Lego Builder

DALL·E Prompt: Lego builder that looks like a 3d printer, which is built using extrusions and a claw whose movement is supported using a belts and pulley mechanism

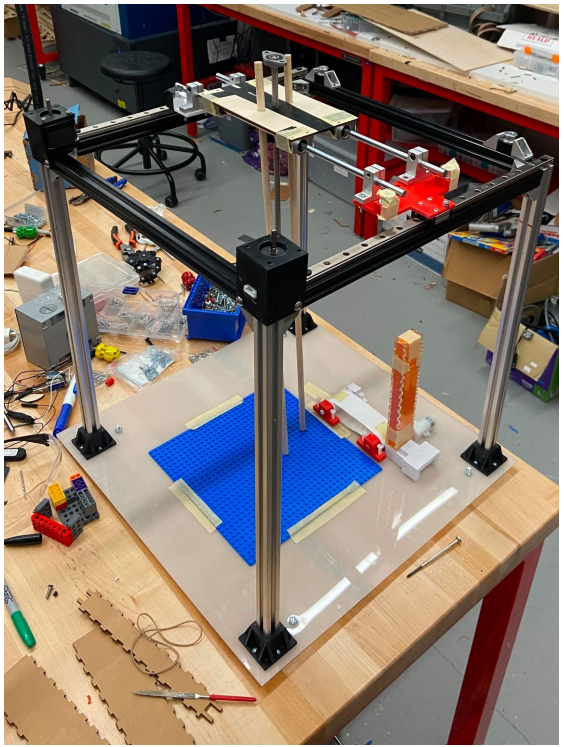
Design Goal

Often overlooked, construction can be a monumental task. People live in buildings every day that take months to years of hard work to create without a second thought about all the specially trained building crews and heavy machinery. Were the process to be moved to robots then a great deal of the construction practice could be expedited.

Our idea is to create a robot on a much smaller scale that takes legos from a lego brick reservoir and positions them down, on a lego base plate, to create a structure from the given instructions.

The bricklayer robot would be roughly the size of an Ultimaker and would be able to sort lego bricks and orient them for placement.

This project represents a proof of concept to automate the construction of buildings and ultimately construct buildings free of human error and in a much quicker timeline.



Overall Design

Taking inspiration from various 3D printers, our design can be broken into 4 main components:

a. the **Frame and Base**,

The **Frame and Base** serve as the support for the entire system, securing our motors and ensuring maximum precision.

b. the **Moving Mechanisms**,

The **Moving Mechanics** work by a high-precision coreXY gantry system that utilizes two stepper motors to create planar motion. Additionally, a lead screw is manipulated on our carriage by a driven nut to create motion in the z-direction, which simultaneously supports and drives the claw while it properly connects the legos.

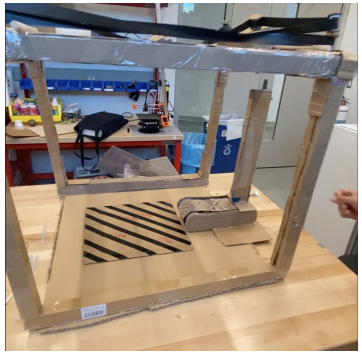
c. the Pick-up Unit (PU) & **Claw**,

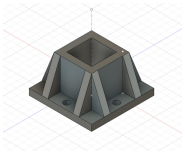
The **Claw** picks up our legos from a known pickup site and connects them to the lego board in the correct orientation.

d. the **Magazine**.

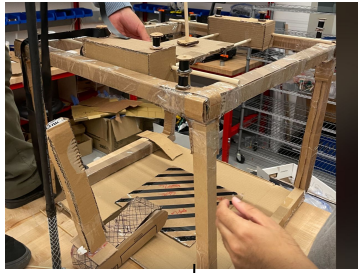
Lastly, our **Magazine** holds our reservoir of legos and ensures consistent delivery of material to our **Claw** through the implementation of a conveyor belt system and spring-loaded lego pusher.

