Bottle Lift and Transfer Project

Quan Nguyen, Allen Luo, Brion Song, David Shin, George Huang
Sponsor: Mohamed Shorbagy

UCI Samueli School of Engineering

Executive Summary: The main objective of this lab is 1) To transfer a 16 oz water bottle from Point A(from the table) to Point B(Platform), and 2) make sure our final design is timely, inexpensive, repeatable, and autonomous. To complete these objectives and meet our requirements, our design incorporates mechanisms that produce motion in the vertical and horizontal directions. To identify a suitable mechanism, functional requirements and trade studies were conducted for each mechanism. The mechanisms that are needed in order to complete the project are horizontal and vertical motion actuation, which is done through a rack and pinion gear for horizontal motion and a pulley system for the vertical motion. A claw-carriage system is used in order to grip the bottle and transfer it on the platform. IR sensor and Hall Effect sensor are used to detect the platform, which has the IR light and magnet.

Design Process:

Subsystem	Form	Function
Vertical Lift	1) Aluminium Extrusion 2) Vertical Actuator/Pulley	1) Hold Carriage for Vertical Motion 2) Power Vertical Motion Using Actuator/Pulley
Carriage	1) Carriage Platform 2) Claw 3) Railing 4) Horizontal Extrusion	1) Hold Claw and Railing in Place 2) Grip Bottle with Claw 3) Hold Claw in Place with Railing 4) Extends Claw to Platform with Horizontal Extrusion
Electronics	1) Hall-Effect Sensor 2) IR Sensor 3) Time of Flight Distance Sensor 4) Battery 5) Servo Motors	1) Detect Magnet with Hall-Effect 2) Detect LED light with IR 3) Recognize Height of Carriage Using Time of Flight 4) Power Motors Using Battery

Figure 1: Subsystem Component Breakdown and Function Identification

Society Impacts:

- Finding an autonomous way that improves a menial, repeatable task to improve efficiency in a manufacturing/ packaging process

Future Recommendations:

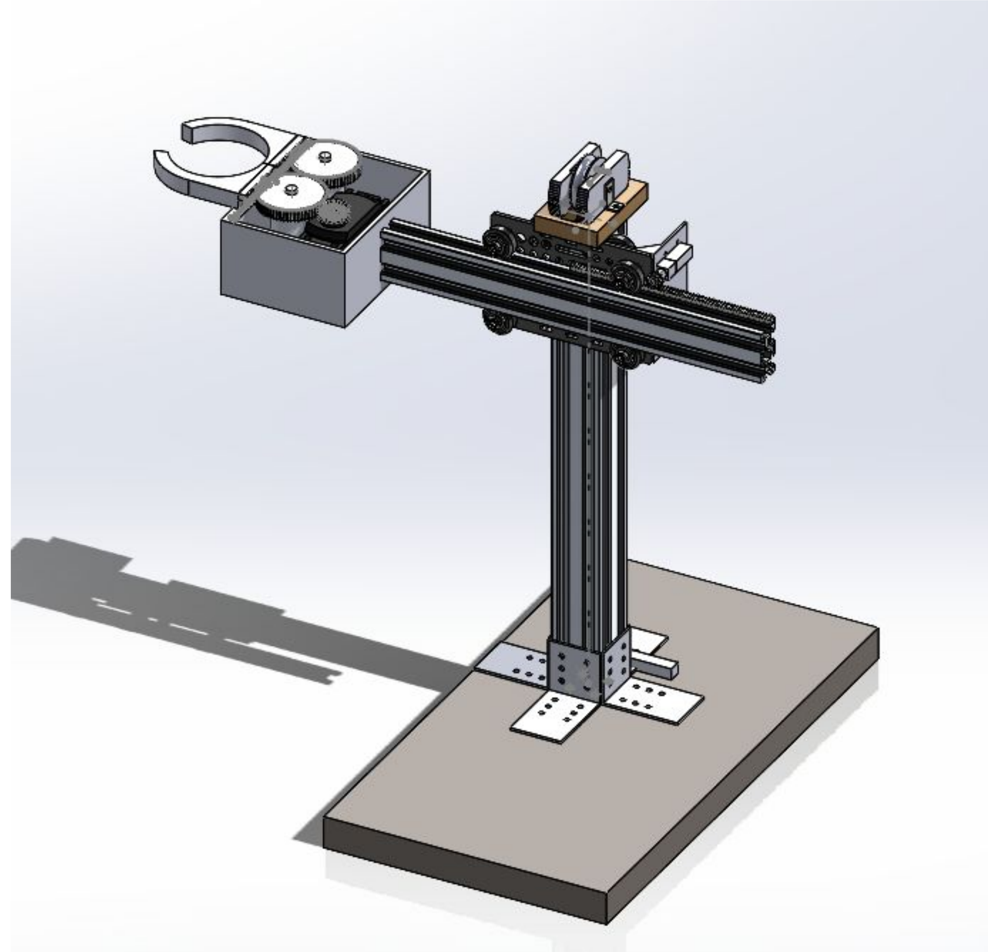
- Find material with imperial unit for easier assembly and purchasing
- Less budget constraints may enable linear actuator for more accurate movement

