IHCI REPORT

By- Group 6_8

Bhagesh Gaur

Sejal Kardam

Vasu Khanna

Sidhant Agarwal

Links to our works:

1.) Figma:
https://www.figma.com/proto/9qre297vq89Rc5LWll37h8/6_8?node-id=110%3A23&scaling=scale-down&page-id=0%3A1

2.) YouTube Demo (A very comprehensive demo of our device by a test user):
https://www.youtube.com/watch?v=8G76Yl9aVRM
This video received great response from the community.

3.) Google Drive Folder
Containing interview recordings, focus group discussion recordings, consent forms, device voice-overs, presentations, low-fi designs, and other videos
https://drive.google.com/drive/folders/1RwagQczJUd-WD525z5pO9KAoyzUtdToY?usp=sharing

Abstract:

We, the members of group 6_8, got our IHCI project in which we had to work on such a device and its support application that could aid the community and improve the lifestyle of many. So, after getting the task, we all started to share our ideas, and at last, we concluded having similar views to help visually impaired people by the medium of a device that we later named ViBrain. All the group members had witnessed blind people facing difficulties commuting on their own. Further, to get more details about this, we talked to some of the blind people in our communities. When we visited the college campus by metro, we saw the visually impaired people facing difficulties. We noticed that the white cane was not effective in helping the visually impaired commute, so we tried to search for alternatives. We went through some of the articles related to our topic and floated surveys to get people's perspective on the above problem. After finalising our idea, we went through our lectures to design the device using a more professional approach. The lessons taught in the class helped us plan all the device components and the application. All the team members put in immense efforts and great ideas to make our application's final prototype using technologies like LiDar®, haptics, etc. We came up with ViBrain's final design and even developed the high-fidelity prototype for the ViBrain's support application.

Introduction:

The most common problem which visually impaired people face is to travel alone in crowded places. They generally face major accidents while doing so, and having a 24/7 assistant to help them is not a practical solution. Some areas have special arrangements like staircase and elevators for visually impaired people, but it is not easy for them to use those facilities independently. Navigating to their desired destinations becomes very difficult for these people, and asking peoples' help in a crowded place is impossible for them.While facing all these difficulties, these people sometimes face fatal accidents. Due to all this, a solution to this problem was required, which we, the members of IHCI group 6_8, have tried to find by the medium of a device with an assistive application.

We have used Double Diamond design in creation of our application ViBrain:-

Discover

We tried to gather every possible problem faced by visually impaired users in operating an application by himself/herself while traveling in crowded places.

Define

Here we list out the major problems from ‘discover’ part that need to be solved.

Develop

We try to find every possible solution to our problems.

Deliver

We construct the final product based on possible solutions.

The primary motivation towards designing the application was achieved when we(all the group members) went to the college via metro. We all witnessed that visually impaired people face difficulties in commuting on their own. We noticed that in the metro and mostly all the means of transport caused these people problems in commuting from one place to another daily. Further, we individually also witnessed many incidents where blind people have to face many accidents just because they travel alone. All this gave us the motivation to design our application. we decided to conduct informal group discussions within the group members. We floated a survey form and an assumption form to strengthen our ideation process.So we decided to build a device based on the LiDAR scanner which will be supported by haptic feedback, gyroscope sensors and breathable bands. LiDAR stands for ‘light detection and ranging’. This technology maps the 3D representation of the surveyed environment by using laser beam technology that is safe for eyes. The device can scan the nearby surrounding and give directions to the user. It can also help them prevent accidents. Our approach plans to replace the conventional canes/sticks in the longer run. We at a later stage decided to conduct a group discussion to understand the pros and cons of our high fidelity prototype. As the group discussion was conducted in the online mode and due to restrictions on the Figma application that we used for high fidelity prototyping, we had to share the screen and add voice-overs using an external feature. The members analysed the application thoroughly and came up with significant opinions and views. They questioned our design patterns for the device and the logic behind using them. They discussed and agreed with our ideas behind that particular design.

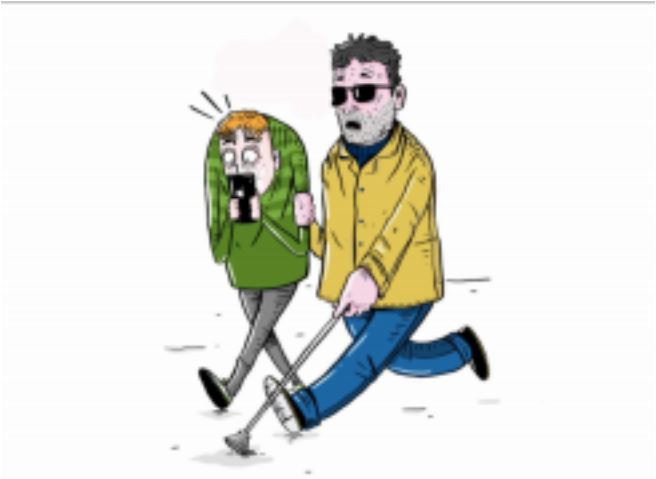
ViBrain is an application which helps visually impaired people navigate from one destination to another with or without any assistance as it contains two modes, a self mode and an assistance mode. Because of the Self and Assistive mode, ViBrain attracts both sighted and visually impaired users.Self mode’s easy user interface helps visually impaired people use it quite easily without any assistance whereas assistive mode provides all the necessary features that are

expected from application and can be used by the sighted people for feeding the information in the application about the user.It has less complex design than usual as it provides navigation from one frame to another with one tap with lesser options and voice command features for accessing different routes. Also it will navigate the user with the help of voice feedback for every well known landmark with calculated steps. Eg - ‘A’ bus stop to ‘B’ bus stop to ‘C’ metro station to ‘D’ your destination. Assistive mode is for normal users and for the person who wants to assist the visually impaired. It contains usual navigational user interface with every required features like google search bar with voice search, map preview, searching option for nearby necessary places like Restaurants, ATMs, Petrol, Airport, Hotel, Hospital etc.. for sudden need. ViBrain will feed all the necessary information about the user under proper privacy secured terms and conditions for the emergency situations like if the user meets an accident then he/she can call for help with one tap on the emergency button or by calling voice command ‘HELP’. In such a situation , ViBran instantly sends an emergency message with the user’s current location to the saved contacts of the user.Now the question is, how ViBrain is different from other navigation apps like Google Maps and Apple Maps .The answer to this question is that it can be used in an offline manner as we know how much these apps are dependent on the internet and are of no use without the internet. ViBrain tackles this problem by saving frequently used routes and manually added routes in offline mode(My Routes) so they can be used in conditions when there is no access to the internet.This combination of device and application focuses on ending their sufferings and making them independent.Finally, we wish to serve our target audience with the most useful device and application. Our ultimate goal is to soon build this device under the guidance of Prof. Shah and our mentors and conduct several real-world tests, especially with visually blind people to see the feasibility of the device.

