DIVE- Water Resistant Hearing Aid Cover

GNG 2101 - Protective Hearing Aid Solutions

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Introduction

Our client’s name is Abigail, she is a student who lost her sense of hearing in one ear. She currently has a functioning hearing aid but she has concerns. Our main focus was to develop a product that can resolve the issues she has with her current hearing aid.

Customer Needs

- Earpiece is waterproof
- Earpiece produces a clear audible sound.
- The battery holds a significant charge
- Earpieces are small enough to be both comfortable and secure for long periods of time.
- Battery level indicator.
- Bluetooth connectivity.
- Hearing aid can easily be powered on or off.

Problem Statement

Abigail is a Carleton University student who suddenly lost the ability to hear through her right ear about a year ago. She has been using a hearing aid since then, however it is lacking in some few areas. As a recreational swimmer and active person her primary concern is for a cover that will allow the hearing aid to be water resistant and a software that would inform her about her battery level.

Benchmarking

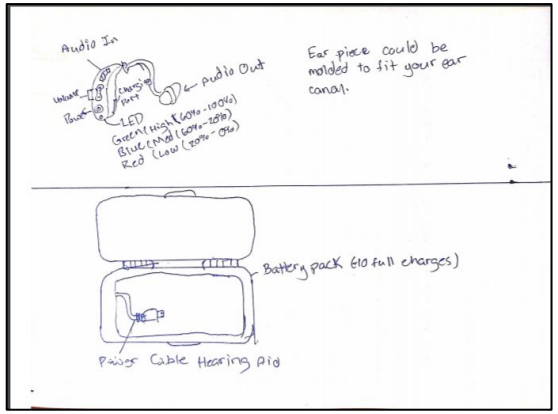
Specifications	1	2	3	4
Company	JINGHAO	Life Changing Products	IQbuds MAX	GNG2101 Team
Material	SIlicone and Iron	Plastic	Silicone	Silicone Gore-Tex
Price	CAD$ 169.99	USD$ 74.20	CAD$ 499.99	Material Cost
Estimated Battery Life	long	35 hours	-	N/A
Water Resistant	Yes	Not mentioned	Yes	Yes
Dimension	0.8 x 1.3 x 4 cm;	12 × 6 × 8 cm	9 mm	= To Current
Power Source	Battery	Rechargeable	Rechargeable	N/A
Weight	3 grams	4 grams	Not mentioned	Varies with model
Noise Cancellation	not mentioned	Not mentioned	Hybrid ANC	N/A
Color	Nude	Grey	Black	Variable

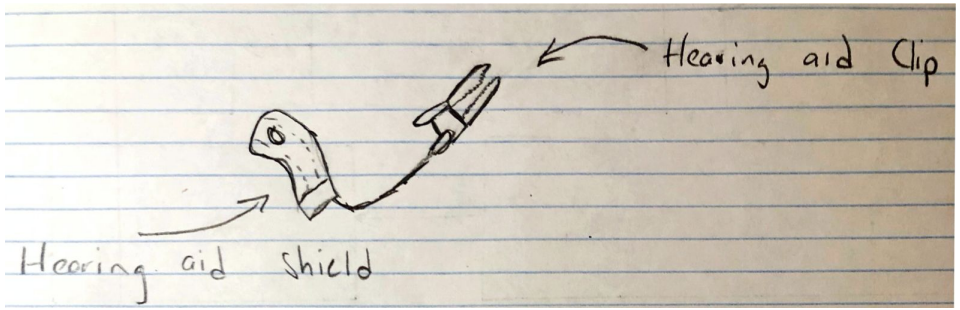
Constraints

- Time
- Cost ($100 Budget)
- Available Resources
- Doing the project remotely

Concepts

The generated concepts all came down to either a fully functional hearing aid build from water resistant material, or a protective case for an existing hearing aid.





Feasibility Study

From the initial concepts generated there were some uncertainties and risks associated with the product.

- The final product can only resists water to some extent (ie. not completely waterproof).
- Keeping the hearing aid on while swimming would prove to be a real challenge
- Long lasting battery and low budget did not mix well together.
- Bluetooth does not work through water

Our Chosen Solution

- Waterproof hearing aid cover, this idea allows us to solve our client’s needs while ensuring the final product is functional and reliable.
- Aim to create battery level estimator software to accompany this design to increase functionality
- The material used for the cover will be ABS plastic as it is easy to use for 3D Printing and also water resistant.

