Hands-On Labs

A Virtual Hands-on Lab Experience

MECHANICAL ASSEMBLY MANUAL

ALL YOU NEED TO KNOW TO MECHANICALLY ASSEMBLE THE ROBOTIC ARM

AHMED KAMEL

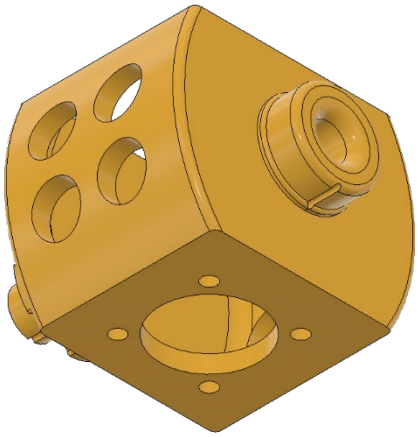
Components and Tools

A complete list with all the components and the tools required for this assembly can be found HERE.

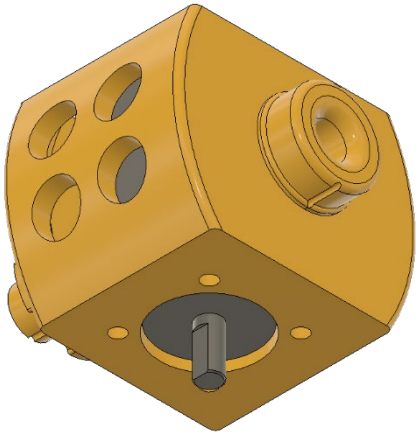
Assembly Manual

Axis 6 (end effector) :

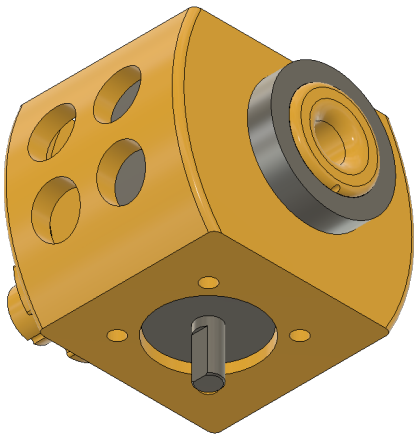
1. 3D Print the part (axis6motorHolder).



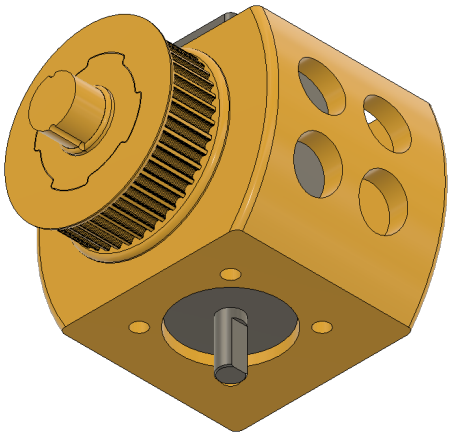
2. Fix the Nema 8 motor using four M2 x 6mm on the 3D printed part.



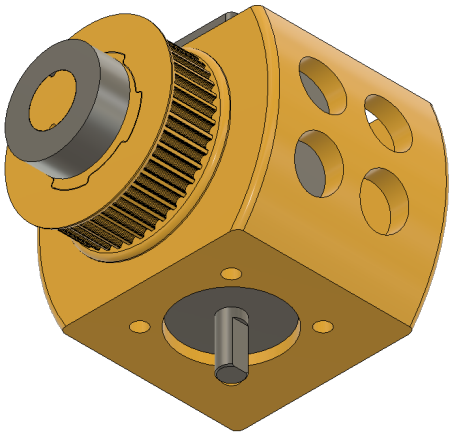
3. Install the ball bearing (21x15x4) on one of the sides.



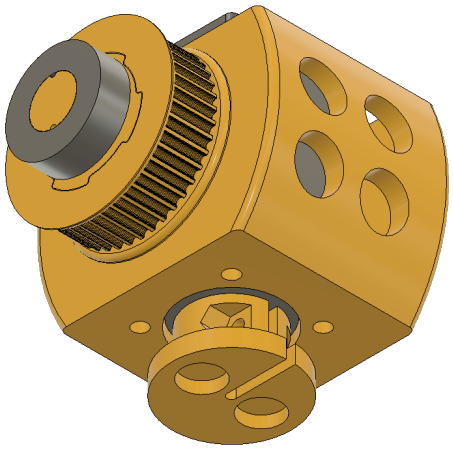
4. Install the 3D printed part (Pulley42) on the other side using glue.



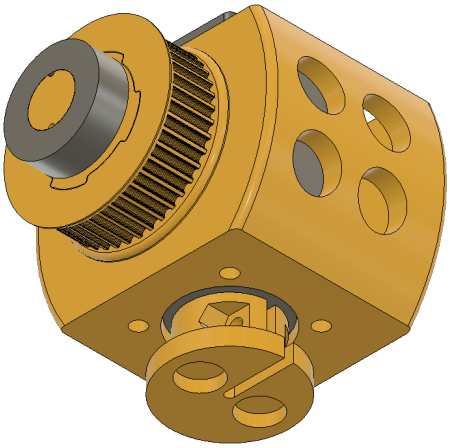
5. Install the ball bearing (16x8x5) on the same side.



6. Install the 3D printed part (Axis6) on the motor shaft using M2x8mm screw and M2 nut.

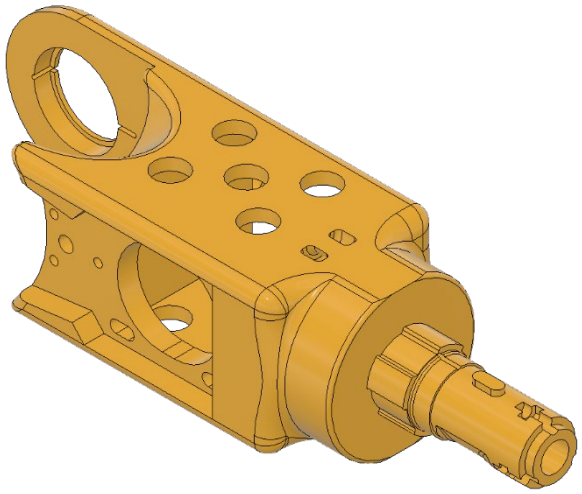


7. Install two magnets on the previously installed part.

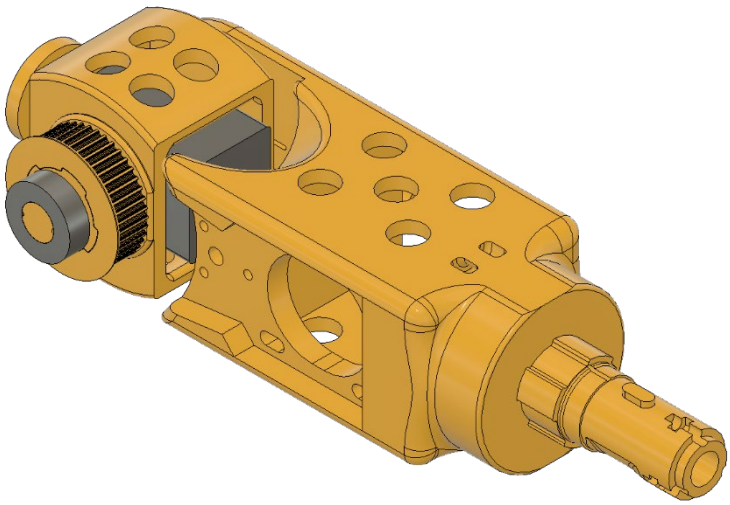


Axis 5:

