Hand

Robotic Hand 2.0 is a servo-actuated parallel gripper with integrated infinite wrist rotation, designed as a modular end effector for the ARM 3.0 system. The gripper is driven by **two DF 45 kg·cm servos**, which feed into a **gear reduction driving dual parallel four-bar linkages**, ensuring synchronized motion and parallel finger closure. The system produces **181 N of grip force**, providing a **3.5 factor of safety** for the 5 kg payload requirement.

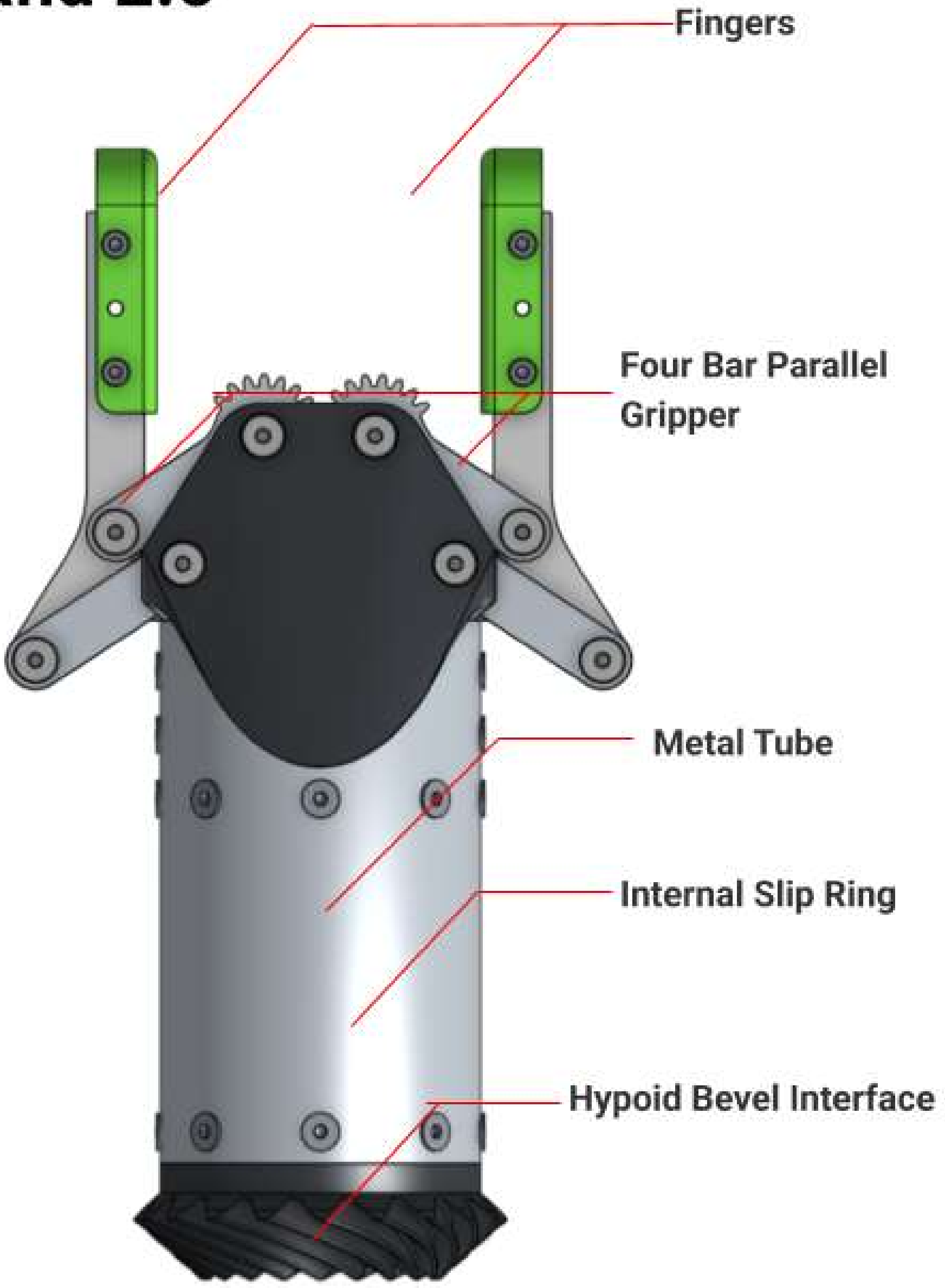
The **gripper fingers are water-jetted from 1/4" 5052 aluminum**, then **sandblasted and bushed** for durability and smooth joint motion. The gripper assembly is mechanically independent from the hand stem, allowing modular replacement. The stem houses an **internal slip ring enabling continuous rotation**, transmitting torque through a **keyed shaft interface to the wrist**. The slip ring housing is constructed from **2.5" diameter 6061 aluminum tube (1/16" wall)**, manually machined to create mounting and interface features. Structural and enclosure components are **3D printed in glass-fiber reinforced ABS**, providing lightweight protection and rapid iteration capability.