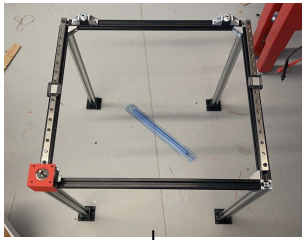
Frame & Base

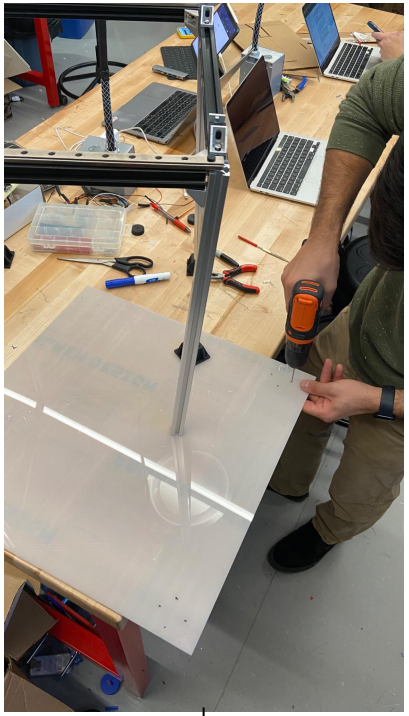




3D printed the stands at the bottom to hold it sturdy





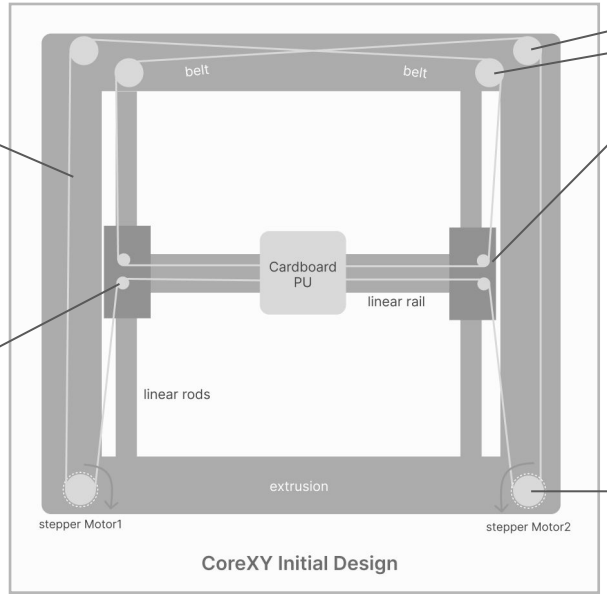


4 Black 400mm extrusion at top
Cut 4 silver 600mm extrusions to 400mm as support

Moving Mechanisms - CoreXY

Belt

⌛3d printed carriages



CoreXY Initial Design

☑️8 Pulleys

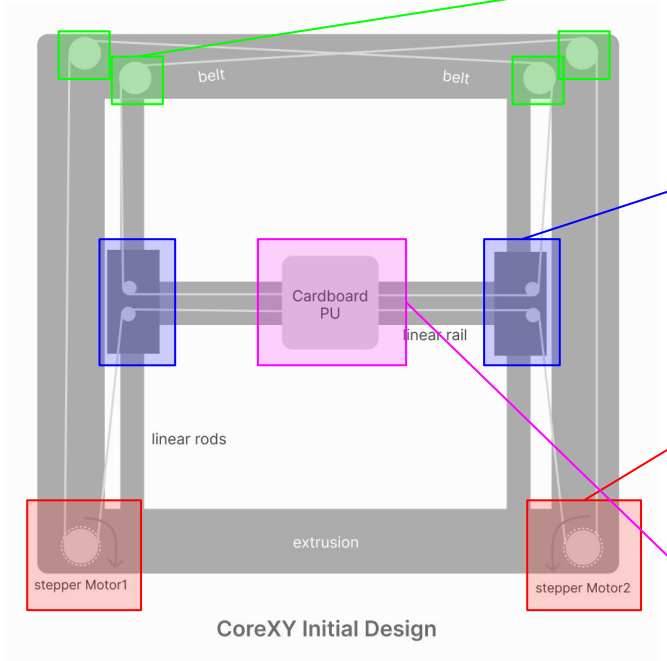
⌛3d printed pulley holders

⌛fix holders on the extrusion

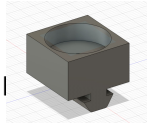
☑️Stepper Motor

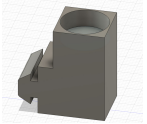
⌛3d printed motor holders

Moving Mechanisms - CoreXY

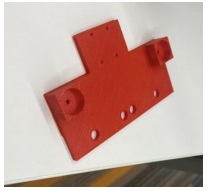


Pulley Holders
Set up pulley holders on the extrusion - two types of holders at top

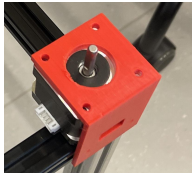


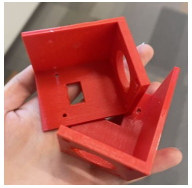


Side Carriages (2)
Holds the rods, two pulleys and mounted on the linear rail on top of the extrusion bars.

