Assistive Transfer Device

UW BME Design

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OUTLINE

I. Problem Statement
   i. Need for Device
II. Design Specifications
   i. Background
III. Review of Previous Design
   i. What went wrong?
   ii. Where can we improve?
IV. Design Analyses
V. Future Work
   i. Design/Fabrication
   ii. IRB

PROBLEM STATEMENT

- Safely transfer patients from wheel chair to exam table
- Patients should feel secure while lifted
- Reduce Physical exertion of both patient and medical personnel

CURRENT LIFTING METHODS

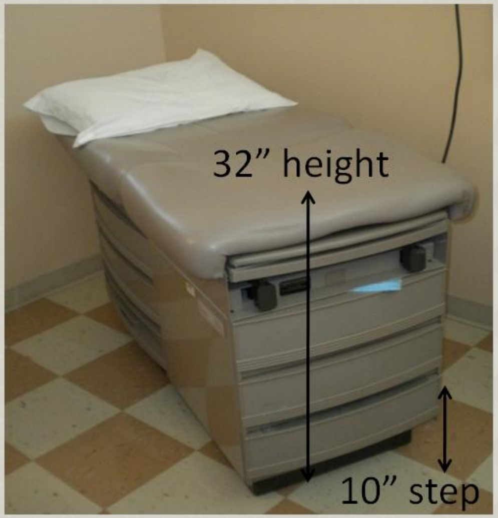
- Manual Labor
  - Method
    - Assistant wraps arms around patient
    - Holds patient while slowly rotating toward table
    - Hoists patient onto exam table
  - Risks
    - Large effort from assistant
    - Uncomfortable for patient and assistant
    - Dependent on assistant strength
- Hoyer Lift
    - Mostly for Wheelchair-bound patients
    - Have to get sleeve underneath patient

http://www.corpmed.com/images/patient-transfer.jpg

http://dehanmedequip.com/images/electric%20hoyer%20lift.jpg

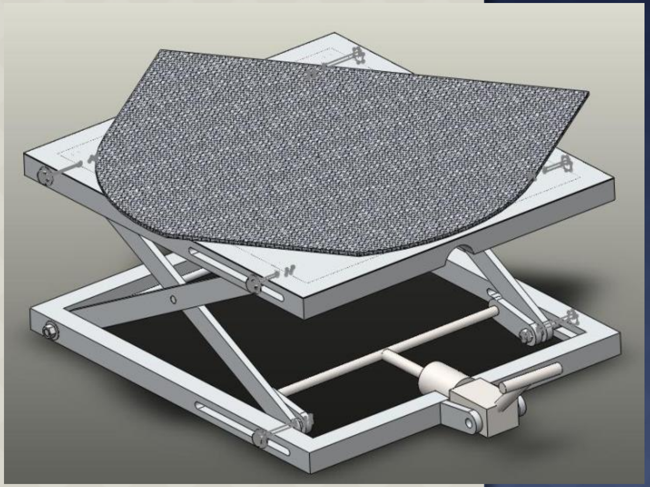
SPECIFICATIONS

- Able to lift 300 lbs.
  - (Safety factor of 2x)
- Lift 10-15 in.
- Rotate Patient
- Portable
  - (Device < 50 lbs. or on wheels)
- Easy Storage
  - Under a bed/behind a door/ against a wall
- Stable



SPRING '10 DESIGN

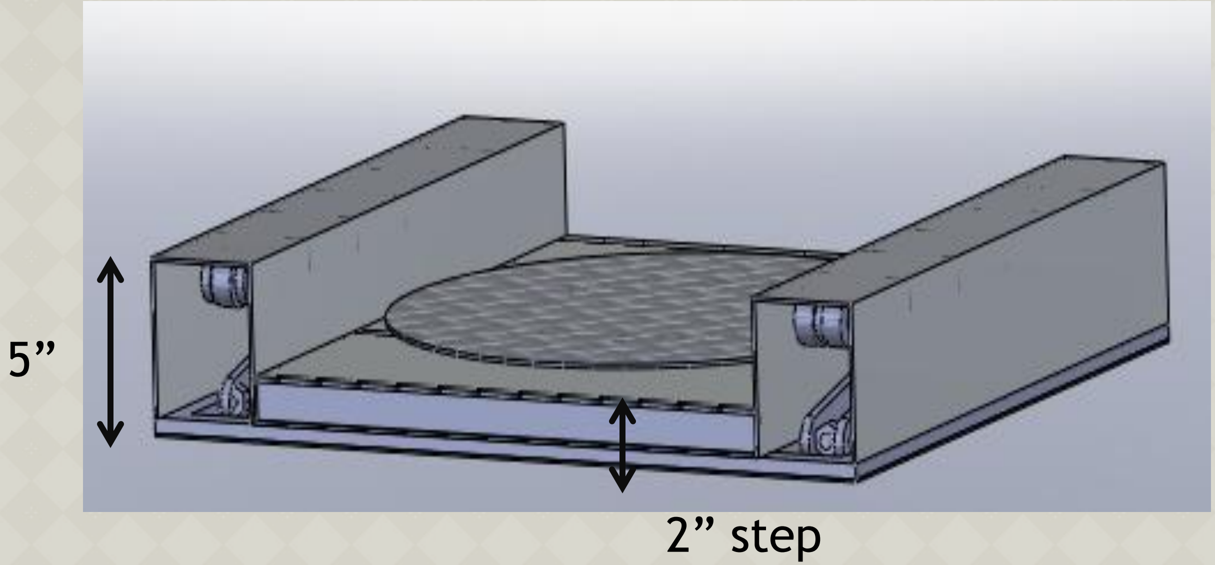
- Limitations
  - Can only help patients able to stand with assistance of nurse or walker
  - Initial Step up is 3.5 in.
  - Friction in joints require oiling
  - Total Weight is 60 lbs.