Business Model

<table>
<tr>
<td rowspan="2">Key Partners

- Hearing Aid Companies (Widex)

- Audiologist & Product Specific Shops

-Wholesaler of Gore Tex and Ninja Flex material
- Disability service companies</td>
<td>Key Activities

- Product Testing/Quality Control
- App Development/Maintenance
- Product Development
- Product line development</td>
<td rowspan="2">Value Proposition

- Improve durability of hearing aids
- Improve aesthetic of hearing aids
-Creating a better customer experience
- More flexibility with hearing aid (can wear more often)</td>
<td>Customer Relationships

- Product supplier
- Product advertising companies
- People in hearing impairment industry</td>
<td rowspan="2">Customer Segments

- Hearing aid users.
- Family members of people with hearing problems
- Disability service representatives</td>
</tr>
<tr>
<td>Key Resources

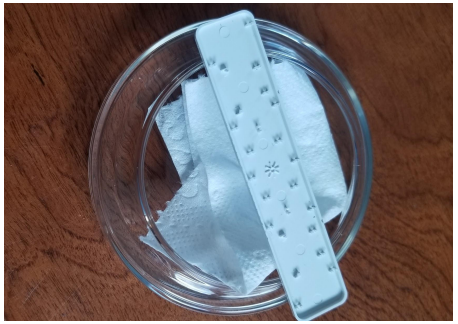
- Manufacturing Facilities
- Website for Online Retail and Customer Interaction</td>
<td>Channels

- popular products would be sold at large retail stores
- Online website for customers to purchase the product well.
-Audiologist and product specific shops</td>
</tr>
<tr>
<td colspan="3">Cost Structure
- Marketing
- Product Development</td>
<td colspan="2">Revenue Streams

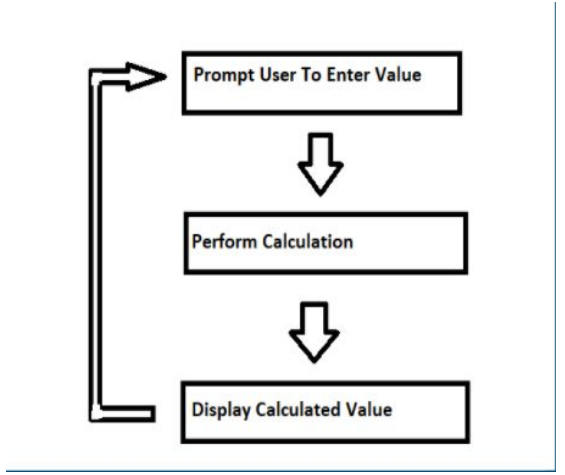
- Through sale of the case.
- Prices will be made and adjusted based on production costs
- Advertising in Application</td>
</tr>
</table>

Prototype 1

This prototype was divided in two. The first part was to test the water resistant property of the ABS material that would be use to make the hearing aid case. To conduct this test a keyboard piece was used to test this. Other component involved were a shallow dish, toilet paper and top water. This test was successful.



The second part of this prototype is a flow chart which highlights the functionality of the software program developed to detect the battery level.



Prototype 2

This prototype is also divided into two parts. The first part focusing on the case and its functionality. The ABS material was tested to note its resistance to extreme weather. After research was conducted on this it was concluded that the ABS material is exposed directly under outdoor sunlight over a very long timeframe it begins to yellow in colour due to UV radiation, but when exposed outdoors to a drastic cold weather it doesn't have much of an effect

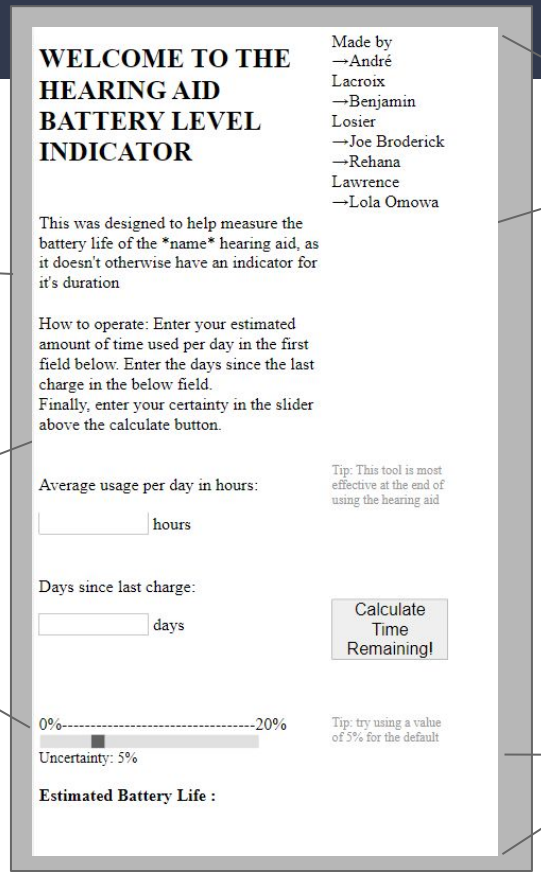
This is a 3D model and a direct model view picture of what the hearing aid case would look like:

Functionality of the App

App accompanying hearing aid was requested from the client.