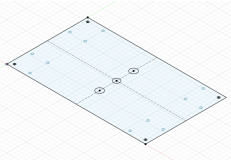


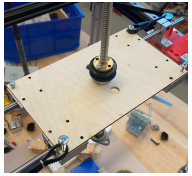
Motor Holders (2)
Holds the motor and mounts on extrusion



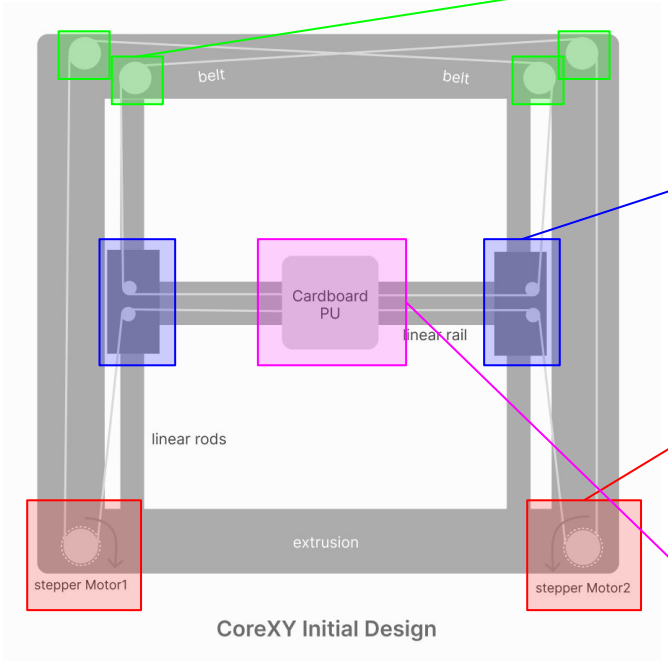


Main Carriage
Holds the Pick-up Unit (PU)