Hand Gripper Remove
Perrybotics

Watch on

Gripper
Perrybotics

Hand 2.0



Hand on Wrist - Onshape

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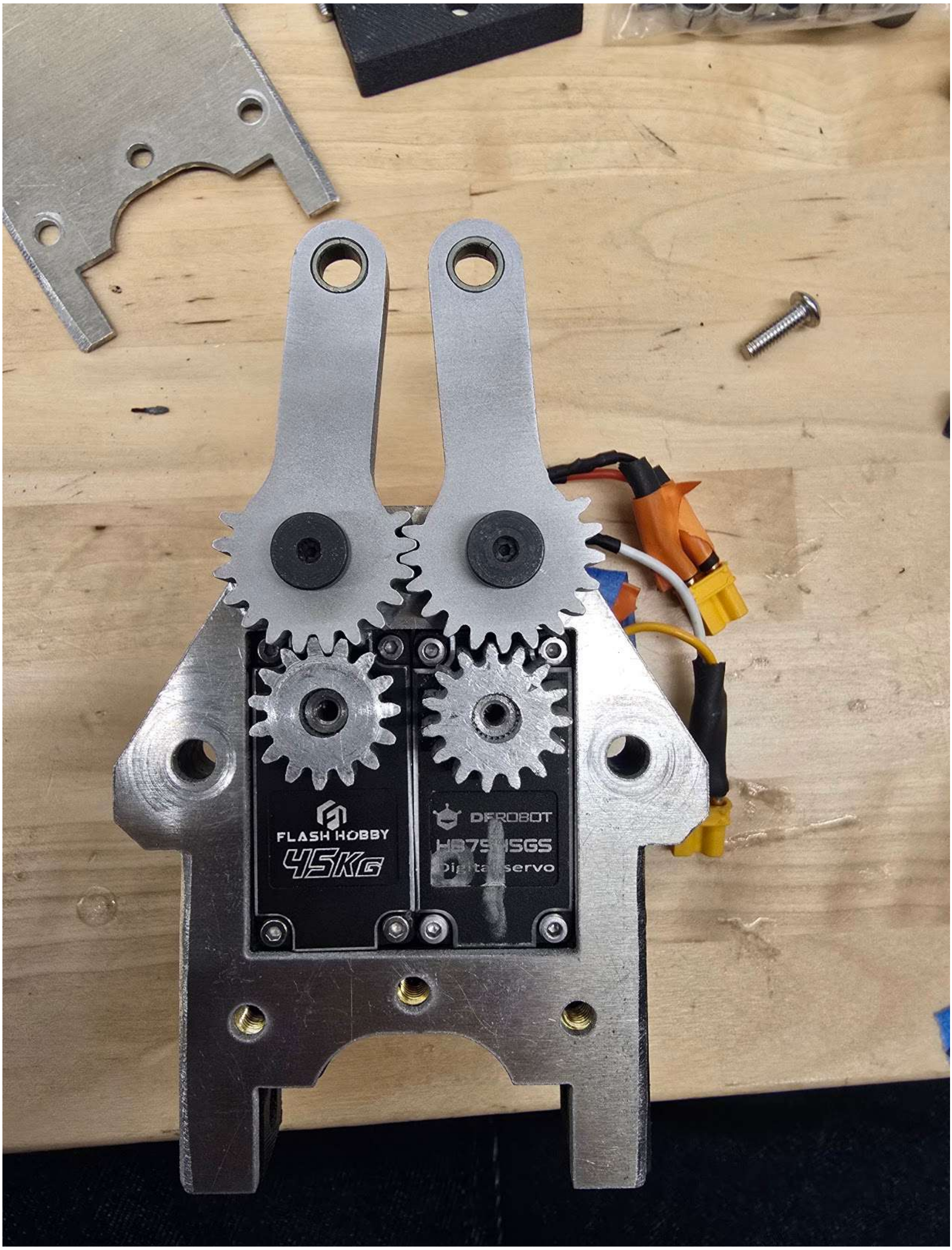
