Cup Daddy

Secure Cup Holder

Group Z13

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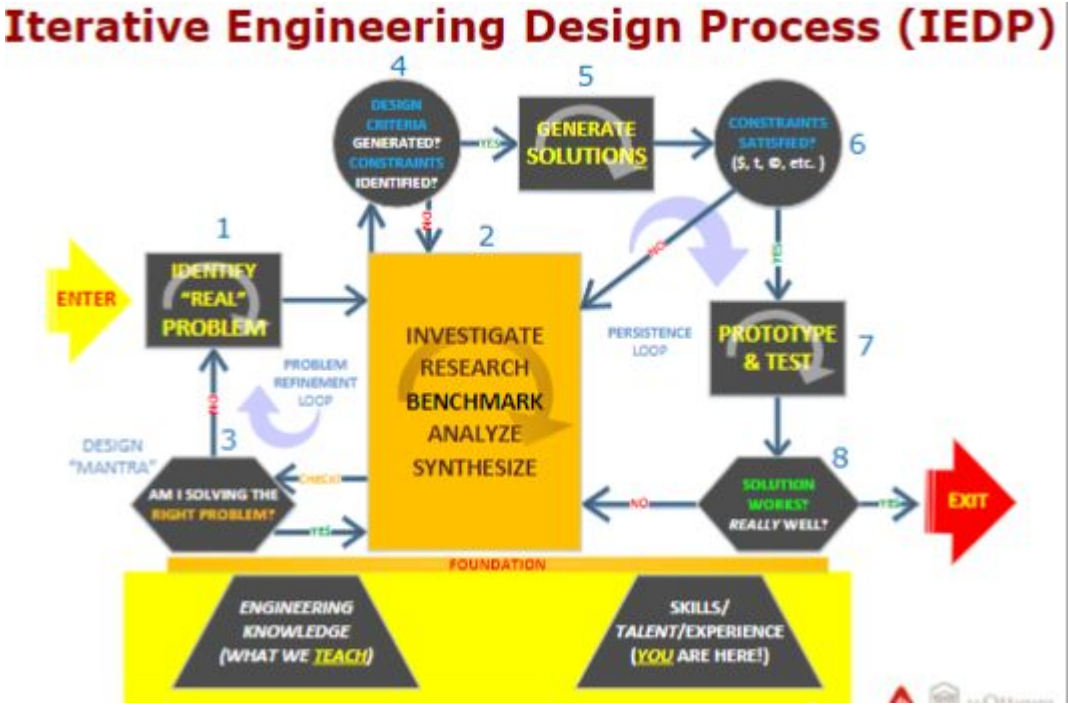
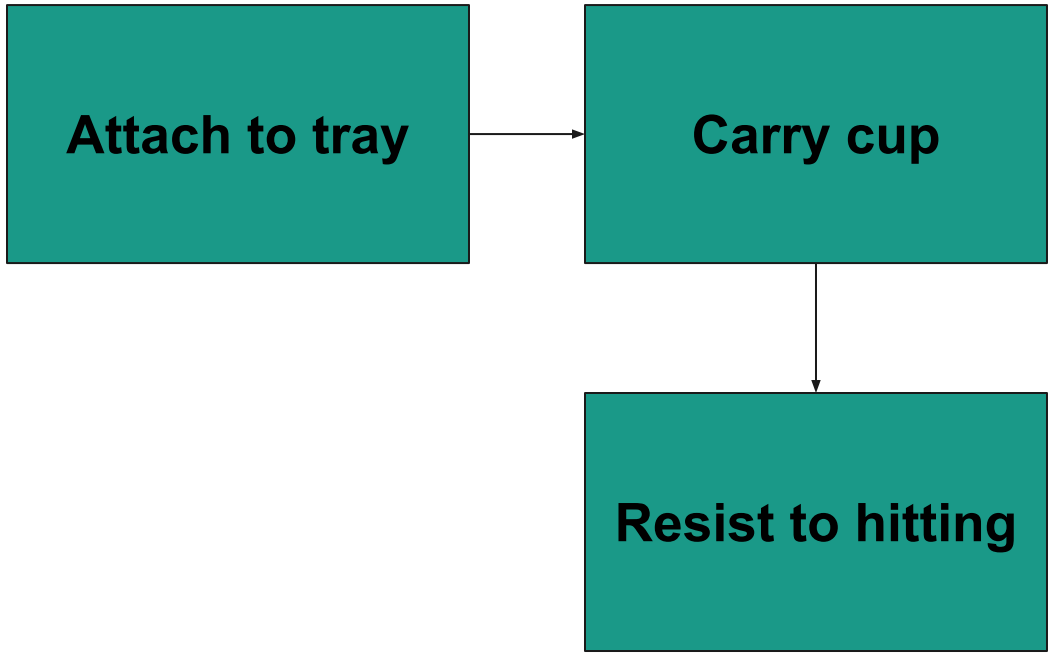


