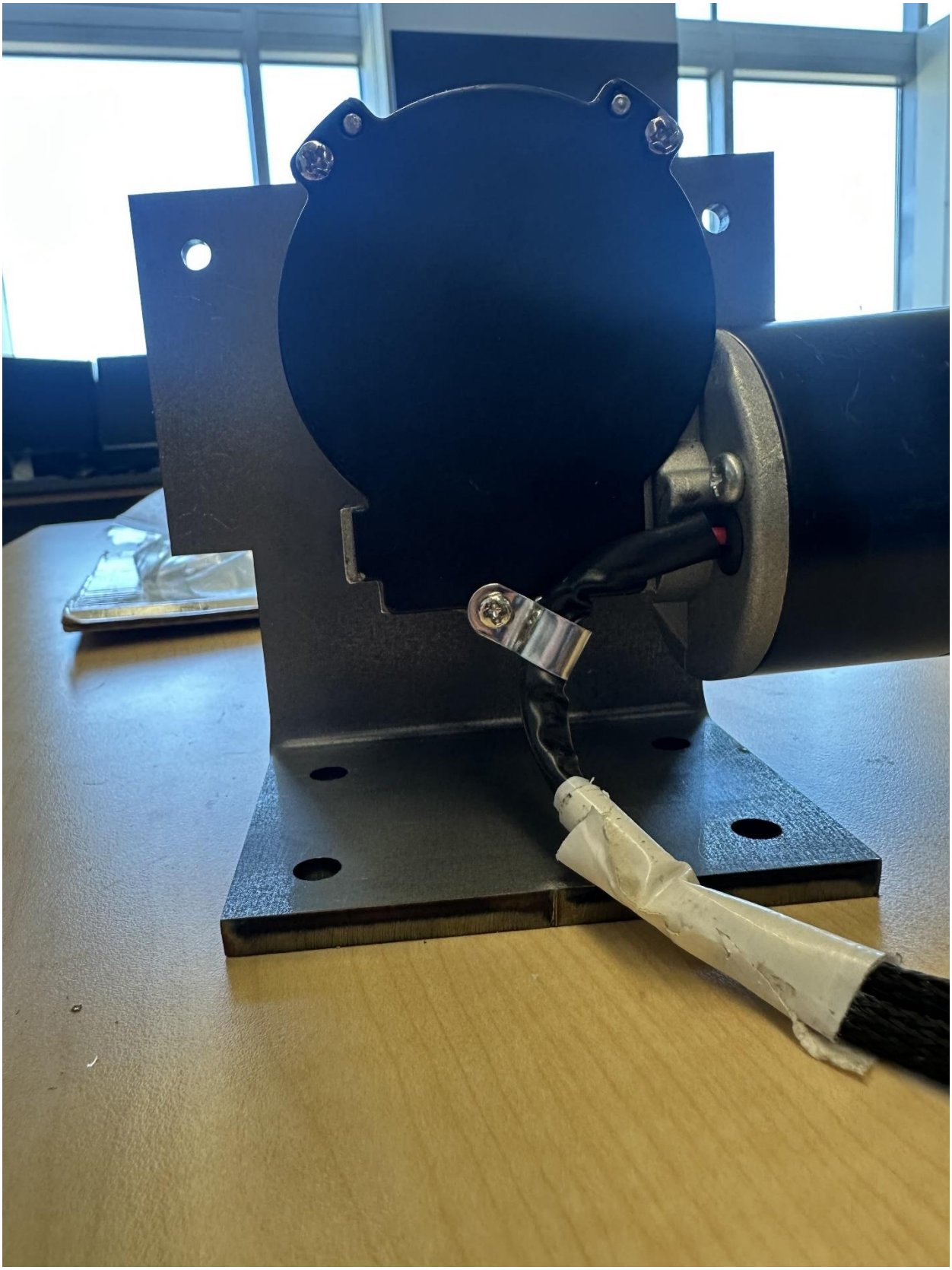
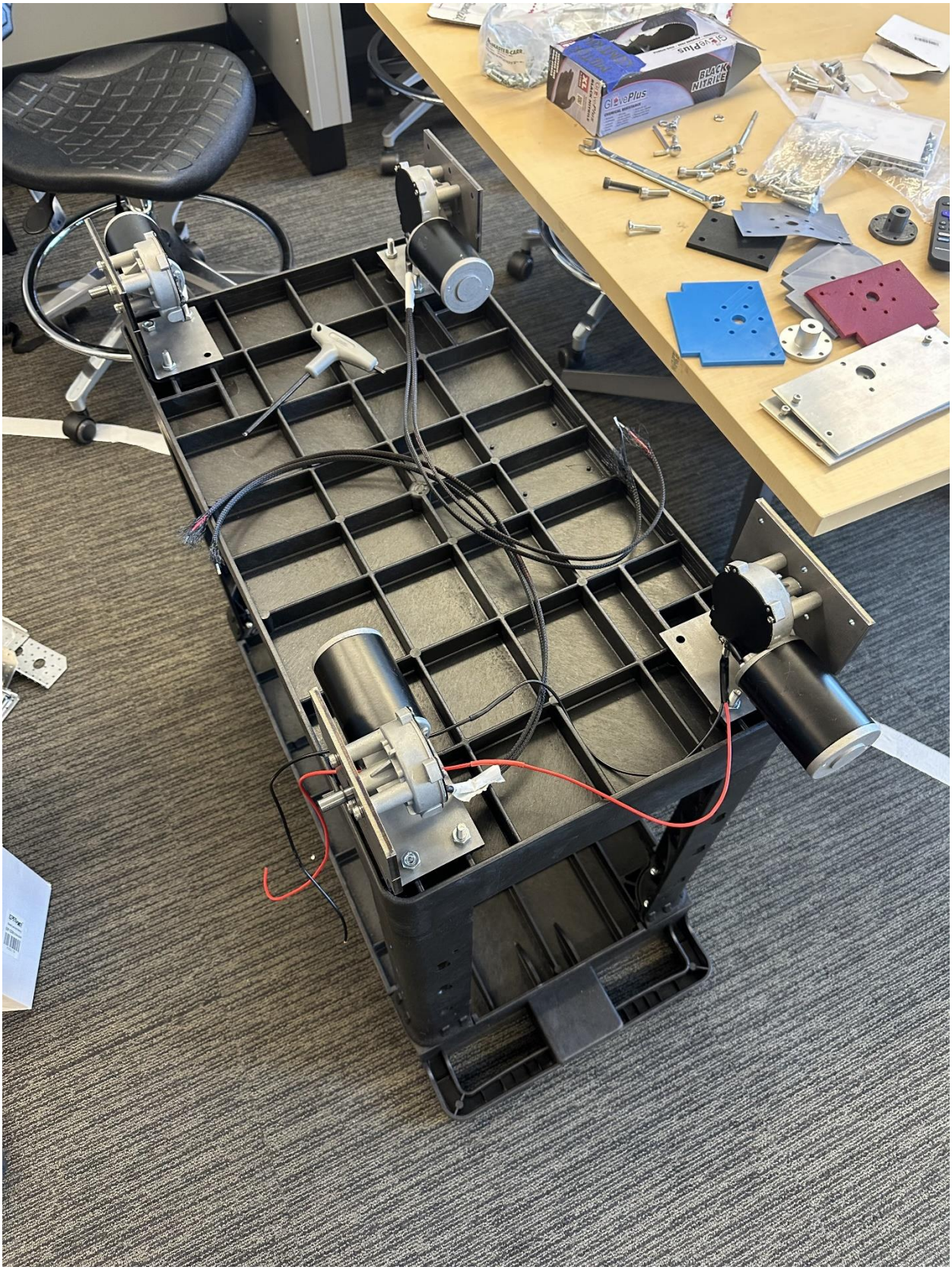
