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DELIVERABLE D CONCEPTUAL DESIGN

Team DISMISS

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1. INTRODUCTION

In the fast-developing and rapidly evolving technology field, the ability to integrate and use smart technologies in our daily lives has never been as important. As new innovations and technologies emerge, one thing that requires attention is helping visually impaired individuals live a life as simple and easy as possible. While meeting all the criteria can be a challenging task. Smart glasses are just one of many devices that could make this possible. However, the problem lies in its functionality and, as per our client, Shabodi, how we could incorporate 5G into them, so it is more responsive in terms of network connectivity.

After evaluating a couple Smart Glasses devices currently on the market, we have noticed quite a few features to imitate or, to the contrary, to avoid. Some of them overlook some facts, such as the fact that the users would wear the glasses for an extended period, requiring a strong network connection, battery backup, and other features to fulfil the needs. We will attempt to incorporate each of those features in our own design of smart glasses for visually impaired individuals.

2. RESEARCH AND ANALYSIS

*3 = green, 2 = yellow and 1 = red

Specs \ Smart glass devices	Importance	Ray Ban Meta Skyler	Envision Glasses: Home edition	Lenovo Think Reality A3
Brand		Ray Ban	Envision	Lenovo
Cost	3	369.99\$	3,461.00\$	1499\$
Wi-Fi/Bluetooth	5	Wi-Fi 6, Bluetooth 5.2	Wi-Fi 802.11ac, dual-band, single antenna Bluetooth 5.x AoA	5G, Wi-Fi 6
Battery	3	4 hours	4 to 6 hours	3 to 5 hours, including an extended battery pack
Charging	2	Charging case	USB Type C	USB Type C
Lightweight	2	50g	46g	130g
Mic / voice command	4	Yes Custom 5 Mic Array	3 beam-forming microphones	3 integrated mics
Camera	5	12MP	8Mp, 80 DFOV	8MP and Dual fish-eye cameras for 6DoF tracking
Object detection	5	No	Yes	Yes
Object recognition	5	No	Yes	Voice, object, and image recognition
Face recognition	3	No	Yes	Yes

Audio	4	Yes - music - 2 Custom-Built Speaker Open Ear	Yes - AI or Hands- free	Integrated speakers
Calls and texting	3	Yes, Meta AI or assistant	Yes Handsfree AI or assistant	N/A
Heads-up display	3	N/A	AR display	Dual 1080p AR display
Quality of Recording / photos	3	1440x1920 Px @30 Fps 3024x4032px	N/A	N/A
Memory	2	32GB Flash Storage 500+ Photos, 100+ 30s Videos	3GB LPDDR4 / 32GB eMMC Flash	8GB, dual channel
Touch control	2	Yes	Multi-touch gesture touchpad	Yes - toggle volume
Total		108	125	116

According to the previous table, the Envision Glasses is clearly the best model of Smart Glasses for visually impaired individuals. While the Envision Glasses does have some negative points, such as its low memory capacity, it is still the most practical product for our problem.

3. CLIENT AND USERS

Our client, Shabodi, demonstrated a wish for a set of smart glasses for visually impaired people. According to our clients wishes and our interpretation, we have identified, organized, and prioritized a list of needs*:

1. The smart glasses have easy accessibility to networks
2. The smart glasses have clear communication between the user and operator/AI
3. The smart glasses are quick and responsive
4. The smart glasses warn user of surrounding hazards and detect obstacles
5. The smart glasses give audible warnings to the user
6. The smart glasses help the user safely navigate streets
7. The smart glasses adapt to different network conditions
8. The smart glasses offer a Heads-Up display features

*1 (high priority) to 8 (low priority)

Those needs fall into two categories: basic needs and safety features.

- Basics needs:
 - The smart glasses have an easy access to networks.
 - The smart glasses have clear communication between the user and operator/AI
 - The smart glasses are quick and responsive.
 - The smart glasses adapt to different networks conditions.
- Safety features:
 - The smart glasses warn users of potential surrounding hazards and detect obstacles.
 - The smart glasses help the user safely navigate streets.
 - The smart glasses offer a Heads-Up display feature.

