# Retractable Overhead Handholds for In-Home Mobility Support & Exercise

Advisors: Eli Patten, Mary Meyer, Stan Chiu
University of Washington Department of Mechanical Engineering

## BACKGROUND

- Aging and degenerative diseases can cause physical capabilities to greatly fluctuate from day to day.
- Current in-home mobility aids are static, expensive, and visually uninspiring.

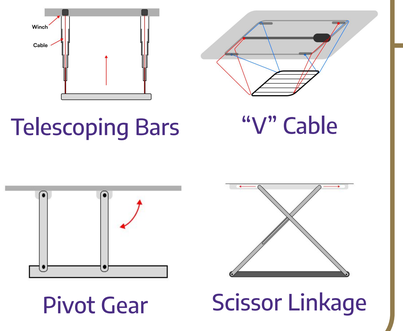
The Adaptable House Project seeks to provide an adjustable, ceiling-mounted handhold system to support individuals with fluctuating mobility and inspire users to move with confidence in their own home.

## CORE REQUIREMENTS

| Customer Requirements | Engineering Requirements |
|---|---|
| Safely support users body weight | System supports up to 1000 lb |
| Adjustable to various heights | Minimum handhold height of 5.5 ft |
| Compatibility with gantry system | Retracts within 12'' from the ceiling |
| Visually integrated in home | Aesthetic design, non-clinical appearance |

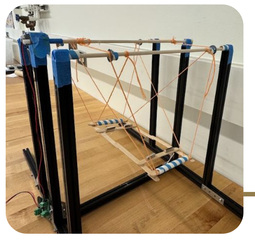
## DESIGN AND DEVELOPMENT

### Initial Concepts

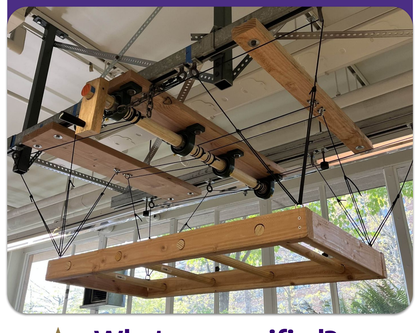



Telescoping Bars | "V" Cable | Pivot Gear | Scissor Linkage

*Initial testing with V-cable configuration to verify stability*

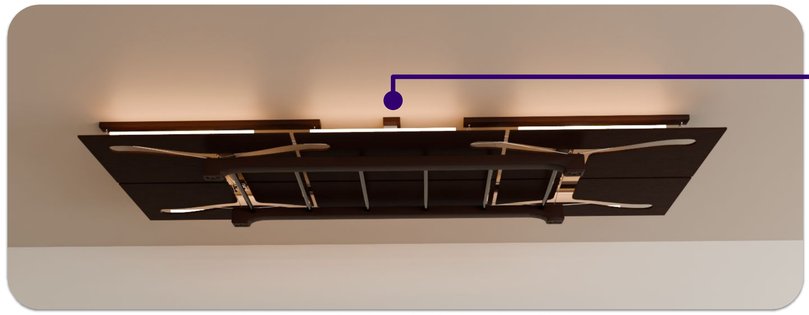


### PROOF-OF-CONCEPT PROTOTYPE

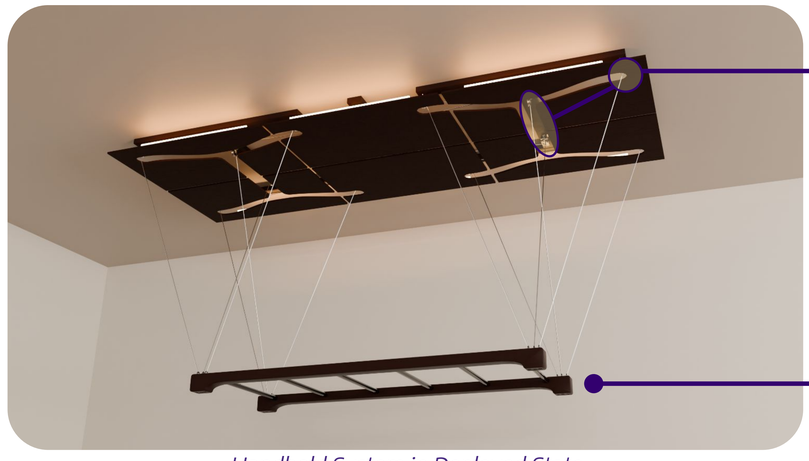


**What was verified?**
- Handholds stay level while raising and lowering
- High stability for walking, swinging, and pull-ups

## FINAL PROPOSED DESIGN



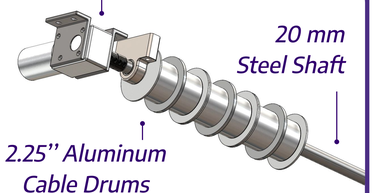
*Handhold System in Retracted State*



*Handhold System in Deployed State*

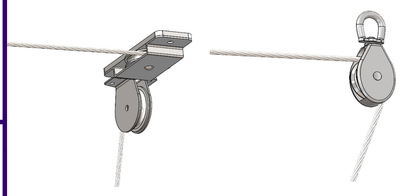
### ACTUATION

*24V DC Gear Motor*




### CABLE GUIDING

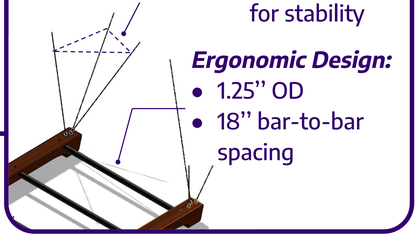
*Mounted + swivel pulleys*



### HANDHOLDS

Cables in pyramid shape for stability

***Ergonomic Design:***
- 1.25'' OD
- 18'' bar-to-bar spacing

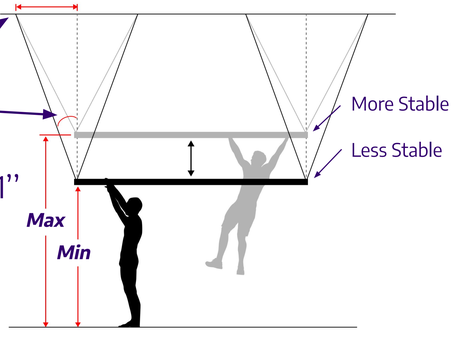


## RESULTS/VALIDATION

**Stability**
- Min. 26'' Flare Out
- Min. 19.5° 'cable angle'

**Ergonomic Range**

Max = [*user height*] * 1.3 - 1''
Min = [*user height*] + 6''




**Estimated Cost:**
- $1150 ~ $1750
- Mainly driven by:
  - Cable material (steel cable/fibrous rope)
  - Mounting Frame (Steel tubing vs. wood)

## FUTURE WORK

**Functional Improvements**:
- Tensioning system to easily adjust cable tension
- Adjust and validate drum design to wind steel cables

**User Testing & Validation**:
- Lower-mobility users
- Install in-home for long-term user testing

**Acknowledgements**

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