Project Progress

Secure Cup Holder

Group Z13

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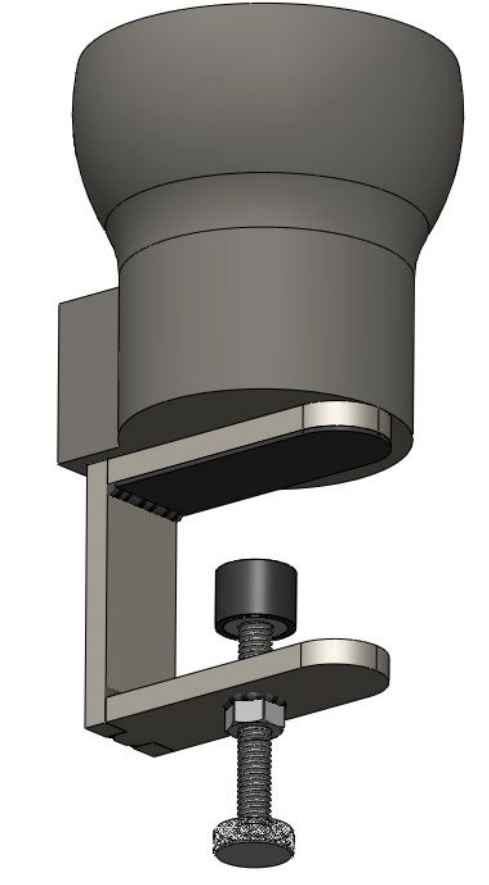

Presentation Content

- Client Needs
- Problem Statement
- Metrics
- Technical Benchmarking Results and Target Specifications
- Original Concepts and Chosen Concepts
- Detailed Design
- Bill of Materials and Parts List
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- Live Demonstration
- Client Meeting 3
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Client Needs (in order of importance)

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

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.

Metrics

Metric #	Metric	Unit
1	Dimension	cm
2	Material heat tolerance	Celsius
3	Force to install/use	N
5	Weight of product	g
6	Assembly/repair time	minutes
7	Cost	$
8	Development Period	Weeks

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]

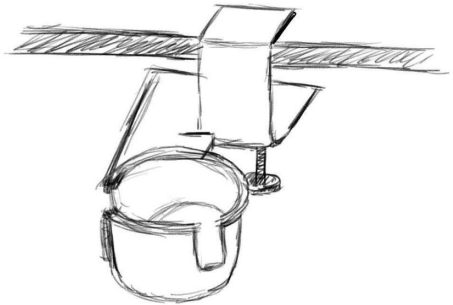
Target Specifications

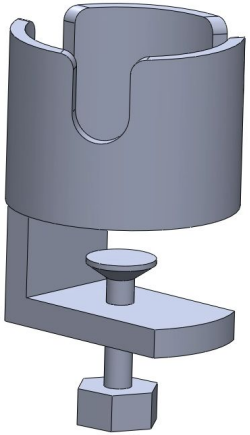
Metric #	Functional Requirements	Relation	Value	Unit	Verification Method
1	Minimum opening (clamp)	>	2.55	cm	Test
1	Cup holder height	><	5 - 10	cm	Test
1	Cup holder diameter	><	7.6 - 8 (approximate)	cm	Test
6	Time to assemble	<	15	seconds	Test
Metric #	**Constraints**	**Relation**	**Value**	**Unit**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

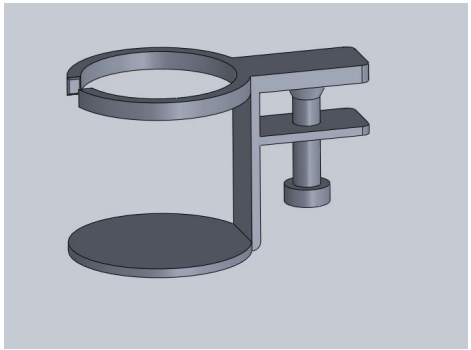
Target Specifications

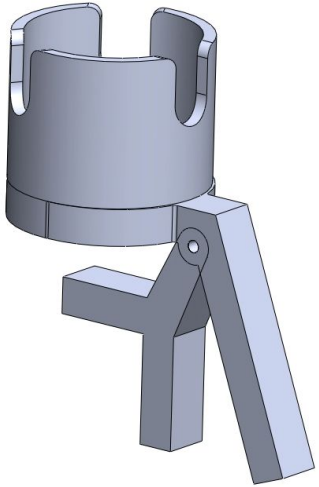
Metric #	Non-Functional Requirements	Relation	Value	Unit	Verification Method
5	Total weight	<	500	g	Test
2, 6	Reliability	>	2	Years	Test
2, 3	Material	=	Hydrophobic Sturdy	N/A	Analysis
3, 5	Ease of use	N/A	N/A	N/A	Test
1	Total height	<	15	cm	Test
1	Total diameter	<	12	cm	Test