Methodology:

1.) **Problem Definition and Identifying Target Users:**

One of the biggest challenges visually impaired people face is using a white cane while navigating thick crowds. Although some places have extra elevators and stairs to help, these people still cannot access them independently, and they feel completely helpless. People do not pay attention and often trip over their cane, bump into them, or simply stop in front of them. Echolocation does not work well for them in crowded situations or noisy environments. When people bump into them or knock their cane out of their hand, they become very disoriented. Airports/ Metro stations/ Railway stations seem to be personal enemies of the white cane. For some reason, when people are set to travel, their attention span narrows, and they wander around in a haze. While facing these problems, the victims have to bear severe accidents and sometimes death too. The visually impaired people could not always have a caretaker with them, so they sometimes have to travel on their own, and for this, they required a machine or a device that could help and guide them constantly, and they could live independently. Navigating to their desired destination becomes very difficult for them, and asking people in a crowded place becomes nearly impossible.



As you can see in the above picture, how the person who is “helping” the visually impaired person is completely busy on his phone.

2.) Requirements Gathering:

Requirements or data gathering is a crucial step required to collect accurate information, general opinions, sufficient details, understand people's behaviour and their reaction so that design can proceed. It assists the gatherers in getting beneficial insights, views and opinions of the stakeholders and the pros and cons of their idea.

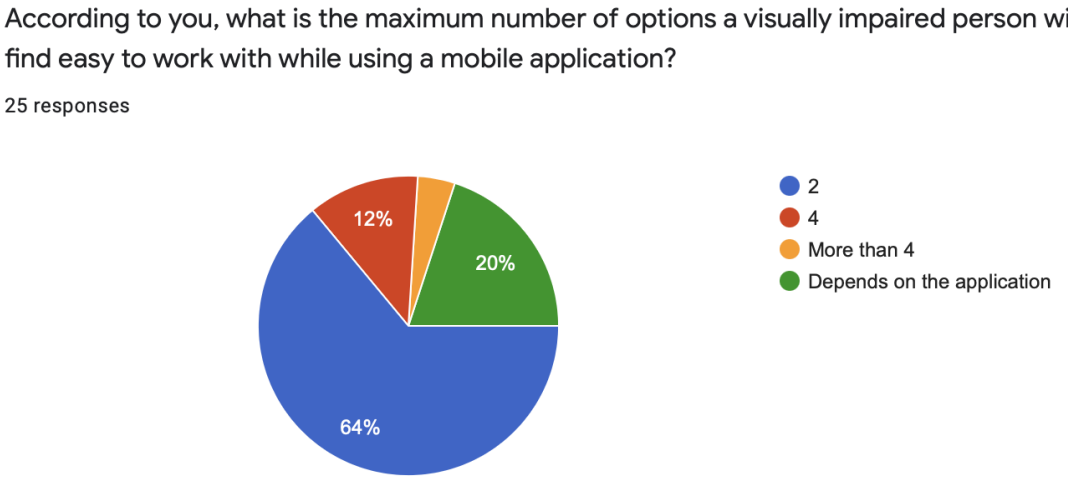
Our project ViBrain primarily focuses to aid the visually blind. Thus, it was necessary to take views and opinions of both, sighted and dim-sighted people.

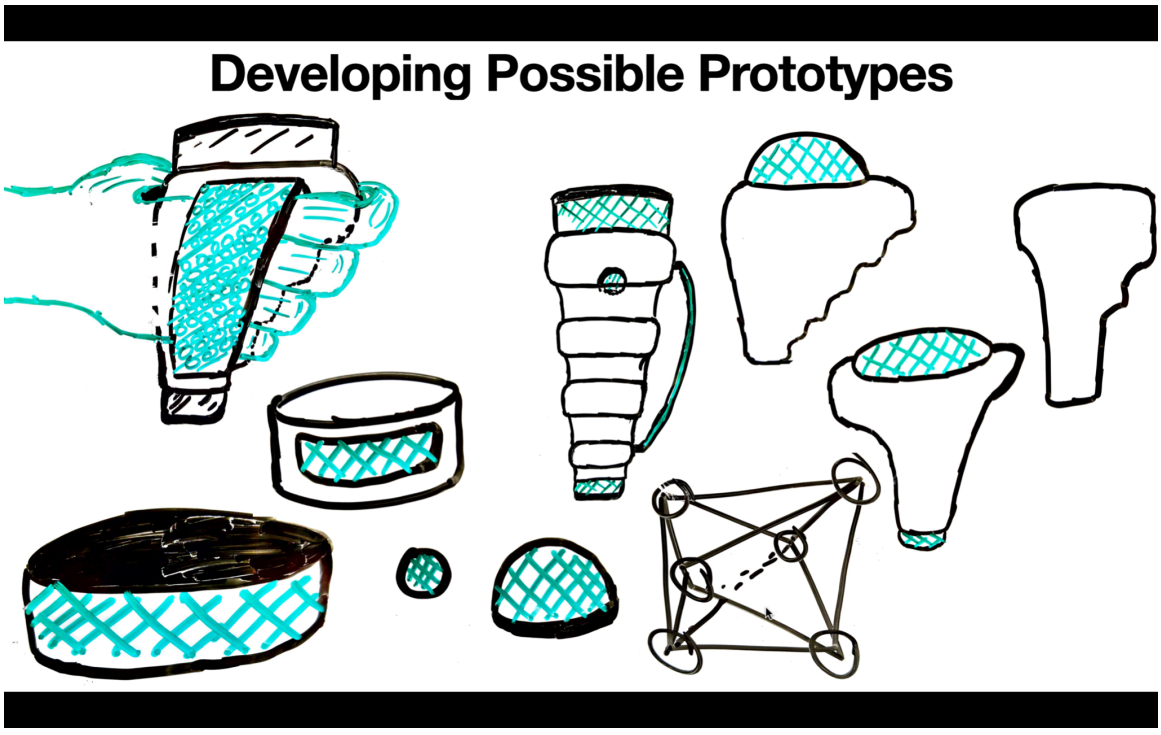
After defining the problem statement which included thorough research, we first decided to gather data through surveys. Given that our device focuses on visually impaired people, it became extremely important for us to identify the correct population for this study. The goal behind conducting the survey, 'VISION WITHOUT SIGHT', was to take opinions from sighted people, visually impaired people and people who have closely followed visually impaired people. We briefly described the issue in the google form for everybody to understand the problem and relate to it. We took the necessary steps to make sure nobody's personal details are leaked.

We kept the survey short and crisp to gather a large audience for the survey. It included questions that were primarily based on their everyday observations. We asked the sighted people if they ever observed a blind person commuting through public transport and if they think that these people face problems or not. We asked the visually impaired if they face issues while travelling. The statistics gained through this data further strengthened our problem statement as most people agreed with us. Then we gave a brief description of the potential solution we had come up with and asked them if they believe it would be actually helpful in real life or not. To this, most people supported our idea and considered it as a potential solution. We also made a separate report consisting of pie charts and percentages for easy understanding of the survey. The data was carefully recorded and later analysed properly for future studies. We floated an assumption survey form to see the validity of our assumptions. Then we shifted our focus from surveys to interviews to get a better understanding. We planned two structured interviews, one with a person who closely observed a visually blind person and the other with a casual observer. Also, we made sure to get a consent form filled beforehand to avoid any issues in future. We concluded from the interview that most believed, visually impaired face troubles while

travelling and a device that can identify the nearby obstacles can be way too helpful. They also agreed to our idea of having a voice-assisted application for the same. Then with the help of some informal group discussions, we gained more insights and finally started working on the prototyping part.