Acknowledgements:

David Copp, Mark Walter, Mohammed Shorbagy

Final Design:

- Delrin V-Wheels are attached to slider carriage allowing movement along aluminum extrusions
- L-brackets screw in from the base will keep mechanism stable from toppling
- Vertical Movement from Extrusion: 13 inches
- Horizontal Movement From Extrusion: 6 in



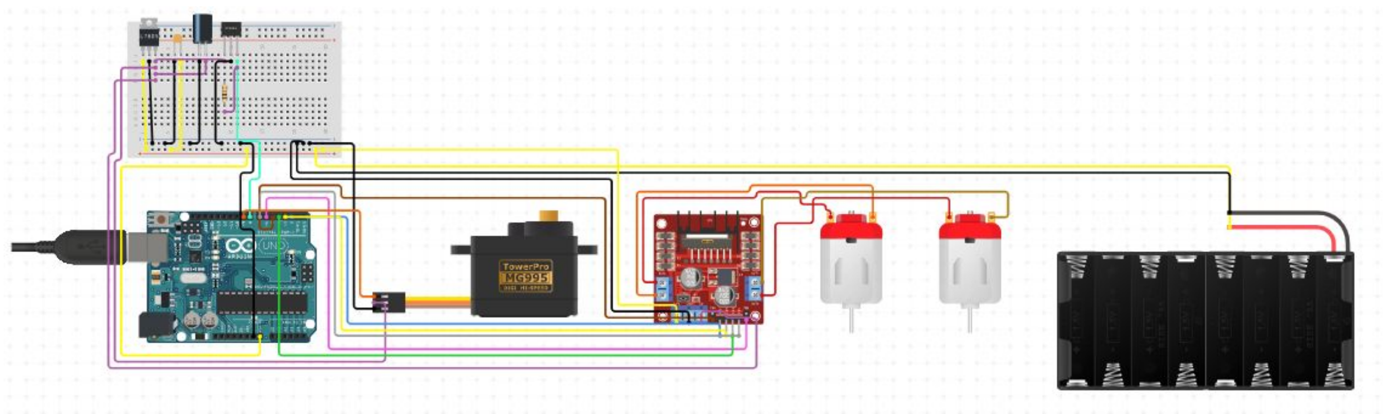


Figure 2: Final Design CAD of mechanism
Figure 3: Wiring Diagram of Mechanism Electronics

Safety Consideration: closed claw system to avoid touching of gears and moving servo

