Adaptable House Project: Support System

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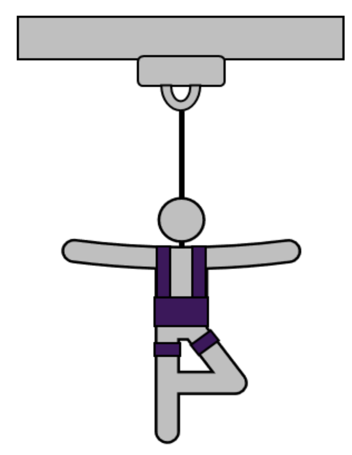
BACKGROUND

The Adaptable House Project aims to increase independence and confidence in the mobility of individuals by providing full or partial body-weight support in a user's home. **This subsystem focuses on the interface between the body-weight support modes and the user**.



CORE REQUIREMENTS

Existing solutions do not allow for varying ranges of mobility in daily life or in-home usage. To address these gaps, our design expects the following:

Customer Requirements

- Ease of use
- Safe and durable
- Comfortable and promotes good health
- Integrable into the user's home

Engineering Requirements

- Full rotation
- Load capacity of 300 lbf (static)
- Customizable
- Scalable in size
- Minimal transition time

DESIGN AND DEVELOPMENT

The system includes 3 distinct modes of support for varying levels of mobility:
Fall Protection mode, **Partial Support mode**, and **Full Support mode.**

Initial Concepts

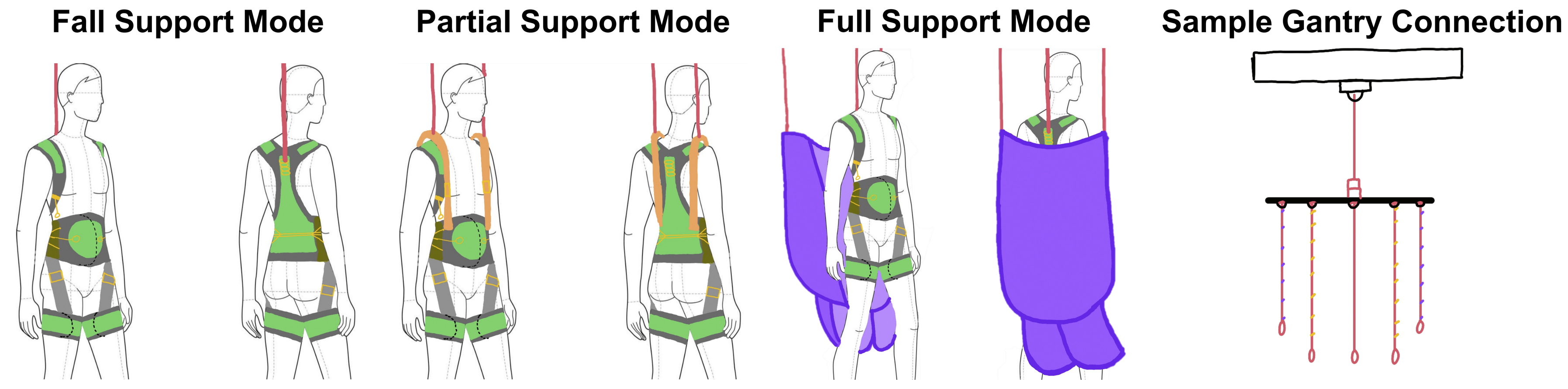


Fig. 1: Initial concepts for the system included three support modes accessible via one connection line to a gantry car. Each mode is attached to a horizontal bar fitted with a rotating carabiner to allow for full rotation and fast switching between modes.

Low-Fidelity Prototypes

Fig. 2: Cinching mechanism testing

Fig. 3: Chair scale modeling to test stiff inserts and arm rests

Medium-Fidelity Prototypes

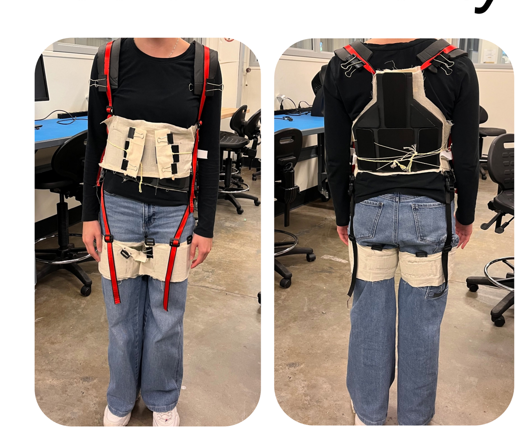


Fig. 4: Fall Protection and Partial Support Modes

Fig. 5: Full Support Mode

Refining Design Parameters

Fig. 6: Tensile and shear tests were performed on fabric and hook-and-loop components to inform the amount of fabric used in the design