- Indicates remaining battery level of hearing aid using some math and inputted data
- The client’s existing hearing aid doesn’t yet have a battery indicator

Our Final Solution- Software



Usage Instructions

Input

Credits

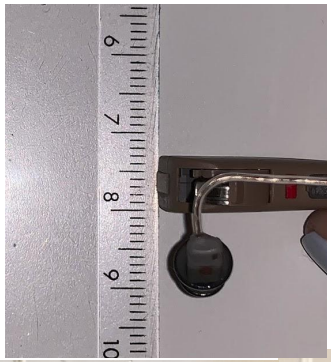
Output

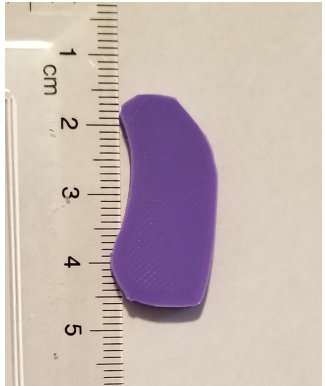
Our Final Solution- Hardware

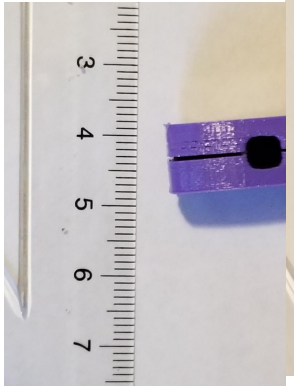
Our final product from a hardware standpoint is a 3D printed ABS case. The interior of the case is coated in a neoprene sponge to cushion the hearing air and ensure a snug secure fit.

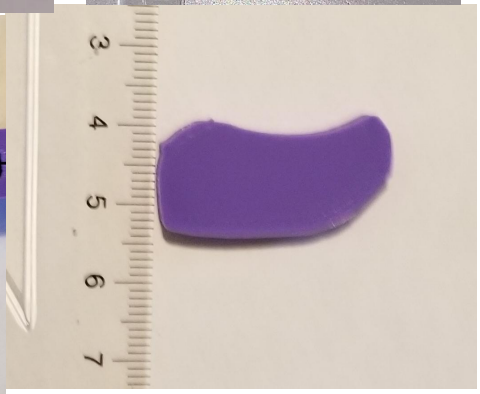
Our client’s hearing aid has a push button which allows her to cycle through different settings on her hearing aid. Our case is designed to allow this button remain accessible when the case is on.

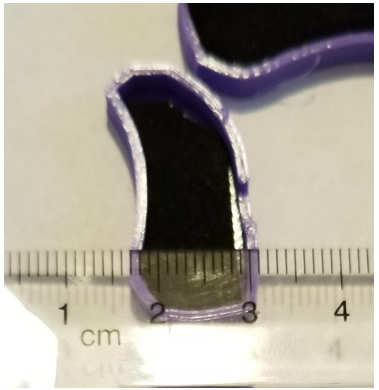
Our Solution - Hardware Pt. 2











Figures 1-3: Our client's hearing aid scaled with ruler.

Figures 4-6: Our case design scaled with ruler.

Figure 7: interior view of case wall thickness scaled with ruler.

Decisions Made

The important decision we made along the way were how to design the app to calculate the remaining battery life. We had multiple options for building the user interface and needed to choose the best one based on the client needs.

Trials and Tribulations

- Communication with the client was difficult at times due to extenuating circumstances.
- Working on the project from different locations made it challenging, particularly to divide work between our group since we needed to create a physical product.
- Getting access to the 3D printers on campus since we are all studying remotely.

Future Work

- Our future work for this project would be to create a phone app since the current software is only available on a desktop or laptop computer.
- Another thing is the ABS case is made with hard plastic material, so finding a different type of material to use as the finish would make the hearing aid more comfortable.
- And finally Testing the fit of our final prototype on the clients hearing aid once social distancing measures are lifted and we are able to see our client in person.

Lessons Learned

- Start working early so we can be better prepared and ensure we meet the deadlines
- Communication with each other is very important
- There is always room for improvement, if more time is available that should be spent on building/testing prototypes
- Prototyping is a very useful way to communicate with the client so we can be certain of satisfying all of the client needs.