Client Needs (From Most to Least Important)

1. Sturdy, resists to hit
2. Detachable system, easy to install
3. Shouldn't make the wheelchair wider
4. Water-resistant
5. Easily repaired if needed



Functional Decomposition Diagram

Problem Statement

Design a strong and removable cup holder to be attached to a wheelchair tray to prevent a drink from being knocked over. The design should provide value to wheelchair users who often knock over their drink.

Technical Benchmarking Results

Metric	Importance	LÅNESPELARE IKEA [1]	Easy to Use Products [2]	W4W Stroller Cup Holder [3]
Cost (CAD)	3	$16.99	$24.99	$19.95
Material	4	wood veneer, aluminum	ABS plastic, rubber	Silicone, plastic
Durability	5	Very durable	Not durable	Somewhat durable
Dimension	4	Height: 9 cm Width: 11 cm	Height: 14 cm Width: 10 cm	Height: 10.2 cm Width: 10.2 cm
Reliability	5	Very reliable	Reliable	Reliable
Ease of use	5	Very easy to use	Easy to use	Easy to use
Weight	2	340 g	118 g	200 g
Total:		**80**	**50**	**62**

Figure 1. LÅNESPELARE IKEA [1]

Figure 2. Easy To Use Products [2]

Figure 3. W4WStroller Cup [3]

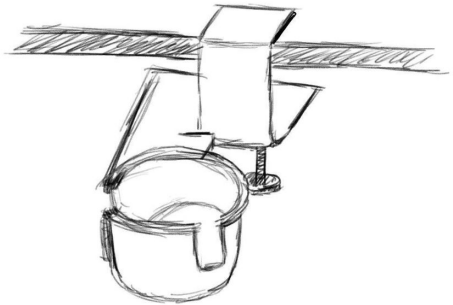
Target Specifications

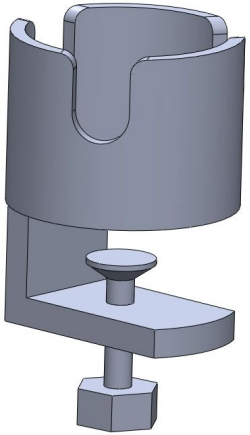
Metric #	Functional Requirements	Relation	Value	Unit	Verification Method
1	Minimum opening (clamp)	>	2.55	cm	Test
1	Cup holder height	><	5 - 10	cm	Test
1	Cup holder diameter	><	7.6 - 8 (approximate)	cm	Test
6	Time to assemble	<	15	seconds	Test
Metric #	**Constraints**	**Relation**	**Value**	**Unit**	**Verification Method**
7	Cost	<	50	$	Analysis
8	Time to complete project	=	14 July 2023 (design day)	Date	Scheduling

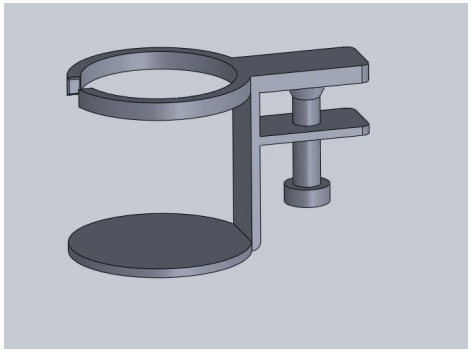
Target Specifications

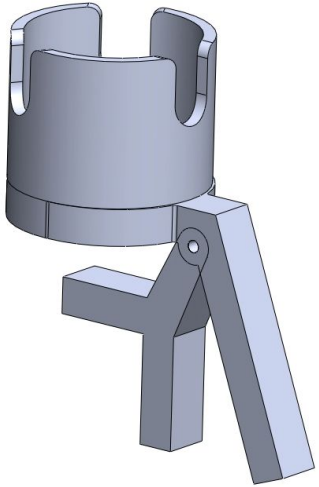
Metric #	Non-Functional Requirements	Relation	Value	Unit	Verification Method
5	Total weight	<	500	g	Test
2, 6	Reliability	>	2	Years	Test
2, 3	Material	=	Hydrophobic Sturdy	N/A	Analysis
3, 5	Ease of use	N/A	N/A	N/A	Test
1	Total height	<	15	cm	Test
1	Total diameter	<	12	cm	Test