All these important processes helped us gather data at different levels of designing. The data gathered before the developing process helped us come up with potential solutions to our problem statement. Data gathered during the interviews helped us come up with effective and efficient prototypes and further helped us in our approach towards the problem.





3.) Ideation and Low-fi Prototyping:

After discovering the problem and coming up with the problem statement, we decided to conduct informal group discussions within the group members. We floated a survey form and an assumption form to strengthen our ideation process. Through data gathering and analysis, we concluded that travelling in public transport is tedious and problematic for visually impaired people. Often, they misplace their canes at crowded places .Also devices made in the past either follow the stick approach or some online platform approach. So we decided to build a device based on the LiDAR scanner which will be supported by haptic feedback, gyroscope sensors and breathable bands. The device can scan the nearby surrounding and give directions to the user. It can also help them prevent accidents. Our approach plans to replace the conventional canes/sticks in the longer run. We decided to assist this device with an application that will be a friendly application for visually impaired people. The purpose behind this is to come up with an application that can even work in offline mode. Hence, we decided to add features such as SoC,long battery life, free from Wi-Fi etc. This will enable visually impaired people to travel alone without having to be dependent on online devices or offline assistants. We worked on our low-fi prototyping by coming up with solutions we were facing at every step. We further formed a question set of these problems and every answer to the problem included a specific approach using which we could build frames for every level.

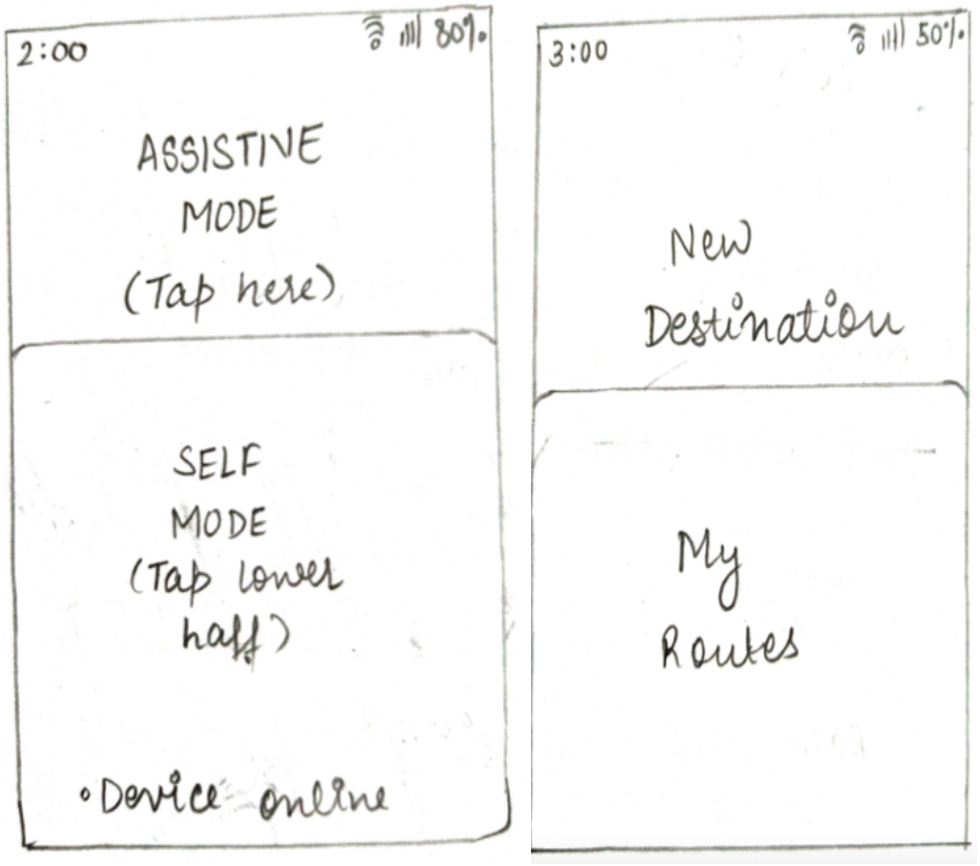
Note*-

1. Lesser options are provided in self mode for convenience so as to remove cluster of options.
2. Frequently used options(Self Mode) are provided at the bottom for convenience of our users.

Format - According to the problems these are some of the low-fi prototype frames that came to our mind(Approach we took to solve these problems).

Question-To create an easy to use navigational app interface for visually impaired people and as well as for normal users.

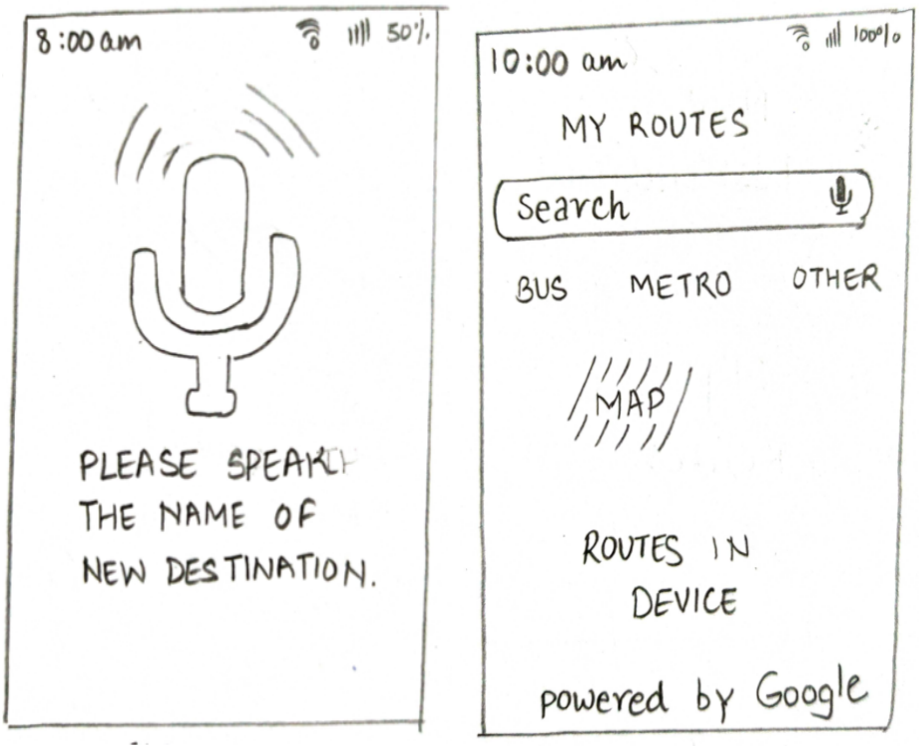
Approach-By providing two modes one is Self mode which is for independent use of visually impaired people and other is Assistive mode if a visually impaired person is taking assistance from someone else.



We are also providing offline features like my routes which will take you to saved routes that are to be used without any internet support and are stored in the device memory.

Question - How is the visually impaired going to search for a destination when they can't see the keyboard on the smartphone screens? And how can a person assisting can search for a destination.

Approach - visually impaired people can search with the help of 'Voice Search' provided in self mode and, person assisting can normally use google search bar and voice search provided in routes section of the assistive mode with quite consistent interface given in every navigational application.