4. PROBLEM STATEMENT

A need exists for visually impaired who are looking to have more independence to enhance situational and physical awareness with audio and visual cues from the smart glasses.

5. PROPOSED SOLUTIONS

5.1. Solution 1 by GABRIELLE CHÉNIER

(Sketch in next page)

Location Subsystem (GPS)

The GPS can be turned on and off by the user. For security reasons, the user can also share their locations with others. To help with the interaction, the app also allows you to save your favorites locations under different names.

Audio Subsystem

The microphone can be turned on and off by the user. Through the app, the user can also adjust the volume. The user also has the option to disable voice warnings. Finally, the app allows the glasses to recognize different voices and to identify them.

Camera Subsystem

The camera can be turned on and off by the user. The user can also adjust the photo and video resolution. The user can also double tap the glasses to take a photo or triple tap to take a video. The resolution of the camera can also be changed with the app. Finally, all the previous videos and photos taken by the glasses can be seen on the app.

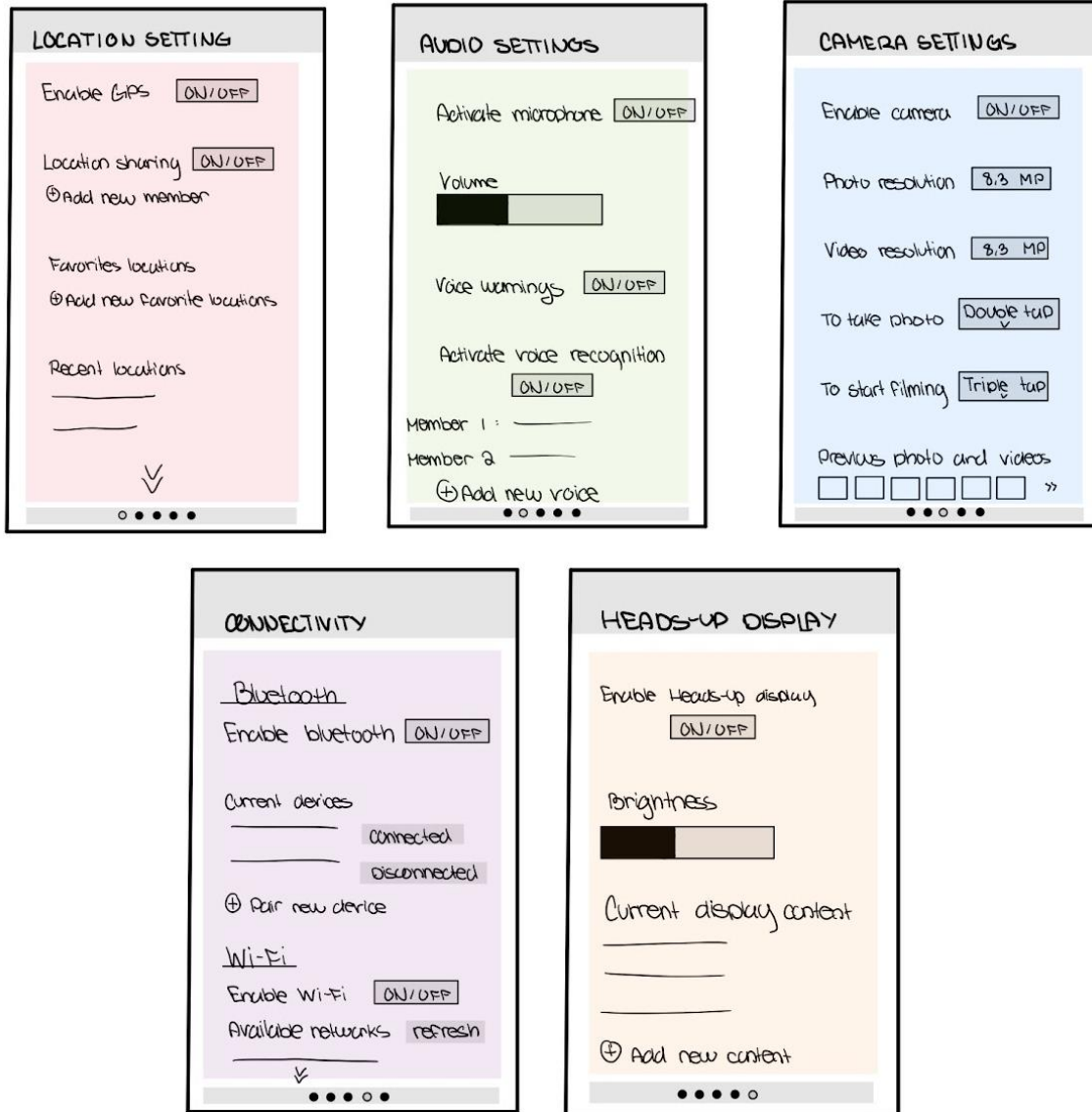
Connectivity Subsystem

Bluetooth can be turned on or off by the user. On the app, the user can see all their previous connected devices as well as their status (connected or disconnected). New devices can also be paired on the app. The user can also connect the glasses to the internet with the help of the app.

Heads-up Display (HUD) Subsystem

The user can turn on or off the Heads-Up display. They can also control its brightness. Finally, the app allows the user to choose if they want to add or remove content from the display.