Original Concepts and Feedback

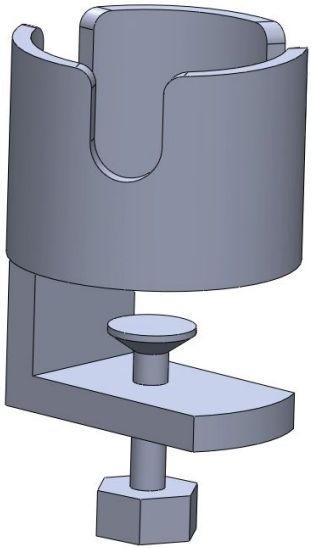




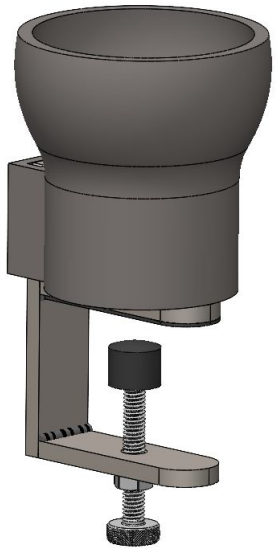




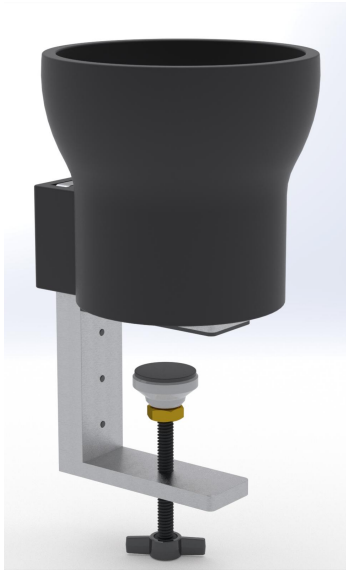
Chosen Concepts and Design Evolution



Initial Concept



First Detailed Design



Final Design

Concept Feasibility Study

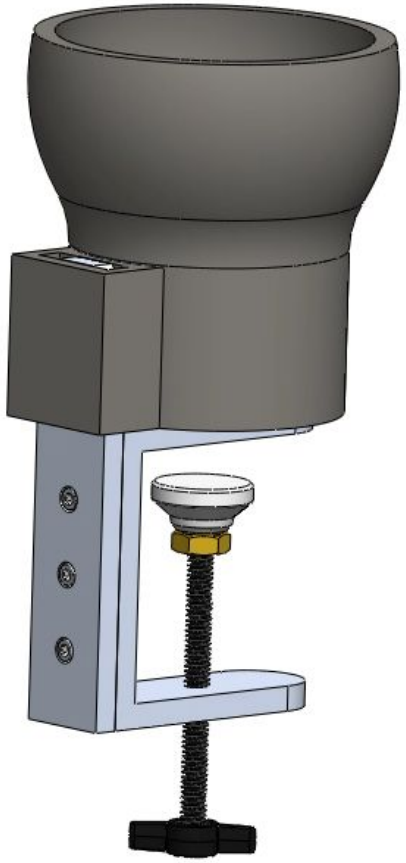
1) Size and shape of cup holder can be adjusted to fit cup ✅

2) Threaded swivel head adjusts to uneven surfaces ✅

3) Clamp opening length can be made bigger than tray depth ✅

4) Cup weighs less than product ✅

5) Magnets and rubber pads can be added for extra protection ✅



Bill of Materials

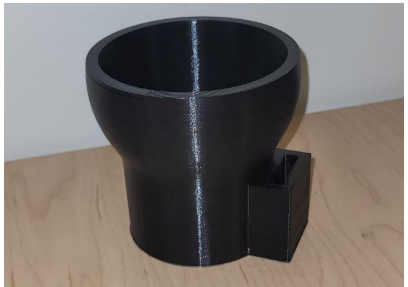
Total Cost of Materials: $9.33

Item #	Part Name	Description	Quantity	Total Cost
1	Flat Bar	0.25”x1”x4.5” Aluminum bar	1	$1.00
2	C-channel	0.25”x3”x3” Aluminum c-channel	1	$2.50
3	Bolt	¼-20 2.5” socket head bolt	1	$0.62
4	Screws	M3x12mm socket head screws	3	$0.28
5	Thumb grip	Plastic thumb grip	1	$0.21
6	Swivel Head	¼-20” threaded swivel head	1	$4.08
7	Rubber strip	1”x2.75” rubber strip	1	$0.25
8	Cup Holder	PLA cupholder	1	$0.39

