University of Ottawa

Faculty of Engineering

GNG2101 Introduction to product Development and management for Engineers

Project Deliverable B

Submitted by

Talk Box. C01, Team C13

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Abstract

The team met with the client and organized the client statements as needs. Metrics were created to be used as a measure of the quality of the teams' prototype. Multiple produces that provide the same capabilities to the user were compared. Finally, based on the values obtained in the benchmarking and the teams judgment target values were obtained.

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1 Introduction

The team has met with the client (Roy) who provided information about the users of Talk box. Our team optimized this opportunity to record the client's statements and behavior which was used throughout the report to scope the problem that we are solving. Group C13 has set a goal to design and produce an innovative idea that can be realised which assists people with disabilities on a wide range of spectrum of disorders. With that said, it is nearly impossible to generalize a solution for almost everyone with disabilities, due to the diversity of cognitive and motor skill restrictions, however our objective is to realise a design where it can be transfigured and is upgradable for the future via iterative usage and testing. The idea is to create a core model which is compatible with the majority of services and devices offered to people with disabilities.

2 Client Meeting

The Client Roy has expertise in the area of accessibility to help people with disabilities to speak clearly enough and dexterity. He represents the users of "Talk box" and aims that such device would aid them to complete simple and customizable daily tasks independently. There is on client in particularly that he emphasized such a device can help him with everyday tasks. The client mentioned a system in BC that provides technology and solutions for independent living. "In BC independent communities of disabled folks help the disabled with smart devices. In ON, we need the same efforts" – Roy.

2.1 Client Statements/ Observations

The following statements were gathered by our team members using our first client meeting with Roy. Roy described the following:

Within the disabled community, there are very few generalisations that we can make. A subgroup, cerebral palsy: problems with speech, problems with motor control, they are intelligible people but do not have the dexterity to use smart phones.

They can't afford a smartphone that is compatible enough to use Alexa. Many can't use individual fingers, they use their whole hand to press a button, some might have spasms at the moment and get stuck on a button for a long time, some get quite nervous with time limits.

The disabled community need to be able to perform daily activities, for example getting up in the morning, turning on/off TV, turning on/off lights.

The specific user of the device can only grip on one-button device and move his wrist.

There is a value in using a voice. Saying what they want: "I'm cold, I want to go inside", "Thank you, I understand". When someone tries to talk to someone with a disability, they automatically assume that they are speech-impaired but clients get quite bored when they actually understand.

The user has never used home automation systems before

Some of the disabled community have few devises, and some have a lot of devices attached to their wheelchair. The talk box should be a simple small device that is attached to the handle of the chair, it could also have a chord connected to the brain of the device that can be tucked away. The device should have a separate user interface form button mechanism.

I would like the device to work for the one user I have described but also modular to be used with other clients. Look for a solution for a whole community not a specific person. Think of a product that can by modified and extended for specific users.

The client aims to expand the world of home automation to the disabled community.

Make the device customization options should be simple to use, as the caregivers are not technically sophisticated, the customization options should be easy and intuitive to figure out.

The device should be attached to the wheelchair and it must operate form either side of their chair. Ideally you should be able to put the device somewhere and give the user the button or keypad. The buttons must be large, separated from each other, and can be pressed with lowest force required.

The buttons that are designed for the people with accessibility issues are generally too expensive and coast is an important factor. As grants and funding agencies are difficult to convince. The device must be affordable.

To create a comfortable device for the user the buttons should be large and properly separated from each other and can be activated with low force.

The disabled community can focus their eyesight; however, their head and neck movements cannot be trusted, therefore, a lot of eye gaze technologies need to be in frame and that's one restriction.