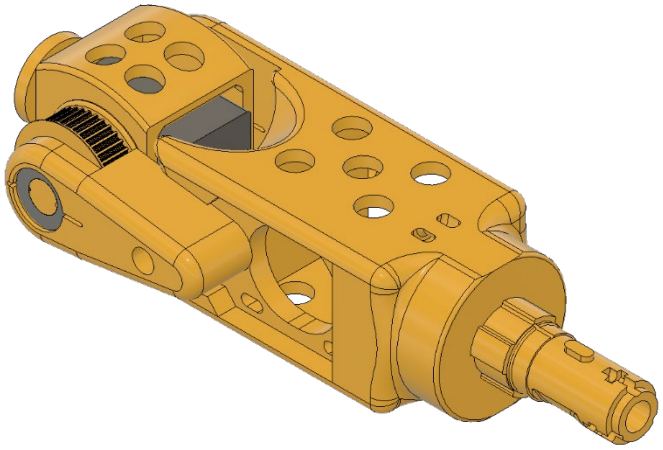
1. 3D print the part (Axis5)



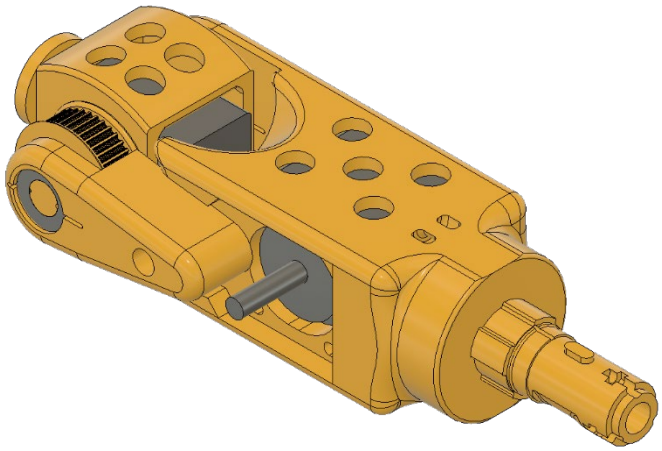
2. Install the previous sub-assembly (Axis6) om the 3D printed part as illustrated in the picture.



3. Use three dowel pins and M3x25mm screws to fix the 3D printed part (Axis5Bracket)



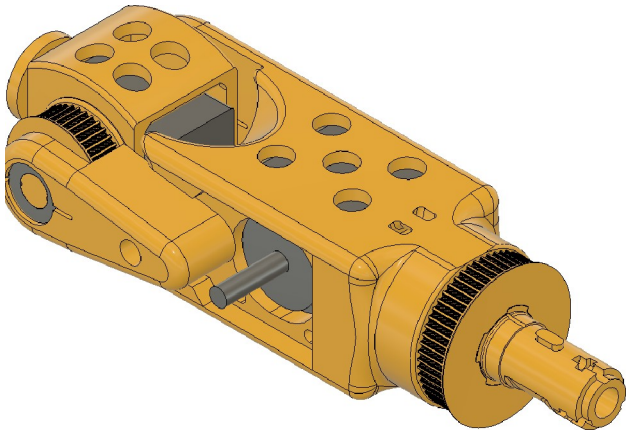
4. Fix a Nema 11 motor into (Axis5) part using four M2.5x8mm screws and M2.5 washers. Then fix GT2 Pulley onto the motor shaft.



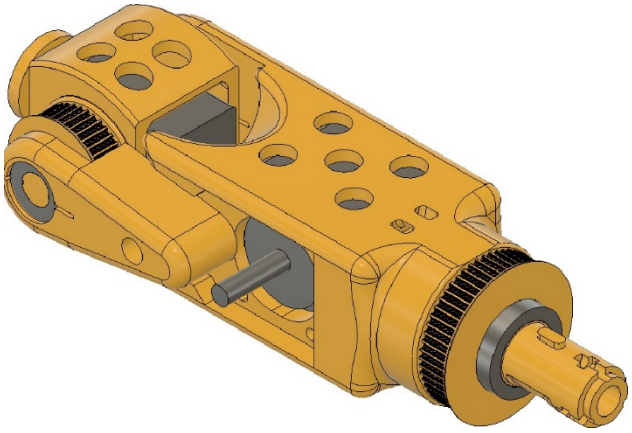
5. Attach the belt GT2 87 between the motor pulley and the gear on axis 6.

Axis 4:

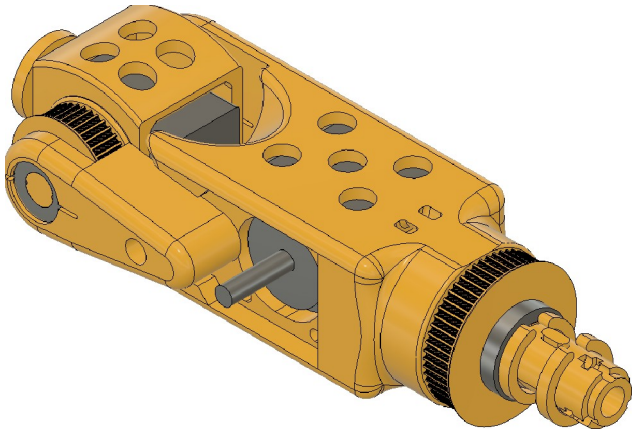
1. 3D print the part (Pulley56) and attach it to the previous sub-assembly as shown in the picture below.



