NAVIGATIONAL SYSTEM FOR VISUALLY IMPAIRED PEOPLE

FOCUSED ON SIGNAGE DESIGN

Semester Project II

Guided By
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Visual Communication Design
M.Des (2015-2017)

Industrial Design Centre
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Semester II Project Report

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APPROVAL SHEET

The Visual Communication Design Project II entitled
“Navigation System Design for Visually Impaired People”
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DECLARATION

I declare that this written document represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources.
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Abstract

Signages are important to daily life. It gives us directions, signals, warnings, and introduces places/buildings. Without the signboards, it will be difficult to navigate in the city. May be one can manage by the architectural mapping but the people with the visual impairment can't see architectures/ buildings to navigate. For them, it is necessary to get signals to navigate in any form of communication which they can access through other senses except visionary. In the lack of signages people with the visual Impairment rely on other people. And because of this, many cases of rapes occurred with visually impaired. If they could know where they are going and which is the place they are standing could help them. This project done to address this problem. One mobile app and a Tactile tile was designed to give signage information. To map all signages beacon technology is considered with the incorporation of google developed to incorporate with tactile pavements to indicate the location of signage.

Motivation

Navigation is one of the most common of everyday activities. We do navigate through signage, Compass, Maps, apps. Among these, people frequently use signboards. Signboards feed us a variety of information throughout the day. Signboards make our navigation easy. But today, Signboards only stand for sighted people. There is no system to make signage accessible to visually impaired except braille signboards. But to locate braille signage, there is no system developed yet. And this is the scope for this project. Number of users are significant. This project is an attempt to design a navigation system to make signage accessible to the visually impaired. The problem is not that braille signage design is bad or not working but the problem is in locating them.There are several apps out there to give navigation and some of the apps claim to give signage information too. While It was studied, those apps have several problems: every app's UI/UX was designed as if they are for sighted persons. Every app included voice command and screen readers that alone can't solve the problem. The voice control can't work in noisy places, there has to be a touch interface to navigate through the screen.

While I was designing the app system, I found out some limitations of this solution. That this app is going to work on mobile phone. which is going to run on power and that it will be a device, and will need to be carried. One may forget to carry a device and it can run out power. The main problem is that not every person is capable of buying mobile phones or not comfortable with using them too. So The tactile tile is designed to give signals whenever signboards will come. These signboards are Braille printed and installed nearby the tactile tile. There is no technology in it, so no need of power and device to access the tactile tile.

There is incidents of misguiding and harassment cases with the people with Visual Impairment.

Case 1

It was supposed to be the start of a new life, but after moving to Stevenage Old Town in Hertfordshire last November, I found myself a target of haters and abusers in public. I still don't know why.

It began with a group of young lads attempting to guide me in to a lamppost before laughing and running away. Not long afterwards, the situation grew worse, with groups of mainly younger males circling me, swearing, and in one harrowing case, telling me they were filming for YouTube.

Source; https://www.theguardian.com/commentisfree/2014/may/12/victimised-blind-body-worn-cameras-abused

Case 2

A 19-year-old blind woman was raped Wednesday (March 16, 2005) night by a man who offered to guide her after she got off at the wrong subway stop in Queens, the police said yesterday.

The woman, who can see only bright lights and some colors, and walks with a white cane, got off at the Jamaica Center stop on the E line about 8 p.m., past the stop she wanted, also in Jamaica.

The police said she told them that a man came up and asked her, "Are you lost?" and "Do you need help?" and she told him she needed to get back to the stop she missed.

The man said he was going to escort her to an elevator in the station, but instead guided her to a dark, shadowy area and held a sharp object to her neck.

He said, "Don't be frightened, I won't hurt you," according to the .

police, before pinning her against a wall and raping her. The man then fled.

A woman later approached the victim and helped her get back on the E train to her intended stop

The woman told her roommate what had occurred and the roommate called the police about 24 hours after the rape, the police said. She was taken to a hospital, where doctors said she had suffered injury to her pelvic area.

The police said that the woman estimated her assailant to be about 5-foot-5.

Even without witnesses, detectives said they were hopeful that they might be able to identify the attacker, using a DNA sample from the medical exam performed at the hospital.

A detective involved in the case also said that videotape from surveillance cameras at the station may yield a photograph of the suspect.

Source; http://www.nytimes.com/2005/03/19/nyregion/blind-woman-is-raped-in-subway.html?_r=0

There Is lots of other cases of rape by misguiding the visually impaired.

Goal

Goal of the project is to make visually impaired confident to move around without hesitation. By making Signage accessible to visually impaired.

Design Process

The classical design process for this project would be to conduct the secondary study, primary study, generate insights and design ideas,prototype and then evaluate the best ideas. Based on the theoretical understanding of the project, evaluate ideas heuristically and theoretically. Then to finalize upon an idea based on the evaluation.

Secondary study

I read guidelines and standards in the field of developing barrier free environments. Published in *"Harmonized Guidelines and Space Standards For Barrier Free Built Environment for Persons with Disability and Elderly Persons"* (February,2016) by Govt. of India, Ministry of Urban Development.

Under the walks and paths These guidelines are set for the people of vision impairment

.

-Texture change should be provided for persons with vision impairment in walkways adjacent to seating by means of warning tactile paver's.

-Avoid gratings and manholes in walks.

Tactile paver's: guiding & warning blocks

Tactile guiding blocks (Line-type)

This block indicates a correct path/route to follow for a person with visual impairment. It is recommended to install one/two rows of tactile guidance tiles along the entire length of the proposed accessible route. Care must be taken to ensure that there are no obstacles, such as trees, poles or uneven surfaces, along the route traversed by the guidance blocks. Also, there should be clear headroom of at least 2.1 meters height above the tactile guidance blocks, free of protruding objects such as overhanging tree branches and signage, along the entire length of the walk.

Source; Harmonized Guidelines and Space Standards For Barrier Free Built Environment for Persons with Disability and Elderly Persons" (February,2016) by Govt. of India, Ministry of Urban Development.

Tactile Paving:

Tactile paving (also called truncated domes, detectable warnings, Tactile Ground Surface Indicators, detectable warning surfaces) is a system of textured ground surface indicator found on footpaths, stairs and train station platforms to assist pedestrians who are blind or visually impaired.

Tactile warnings provide a distinctive surface pattern of truncated domes, cones or bars detectable by long cane or underfoot which are used to alert the visually impaired of approaching streets and hazardous surface or grade changes. There is a disagreement in the design and user community as to whether installing this aid inside buildings may cause a tripping hazard.

Originally instituted at pedestrian crossings and other hazardous road situations by Japan, the United Kingdom and Australia, the United States picked up the standard in the early 1990s, after passage of the Americans with Disabilities Act (ADA). Canada started incorporating them into transportation first in the 1990s, and then added them to other aspects of the built environment in the early 2000s.

Source; https://en.wikipedia.org/wiki/Tactile_paving

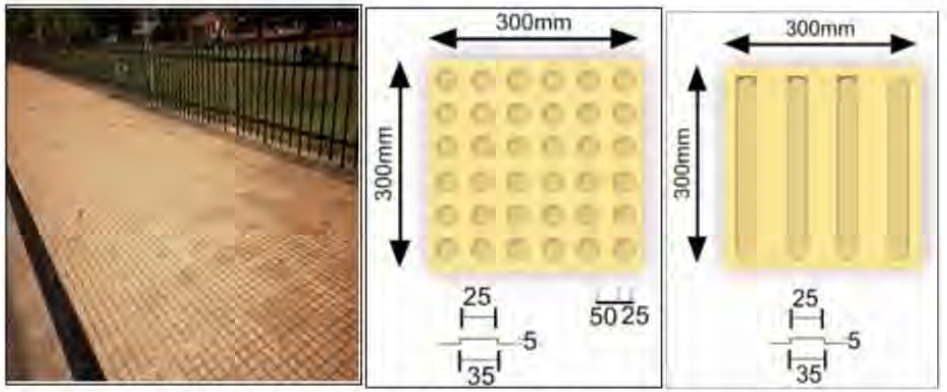

Figure 5-1: **Chequered tile on footpath** Figure 5-1: **Warning blocks** Figure 5-3: **Guiding blocks**

Source; Harmonized Guidelines and Space Standards For Barrier Free Built Environment for Persons with Disability and Elderly Persons" (February,2016) by Govt. of India, Ministry of Urban Development.

5.1.3 Tactile pavers: guiding & warning blocks

This block indicates a correct path/route to follow for a person with visual impairment (Figure 5-3). It is recommended to install one/two rows of tactile guidance tiles along the entire length of the proposed accessible route (Figure 5-1). Care must be taken to ensure that there are no obstacles, such as trees, poles or uneven surfaces, along

the route traversed by the guidance blocks. Also, there should be clear headroom of at least 2.1 meters height above the tactile guidance blocks, free of protruding objects such as overhanging tree branches and signage, along the entire length of the walk.

5.1.3.2 Tactile warning blocks (Dot-type)

This block indicates an approaching potential hazard or a change in direction of the walkway, and serve as a warning of the approaching danger to persons with visual impairments, preparing them to tread cautiously and expect obstacles along the travel path, traffic intersections, doorways, etc. (Figure 5-2). They are used to screen off obstacles, drop-offs or other hazards, to discourage movement in an incorrect direction, and to warn of a corner or junction. Two rows of tactile warning tiles should be installed across the entire width of the designated accessible pathway, before intersections, building entrances, obstacles such as trees, and each time the walkway changes direction (Figure 5-4). Warning blocks should be placed 300mm at the beginning and end of the ramps & stairs, at landings and entrance to any door.

- Texture change should be provided for persons with vision impairment in walkways adjacent to seating by means of warning tactile pavers.
- Avoid gratings and manholes in walks.

Source; Harmonized Guidelines and Space Standards For Barrier Free Built Environment for Persons with Disability and Elderly Persons" (February,2016) by Govt. of India, Ministry of Urban Development.

Source; *http://www.archiexpo.com/prod/viakan/product-68159-1290003.html*

Tactile Pavements

Tactile pavements or Braille pathways are the same. This is one kind of navigation system for the Visually Impaired. This includes two types of tiles, one is to walk straight, and other is to indicates intersections and stairs.

Source; *https://grittechnologies.com/tactile-paving-for-visually-impaired/*

Block Indicates "Go"

Block Indicates "Stop"

Guidelines are already made to make the tiles or to apply them into the environment. The bump (raised part of the tile), the size of the dots and stripes, all these standards are per-defined.

Braille Signage

Braille signage are becoming popular these days. We can see them on toilet doors mostly to indicate the toilets for men and women. But in other countries its can be seen on other places too.

Example :

Source; *http://www.archiexpo.com/prod/moedel-schilderfabrikation-gmbh/product-119551-1269695.html.*

Source; *http://www.orissadiary.com/CurrentNews.asp?id=43245.*

Source; *http://universaldesignaustralia.net.au/2015/12/.*

Source; http://cmbrailleservices.com/tag/braille-signs/.

These signage are serving the purpose gracefully in terms of perceivability. But in the terms of accessibility, there is no system which can help them to locate these signboards.

10.4.3 General Station Interiors

- There should be a tactile layout map of the station with Braille and audio labels placed at the entrance. Tactile map should be marked by floor tactile guidance for persons with visual impairments to access it.
- The lobby/corridor width should be at least 1800 mm.
- The floor surfaces should be non-slip and level.
- There should be directional signs indicating all the facilities and the various platform numbers.
- The signage should also be displayed in Braille/raised numbers to aid people with visual impairments.
- Guiding and warning blocks should be installed on the corridors/concourse.
- Stairs should comply with Section 7.3.
- Lifts should comply with Section 7.4.
- All the audio announcements should be supplemented with visual information displays for people with hearing impairments.
- Seating areas should be provided at regular intervals for people with ambulatory disabilities.

Source; Harmonized Guidelines and Space Standards For Barrier Free Built Environment for Persons with Disability and Elderly Persons" (February,2016) by Govt. of India, Ministry of Urban Development.

Papers read

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Voice Based Navigation System for Blind People Using Ultrasonic Sensor

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Abstract: As the technology is advancing day to day, the human machine interaction has become a must in our daily life. The interference has progressively become more important and advanced in order to ease the interaction process of the user and provide friendly operation. There are a few advanced technologies which are now accessible in the market to cater the needs, yet they have their own particular drawbacks, thus one of the efficient solutions is to use an embedded system. The primary objective of this work is to permit blind persons to explore autonomously in the outside environment. Ordinary route navigational systems in the outdoor environment are expensive and its manufacturing is time consuming. Blind people are at extensive drawback as they regularly do not have the data which is required, while passing obstacles and dangers. They generally have little information about data such as land marks, heading and self velocity information that is crucial for them to explore them through new environment. It is our conviction that advances in innovations could help and encourage these blind people in their regular operations. This work goes for giving the route to blind persons, by designing a cost – effective and more flexible navigation system. Here we are developing a navigation system that makes use of sounds in order to provide navigation instruction to the user. The conversion of speech into a text is done by a pocket sphinx and Google API, whereas the text to speech conversion is done by Espeak and here we are trying to convert the speech into an Indian language (Hindi). Route navigation is taken care by a Raspberry pi. The route questions queries of the destination location are geocoded utilizing Geo-coder module and then passed to Espeak (text to speech) module to create a pedestrian route. The user can include the location by talking into a microphone connected to raspberry pi. The whole system is mounted to a pack that sits on the client waist. It is light and convenient and it doesn't obstruct any of the client's detects while it is being utilized.

Keywords- Espeak, GoogleAPI, Pocket sphinx, Raspberry pi, ultrasonic sensor, GPS, Geocoder, Reverse geocoder.

*****

I. INTRODUCTION

A. *Background*

There are approximately 38 millions of people across the worldwide mainly in developing countries who are blind and visually impaired, over 15 million are from India. Blind persons most of the time are withdrawn from the society because they feel that people and the society are prejudiced and they may not be welcomed most of the time .The remarkable achievement, which is the outcome of persistent struggle and hard work between "Anne Sullivan" – the teacher and "Helen Keller "-the blind student resulted in a revolutionary method of learning and communication, which ultimately culminated in the development of Braille language. Blind person do not need pity, but require empathy, so as to mingle in the society and be independent for their routine chores (activity).Hence blind people need an assistive device that will allow blind user to navigate freely and this requirement has become crucial. Most of the blind people depend on other individuals, white cane or guide dogs to travel freely. Currently, there are several visual information that helps visually impaired people to move in a right way (e.g. takes a right direction, take left, move forward, move backward and avoid obstacles,) but they all limit the freedom of the user. Walking securely and unhesitatingly with no human help within urban environment is a troublesome undertaking for visually impaired and blind individuals. The fundamental goal is to give an ease or financially savvy approach that will permit visually impaired individuals to explore freely or independently in the outdoor environment. Based on this real context or condition we focused the work on developing assisting technologies that may help blind individuals bringing them back to the society. Our main objective is to make a compact, self-sufficient system that will permit these blind people to travel through an environment .This voice based route navigation system can provide solution to this problem. This System is based on embedded system and provides navigation instructions to the user by giving audio instructions through speaker which is connected to raspberry pi using a USB jack. This navigation system will detect an obstacle using HC-SR 04 ultrasonic sensor and guide blind person by providing an audio instructions through 3.5 mm speakers.

B. *Motivation*

In order to improve the quality of life for visual impaired or

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Visual Challenges in the Everyday Lives of Blind People

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ABSTRACT
The challenges faced by blind people in their everyday lives are not well understood. In this paper, we report on the findings of a large-scale study of the visual questions that blind people would like to have answered. As part of this year-long study, 5,329 blind users asked 40,748 questions about photographs that they took from their iPhones using an application called VizWiz Social. We present a taxonomy of the types of questions asked, report on a number of features of the questions and accompanying photographs, and discuss how individuals changed how they used VizWiz Social over time. These results improve our understanding of the problems blind people face, and may help motivate new projects more accurately targeted to help blind people live more independently in their everyday lives.

Author Keywords
Blind Users; Q&A; Accessibility; Crowdsourcing; Mobile

ACM Classification Keywords
H.5.m Information Interfaces and Presentation: Misc.

General Terms
Human Factors; Experimentation.

INTRODUCTION
Blind people confront a number of visual challenges every day – from reading the label on a frozen dinner to figuring out if they're at the right bus stop. While many tools have been introduced to help address these problems using computer vision and other sensors (talking OCR, GPS, radar canes, etc.) [18, 16, 6, 5], their capabilities are dictated as much by the state-of-the-art in technology as they are by real human problems. A deeper understanding of the questions that blind people would like to ask in their day-to-day lives may help to direct innovation to solve them.

In this paper, we present the results of a year-long deployment of *VizWiz Social* that provides a new look into the diversity of questions that blind people want answered about their visual environment. VizWiz Social is an iPhone application that lets a blind person take a picture, speak a question they'd like to know about the picture, and then get an answer back within a minute or so from "the crowd" [5]. VizWiz Social has been released "in the wild" since May 2011, and blind users have asked over 40,000 questions since then. Today's technology is targeted at answering some of them, e.g. "What color is this shirt?" and "What does this letter say?" But, others it cannot, for instance, "How many lines are on this pregnancy test?", "What does the sky look like right now?", and "Is my girlfriend hot?"

To help make sense of this diversity, we developed a taxonomy of the questions asked. By outlining the types of questions asked frequently, we hope to improve understanding of the challenges blind people face and help to motivate research into new technology to answer those questions automatically, which would be cheaper and faster. VizWiz Social also provides a rare look into the adoption of an assistive technology over the long term, and how a human-powered access technology [6] affects the user. For instance, do blind people become better photographers as they use VizWiz Social?

VizWiz Social provides insight into a specific but important subset of challenges faced by blind users, i.e., those that can be represented with a still photograph and brief audio description and that can be answered quickly but asynchronously. Other types of challenges, such as those where a user needs help in a situation requiring conveying and/or receiving continuous information, are beyond the bounds of the current study. The pattern – taking a picture and receiving information about it – is also present in much of the automatic technology in use today, and so is a familiar paradigm.