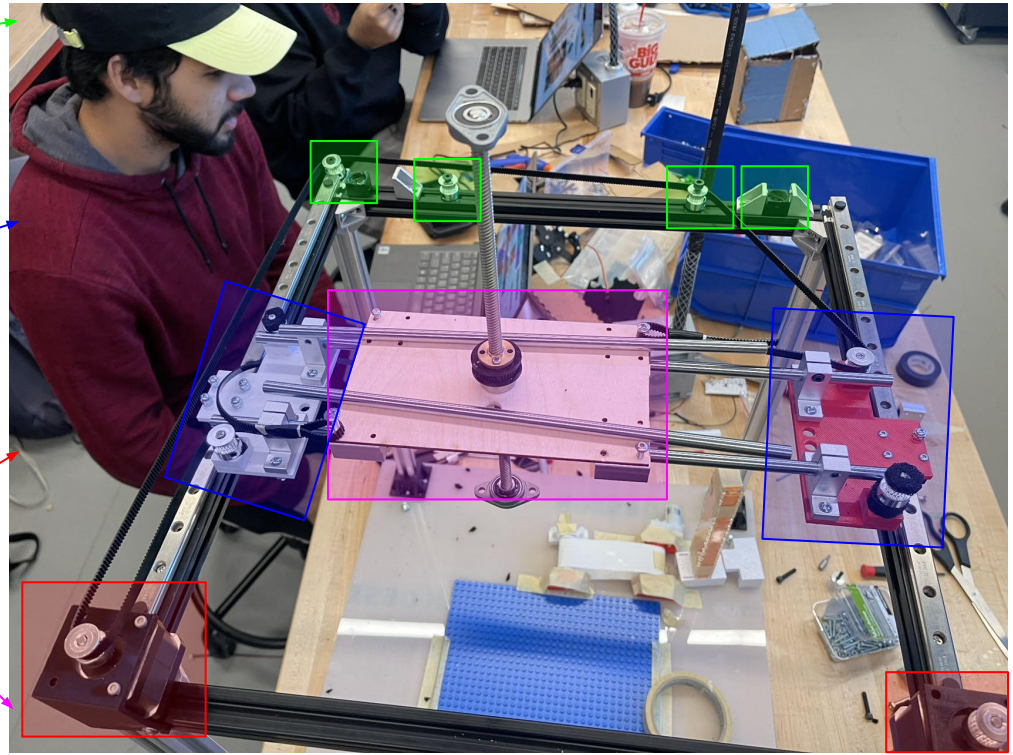




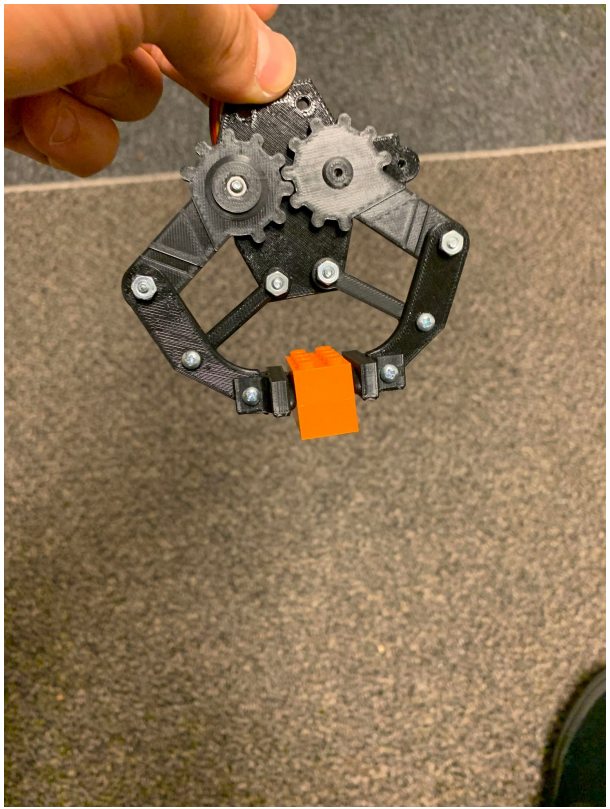
Moving Mechanisms - CoreXY

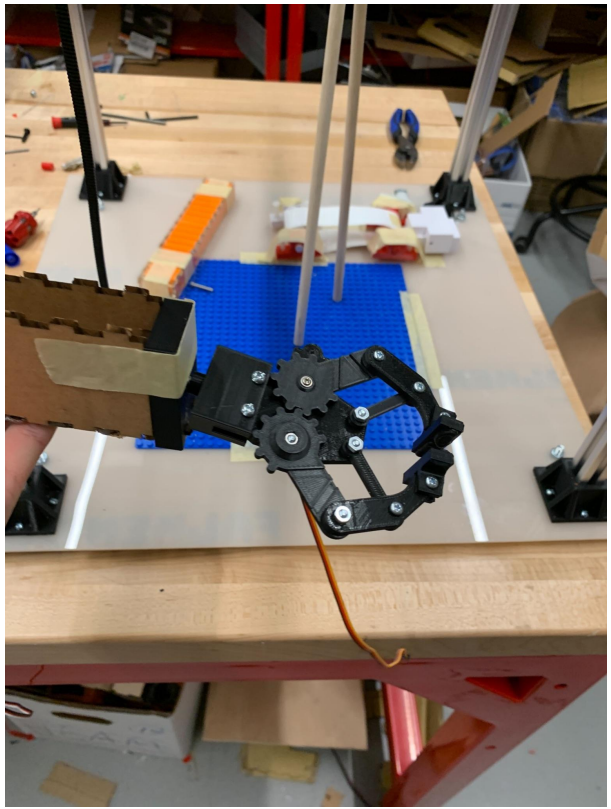


CoreXY Initial Design



