FINAL PROJECT REPORT ON

“ Making Mobile Payment Applications Accessible For The Visually Challenged”

(In partial fulfillment of end-term examination of Human-Computer Interaction)
Under the guidance of Professor Linus Kendall

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CHAPTER 1:INTRODUCTION AND CONTEXT OF STUDY

1.1.Introduction

The usage of mobile payment apps over a period of time has seen staggering growth, mainly because they allow for a seamless and relatively low cost of funds. People are using mobile payment apps for a variety of purposes from phone recharge, bill payments, shopping to flight bookings. This has allowed various mobile payment service providers to tap into the mobile payment market for cashing on its unparalleled advantages. Though there are numerous benefits of using these mobile payment apps, still the transition from a cash to a completely digitized payment landscape would take time. Thus, it becomes important to investigate how different people perceive these mobile payment apps, including the visually challenged one. Through this research we tried to understand the pain points and frustrations of visually challenged individual who are using mobile payment applications;their reasons for adoption and deterrents for non-adoption and ultimately we tried to design prototype of the payment interface which would be accessible for them.

1.2.Context of Study

Varun, 23-year-old, visually impaired youth, while traveling via bus from home to office, needs to make a mobile payment while commuting. But there's a problem- whenever he tries to log in, the screen reader reads out his password aloud and clear, so clear that the person sitting next to him can hear his password. Varun, like many other visually impaired people, faces the issue of privacy and security every time they perform a transaction via the mobile payment app.

Through this user study report, we aim to understand the nuances of visually impaired people using a mobile payment interface in the public /private space. We focussed on the following parameters -

•(Usability issue)-What are the existing mobile payment apps that they are using? Why are they using it? (What are they not using?)

•(Privacy and security)-What are the privacy and security concerns that a visually impaired person faces while using a mobile payment interface?

•(Usability and accessibility)-What assistive technologies are being currently used by the person with visual impairment for payment via mobile?

•(Language barrier)- Do they face language barriers while using mobile payment apps? What assistive technology do they use to bridge this language barrier?

•(Independence and autonomy)-How is the sense of independence and autonomy is being protected when the person is carrying out their own payment using an accessible mobile payment interface?

CHAPTER 2: USER RESEARCH

2.1.Methodology

We are following the qualitative research method because we are more focused on understanding the experiences of visually impaired people who are using digital modes of payment. Qualitative data allows understanding the nuances of the context which in turn assists us to break down the experience and get a better insight into the situation.

- **Permission to conduct the research**

  As our research study is targeted towards individuals not associated with any particular organization or institution, we rolled out a consent form to take the permission of the respondents. Once we got the consent of the respondent, we carried out our research study with them.

  We mailed the consent form and the participant information brochure to the participants, as one of our teammates personally know all the visually impaired respondents and had their email id.

  Given below are the links of the consent form and participant information brochure respectively:

https://docs.google.com/forms/d/e/1FAIpQLSd8173EYlR3l_8kwhR3FVbcYf1hNKIl8y-0m5j2ZWo2D1VNcg/viewform?usp=sf_link

https://drive.google.com/file/d/11Jgvvl1JpVExpD9AqmfcoOxoDvj8-pVG/view?usp=sharing

- **Dairy Study**

  Initially, we were thinking to conduct a diary study to know the experiences and pain points of visually impaired people using digital mode of payment. However, as our respondents are visually impaired, it was difficult for them to make a digital or offline

diary, so we asked them to make an audio diary whenever they made any digital payment.

We gave the respondents a template which suggested questions they have to answer daily while they were making digital transaction. The template had the following questions-

1. Mention the digital mode of payment you are used to make the transaction
2. Describe the following points in the context of your use of the digital mode of transaction
    a. Did you use it in public or private space?
    b. Were you able to perform the transaction individually or you took somebody's help
    c. If you took somebody else's help, then how many times, also mention the where you got stuck
3. Any other insights

We asked them to follow this for 5 days. We employed this indirect mode of observation since the respondents are scattered in different states of India.

- **Video/Audio Interviews**

  On the sixth and seventh day, we conducted video interviews. To know the pain points of visually impaired people while using a digital payment interface in the user context, we used zoom platform for video interviews since its more accessible compared to other counterparts. Though we got their consent to record both the audio and video of the video call interviews in the consent form, some of the participants preferred to only record their audio and video at the time of actual interview. Respecting their decision, we only recorded audio of these interviews.

  We conducted interviews to understand user's first encounter with the mobile payment app, whether they opt for it for transacting frequently, and if not then why. The interview also gathered data about what difficulties they face while using mobile payment apps, assistive technology they use to access them, how long they have been using such assistive technologies.

We also asked questions related to the user interface of mobile payment apps, like average time to perform a transaction, which parts of the application do they find easy to navigate to and which ones do you face challenges with, what changes would they like to have in the mobile payment interface, compatibility between mobile payment app and the assistive technology used.

- **Auto-ethnography**

  During this one week, a member of our group, who himself is a visually impaired person performed autoethnography to identify the areas of vulnerability concerning visually impaired users of digital mode of payments.

2.2.Recruitment of participants

One of our team members, who himself is a visually impaired person, is a part of the visually impaired community. As he is in contact with them and we will be recruiting participants from his social contacts.

As per the International Classification of Diseases 11 (2018), under the category distance vision impairment, we have the following 4 subcategories:

- Mild – presenting visual acuity worse than 6/12
- Moderate – presenting visual acuity worse than 6/18
- Severe – presenting visual acuity worse than 6/60
- Blindness – presenting visual acuity worse than 3/60

The following table gives the detail of the participants we recruited-

Participant	Age	Gender	Blindness Type
P1	26	Female	Moderate Blind
P2	23	Female	Completely Blind
P3	24	Male	Moderate Blind

P4	26	Male	Mild Blind
P5	23	Male	Completely Blind
P6	28	Male	Completely Blind
P7	25	Female	Moderate Blind

Currently, we were able to get a dairy study from only 4 participants and we have interviewed seven participants till now. We are planning to interview more in the near future to delve into the problem.