After discussing related work and describing the VizWiz Social application and the data set that we collected through its deployment, we present our analysis of 1,000 questions asked by VizWiz Social users. This unique data set provides insight into the types of challenges faced by blind users and the types of technological solutions that might best address them. We discuss common question types, the nature and urgency of the information being sought, and photographic subjects and quality. We also analyze the behavior of 100 users, to understand what novice and expert interactions with VizWiz Social can teach us about deploying a technology for this audience. We conclude by discussing the implications of our findings on technology design for blind users.

RELATED WORK
Work related to VizWiz Social includes (i) existing mobile access technology used by blind people, (ii) work exploring

CHI 2013, April 27–May 2, 2013, Paris, France.

CHI 2013, Peris, France

Session: Privacy CHI 2014, One of a CHInd, Toronto, ON, Canada

Personalisation and Privacy in Future Pervasive Display Networks

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ABSTRACT

There is increasing interest in using digital signage to deliver highly personalised content. However, display personalisation presents a number of architectural design challenges – in particular, how best to provide personalisation without unduly compromising viewers' privacy. While previous research has focused on understanding specific elements of the overall vision, our work presents details of the first significant attempt at a system that integrates future pervasive display networks and mobile devices to support display personalisation. We describe a series of usage models and design goals for display personalisation and then present Tacita, a system that supports these models and goals. Our architecture includes mobile, display and cloud-based elements and provides comprehensive personalisation features while preventing the creation of user profiles within the display infrastructure, thus helping to preserve users' privacy. An initial evaluation of our prototype implementation of the architecture is also included and demonstrates the viability of the Tacita approach.

Author Keywords

Digital signage; personalisation; privacy; architecture.

ACM Classification Keywords

H.1.2 User/Machine Systems: Human factors.

INTRODUCTION

Large digital displays are commonplace in shopping centres, city streets and other public spaces. Traditionally such displays have acted as a simple broadcast medium with content "pushed" to passers-by with no regard for viewer preferences. However, recent advances in video-based sign analytics[1] mean that display owners are now able to personalise content based on factors such as the age and gender of those in front of the display. This move towards personalised content in the signage industry precisely mirrors the shift towards personalised content that has occurred in the Web.

[1]e.g. Intel® AIM (https://aimsuite.intel.com/)

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Whilst personalisation is often motivated by advertising, within the digital signage domain it offers the opportunity to transform the medium by adding value for viewers who have previously been shown to avoid or ignore digital displays [17]. In everyday life many of us are familiar with the desire to personalise displays around us; perhaps to change the channel in a sports bar, highlight relevant flight details at an airport, see navigation signs in our own language, or simply ensure that advertising content is more relevant. Personalisation of displays offers the potential to transform digital signage from a simple broadcast medium to an interactive system that responds to the needs and preferences of viewers.

Personalised public displays are not a new idea, and a range of usage models have been proposed. Weiser's classic ubicomp article describes the work of Theimer and Nichols [23] who created a public display that "attunes its public information to the people reading it". More recently, researchers have created prototypes in which mobile users can ask displays to show personalised information such as maps, public transit timetables and daily menus from local lunch spots [5] or express their allegiance to local soccer teams [12]. Similarly, appropriating displays, e.g., as an external display to supplement a user's mobile device has also been proposed to support medical experts [3].

In all of the above works, the proposed approaches rely on users passing identity information (either explicitly or implicitly) to the displays that they wish to personalise. What is still missing, is a *comprehensive* system architecture designed to support display personalisation without unduly compromising user privacy, i.e. without allowing a display network to track and profile individual viewers. Our work builds on demonstrations of such a system shown at HotMobile 2012 and Mobisys 2012 [14] and is, we believe the first significant attempt to describe such an architecture in detail.

In this paper, we identify a set of usage models for personalisation of displays and highlight key privacy concerns. We present an approach for designing privacy-aware display personalisation that avoids the creation of profiles within the display infrastructure and demonstrate its viability through a sample implementation and evaluation.

PERSONALISTION USAGE MODELS

We identify three distinct usage models for display personalisation. The most well-known form is *walk-by personalisation* in which viewers passing by a single display see content that is relevant to them (as exemplified in the 2002 film Minority

I used their references for my study. These papers published in very reputed organizations. So the data used in it is trust worthy. I got to know on going projects. Future possibilities in the field of my project. Ultra sonic sensors, personalized displays, challenges in visually impaired life. These three papers were enough to bring understanding to my project.

Personalized displays gave me insight to my project. In future everyone going to have there own signages according to there device and needs. It helped me to think to design a signage system for blinds. Every person going to have their own signage, in their own pocket. I came up to with the idea of filters. One person wants every information and other wants very few. So by activating the filters they can have their choice of data

I studied existing solutions and ongoing projects, read papers in the field of accessibility. I used some of the apps to generate questions for the interview and to find out insights.

Study of Existing Apps:

Ariadne-GPS
BlindSquare
Myway Classic

I read reviews and articles on all the apps. I tried using some apps but It was not working here (IIT).

Blind Square

BlindSquare does not yet offer turn-by-turn navigation.
It only gives the name of streets and announce intersections.
It gives the list of nearby point of interests.
Does not speak all kind of signage.

Ariadne-GPS

The app does not provide information on public POI and does not support turn-by-turn navigation.

Myway Classic

This App enables the recording of routes only. It is not designed to speak Signage. Although it notifies the intersections, and when directions change.

All the above solutions are adding some kind of value to visually impaired people's life in some way. But it is observed that if these apps can be combined, it would be beneficial for the visually impaired. And with some changes and additional features make visually impaired people's life easy in terms of navigation.

Takeaways

Every app have their own specialty in that they are best. So those can be borrowed from them.

Information can be designed in simple but effective manner.

Home page of the app is not used for better purpose.

If a user using the app by touch inputs, it can be playful.

No filters designed to reduce information clutter.

Braille Pathways are doing a good job, but not giving information about signage.

Braille signage is a good solution but it is hard to locate them.

Android Accessibility Standards

Directional controls:
Verify that the application can be operated without the use of a touch screen.
Attempt to use only directional controls to accomplish the primary tasks in the application.
Use the keyboard and directional-pad (D-Pad) controls in the Android Emulator or use gesture navigation on devices with Android 4.1 (API Level 16) or higher.

Note: Keyboards and D-pads provide different navigation paths than accessibility gestures. While gestures allow users to focus on nearly any on-screen content, keyboard and D-pad navigation only allow focus on input fields and buttons.

TalkBack audio prompts:
Verify that user interface controls that provide information (graphics or text) or allow user action have clear and accurate audio descriptions when TalkBack is enabled and controls are focused. Use directional controls to move focus between application layout elements.

Explore by Touch prompts:
Verify that user interface controls that provide information (graphics or text) or allow user action have appropriate audio descriptions when Explore by Touch is enabled. There should be no regions where contents or controls do not provide an audio description.
Touchable control sizes: All controls where a user can select or take an action must be a minimum of 48 dp (approximately 9mm) in length and width, as recommended by Android Design.
Gestures work with TalkBack enabled: Verify that app-specific gestures, such as zooming images, scrolling lists, swiping between pages or navigating carousel controls continue to work when TalkBack is enabled.

If these gestures do not function, then an alternative interface for these actions must be provided.
No audio-only feedback: Audio feedback must always have a secondary feedback mechanism to support users who are deaf or hard of hearing, for example: A sound alert for the arrival of a message should also be accompanied by a system Notification, haptic feedback (if available) or another visual alert.

User Study

The users overall were asked the following questions during the semi-structured interview, although not necessarily in the order shown. Some questions might have been skipped for certain types of users and depending on the context. Each question is a type of a conversation starter to discover deeper problems and ideas in the users' experience. The aim was to empathize with the user and probe into the users' thought process while working on a problem.

Questionnaire

How do you reach your office/workplace/school/home explain in detail ?
This question was asked to check that what is the first decision they took to reach somewhere, what is the thought process worked behind the decision.

How frequently do you go out to random (unfamiliar) places?
This was asked to probe into the user's experience with new places and gain insights about user journey and touch-point.

What kind of places do you prefer to go usually?
This was asked to find common interest of place between users.

Do you use any kind of device or app or system for navigation?
This was asked to know about the effective existing solutions in the current scenario. To know if there are any patterns for navigation.

What, do you wish, was easier in the process?
It was asked to find the immediate pain points that the users themselves could identify.

Other questions that were asked included the following.

Which place you feel is designed for you or make you more independent in terms of navigation?

- Is signage are helping for you?
- Do you hesitate to ask for help to crossing the road/direction?
- Do you felt cheated anytime or do people mislead you?
- How do you manage to walk in the city if there is no assistance?
- Is braille signage serving the purpose? How do you locate them?
- Is braille pathways a good solution for navigation?

User Statements :

It is not tough to navigate in known environments because

I make a mental model of the place and then it is easy to navigate.

I go to random places and it is difficult to navigate in new places. And more difficulties are faced in finding places.

Usually I prefer known places or less busy areas.

I used blind square app. And braille pathways on metro stations.

Wish blind square was free and supported android devices also.

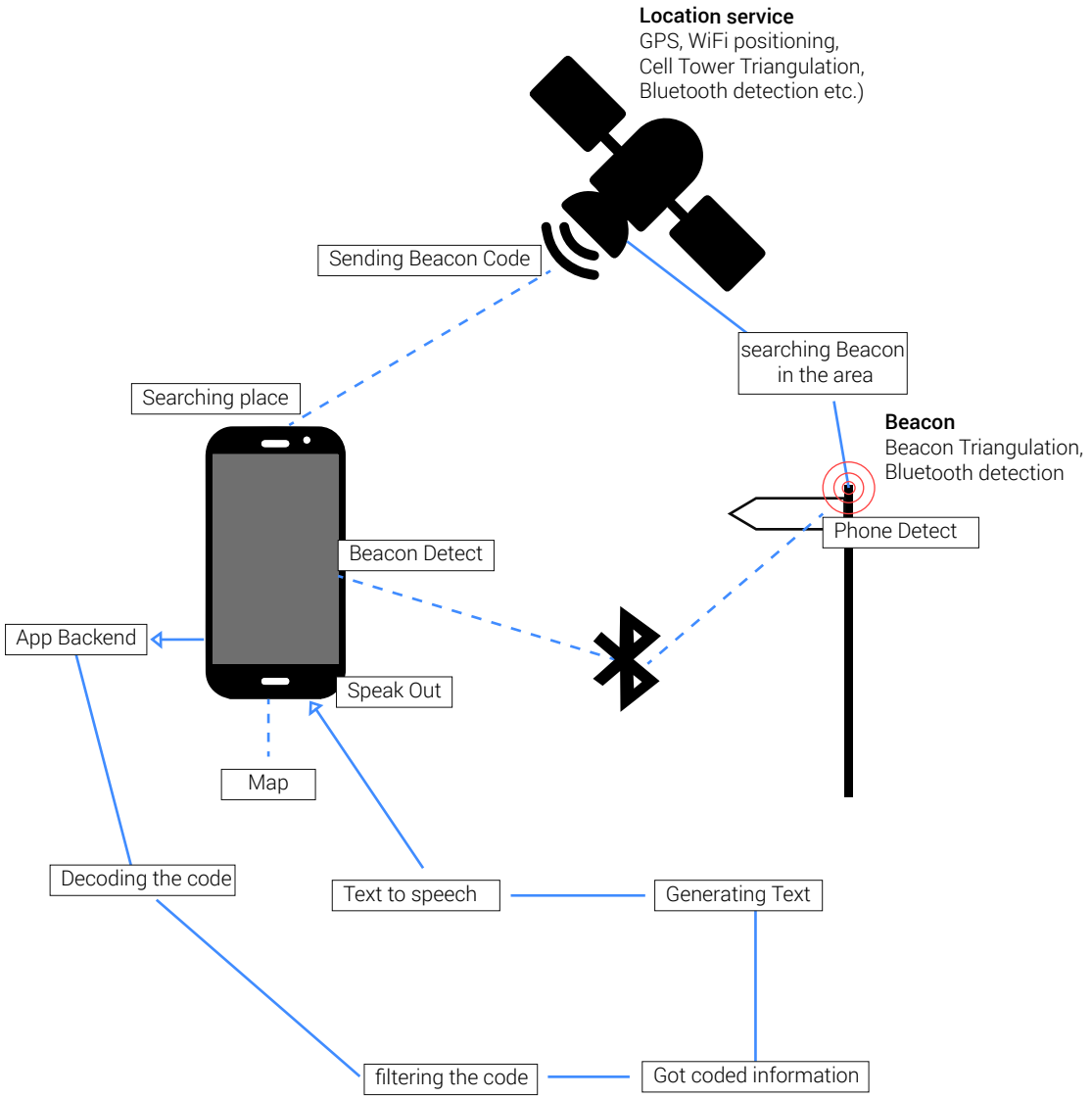
Mostly Apps are full of information. It is easy to navigate in the city than navigating the app.

Redifined Brief and Concept Generation

After primary and secondary study, project lead to the conclusion of Ideas.

The key features are clear at this time, that solution must be audible or tactile. First it was thought that some kind of earphone device can be used to give audible navigation or wrist bands to give vibration signal to notify while crossing any signage, but the problem was that it is going to be just another device. That has to be carried all the time. There are already some devices those can perform the same functions. So why should one add one more thing to carry. So It was decided making an mobile integrated App which can be used in smart watches also. This app can access all kind of signage according to needs.

So how will it work?
It will work by using GPS locations. This App can trace GPS location using mobile phone and then all the signage can be marked with their GPS locations. Whenever a person with the App comes across the location, the App will speak out that tagged information. But in GPS technology, there are some flaws like GPS accuracy being not good enough to give exact location info. It can be wrong sometimes. Also it is almost impossible to give indoor navigation by using GPS technology because of coverage and resolution



issues. But today we have one another technology that can serve the same purpose with accuracy. The technology is “low bluetooth energy beacons”.

To know more about indoor navigation, I read about Sensuslabs (http://sensuslabs.com). It is a startup, working in the field of indoor positioning and navigation. I had conversation with the CEO of the startup over a phone call. They claimed to achieve 3cm accuracy by using some technology which they can’t discuss. But they were very friendly. Although they gave a clue like “we’re using one sensor which is cost 2000/- rupees for one sensor. ”

Then study took a turn into the field of indoor navigation to find out the technology and I came to know about Apple iBeacon. Which Apple talked about in 2013 and now they have made all their mobile devices to detect the beacons technology. Apple is proposing these beacons to retail business.

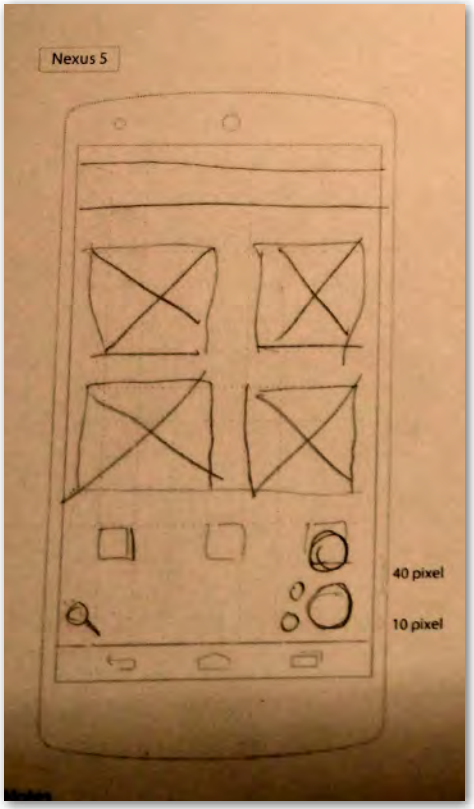
These beacons will be used for advertisements, offers/sale and similar kinds of information. So whenever any apple phone comes in the range the beacon, it will respond with encrypted message. So let’s assume every shop and every mall has these beacons so we can use them. Owner will allow use of their beacons because we are giving information and location of their shop only. Like this, we have to install beacons to every signboard. And then we can have accurate information of every signboard.

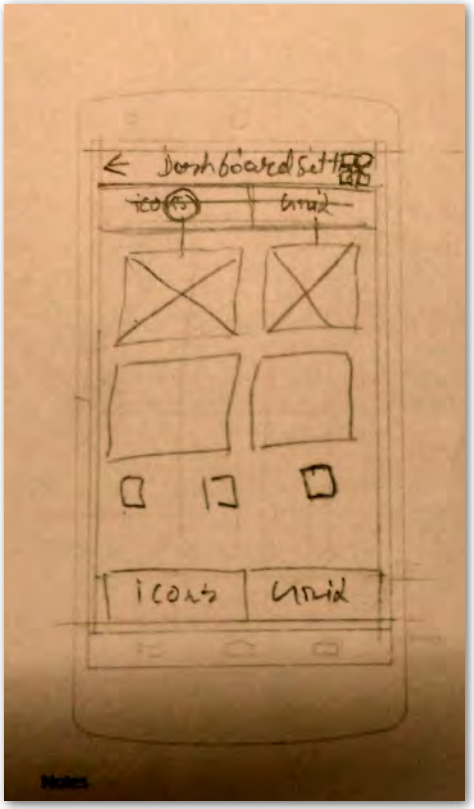
It approves the validation of the project that it can work in real scenario. But the contribution of this project is not the technology part of it. Solution is the concept of the app, how it is going to give information to user what will be that information, and how user is going to use it. In simple words the UI/UX of the app.

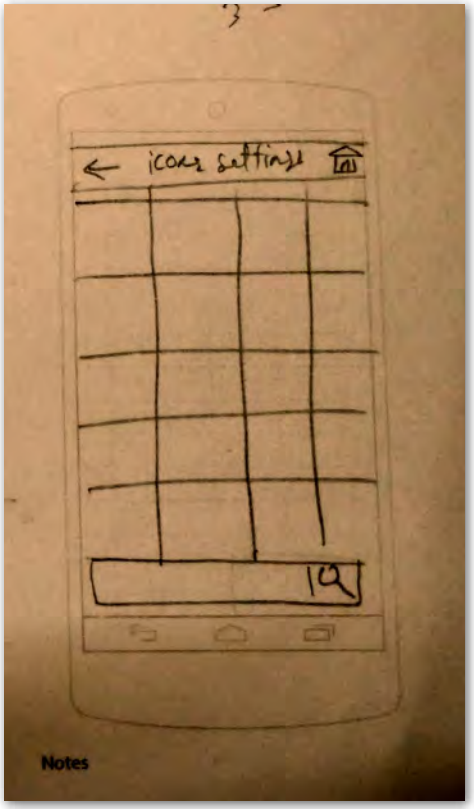
So the App will work on the combination of GPS and Beacon technology. With this App user can seek out signage/signboard, search places, get directions, and add location through audio. There will be filters like Market place, Shopping Mall, Walking on footpath, Traveling by Taxi.