Original Concepts and Feedback

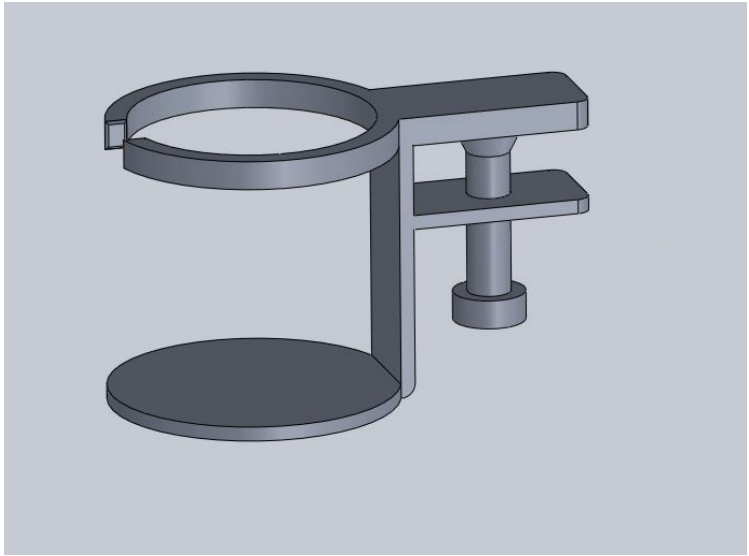


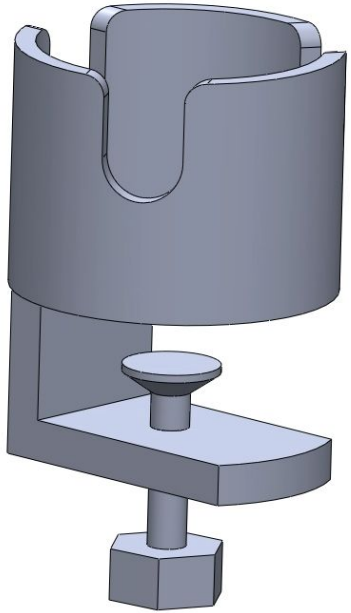




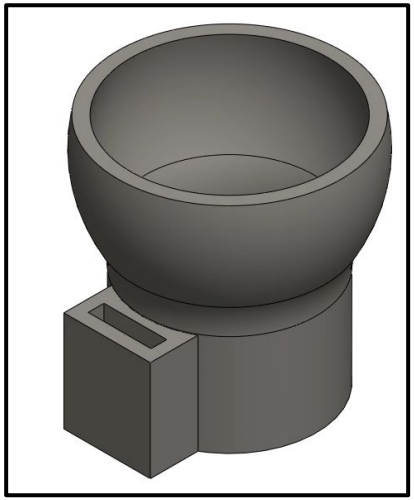


Chosen Concepts





Detailed Design



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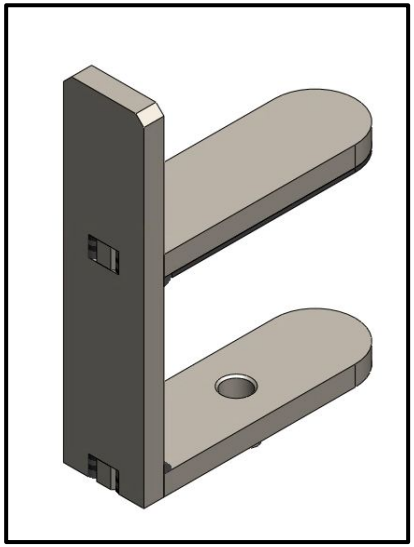

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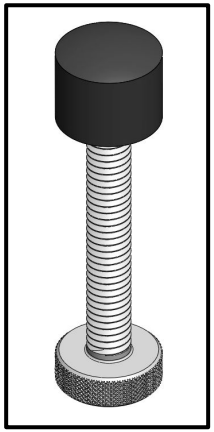