2.3.Data Collection Protocol

The respondents submitted a dairy study in the form of audio recordings of any digital transaction they made during a day. We sent a gentle reminder to them every day to do the same.

The interviews lasted for approximately 22 minutes on average and were conducted in English since it was the commonly spoken language for all the interviewees and the interviewer. We recorded audio and in few cases audio and video both of the conversations upon receiving oral consent from the interviewees.

After we had audio dairy of the respondent, the audio and video recordings of the interview, we transcribed them. After multiple readings, we performed coding on the transcript and autoethnography. We later did axial coding in the excel sheet.

These lead to the emergence of a few main themes which have been discussed in the findings.

2.4.Major Findings

We did coding and later axial coding of the dairy studies, interview responses, and auto-ethnography to come up with the following themes

- **Initial Configuration-** Our respondent pointed out the initial configuration of the payment interface as one of the major reasons for not using the mobile payment interface. The visually impaired people have to share their debit card details

including the card number, pin card number, expiry of the card. The person who will be assisting the visually impaired person will also know his pin. One of the respondents quoted " *The hardest part is the initial stage, you know, you install an app and then you have to find someone, who can then help you to be in the app, to get started in the app, by filling card details. You share a lot of details in the process. (with the person)*"

- **The cluttered interface of mobile payment apps**

The cluttered interface of the login screen is the first problem, which our respondents said they encountered after installing the mobile payment apps.

All the participants agreed that the login screen must have only the most essential controls like user id, password, forgot the password, submit button and new registration. Unwanted options lead to confusion and make it harder to navigate across the app for visually impaired people.

- **Inaccessible ATM-**

Five out of seven respondents pointed out the inaccessibility of ATM, in terms of

lack of audio feedback, inability to find the exact position of ATM slots (independently)

One of the respondents quoted "*I don't use ATM much because I find it hard to locate the atm slot, also there's no headphone port available at ATM. I can't get my money from atm if I go alone*"

- **One payment interface is more inclusive than the other**

During the interview, we found that most of the respondents consider google pay and UPI apps comparatively more inclusive in terms in terms of layout and color pallet than other mobile payment apps. The banking apps turned out to be the least inclusive app as per our interview responses.

2.5.Initial observation and reflection from the data

Initially, we had the notion that mobile payments apps would be very difficult to use for a person with visual impairment but on the contrary, it turned that some of these apps are very easy to

use. The participants had a very negative opinion about ATMs though they are claimed to be friendly for blind people.

Visually impaired individuals pursue Grid patterns, easy to use especially on the mobile platform. The number of steps is inversely proportional to the convenience. Wherever possible tapping action to fill in the information is more convenient. It's sometimes difficult for a visually impaired person to do the transaction in public spaces since the screen reader reads out the password loudly thus compromising the privacy of an individual. Initial setup configuration is a big let down according to most of the participants and demoralizes them from adopting a new interface. Banking interfaces were the least inclusive of all the platforms both native and web app, the desktop version, and even the ATMs.

According to the insight from participants about most banking interfaces, the screen reader finds it difficult to read buttons because of the lack of labels. They would mostly need the assistance of some other person while dealing with banking interfaces. Google pay and UPI payment apps were the most favored. Sometimes entering the OTP is an issue since there is a time limit to take of.

2.6 Personas, Scenerio and StoryBoard

We created the personas of three visually challenged persons namely: Amit, Minal and Sarita.

PERSONA 1:

Amit

Male

Age-21

Mi note5

Amit is studying humanities at Bangalore University and is currently in his final year. He stays in the hostel within the campus. He is from Bangalore and seldom visits his parents. He likes playing cricket and often travel to nearby places.

Amit uses an android phone and a laptop with a screen reader. Amit's parents transfer money to his bank account since he is dependent. He is fond of mobile payment apps and prefers it over cash within the campus. He carries just enough cash when he is outside the campus and uses digital mode to make purchases.

Goals and Problems

- Since Amit uses a screen -reader that reads out loud his credentials, he has a fear that others might hear his credentials when he’s entering it in a public space and if he doesn't rely on a screen reader, he’s not sure whether he has entered the correct password or not.
- One of the main challenges that Amit faces is finding the exact location of the QR Code. QR code is placed by shop keepers in different places, which makes it harder for Amit to find its exact position, scan and pay quickly. He has to ask other people in the shop to assist him.

Amit wants to know whether the option which he is pressing or double-tapping is responding or not. Vibration or a sound indication would help him to know that a particular option is being activates

SCENARIO 1 :

Amit is one of the members of the blind cricket team and plays a tournament till late night outside the campus during the inter-college cricket tournament competition. When he reaches the hostel for dinner he realized that the mess is closed. So he decides to eat in the canteen. While making payment for the food it was difficult for him to spot the QR code and thus he asked the vendor to help him. While entering password the screen reader would not read the password since he enabled the hide password feature. Only after the third attempt, he was able to make a successful payment since he was was not carrying his headphones. He could not use a screen reader without hiding the password in public space or else it would read out his password loudly.

STORYBOARD OF AMIT

PERSONA 2:

Minal

Female

Age-28

Partially blind

Iphone6

Minal is a graduate in commerce and works in a bank as an accountant. She lives with her parents and uses app-based autorickshaws to commute daily. She sometimes buys groceries on the way back home from a nearby supermarket or mostly orders online groceries.