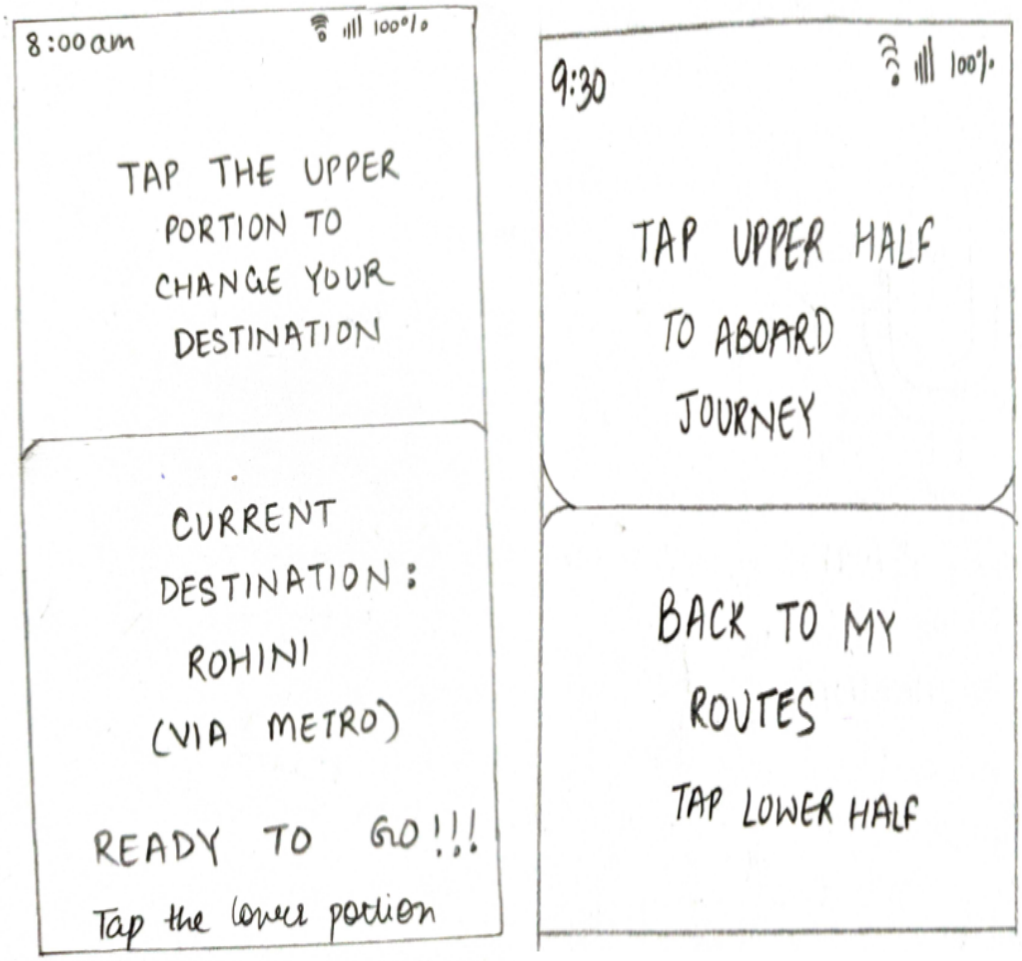


Self mode provides bigger and one tap voice search feature is given for easy use.

Assistive mode contains all primary options like google search bar, already saved routes, route through bus or metro.

Question - How is the user gonna select destination, change destination and navigate back and forth in mobile application?

Approach - as you can see we have given the whole upper half and lower half to use these features and in this way it is easy to remember and operate that even a kid can assist the visually impaired if he/she is unable to find an adult in any situation.

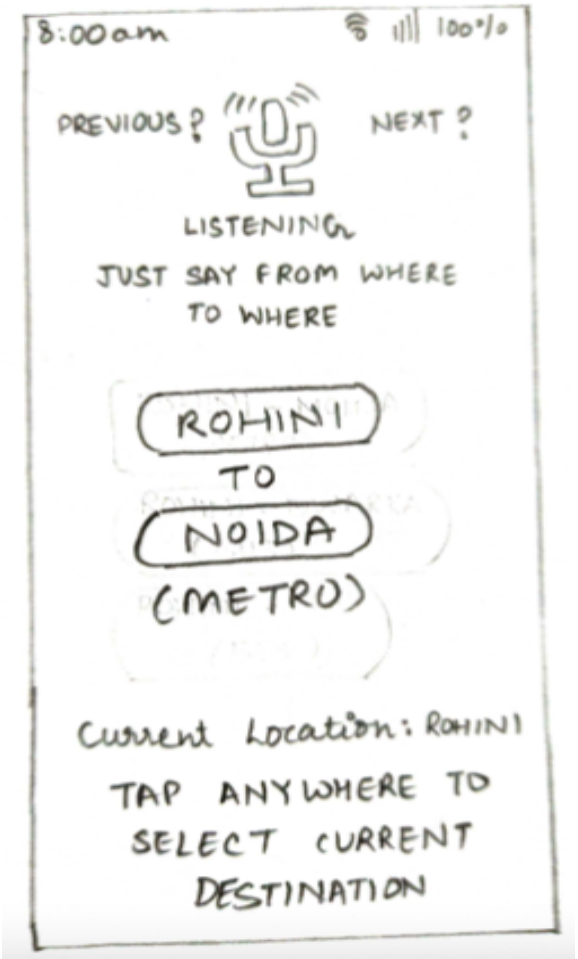


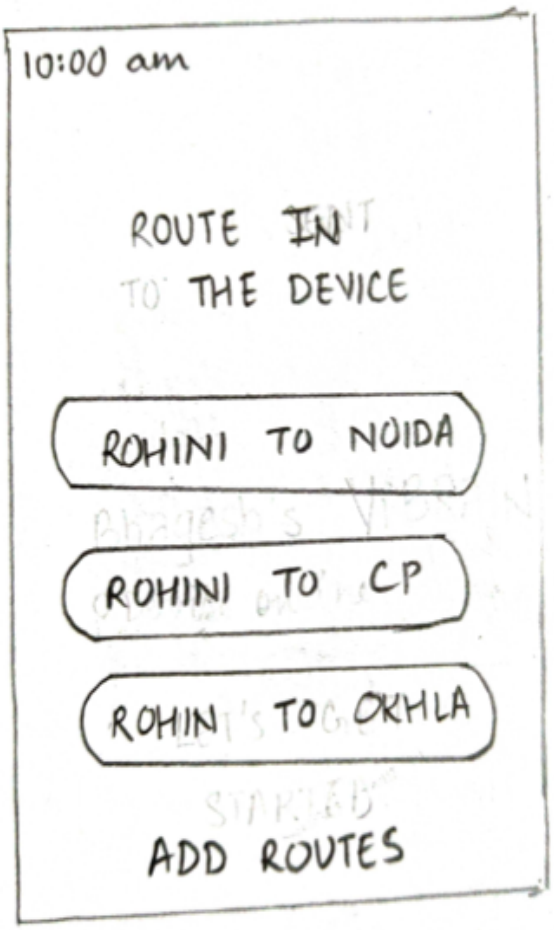
In the first image above half is used for changing the destination and lower half confirming the destination.