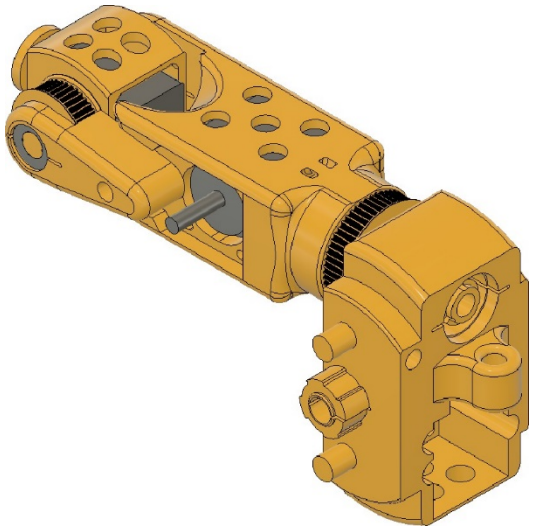
2. Install the ball bearing with the dimensions (21x15x4) after the previously installed pulley.



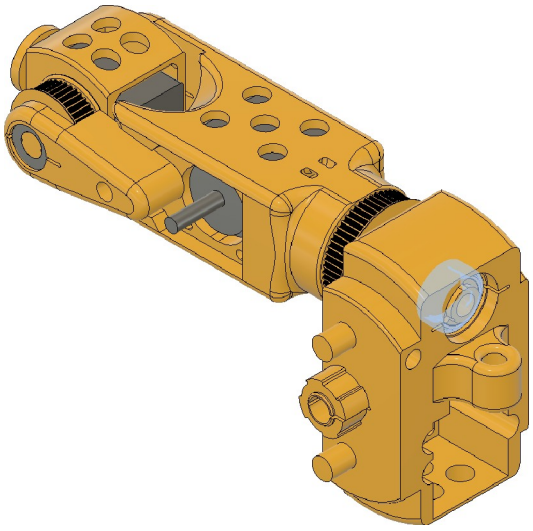
3. Install the 3D printed part (Axis4limit) after the previously installed ball bearing.



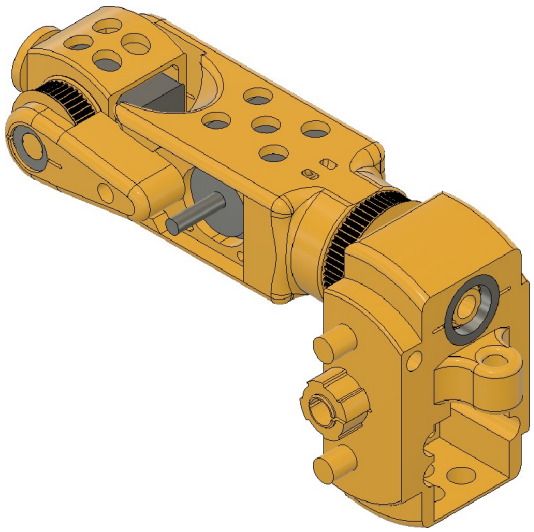
4. 3D print the part (Axis 4) and install it on the sub-assembly as shown below.



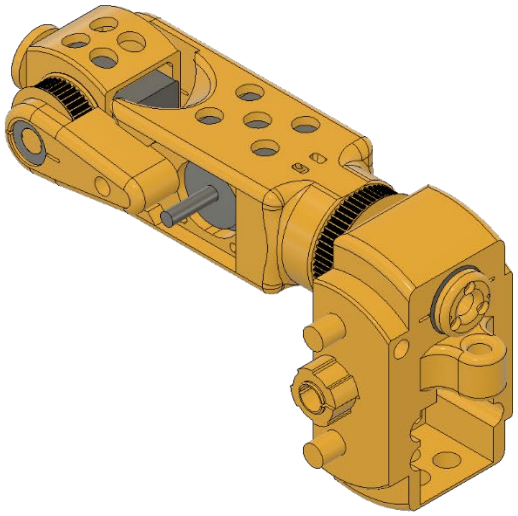
5. Install the 3D printed part (Axis 5 screw holder) using three m2 screws and nuts.



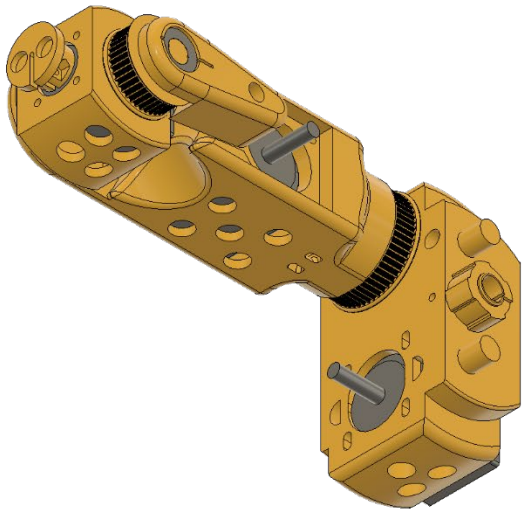
6. Install the ball bearing with the dimensions (21x15x4).



7. Install the 3D printed part (Axis 5 plug) using three M2x12mm screws.



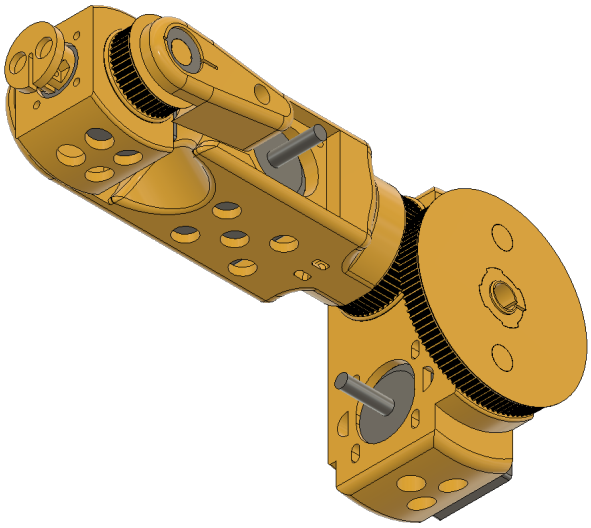
8. Install the Nema 11 motor using four M2.5x8mm and M2.5 washers, then install the pulley (GT2 20 teeth) on the motor shaft.