2.2 Customer Needs

Table 1: Numerical Ranking

Satisfaction Value	*Satisfaction value translation*
5	*Satisfying the need is critical*
4	*Satisfying the need in highly desirable*
3	*Satisfying the need would be nice, but not necessary*
2	*Satisfying the need is not important*

1	*Satisfying the need is undesirable*

Table 2: Customer Needs

#	Need	Importance
1	Commands are controlled by a smart button	*5*
2	Includes a simple dialogue commandes	*3*
3	Can produce sounds of multiple simple phrases	*3*
4	Can access home devices e.g. TV, thermostat	*4*
5	Can connect to WIFI	*3*
6	Features can be customized by a separate user interface	*4*
7	Includes Images/figures representing words/requests	*3*

8	Automate simple daily tasks	*3*
9	Buttons require very low effort to use	*4*
10	Buttons are large and separated	*5*
11	Is resilient against physical damage from indoor and outdoor factors	*2*
12	Supports different languages	*1*
13	Has an emergency contact feature	*2*
14	Is modular and can be upgraded down the line	*5*
15	Is mountable on a wheelchair	*5*
16	Can be installed either side of a wheelchair	*4*

17	Surfaces are smooth and comfortable for the palm of the hand	*3*
18	Uses wheelchair power to operate	*4*
19	Is cost efficient/ inexpensive	*5*

The Importance given to each need is based on the client's emphases on certain functions of the device. As well as the team's judgement on creating a device that encompasses the project description and reduces the user's pain.

2.3 Problem Statement

We want to create a design that can assist people who have motor cognitive disorder or have difficulty speaking and communicating to be able to say what they want to say while maintaining ease of use and automatizing communication and requests.

2.4 Metrics

Table 3: Metrics

# Metric	# Need	Metric	IMP	Unit
1	1	Button response time	5	Processing time
2	2,8	Capability of simple dialogue commands	3	Processing time
3	3	Sound produced	3	dB
4	4,5	Connection to Home devices (TV, thermostat, Wi-Fi)	4	#
5	6	User friendliness	4	Usability
6	7	Quality of images displayed	3	PPI
7	9	Force required to push button	4	N
8	9	Travel Before Activation	4	cm
9	10	Size of button(s)	5	cm^2
10	10	Space between button(s)	5	cm
11	11	Operating temperature	2	Degrees C
12	12	Languages supported	1	#
13	13	Emergency procedure	2	Binary
14	14	Capability of upgrade	5	Binary
15	15,16	Ability to mount on either side of wheelchair	5	Wire length (cm)

16	17	Device comfort	3	Comfort scale
17	18	Electric Consumption	4	W
18	19	Maximum cost	5	Cad $
19	6,7	Screen Size	5	cm
20	15,16	Weight	3	gram
21	1,2,4	Data Storage	3	GB

The Usability unit used for metric 6 is based on customer reviews and customer comments.

The comfort scale unit used in metric 16 is based on an medical article that gives a medical comfort scales based on five attributes (The article is linked below).

2.5 Benchmarking

In this section, five products will be benchmarked according to our metrics. Two of these products are software solutions, and three are hardware solutions.

