GNG2101 Report

Waterproof Hearing Aid
Project Deliverable B

Submitted by

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INTRODUCTION

On the 26th of September 2020, we met with the client, Abigail Adair, to discuss the design of the water resistant hearing aid. We engaged Abigail with important questions, and appropriate notes were written down to understand the need to be implemented to generate a proper design.

Our two primary goals are:

- To understand the specific needs of the customer.
- To use the needs to derive problem statement

MAIN BODY

Needs Identification

Following the meeting with our client, we ascertained how our customer wants the product to work. The needs of the customers are non-technical, and they mirror the customers' understanding of the product.

	Customer Statement	Interpreted Needs	Importance (1-5)
1	Volume and clarity is important	Earpiece produces a clear audible sound.	5
2	The hearing aid is to be worn between 8 to 13 hours a day	The battery holds a significant charge	4
3	The size of the hearing aid causes discomfort when worn a long time	Earpieces are small enough to be both comfortable and secure for long periods of time.	4
4	The client likes to be notified when the battery is running low	Battery level indicator.	2
5	The client wants to be able to access the hearing aid via her phone.	Bluetooth connectivity.	2
6	The client does not like wasting the battery life when not in use.	Hearing aid can easily be powered on or off.	3

Problem Statement

Abigail is a Carleton University student who suddenly lost the ability to hear through her right ear about one year ago. She has been using a hearing aid since then, however it is lacking in a few areas. As a recreational swimmer her primary concern is that the hearing aid be fully waterproof in order for it to be usable while swimming.

Translating Needs into Design Criteria

Following the client meeting, we generated a brief but detailed list of needs based on the information gathered. The needs have been interpreted and outlined as a design criteria. This design criteria contains the functional and non-functional requirements, and constraints.

1. Constraints:
    - Cost
2. Functional Requirement:
    - Water Proof
    - Battery Level Indicator
    - Bluetooth
    - Clear Audio
    - Rechargeable
3. Non Functional Requirement:
    - Aesthetics
    - Product Life
    - Safety

	Need	Design Criteria
	Earpiece produces a clear audible sound.	● contains sound system
	The battery holds a charge for at least 13 hours.	● battery life
	Earpieces are small enough to be both comfortable and secure for long periods of time.	● Weight ● Size(length, width and height)
	Battery level indicator.	● Wireless connection
	Bluetooth connectivity.	● Wireless Connection
	Hearing aid can easily be powered on or off.	

Metrics

Metric #	Needs #	Metric	Importance	Unit
1	2	Duration of Battery	3	Hours (hr)
2	1	Sound level	5	Decibels (dB)
3	6	Amount of time to power off	2	Seconds(s)
4	3	Length of earbud sleeve in ear canal	4	Centimeters(cm)
5	3	Weight	4	Ounces(oz)
6	3	Length of Over ear hook	3	Centimeters(cm)
7	3	Length of earbud frame	3	Centimeters(cm)

Marginal and Ideal Values of Metrics

Metric #	Metric	Unit	Marginal Value	Ideal Value
1	Duration of Battery	Hours (hr)	>6	10
2	Sounds level	Decibels (dB)	>15	60
3	Amount of time to power off	Seconds(s)	<10	3
4	Length of earbud sleeve in ear canal	Centimeters(mm)	<7	4

5	Weight	Ounces(oz)	<0.14	0.8
6	Length of Over ear hook	Centimeters(cm)	<5	3
7	Length of earbud frame	Centimeters(cm)	6	2

Based on the customer statements we derived our set of ideal and marginally accepted values. We chose 10hrs for the ideal value of our battery because our client will not have access to a charger during the day when she is out doing her daily tasks. We decided 60dB is the ideal value for the sound level since that is usually the value of an average human conversation. Three seconds is the ideal power ON/OFF time since it needs to be easily activated whenever our client needs it. 4mm is the ideal value for the length of earbud sleeve in the ear canal because it will be effective yet not cause discomfort when used for long periods of time. We decided 0.8oz would be the ideal weight of the hearing aid since the client said it can cause discomfort if the ear bud is unnecessarily heavy.