Sketches



5.2. Solution 2 by RUSAFI KAMAL

(Sketch in next page)

Location Subsystem (GPS)

Since our phone already has a good built-in GPS, we could use it to get our coordinates (latitude and longitude) and make sure that the navigation is working precisely. One thing is, we need to assume the user will be carrying it with themselves when using the smart glasses.

Audio Subsystem

We could have a built-in headphone speaker in the sides of the glasses so that the audio is clear, especially for the voice warnings, as well as makes sure that there is no audio leak.

Camera Subsystem

The camera could be used in a way to help with both obstacle-detection as well as record videos.

Connectivity Subsystem

Just like the first two, we could incorporate the already great Wi-Fi module in our phone and connect it via Bluetooth between the glasses and the phone. This would significantly reduce the weight of the glasses.

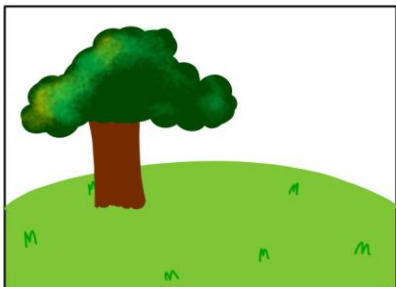
Heads-up Display (HUD) Subsystem and Obstacle Detection

Using red colour hints around or on the glass screen when an obstacle or transparent when clear could be used as a feature for the heads-up display since the intended user being blind means they will not need a precise display. Besides that, there will be a few options to choose from based on types of visual impairment, which has been further explained in the sketches.

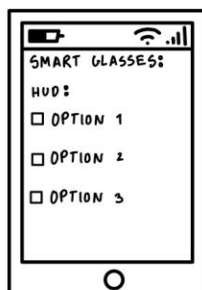
Sketches

HUD SUBSYSTEM

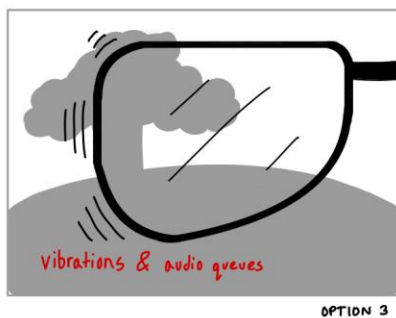
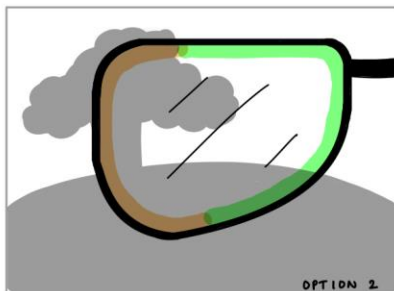
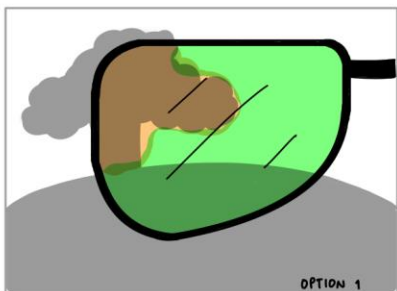
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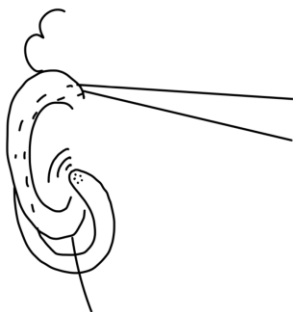
A FEW OPTIONS TO CHOOSE FROM



