DESIGN PROJECT I: COFFEE MUG

Project Background and Introduction:

- Every year, there are many hand injuries that involve finger amputations
- Those with finger disabilities have difficulty with many daily activities, including drinking from a mug
- Our design team was given the objective of developing a mug that these people can easily use

Mission Statement:
Product Description: A coffee mug in which a person with one finger can use
Primary Market: A person with one finger
Secondary Market: People with other disabilities
Assumptions: They have stability and can use the mug correctly
Stakeholders: People with one figure/disabilities

Customer Needs and Rankings:
- First created the five first-layer attributes
- Eighteen second-layer attributes
- Used the Analytical Hierarchy Process to rank the attributes
- Sample AHP
- 10 most important attributes

Relative importance of needs (AHP):
1. Stable (0.163)
   - Balanced weight (0.039, 0.241)
   - Good grip (0.084, 0.517)
   - Hard to spill (0.039, 0.241)
2. Easy to Use (0.319)
   - Lightweight (0.111, 0.348)
   - Handicap Accessible (0.020, 0.063)
   - Portable (0.154, 0.463)
   - Microwaveable (0.020, 0.063)
   - Easy to store (0.057, 0.178)
3. Practical (0.319)
   - Insulated (0.032, 0.100)
   - Cheap (0.086, 0.300)
   - Simple (0.160, 0.500)
   - Easy to clean (0.032, 0.100)
4. Aesthetically Pleasing (0.036)
   - Sleek (0.00605, 0.168)
   - Good looking (0.0199, 0.554)
   - Functional Size (0.00605, 0.168)
   - Fits in cupholders (0.03996, 0.111)
5. Durable (0.163)
   - Shatter proof (0.122, 0.750)
   - Long lasting (0.0408, 0.250)

<table>
<thead>
<tr>
<th></th>
<th>Lightweight</th>
<th>Handicap Accessible</th>
<th>Portable</th>
<th>Microwaveable</th>
<th>Easy to Store</th>
<th>Total</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Lightweight</td>
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<td>5</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>15</td>
<td>0.348</td>
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<tr>
<td>Handicap Accessible</td>
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<td>1</td>
<td>0.2</td>
<td>1</td>
<td>0.333</td>
<td>2.733</td>
<td>0.063</td>
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<td>Portable</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>15</td>
<td>0.348</td>
</tr>
<tr>
<td>Microwaveable</td>
<td>0.2</td>
<td>1</td>
<td>0.2</td>
<td>1</td>
<td>0.333</td>
<td>2.733</td>
<td>0.063</td>
</tr>
<tr>
<td>Easy to Store</td>
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<td>3</td>
<td>0.333</td>
<td>3</td>
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<td>7.666</td>
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<td>43.132</td>
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Concept Generation:

- Lightweight
  - Thin walls
  - Hallowed walls
- Portable
  - Small handles
  - Small overall size
- Cheap
  - Cheap materials
  - Small volume
- Simple
  - Easy to carry
  - Easy to drink from
- Shatter-proof
  - Ceramic/Plastic
  - Strong materials
- Long lasting
  - Scratch-proof coating
  - Sturdy build
- Good Grip
  - Rubber inside handles
  - Tighter handles
- Fits in cupholders
  - Extended base
  - Slim handles
- Easy to Store
  - Simple shape
  - Shorter size
- Balanced Weight
  - Wide base
  - Evenly weighted handles
Concept Selection:

<table>
<thead>
<tr>
<th>Material</th>
<th>Tin Walls</th>
<th>Hollowed Walls</th>
<th>Small Handle</th>
<th>Cheap Material</th>
<th>Small Volume</th>
<th>Easy to Drink From</th>
<th>Strong Material</th>
<th>Scratch Proof</th>
<th>Weighted Bootom</th>
<th>Rubber Inside Handle</th>
<th>Extended Base</th>
<th>Slim Handle</th>
<th>Simple Shape</th>
<th>Shorter Size</th>
<th>Wide Base</th>
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<tbody>
<tr>
<td>Simple</td>
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<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Portable</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
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</tbody>
</table>

- Sam's: 3, 2, 4, 1, 4, 1, 2, 1, 2, 1, 3, 1, 3
- Sam D: 1, 2, 1, 3, 1, 3, 2, 4, 6, 2, 4, 2, 3, 3, 3
- Sam B: 1, 1, 0, 1, 0, 1, 0, 1, 0, 3, 0, 1, 0, 3
- Net Score: 2, 1, 4, 0, 4, 0, 4, 1, 1, 0, 0, 0, 1, 0, 3

<table>
<thead>
<tr>
<th>Concept</th>
<th>Combine (C)</th>
<th>Combine (B)</th>
<th>No Combine (N)</th>
<th>Yes Combine (Y)</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>No</th>
<th>No</th>
<th>No</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>No</th>
<th>No</th>
<th>No</th>
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<td>3</td>
<td>10</td>
<td>4</td>
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<td>Continue?</td>
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<td>Combine (B)</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strong Material</th>
<th>Scratch Proof</th>
<th>Tin Hollowed Walls</th>
<th>Small Handle</th>
<th>Small and Short</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Rating</td>
<td>Weighted Score</td>
<td>Rating</td>
<td>Weighted Score</td>
<td>Rating</td>
</tr>
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<td>Simple</td>
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<tr>
<td>Portable</td>
<td>0.34</td>
<td>0.72</td>
<td>0.72</td>
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<tr>
<td>Light-weight</td>
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<td>0.57</td>
<td>0.57</td>
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</tr>
<tr>
<td>Cheap</td>
<td>0.17</td>
<td>0.51</td>
<td>0.51</td>
<td>0.38</td>
</tr>
</tbody>
</table>

- Total Score: 3, 2.813, 3.206, 3.275, 3.436

Prototype and Testing:

- Two handles makes it easier for the disabled to carry around
- Thin walls makes it lightweight
- Strong materials decreases the chance of shattering when dropped
- Small, thin handles make the mug portable, easier to carry, and lighter

I learned a lot through doing this project, such as teamwork, time management, and the engineering design process. The difficulties involved concept generation, having multiple concepts and communicating with my teammates.