ME 489 Formal Design Review

September 11, 2002

Overview

- Problem definition
- 3 design solutions
- Final design concept chosen
- Project plans
Background

- xxxxxxxxxxxxxxxx
- Spina Bifida
- Clients Assigned
  - xxxxxxxxxxxxx
  - xxxxxxxxxxx
  - No movement in lower body

Project Goals

- Design a multi-functional device
  - Wheelchair to floor
  - Floor to bath
- Minimize adult assistance
  - Automated
- Safety
- Generic design
- Stay within budget
Design Issues

Social
• Helpful to family

Economics
• Budget, smart expenditure

Manufacturability
• Manageable to build

Sustainability
• Durable, adaptability

Health and Safety
• Safe operation, avoid allergic materials

Where we are now

• XXXXXXXXXXXXXXX XXXXXXXX

• Identified bathroom constraints
  – Dimensions
  – Facility locations

• Three Initial Design Concepts
  – One Concept Chosen
“The Crane”

- Trolley w/ wench mechanism
- Control box
- Tub wall
- Locking wheels (4)
- Wheelchair

“Rotating Chair”

- Guide bar and seat travel along track
- Seat fixed to guide bar
- Controls Up/down
- Controls Rotation
- Locking Swivel Wheels (4)
- AC Electric Motor
- Aluminum Base Plate
- Bathtub
Chosen Concept – “The Elevator”

Prioritization Matrix

<table>
<thead>
<tr>
<th>Criteria (weight)</th>
<th>&quot;The Crane&quot;</th>
<th>&quot;Rotating Chair&quot;</th>
<th>&quot;The Elevator&quot;</th>
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</thead>
<tbody>
<tr>
<td>Safety (0.2)</td>
<td>0.2</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Weight (0.07)</td>
<td>0.21</td>
<td>0.07</td>
<td>0.14</td>
</tr>
<tr>
<td>Cost (0.09)</td>
<td>0.18</td>
<td>0.09</td>
<td>0.27</td>
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<tr>
<td>Stability (0.15)</td>
<td>0.15</td>
<td>0.3</td>
<td>0.45</td>
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<tr>
<td>Ease of Use (0.1)</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Mobility (0.09)</td>
<td>0.27</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Space Efficiency (0.08)</td>
<td>0.24</td>
<td>0.16</td>
<td>0.08</td>
</tr>
<tr>
<td>Ease of Assembly (0.07)</td>
<td>0.14</td>
<td>0.07</td>
<td>0.21</td>
</tr>
<tr>
<td>Size (0.07)</td>
<td>0.14</td>
<td>0.07</td>
<td>0.21</td>
</tr>
<tr>
<td>Adaptability (0.08)</td>
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<td>0.16</td>
<td>0.08</td>
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<tr>
<td>Total Score</td>
<td>1.87</td>
<td>1.7</td>
<td>2.43</td>
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Project Timeline

- 8/29/02: Brainstorm Ideas
- 9/5/02: Initial Design Concepts
- 9/12/02: Prioritization Matrix
- 9/19/02: Meet with Customer
- 9/26/02: Formal Design Review
- 10/3/02: Analyse Concept Chosen
- 10/10/02: Investigate Costs
- 10/17/02: Calculations
- 10/24/02: Order Parts
- 10/31/02: Design Review 1
- 11/7/02: Build

Budget Constraints

- Total Project limit of $1600
- Expenditure limit of $450
- Machine Shop time limit of 14hrs
- Donations may not exceed $800
Budget Breakdown

- Air Compressor: $150
- 2 Pneumatic Cylinders: $100
- Platform: $25
- Control Materials: $75
- Other Materials: $50
- Machine Shop time: $250 (10hrs)

Estimated Cost: $650.00

Necessary Analyses

- Stress/Strain – frame, cylinder
- Deflection – platform
- Buckling – frame, platform
- Fatigue/Life – frame, cylinder
- Pneumatic calculations
Conclusion

- Elevator concept will solve problem
- Remain under budget
- Completed in timeframe of project
- Safe operation
- Next steps

Questions?