9. Attach the belt GT2 87 between the motor pulley and the gear on axis 5.

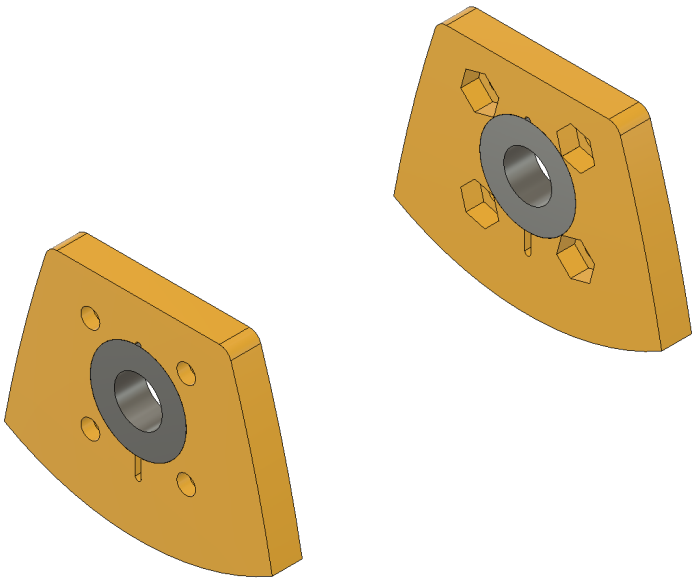
Axis 3:

1. 3D print the part (Pulley100) and attach it to the previous sub-assembly as shown in the picture below.

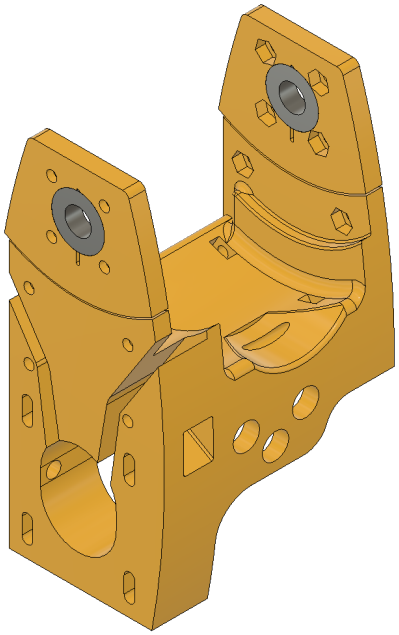


2. Install the hollow stainless tube with diameter of 8mm. The tube should be installed using M2x10mm. Then, Install a ball bearing (16x8x5mm) on each end of the tube.

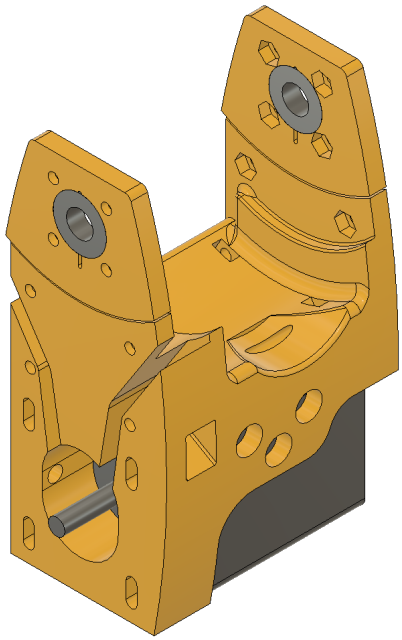
3. Install the 3D printed parts (Axis 3 Bearing Holder) using 4 M3 bolts and nuts on each side as shown.



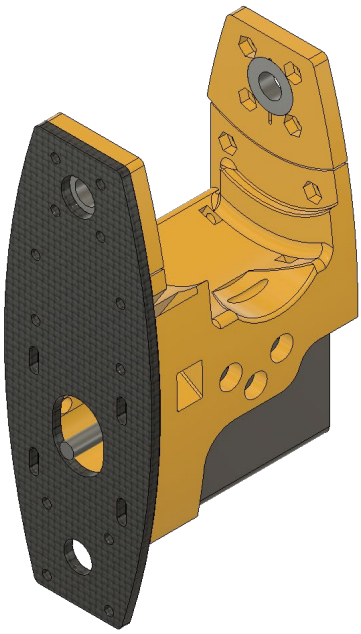
4. 3D print the part (Axis3part2) and place the parts from the previous steps as shown.



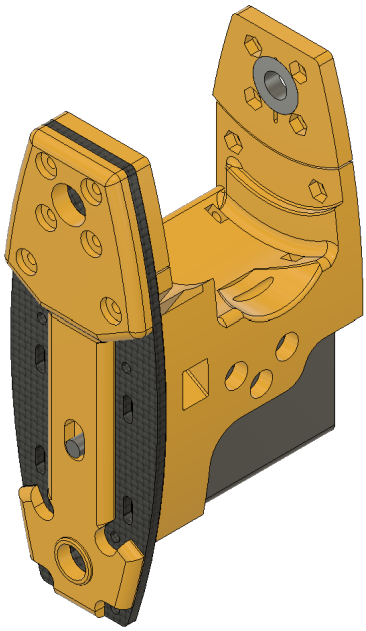
5. Install the Nema 17 motor on the part (Axis3part2) and then place a GT2 20 teeth pulley over the shaft of the motor.



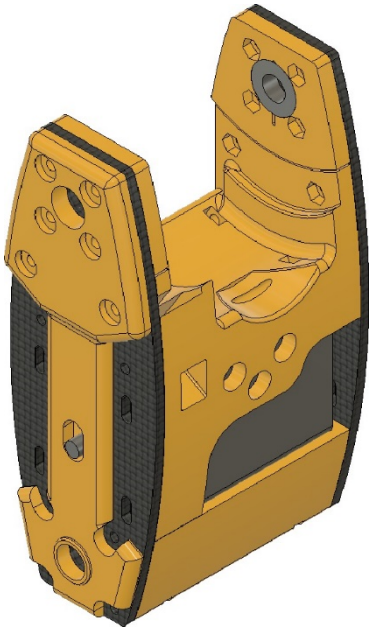
6. 3D print the part (Axis3part1) using carbon fiber filament, then it should be attached with the sub-assembly from the previous step as shown using two M3x20mm screws & four M3x25mm screws.



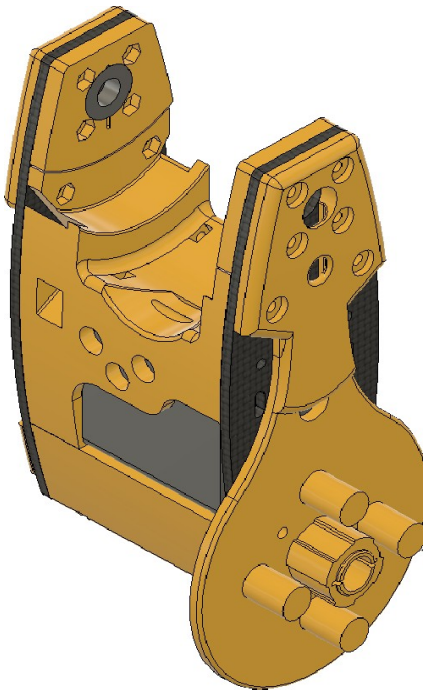
7. 3D print the part (Axis3cover1) and fix it with the previous sub-assembly using six M3x12mm, washers, and nuts as shown below.