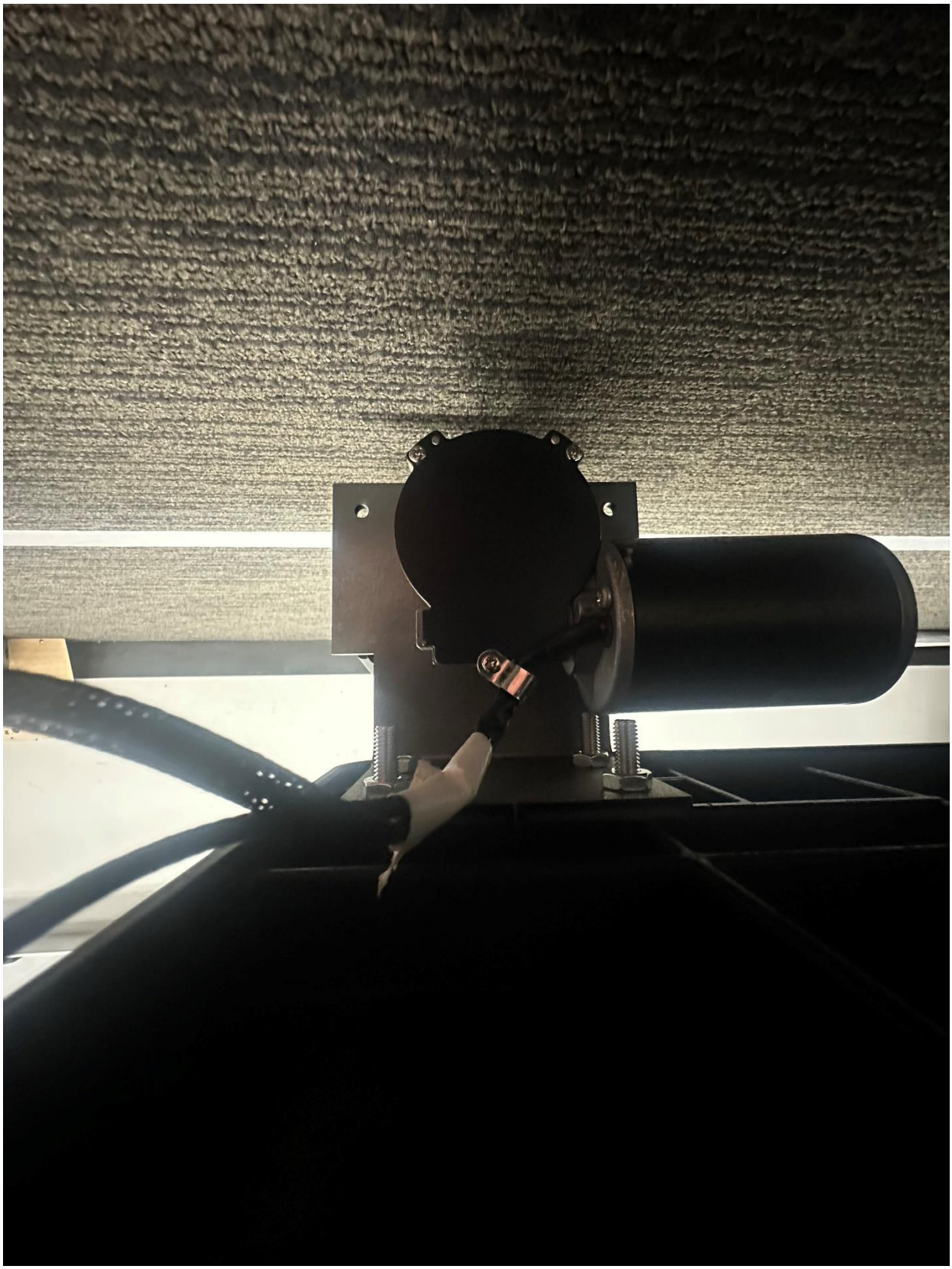