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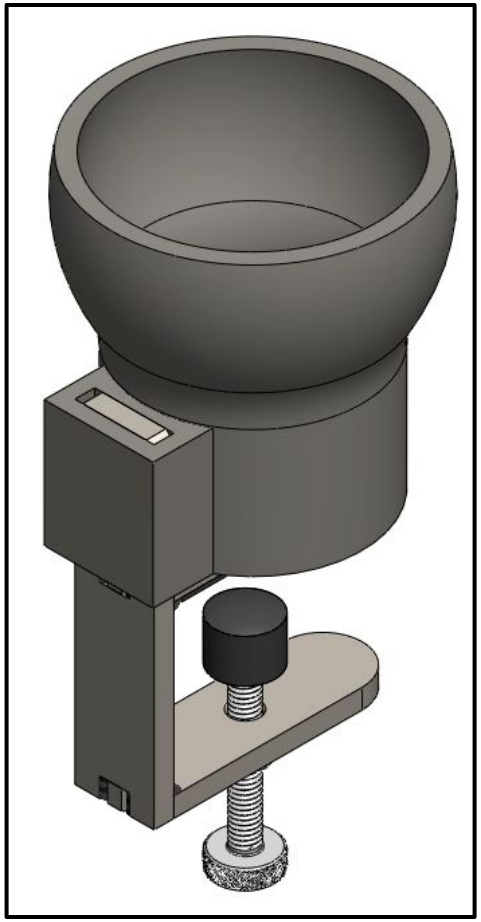

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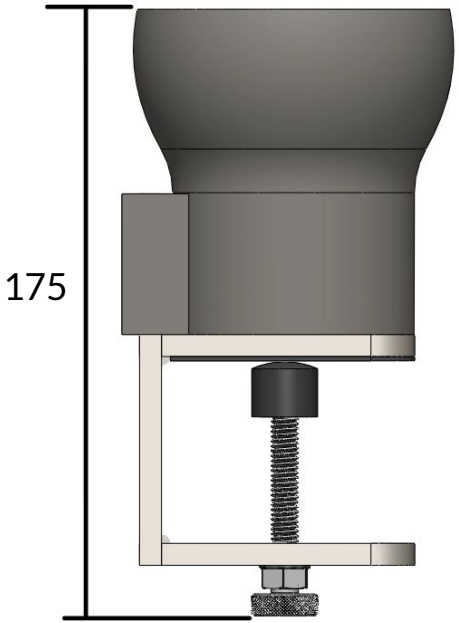
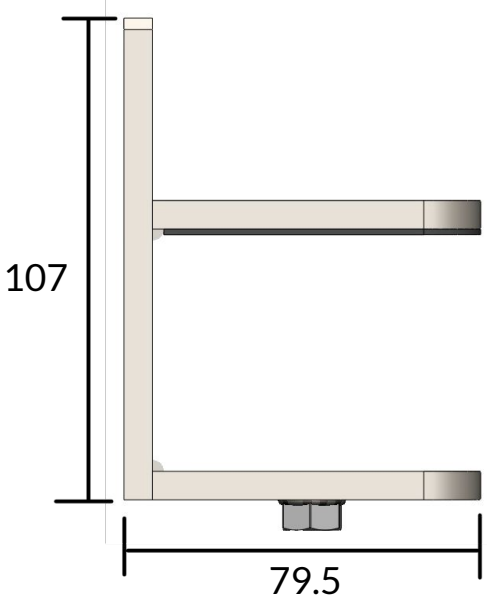
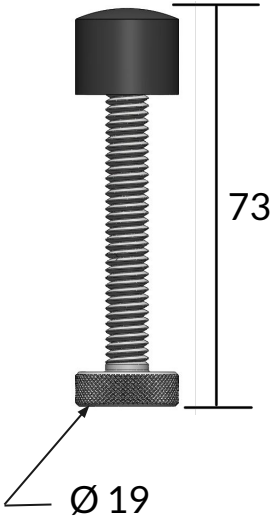
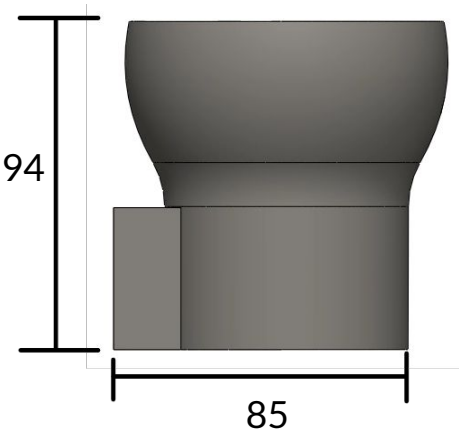
Detailed Design (Dimension Drawings)

