Upper Arm Design v3

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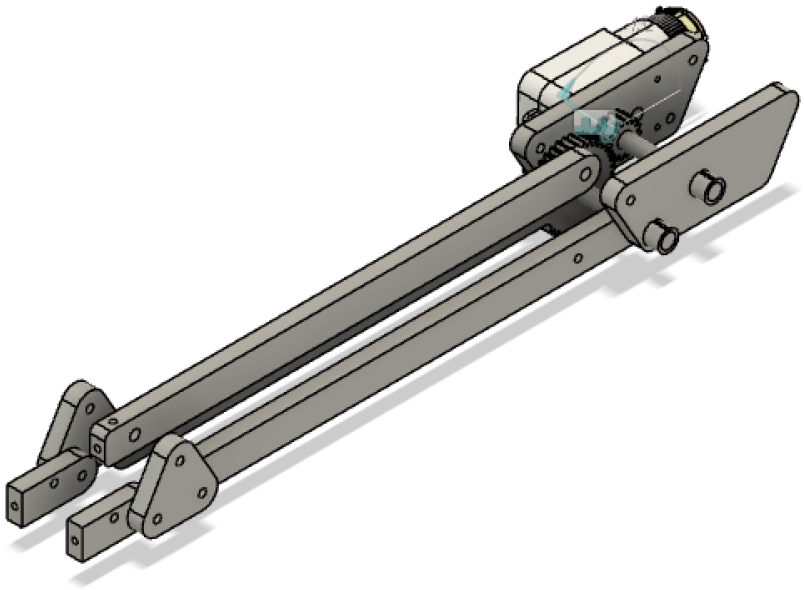
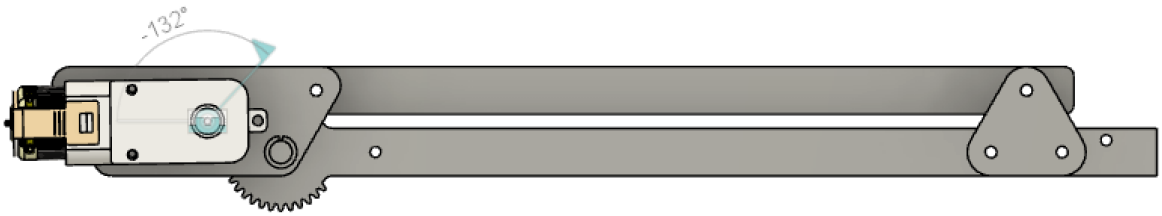


(isometric and left view)



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[1] Abstract

This is the third design that was made for the upper arm of the robotic arm. This design improves the functionality of the arm by making it longer. As a result, the gear ratio is increased to compensate.

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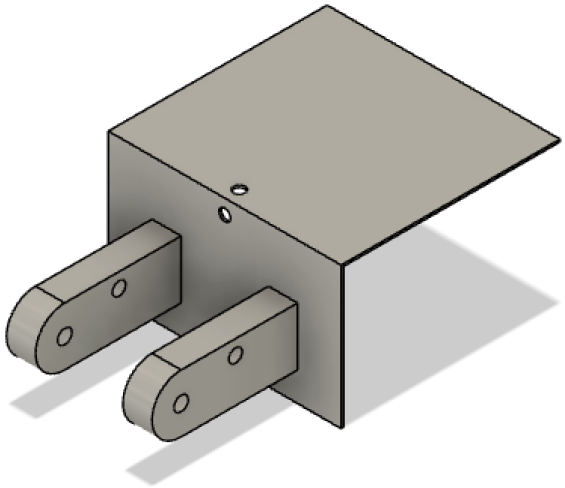
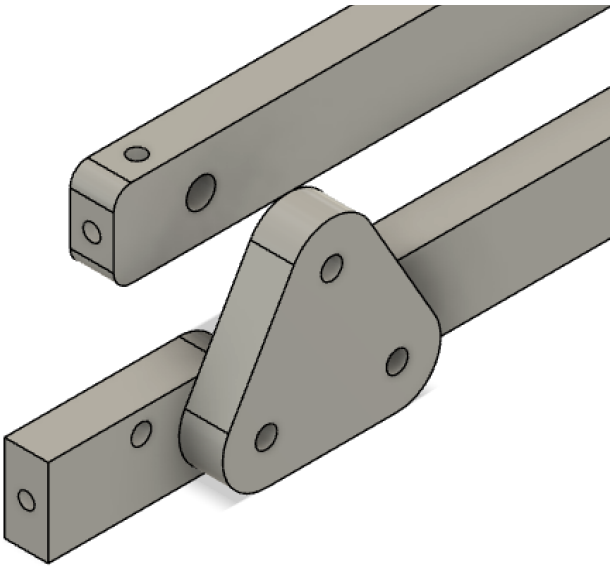
[2] Parts