Prototype 1

Purpose:

- Quality check of the 3D print
- Print time
- Fit and function
- Weight and Strength
- Dimensions and tolerances
- Infill



Test Objective	Description of Test Method	Description of Results Collection and Interpretation	Estimated Test Duration and Time	Result
Test ease of carrying the cup holder	Measure weight of cup holder by placing it on a mass balance	Record the reading on the mass balance Positive result: Cup holder is less than 150 g	1 minute 9 pm 2023-06-04	107 g
Test the force the cup holder can withstand	Place a 5 lbs weight on the cup holder when it is longitudinal and diametral	Positive result: Cup holder is intact and doesn't break	2 minutes 9:02 pm 2023-06-04	✅
Test resistance of cup holder to water	Wash cup holder with lukewarm water	Positive result: Cup holder is intact after being washed	2 minutes 9:04 pm 2023-06-04	✅

Prototype 2

Purpose:

- Ease of use
- Dimensions
- Opening
- Cost
- Assembly time
- Completion time

Target Specification	Desired Value	Actual Value	Target met?	Estimated Test Duration and Time
Time to complete	8 hrs	4 hrs	Yes	12:00-16:00 2023-06-21
Material	Hydrophobic	Hydrophobic	Yes	18:00-18:02 2023-06-21
Ease of use	N/A	Easy to use	Yes	18:02-18:04 2023-06-21
Height	5-10 cm	12.2 cm	No	18:04-18:05 2023-06-21
Minimum opening	2.55cm	4.5 cm	Yes	18:05-18:06 2023-06-21
Time to assemble	<15 seconds	=15 seconds	Yes	18:06-18:07 2023-06-21
Cost	<$50	$12.12	Yes	14:00-14:30 2023-06-22

Final Product

- Prototype 1 was discarded
- New cup holder design was printed
- Prototype 2 was modified
    - Rounded edges, shortened screws, rubber grip
- Thumb screw grip was pressfitted

Sustainability Report

	Positive	Negative
Environmental Impact	1) Biodegradable PLA 2) Non-perishable good 3) Recyclable aluminum (clamp subsystem)	1) Land pollution 2) Heat generation
Social Impact	Helpful for 1) Customers who with uncontrolled movements 2) Gamers and babies	1) Cleaning, installation, and maintenance 2) Lost parts
Economic Impact	1) Financial growth and stability 2) Economic growth	1) Financial risks 2) Market competition

Business Model

<table>
<tr>
<td rowspan="2">Key Partners:
- Material suppliers
- Wheelchair companies</td>
<td>Key Activities:
- Securing a cup to a wheelchair tray</td>
<td rowspan="2">Value Proposition:
- Prevent spills
- Customizability
- Interchangeability
- Long Lasting</td>
<td>Customer Relationships:
- Improve the life of wheelchair (and other) users
- Varied clamp dimensions</td>
<td rowspan="2">Customer Segments:
- Wheelchair users
- Stroller users
- Gamers
- Boat users
- etc.</td>
</tr>
<tr>
<td>Key Resources:
- Machine shop to manufacture the parts
- Injection molder to make the plastic pieces</td>
<td>Channels:
- Through the wheelchair companies, in stores, online</td>
</tr>
<tr>
<td colspan="3">Cost Structure:
- Rent for machine shop
- Purchasing of machines/equipment
- Marketing and sales
- Product development
- Administrative costs
- General costs (material, salaries, etc.)</td>
<td colspan="2">Revenue Streams:
- Sale of product (retail, e-commerce, etc.)</td>
</tr>
</table>

3-Year Income Statement: Cup Daddy

Position #	Description	2023	2024	2025
10	sales	$ 37,500.00	$ 75,000.00	$ 150,000.00
10.1	**total revenue**	**$ 37,500.00**	**$ 75,000.00**	**$ 150,000.00**
20	Operating Expenses			
20.1	Components & Materials	$ 15,888.19	$ 15,888.19	$ 15,888.19
20.2	Equipment			
20.2.1	Injection Moulder	$ 3,000.00	$ -	$ -
20.2.2	Mill	$ 5,000.00	$ -	$ -
20.2.3	Metal chop saw	$ 500.00	$ -	$ -
20.2.4	Misc. tools	$ 1,000.00	$ -	$ -
20.3	Marketing	$ 3,750.00	$ 3,750.00	$ 7,500.00
20.4	Electricity	$ 3,600.00	$ 3,600.00	$ 3,600.00
20.5	Salaries	$ 80,000.00	$ 80,000.00	$ 80,000.00
20.7	Rent	$ 24,000.00	$ 24,000.00	$ 24,000.00
20.8	Depreciation Allowance	$ 475.00	$ 475.00	$ 475.00
20.9	**Total Operating Expense**	**$ 137,213.19**	**$ 127,713.19**	**$ 131,463.19**
30	**Operating income**	**$ (99,713.19)**	**$ (52,713.19)**	**$ 18,536.81**