Note: All dimensions in mm

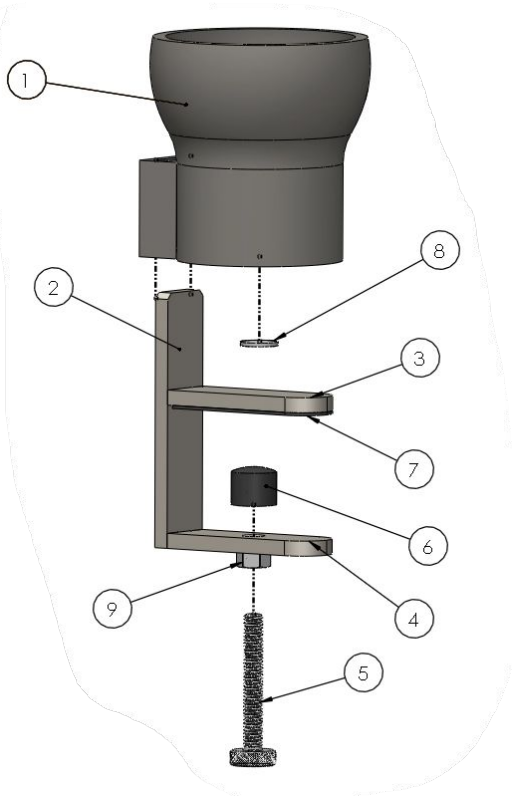








Parts List



Part #	Part Name	Description
1	Cup Holder	3D printed from PLA
2	Long Clamp Arm	Milled from steel flat bar purchased from Metal Pros Ottawa
3	Upper Clamp Arm	Milled from steel flat bar purchased from Metal Pros Ottawa
4	Lower Clamp Arm	Milled from steel flat bar purchased from Metal Pros Ottawa
5	Steel Knurled-Head Thumb Screw	Purchased through McMaster-Carr
6	Neoprene Bumper	Purchased through McMaster-Carr
7	Rubber Pad	Purchased through McMaster-Carr and cut to dimension
8	Neodymium Magnet	Purchased through McMaster-Carr
9	Steel Hex Nut	Purchased from Home Depot

Bill of Materials

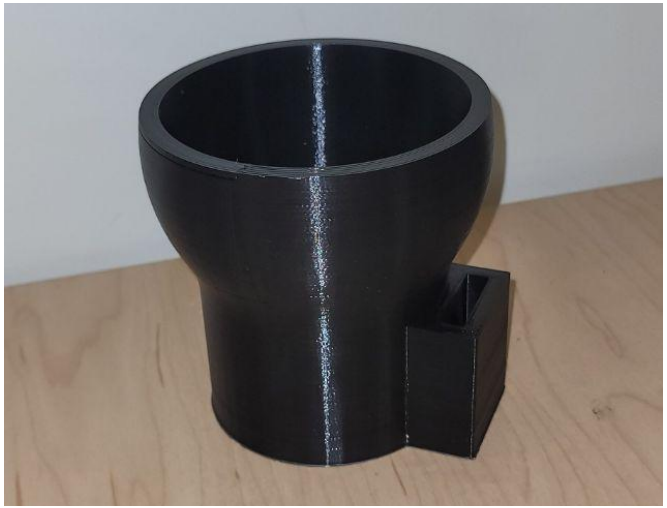
Item #	Part Name	Description	Quantity	Unit Cost	Extended Cost
1	Hot Rolled 44W Steel Flat Bar	¼" x 1" x 12" metal bar used to make the main body	1	$6	$6
2	3D Printed Cup Holder (PLA)	The plastic filament used by the school	140.5 g	$0	$0
3	Steel Knurled-Head Thumb Screw	Threaded thumb screw used for the clamp system	1	$5.69	$5.69
4	Rubber Bumper	These can be mounted on a threaded stud, in our case it will be mounted on *Item 3*.	1	$5.38	5.38$
5	Disc Magnet	Will be placed on the bottom of cup holder to help secure 3D printed part to the steel	1	$1.62	$1.62
6	Multipurpose paint	Spray paint used to coat our 3d printed part (**Optional**)	1	$12.81	$12.81
7	Rubber Sheet	A rubber grip is attached to the metal piece of the clamp system that will be attached to the tray to add friction.	1	$8.53	$8.53
8	Hex nut	Used for the clamping system, our threaded thumb screw will pass through it (*Item 3*)	1	$0.20	$0.20
				Total:	$40.23

