Design Project 1: Coffee Mug for People with Hand Disabilities

Every year there are around 2,000 upper extremity amputations in the United States [2]. In addition to the amputations that occur each year, there also hundreds of people who are born with missing fingers and other handicaps that disable them from the movement and flexibility in their hands and fingers. Many of these people are restricted from daily activities that the average person takes for granted. One of these tasks includes enjoying a cup of coffee. Just because they are disabled does not take away their right to be able to drink hot beverages just like the average person.

The need for products that accommodate to people who are missing fingers/hands is on the rise. Some of these accommodations are simple and easily implemented in everyday life such as a handicapped button for a door. However, there is still much progress that can be made in order to make these people more mobile as well as feel like they no longer have a disability.

As aspiring engineers, our goal was to find and analyze current coffee mug designs and then create or improve a design so that it is better suited for a one-fingered disabled person. The idea behind it was that if a person with one-finger could use the mug, then the average person could also use it. In addition to our goal of creating a better suited mug, we also wanted to create a product that would not make our customer stick out if he or she were to use it in public. Many disabled people already feel like they stick out in public, and we want to make sure that if they are using our product they feel as normal as possible.

Tools:

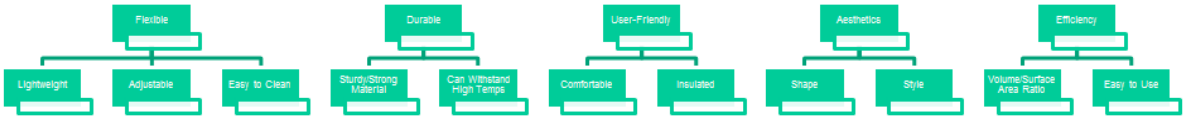
1. AHP

- uses pair-wise comparison to compare attributes of a given design. You rank all the attributes from 1-9 using the table below as a key.

The Fundamental Scale for Pairwise Comparisons		
Intensity of Importance	**Definition**	**Explanation**
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation
Intensities of 2, 4, 6, and 8 can be used to express intermediate values. Intensities 1.1, 1.2, 1.3, etc. can be used for elements that are very close in importance.		

AHP TABLE

	Temperature Control	Cable Rentention	Shock Absorption	Stacking	Total (Ri)	Weight
Temperature Control	1	0.333333333	0.333333333	0.2	1.86	0.08306043
Cable Retention	3	1	1	0.6	5.6	0.25007443
Shock Absorption	3	1	1	0.6	5.6	0.25007443
Stacking	5	1.666666667	1.666666667	1	9.33333333	0.41679071
Total					22.3933333	
Temperature	can withstand hot temperatures	space between each port	water cooling system	fan		
can withstand hot temperatures	1	0.2	1	1	3.2	0.125
space between each port	5	1	5	5	16	0.625
water cooling system	1	0.2	1	1	3.2	0.125
fan	1	0.2	1	1	3.2	0.125
Total					**25.6**	
Cable Rentention	clamps	tube for power cable	zip ties to post			
clamps	1	0.20	0.333333333		1.53	0.11111111
tube for power cable	5	1.00	1.67		7.67	0.55555556
zip ties to post	3	0.6	1		4.6	0.33333333
Total					**13.80**	
Shock Absorption	suspension system	rubberized bottom	gel			
suspension system	1	0.333333333	1		2.33333333	0.2
rubberized bottom	3	1	3		7	0.6
gel	1	0.33	1		2.33	0.2
Total					**11.67**	
Stacking	cylindrical screwing	lego style	slots			
cylindrical screwing	1	0.33	0.2		1.53	0.11111111
lego style	3	1	0.6		4.6	0.33333333
slots	5	1.666666667	1		7.66666667	0.55555556
Total					**13.80**	

2. Concept Generation Tree

- This is used to develop innovative solutions to customer needs/wants.