1) Hive Active Smart Plugs and Hub 360

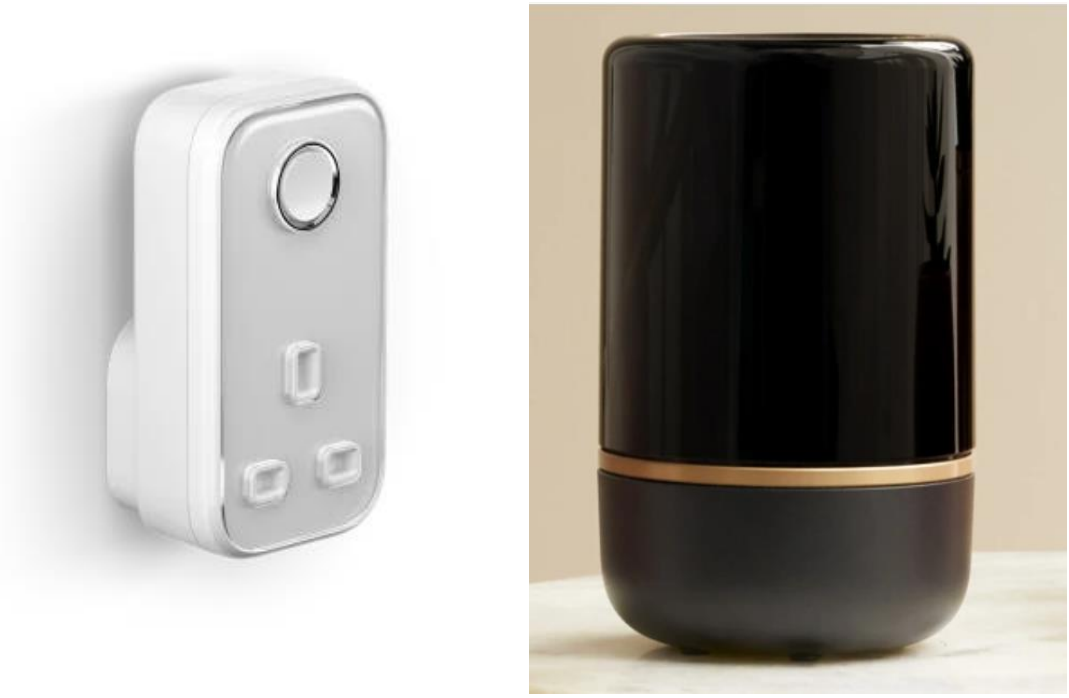

Figure 1: Hive Smart Plug (left) and the Hive 360 Hub (right)

The smart plugs can be paired with smart bulbs, smart heating systems, smart security systems, and smart leak monitoring systems. All devices mentioned above can be monitored and controlled through the Hive app.

The hub 360 is a device that connects all smart home hive products. It detects important sounds around the house like glass windows breaking, scenes smoke or carbon monoxide. In addition, when connected with other devices it can turn lights on/off, heat or cool the house.