Pick-up Unit (PU) & Claw





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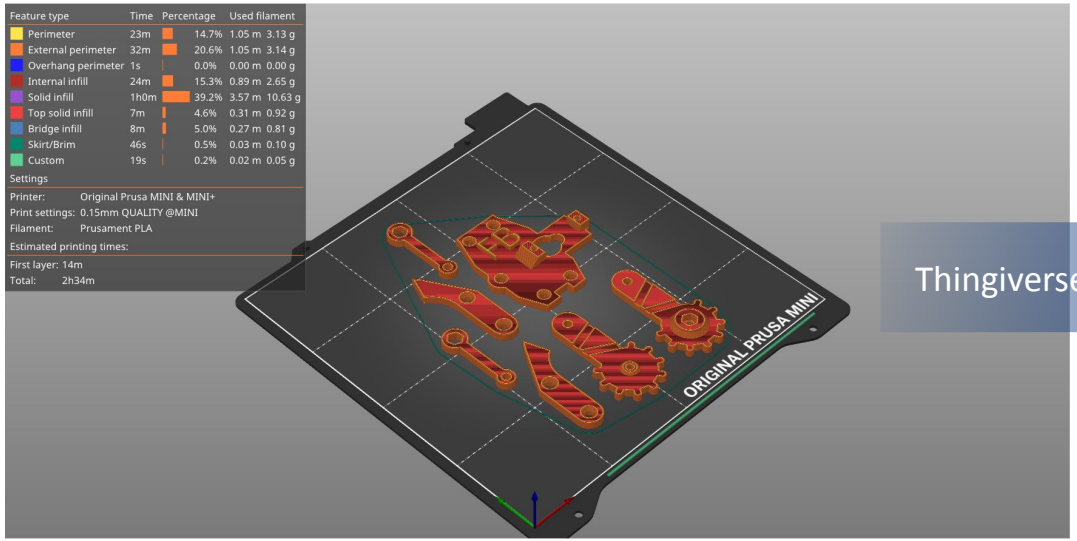
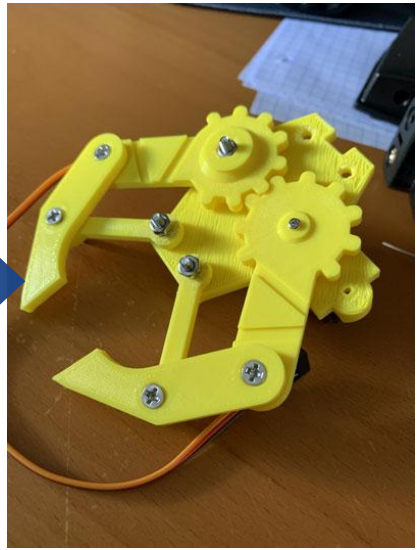
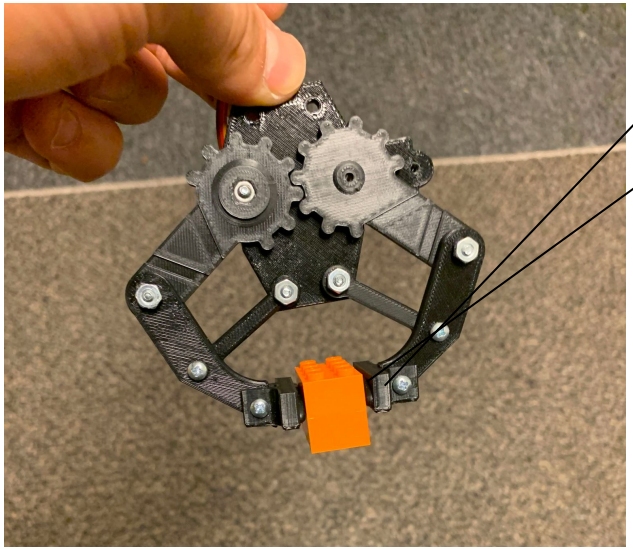