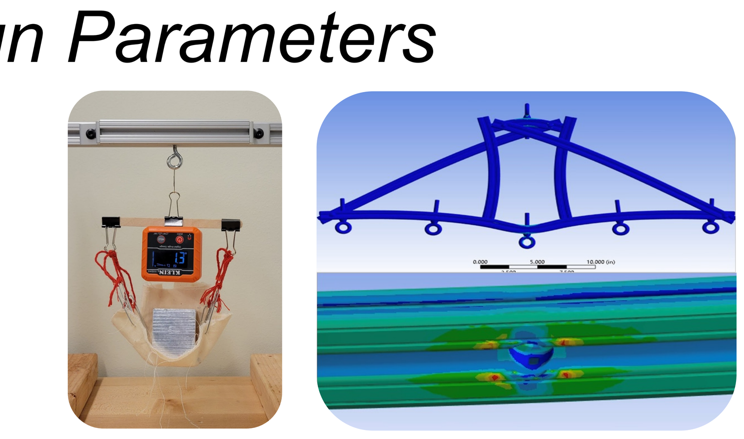


Fig. 7: Model chair frames were analyzed for tilt angle. Finite element analysis was used to find the maximum bending stress and safety factor (3.49) for the final frame.

RESULTS & VALIDATION

Frame dynamically loaded and supports 300+ lbf for all system modes

Fig. 8: Final Frame

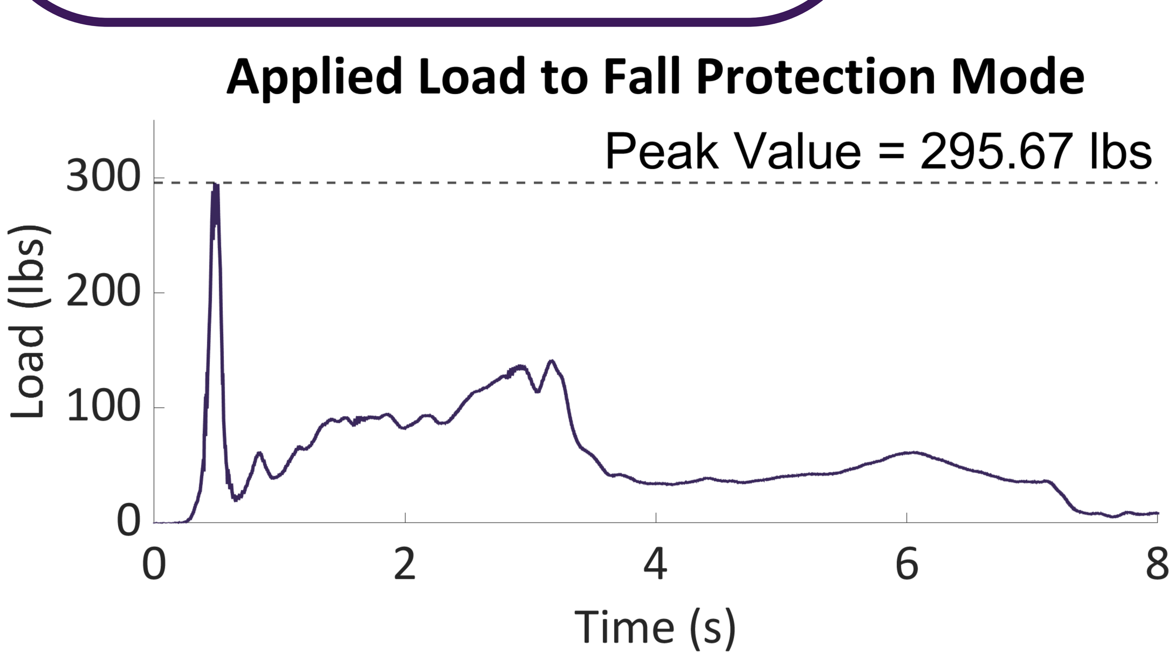


Fig. 9: Dynamic loading test for the Fall Protection Mode

Harness dynamically loaded and supports up to 300 lbf

Users can comfortably wear system freely for 4+ hours and can apply full body-weight during harness modes.

Fig. 10: Users testing and wearing the harness in daily activities

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CONCLUSION & NEXT STEPS

- Successful testing has grown confidence in the harness subsystems for manufacturability and use in an in-home setting.
- Further development of stowing methods for each mode should be explored for ease of use.
- Full support mode should consider a wider variety of stiffer chair designs for more comfort.

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