2) The Tecla App and the Tecla-e

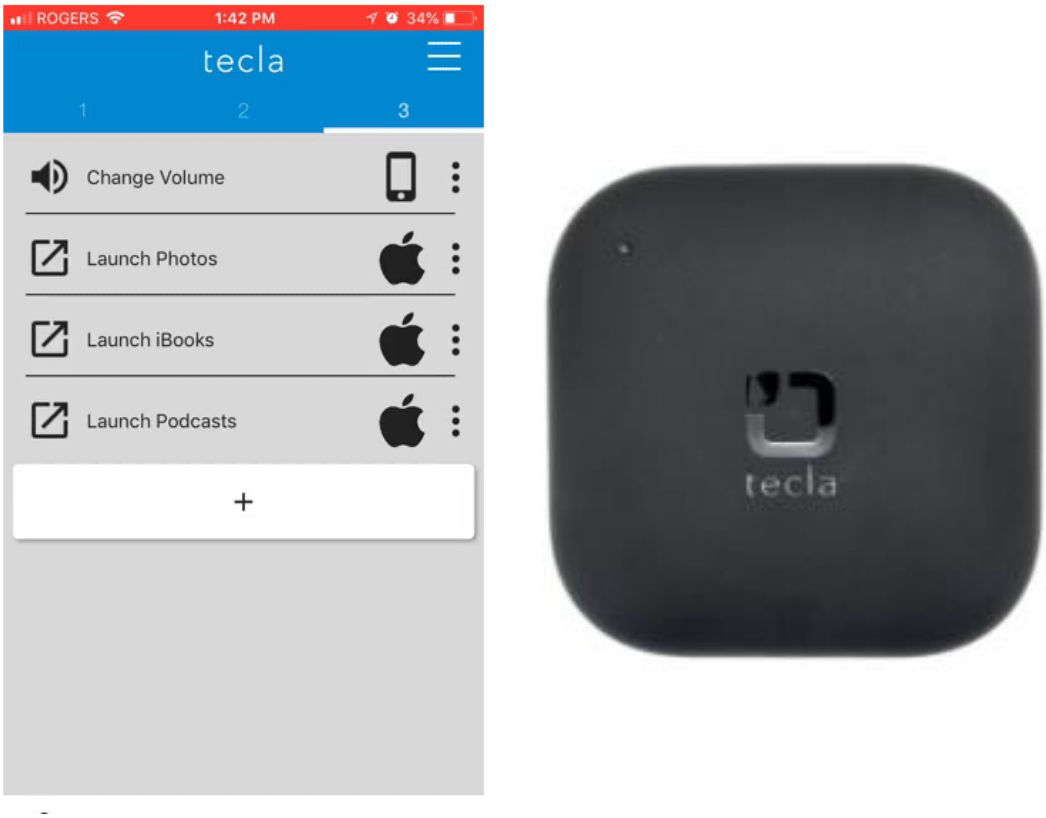

Figure 2: The Tecla App (left) and The Tecla-e (right)

The Tecla App is similar to the Hive app in a way that it can monitor and control all Tecla products. However, the Tecla app also uses the IFTT app to create easy button commands that requires a 3-step setup and can be easily used. In addition, the Tecla app can be used to perform separate commands without the need of any other Tecla products.

The Tecla-e is a smart button assistive device that gives people with upper body mobility impairments the ability to fully access smart devices and mainstream technology. It is compatible

with all apple products and other smart home devices such as the thermostat, lights, enter commands using Siri.

3) The Adaptive/Assistive 3.5 mm Button

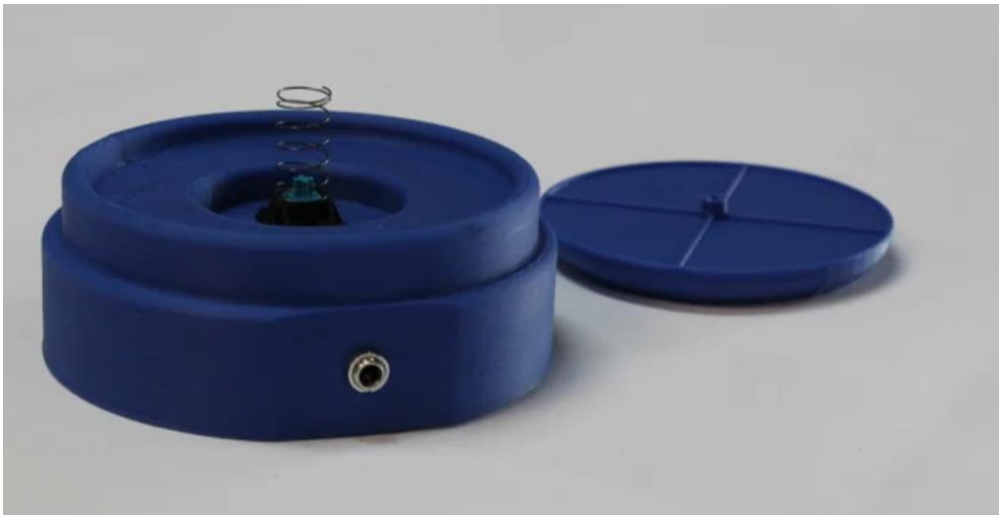

Figure 3: The adaptive Button

The Adaptive button is a smart 3d printed button controlled by an Arduino to assist people with physical disabilities. This button can be used to adapt with home applications. In addition, with the use of a compression spring the buttons actuation force can be adjusted.