WHAT THE USER SEES:



AUDIO SUBSYSTEM



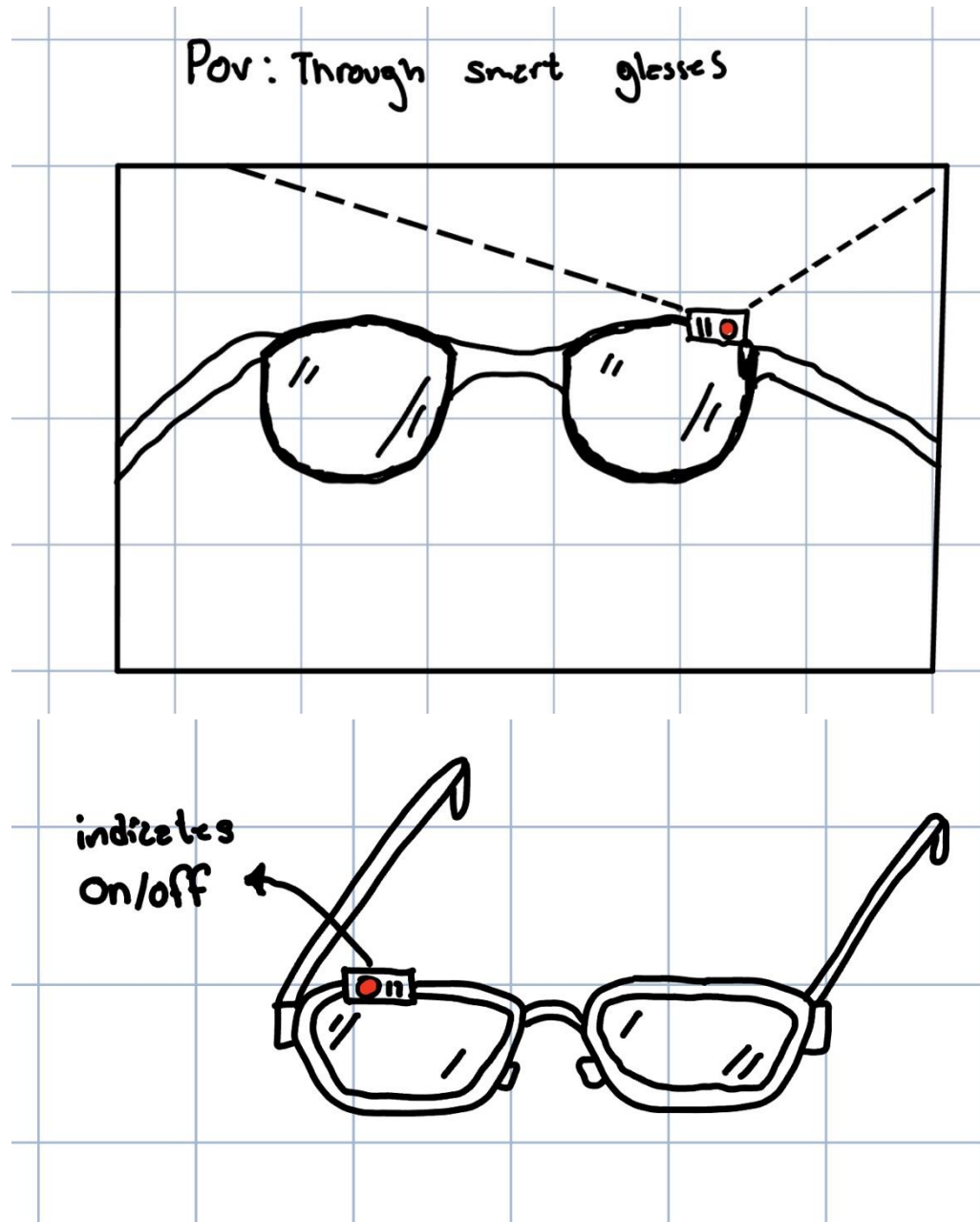
LOCATION SUBSYSTEM



5.3. Solution 3 by DARRIEN CHEN

Visual Perception subsystem

The visual perception system is involved with all the input data given to the smart glasses. Input data would include cameras and all various sensors. The camera would be involved to help with obstacle detection, facial recognition, text recognition, etc. Various sensors could include depth perception, gyroscope to help with balance, etc. We would include AI to help gather and sort all this data for the algorithm. The AI would oversee recognizing speech, recognizing faces, and sending it back to the processing unit.



Auditory Feedback subsystem

Our main idea on how to convey information to visually impaired users is to give them auditory feedback. This is mostly the output area of our smart glasses. The auditory feedback system will oversee warning users about obstacles, music, audible directions, phone calls, help answer voice commands, etc. It processes visual data and outputs auditory feedback to users. Since our smart glasses are more visually impaired focused, we would heavily focus on auditory feedback compared to visual feedback.

User Interface and Control subsystem

This subsystem is another input subsystem that is based on physical user touch, which is manually changing the volume, or pressing side buttons on the camera for various controls. We can also categorize visual cues to users in this category such as light warning to warn visually impaired users. Just overall HUD and tangible parts of the glasses

Location Subsystem (GPS Systems)

This subsystem focuses on the location of the user, using GPS technology. We would incorporate this by adding a chip tracker into the glasses that would relay the location to the API. This is essential to our software, as we need the location of the user to use various features such as find my and using it to navigate the city.

Connectivity Subsystem (Bluetooth)

Connectivity is solely focused on how well the Smart Glasses connect to certain networks. In our case we are working on the glasses to connect to 5G networks for data, cause our glasses will be wireless and not connected to any router. Having data will allow users to roam, around the streets, using the Shabodi API.

5.4. Solution 4 by HANNAH KNIPE

Location