10A

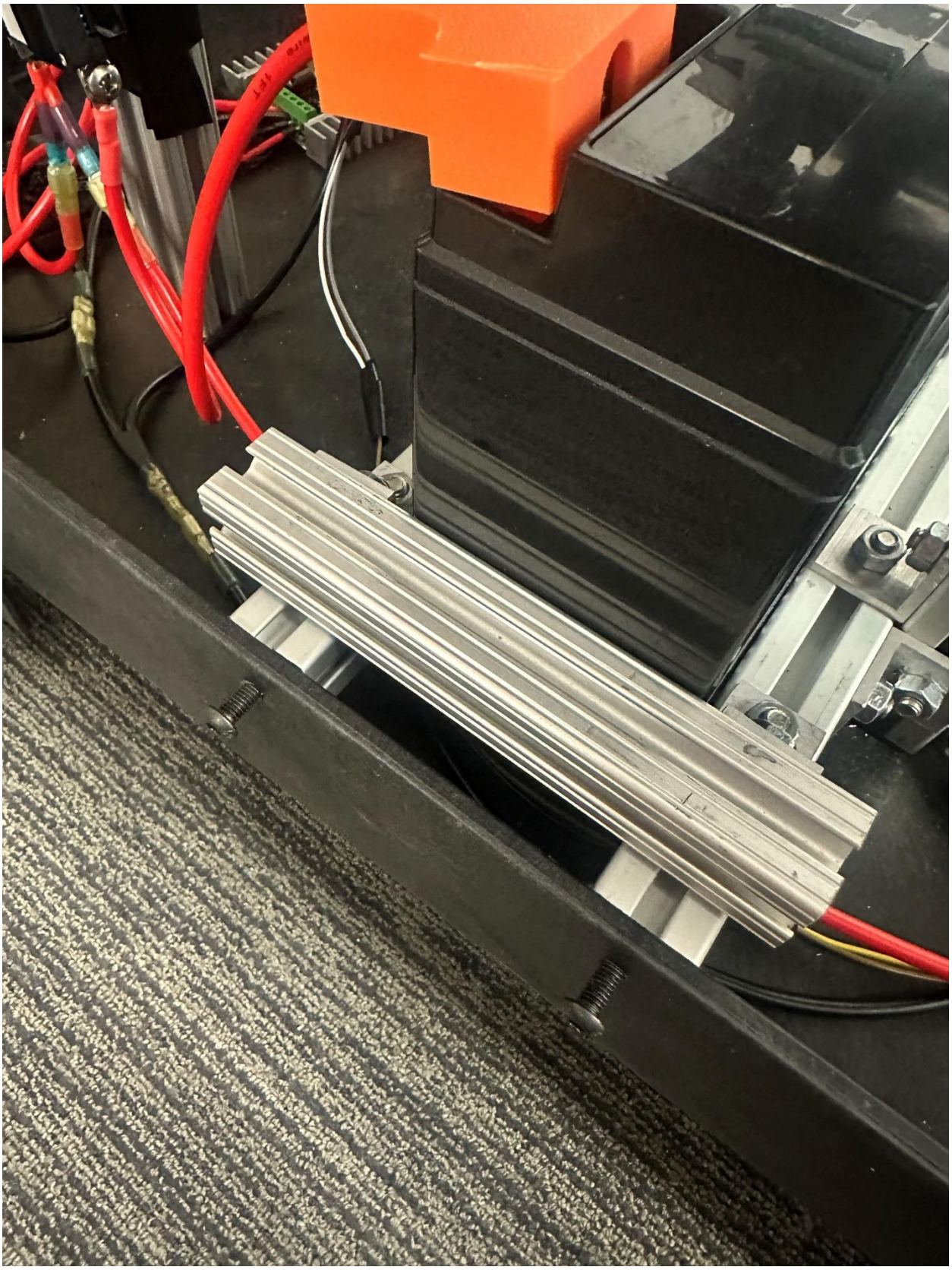


