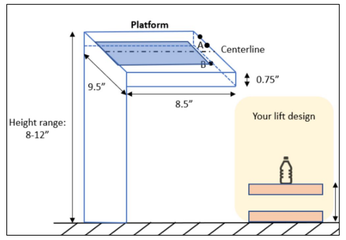
Bottle Lift and Transfer — Team 17C

By: Akhil Boddu, Mindy Huynh, Jeremy Rose, Qinyi Xu
Sponsor: Shorbagy Mohamed

UCI Samueli School of Engineering

Executive Summary

- Problem Definition: Design a lift that allows the user to place a plastic bottle onto a platform and automatically raise to a specified height between 8 and 12 inches. The lift would then place the bottle centered on a secondary platform, in a range of 6” x 7.5”, and then return back to the start position, ready to accept another bottle.
- We expect the mechanism to successfully transfer and keep the bottom upright and return to the original position all within 30 seconds - 10 times out of 10 trials.



Engineering Analysis

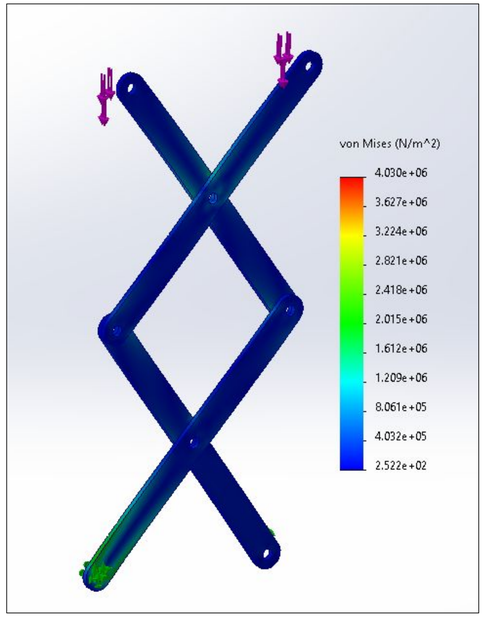
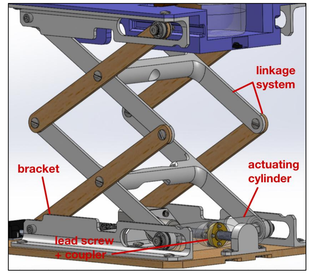


Figure 1. FEA simulation with an applied compression load of 12 N. There is a hinge constraint at the bottom corner and a fixed constraint on the sliding bottom linkage. The maximum stress experienced by the linkage system, 4.03E+06 Pa, is below the ultimate strength of birch wood, 1.38E+07 Pa.

Key Features

Vertical Component - Scissor Lift Mechanism

Figure 2. Scissor lift mechanism that consists of a 4 bar linkage system. The stepper motor turns a lead screw that will pull in the actuating cylinder, therefore opening up the linkage system and moving the bottle up.



Horizontal Component - Rack and Pinion

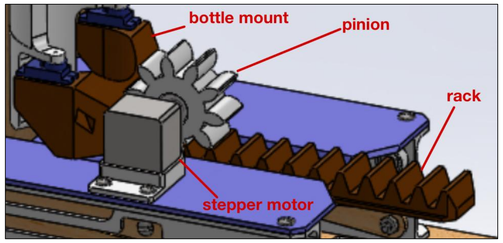


Figure 3. A stepper motor is connected to a pinion via a coupler, and will rorate the pinion. The rotation of the pinion will provide linear motion to the bottle as the rack moves.

Vertical Height Sensor - IR Sensor

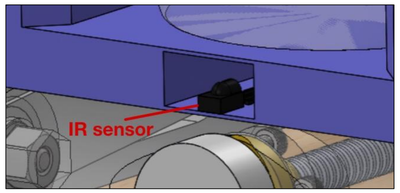


Figure 4. To detect the height of the bottle with respect to the desired platform, IR sensors are embedded in the top plate of the lift. The IR sensor will detect proximity by detecting reflected light from the IR transmitter already embedded in the desired platform.

Actuator - Stepper Motors

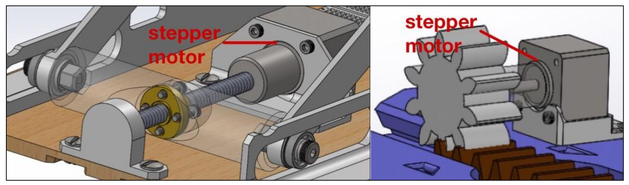


Figure 5. Stepper motor that actuates both the horizontal and vertical component.

Prevention of Bottle Tipping - 3D Printed Servo Arms

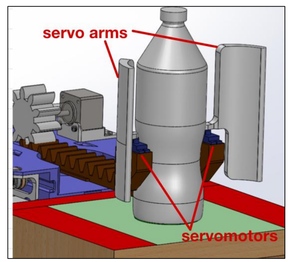


Figure 6. Tall 3D printed servo arms that will hug the bottle to prevent the bottle from tipping over, and open to release the bottle.

Final Design

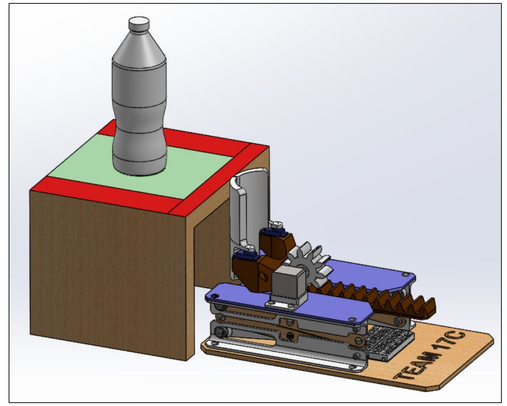
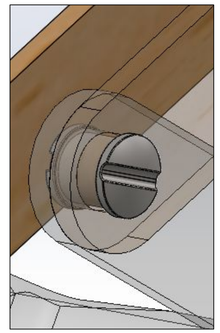


Figure 7. The final design of our mechanism consists of the key components, as well as smaller components such as bearings and couplers. The mechanism is expected to perform the full operation and return to original position within 30 seconds.

Future Improvements

1. **Center of mass** - ensure that the center of mass of the top platform is in the center so that the weight is distributed evenly on the linkage system



1. **Rotating hinges** - ensure that the hinges are fixed axially but are able to freely rotate

References & Acknowledgements

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We would also like to thank **Professor Walter** and **Professor Copp** for guiding us through the design process to make informed decisions for the final design.