There are quick icons on main screen for frequent tasks. Bus stops, railway stations, metro stations, toilets, etc., Can be those tasks, for example. Add location is an important feature with which user can mark any place to make a virtual signage. Whenever user comes across the same tagged location App will notify her. These marked locations are entirely personal who marked them but she can also share it to all and the new locations are included after automated verification from four close-by users.

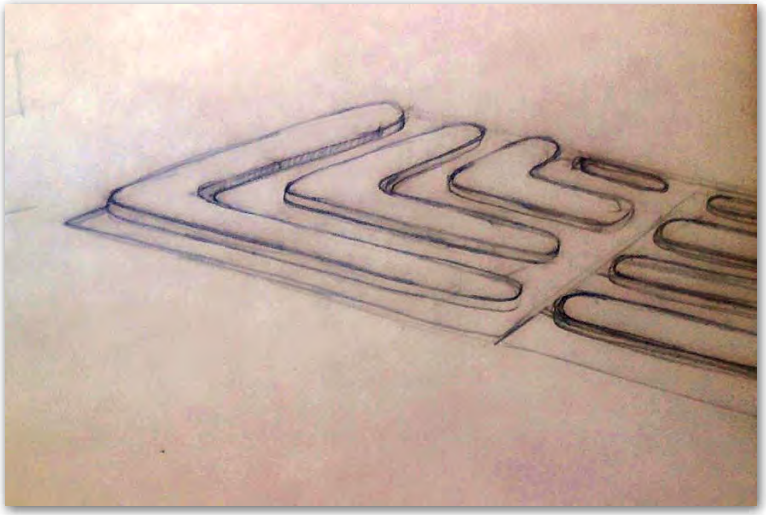
Initial concept sketches

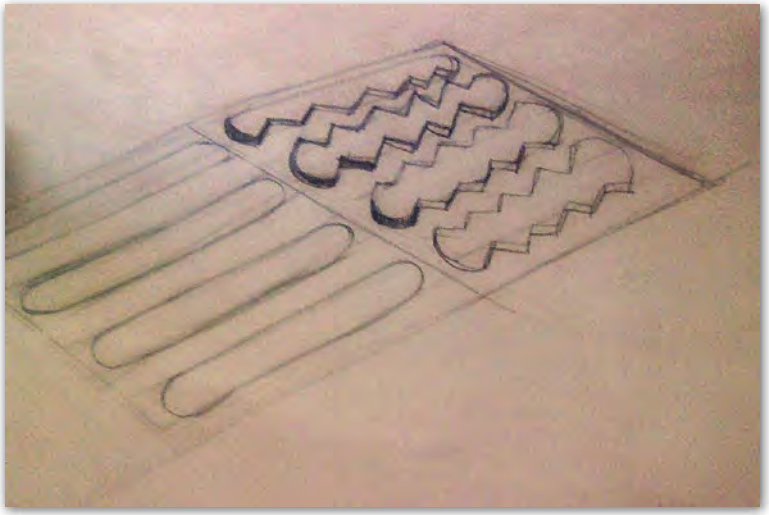






Initial Sketches





These marked locations can be permanent and temporary also. Say, municipal corporation is repairing under- ground wires and digging holes in between the way, it can be marked temporary.

So this App is not just for blind people, it will be helpful to sighted people also in some way. It will tell you near by bus stops and which one is closest. All the dustbins also marked can be searched later via "Near by dustbins." *(In support of Swachh Bharat Abhiyaan).*

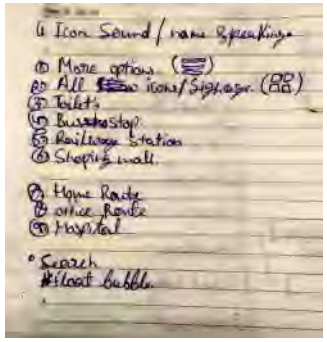
For the Interface there are sounds for every action, interaction micro-interaction, voice feedback, voice control for using the app.

But as we know there are lots of Apps, technology to give navigation to visually impaired person. May be one day someone will design a device which can help them see too. But at the end of the day all these will be the technologies. And to run technology we need power. To make it work we need equipments. When we are using this it will probably be through a device.

Technology solutions can fail, corrupt, and be hacked. Power can be drained and equipment and devices can be stolen or lost. So in that situation what will work? In one hand we are forcing them to be dependent on technologies. These kind of solution will easy their life but also may reduce their practice of other senses.

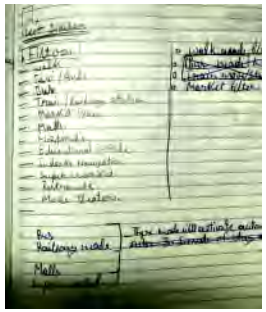
So there should be a solution which can't be failed by virus/corrupting files, don't run on power, can't be stolen, and need not be carried.

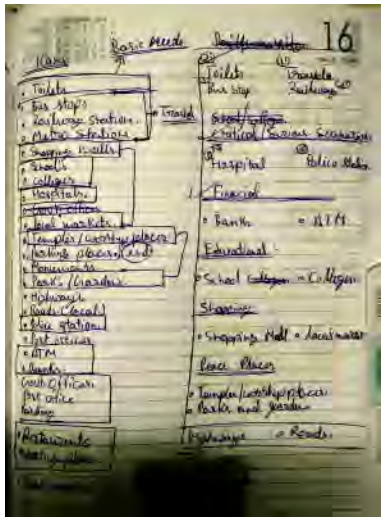
So I am designing a Tactile Tile to add in braille pathways (tactile paving for blinds to walk). Whenever user comes across the X tile. That means, there is braille signage installed in the range so user can touch and sense it easily (let's assume 'X' is the name of the tile).



Initial Chunking and Grouping

Initial visualization of Gestures





Initial Chunking and Grouping

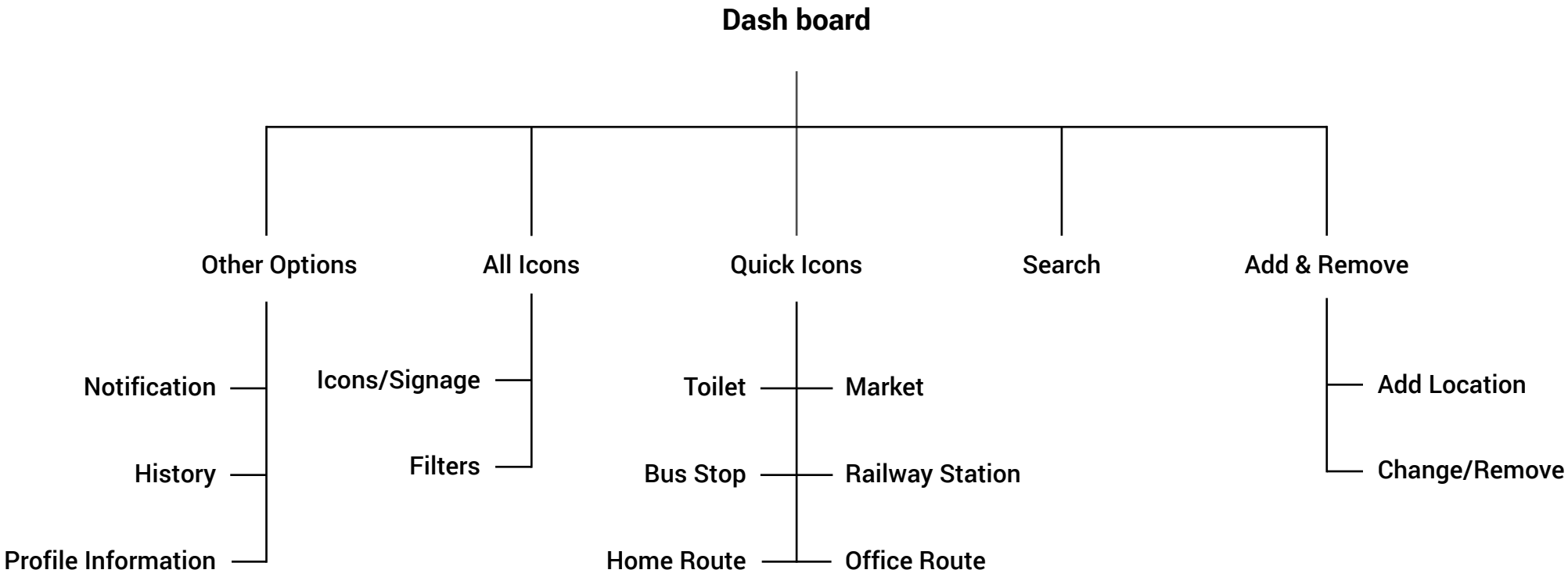
list of Initial key features of the app

Detection of signboards
Navigation to places/signboards
Add location/signboard virtually
Search for places

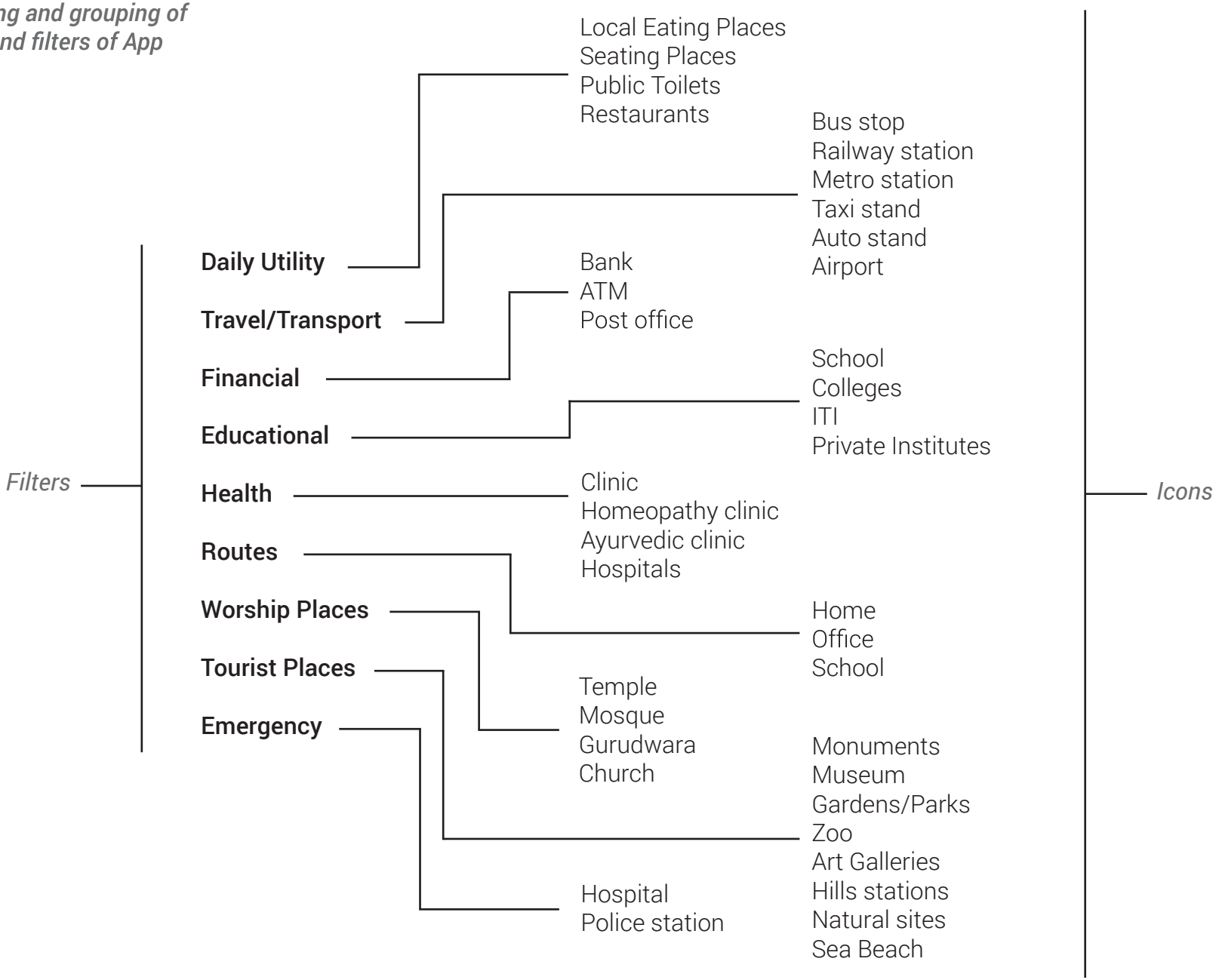
Additional Elements

Filters
Gestures
layout Grid of app
Sound feedback
Location Map
Quick icons
Keyboard
History

This is the Initial list of features.
Some are removed in later concept and some added.


Dash board
Other Options
All Icons
Quick Icons
Search
Add & Remove
Notification
History
Profile Information
Icons/Signage
Filters
Toilet
Market
Bus Stop
Railway Station
Home Route
Office Route
Add Location
Change/Remove

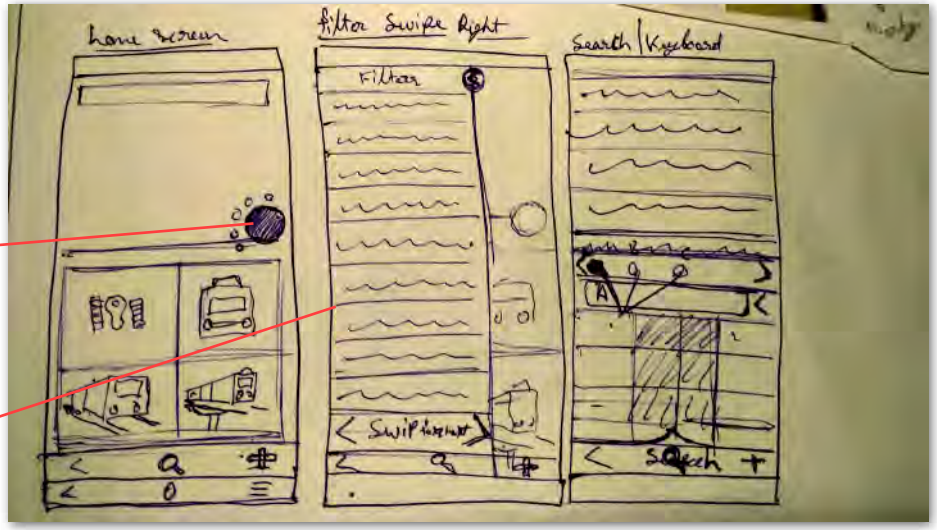
chunking and grouping of Icons and filters of App