- Issues to improve
  - Mechanical advantage of actuator
  - Reduce Extrusions (wheels and cylinder) –ideally fitting both underneath device
  - General Stability during ascent and descent
  - Binding issues of scissor-links

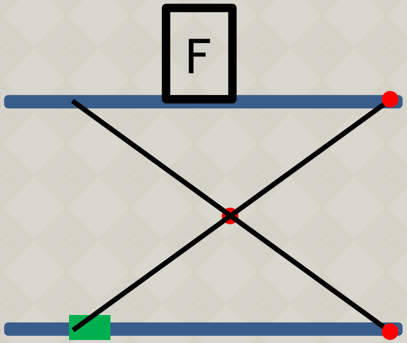
VALLEY CONCEPT

- Reduces Step height
- Increases Mechanical advantage

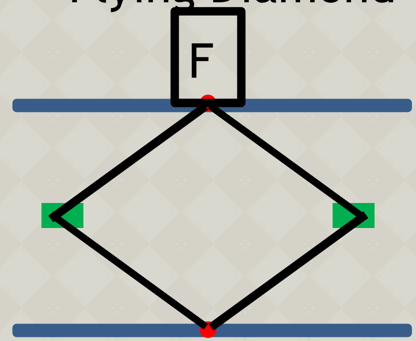


Possible Geometries

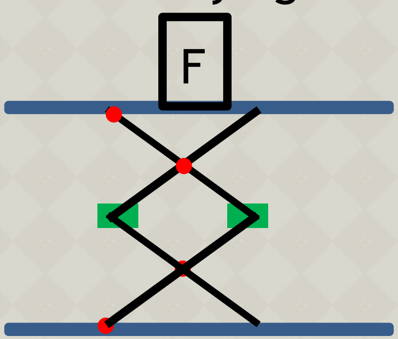
Last Year



Flying Diamond

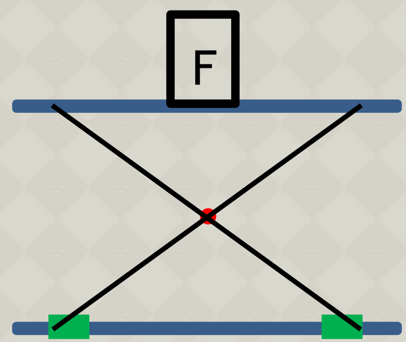


Double Flying Diamond



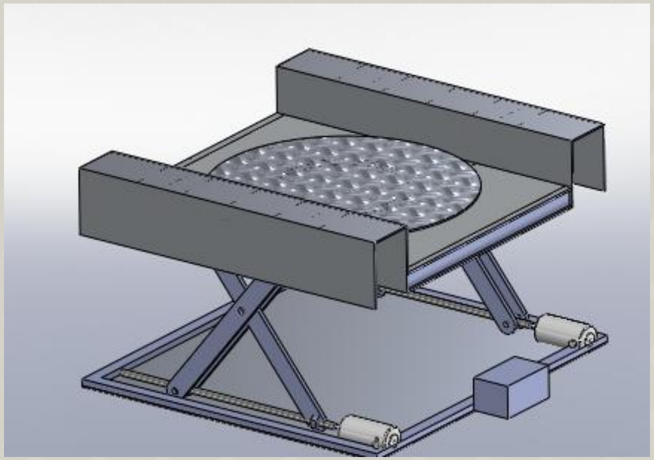
$$F_x = F_y \frac{\sqrt{L^2 -}}{y}$$

Double Whammy



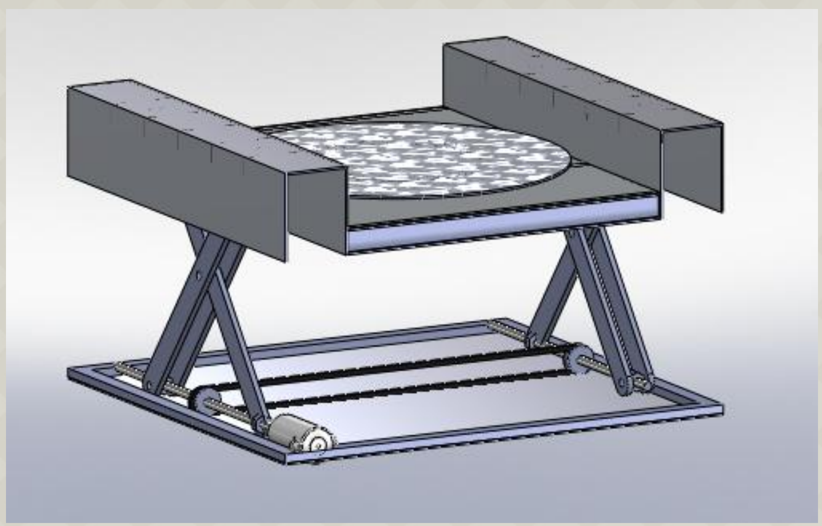
$$F_x = \frac{F_y}{2} \frac{\sqrt{L^2 -}}{y}$$

