GNG2101- Intro. to Product Dev. and Mgmt. for Engineers Faculty of Engineering – University of Ottawa

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

Submitted by

A1-Seat Belt Guide

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1 Introduction

According to the World Health Organization, about one billion, or 15% of the world's population experience some form of disability. In an age where vehicle transport is so prevalent, mobility becomes a daily struggle. The seat belt guide is a tool that can be used to aid with arm and core strength related mobility issues. The seat belt guide is a universal tool, allowing children and adults to wear their seatbelts safely and easily. Our client is Clinton, a father of a 6-year-old girl suffering from a condition called arthrogryposis. This limits her strength and flexibility which makes small tasks like putting on a seat belt a challenge. Clinton would like a device that is able to help apply the seat belt, would like functionality over the cosmetics, and for it to grow with her. Clinton also wants the device to be safe in a crash and to be easy to install. This deliverable covers the client needs, our observations, problem statements, benchmarking, and metrics.

2 Client Statements/Observations

Table 1 Clients' Needs

The client needs a device to assist them in buckling up their seat belt
The device shouldn't hinder the sliding of the male part, as the previous groups did
The safety of the user should be most important. Any modifications should not endanger her
The product should last for at least five years. It should adapt with her growth and still function when she outgrows her booster seat
The client's favourite colours are pink and purple
The device should be small, so it is out of the way in case of accidents
The client uses two hands to pull the male part of the buckle but would need a third hand to hold the female part steady

The device should fit mostly on the client's 2016 Honda Odyssey, but should be adaptable to most cars
The device shall not obstruct the safety or functionality of the airbags. The Honda Odyssey consists of curtain airbags on the rear sliding doors, B and C pillars.
The device is preferred to be ambidextrous, but the user sits in the rear left passenger seat.

3 Customer needs

Prioritized customer needs

Table 2 Prioritized Customer Needs

#		Need	Importance (5 = most important)
1	The device	Fits around different car seats, including child seats.	5
2	The device	Does not hinder the functionality of the seat belt.	4
3	The device	Is easy to install.	3
4	The device	Is lightweight.	3
5	The device	Is affordable.	3
6	The device	Is durable.	4
7	The device	Is safe in a crash.	5
8	The device	Is intuitive to use.	4
9	The device	Aids mobility.	5
10	The device	Is pink or purple.	1
11	The device	Will work as the client grows.	4

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12	The device	Reduces the amount of strength required to buckle and unbuckle	5
	This device	Is ambidextrous and can work on driver, passenger, center, rear left/right passenger seats.	5

4 Problem Statement

The client needs a way to reach the male part of the seat belt and guide it into the female part of the seat belt while allowing for the user's limited mobility and not hindering the safety of the seat belt.

5 Metrics

Table 3 Metrics Table

Client Need Number	Description	Unit
4	Weight	g
5	Cost	CAD ($)
9, 12	Force required to pull the seatbelt	N
9, 12	Force required to unbuckle	N
9	The distance the client's arms must travel	m
3	Installation time	min
1, 11	Versatility	% (Percent of configurations the device works on)
6,7	Max impact the device can substant.	N

2,8	Amount of time for an unfamiliar user to buckle their seat belt	s

6 Benchmark

Product A- Seat Belt Grabber Handle

- The seat belt grabber handle attaches to the webbing on the seat belt and gives you extra inches and an easy handle to reach your seat belt.
- https://www.amazon.ca/Seat-Belt-Grabber-Handle-buckle/dp/B003AU1BP0/ref=sr_1_4?crid=1HL9MBT1E01JH&keywords=seat+belt+grabber&qid=1663788283&sprefix=seat+belt+grabber%2Caps%2C102&sr=8-4

Product B – Seat Belt Buckle Booster

- The Buckle Booster raises back seat receptacles to make it easy to buckle yourself or your child in.

- https://www.amazon.ca/2-Pack-Seat-Belt-Buckle-Booster/dp/B07PQMM114/ref=sr_1_2_sspa?crid=3USZ3LE9HUCO8&keywords=seat%2Bbelt%2Bextenders%2Bpro&qid=1663788206&sprefix=seat%2Bbelt%2Bextenders%2Bpro%2Caps%2C88&sr=8-2-spons&smid=A34LWHIP1XDWV&th=1

Product C – Seat Belt Buddies

- This product has a buckle booster for easier buckle access along with an attachment to the male part to more easily get the belt.