8. Repeat step 7 on the other side of the sub-assembly.



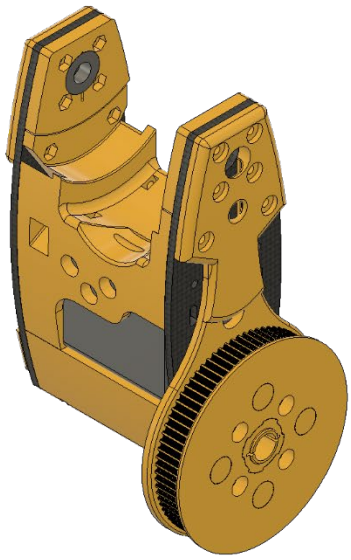
9. 3D print the part (Axis3cover2) and install it on the same side from the previous step using six M3x12mm screws.



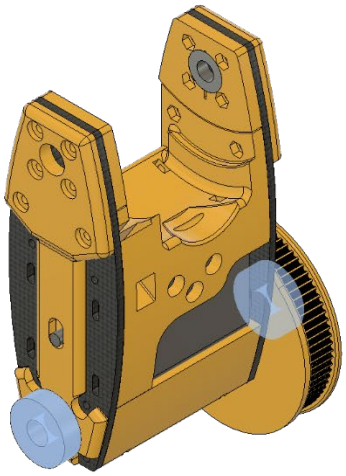
10. Install the stainless tube and make sure it centered.

Axis 2:

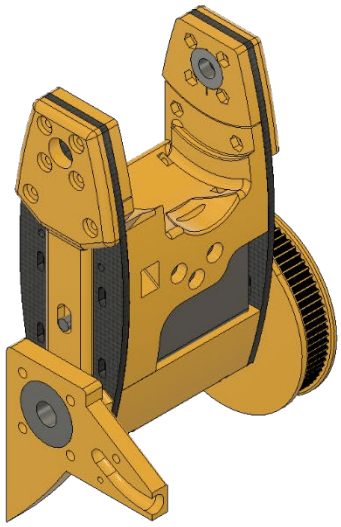
1. 3D print the part (Axis 2 Pulley) and attach it on the previous sub-assembly as shown below using four M3x30mm screws & washers.



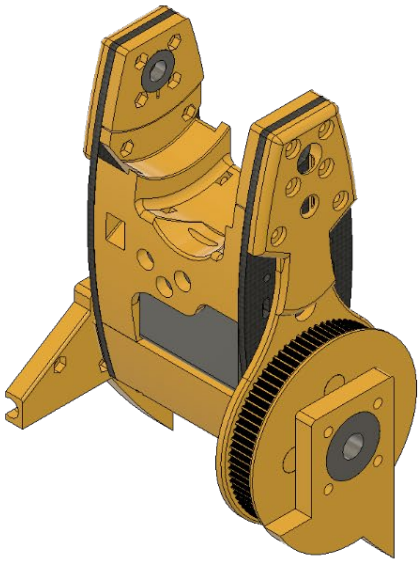
2. Install two ball bearings (26x10x8mm) on each side of the stainless tube as shown.



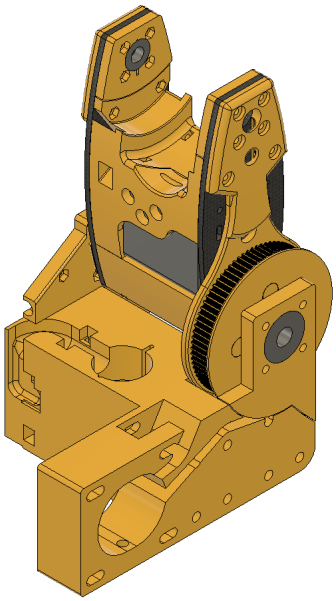
3. 3D print the part (Axis2bearingHolder) and install it as shown with the previous sub-assembly using four M4 screws and nuts.



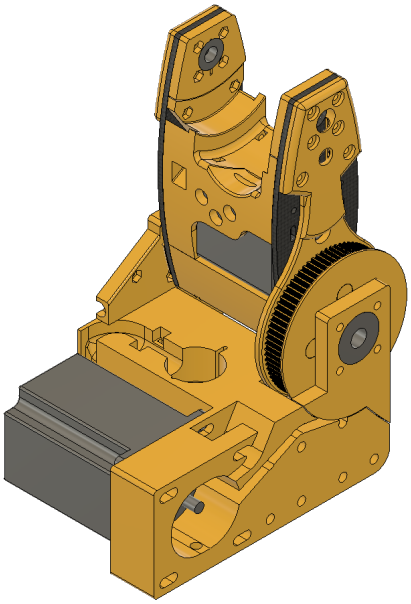
4. 3D print the part (Axis2bearingHolder(1)) as shown below using four M4 screws and nuts.



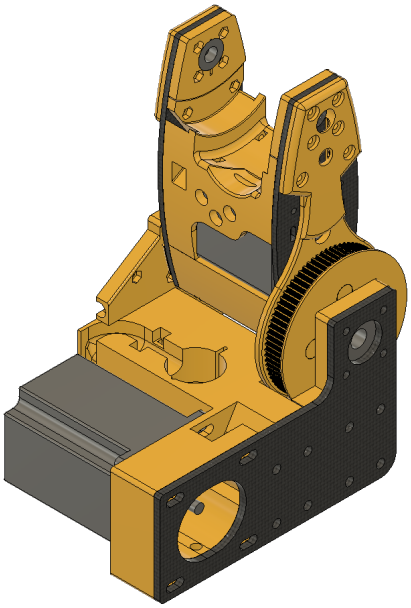
5. 3D print the part (Axis2part2) and align it with the previous sub-assembly as shown.



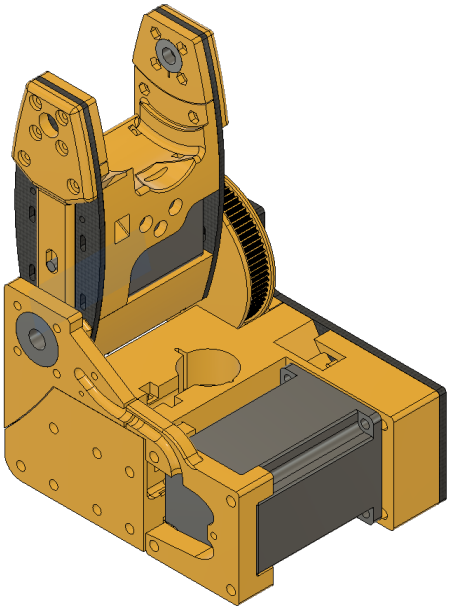
6. Install the Nema 23 motor. Then, install GT2 3mm 20 teeth pulley to its shaft.