[2.1] Gripper Linkage



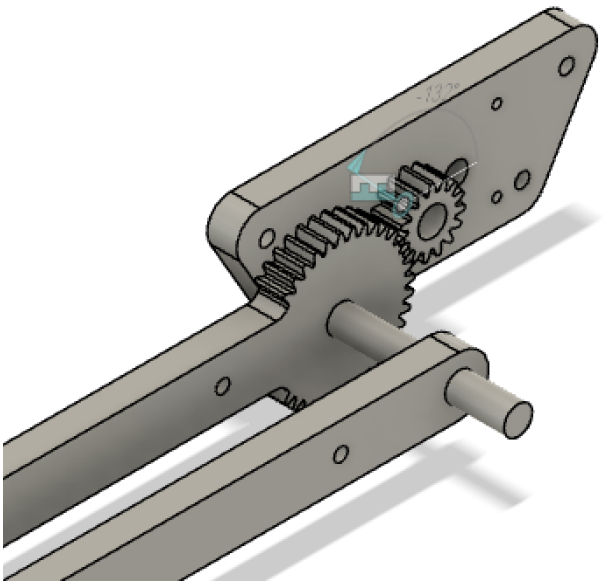
- The gripper linkage uses a 6-32 screw to connect to the gripper mount. This hole is tapped so no nut is needed and is on the rectangular face.
- The gripper linkage uses a 40-40 screw to hold the spring in place via a clearance hole.
- **Changed**:
    - The gripper linkage uses a 10-32 screw to connect to the triangle mount via a tapped hole instead of clearance.

[2.2] Triangle Mount



- The triangle mount is used to connect the grip linkages to the upper linkages. It acts as the wrist, albeit it is rigid.
- The triangle mount uses 10-32 screws to connect to the linkages and these holes are tapped holes.

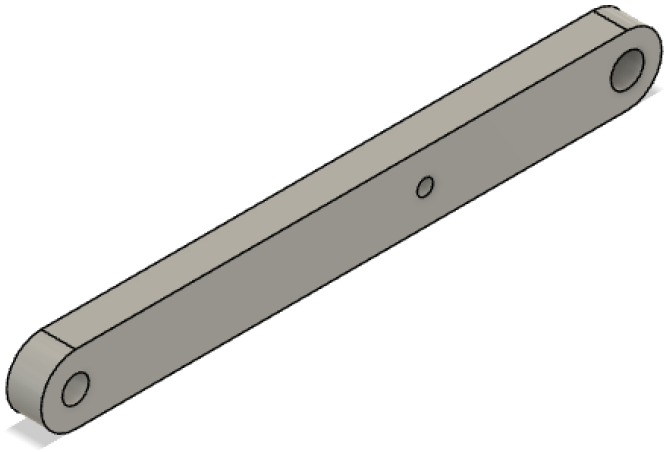
[2.3] Upper Linkage 1 (Motor-Side)



- The upper linkage 1 connects to the triangle and trapezoid mount.
- The upper linkage 1 uses a 10-32 screw to connect to the triangle mount via a clearance hole.

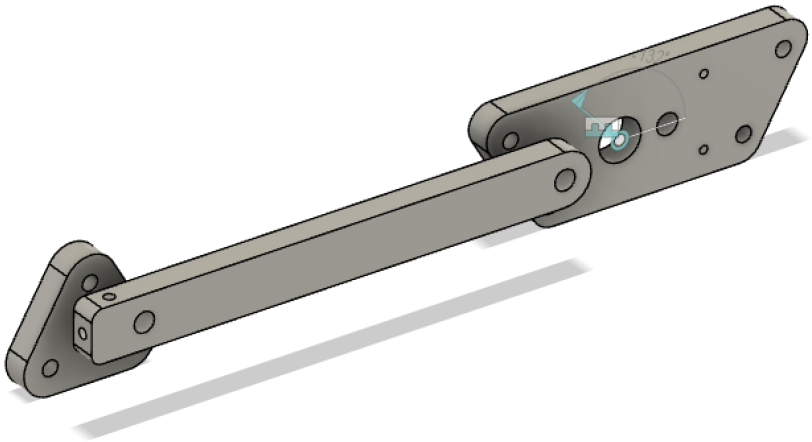
- A 0.24 inch aluminum shaft is press-fit into the linkages to connect it to the opposing non-motor side linkage and the trapezoid mounts.
- It uses a 4-40 screw to hold the spring in place via a clearance hole.
- **Changed**:
    - Gear teeth were added to this linkage in a ratio of 2:1.
    - Length changes from 4 inches to 7 inches.