Location is an important subsystem in the smart glasses. Using a GPS that is connected to the smart glasses itself, GPS will ensure the ease of navigation, as well as finding your devices. If users lose their smart glasses, the GPS allows them to find it through the application on their devices. If users lose their devices, the smart glasses could also track down saved devices. Furthermore, the satellite information given will inform users of their location (location of the glasses) and the distance and time it takes to get to their destination, as well as known landmarks, visuals and obstructing obstacles around them, which in turn will boost independence and safety.

Audio

Audio is a necessary feature in the smart glasses. There are two types of audios: input and output.

Audio output will be integrated into the smart glasses using built-in speakers, that will project a voice to the user. The voice will inform the user of errors in the system, warnings, external information, and extras.

Error: If an error occurs in the system, such as low battery, irregular temperature in the device, unstable connectivity or any other malfunctions, the voice will inform the user right away.

Warnings: If the glasses detect nearby objects that interfere, obstruct or endanger the user, the voice warnings will inform the user in real time, a few seconds and meters in advance. If the system is overwhelmed by the quantity of nearby objects, the system will inform the user of the issue, as well as a solution to avoid such objects.

Information: When commanded to do so, the glasses will recognize faces, voices, animals, objects, words, and answer the users. Plus, the system will audibly inform the user of their location or of any features in the smart glasses that are being actively used.

Extras: The glasses can play music that is connected to a device through Bluetooth. The glasses can pick up calls and read out texts or other chosen notifications. The glasses can listen to another person speak and translate the message in real time.

Audio input will be integrated in the smart glasses using built-in microphones. The user may use voice commands, and the smart glasses will respond accordingly. There are diverse types of voice commands: toggling on/off functions, informing the user and using extra features.

Toggling on/off functions: Some examples would be to toggle the FOCUS tool, mic, GPS, camera, etc...

Informing the user of their location, people, objects, weather...

Using extra features can consist of taking pictures and videos, calling, playing music...