Intellectual Properties

- Industrial Design

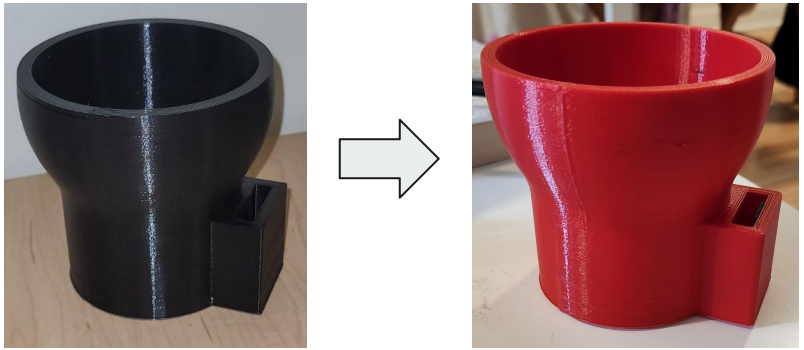
  - Protects our rights to the exterior design
  - Not recognized after 15 years
  - Must reapply

- Copyright

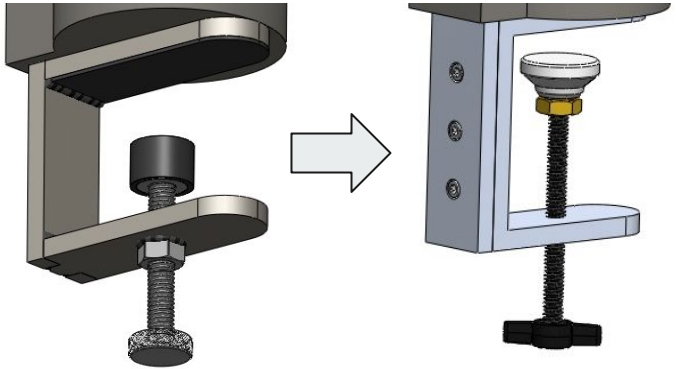
  - Protects the exclusive rights of creators of the original works
  - Encourages creativity and innovation
  - After the copyright protection period expires, the works may be freely used and distributed

Trials and Tribulations

- Prototype 1 tolerances were off, was made too small



- Eliminated welding from the manufacturing process

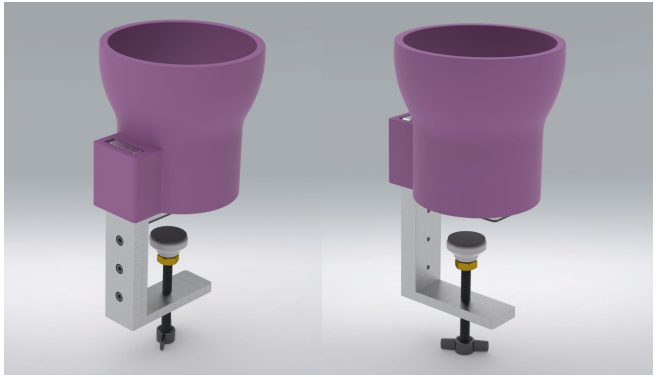


Lessons Learned

- Difficulties of cerebral palsy to simple, everyday life
- Methods of communicating with clients to get useful information
- Project management skills
- Benchmarking and target specifications
- Teamwork skills
- Design for manufacturing
- Product development skills

Future Work

- Adjust design for better slot fit
- Offer colour and size variety (for both clamp and cup holder)
- Design other clamp attachments (cutlery, electronics, smartphone, etc.)



Tasks Schedule

		May				June				July			
N°	Tasks	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
1	Team Creation & Contract												
2	Problem Definition & Concept Development & Project Plan												
3	Detailed Design & BOM												
4	Prototype 1 & Progress Presentation												
5	Design Constraints & Prototype 2												
6	Buisness Constraints												
7	Design Day												
8	Final Presentation												
9	Video & User Manual												

All tasks were completed during team meetings together each Saturday

represents our client meetings

Questions, Comments, or Feedback