In the second image above half is to aboard the journey and lower half for going to my routes in self mode.

Question - How does the user add new routes and access the recently saved routes from the previous journey?

Approach - My routes will store the most frequent and manually saved destinations
Users can access different saved destinations with the help voice commands example ‘Previous destination’ or by calling destination by name.



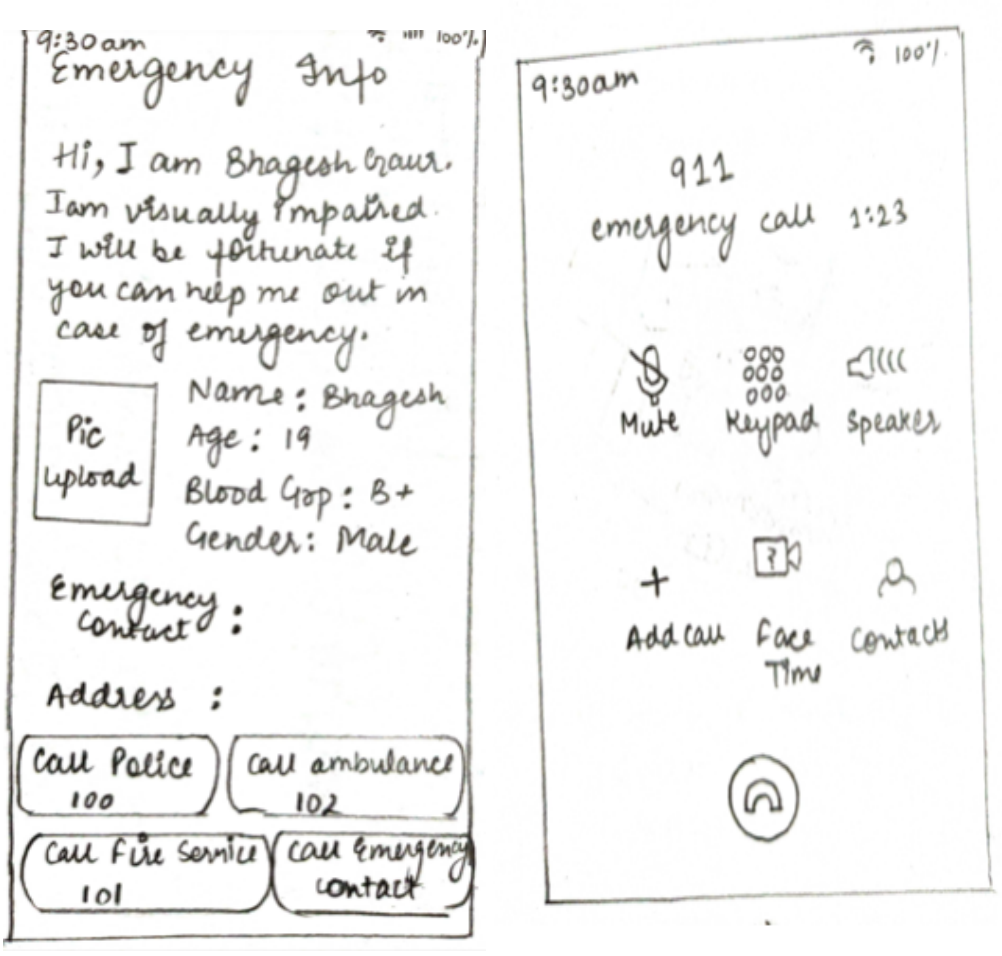


My routes contains an ‘Add Routes’ option for manually adding routes.

After getting the needed destination route, the user can tap anywhere on screen for confirming the destination.

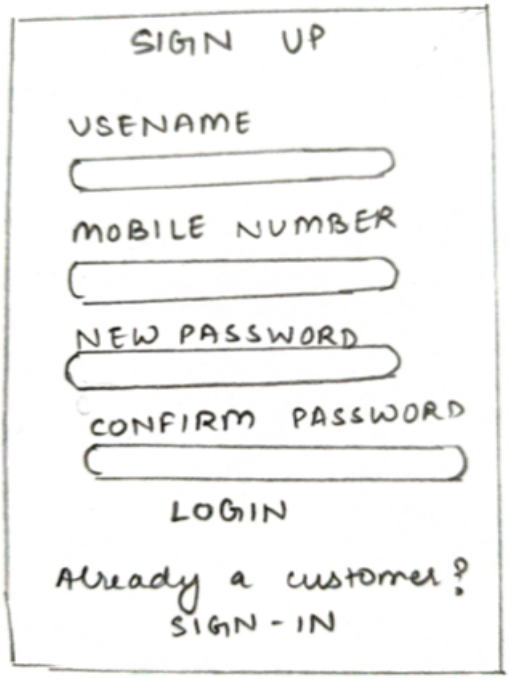
Question - How are we going to ensure the safety of the user if any accidental situation arrives?

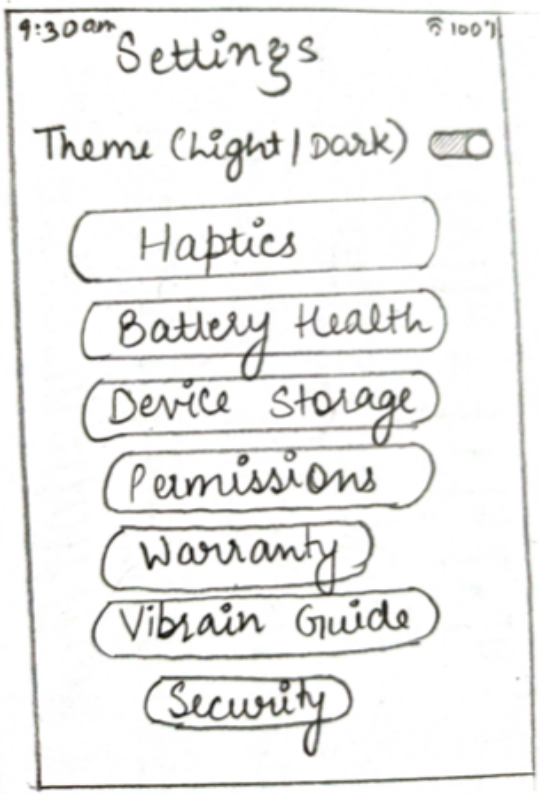
Approach - With one tap emergency call and HELP voice detector in any of the approach, ViBrain itself gonna send notification to numbers feeded earlier for emergency and to nearby emergency staff of state government.