She does not prefer mobile apps for payment while shopping at the supermarket because she finds it difficult to perform the transaction in a limited time frame in a crowded place where she cannot correctly hear the screen reader. Minal pays most of her utility bills using mobile payment apps but sometimes struggles to easily find the login element in the cluttered landing screen, where she needs to enter her credentials to login into the app.

Goals and Problems

- Cluttered interface - Minal finds it difficult to use mobile payment apps because of the cluttered interface. She needs mobile payment apps that are less cluttered and more organized. She wants only login and password options on the login screen.

- Unlabelled button - While using “SBI anywhere app” , Minal found some unlabelled button - when she puts her finger over that button - the screen reader read “button” - and tells nothing about the functionality of that button. Since the screen reader reads from left to right, if a checkbox or radio button is placed before the text describing it, it becomes unclear to Minal to appropriately understand the labels and perform the desired actions. According to her, the label text should come before its respective control.

- Time out - There are times when she faces the issue of timeout while performing transactions using mobile payment apps. Sometimes, she requires a larger time window to enter her credentials and complete the transaction as compared to a sighted person.

PERSONA 3:

Sarita

Female

Age - 30

Mildy Blind

Oppo F3 - initial configuration

Sarita, who is married for 3 years is a mildly blind (vision: 6/12) housewife who stays in Indore with her husband. Her husband stays out of the station most of the time due to work-related purposes. In her spare time, she likes to read ebooks on her phone with the help of a screen reader. Even though she is mildly blind, she doesn't like to depend on anyone to do her chores. She does most of the transactions by cash, but it is difficult for her to differentiate between notes of different denominations and also to calculate the exact amount in hand, without hassles.

She wishes to use mobile payment apps for transacting as she thinks it would be more convenient and less error-prone for her since she's already well-versed in the usage of a screenreader. However, she struggles to set up the initial configuration required to use the app.

Goals and Problems

- She decided to switch from cash to mobile payments so that she doesn't have to worry about differentiating between different notes. But she has to take somebody else's help to set up the initial configuration in the mobile payment app to start to use it.

- It is also difficult for her to find a person with whom she can share her card details including her card number, CVV, name on the card and expiry date of the card, along with the password of the mobile payment application. In the process, she feels like she is losing her sense of autonomy.

SCENARIO 2:

A few days ago, Sarita handed a 500 rupee note to the grocery store owner instead of 20 rupee note since both are of the same size. After many such incidences, she realized that cash is not the best-suited method of transaction for her. Her friends suggested her to switch to mobile payment apps to perform day to day transactions. Though she is digitally literate and often uses android to read an e-book using a screen reader or to listen to music on youtube or google search, she has never used mobile to perform transaction before.

For making an account in these mobile payment apps, she has to do initial configuration which involves entering the correct details of the bank and card including her card number, CVV, name on the card and expiry date of the card, atm pin along with the password of the mobile payment application. She asked her sister to help her with the initial configuration but in the meanwhile, she loses her sense of autonomy. Moreover, the one assisting her also faces difficulty to enter card details like credit card statement name if they are not acquainted with English.

2.7.Ethical Issue

- Confidentiality

Maintaining the confidentiality of the respondents while handling the risk of deductive disclosure, while presenting detail qualitative data.

- Human subjects protection

As the participant of this research study involves people with visual impairment the research question could have made them uncomfortable. However, we made sure that the questions we framed are empathetic, taking insights from one of our team members who himself is a visually impaired person. Moreover, we tried to build a personal bond before actually questioning them.

- Informed consent

We let the participants know about the motive of our research study before we recruited them. At all stages of the study, we will update them regarding our approach of study so that they can form a fair opinion about their participation in this study.

- Right to withdrawal

The participant can withdraw at any point in time from the research study without giving a reason.

- Anonymity

We will not disclose the identity of participants in any way and maintain their anonymity in all phases of research.

2.8.References

1. Who.int. (2019). *Vision impairment and blindness*. [online] Available at: https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment [Accessed 1 Oct. 2019].

https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment

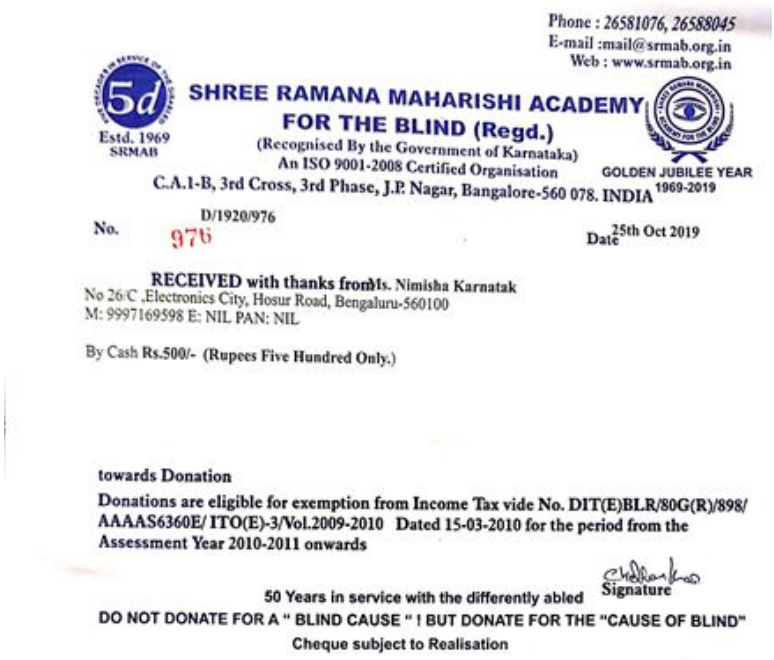
CHAPTER 3: DESIGN CONCEPTS

After understanding the pain-points of the user from the user-research, we tried to understand the problem in a better way by organising an inspiration card workshop. The aim of this workshop was to get design concepts by using technology and domain cards.