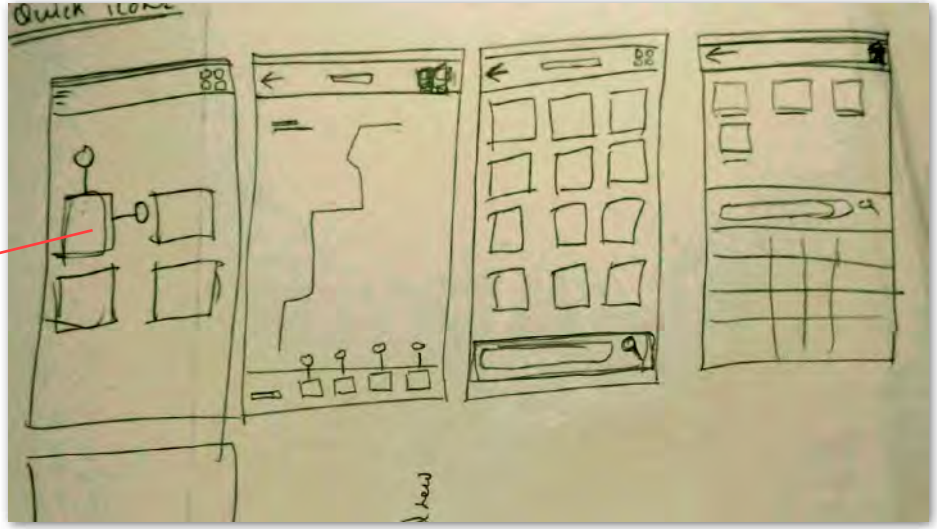
Initial gesture concepts

Tap and hold to listen information

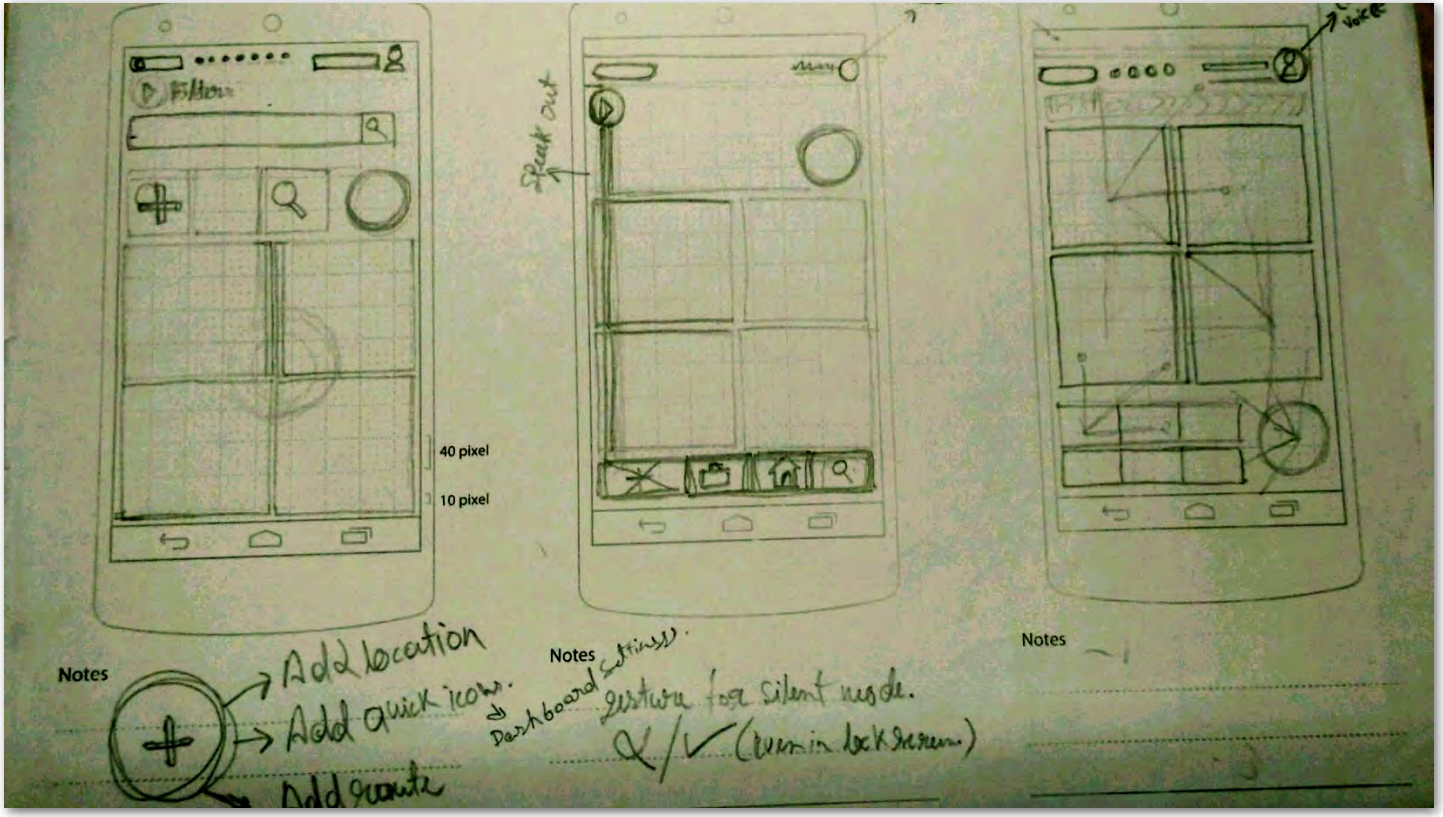
Swipe right for filter



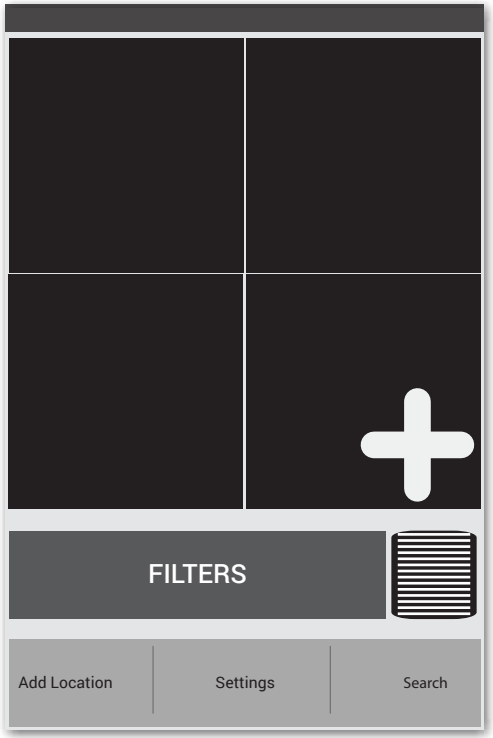
Two options swipe up & swipe right

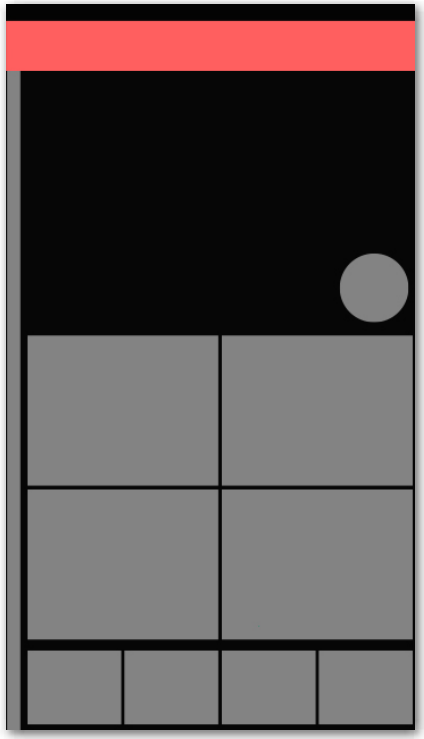


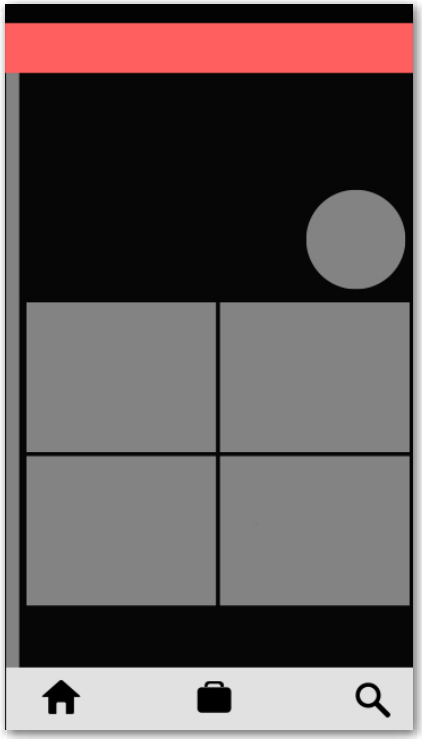
Initial Ideas for home page

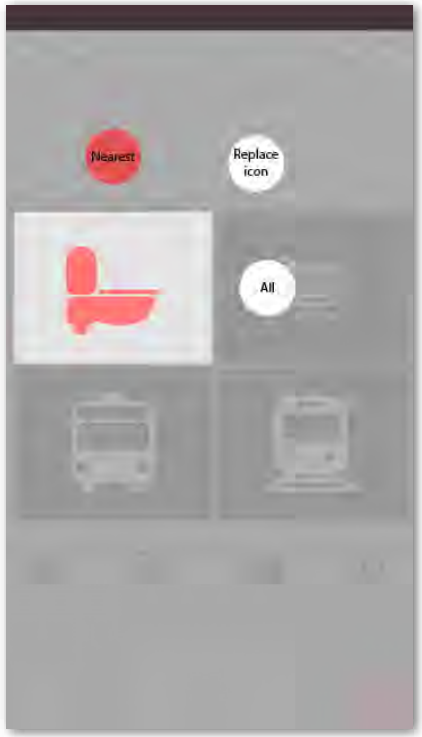


Initial Ideas for home page









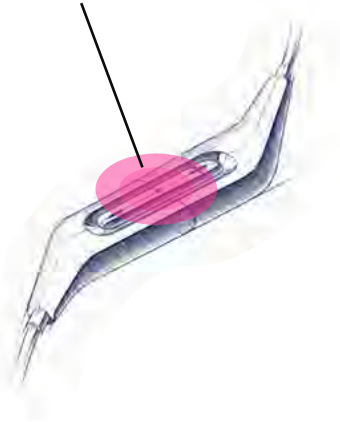
Voice Control

Scenario 1

1.1

Let's assume a scenario, our user wants to go to the toilet and he is walking on the streets of Hiranandani Township. He/she can double tap and hold the lock button/home button of mobile phone or access by earphones call pic-up button by tap once and hold long to give voice command. User need to give command like, " Navi, find toilet" or "Navi' give me directions to nearest and hygienic toilet". There is no specific keywords to give command. App understand Sentences, phrases, words. App figures out what you need exactly.

Tap once and hold long you earphone's call pick-up button key to give voice command



Tap twice and hold long you mobile phone's home button/lock button key to give voice command

Quick Icons

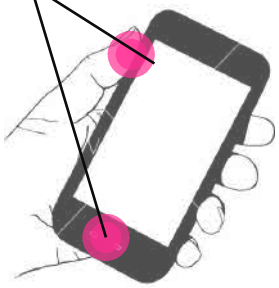
Concept of Quick Icons explained

1.2

Another way of giving command to the app is by navigating through mobile screen. User can access App just by pressing home/lock button twice and holding to open the app (same as the voice command). Then navigate through icons located on mobile screen. Find toilet icon, press and hold to listen or swipe up to get directions.

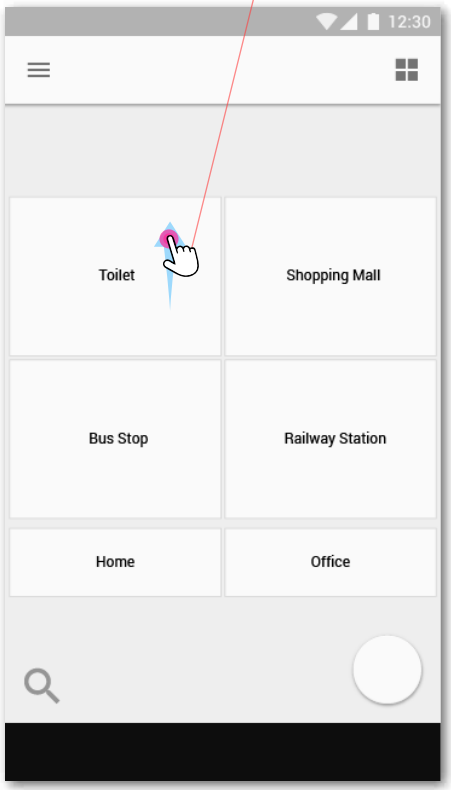
(Mostly select gesture is up swipe in the app)

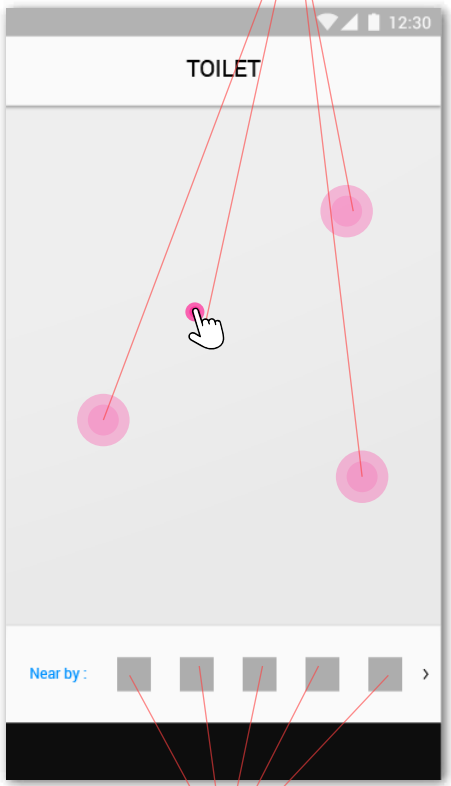
press twice and hold long you mobile phones home button/lock button key to give voice command



swipe up to get directions

Tap anywhere in the screen to know the current position and remaining path. and tap twice to show google map on the screen.





To get directions to the nearby options

Keyboard

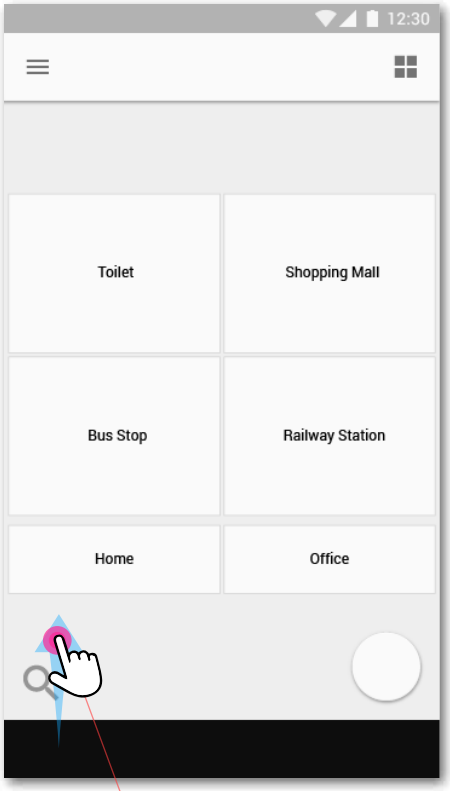
Explanation of Search option
and Keyboard

2.1

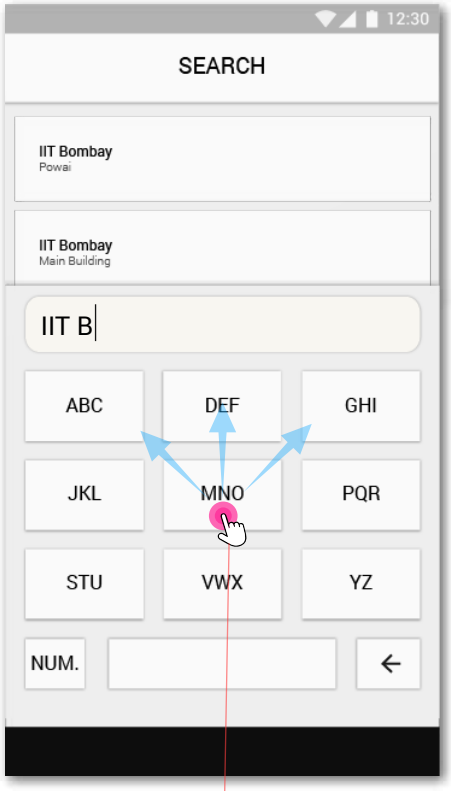
To get directions to the place by typing the place name, user has to tap and swipe up in bottom left on the mobile screen. There is a search button there. Once she selects the search icon, keyboard will appear at the bottom of the mobile screen. Then person can type desired place to get directions.

To type user has to tap and locate buttons on the mobile screen. Alphabets are arranged alphabetically. There are nine buttons in the key board and each button has three alphabets on it.

by tapping once on any button will speak letters on the button by swiping up left will select first letter located on the left on the button, swipe up center will select the center located letter on the button and up right will select the right button.



swipe up to Search places



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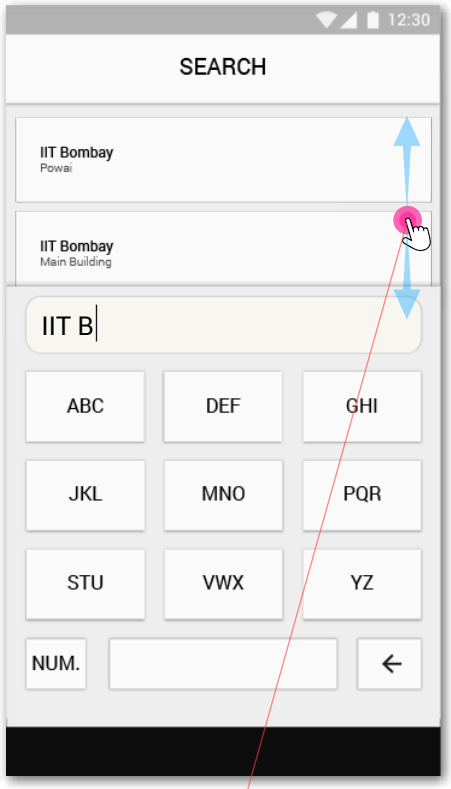
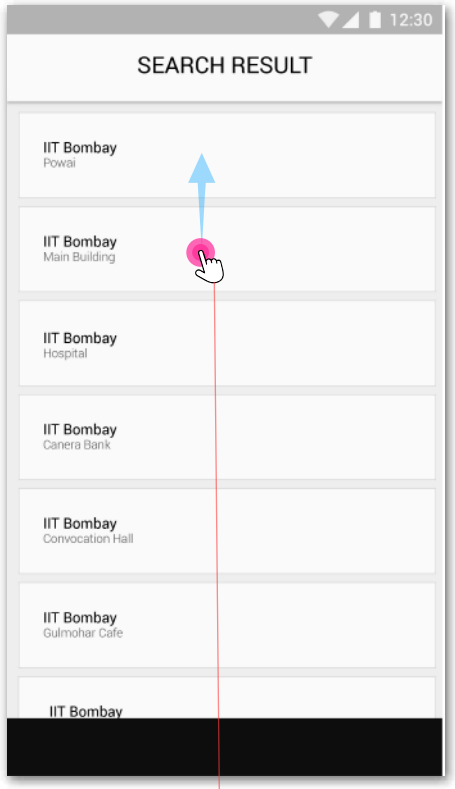
2.2

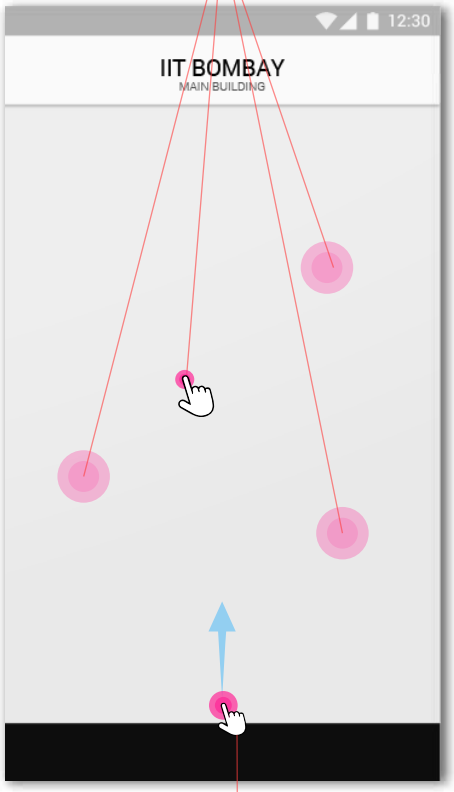


tapping once will speak the information Scrolling up and down take the user on the list of suggestions.