DESIGN CONCEPTS



Hydraulic Actuator

Premade Electric Car Jack
http://www.m-99.co.uk/Electric_Car_Jack/electric_car_jack.html



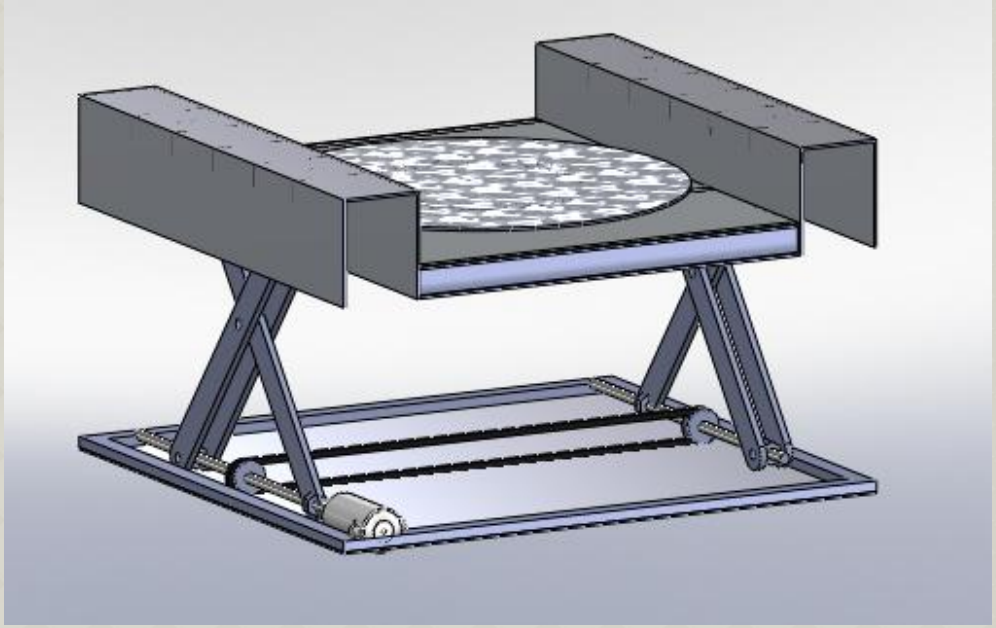
Electric Motor - Drive Shaft

LIFTING METHODS

	Cost	Feasibility (x2)	Storage	Design Variability (x2)	Safety	Total
Hydraulics	1	4	4	5	4	18
Premade Electric Jack	4	8	1	4	4	21
Drive Shaft	2	5	4	8	4	23

FUTURE WORK

- Perform force calculations on SolidWorks model
  - Calculate motor torque
- Order Materials
- Fabricate
- Apply for IRB



PARAMETER RESEARCH

Step Height

- Stair heights range from 6 ½” to 9 ½” [4]
- Elderly women range of motion of about 59.23 ± 13.77° [2]
- Maximum knee flexion during an 8” step is 90.8° [5]
- A study showed that 80% of the women tested (ages 75-93) were able to step up higher than 20 cm (7.87”)[1]

Stance

- Stance width ranges from 0.05 m to 0.29 m (2” to 11.4”)[3]

Designing Our Own Experiment

- Target population: nursing homes
- Significance:
  - Maximum step height
  - Stance Width

- Social Science IRB Approval
- Survey for elderly people
  - Test different step heights
  - Rate on comfort/difficulty

Does Anyone Have Questions?

REFERENCES

[1] Bergland A, Sylliaas H, Jarnlo GB, Wyller TB. Health, balance and walking as correlates of climbing stairs. *J of Aging and Physical Activity*, 2008;16:42-52.

[2] Larsen AH, Sorensen H, Puggaard L, Aagaard P. "Biomechanical determinants of maximal stair climbing capacity in healthy elderly women." *Scandinavian J of Med & Science in Sports*, 2009;19:678-686.

[3] McIlroy WE and Maki BE. "Preferred placement of the feet during quiet stance: development of a standardized foot placement for balance testing." *Clinical Biomechanics*, 1997;12:66-70.

[4] Occupational Safety and Health Administration. Standard 1910.24(e). <http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9716>.

[5] Smutnick JA, Bohannon RW. "Hip and knee flexion of lead and trail limbs during ascent of a step of different heights by normal adults." *Phys Ther*, 2009;95:289-293.