1) The Ablenet Pillow Switch

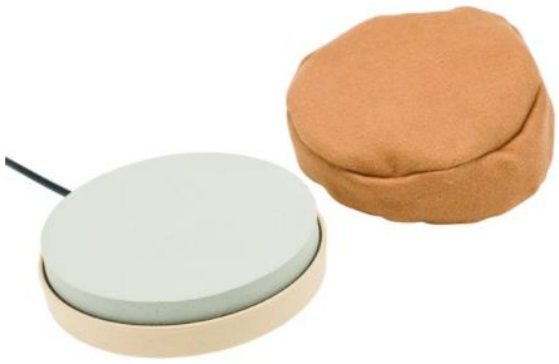

Figure 4: The Ablenet Pillow Switch

The Ablenet Pillow Switch is one of Tecla smart button that features a soft foam activation surface. It can be used to send commands to the Tecla app, and it is programmed through the Tecla app. It has a large activation surface (8cm activation surface) and requires 1.77N force to activate it.

4) The Ablenet Buddy Button

Figure 5: The Ablenet Buddy Button

The Ablenet Buddy Button is similar to the Ablenet pillow button, both are Tecla products and are set up the same way. However, is has a smaller activation area (6.4 cm) and a smaller activation force 0.98N.

Finally, during the first client meet the client referenced the products created by Technology for independent living. The switches and devices shown in their website are very similar to the ones discussed above. The organization provides custom products, hence, does not provide any product specs. The team will attempt to contact them through email to learn more about their products.

Table 4: Benchmarks on Metrics

# Metric	# Need	Metric	Imp.	Unit	Hive Active Smart Plugs /hub 360	The Tecla App/ Tecla-e	Adaptive/Assistive 3.5 mm Button	Ablenet Pillow Switch	Ablenet Buddy Button
1	1	Button response time	5	Processing time	N/A	Fast	-	Fast	Fast
2	2,8	Capability of simple dialogue commands	3	Processing time	-	-	N/A	N/A	N/A
3	3	Sound produced	3	dB	80-90	80-90	N/A	N/A	N/A
4	4,5	Connection to Home devices (TV, thermostat, Wi-Fi)	4	#	5+	11+	5+	11+	11+
5	6	User friendliness	4	Usability	5	4	2	4	4
6	7	Quality of images displayed	3	PPI	~400	~400	N/A	N/A	N/A
7	9	Force required to push button	4	N	N/A	8.83	custom	1.77	0.98
8	9	Travel Before Activation	4	cm	N/A	9.8x 9.8	-	0.2	0.12
9	10	Size of button(s)	5	cm	N/A	NA	6.35	8	6.4
10	10	Space between button(s)	5	cm	N/A	NA	custom	custom	custom
11	11	Operating temperature	2	Degrees C	15-30	15-30	-	-	-
12	12	Languages supported	1	#	3	1	1	1	1
13	13	Emergency procedure	2	Binary	N	Y	N	N	N

14	14	Capability of upgrade	5	Binary	Y	Y	Y	Y	Y
15	15,16	Ability to mount on either side of wheelchair	5	Wire length (cm)	N/A	N/A	15.2	15.2	-
16	17	Device comfort	3	Comfort scale	5	4	1	4	2
17	18	Electric Consumption	4	W	240	custom	~1	~1	~1
18	19	Maximum cost	5	Cad $	100-400	640	50	135	70
19	6,7	Screen Size	5	cm	custom	custom	NA	NA	NA
20	15,16	Weight	3	gram	320	N/A	custom	90.72	68.04
21	1,2,4	Data Storage	3	GB	N/A	0.027	N/A	N/A	N/A

**Note: N/A indicated not applicable or uncertain as of currently.*
***Custom refers to the unknown variable of the product which varies from user to user*

Multiple Ablenet buddy buttons can be used to control sophisticated devices. One of the Ablenet Buddy Button users programmed multiple buddy buttons to customize his control of a DJI drone, a link to video “Sky’s the Limit” is listed in the biography sections.

Usability is in a scale used in this table is based on customer reviews and stories and the team’s assessment of the product capabilities.