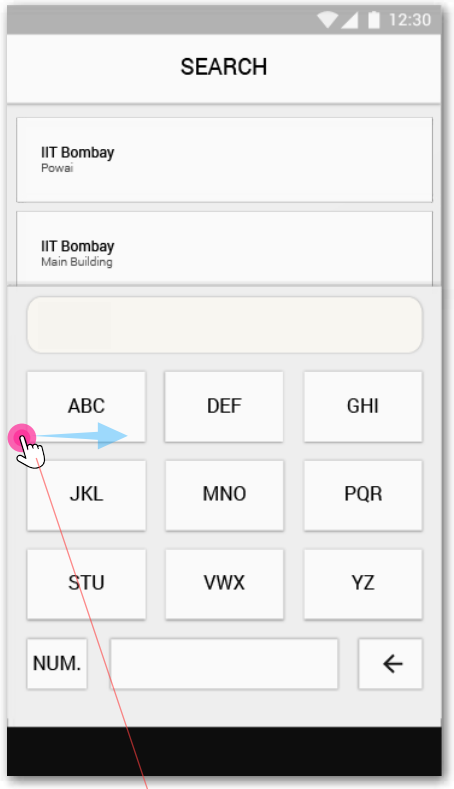


Tap to listen the information, to select or get directions swipe up.

Tap anywhere in the screen to know the current position and remaining path. and tap twice to show google map on the screen.



To type again swipe up anywhere at the bottom of the mobile screen.



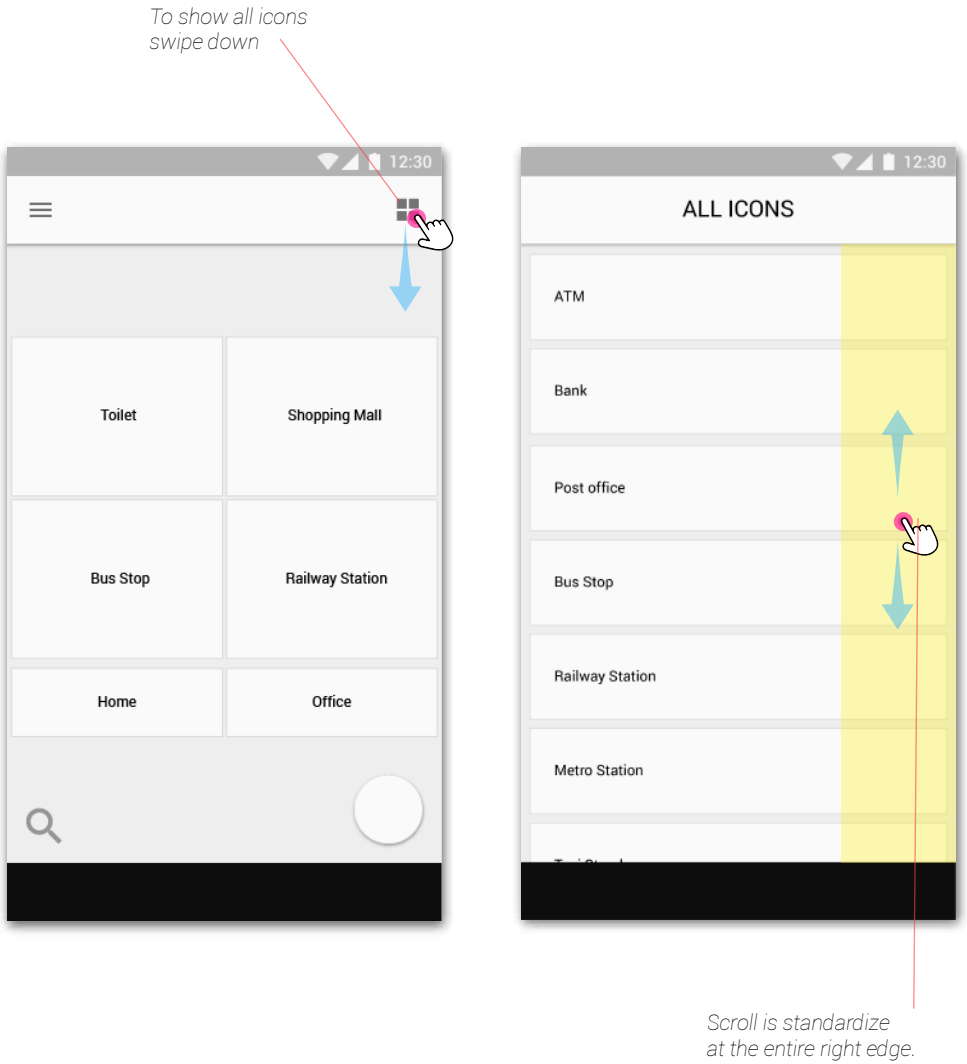
To go back from any page, swipe right anywhere at the left edge of mobile screen.

Scroll & Filter

Standardization of Scroll and Filter

3.1
Some standardization has been done for the app. For scrolling the page it is standardized that entire right edge (86px wide) of the mobile screen will be scrolla-ble area. (If a long list appears.)

User gets the list and he has to check whole list. She has to scroll at the right edge of the mobile screen because left part is to scan or listen the information.



3.2
Position of filter is also standardized. Whenever filters option is needed, it is placed at the bottom edge of the mobile.

Filters are designed to find icons easily. There are twelve types of filters to provide chunked data to the user.

Filters:

All Icons

Emergency Financial

Health

Routes

Travel & Transport

Educational Places

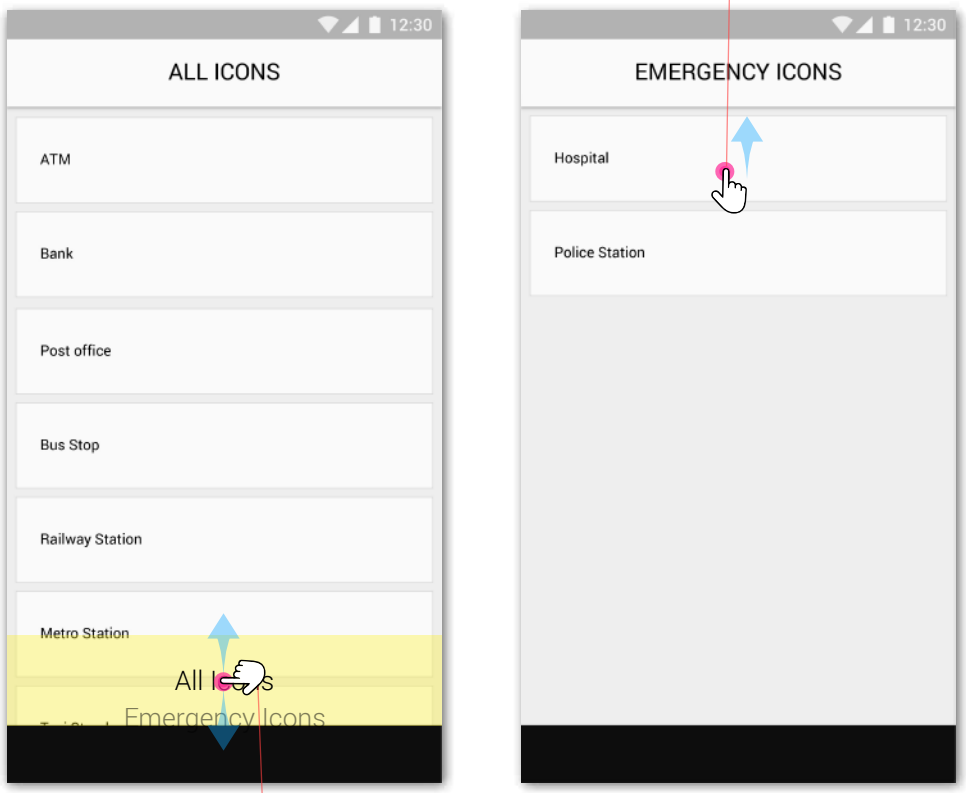
Common Places

Spiritual Places

Tourist Places

Added Locations

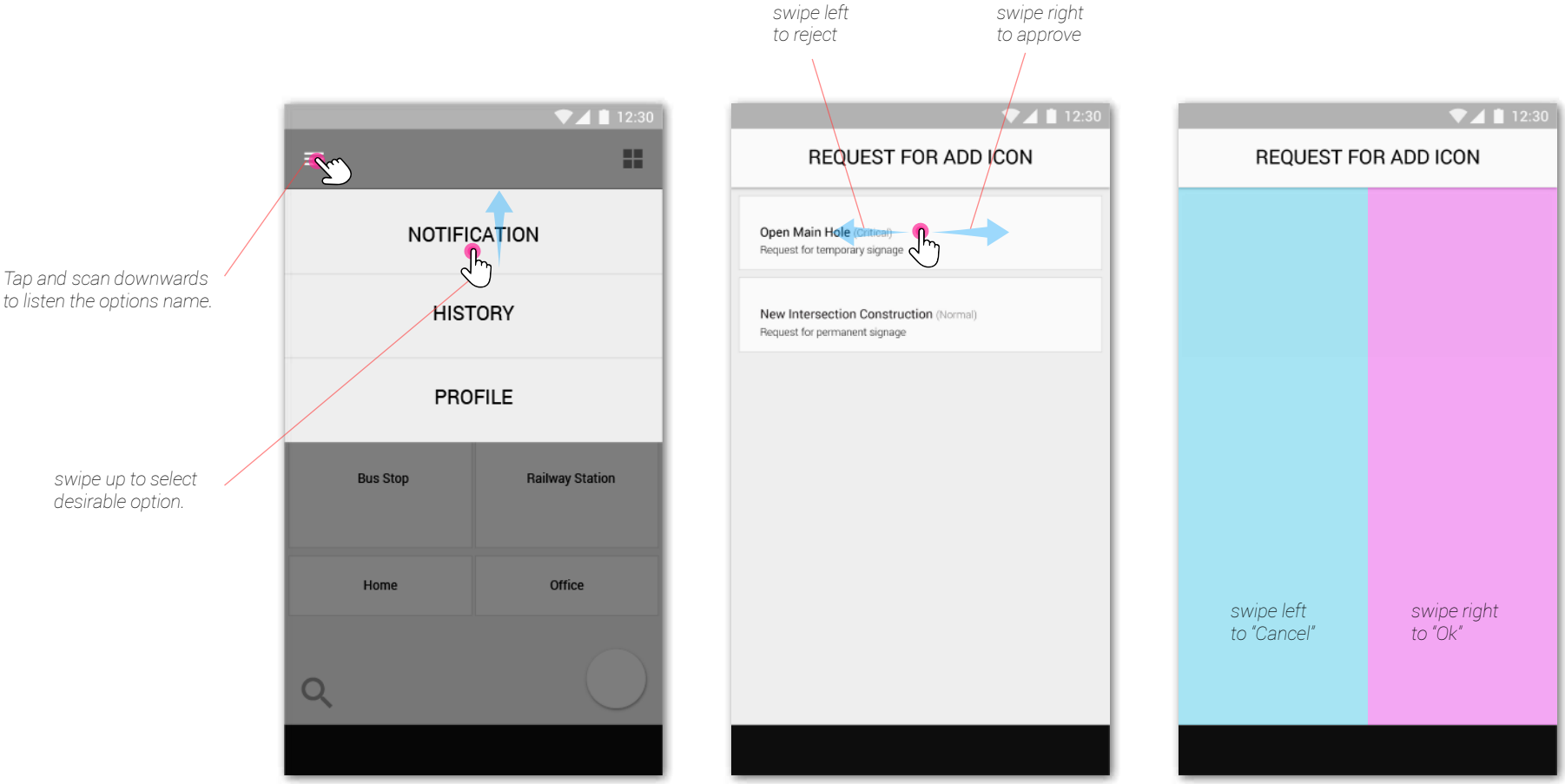
Other Places



Other Options

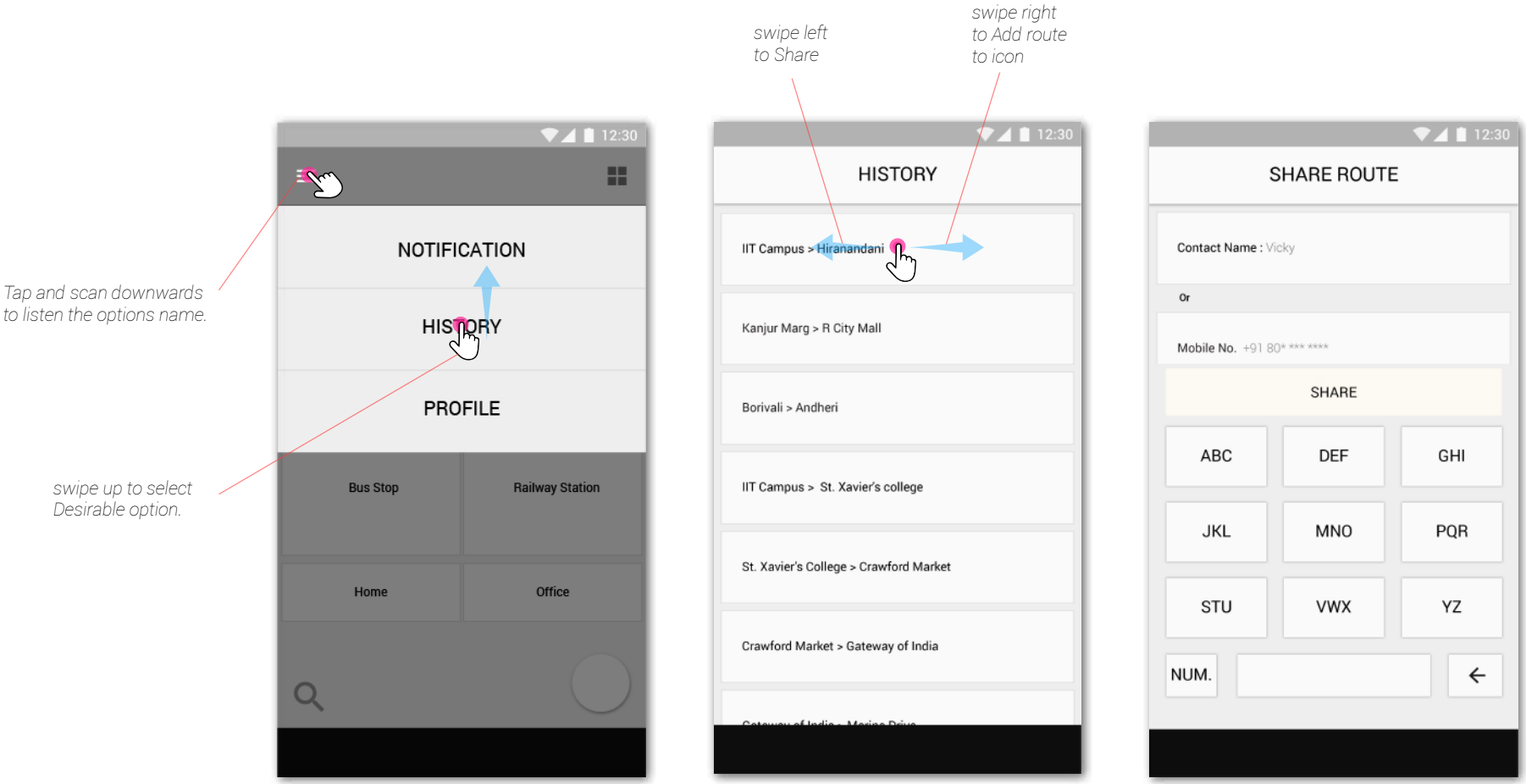
Notification | History | Profile

4.1
Tap and scan the screen for information,
swipe right to select desirable option.



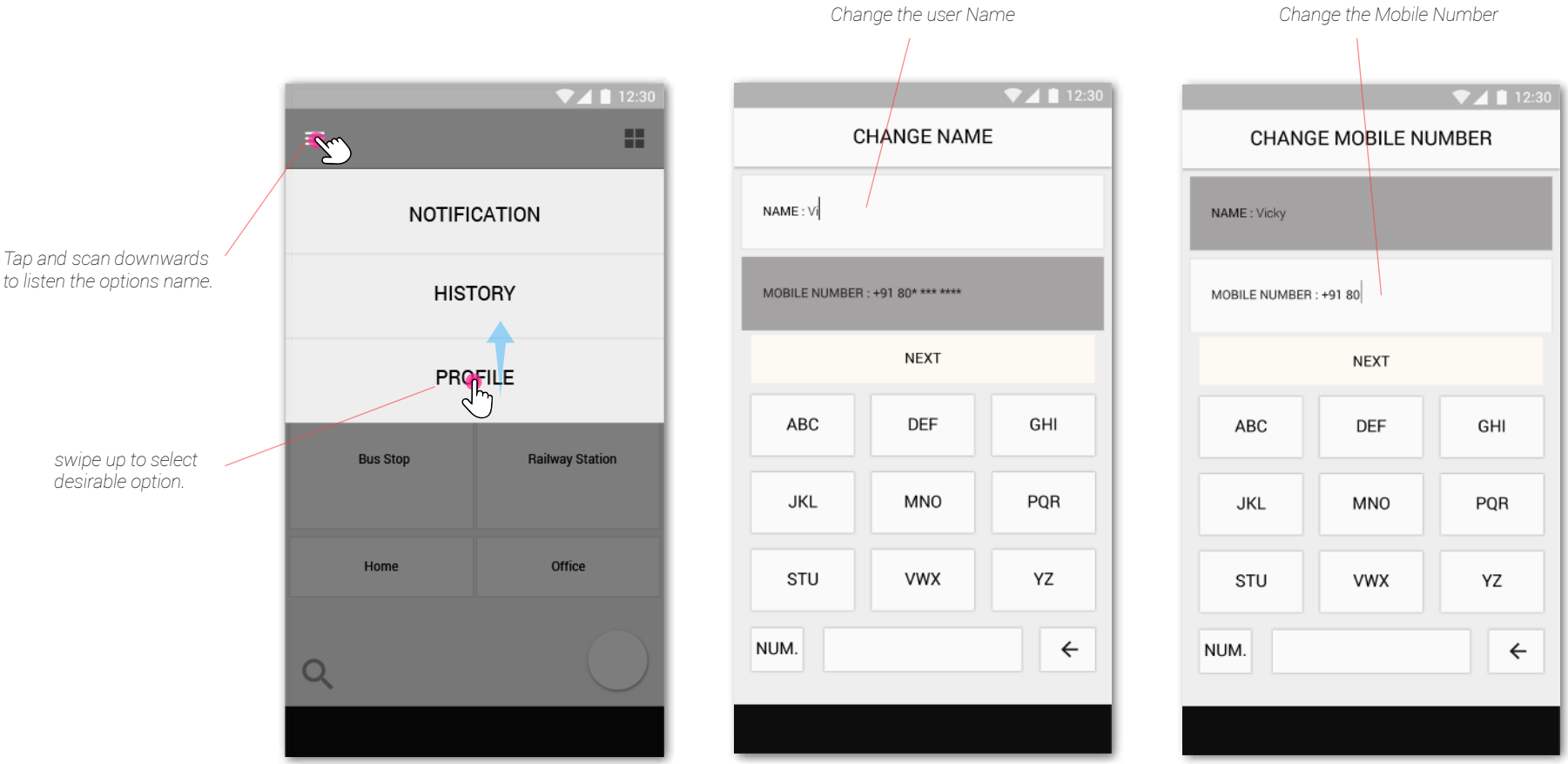
4.2

App records previous visited places' routes and store them under the history option. These routes can be shared and added as an Icon in the app. All the history is personal to respective user until she wants to share it with someone.