Benchmarking

After surveying and assessing similar water resistant hearing aids that are currently available to customers we gathered information that can give us an idea for the direction to go with our design.

Specification	JINGHAO Upgrade Waterproof Sweat Proof Digital Hearing	Rechargeable Hearing Aids Sound Amplifier	IQbuds MAX	GNG2101-CHH A1-Water Resistant Hearing Aid Covers (2017)
Company	JINGHAO	Life Changing Products	IQbuds MAX	GNG2101 Team (ddani044)
Material	SIlicone and Iron	Plastic	Silicone	Silicone Gore-Tex
Price	CAD$ 169.99	USD$ 74.20	CAD$ 499.99	Material Cost
Estimated Battery Life	long	35 hours	-	N/A
Water Resistant	Yes	Not mentioned	Yes	Yes
Dimension	0.8 x 1.3 x 4 cm;	12 × 6 × 8 cm	9 mm	Fit Over Existing Hearing Aid
Power Source	Battery	Rechargeable	Rechargeable	N/A
Weight	3 grams	4 grams	Not mentioned	Varies with model
Noise Cancellation	not mentioned	Not mentioned	Hybrid Active Noise Cancellation	N/A
Color	Nude	Grey	Black	Variable

Conclusions and Recommendations for Future Work

After meeting the client, we were able to focus on our design criteria.A problem statement was made based on our clients needs: Abigail is a Carleton University student who suddenly lost the ability to hear through her right ear about one year ago. She has been using a hearing aid since then, however it is lacking in a few areas. As a recreational swimmer her primary concern is that the hearing aid be fully waterproof in order for it to be usable while swimming.. Our clients needs were then analyzed and converted into design criteria. Adding metrics to our design criteria helped us to prioritize and establish focal features for our design. Through benchmarking we have an idea of what products are already in the market. Using these products as reference will help with generating a design for our prototypes. Through the preliminary research that has been done so far, we see that there are many aspects to this project. We know that each member will have to pull their fair share so that we can have an overall high success rate. For future work we plan to get started early so that we can produce good work. We also have to stay creative and always think of ways that we can improve our design.

Bibliography

- *JINGHAO Upgrade Waterproof Sweat Proof Digital Hearing Amplifiers Behind the Ear Personal Hearing Enhancement with Mode Adjustable Noise Reduction for Left Ear with 2 Batteries: Amazon.ca: Health & Personal Care*, www.amazon.ca/Waterproof-Amplifiers-Enhancement-Adjustable-Reduction/dp/B07QGCW1VC/ref=sr_1_5?crid=2UBQQMGNOSQ6E.
- "Rechargeable Hearing Aids Sound Amplifier." *Life Changing Products*, lcpshop.net/product/rechargeable-hearing-aids-sound-amplifier/?gclid=Cj0KCQjwnqH7BRDdARIsACTSAdseM9a7ThLvns-1Lu8kPM_HIYreKC6iCbBxthPs8kcp4E23Bqldfg0aAmAhEALw_wcB.
- *Nuheara.com*, www.nuheara.com/ca/products/iqbuds-max/?gclid=Cj0KCQjwnqH7BRDdARIsACTSAdvlTUcTAYn9O17G-qZ_yF_Je58lnV8u9uaNI-TMcAN8DP9ND1zu_M4aAnmyEALw_wcB.

APPENDICES

Images of the waterproof aid used in benchmarking

- JINGHAO Upgrade Waterproof Sweat Proof Digital Hearing Amplifiers Behind the Ear Personal Hearing Enhancement with Mode Adjustable Noise Reduction for Left Ear with 2 Batteries:

- “Rechargeable Hearing Aids Sound Amplifier.” *Life Changing Products*,

- IQbuds MAX