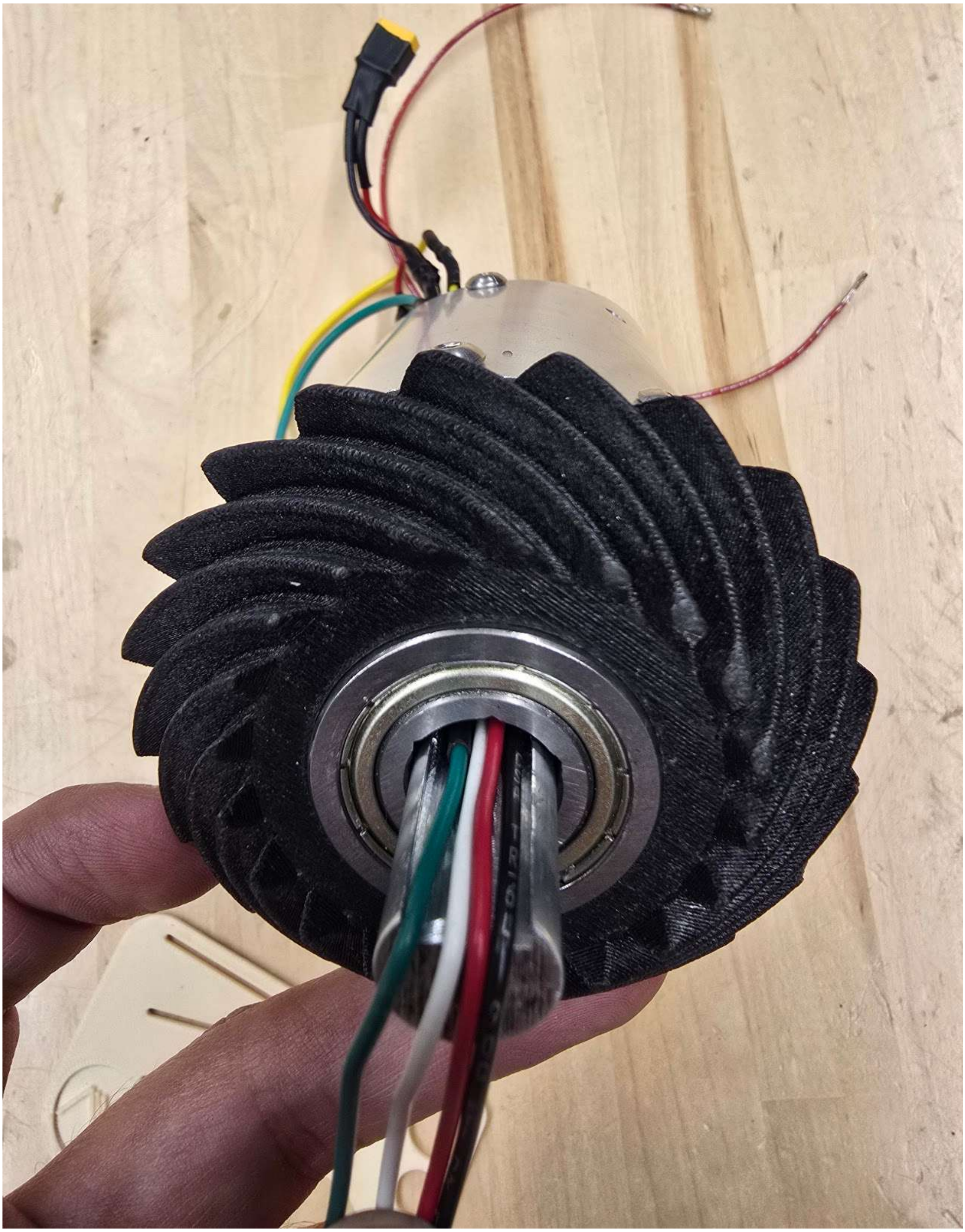
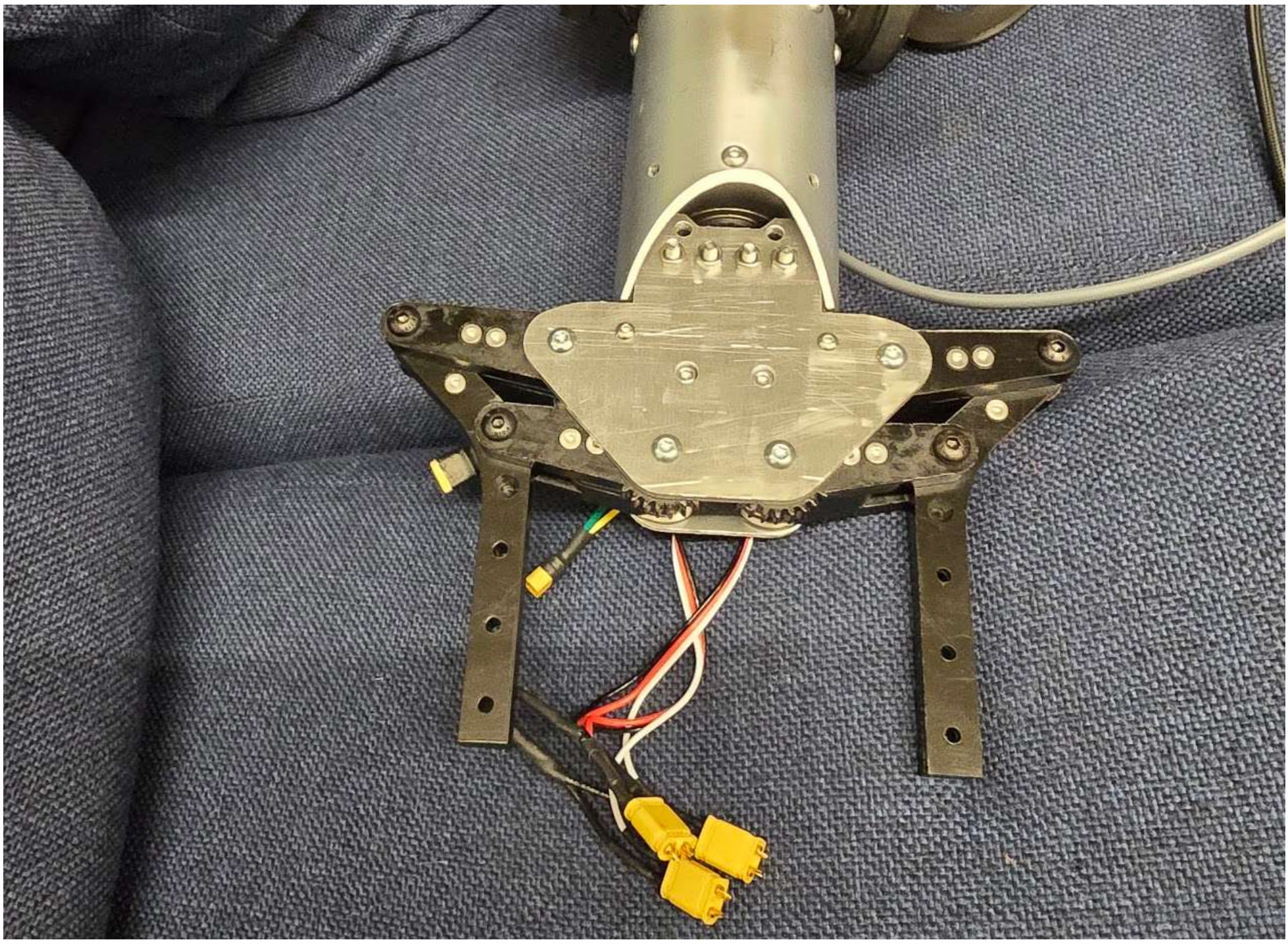
AI PRAXIS