Thingiverse Model



Claw Link: https://www.thingiverse.com/thing:4811915

Pick-up Unit (PU) & Claw



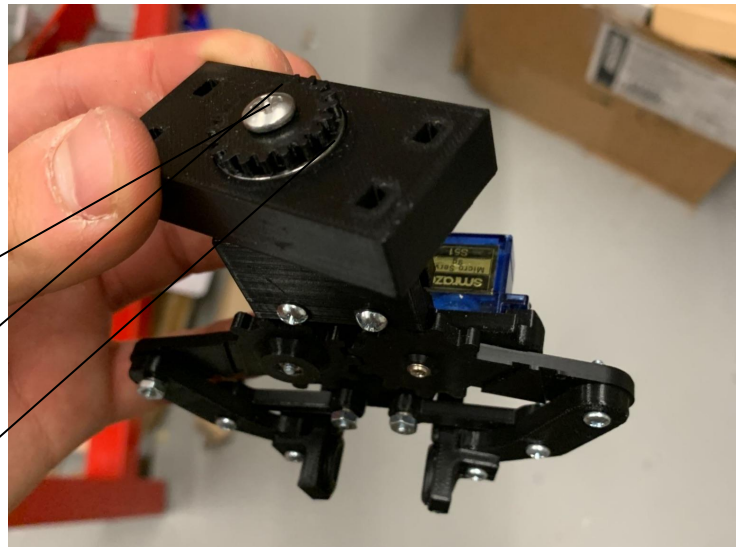
Finger attachment

Friction pads

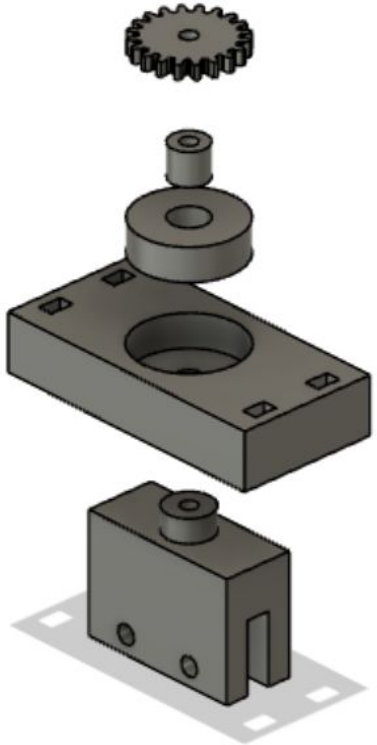
Gear Attachment

Cool bearing

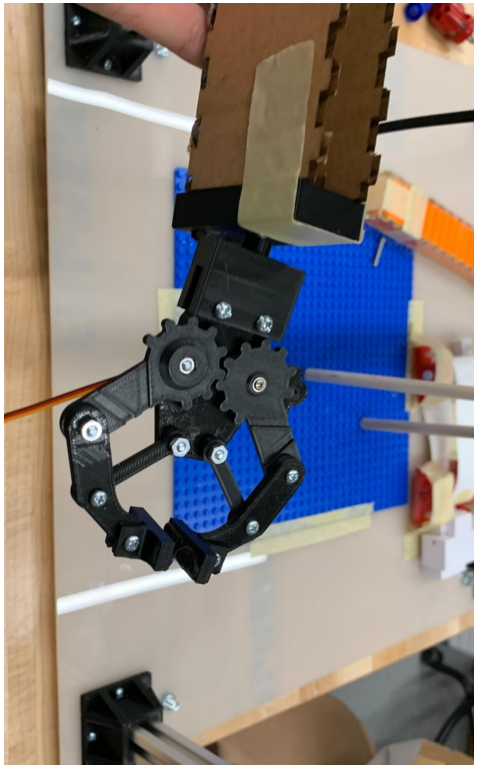
Claw Cube Cage



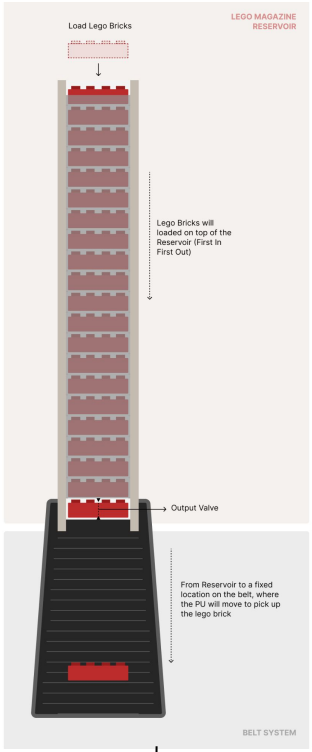
Pick-up Unit (PU) & Claw

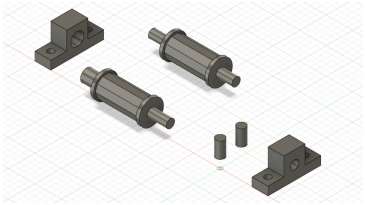