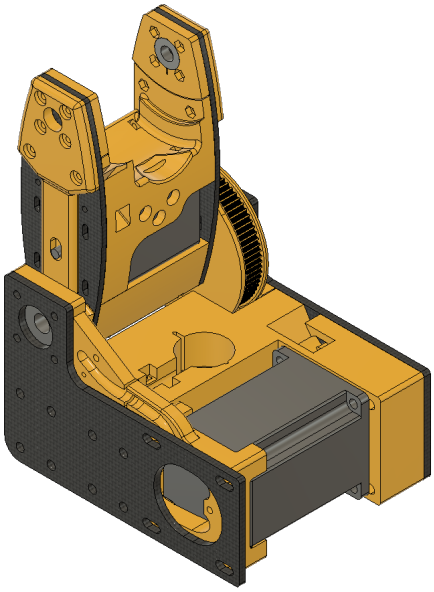
7. 3D print the part (Axis2part1) using carbon fiber filament and fix it with the previous sub-assemblies as shown below using four m4x12mm screws & 8 m5x50mm screws, washers, & nuts.



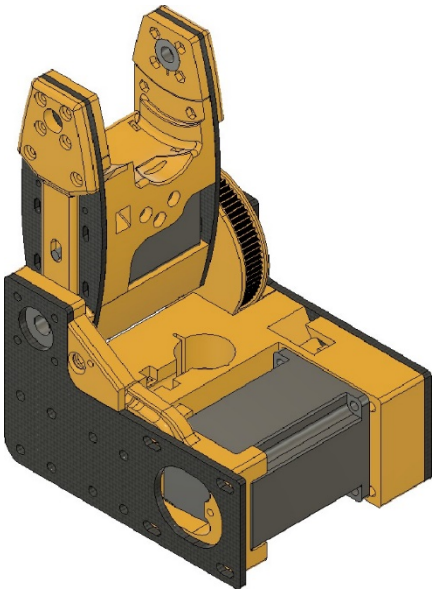
8. 3D print and install the part (Axis2MotorOP) as shown.



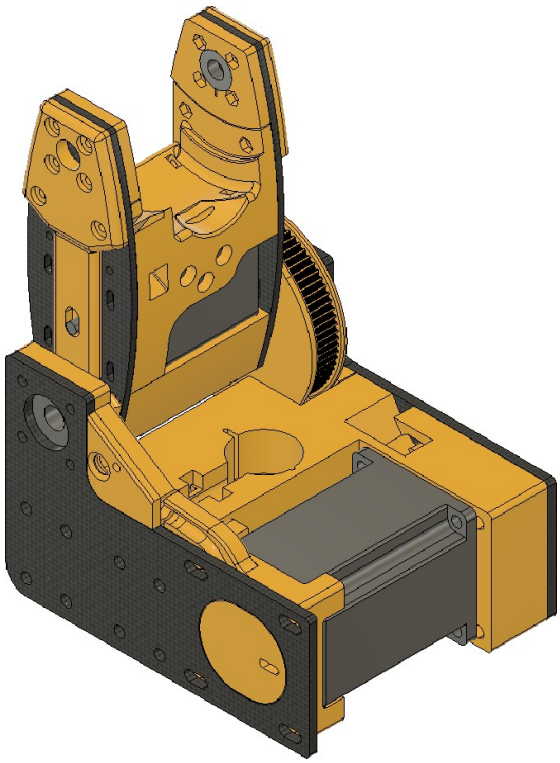
9. repeat step 7 on the other side as shown below.



10. 3D print the part (Axis2bearingHC) and fix it using a dowel pin and an M3x12mm screw as shown.

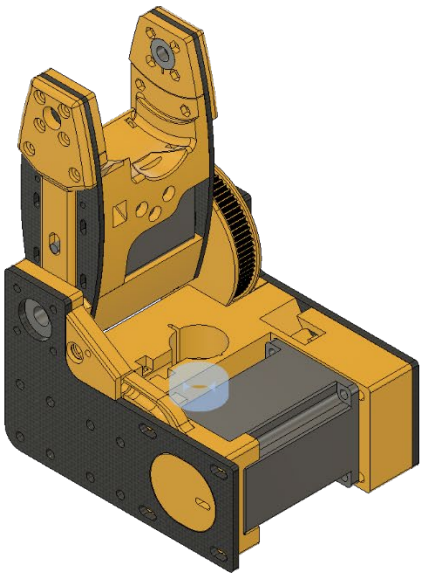


11. 3D print the part (Axis2Motor0pC) and fix it using M3x12mm screw as shown.

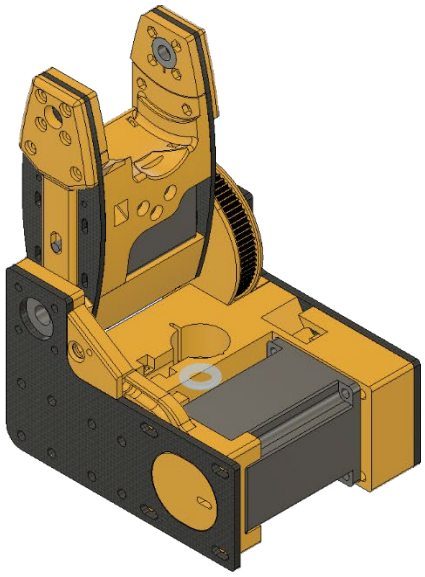


Axis 1:

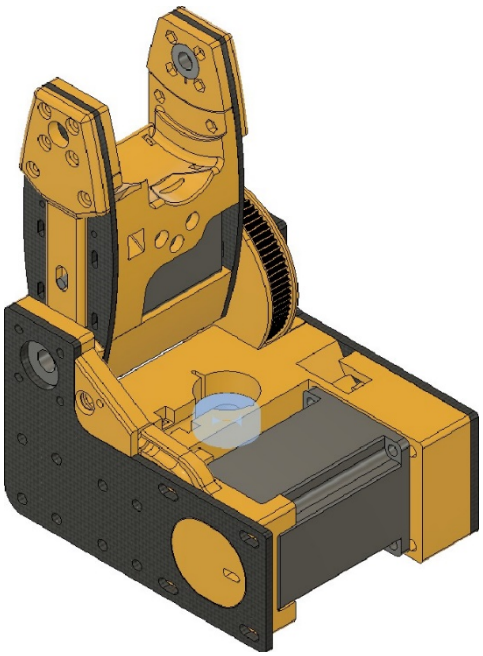
1. Install the thrust bearing (18x16x28) as shown below.



2. 3D print the part (Axis2washer) and install it on top of the thrust bearing as shown below.

