

**GNG 2101**

**University of Ottawa: Faculty of Engineering**

**Project Deliverable B: Needs, Problem Statement, Metrics, Benchmarking and Target Specifications**

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**Group Z-22**

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## Introduction

This project aims to create a Power Grabber Handle that accommodates people living with physical disabilities who lack the finger dexterity, mobility and strength to operate a basic mechanical grabber handle. In the case of this group, the user suffers from arthrogyriposis. This refers to joint contractures, a condition where the range of motion of a joint is limited. In some cases, it may be unable to partially or even fully extend and contract. This condition makes it impossible to use a regular grabber handle, as the users' thumbs do not function the same as those of an able-bodied person. Also, the user lacks strength and mobility in their fingers. The Power Grabber will use a motor to minimize the effort the user must expend. The product primarily aims to help the user pick up objects from the floor. In this deliverable, the group will outline the client's statements as well as determine what metrics to prioritize. Furthermore, a final problem statement will be created, and benchmarking shall be conducted.

## List of Client Statements/Observations Obtained from Client Interview:

- Paul is our client, he is a part of Tetra Society, which works to address and overcome environmental problems faced by people with physical disabilities.
- The product is being developed for Paul's Grandson Liam. Liam is 12 years old, lives in Toronto, is active in sports and community activities and lives with arthrogyriposis.
- Arthrogyriposis refers to joint contractures, a condition where the range of motion of a joint is limited. In some cases, it may be unable to partially or even fully extend and contract.
- The user Liam is improving on his condition, but still struggles to pick up light, small objects off the ground. He uses a walker but is not dependent on it. Therefore, he can access the Power Grabber with one hand while holding the walker with the other, or even support himself.
- Due to his condition, his fingers are not strong enough to operate a regular grabber handle.
- The objects to be picked up range in size from a piece of Lego to a water bottle.
- The customer is willing to supply the team with financial support if the budget is not realistic. However, we will try our best to stay in the constraints.
- The use for the Power Grabber is mostly indoors, although weather proofing would be ideal.
- In terms of longevity, the Power Grabber should last at least a few days if used approximately ten times per day.
- It is important to keep in mind the force of the grabbing claw. For example, when picking up a gentle object, it must not overpower the object and cause damage.
- The Power Grabber must be as light as possible.
- The length for the Power Grabber must be approximately 16-20inches.
- The Power Grabber can be used with two hands and could include an ergonomic grip on the shaft to facilitate secondhand use.

## Prioritized Customer Needs:

After review, we have compiled this list of needs and ranked them according to their importance using a scoring system from 1 to 5.

- 1 - Satisfying the need is undesirable
- 2 - Satisfying the need is not important
- 3 –Satisfying the need would be nice, but is not necessary
- 4 –Satisfying the need is highly desirable
- 5 –Satisfying the need is critical

*Table 1: Needs for the Power Grabber*

	<b>Need #</b>	<b>Product Need</b>	<b>Score</b>
1	The Power Grabber	Has a magnetic tip	1
2	The Power Grabber	Includes a force sensor	4
3	The Power Grabber	Has a hook attachment	2
4	The Power Grabber	Operates in the rain and harsh weather conditions	2
5	The Power Grabber	Is automatic (motorized)	5
6	The Power Grabber	Is a manageable weight	5
7	The Power Grabber	It is ergonomic for people with arthrogryposis	5
8	The Power Grabber	Is appropriate length for varying users	4
9	The Power Grabber	Includes a grip/loop along its shaft for second hand	3
10	The Power Grabber	Can lift sizeable objects	5
11	The Power Grabber	Is safe for client use	5
12	The Power Grabber	Is aesthetically appealing	3
13	The Power Grabber	Is durable	4
14	The Power Grabber	Is battery efficient	4
15	The Power Grabber	Is portable	5

## Problem Statement:

The client requires a modified grabber handle to accommodate people with physical disabilities who have limited strength, finger dexterity and overall range of motion. It needs to be safe, lightweight, grab objects automatically, and ergonomic.