3.1 Approaching NGO

Since our aim is to make the mobile payment app accessible for the visually impaired people, it was hard for us to find more than one visually impaired within the campus, thus we approached NGOs so that we can organize our inspiration card workshop with them.

We contacted more than 10 NGOs by phone and then the NGOs that shared their email id, we mailed them, describing our project and our aim. We got a positive response from three NGOs, out of which one gave us permission to organize the workshop today, which is on 25th October 2019. The name of the NGO was - “Shree Ramana Maharshi Academy for the Blind.” We also donated 500 rupees to the academy.



Phone : 26581076, 26588045
E-mail :mail@srmab.org.in
Web : www.srmab.org.in

SHREE RAMANA MAHARISHI ACADEMY FOR THE BLIND (Regd.)
(Recognised By the Government of Karnataka)
An ISO 9001-2008 Certified Organisation
C.A.1-B, 3rd Cross, 3rd Phase, J.P. Nagar, Bangalore-560 078. INDIA

Estd. 1969 SRMAB

GOLDEN JUBILEE YEAR 1969-2019

No. D/1920/976 976

Date 25th Oct 2019

RECEIVED with thanks from Ms. Nimisha Karnatak
No 26/C ,Electronics City, Hosur Road, Bengaluru-560100
M: 9997169598 E: NIL PAN: NIL

By Cash Rs.500/- (Rupees Five Hundred Only.)

towards Donation

Donations are eligible for exemption from Income Tax vide No. DIT(E)BLR/80G(R)/898/ AAAAS6360E/ ITO(E)-3/Vol.2009-2010 Dated 15-03-2010 for the period from the Assessment Year 2010-2011 onwards

Signature

50 Years in service with the differently abled

DO NOT DONATE FOR A " BLIND CAUSE " ! BUT DONATE FOR THE "CAUSE OF BLIND"

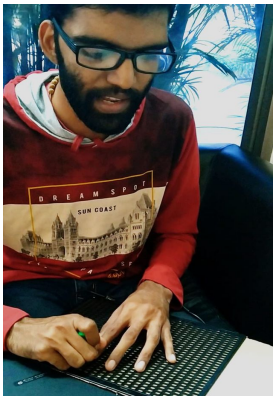
Cheque subject to Realisation

The other two NGOs that said agreed are -

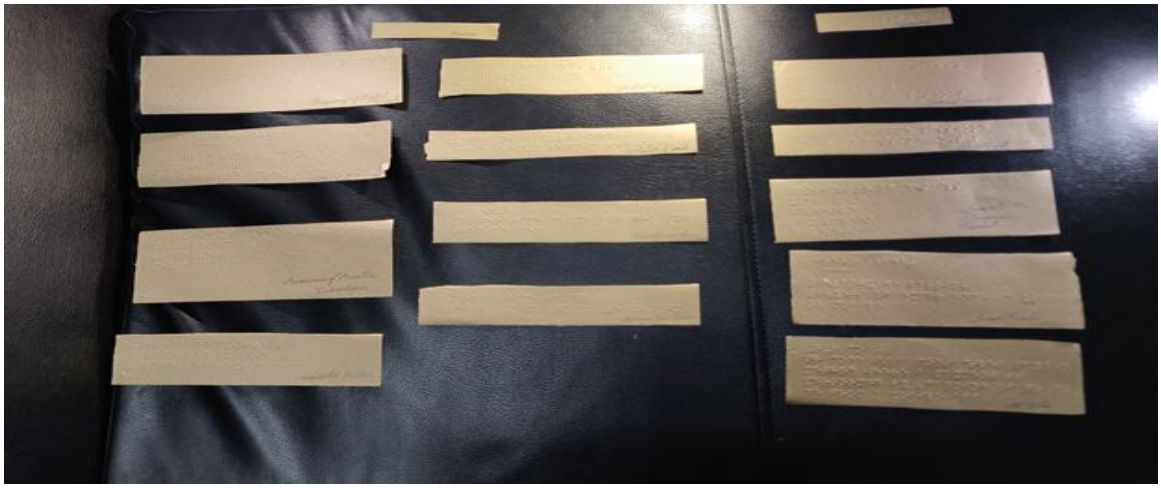
1. Welfare Association for Blind NGO
2. Vinyasa Trust for differently challenged people

They scheduled our workshop after next week.

3.2 Inspiration card



Since our target audience is visually impaired we had to make inspiration cards with braille script. We used the braille board to inscribe the script on paper and later converted it into cards. We wrote descriptions in English on the card in the corner for our reference.



Through our user study, we classified our findings into domain cards and technology cards. Below are the domain cards we made-