[2.4] Upper Linkage 1 (Non-Motor Side)

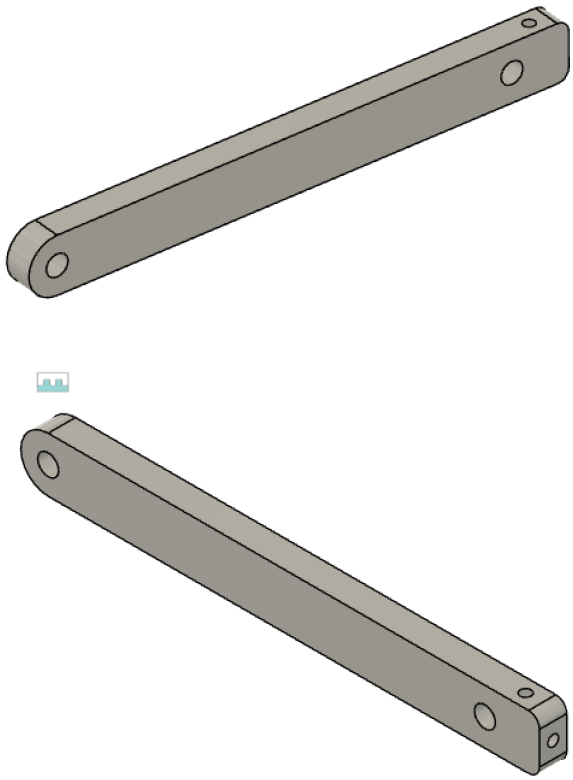


- The non-motor side linkage functions similar to the motor-side linkage but acts as support to ensure the sides of the four-bar linkage move.
- It uses a 10-32 clearance hole at the end to connect to the triangle mount and a 0.24 inch shaft is press-fit into the other end to connect it to the other upper linkage.
- **Changed**:
    - Length changes from 4 inches to 7 inches.

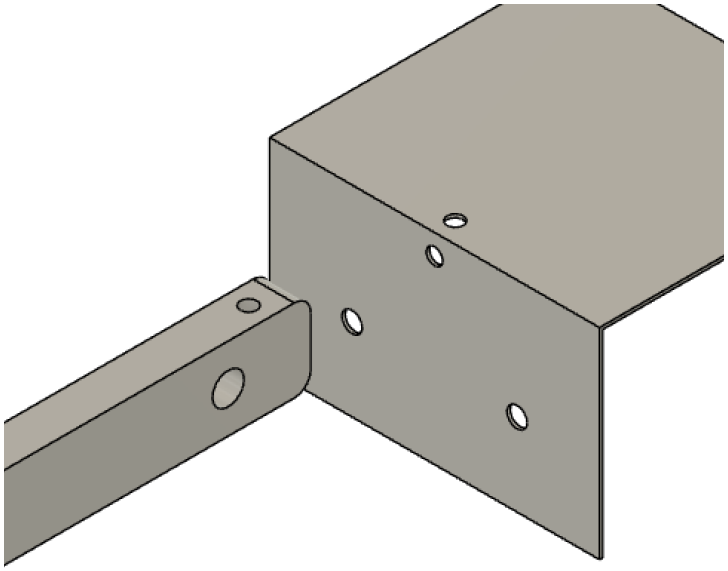
[2.5] Upper Linkage 2



- The upper linkage 2 connects to the trapezoid and the triangle mount as well.

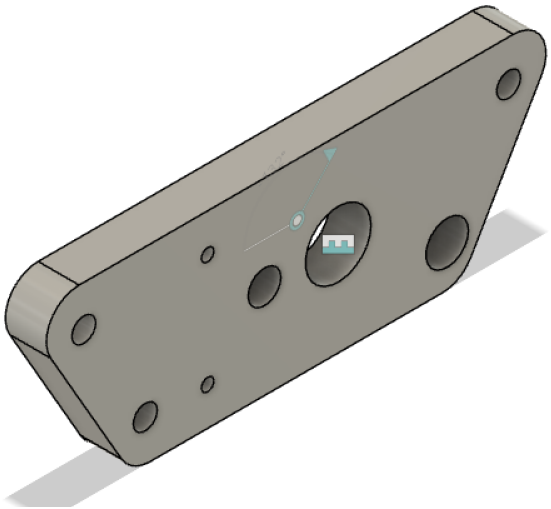


- **Changes**:
    - The upper linkage uses 10-32 screws to mount to both the mounts via a clearance hole.