4.3

Profile information has the name of the user and the mobile number. User can change this information anytime.

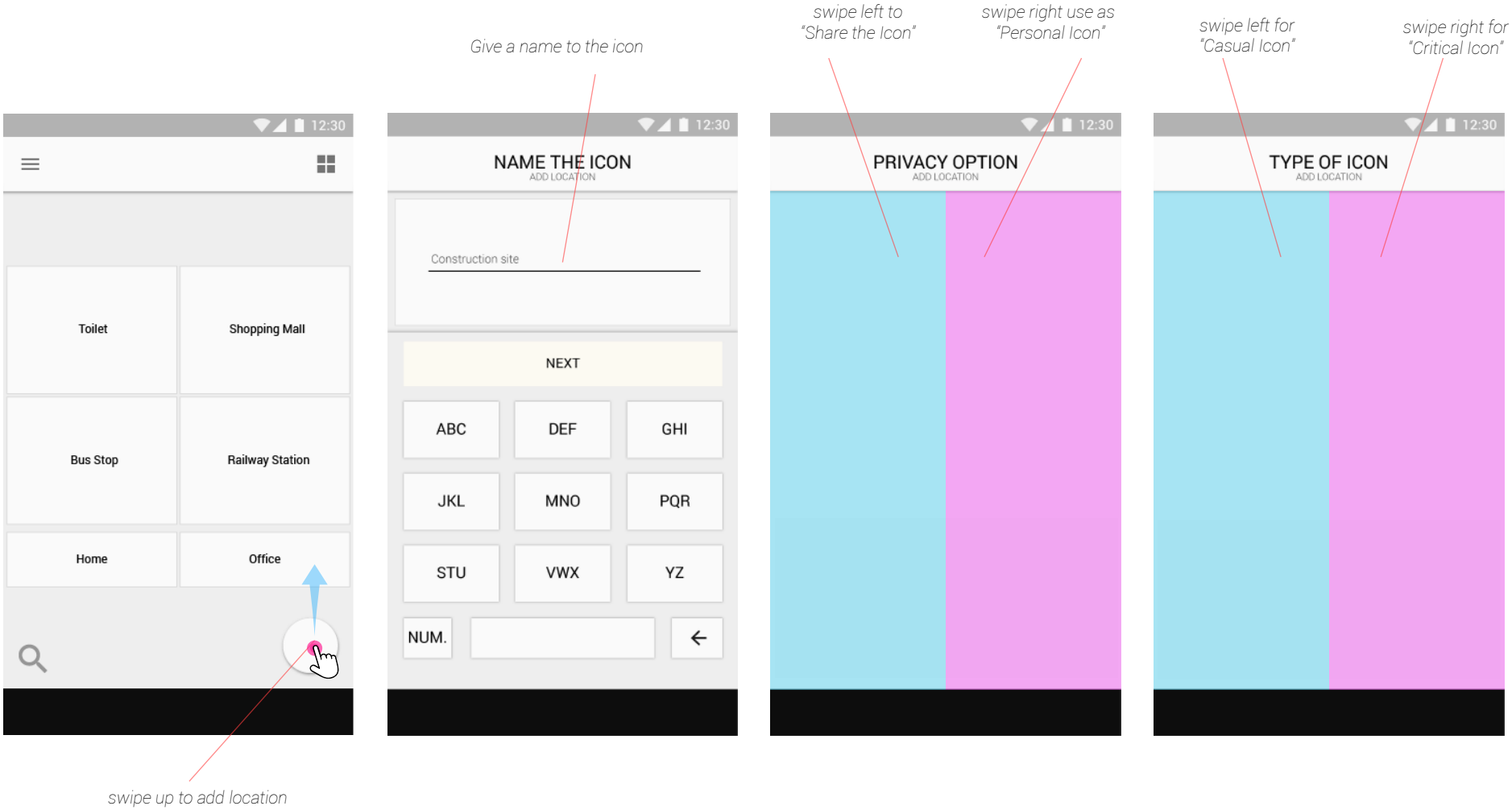


Add and Remove

Add location | Change Icons | Remove Icons

5.1
Add location and change quick icons options are located on the home page, at the right bottom of the mobile screen.

To add new signage to location, swipe up and to change quick icons swipe left.



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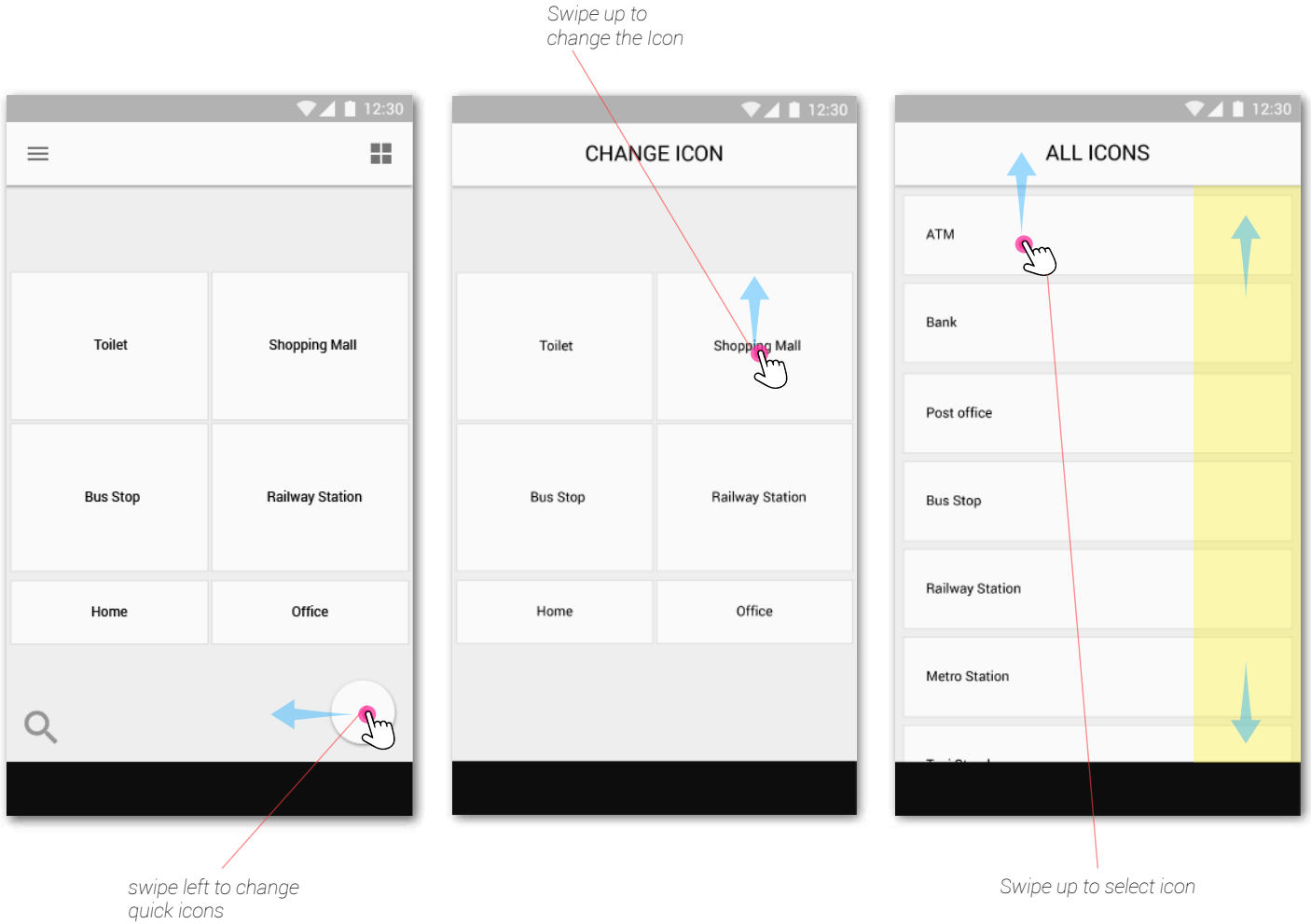
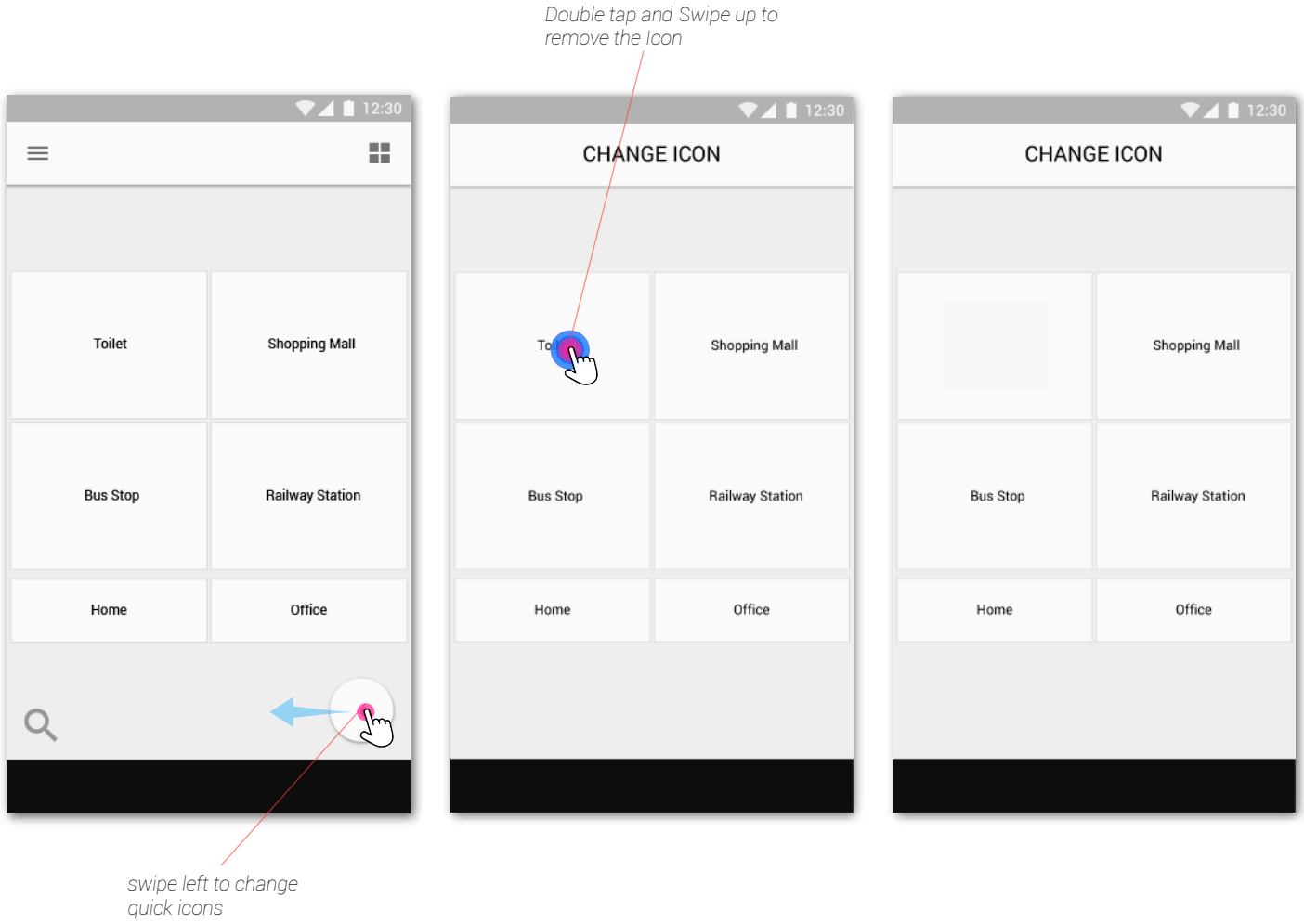
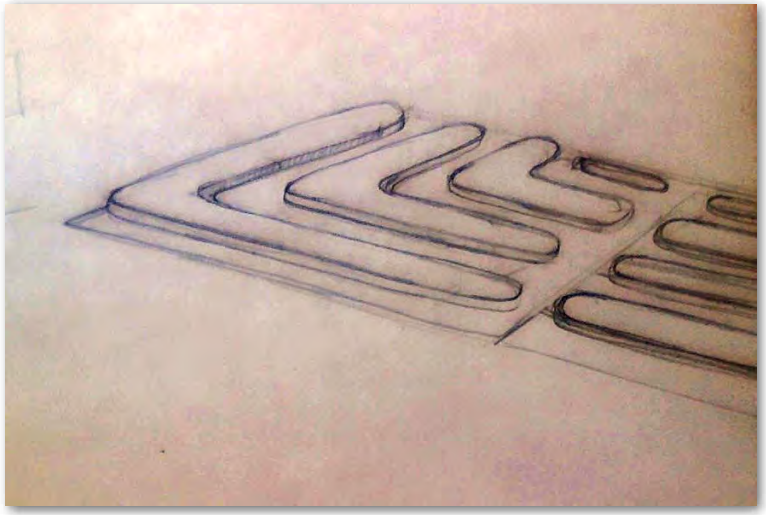
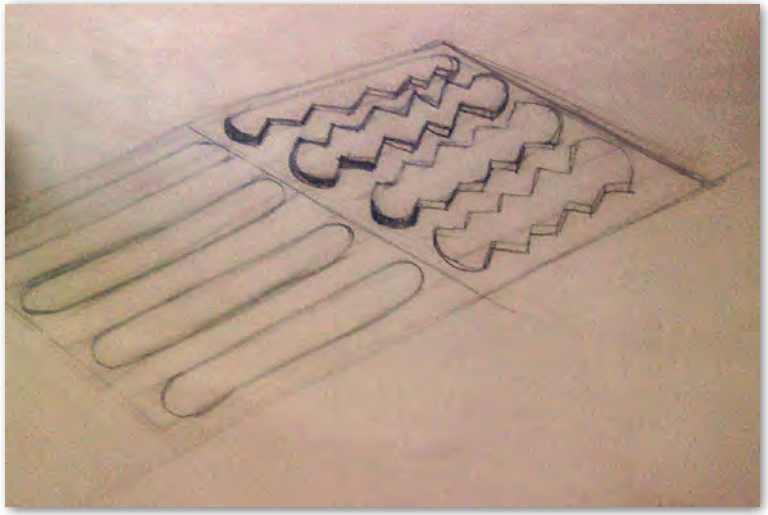


5.2
Double tap and swipe up to remove the Quick Icon.



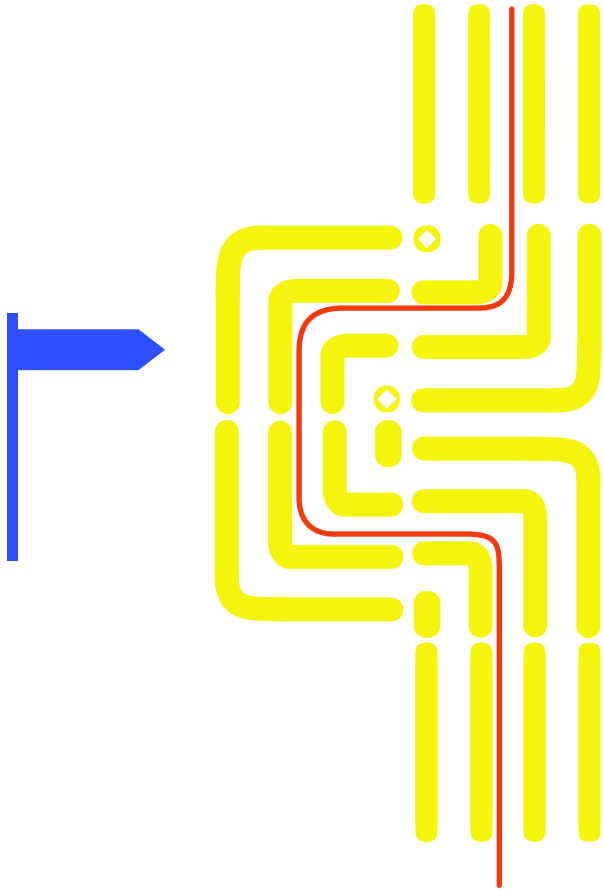
Initial Sketches



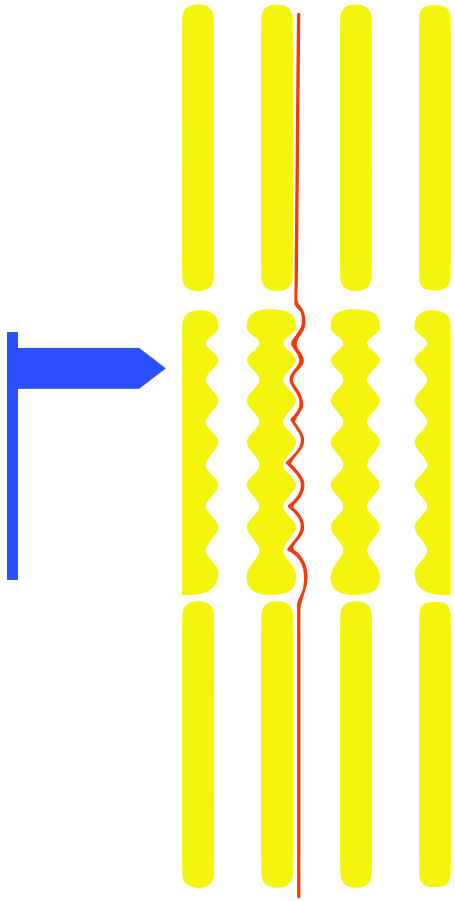


Tactile Tile

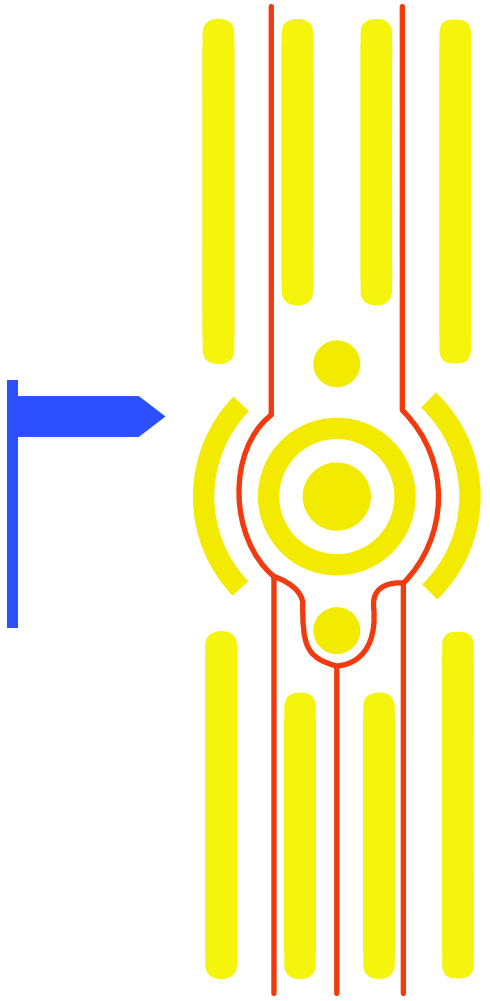
Concept Explanation



First Idea
The Idea came by the placement of the signboard. In India left hand side driving is an law so signboard should be placed left side. Braille Pathways located at the center on footpath so to access the signboard he has to go to the left to read the information. Thats why It designed to take the user to the signboard and bring him back on the path



Second Idea
This shape stripes selected to give vibration feedback If user using white cane. As mobile phones vibrates when notification come.