3.2.1 Domain card

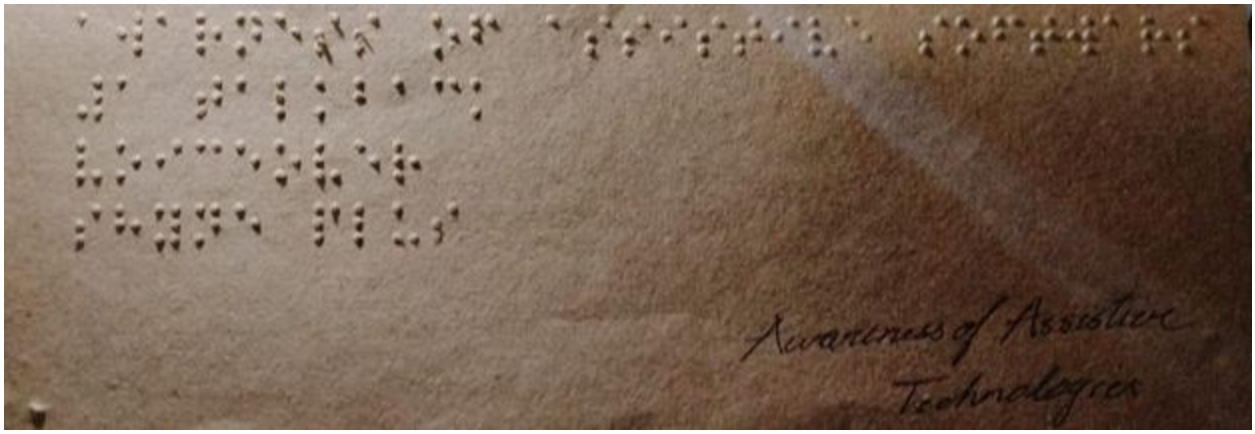
a) Average time needed to perform a transaction

The average time required to do a transaction would typically vary from 2min to 5min.

b) Cluttered Interface

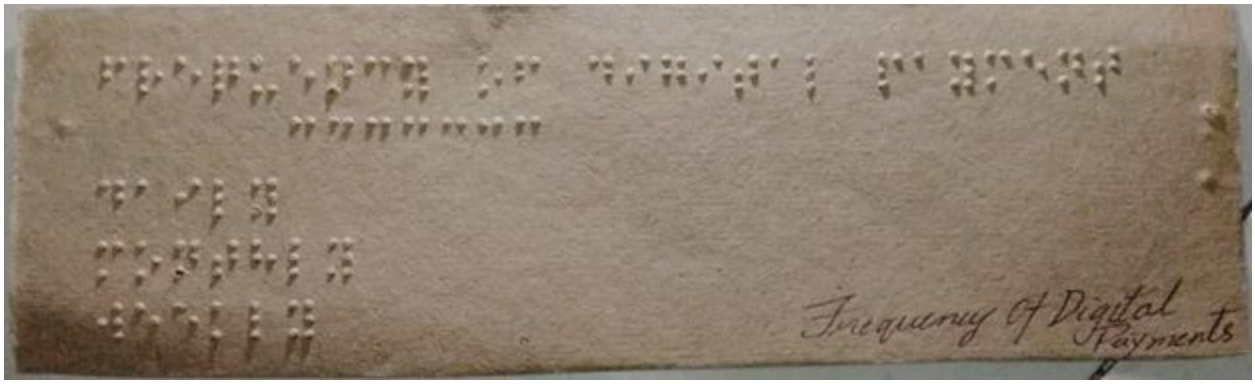
Through our user study, we realized that unwanted icons on the screen trouble visually impaired people. The grid layout which involved incorporation of rows and columns was perceived friendly by respondents.

c) Awareness of assistive technology



This card was to know if our target group is aware of assistive technology or not. We came across names of a few screen readers which include talkback, shine plus, voiceover, commentary.

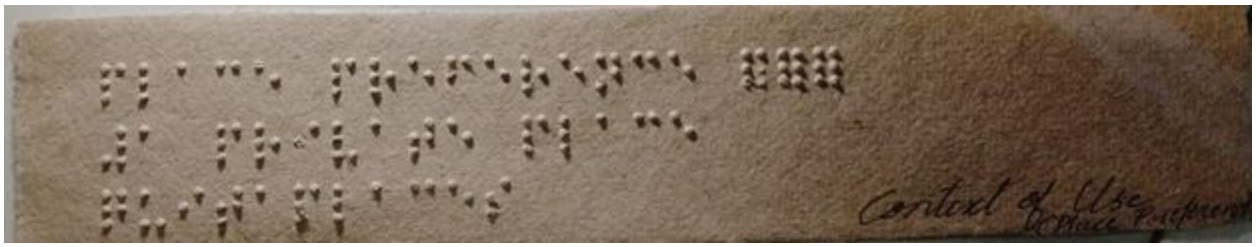
d) Frequency of digital payments



Frequency of use affects the experience while using mobile payment. The more the person uses it, easier it gets for him.

e) Context of use

The surrounding affects the way a visually impaired person does a transaction**.**



f)Use of ambiguous words

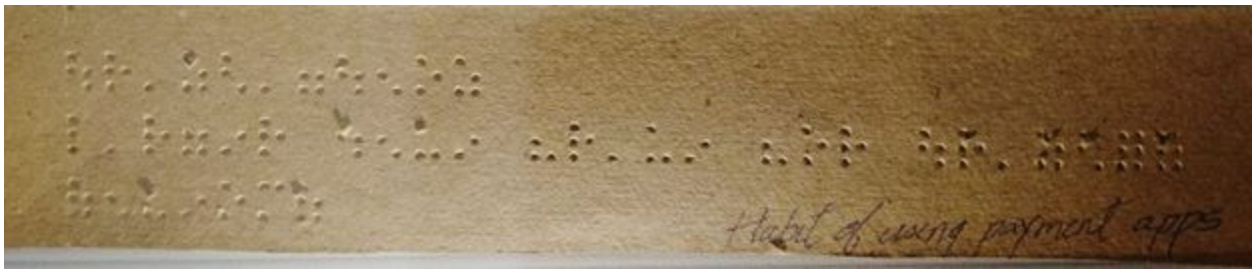
Sometimes use of ambiguous words confuses a visually impaired person to perform necessary steps. For example Login, Signup, Sign in, Register.

g)Unlabelled controls

Unlabelled textbox and buttons remain undetected by screen readers.