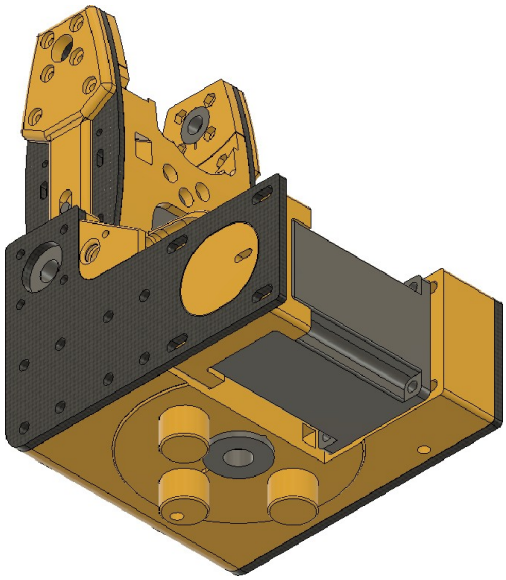


3. Install the ball bearing (28x12x8mm) on top of the washer from the previous step.

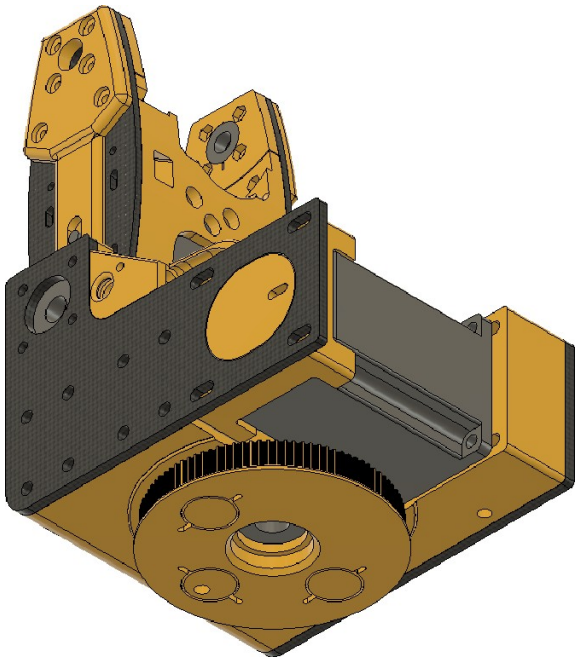


4. Install the stainless tube through the previous bearings.

5. Install the ball bearing (28x12x8mm) from the bottom as shown below.

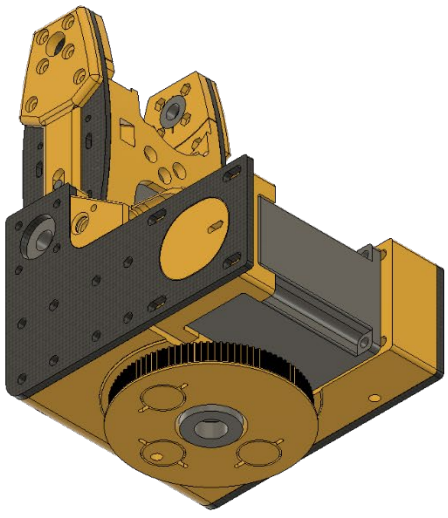


6. 3D print the part (Axis1Pulley) and attach it with the previous sub-assemblies as shown below.

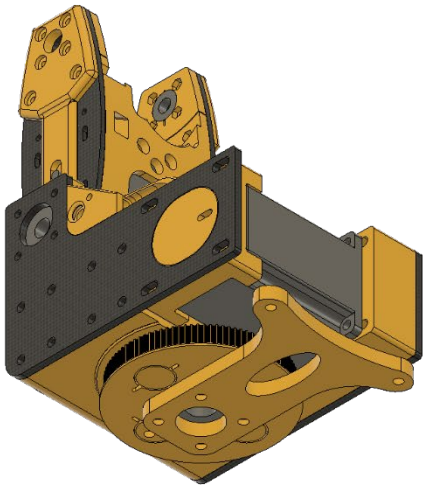


7. Install a M5x40mm limiting screw, washer and nut.

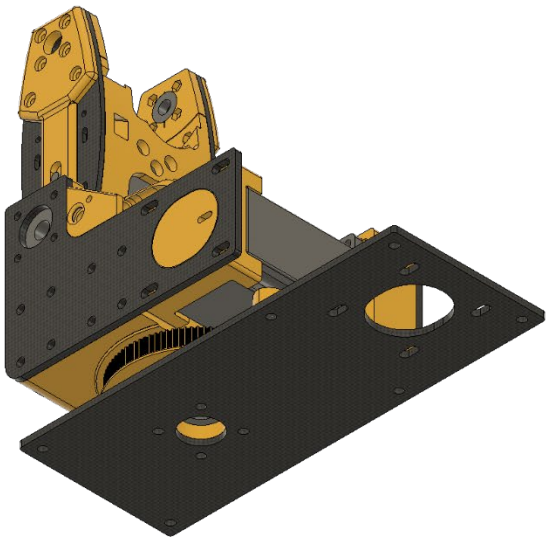
8. Install the thrust bearing (28x16x28) at the bottom of the pulley as shown below.



9. 3D print the part (Axis1washer) and install it using four M5 screws and nuts under the pulley as shown below.

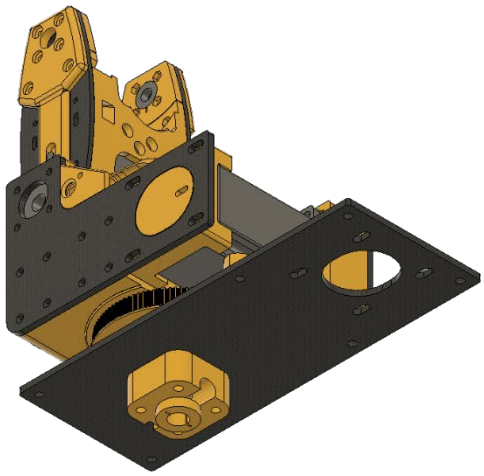


10. 3D print the part (Axis1part2) using carbon fiber filament and align it with the holes from axis1washer as shown below.