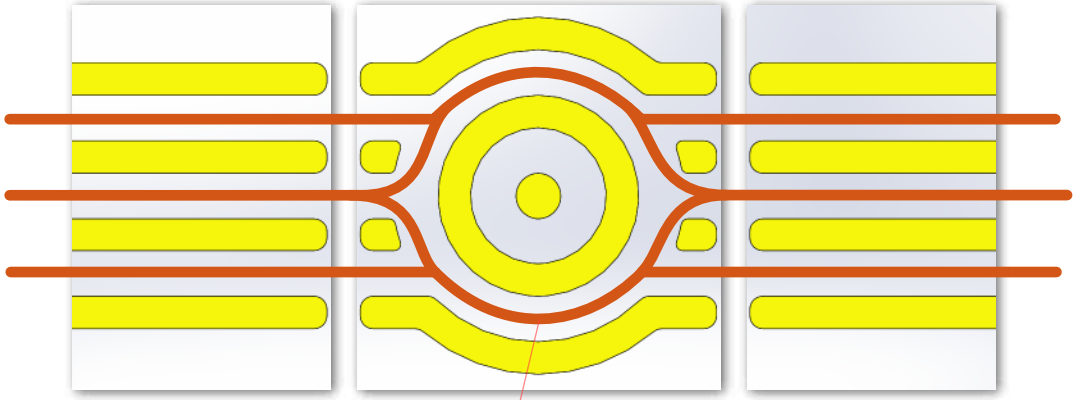


Third Idea
This Idea is come from the signals visual representation. signals visualization is circles starts from the point and become bigger and getting fade. So I chose circles started from the dot and become bigger

Tactile tile

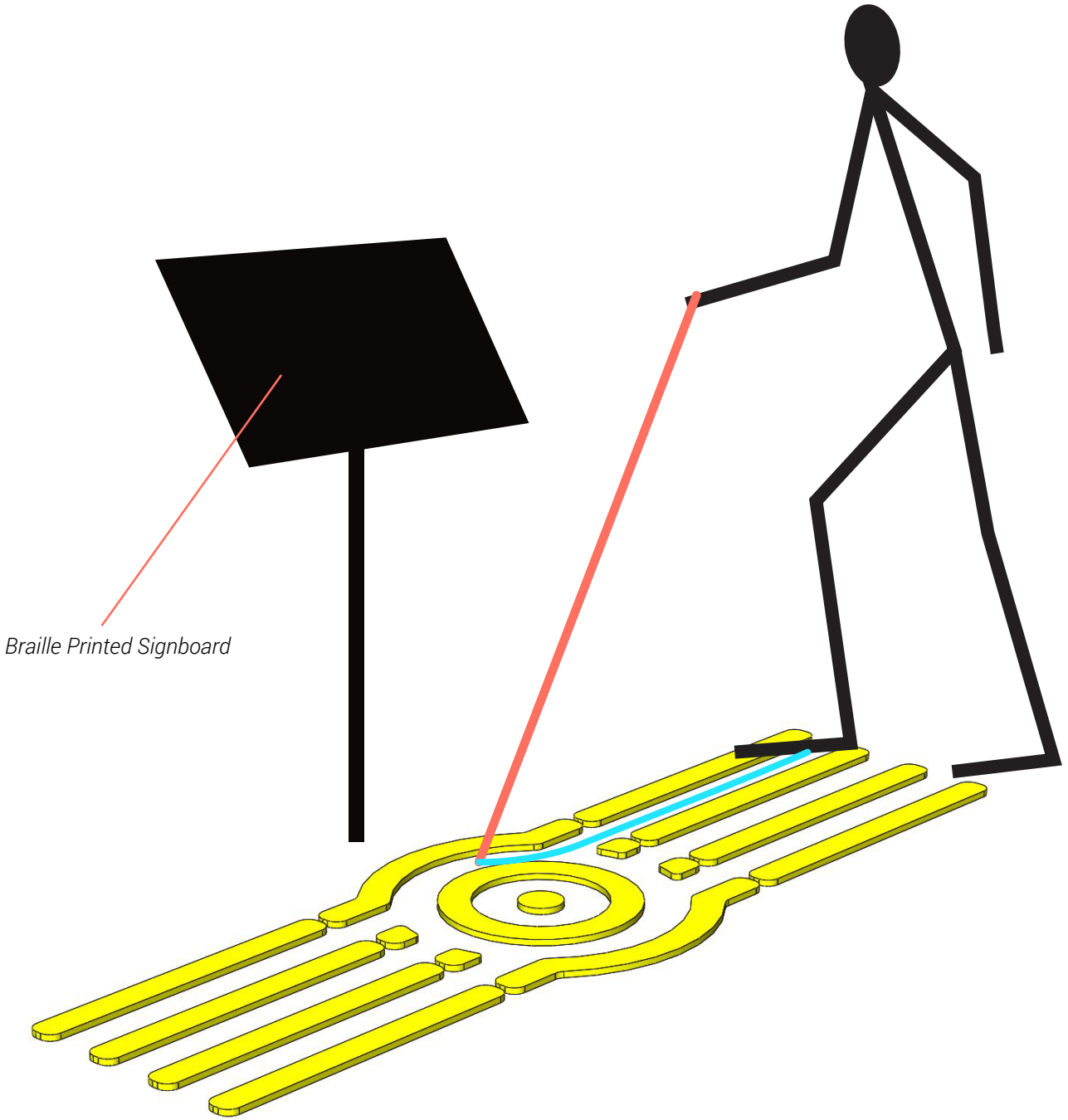
Final concept

The final concept inspired from the wireless signal's visualization and the "eye". This tile is giving signals to visually impaired to locate signboards. In some sense this tile is working as an eye in this context. So both the shapes were incorporated to make an shape which can give signals to signages and should not obstruct user. This tile let user know about the location of the signboard. And if user don't want to read the signboard it do not obstruct him.



These red stripes representing path of white cane

Live scenario



Limitations

Mobile Application

This app can only tell the information which is preloaded. It can not detect obstacles.

Beacon Technology can give accurate location but there is some issues in implementation.

To use this solution user need to wear headset/earphone all the time.

Sound Design is not an easy job to do. Some sound signals are evident but lots of need to standardize.

Tactile Pavement

India is a very crowded place and footpath are occupied by shop Keepers. And lots of places even don't have footpaths.

The spitting habits of Indian population are making it more difficult to implement. People use to spit on boards and walls. People with visual impairment have hygiene issues, because they have to touch those signboards.

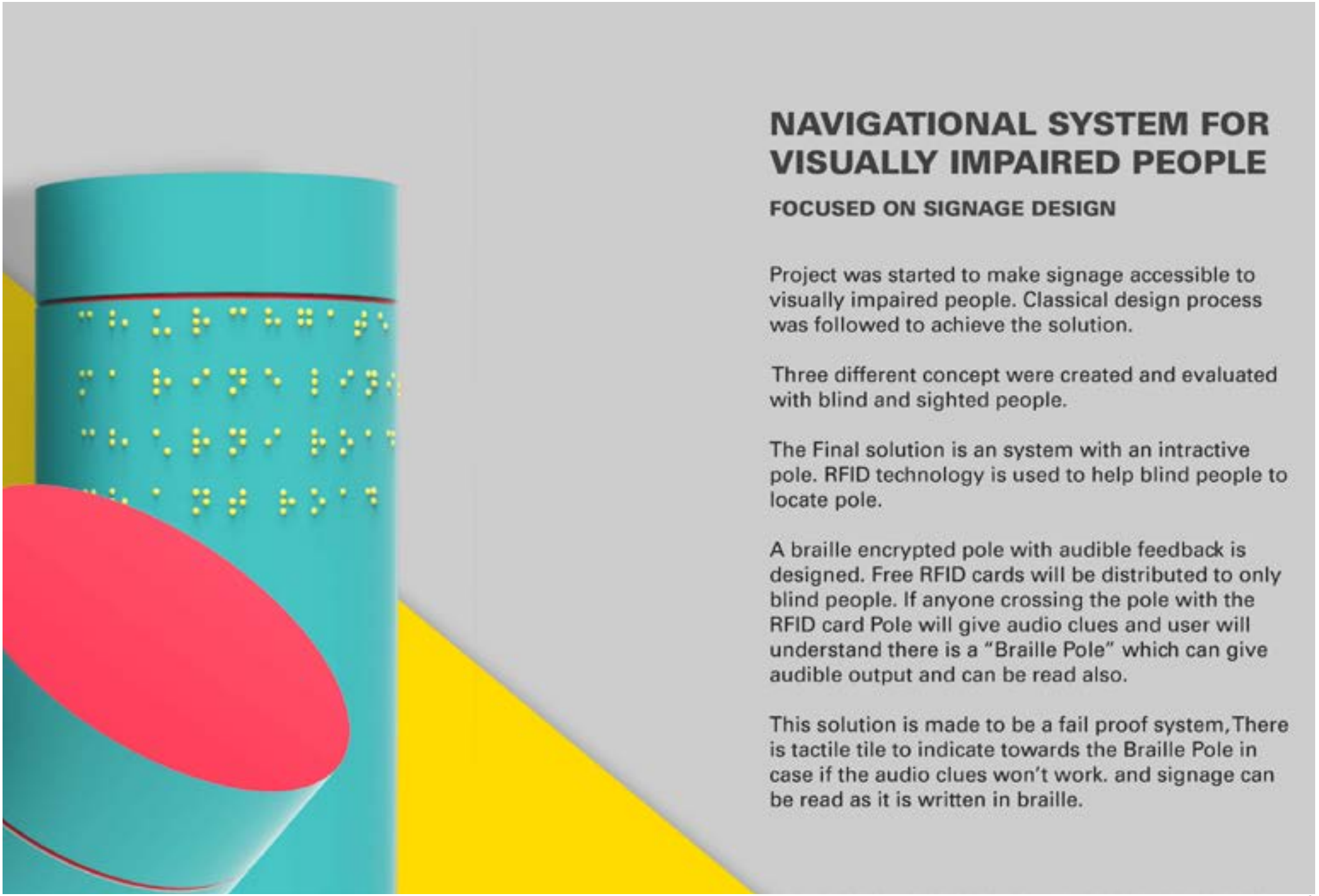
future Work

Mobile Application

Sound design
User Testing
Evaluation
App Coding
Testing in Live Scenario

Tactile Tile

User Testing and Evaluation



NAVIGATIONAL SYSTEM FOR VISUALLY IMPAIRED PEOPLE

FOCUSED ON SIGNAGE DESIGN

Project was started to make signage accessible to visually impaired people. Classical design process was followed to achieve the solution.

Three different concept were created and evaluated with blind and sighted people.

The Final solution is an system with an intractive pole. RFID technology is used to help blind people to locate pole.

A braille encrypted pole with audible feedback is designed. Free RFID cards will be distributed to only blind people. If anyone crossing the pole with the RFID card Pole will give audio clues and user will understand there is a "Braille Pole" which can give audible output and can be read also.

This solution is made to be a fail proof system, There is tactile tile to indicate towards the Braille Pole in case if the audio clues won't work. and signage can be read as it is written in braille.

Form and pattern Exploration

Started with Idea of giving directions towards signboards.

The first thing comes in mind to give directions is arrow.

So decided to explore arrow for tactile tile to give indication towards signage.

The single arrow would be too big to differentiate while walking with the feet.

while Patterns were create,. It was realized that it needs to be Simplified as the existing

Other kind of patters also tried one of this the more relevant from them.

But all patterns above going to be felt by the feet (shoes on). So the pattern must be a basic shape which can be relevant to context and simple and differentiable in existing two.

Final selected one.

Visual pattern is took from the aim symbol. It conveys the meaning of, how perfectly user can mark the signage.

This tile going to be installed on pathways with the existing braille pathways. When ever this tile come across, that means there is a braille signage.

Basic shape of circles and rings was decided to take ahead, It is very different to existing ones. So it is easy to differentiable. And also it won't block the stick of visually impaired person.

Evaluation

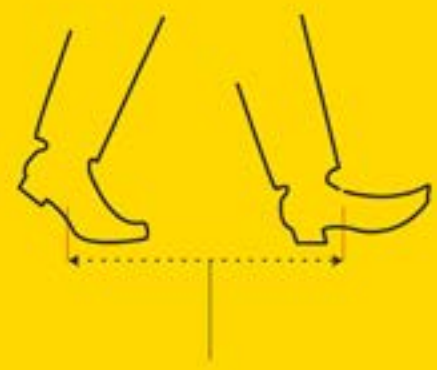
Tile should be bigger.
Tile can be skipped because its size.
bigger tile will increase the accuracy in differentiation.

There is 34 cm *(or may be more, according to height)* gap between the footsteps of a common average Indian man's walk-cycle.

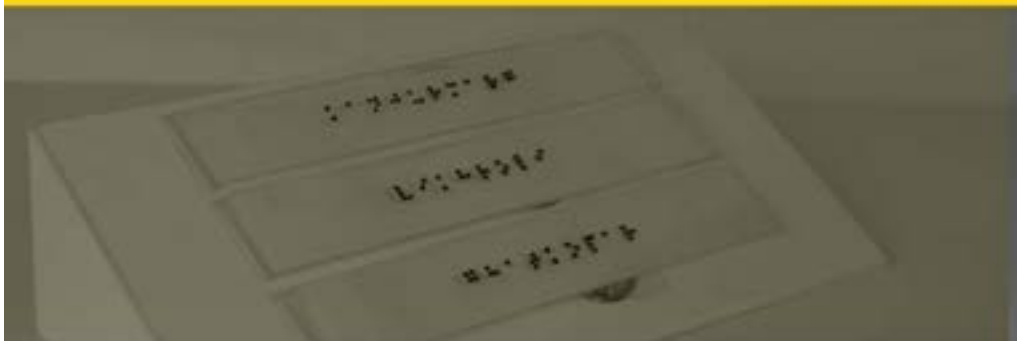
And the size of the tactile tile is 30 cm.

So there is chances to skip a this tile on every 8th step if user starts his walk from the edge of the tile.

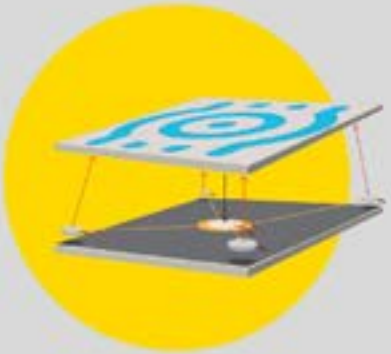
Its the probability of skipping tile if signage tile comes exactly on the 8th step.



There is 34 cm gap between the steps of a common average Indian man's walk-cycle.