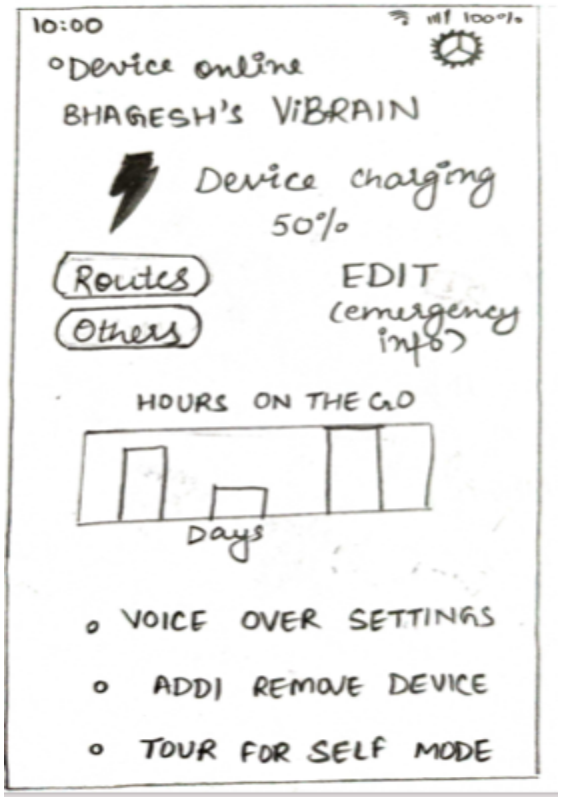


Low-fi images contain already feeded users details and contacts.

These are some of the self explanatory Lo-Fi prototype frames:-







4.) Hi-fi Prototyping:

After the process of coming up with low-fi prototyping, we started working on the high-fi prototype in Figma. We used the low-fi prototypes and pointers from our surveys, group discussions, interviews as the basis for the initial design we started with ViBrain home. The design of ViBrain home itself, displays and defines the overall tone of the application. Being an application for the visually impaired the functionality of the application was more important to us than the visual appearance of the application.

We adopted the two option based approach in Vibrain home and throughout the self mode as it's easy to navigate through, along with appropriate voice-overs. The overall theme of the application was kept dark so darker themes are lighter on the batteries hence increasing the functional time for the device-app use scenario. The self-mode option was kept at the bottom end as the options near the thumb or in the lower part of the screen are easier to select in single-hand use with the device in the other hand. The assistive mode is there for the use of the person who isn't visually impaired and is assisting the user of self-mode and follows the same conventional design as the other applications designed for people without visual impairment.

Similar, two options based approach was followed consistently throughout the self-mode. The frame on the right shows the two options in self-mode, new destination to travel or routes that were already saved in the device for offline use. If the user selects my routes option then they have the option to choose between the saved routes by just saying previous or next after hearing the current route on the screen, if they wish to select it then they need to tap anywhere on the screen.

If the user goes for the new destination option, then they will be speaking the name of the destination and after taking the input, the application will give them two options on the next frame to confirm or give the input again for changing the destination.

All of the functionalities in the self-mode are by default voice-over enabled and use features like always-on microphone for the proper functioning of the application.

Now the route and the travel details are sent to the device and the device status is told to the user. After that, the next frame is the one that gives the user (while commuting) the option to aboard journey and go back to the self mode or go to my routes to select another destination.

If the user drops the device or is involved in an accident, then the application goes to fall detection mode, this happens because of the fall detection functionality added to the device. The user has the option to immediately go to emergency mode if he/she might hac=ve been involved in something more serious. The fall detection mode also sends alerts to the emergency contacts in the application to help give an early message in case of a mishap.

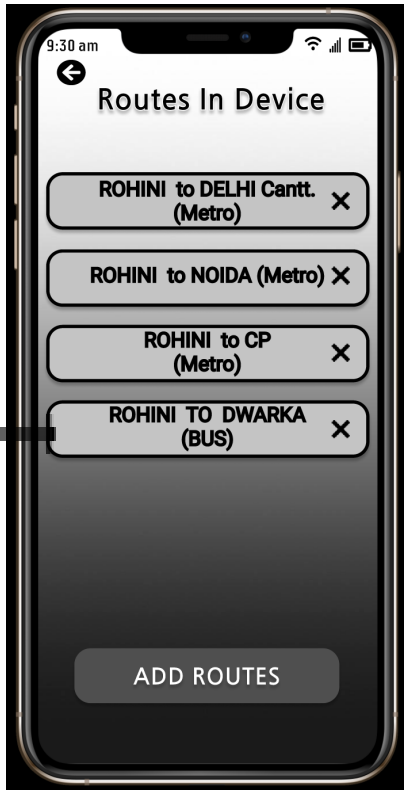
If they choose to go emergency mode then they have an option to again turn it off or make an emergency call by tapping the appropriate half. If they turn it off then they go back to the journey mode to resume or aboard their journey.


9:30 am
ASSISTIVE MODE
Tap Here
ViBrain
SELF MODE
Tap the Lower Region
Device Online


9:30 am
Device Online
Bhagesh's ViBrain
Device Charging
88%
Routes
Emergency INFO
Other Metrics
Hours on the Go
Last 3 Days
VOICE-OVER SETTINGS
ADD/REMOVE DEVICES
Tour for SELF-MODE


9:30 am
Settings
Theme(Light/ Dark)
Haptics
Battery Health
Device Storage
Permissions
Warranty
ViBrain Device Guide
Security


9:30 am
Routes
Search here
Bus
Metro
More
Routes In Device
powered by Google


9:30 am
Routes In Device
ROHINI to DELHI Cantt. (Metro)
ROHINI to NOIDA (Metro)
ROHINI to CP (Metro)
ROHINI TO DWARKA (BUS)
ADD ROUTES


9:30 am
VOICE-OVER SETTINGS
Play-Back Speed
Always-On Listening
Voice-Assistant
Language
Voice-Over History
Voice-Over Demo
Terms of Service

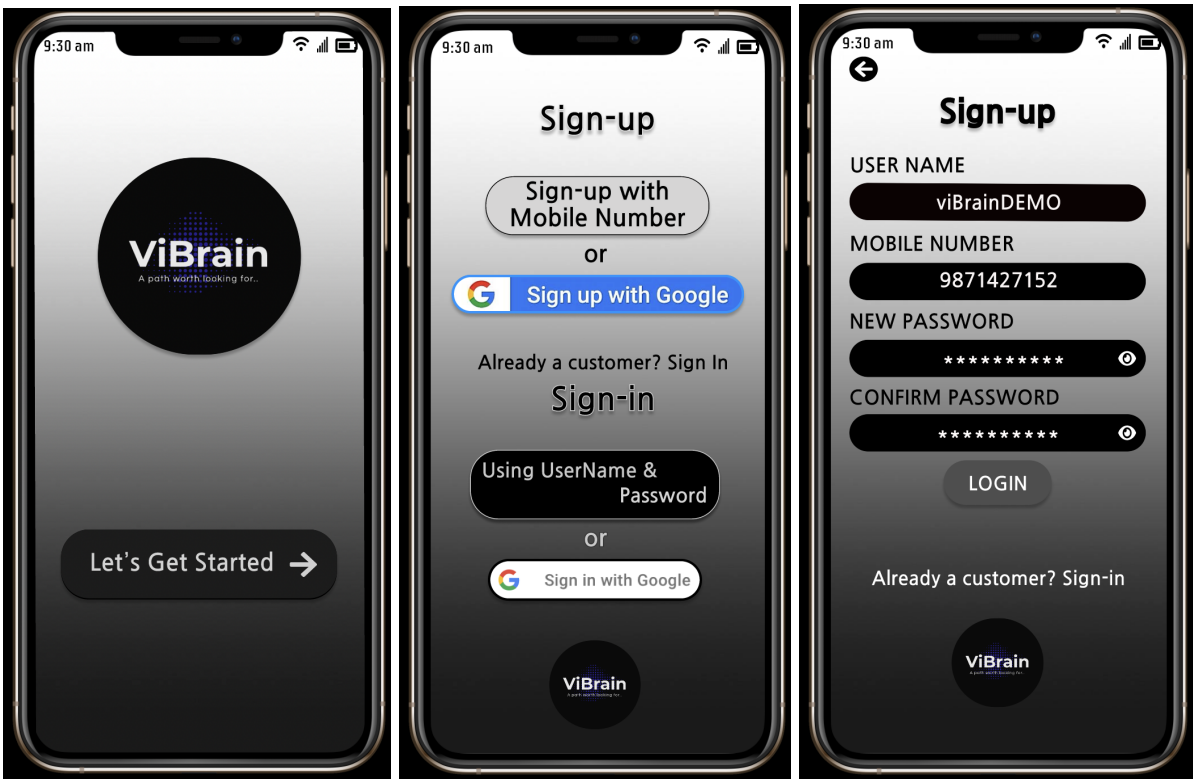
When the user chooses the assistive mode they have many options such as settings, voice-over settings, routes, emergency information, etc. If we click on the settings icon we get options such as haptics, theme, etc. In emergency mode, assistive user can edit the emergency numbers and messages, and similarly for others. It also shows the status of the device connection and battery.