h)Habitual to payment apps

Frequently using these apps create a sense of user-friendliness

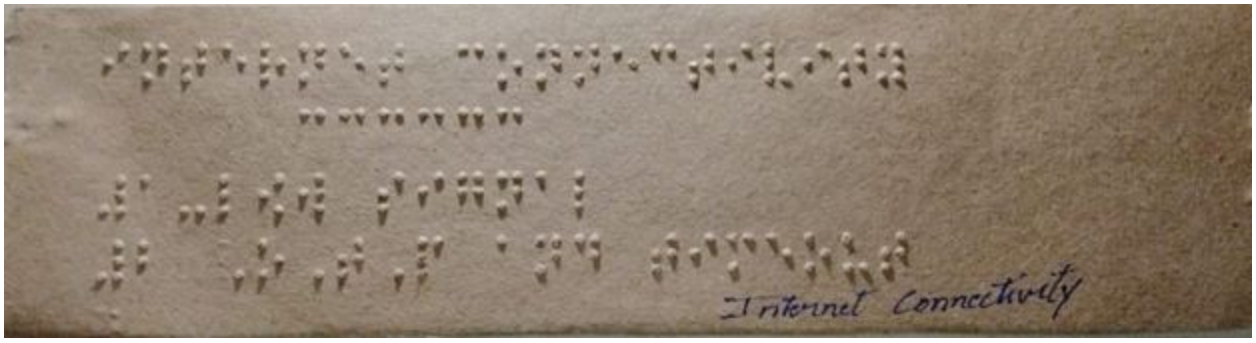


i)Early Timeout

Larger time frame to enter details

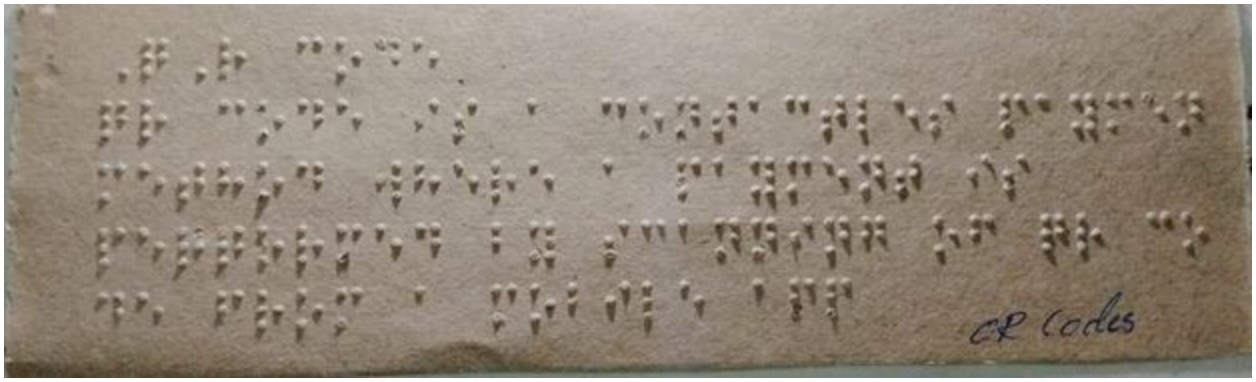
3.2.2 Technology card

a)Internet connectivity



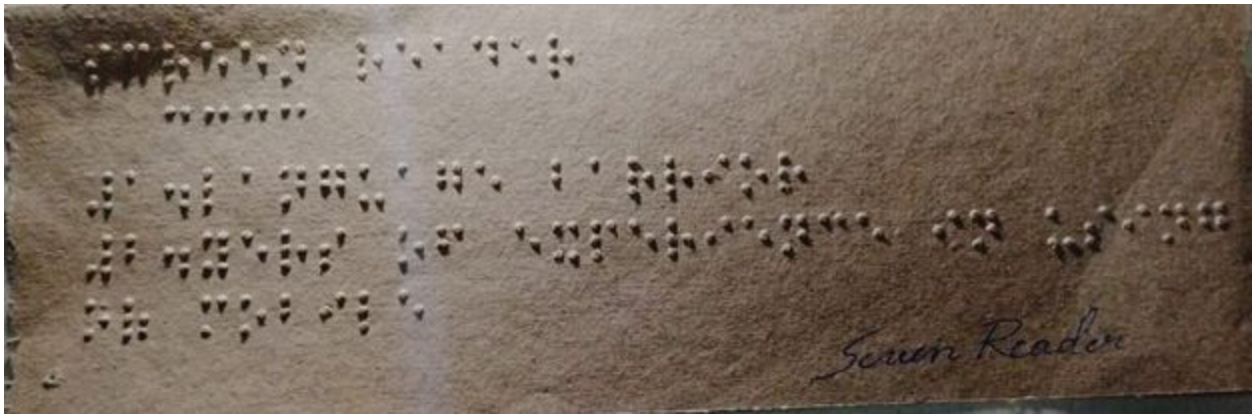
Low signal

b)QR Code



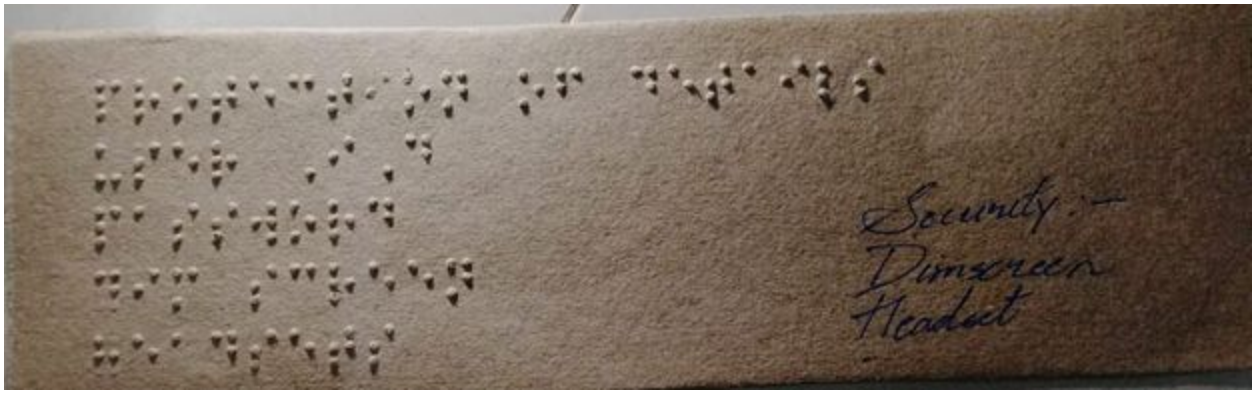
The convenience of QR codes

c)Screen reader



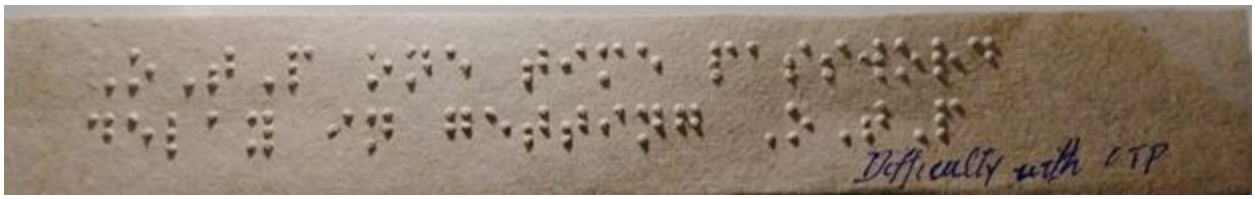
Language barrier

d)Security measures (Dim screen)



Dim screen improves security features in public space.

e)OTP



Sometimes it becomes difficult to enter OTP and sometimes there is a delay in getting OTP.

f)Headset

Headset sometimes makes it easier to use a screen reader in public space.

3.3 Shortcomings

We had to give cards one by one the participant since it was difficult for them to process all the cards at the same time. This would create a cognitive load on the respondent since it was not possible to include visual clues. So it was taxing for the respondent to first remember the cards and then correlate it.

3.4 Summary of the workshop

The NGO which we visited has one completely blind person who uses google pay as one of the modes of transactions. There was one partially blind person and one low vision person, who didn't use any digital mode of transactions. Both of them were non-user of mobile payment apps. They were unsure about what steps to perform. In

other apps, they would just practice by tapping multiple times to get the sense of the functionality of different buttons, but in case of mobile payment apps, they not confident enough to use the app since any mistap would result in loss of hard-earned money.

The one using the goggle pay finds it easier to use, but he suggested in the inspiration card workshop that there has to be a dedicated place where the QR code should be kept in each shop so that the visually challenged people can make transactions easily.

3.5 Design concept from inspiration card workshops

We are following Hick-Hyman law for designing the interface and making it more convenient for the screen-reader user. The law states that more stimuli to choose from, the longer it takes the user to make a decision. Users bombarded with choices have to take time to interpret and make a decision, thus increasing the overall time to perform a task. The common problems with most of the payment applications are, that they lay out a variety features altogether which makes the interface cluttered. Our idea is to cluster similar features together to make the app more inclusive and convenient to use. This is our first design concept.

