

Hitachi Team CFP 2 Handout - 11/19 SGM

Overview

Problem: During our needfinding at local supermarkets, we observed that the older adults had a difficult time trying to reach items from the lower shelves; another interesting finding was that they didn't ask for help even when the shop workers were around. Upon benchmarking, we tested a variety of fridges at the home appliance store, and found that it takes efforts to pull open the bottom drawer and grab items.

Need: We want a feature (a physical mechanism) to make it easier for the older adults to reach and grab items from lower sections.

Background: We are inspired by the pull-down shelf organizer (Figure 1).



Figure 1: pull-down shelf and its mechanism

Goal for this CFP: For this CFP, we decided to make a simple pull-up mechanism and test to see how it functions and if it is feasible to incorporate it to the appliances such as fridge, cupboard, or shelf.

Question: *Would the implementation of a physical mechanism with hydraulics, such as a pull-up mechanism, be helpful to improve the accessibility of the lower compartments?*

Prototype setup and test procedures

We purchased a pair of four-bar linkages with hydraulic cylinders, as shown in Figure 2.



Figure 2: Four-bar hinge

We attached the hinges to a cupboard box and made a little pull-up mechanism. Figure 3 shows both the compressed and extended states.



Figure 3: Compressed (left) and extended (middle & right) states of the prototype.

We tested pulling and pushing the box with different weight inside.

Outcomes and insights

- We found that it was easier to pull the mechanism up when there was less weight inside, whereas it was easier to push it back when there was more weight inside.
- For the pull-up systems, we found that a fixed amount of initial weight is required to keep the box at the compressed state. For this specific system, the weight is ~1kg.
- It was easy to pull the box up from its compressed state; in fact, a little kick on the bottom would lift the box up.
- However, pushing the box back from the extended state to the compressed state is rather difficult. The four-bar linkages we purchased includes gas hydraulic pistons with a force of 130N each, which might be the reason for the rather difficult push-back. Therefore, we need to investigate the possibilities of incorporating other hardware or mechanism to make a smoother transition smooth (maybe motorize the system or use a different piston).
- For this prototype, we attached the system simply to a piece of cardboard, which is not very rigid and stable as a platform; therefore the system rotated in the vertical axis during lifting. Though we would use more rigid materials, we need to keep this behavior in mind.
- This specific system would not be suited to a cart as it changes the center of mass of the platform in extended position, and requires a force in the horizontal direction, both of which may topple a light cart. A system that moves purely vertically would work better.

Reference:

[1] <https://www.amazon.com/Cabinet-Kitchen-Storage-Organizer-30inch>