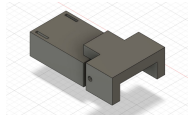
Neat cage where servo will attach

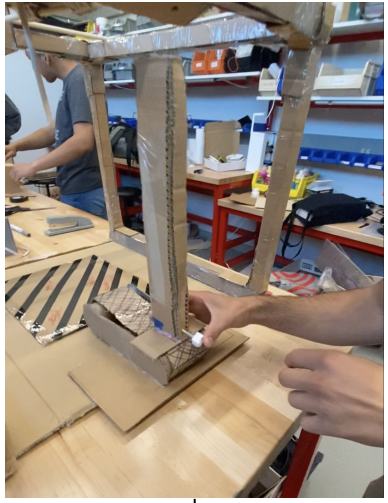


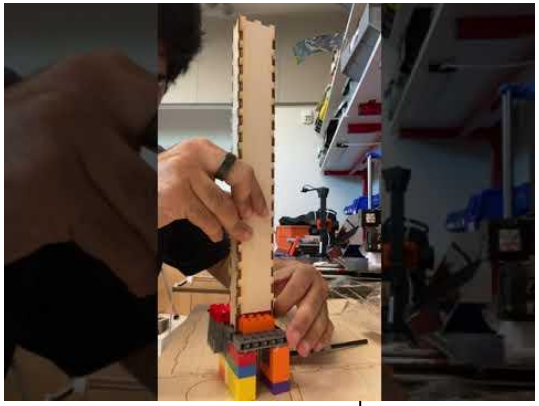
Magazine

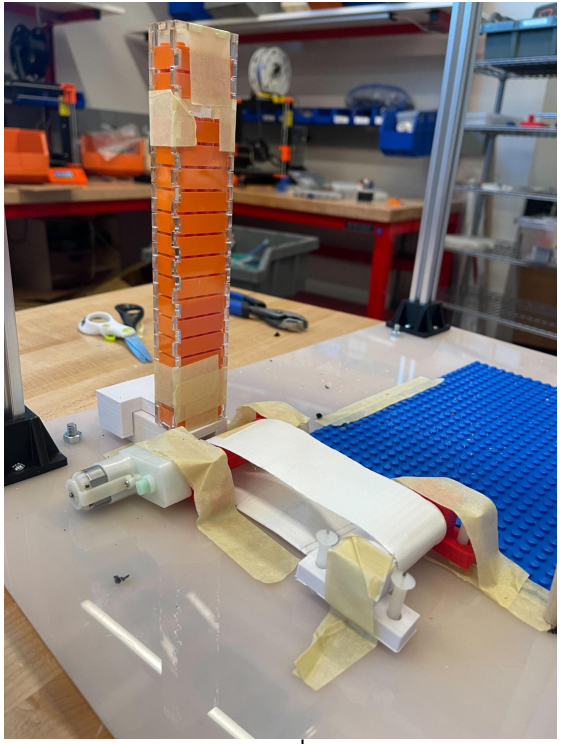

LEGO MAGAZINE RESERVOIR
Load Lego Bricks
Lego Bricks will loaded on top of the Reservoir (First In First Out)
Output Valve
From Reservoir to a fixed location on the belt, where the PU will move to pick up the lego brick
BELT SYSTEM