Prototype 1

Focused physical prototype of the cup holder subsystem

Purpose:

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



Prototype 1 - Testing Results

Type of test	Description	Target Specification	Result
1. Weight Test	Measuring the Weight	< 150 g	107 g
2. Print Time	Time to Print	< 6 hrs	5 hours 26 minutes
3. Water resistance test	Handwashing with Lukewarm water	N/A	Cup holder is intact after being washed

1

Prototype 1 - Testing Results (Continued)

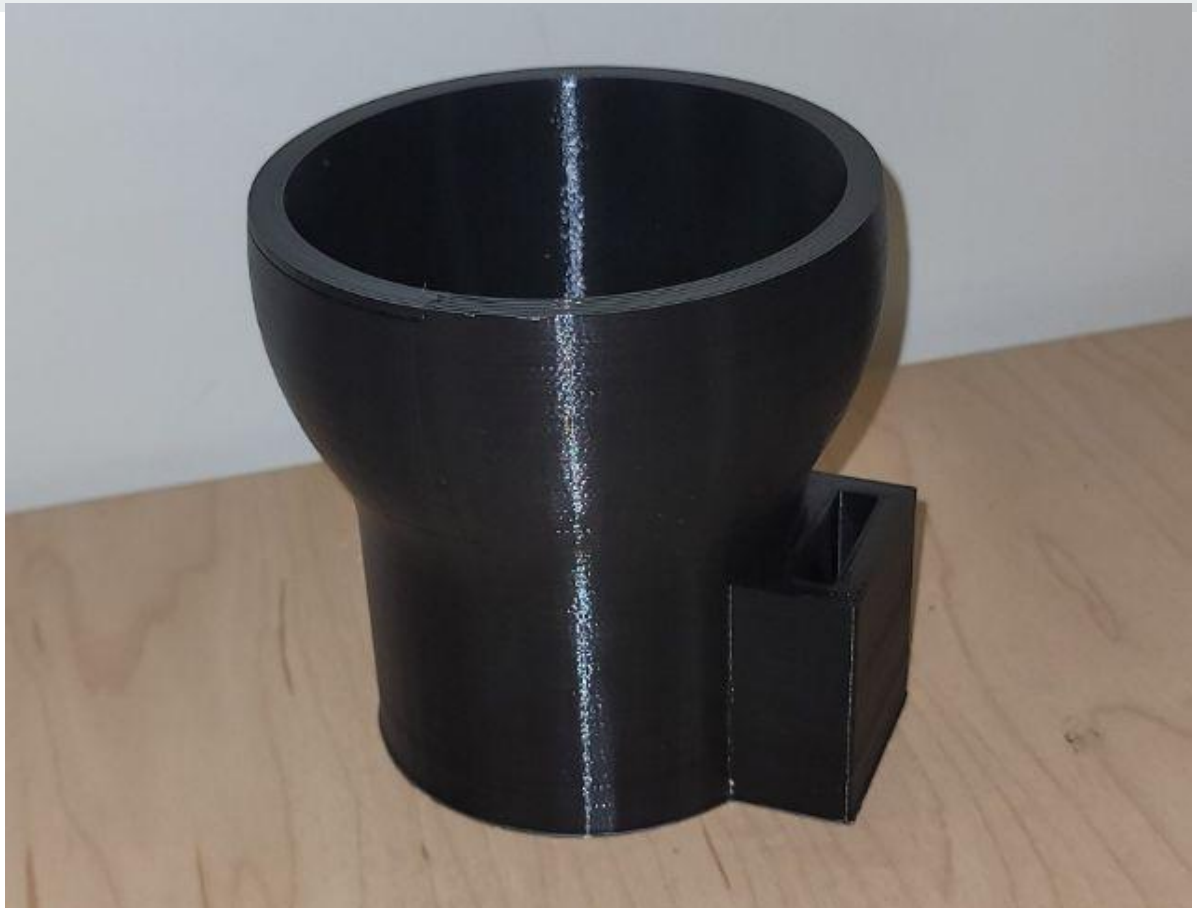
Type of test	Description	Target Specification	Result
4. Dimension Tolerance Test	Accuracy of 3D printer	+ 0.5 mm	- 0.4 mm for slot +/- 0.2 mm for diameter
5. Strength Test	longitudinal and diametral compression forces	5 lbs < (22.25 N)	Withstands 5 lbs of force

Successful Prototype

- Good print quality
- Adequate print time
- Lightweight construction
- Strong part
- Tolerances slightly less desirable (might require post-print modifications)
- Adequate infill, but could be increased for extra strength

Prototype 1.