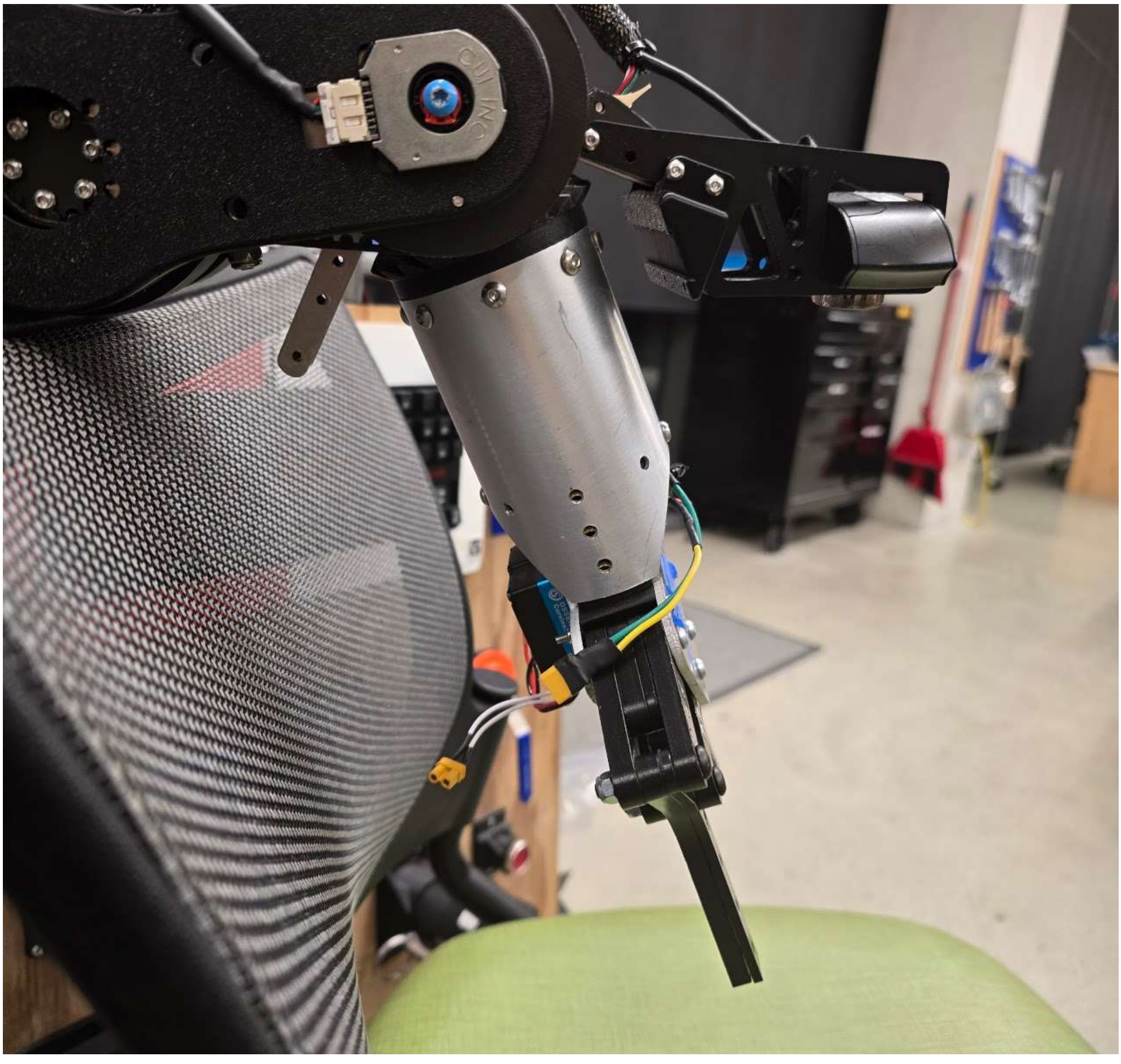
Extra Photos:

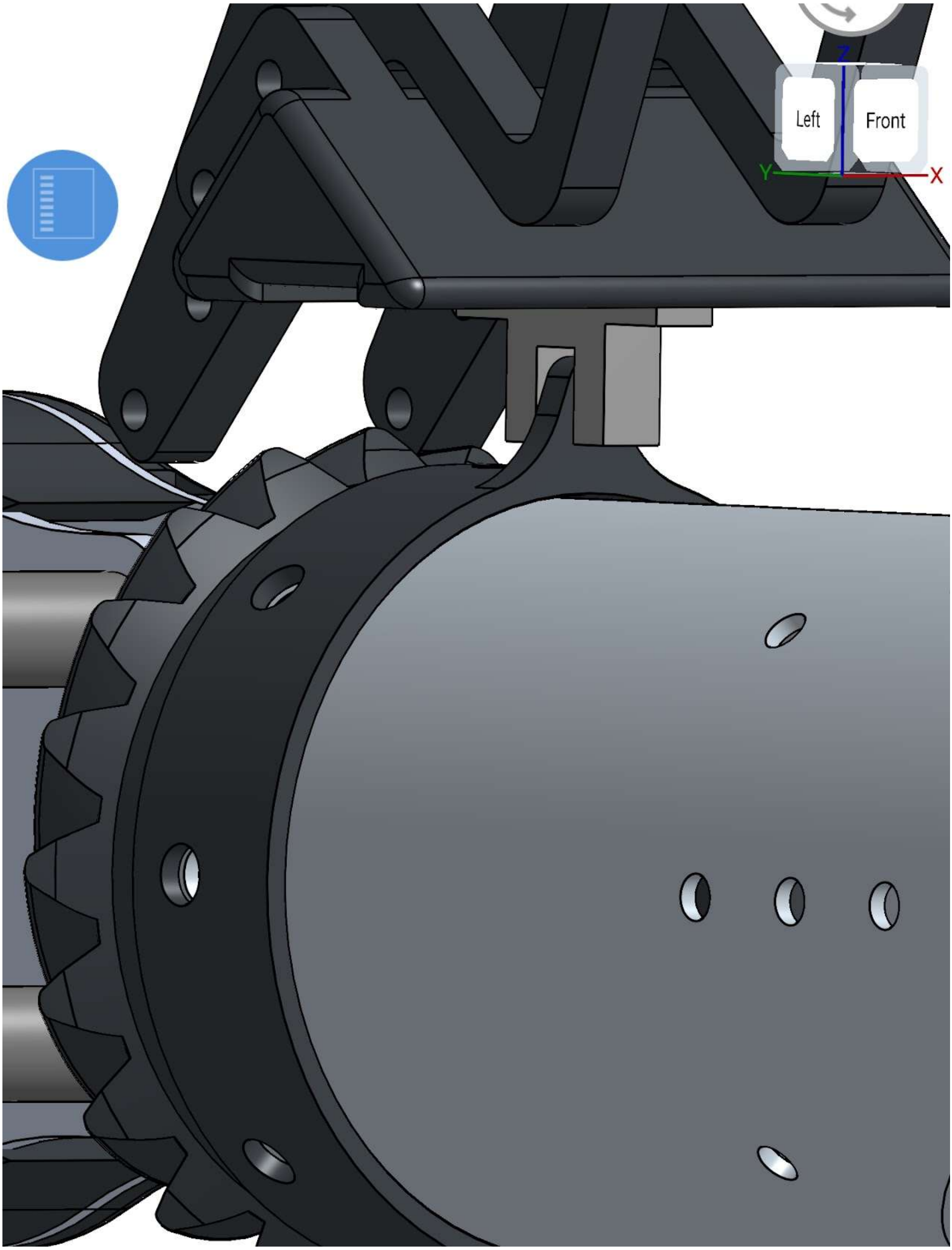

EXIT ONLY


FLASH HOBBY
45KG
DFROBOT
servo



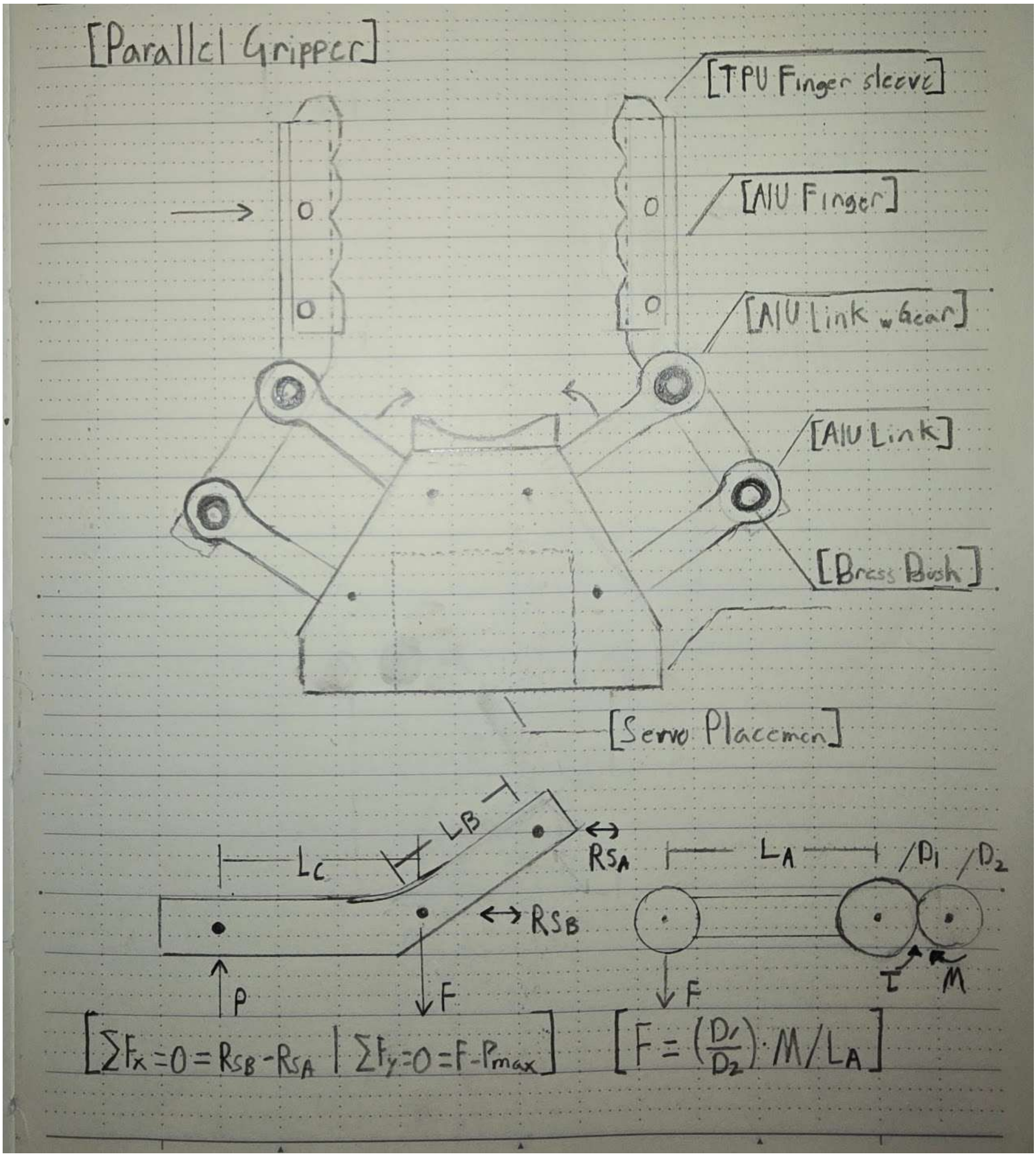





Z
Left
Front
Y
X

Given the torque and size constraints imposed by the wrist, the hand was designed to remain under **0.3 m in length** while supporting the required grip force and structural loads. A **through-bore slip ring configuration** was implemented, allowing a **keyed shaft to pass through the hand stem**, enabling **continuous rotation without increasing overall length** and minimizing bending moments on the wrist.

Unlike Hand 1.0, the **gripper assembly is fully modular and independently replaceable.** The gripper can be **removed and swapped without redesigning the hand stem**, allowing future teams to integrate new end effectors while retaining the same wrist and slip ring interface. Additionally, the **gripper fingers themselves are interchangeable**, enabling **rapid iteration and task-specific customization** without modifying the core mechanism. This modular architecture separates the **rotation, structure, and gripping subsystems**, improving serviceability, adaptability, and long-term usability.