- https://makerepo.com/Quach/1211.gng2101z24belt-buddiesseat-belt-guide

Product D – Seat Belt Tensioner

- The seat belt tensioner gives an extra couple of inches to your belt buckles, allowing easier access when buckling in.
- https://www.walmart.ca/en/ip/Seat-Belt-Tensioner-Car-Seat-Belt-Tensioners-Seat-Belt-BuckleSeat-Belt-Tensioner-Car-Seat-Belt-Tensioners-Seat-Belt-Buckle/PRD1EOXJ3ZPTYDR

Table 4 Benchmarking

Selection Criteria	A: Grabber Handle	B: Buckle Booster	C: Buddies	D: Tensioner
Purchase Price (CAD)	$14.99	$17.99	$60	$57.90
Ease of Use (1 = easy, 5 = hard)	1	1	2	2
Able to use on different vehicles	yes	yes	yes	yes
Manual or Electric	manual	manual	manual	manual

Ease of installation (1 = easy, 5 = hard)	1	1	2	1
Size	small	small	small	s
Durable	yes	yes	somewhat	yes
Aids with mobility issues (1 = helps a lot, 5 = no use)	3	3	2	4
Compatibility with a booster seat (1 = designed for booster seat, 5 = not compatible)	2	1	3	3
Reduces the amount of force needed to unbuckle (1 = Requires almost no force, 5 = Does not reduce the amount of force)	5	5	4	5
Reduces the amount of force	5	5	4	5

needed to pull (1 = Requires almost no force, 5 = Does not reduce the amount of force)				
Reduction in the amount of distance the client's arm must travel	~10%	~5%	~15%	~5%
Weight	82 g	100 g	~100 g	~200 g

According to the metrics chosen, Seat Belt Buddies' product is the best solution so far. It has the greatest reduction in the amount of space the user's arms must travel and it reduces the amount of force required to unbuckle. It also essentially combines two of the other products on the list (the Grabber and the Booster), adopting the best parts of each design.

7 Target Specifications

Table 5 Target specifications

Selection Criteria	Marginal Value	Ideal Value
Purchase Price (CAD)	$15-$60	$40
Ease of Use (1 = easy, 5 = hard)	2-4	2
Able to use on different vehicles	Yes	Yes
Ease of installation (1 = easy, 5 = hard)	1-3	1

Size	Small	Small
Durable	Yes	Yes
Aids with mobility issues (1 = helps a lot, 5 = no use)	2-4	2
Compatibility with a booster seat (1 = designed for booster seat, 5 = not compatible)	1-3	1
Reduces the amount of force needed to unbuckle (1 = Requires almost no force, 5 = Does not reduce the amount of force)	3-5	4
Reduces the amount of force needed to pull (1 = Requires almost no force, 5 = Does not reduce the amount of force)	3-4	3
Reduction in the amount of distance the client's arm must travel	5%-25%	20%
Weight	80-200 g	100 g

The marginal values were chosen based on the outlier values of the other benchmarked products. Generally, the lowest and highest benchmarked values were used for the marginal values. If there was not a significant difference between the best and worst values, then the marginal value was extended to provide a higher expectation for this product. The ideal value was usually chosen as the mean of the marginal values, or to be slightly higher than the median of the benchmarked values, whichever one was more favourable to the client.

8 Reflection

Because our client meeting was so close to the deadline, we started making an outline of our deliverable early. This meant that most of our customer needs, benchmarking and target specifications were generated from the prompt and the previous attempt. The client meeting allowed us to home in on what the client wants from the product, receiving first-hand information about things we hadn't thought about, such as; the daughter's limited strength, or the way it would fit around the booster seat. We used the information from the client meeting to fine tune the customer needs and metrics and finish up the target specifications. The meeting was essential to connecting with the client and getting direction for our system. As we go through the design process, we will continue to seek out the information we don't know, allowing us to develop a fully fleshed out device.

9 Bibliography

Lisa I Iezzoni, E. P. (2001, April). Mobility Difficulties Are Not Only a Problem of Old Age. *J Gen Intern Med, 16*(4). doi:10.1046/j.1525-1497.2001.016004235.x