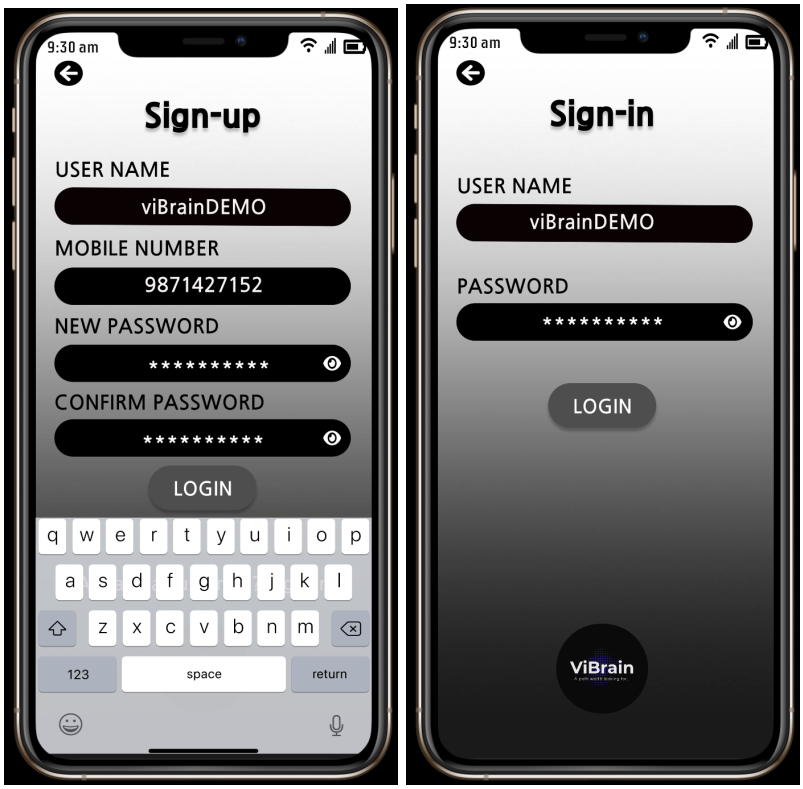
All the features in self mode are voice-over enabled.

As the whole design process is quite an iterative process, we went on with group discussions and surveys and took some really valuable feedback and did some really nice improvements and changes in our design throughout the process. Based on the feedback from our TAs Tharun sir and Riya Ma'am, we went on to implement some more improvements in our high fidelity prototype.

We have implemented a consistent, easy to learn and understand design that serves its purpose in the best way possible. We look forward to improving it further as the iterative loop of design continues.

Some more frames:





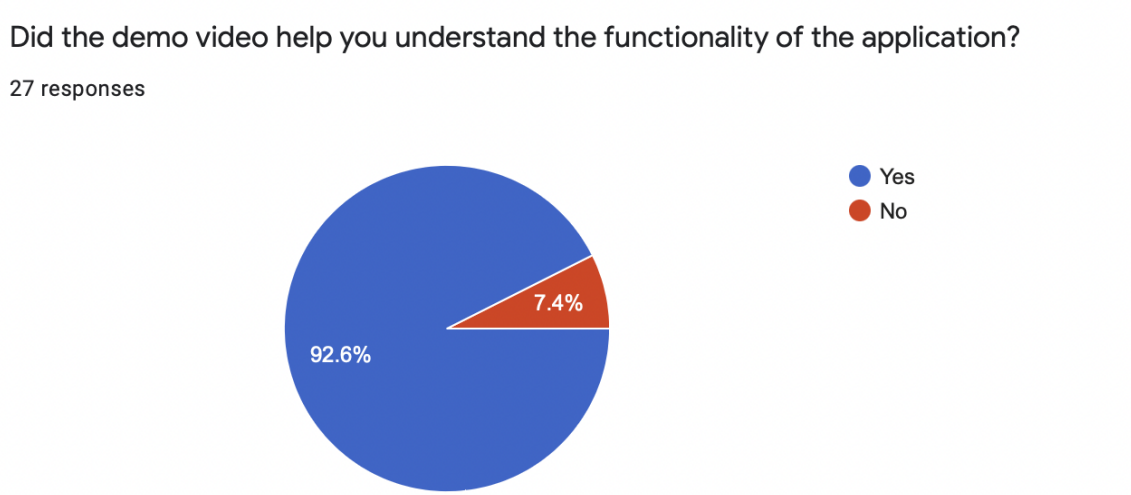
5.) Evaluation:

Evaluation is an integral part of the complete design process. We first decided to conduct a group discussion to understand the pros and cons of our high fidelity prototype. As the group discussion was conducted in the online mode and due to restrictions on the Figma application that we used for high fidelity prototyping, we had to share the screen and add voice-overs using an external feature. The members analysed the application thoroughly and came up with significant opinions and views. They questioned our design patterns for the device and the logic behind using them. They discussed and agreed with our ideas behind that particular design.

They even admired our thought of having fewer options on each frame as more options can lead to confusion for the visually impaired. Other features such as gyroscope for detection, emergency settings were also talked about. Some important questions regarding privacy concerns with the 'always on' microphone service were also raised. We dealt with these issues by giving the user the option to edit history and delete locally stored files. The group discussion helped us reevaluate our solution and prototyping and come up with the final product. This data helped us examine if the application and device were appropriate and acceptable by the crowd or not. It further helped us in exploring alternative approaches to some specific functions. Next, we conducted a small activity where one of our group members had put on blindfolds and then he tested the high fidelity prototype. A proper voice over for each step was played for easy navigation and understanding. We plan to conduct more such activities with the visually impaired to get a better understanding of the application. This activity helped us evaluate obstacles one might face while using the help. Accordingly, we made changes. Lastly, we circulated a survey form that had the link to our hi-fi prototype and we also attached the activity's video for a better understanding of the prototype. More than 95% of the participants found the demo video

(https://www.youtube.com/watch?v=8G76Yl9aVRM) helpful. Almost 80% of them either liked or loved the user interface. 80% of them were able to navigate easily through the prototype and almost 65% of the participants agreed that it will be useful for a visually impaired person. Lastly from the suggestions, we concluded that it is extremely important to take feedbacks about our hi-fi prototype from visually blind people and

conduct ‘demonstration’ activities with them which we plan to do later in an offline manner. These surveys, interviews, group discussions and some activities greatly helped us evaluate our design process and helped us investigate new solutions.