HAPTIC FEEDBACK TACTILE TILE WITH AUDIBLE BRAILLE SIGNAGE



Haptic feedback tactile tile

Braille printed audible signage

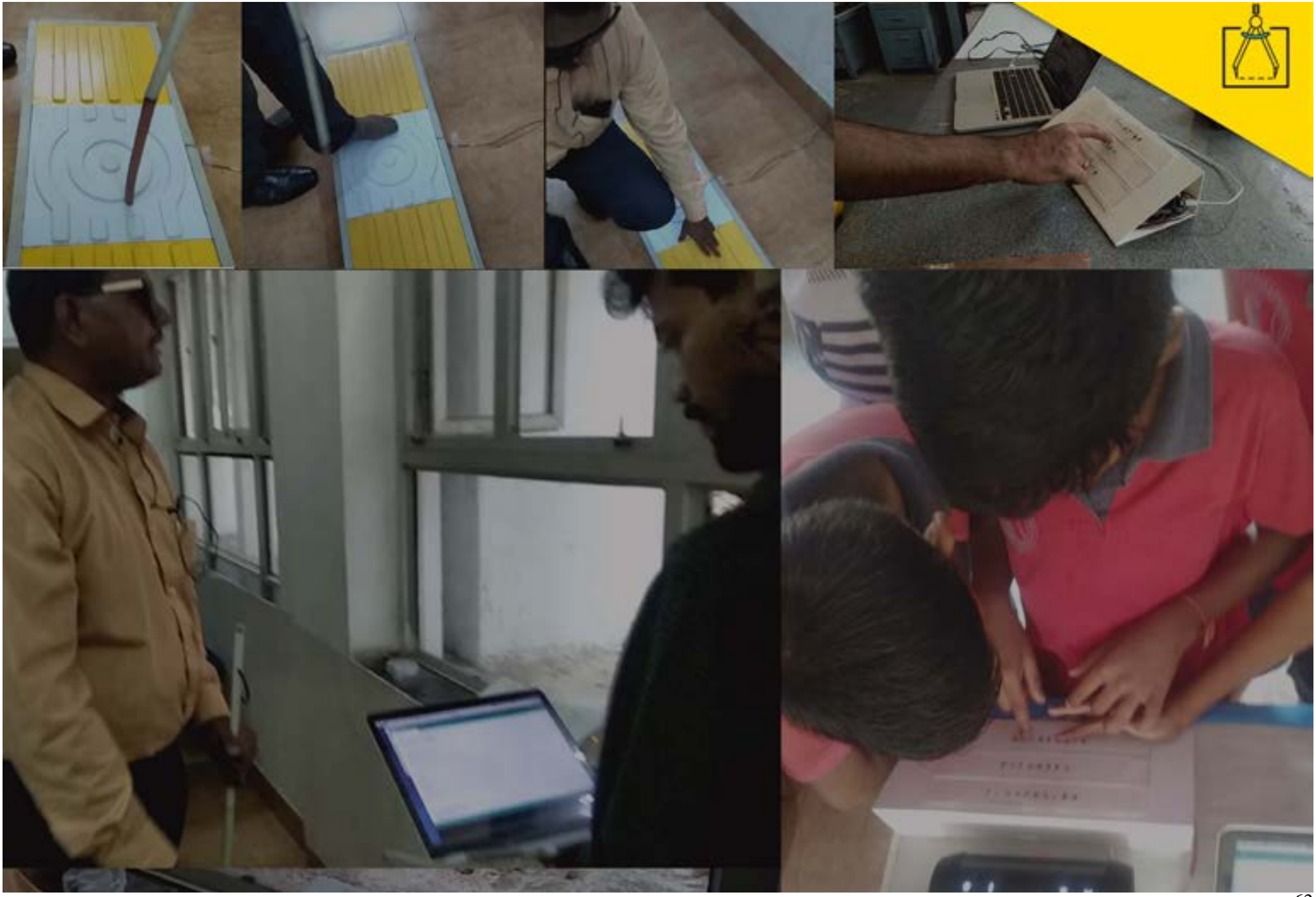
Working Prototype

Working Prototype

Concept

In this concept tactile tile is same but it has five small mobile Vibrators to give haptic feedback.

When ever user step on it will sense the pressure and give haptic feedback, thats how user get to know that there is a braille signage.



EVALUATION | Findings

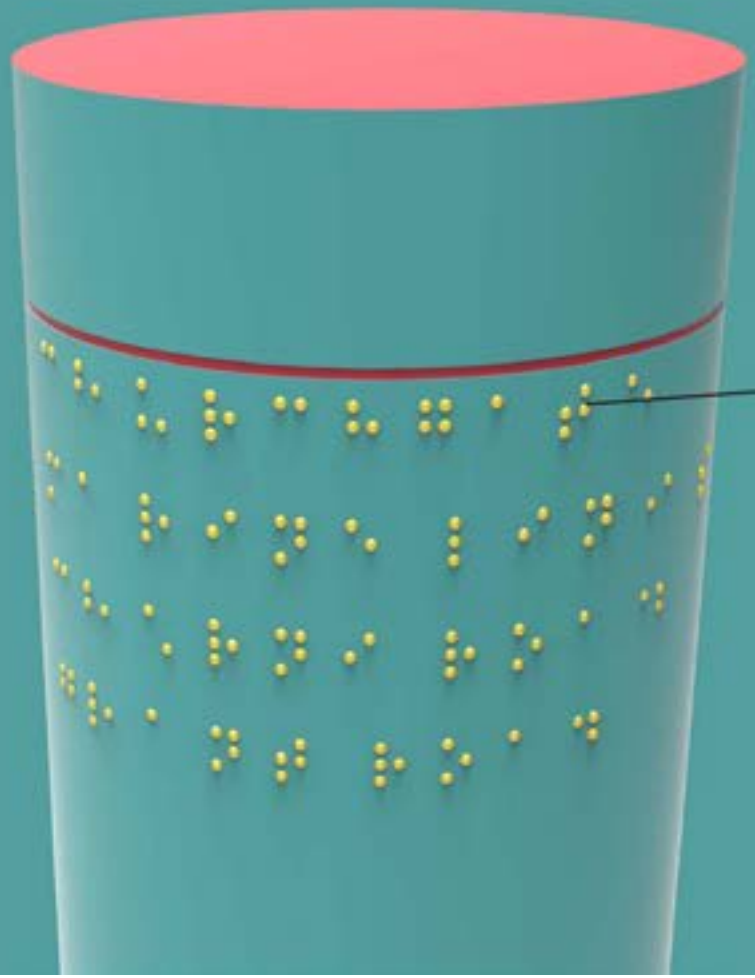
- User could hear the virator motors but couldn't able to feel haptic feedback.
- Code worked properly, everything was as good as thought but becase of heavy
- weight of the user vibrators coulddn't able to give sensation.
- Vibrators are too small to give sensation to a 70-80 kg person.
- And if I consider bigger Vibrators it cost more energy and space, so for now it can't work.

- But the audible braille signage is working perfectly.
- I am take it forward for the next concept.

Design Brief:

From the findings of previous concept and evaluation I got the Idea that I should use audible clues to help user to locate signage. Previously I was avoiding sound clues Idea because of noise pollution. But with the RFID technology I got control over this problem. Now the sound will be played only when any blind person comes in the picture. For normal people it would be a simple garden light.

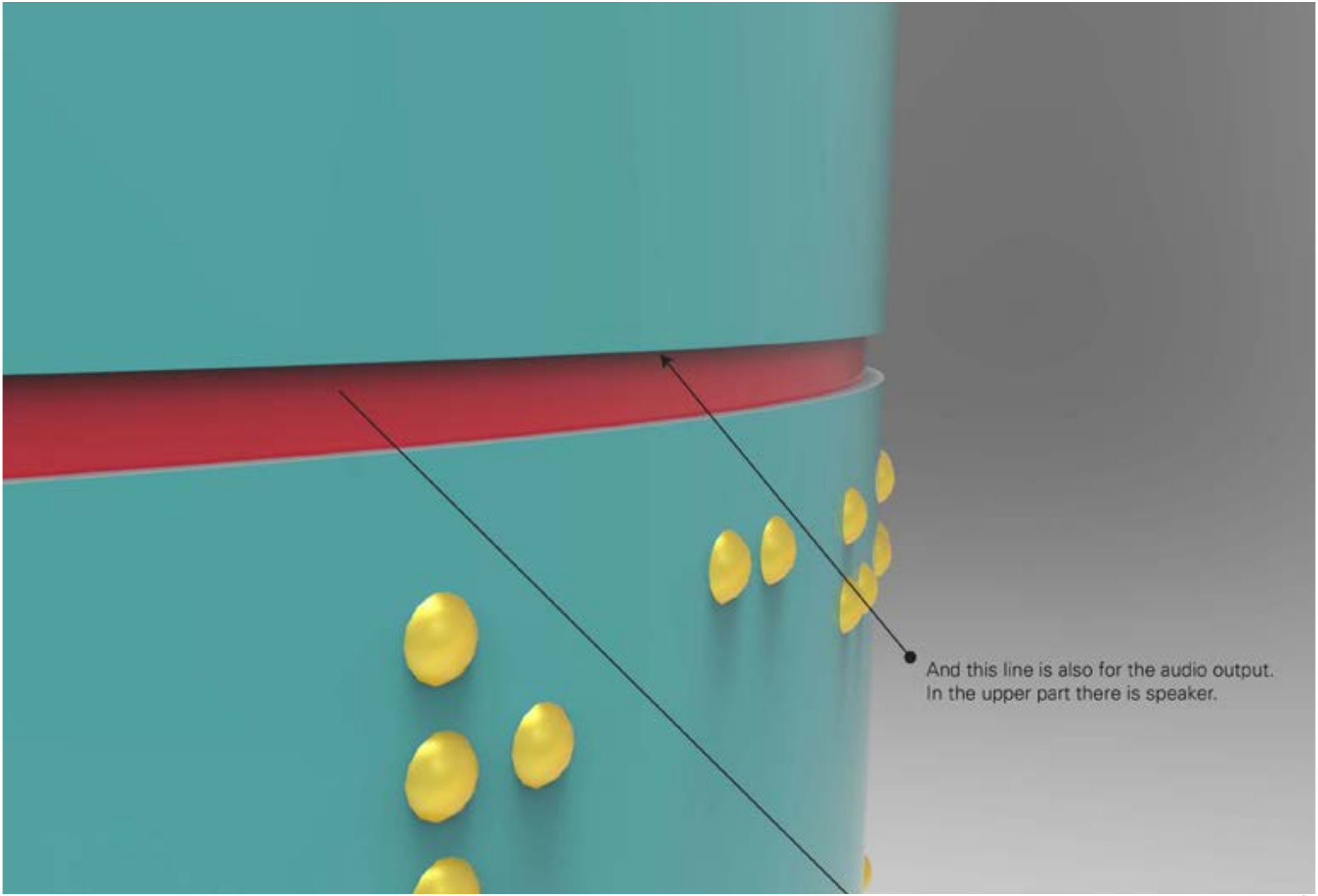
So the solution is a pole with braille signage and with audio output. It helps user to locate signage and also to read the information.

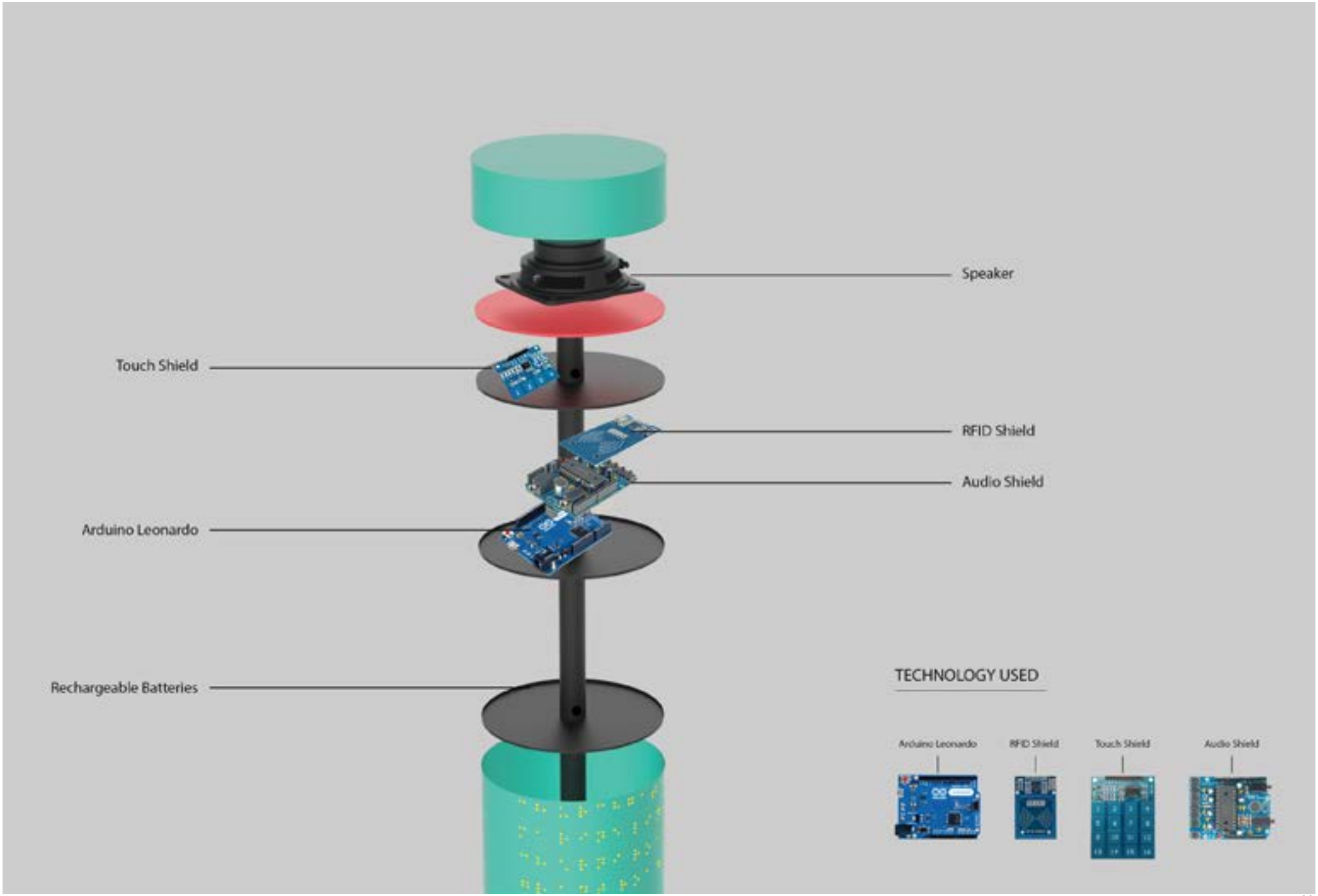


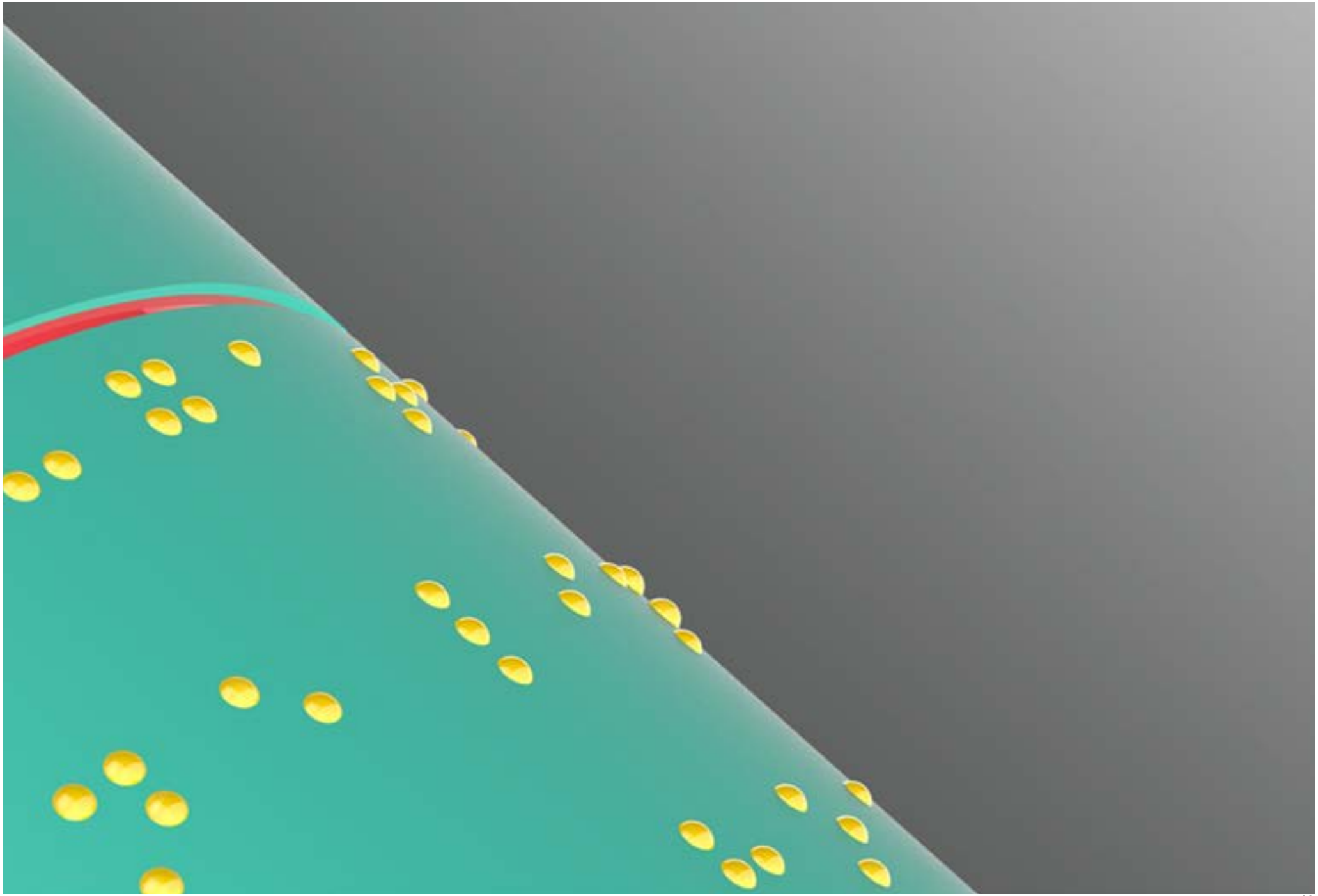
Braille embossed on the pole to give information in written format.
Also just by giving little pressure to these dots, user can have audio output of the written matter.

It will speak only the information which is touched and pressed by the user. To listen out every information user have to press them separately.

Double tap to stop the audio.


And this line is also for the audio output.
In the upper part there is speaker.


Speaker
Touch Shield
RFID Shield
Audio Shield
Arduino Leonardo
Rechargeable Batteries
TECHNOLOGY USED
Arduino Leonardo
RFID Shield
Touch Shield
Audio Shield



Future Posibilities:

It can be synced with the traffic signals, so when signal is red for pedestrians, it will give audible clues to the user.

Once traffic light is green for the pedestrians it would say "you can cross the road".

According to my study, people feel comfirtable and easy to ask someone for the directions rather than reading the map.

So hypotheticaly, it can also integrate voice input like google, siri, john to have audio assistance. User can simply ask for directions and bus routes and what not.

Conclusion:

This project means lot to me. It has potential for the better tomorrow.

Also It can't be implemented without proper pedestrian.

In the starting it was mentioned that user don't want to carry any device and I also emphasised on this point so much, but at the end I came up with a kind of device called RFID sensor. But this device don't need to be charged and it too small. It can be ring, locket or card, mobile case. And its too cheap also.

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