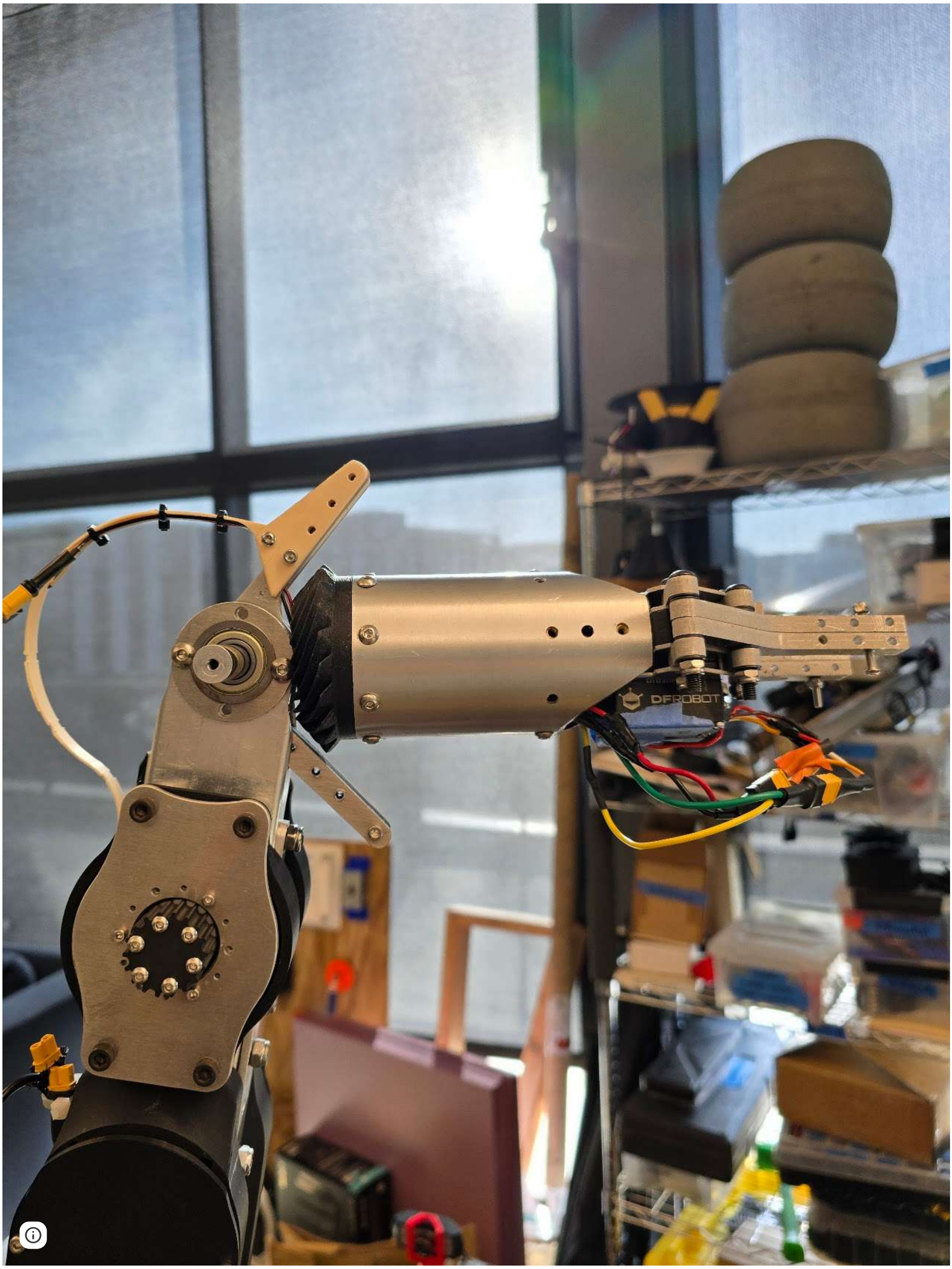


Structural and enclosure components were **3D printed in glass-fiber reinforced ABS using a Bambu P1S with a hardened steel nozzle**, providing high stiffness and wear resistance. The **6061 aluminum slip ring housing tube was machined manually in the DIB machine shop**, where I designed and used a **custom radial marking jig** to ensure accurate hole placement before cutting and drilling features by hand.

The **gear and linkage components were water-jetted from 5052 aluminum in the MAE machine shop**, then **sandblasted and brushed** to achieve a smooth, low-friction finish at bearing interfaces. The **servo drive gears use stamped fine-pitch teeth** to ensure proper meshing and torque transfer. This manufacturing approach combined **precision machined metal load-bearing components with rapidly iterated printed structures**, enabling a lightweight, modular, and serviceable gripper assembly.

The hand is assembled using **M4 and M5 fasteners**, with the **slip ring housing secured by top and bottom aluminum caps featuring radial mounting screws** for structural retention and service access**.** The gripper is built as a **hybrid plastic–metal structure**, with **ABS-GF printed components providing mounting geometry** and **water-jetted aluminum linkages providing structural strength and load transfer.**

All gripper joints pivot on **M5 shoulder bolts with precision spacers (McMaster-Carr)**, ensuring proper alignment, low friction, and repeatable motion**.** The layered assembly approach separates **structural load paths (metal)** from **mounting and enclosure features (plastic)**, improving rigidity, durability, and serviceability while allowing rapid iteration of the gripper mechanism**.**



About

Resume(PDF)

Portfolio(PDF)

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