Assistive Transfer Device

Team
Luisa Meyer (Leader)
Sarah Springborn (Commun.)
Gerhard van Baalen (BSAC)
Scott Sokn (BWIG)
Bucky (Inspiration)

Clients
Diana Eastridge, RN, CNP
Lisa Kaikuanna, RN

Advisor
Professor Thomas Yen, PhD
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
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
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

Double Whammy

Flying Diamond

Double Flying Diamond

Double Whammy

\[ F_x = F_y \frac{\sqrt{L^2 - \gamma^2}}{\gamma} \]

\[ F_x = \frac{F_y}{2} \frac{\sqrt{L^2 - \gamma^2}}{\gamma} \]
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
<table>
<thead>
<tr>
<th></th>
<th>Cost</th>
<th>Feasibility (x2)</th>
<th>Storage</th>
<th>Design Variability (x2)</th>
<th>Safety</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydraulics</strong></td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td><strong>Premade Electric Jack</strong></td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td><strong>Drive Shaft</strong></td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>23</td>
</tr>
</tbody>
</table>
FUTURE WORK

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