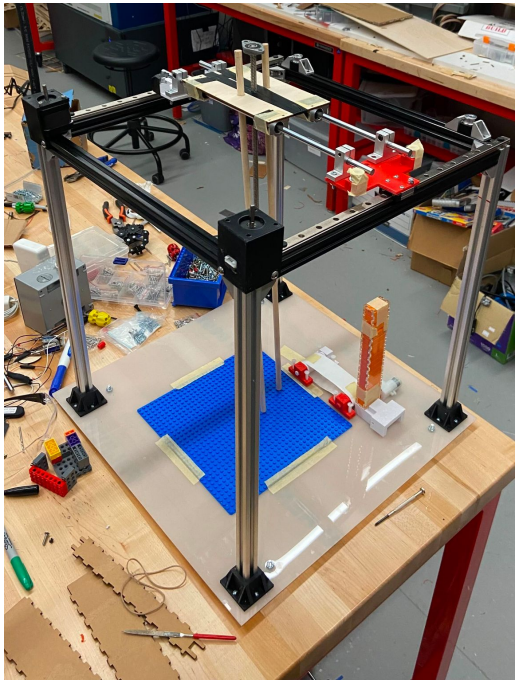








Putting it Together

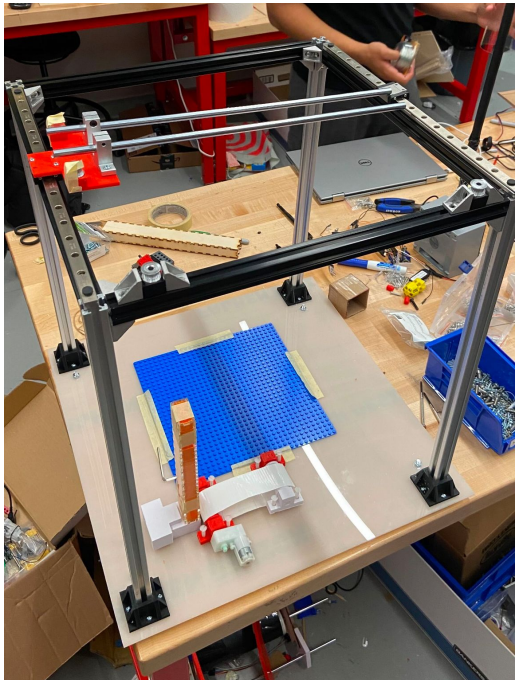


Frame and Base

Magazine

CoreXY

Pick-up Unit(PU) & Claw



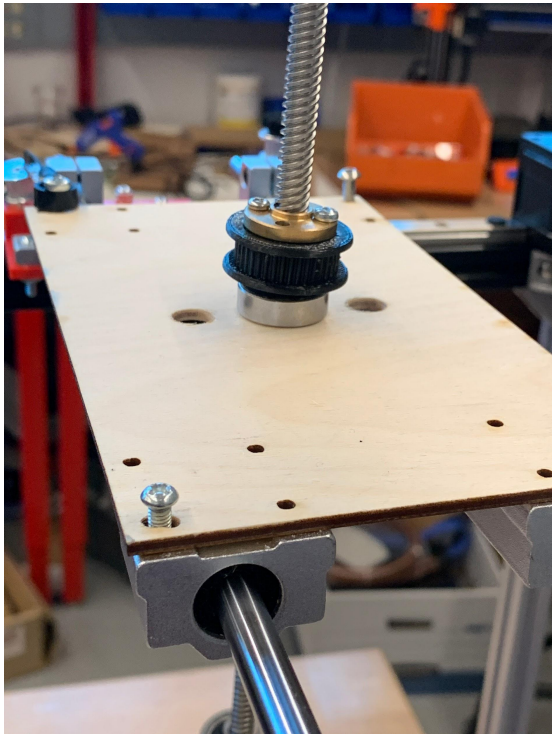
Next Steps: Claw and PU

Servo and Claw Box Optimization

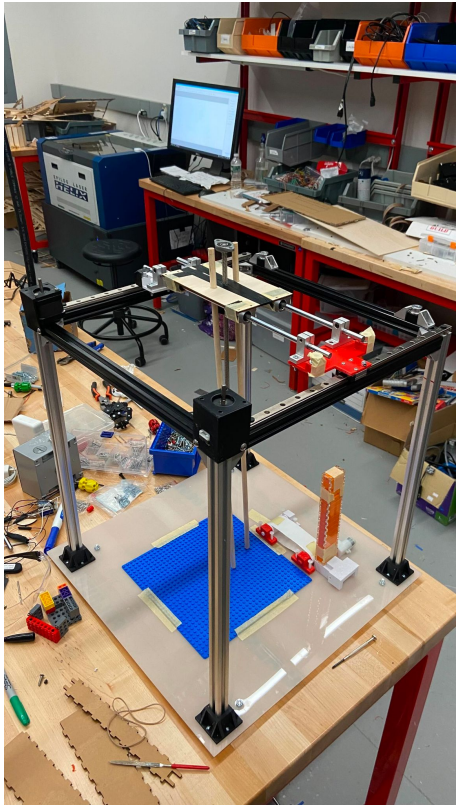
- Size
- Distance between servo gear and claw gear

PU Optimization

- Screws and dimensioning of laser cuts
- Coupling between GT2 Pulley (printed) and Stepper
- Stepper bracket for PU

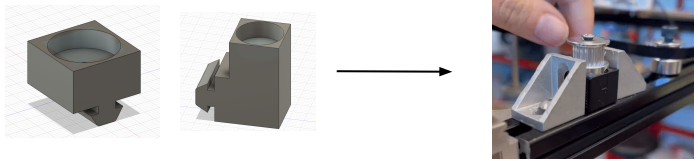


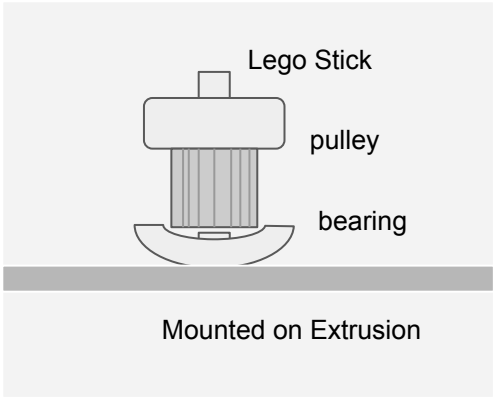
Next Steps: CoreXY & Magazine



CoreXY:

1. The pulleys need to be in the same xy plane. The varying height is a major issue, as we'd imagined. Since the motor is the one with the highest pulley we will need to achor all other pulleys based on that.
2. Set up pulley holders on the extrusion. Two types of pulley holders at top





Magazine:

1. How might we make sure that lego blocks stacked on top of each other in the reservoir don't get entangled within their groves?
2. How might we determine the force of the push-out mechanism such that it always lands in a predetermined location on the conveyor belt?
3. How might we solve for the downward force which will be exerted on the bottom-most lego brick while the push-out mechanism underway?

Scotch Yoke Mechanism:
https://www.youtube.com/watch?v=HhX-8RyP214