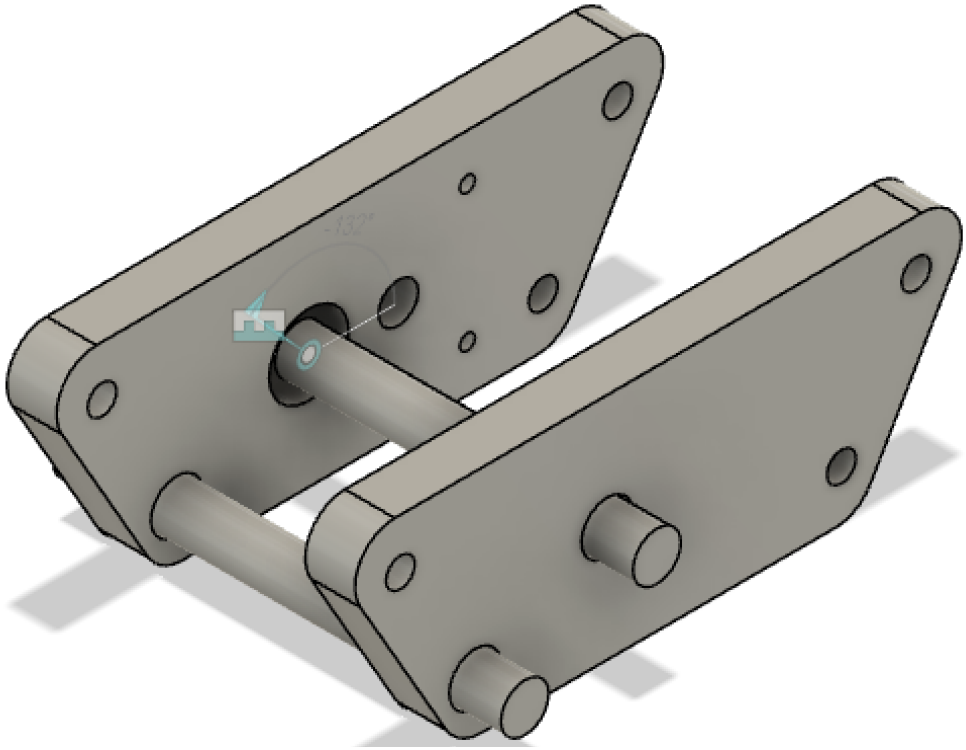
- In order to offer extra support for the gripper linkages, holes are cut out of the upper linkage 2 and sheet metal to allow a fishing line to connect these two parts to reduce load on gripper linkages.

[2.6] Trapezoid Mount (Motor Side)



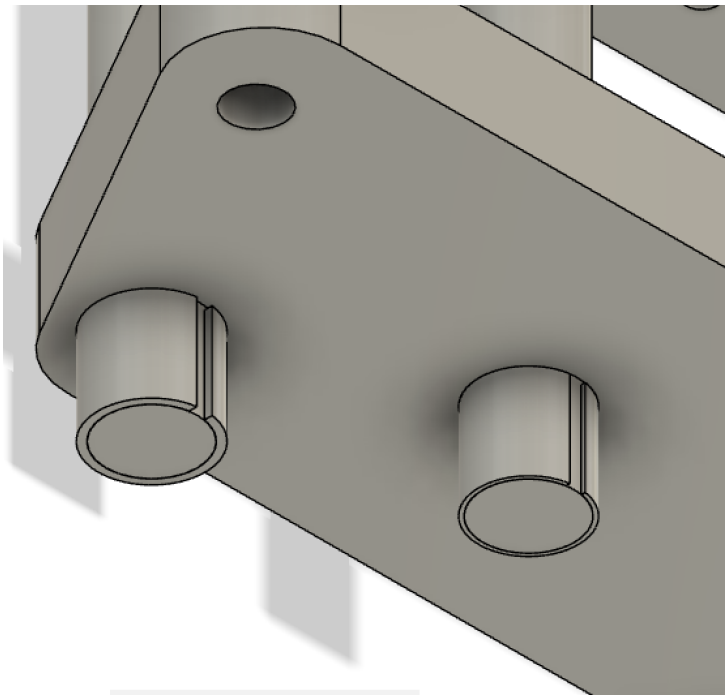
- The motor side trapezoid mount uses 10-32 screws to connect the upper arm and lower arm together. These holes are tapped since there is not enough space for nuts.
- For the shaft connecting to the driven gear, a 0.26 inch clearance hole was used to connect the trapezoid mounts together (in the bottom right corner).
- To mount the motor, 4-40 tapped holes were used.
- The motor-side trapezoid mount also has other holes near the center to allow a correct mounting and transmission of the motor shaft.