Camera

The camera tool enhances communication between the user and the network by allowing the operators on the other side to have access to the user's point of view, facilitating decision-making and quick thinking. Some features which require the camera tool consist of facial recognition, object recognition, animal species recognition, and reading text. The information captured by the camera is either portrayed on the HUD, downloaded to the application, or audibly said to the user. Animal and object recognition might need Wi-Fi or data to function. Pictures and videos may also be captured and saved on the glasses. The storage on the glasses is very limited, so saved captures must be transferred to another device to free up space.

Connectivity

The smart glasses won't be able to directly connect to networks or the internet. It requires connectivity with a device via **Bluetooth**, such as a **phone**, to be able to connect externally. When permission is given, some **apps** on the phone may be used with the glasses, like 'Phone', 'Messages', 'Weather', 'Spotify', 'Voice Memos', 'Photos' and 'Camera', 'Calendar', 'Mail', 'Translate', 'Maps', and more. Not only that, but the glasses will also be connected to a **virtual assistant**, whether it is AI or a person connected on the other side, that will provide real-time assistance for the user.

If the glasses cannot find a stable connection, then it will continue to run based on its default settings without the add-ons ; focus tool and obstacle detection will be available at anytime anywhere, but new audio instructions will be not be active because of the lack of connectivity. However, the glasses can store some external information, for example a face using facial recognition, and use it later. If saved directly onto the glasses, some audio instructions will still be functional even without connectivity. Storage can be transferred to a device using a physical cord or the internet.

The glasses also come with an application which can customize permissions, features and add-ons. The application can: give permission, enable camera, enable microphone, customize virtual assistant, toggle/customize focus tool, customize audio instructions, add new add-ons, find your glasses, and much more...

Heads-up Display (HUD)

The HUD will not project too many things so that the user gets easily distracted. Bright lights and the focus reticle are enough. Bright red lights will warn the user of any dangers that arise. The focus tool allows the user to focus on an object or person and interact with it. When focusing on an object, you may ask of its identity, shape, color, and other things that the camera can pick up on. Without the focus tool, you cannot learn information about an object or person because the system does not know what the user is trying to interact with.

5.5. Solution 5 by QUAN LUU

Features	Concept 1: AI assisted Navigation	Concept 2: Multi-Functional Assistance	Concept 3: Obstacle Detection Assistance
Camera	Camera for navigation	Camera for facial recognition	Depth sensing camera for obstacle detection
Connectivity	Bluetooth and Wi-Fi for synchronizing and cloud-based updates	Bluetooth or Wi-Fi for notifications and cloud sync	Bluetooth for smartphones and Wi-Fi for cloud
HUD	Transparent OLED with real time navigation overlay	Projection which shows reminders and light navigation	HUD with obstacles icon and hazard alert
GPS	Smartphone based GPS	GPS for location-based reminders and navigation	GPS with obstacle aware route planning
AI assistance	AI powered navigation voice command route optimization	AI for scheduling notifications and voice inquiries	AI for real time obstacle detection and route suggestions
Primarily Use Case	Navigation and safety	Everyday assistance	Visually impaired navigation and safety

1. Camera Feature

The camera captures the surrounding environment and provides real-time visual data to the AI system, allowing it to identify obstacles or landmarks and guide the user through complex environments. The camera captures the surrounding environment and sends real-time data to the AI, allowing the system to detect obstacles and landmarks for more accurate navigation assistance.

2. Connectivity Feature

Connectivity via Bluetooth and Wi-Fi ensures that the glasses can sync with a smartphone and access cloud services, enabling the glasses to receive real-time updates, sync GPS data, and deliver notifications to the user seamlessly. For example, the glasses connect to the user's smartphone via Bluetooth and to cloud services via Wi-Fi, allowing them to retrieve GPS data, access AI updates, and deliver notifications to the user in real-time.

3. Heads-up Display (HUD) Feature

The heads-up display, using transparent OLED technology, projects crucial information such as navigation routes, notifications, and obstacle alerts directly into the user's field of vision, providing real-time guidance without obstructing the user's view. For example, the heads-up display projects real-time navigation directions, such as arrows and turn indicators, onto the transparent OLED screen, ensuring that the user receives continuous guidance without their vision being obstructed.