# Benchmarking

## Technical Benchmarking

Table 2: Benchmarking different Power Handle Grabbers

	Product 1	Product 2	Product 3
Product and Features	 <p>The Helping Hand Handi-Grip Pro Reacher (Brand: The Helping Hand)</p>	 <p>Grabber Reacher Tool, FitPlus Premium Grabber (Brand: FitPlus)</p>	 <p>Stainless Steel Reacher Grabber Made in South Korea</p> <p>Solid Construction and Durability Made from Premium Stainless steel &amp; Engineering plastic</p> <p>Heavy duty</p> <p>Ergonomic handle with Comfortable grip</p> <p>Store Easily when not in use</p> <p>Size: 28 in. 40 in. 48 in. 60 in.</p> <p>FTH All Stainless Steel Grabber Reacher (Brand: FTH)</p>
cost	\$32.99	\$35.22	\$59.99
length	26-32 inches	32 inches	40 inches
One-handed	Yes	Yes	Yes
Lightweight	Yes	Yes	Yes
Simple trigger (pistol grip)	No	Yes	Yes
link	<a href="https://shop.wellwise.ca/products/the-helping-hand-handi-grip-pro-reacher">https://shop.wellwise.ca/products/the-helping-hand-handi-grip-pro-reacher</a>	<a href="https://www.amazon.ca/Grabber-Tool-FitPlus-Premium-Reacher/dp/B07T3HTBD9?th=1">https://www.amazon.ca/Grabber-Tool-FitPlus-Premium-Reacher/dp/B07T3HTBD9?th=1</a>	<a href="https://www.amazon.ca/dp/B086VM41QN/ref=sspa_dk_detail_0?psc=1&amp;pd_rd_i=B086VM41QN&amp;pd_rd_w=bVA2z&amp;pf_rd_p=1986fb7c-bf95-4573-9455-3f596023ae02&amp;pd_rd_wg=M7FEG&amp;pf_rd_r=S55FF2JM56H6GET78KXX&amp;pd_rd_r=07db12db-24ad-45ba-b553-3b591bdf3936&amp;s=hi&amp;spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUExVUxjM2SvBJJmVuY3J5cHRlZElkPUEwMjUyODYyMzJUT0RVQVRMNDIViZlbnNveXB0ZWZlZkRPUwMzZmMjg3MkRER0NVNIA4SkNVQyZ3aWRnZXROYWllPjYyZmY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0Ns aWNRPXRydWU=">https://www.amazon.ca/dp/B086VM41QN/ref=sspa_dk_detail_0?psc=1&amp;pd_rd_i=B086VM41QN&amp;pd_rd_w=bVA2z&amp;pf_rd_p=1986fb7c-bf95-4573-9455-3f596023ae02&amp;pd_rd_wg=M7FEG&amp;pf_rd_r=S55FF2JM56H6GET78KXX&amp;pd_rd_r=07db12db-24ad-45ba-b553-3b591bdf3936&amp;s=hi&amp;spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUExVUxjM2SvBJJmVuY3J5cHRlZElkPUEwMjUyODYyMzJUT0RVQVRMNDIViZlbnNveXB0ZWZlZkRPUwMzZmMjg3MkRER0NVNIA4SkNVQyZ3aWRnZXROYWllPjYyZmY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0Ns aWNRPXRydWU=</a>

### User benchmarking:

Product 1: Even though it claims to have a non-slip grip, which would be useful, a customer reported that it cannot easily pick up items, and those that can be picked up only for a short time. Has a wider jaw to pick up bottle like object.

Product 2: The main complaint about the product is that it had to be assembled and the connection was insufficiently strong. The customer also expressed disappointment with the amount of strength required to grasp an item. can also rotate to a 180-degree angle which is shown to be useful

Product 3: Many of the reviews complained about how cheap and thin the material is. It is preferable to use it outside rather than inside. Because of the shape, it is impossible to pick up objects such as bottles or anything cylindrical.

### Metrics

This list of metrics was compiled using a scale of 1-5 for importance.

- 1 - Satisfying the need is undesirable
- 2 - Satisfying the need is not important
- 3 –Satisfying the need would be nice, but is not necessary
- 4 –Satisfying the need is highly desirable
- 5 –Satisfying the need is critical

*Table 3: Metrics of the Power Grabber and their Importance*

<b>Metric #</b>	<b>Need #</b>	<b>Metric</b>	<b>Importance</b>	<b>Unit</b>
1	6	Weight of the Grabber	4	Pounds
2	8	Length of the Grabber	4	Inches
3	2	Force applied to object	5	Pounds
4	10	Object weight	4	Pounds
5	14	Battery Life	2	Hours
6	5	Motor speed	4	RPM

## Target Specifications

This list of metrics was compiled using a scale of 1-5 for importance.

- 1 - Satisfying the need is undesirable
- 2 - Satisfying the need is not important
- 3 –Satisfying the need would be nice, but is not necessary
- 4 –Satisfying the need is highly desirable
- 5 –Satisfying the need is critical

*Table 4: Target Specifications*

<b>Metric #</b>	<b>Need #</b>	<b>Metric</b>	<b>Unit</b>	<b>Marginal</b>	<b>Target</b>
1	6	Weight of the Grabber	Pounds	1.7	1
2	8	Length of the Grabber	Inches	16	20
3	2	Force applied to object	Pounds	1	3
4	10	Object Weight	Pounds	1	3
5	14	Battery Life	Hours	5	8
6	5	Motor Speed	RPM	N/a	N/a

## Conclusion

To conclude, proceeding the team's meeting with the client, a list of needs was developed based on the requirements that the client provided. Once the table of needs was created, they were ranked on a scale of 1 to 5 based on the importance of the need based on the information the client provided to establish a problem statement. The team proceeded to make a table of metrics to compare and benchmark various other products on the market to create a table of target specifications. With the information obtained by the client and tables formulated in this deliverable, the team can proceed to begin the conceptual design phase and begin generating solutions.