**GNG2101 Deliverable B**

**Accessible Directions - Needs Assessment, Problem Statement, Metrics, Benchmarking, and Target Specifications**

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# Abstract

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The objective of this document is to evaluate the needs and requirements of a hands free navigational aid device for blind persons. It includes benchmarking and metrics for existing devices and the parameters for our device provided by the client. From our interview and further brainstorming, the team settled on the development of accessible smart-glasses with bone conduction audio instructions and vibrational feedback to indicate direction.

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# Introduction

The objective of this project is to develop a navigational device that aids persons with low visibility in high background noise environments without requiring the user to hold anything or interacting with it in such a way that it distracts them from their surroundings. This report outlines information gathered from our initial client meeting. It brainstorms and interpretes the client’s, Kim Kilpatrick, comments on existing accessible navigation aid technologies as well as the requirements for the device we are tasked with developing.

# Client Statements

**Needs:**

* An electronic system that can physically guide the consumer
* Helps with building entrances
* Connects with a gps software to guide
* vibrations/bone transduction guidance
* Waterproof and Durable
* Easily to navigate (voice activated)

**Wants:**

* Stylish that doesn’t stand out in public, could be incorporated into a cane
* Motion sensors or area sensors

**Statements:**

“Since covid a few navigational challenges. 1: not knowing if a building has all

the entrances open (sometimes 3 entrances and only 1 available), for example a parking lot is accessible for drivers

but not so much for pedestrians.”

“For blind people we have to listen a lot more, like the sound of traffic,etc. we use our ears a lot to navigate so when GPS and such yammer at us it is harder to filter info we need to know especially if it's very noisy.”

“I would like something that vibrates when you must turn or something that doesn’t rely on hearing.“

“In this point I think physically guide you, since COVID and maybe have some physical distance aspect haha. Maybe more how to guide you.”

“something that you can attach to your cane (handle,etc.). A wearable like a jacket and you would have a

sensor on right and left arm to tell you.”

“I think it would have to be durable since it's out and about, especially if it’s on a cane or glasses with a reasonable battery life and weatherproof so when it rains it won't be damaged.”

# Prioritized Customer Needs

1. Receive navigational instructions without having to hold anything or listen to anything
2. Be rugged and waterproof
3. Be aesthetically pleasing and blend in
4. Control vibration sensitivity
5. Toggle audio instructions via bluetooth on phone
6. Feature to assist in physical distancing
7. Cane attachment
8. Minimal cost

# Problem Statement

There is a need for people with visual impairments to be able navigate with the use of a gps without requiring audio aids. It is difficult for people with visual impairments to navigate VIA gps when out in public due to an access amount of noise.

 Our plan is to create a system that is able to guide the consumer with the use of vibrations and bone conductors, that provides the user with little distractions to effectively assist them in arriving at their intended destination.

# Metrics

* Cost ($)
* Dimensions (In, cm)
* Weight (Id)
* Battery life (time)
* Charge time (time)
* Range (meter, feet)

# Benchmarking Similar Products

# Target Specifications

Accessible Directions - Smart glasses (possible integration of cane)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Component** | **Units** | **Ideal** | **Marginal value** |
| 1 | Mass of glasses | g | <40 | 25-50 |
| 2 | Bone conduction frequency range | Hz | ~3100 (obstacles)~2500Hz (directions | 4000 |
| 3 | Battery life (lithium-ion) | Hrs | >10 | 7-13 |
| 4 | Lithium ion battery capacity | mAh | 500 | 400-600 |
| 5 | device power consumption | mA | ~30 | <60 |
| 6 | Waterproof depth | m | 3 | <2 |
| 7 | Bluetooth range | m | 10 | <5 |
| 8 | Cost | CAD$ | <100 | <100 |

Component:

1. Mass of glasses (g): The average weight of prescription and commercial glasses fall between 25-50g, with the google glass (smart-glasses) weighing 36g. The optimal mass of the glasses is <40g to achieve comfortable wear for the client while still keeping in mind that there will be electronic components integrated within these glasses.
2. Bone conduction frequency range (Hz): range of hearing in humans falls from 20-20,000Hz but hearing is most sensitive within the range of 2000-5000Hz. The ideal frequency is 3100Hz since higher frequencies inflicts a stronger response (higher pitched noises) for the user, which is necessary for alerting the client of obstacles, and 2500Hz is the ideal frequency for giving the user directions since the lower frequencies prove to be much more tolerable than the higher frequencies.
3. Battery life of lithium-ion batteries (Hrs): Ideally the battery life of the smart glasses will range between 7-13 hours, with anything over 10 hours being perfect for use throughout the day.
4. Lithium ion battery capacity (mAh): The battery life depends on the battery capacity and the energy consumption of the device. The battery capacity marginal values fall between 400-600 mAh with the ideal value being a 500 mAh lithium ion battery capacity since other smart glasses fall slightly above these ranges and contain features that are not needed for the client.
5. Device consumption (mA): With the battery capacity falling between 400-600 mAh (ideally 500 mAh), the device must consume less than 60 mA (ideally ~30 mA) in order for the battery life to reach its desired conditions. This was mathematically calculated using the the following equation:

Battery Life (Hrs) = (battery capacity [mAh]) / (device consumption [mA])

1. Waterproof depth (m): Ideally the depth at which the smart glasses can still function should be around 3m. This addresses the issue of accidentally dropping the glasses in a body of water.

Sidenote: Possible material → Polyvinyl chloride (waterproof, malleable, flame retardant, low-cost, light-weight, durable, insulator)

# Client Meeting Reflection

The client meeting was a very good insight onto the everyday life of someone who lives with a disability. It allowed us to get more info on the everyday struggles living without vision such as low situational awareness, having trouble with locating doors, entrances and exits, lines of people, and many more. With the pandemic parameters still in effect, it has made life for those who are blind even more challenging. Not only have we been able to grasp the everyday hardships that our client may encounter, but we’ve also been able to better understand how we can help solve some of the issues aforementioned. Going into the client meeting, we had a very brief description of the product that we were meant to develop in order to meet the needs of the client. In fact, our only description was to develop a system to indicate directions without the need to hold or see it, with a proposed solution of a belt integrating vibrational technology. As a result, our questions heading into the meeting were very general and open but also providing insight into what technologies they think could be appropriate. The client seemed very keen on the idea of bone conduction transducers having attempted them in the past. As the meeting continued, it seemed to be more clear that although there were many different options provided by both us and the client, that the bone conduction technology might be the focal point for our solution. This has allowed us to focus very strongly on this concept of technological integration into the product that we now hope to develop for the client, and perhaps sideline some of the initial solutions that we came up with such as a vibrational cane. Overall, the client meeting allowed us to determine the needs of the client, the importance of each need as well as being able to compare our ideas with those of products that the client already uses or has used in the past.

# Conclusions

The client provided very informative insight into the challenges of everyday life for people with impaired vision and ideas to help ease those challenges. Following the clients ideas and feedback, we decided to focus our approach on accessible smart glasses that have bluetooth compatibility with IOS and android OS. We’re planning on having bone induction iterated to the smart glasses to send frequencies pertaining to the direction the client wants to go in (right ear will send a frequency to turn right, left ear will send a frequency to turn left) and sensors/camera to inform the user of any obstacles in their path. The camera will serve to read any text within proximity of the user and send a notification on their phone for them to read user braille software (much like microsoft narrator, or android talkback software). Finally, we aim to make the glasses waterproof as well as affordable. The ideal material which fits both criteria is Polyvinyl chloride, a type of plastic that is waterproof, malleable, flame retardant, low-cost, light-weight, durable, and a great insulator. For the future, we are going to narrow down each component of the prototype and aim to make them as cost efficient, safe, and user friendly as possible by researching parameters and getting feedback from the client.

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