Another pain point of the user that we encountered during our user study is that the grid view of the interface was not very optimum for the screen reader. Almost all the payment apps including Paytm, Google pay, Phone pay use grid view. Our second design concept is to introduce a list view that will eliminate the problem of navigational ambiguity.

After brainstorming we filtered four feasible solutions for improving situational awareness while using the app like whether the amount entered is correct or not, or whether the option the user is choosing is correct or not, or the status of task completion.

1.Use Minimal Design -

Our idea is to design the app in a minimalistic way. The app will be restricted to the intended use which involves making and receiving payment only. We will keep the design simple with few buttons which will reduce the cognitive load and will increase the overall user experience for the visually impaired person.

2.Use of haptic cues-

We will be using three different vibrations for three different types of actions-

- Negative action including cancel, delete, deny will be conveyed with high-intensity vibration
- Neutral action, for instance, steps that lead to one screen to another, or selecting the recipient of the transaction or clicking a radio button will be conveyed with medium intensity vibration
- Positive action that includes the final step of the transaction will be conveyed with Low-intensity vibration

We choose high-intensity vibration for negative action and low intensity for vibration for positive action because there should be a clear distinction between them and these actions should lie at the opposite ends of the spectrum to increase the learnability of the user.

3.Use of sound ques-

We are thinking of using three different sounds for three types of actions:

- Negative actions will be associated with high pitched sound
- Neutral will be associated with a medium pitched sound
- Positive will be associated with low pitched sound

4. Use of list view

The use of the list view makes the app easy to navigate, though overall steps to make a payment increase, the confusion can be considerably reduced.

Since it is easier to drag from top to bottom for the user with screen-reader, rather than left to right swipe which is not a continuous motion - as the user has to swipe left to right for every row, the list view is more user-friendly as it is a continuous movement which enables the user to navigate seamlessly.

5. Adding a pop-up

Add a pop up saying that - ‘Do you really want to transfer XXX money to ABC person’ because the amount entered is read-only once by the screen reader and if the person didn’t hear it properly, he might make a wrong transaction.

CHAPTER 4: PROTOTYPING

Using the major design concepts that we got from inspiration card workshop and user research, we designed the low fidelity prototype using cardboard, high fidelity Adobe XD Version and high fidelity HTML version.