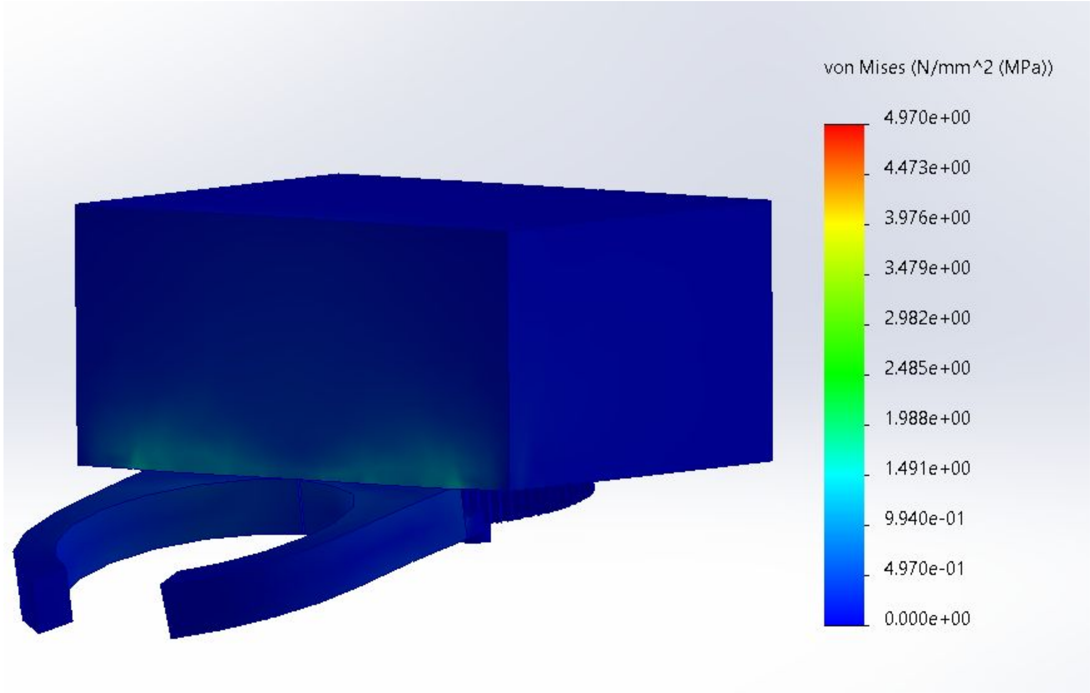


Figure 5: Static Simulation of 10 N being applied to the claw due to weight of water bottle: stress below yielding

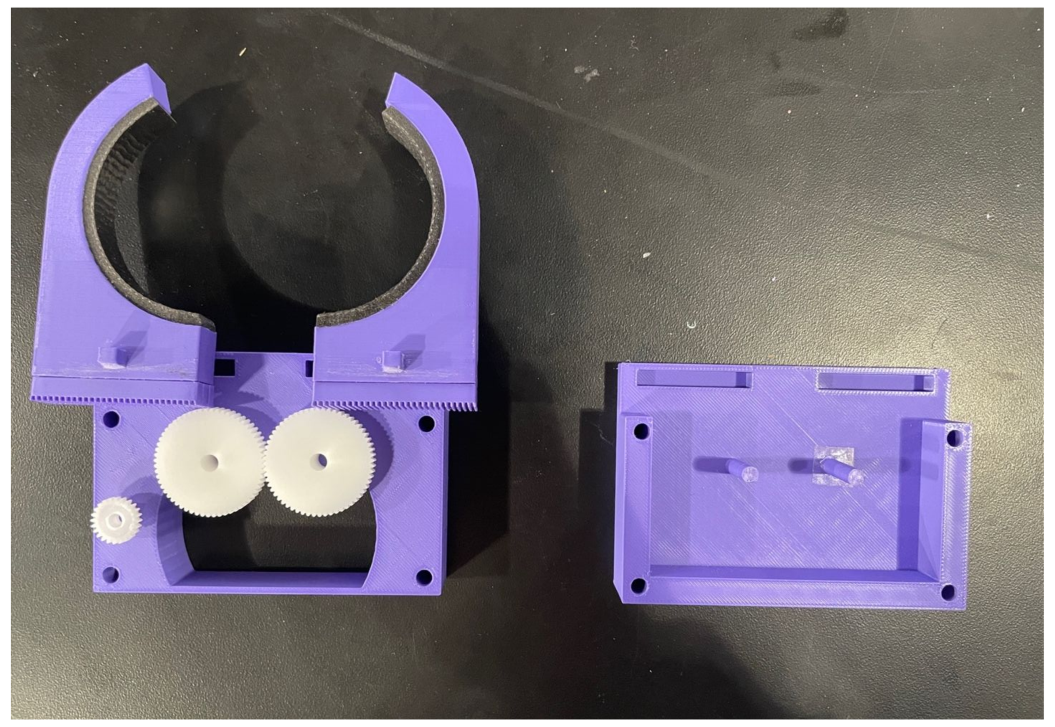


Figure 6: 3D printed part of claw assembly: claw, gears, and base on the left, lid on the right