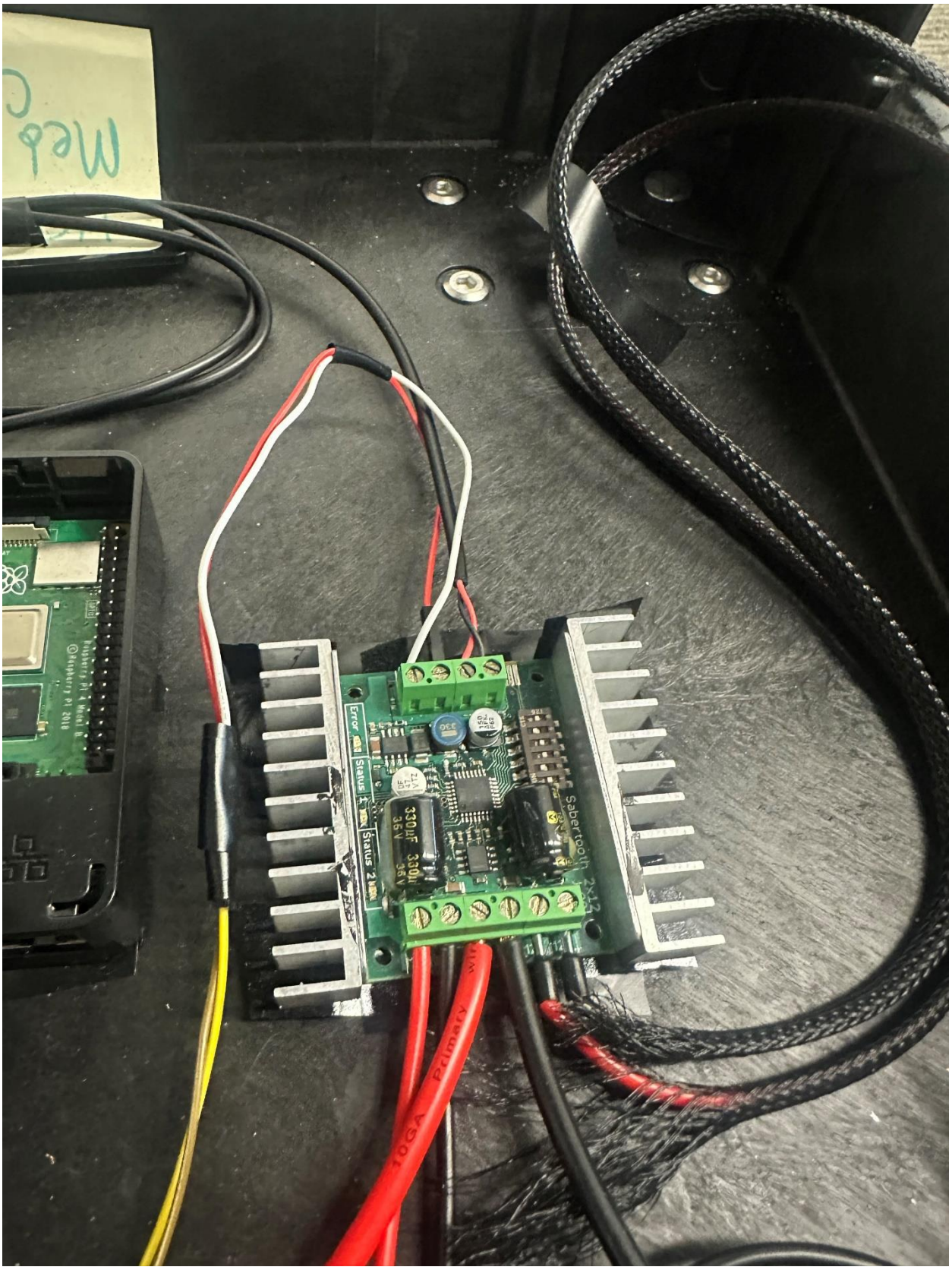

RPLIDAR

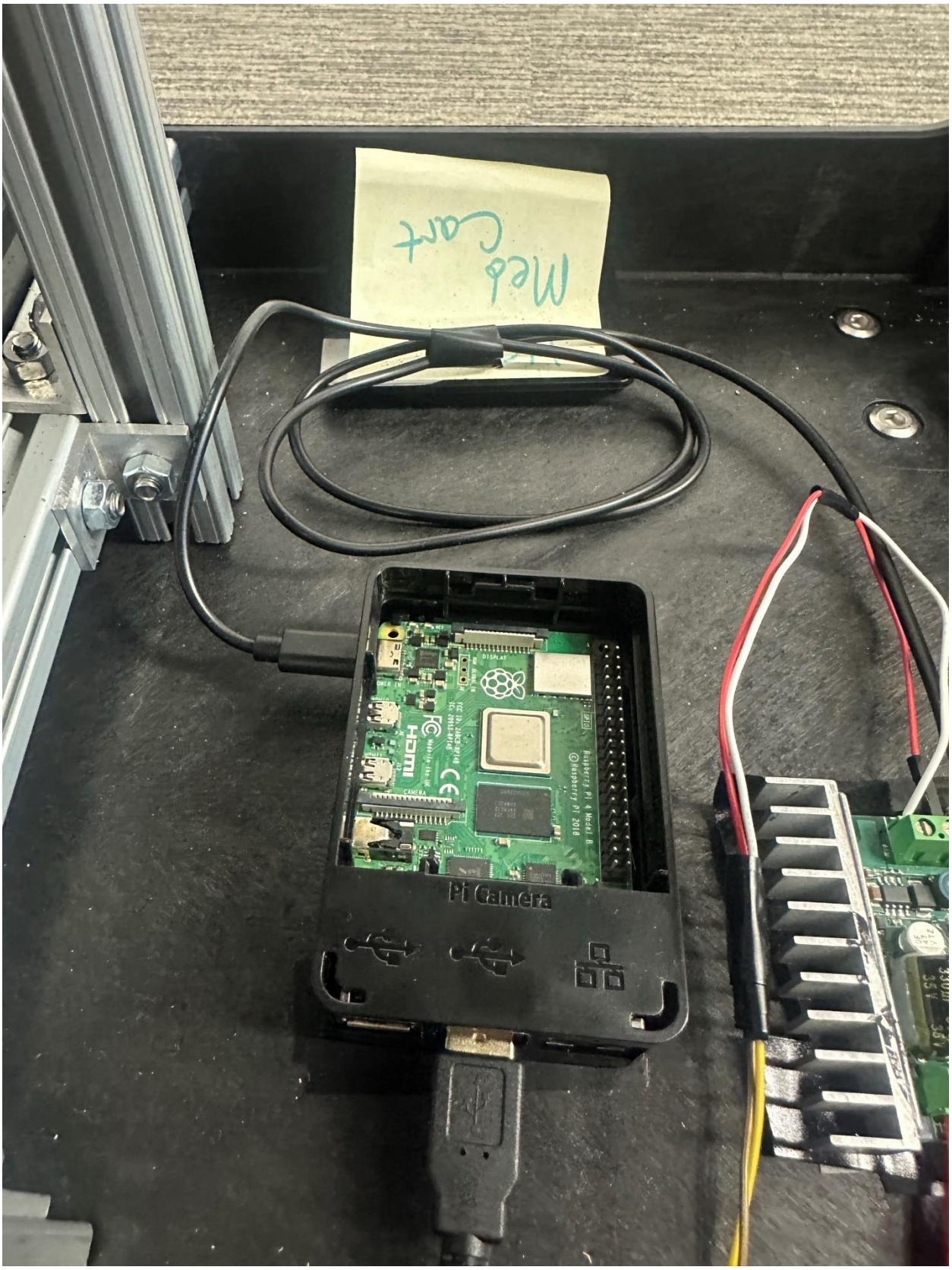



GlovePlus
BLACK NITRILE






Error
Status 1
Status 2
330µF
35V
Sabertooth 2x32
16GA Primary


Pi Camera