4. GPS Feature

GPS integration provides continuous real-time tracking of the user's location, which is displayed through the heads-up display, allowing for optimized route planning and navigation, especially when combined with AI-driven decision-making. For example, the integrated GPS provides real-time tracking of the user's location, working with the AI system to display optimized routes and directions on the HUD.

5. AI Assistance Feature

AI assistance processes input from the camera and GPS to offer real-time voice prompts and visual cues, helping the user avoid obstacles, follow optimized routes, and receive important notifications or reminders throughout their journey. For example, the AI processes information from the camera and GPS, providing voice prompts and visual cues to guide the user through complex routes while alerting them to potential obstacles along the way.

6. EVALUATION BASED ON DESIGN CRITERIA

Priority number*	Design criteria	Gabrielle's concept	Rusafi's concept	Darrien's concept	Hannah's concept	Quan's concept
5	GPS	4	1	2	5	3
5	Obstacle detection	2	5	3	4	1
3	Heads-Up display	3	5	1	4	2
2	Aesthetic	5	4	3	2	1
3	Bluetooth / Wi-Fi / GPS	4	3	2	5	1
5	Voice warnings	2	3	4	5	1
Total		71	77	60	101	48

* Ranking ideas best (5) to worst (1) from each team member

7. CHOSEN SOLUTION

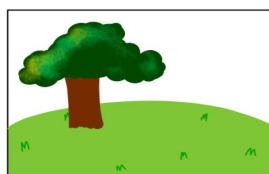
Location subsystem

For the location subsystem, we have chosen to go with Gabrielle's concept, as it offers a unique concept of the ability to turn off and on the location. This falls into our number one priority as it provides an added safety feature, to prevent further hackers to release valuable data to the public. Another concept we all agreed upon as a group was the addition of adding favourite spot locations, this would be a fun feature to save users the hassle of recurring searches.

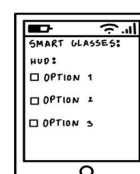


HUD SUBSYSTEM

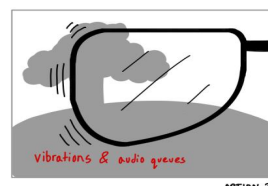
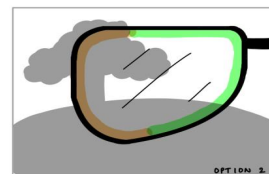
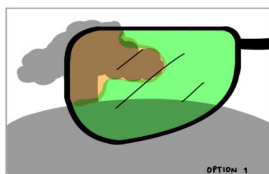
WHAT YOU SEE:



A FEW OPTIONS TO CHOOSE FROM



WHAT THE USER SEES:

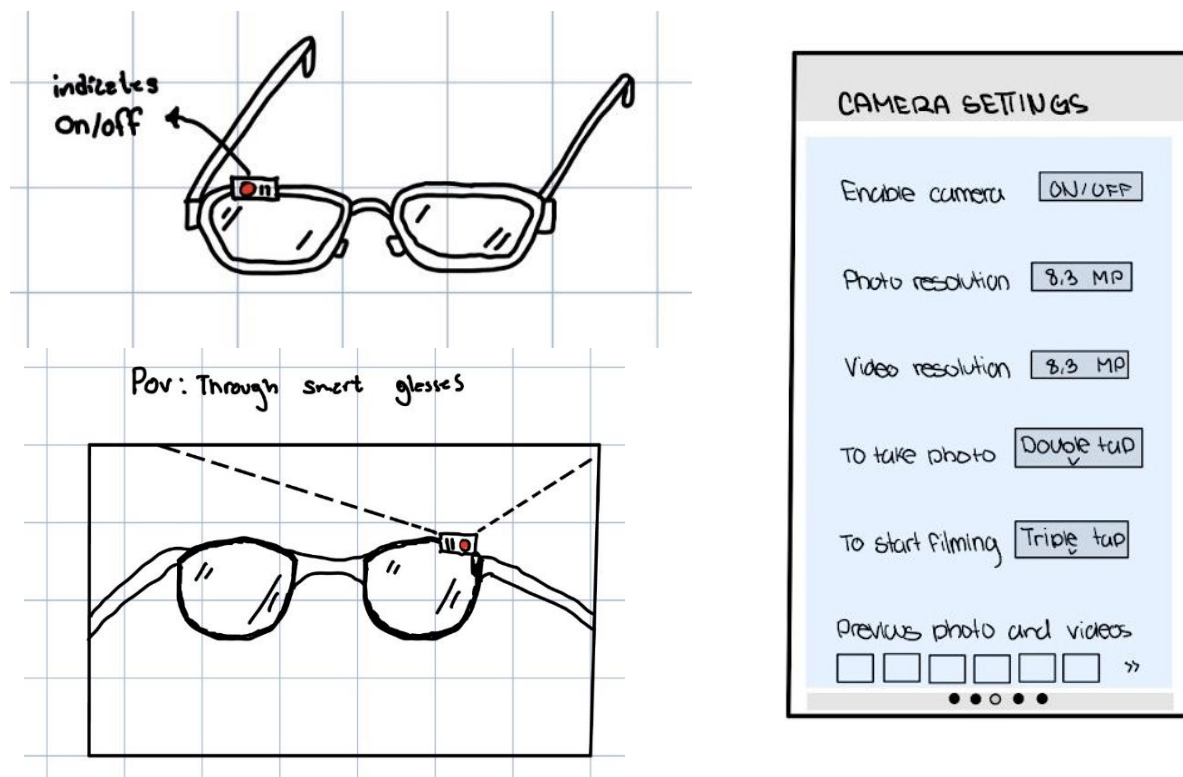


Heads-Up Display subsystem

Our final Heads-Up Display will integrate two key concepts to enhance obstacle detection for visually impaired users: vibration alerts and light notifications. The vibration warning system uses small vibration motors embedded within the glasses. When obstacles are detected nearby, the entire frame vibrates, providing immediate feedback to the user. Additionally, a ring light system is incorporated around the frame of the glasses. This system offers a non-intrusive visual cue, with side lights illuminating to signal the presence of obstacles ahead.

Camera subsystem

For the camera subsystem, we have chosen to go with Darrien's and Gabrielle's concepts. First, a light we indicate whenever the camera is on to warn other people that they are being filmed. On the app, you could also choose to activate or deactivate the camera. With the simple touch of your finger, you could either take a video or take a photo, which you could access whenever you want with the help of the app. You could also change the photo and video resolution.



Audio subsystem

We have selected a conventional mini speaker to provide audible feedback for the visually impaired user. The primary output of the Smart Glasses will be auditory cues across all applications, including navigation, obstacle detection, music, phone calls, and more. Additionally, we are incorporating a spatial awareness feature. This feature will deliver progressively intense beeps as the user approaches obstacles, enhancing their awareness of their surroundings. We'll also make it possible for the user to turn the microphone on and off. Through the app, they can also adjust the volume. We have selected a conventional built-in speaker to provide audible feedback for users.



Connectivity Subsystem

For the connectivity subsystem, we have chosen to go with Rusafi's and Gabrielle's concept. Gabrielle's concept will enable the user to choose between many different options. For instance, Bluetooth and Wi-Fi can be turned on and off by the user. They can also see all their previous connected devices. With the help of the app, they also pair new devices. Our main method of connectivity is through 5G data, as this allows us to create a portable smart glass in the outdoors to help navigate external areas. 5G data is the fastest form of data as it has the biggest bandwidth and lowest response time.

8. CONCLUSION

The ideation stage is one of the main stages during a product development as it gives us a wide variety of list of concepts to choose from. This report gives a rundown of every step we took in terms of choosing our final solutions. In our evaluation process, we had quite a variety of concepts we touched on and it made our final solution diverse as we incorporated ideas from the whole team. We made sure to revise the advantages and disadvantages of each concept and chose the one which seemed reasonable to us. Our next step would be to keep the final solutions on mind and start coding the software for it. Of course, we would incorporate the Sandbox which would be provided to us by our client SHABODI, but while we wait for that, we will start

thinking about the next stage which is prototyping, and based on what we have there are quite a few prototyping methods.

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