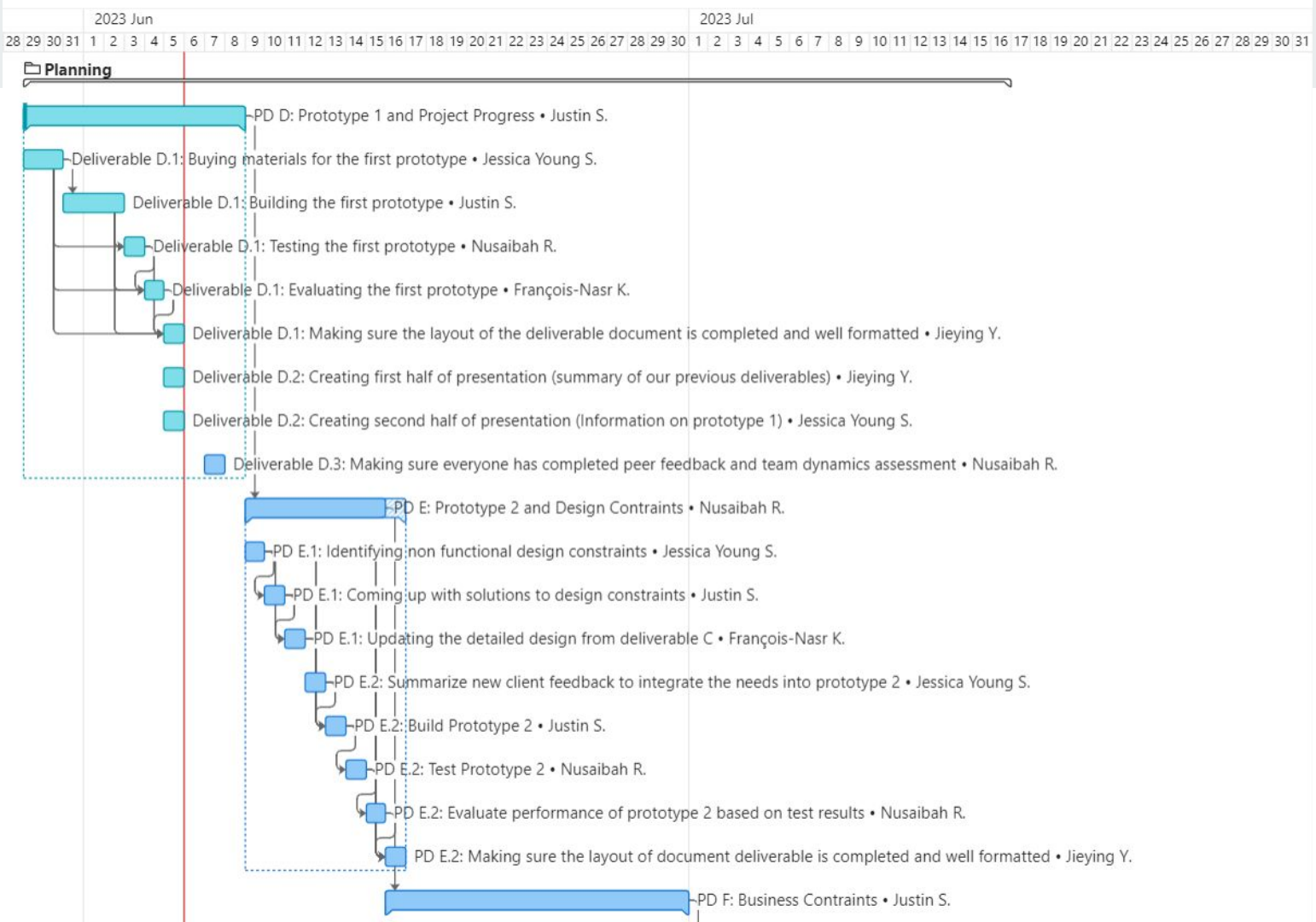
Live Demonstration



Client Meeting 3

- Presenting prototype 1
- Presenting CAD model of entire product
- Explain metrics to get feedback
- Client feedback and conversation

Tasks Schedule



Questions, Comments, or Feedback