[2.7] Trapezoid Mount (Non-Motor Side)

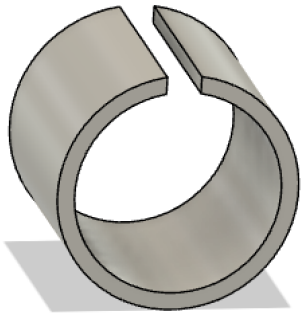


- The non-motor side trapezoid mount is connected to the other mount with a shaft.
- It uses a 10-32 screw to connect the linkages and is tapped at the corners
- At the center of the mount is a 0.26 inch clearance hole to allow the shaft to pass through.

[2.7] Shaft Collar



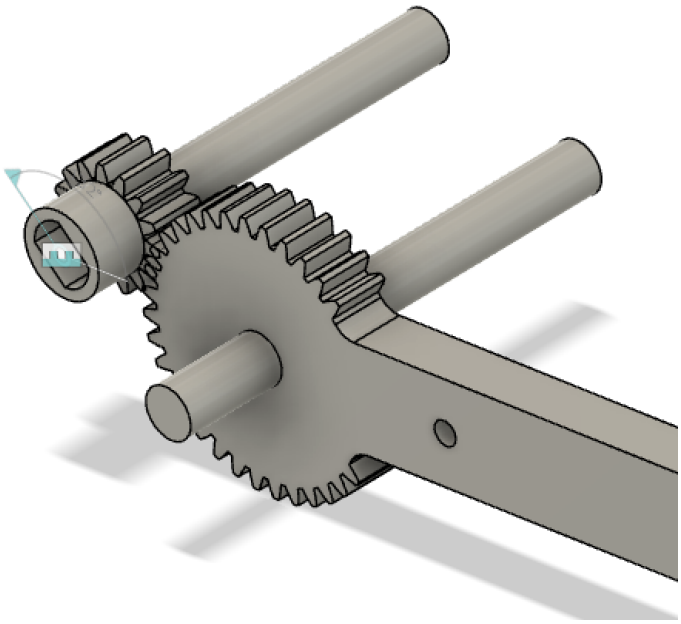
- In order to prevent the shaft from translating linearly, shaft collars were used.



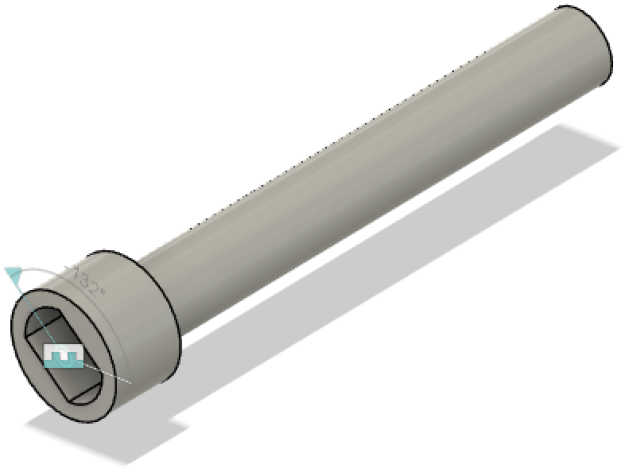
[2.8] Aluminum Shafts

- One shaft is 2.25 inches in length and is used to connect the upper linkages together.

[2.9] Motor Hub



- A motor hub is used to better transfer torque from the motor shaft to the driving gear. This part will be 3d printed.



[3] Current Problems

[3.1] Torque

- The arm is unreliable and sometimes stalls when it tries to go above the horizontal. A greater gear ratio can solve this problem.

[3.2] Range of Motion

- Due to the screw at the top of the parallelogram, the lower linkage collides with the screw and is unable to achieve a full range of motion.