Analysis and Future Work:

Our project ‘ViBrain’ primarily focuses on providing the required aid to visually blind people. Our device can replace their conventional canes/sticks in the longer run. To ease their process of using the device, we planned to build an application absolutely based on voice overs. This application alleviates the stress of using a device. We conducted a survey before the start of the process to examine the feasibility of our idea. Most participants not only agreed with our idea but also gave some relevant feedback. Given it was one of the most important surveys, we did a detailed analysis of it.
(https://docs.google.com/document/d/1ng0_I2-DL00AJHnWNWN-UT-__cWw1aueOSsjWyagHx0/edit?usp=sharing)
Participants believed that it sometimes becomes way too difficult for visually impaired people to travel alone especially while boarding and deboarding metros. It resonated with one of our group member’s experiences. Furthermore, participants also believed that a technology-based device would be really helpful for blind people. Thus, we started working on our ideation process and finally came up with a low fidelity prototype for the device and for the application. We later conducted interviews. Interviewees liked the idea of our device and application and gave some really helpful feedback like using fewer options on a screen.The detailed analysis of the

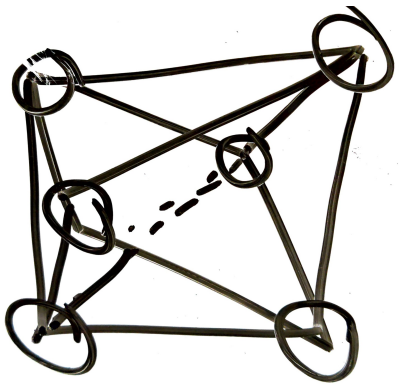
interview further helped us in exploring prospective approaches to the same problem like the addition of an emergency frame in our prototype etc. (https://docs.google.com/document/d/1bVBqIHglQRBPkPR5WUZCv2F3tKRPqr7kjmR1Byr8TXc/edit?usp=sharing)

We also floated an assumption survey form to see the validity of our assumptions. (https://forms.gle/j9ifvipnYSwJuYR9A)

Luckily most participants were satisfied with our assumptions so we decided to bring those assumptions into practice. Taking important notes from all the gathered data, we worked on a hi-fi prototype. After doing multiple surveys and informal group discussions, we analysed that our application can raise privacy issues so we decided to add more features of clearing history, deleting locally stored files etc. Also, we interpreted from the recordings that we should add more frames of similar kinds for easy navigation. After completing the high fidelity prototype, we conducted formal group discussions and floated a survey form. Both of them gave us needful insights into our prototypes. We implemented those changes like we worked more deeply on the voice-overs, added extra frames resolving the issues raised by the participants and were finally able to come up with our final prototype for our application.

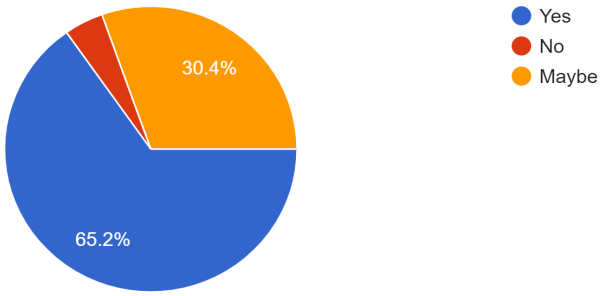
In future, we plan to work on our device and its features like haptic feedback, gyroscope sensor and breathable band etc. Our goal is to soon build this device under the guidance of Prof. Shah and our mentors and conduct several real-world tests, especially with visually blind people to see the feasibility of the device. We also wish to re-evaluate the working of our device after every stage so as to overcome drawbacks if any found in our final prototype. Working on the application is also essential and bringing continuous improvement is an important aspect we would like to work on.

Finally, we wish to serve our target audience with the most useful device and application.



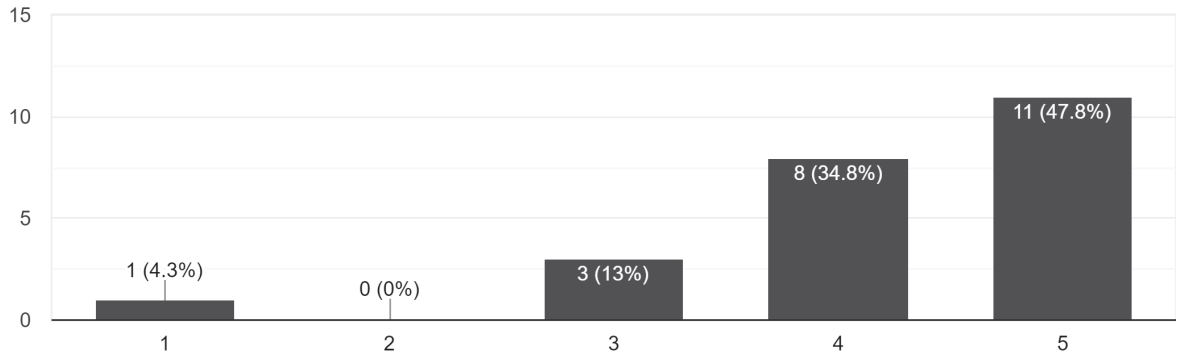
Do you think that it's useful for a visually impaired person?

23 responses



How would you rate the overall User Interface?

23 responses



Conclusion:

The group members came up with a prospective and potential solution to a commonly faced problem by visually impaired people that are travelling via public transport especially in thick crowds.Our device ViBrain aims to replace conventional sticks. The LiDAR scanner in the device can easily map the surroundings and through proper settings, it will be able to warn the user before a mishap. It will be even assisted by an application which can run even in offline mode.The application will consist of basic user information for emergency, will alert the user via sounds if the device falls and will help him travel easily with the help of voice overs. Features such as self and assistive mode will be provided.Furthermore users will be able to select routes and add new routes at any point of time. Navigation through the app will also be easy as most frames have not more than two options so that the user does not get confused. Also, the application will work even in offline mode and additional features such as SoC, long battery life, free from wi-fi etc only add to its value. This combination of device and application focuses on ending their sufferings and making them independent. After doing a lot of surveys, interviews and group discussions, we could finally make a high fidelity prototype for the application. We plan to work more on device and application and bring changes if required to serve the target audience in the best possible manner.

Our Team:

- **Bhagesh Gaur**
- **Sejal Kardam**
- **Sidhant**
- **Vasu Khanna**

Thank You..

Rajiv Ratn Shah

We are grateful for the support and guidance of Prof. Rajiv Ratn Shah.

References:

- https://velodynelidar.com
- https://www.google.com/imghp?hl=EN
- https://www.youtube.com/watch?v=wBRBvErdL1I
- https://www.youtube.com/watch?v=09_QxCcBEyU
- INTERACTION DESIGN beyond human-computer interaction