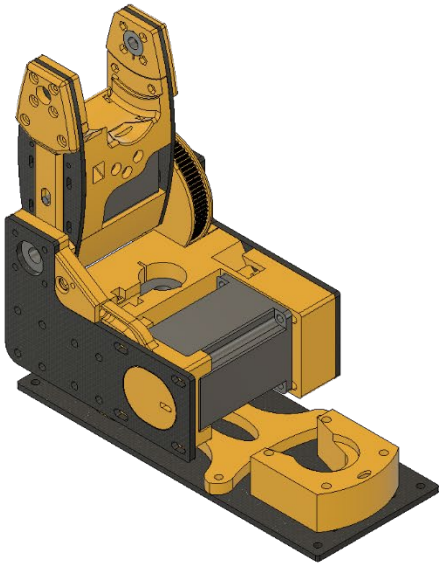


11. Insert the stainless-steel tube through the previous parts.

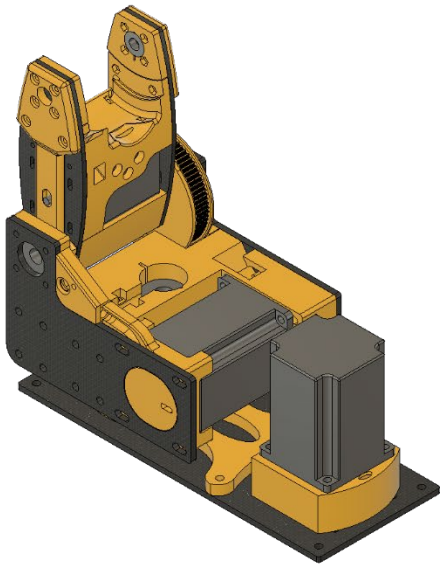
12. 3D print the part (Axis1Holder) and install it at the end of the tube and use two M3x16mm screws to fix it as shown.



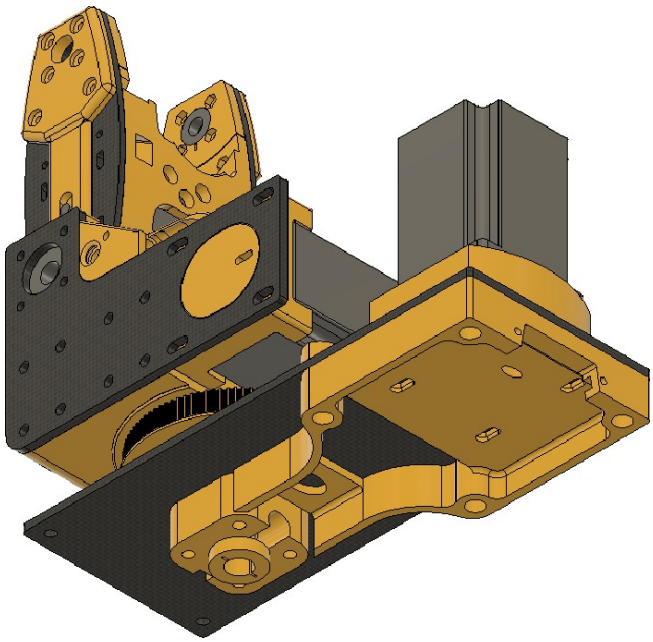
13. 3D print the part (Axis1motorholder) and install it on top of the part (Axis1part2) as shown below.



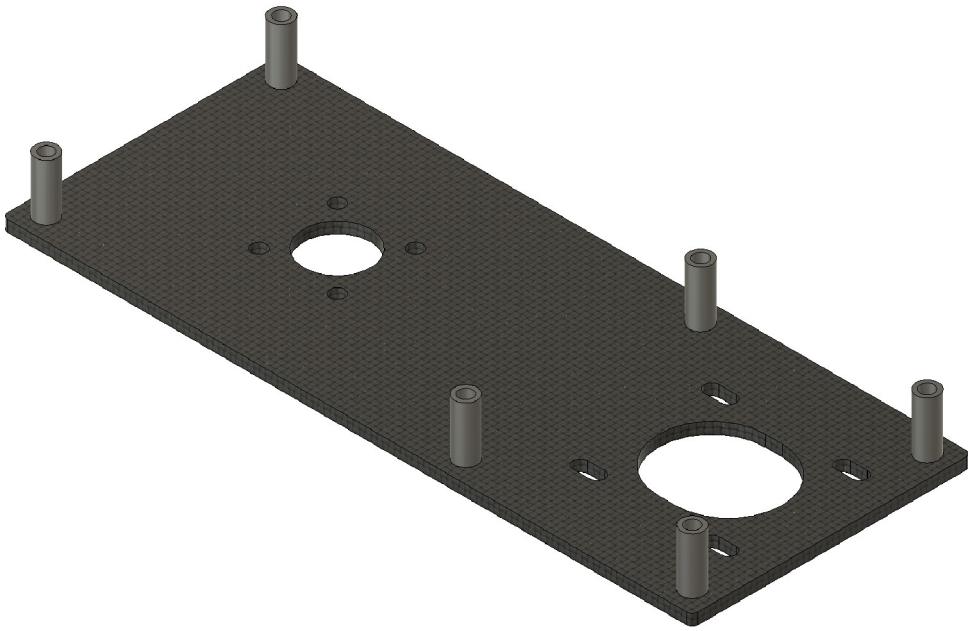
14. Install the Nema 23 motor on top of the part (Axis1MotorHolder) from the previous step using M5x50mm screws, nuts, and washers. Then, install the pulley GT2 3mm 20 teeth on its shaft.



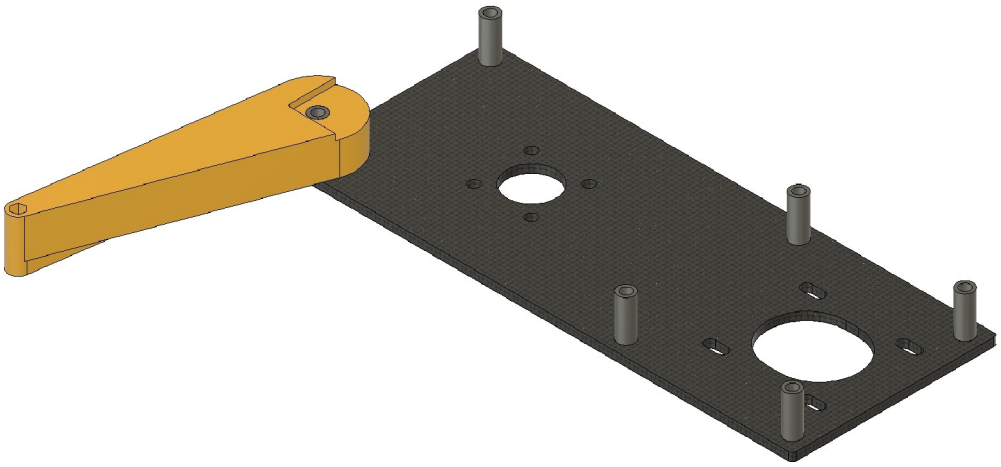
15. 3D print the part (Axis1MotorHolderOP) on the bottom side of the part (Axis1part2)



16. 3D print the part (Axis1part2) using carbon fiber filament then attach seven standoffs to it as shown below.



17. 3D print the left and right legs and install them as shown below.



Complete Assembly:

When you are done with all the previous steps the assembly should look like the rendered images below.