The hive and the Tecla screen size are based on the user’s phone size.

Table 5: Usability Scale legend

1	Poor performance and low compatibility
2	Accepted performance and low compatibility

3	Good performance and accepted compatibility
4	Good performance and good compatibility
5	Great performance and great compatibility

User friendliness is based on reviews and app ratings also based on medical definition of user friendless.

2.6 Target Specifications

Table 6: Marginal and Ideal Values

#	Metric	Unit	Marginal Value	Ideal Value
1	Button response time	Processing time	Fast	Fast
2	Capability of simple dialogue commands	Processing time	N/A	N/A
3	Sound produced	dB	>60	>75
4	Connection to Home devices (TV, thermostat, Wi-Fi)	#	>1	>2
5	User friendliness	Usability	3	4
6	Quality of images displayed	PPI	~116	~150
7	Force required to push button	N	>4	~4
8	Travel Before Activation	cm	N/A	N/A
9	Size of button(s)	cm^2	~6.5	~9
10	Space between button(s)	cm	N/A	N/A

11	Operating temperature	Degrees C	15-30	15-30
12	Languages supported	#	1	>1
13	Emergency procedure	Binary	Yes	Yes
14	Capability of upgrade	Binary	Yes	Yes
15	Ability to mount on either side of wheelchair	Wire length (cm)	N/A	N/A
16	Device comfort	Comfort scale	N/A	N/A
17	Electric Consumption	W	2-5	2-5
18	Maximum cost	Cad $	>=100	100>
19	Screen Size	cm	~20-25	~38
20	Weight	gram	<~1000	<~800
21	Data Storage	GB	8	Cloud

Table 7: Final Specifications

#	Metric	Unit	Value
1	Button response time	Processing time	Fast

2	Capability of simple dialogue commands	Processing time	N/A
3	Sound produced	dB	>60
4	Connection to Home devices (TV, thermostat, Wi-Fi)	#	>1
5	User friendliness	Usability	3
6	Quality of images displayed	PPI	~146
7	Force required to push button	N	>4
8	Travel Before Activation	cm	N/A
9	Size of button(s)	cm^2	~6.5
10	Space between button(s)	cm	N/A
11	Operating temperature	Degrees C	15-30
12	Languages supported	#	1-2
13	Emergency procedure	Binary	Yes
14	Capability of upgrade	Binary	Yes
15	Ability to mount on either side of wheelchair	Wire length (cm)	N/A
16	Device comfort	Comfort scale	N/A
17	Electric Consumption	W	2-5
18	Maximum cost	Cad $	>=100
19	Screen Size	cm	~38
20	Weight	gram	<~1000

21	Data Storage	GB	16

**Note: N/A indicated not applicable or uncertain as of currently.*

3 Conclusion and Client meeting reflection

The client meeting allowed us to understand how the disabled community is currently unable to communicate due to their different conditions. Despite the innumerable disabilities, we were able to determine key elements in the discussion that were essential to include in our device. These points have the capability of allowing a great number of the community to benefit from them, while still allowing the option of refinement for specific disabilities. This assignment has allowed us to understand the process of meeting a client, clearly defining the problem, extracting their needs, and turning them into valid measurements that can be included into our device. We were also able to see how our metrics compared against actual competitors whose devices are already in the market. This report has helped us prepare for the next process in the design iteration method.

4 Bibliography

How to measure usability metrics
https://usabilitygeek.com/usability-metrics-a-guide-to-quantify-system-usability/

How do you address the subjectivity of medical device comfort?

https://starfishmedical.com/blog/medical-device-comfort/

https://www.medtechintelligence.com/feature_article/what-patients-expect-out-of-their-wearable-medical-devices/

List of buttons
https://solano.networkofcare.org/veterans/assistive/list.aspx?indexingterms=buttonswitch

Similar to our capabilities project

https://www.thingiverse.com/thing:1471760