We made the following prototypes :

1.Low fidelity (Cardboard version):

Used it to check the concept we extracted from the inspiration card workshop and user research

2.High Fidelity (Adobe XD version):

The Adobe XD version of prototype with visual design for sighted users

3.High Fidelity (HTML version):

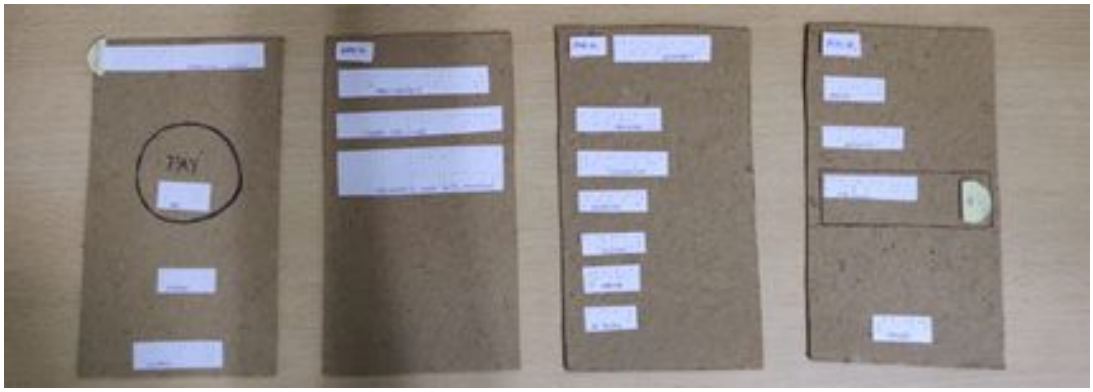
Barebone Html structure of app which could be read by screen readers for Visually impaired people.

4.1.Low fidelity prototype : Tactile paper prototyping approach with Braille

● We performed two iterations with low fidelity prototype.

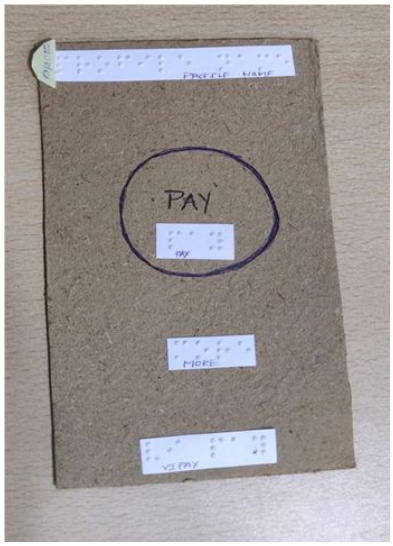
●We tested usability and understandability using the prototype.

●We used braille tags for user to visualising screen by hands.

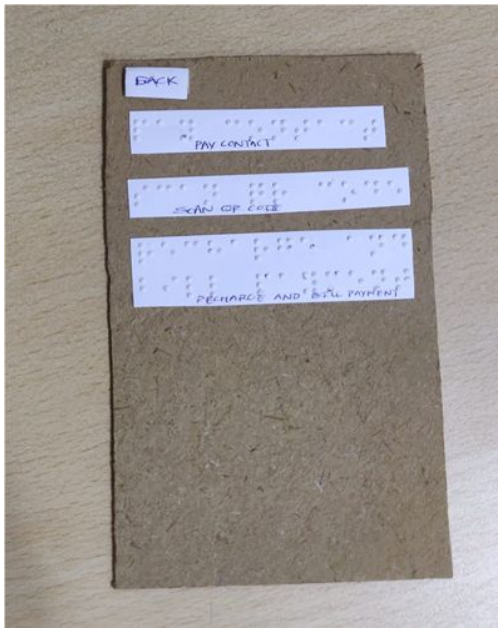


As our target audience is visually impaired, we made Braille tag for the functional button to ensure readability. We made a low fidelity prototype of the screen out of cardboard instead of paper to ensure stiffness since the user would be pressing against the braille tags to interpret the text.

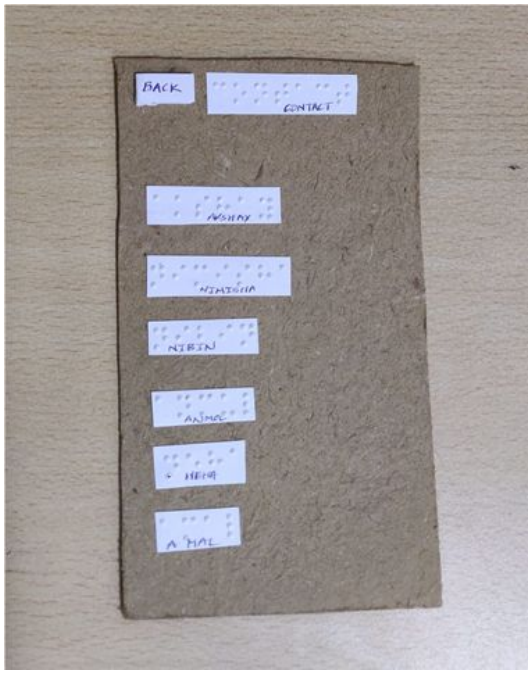
1. This is the home screen of the prototype we made. Since pay is the primary function of the app, we emphasized it on the home screen, as one of the major problems that our respondents told was the cluttered interface. The ‘More’ button includes the frequently made payment either to merchant or peer to peer, an option to check bank balance and rewards.



2.The VI user has to select the type of payment. The payment can be made to a contact or a vendor with QR code or recharge and bill payments.



3.The VI user has to select a contact number to make the payment. He can search the contact by using a search box. The elevated back button is on the top left corner.

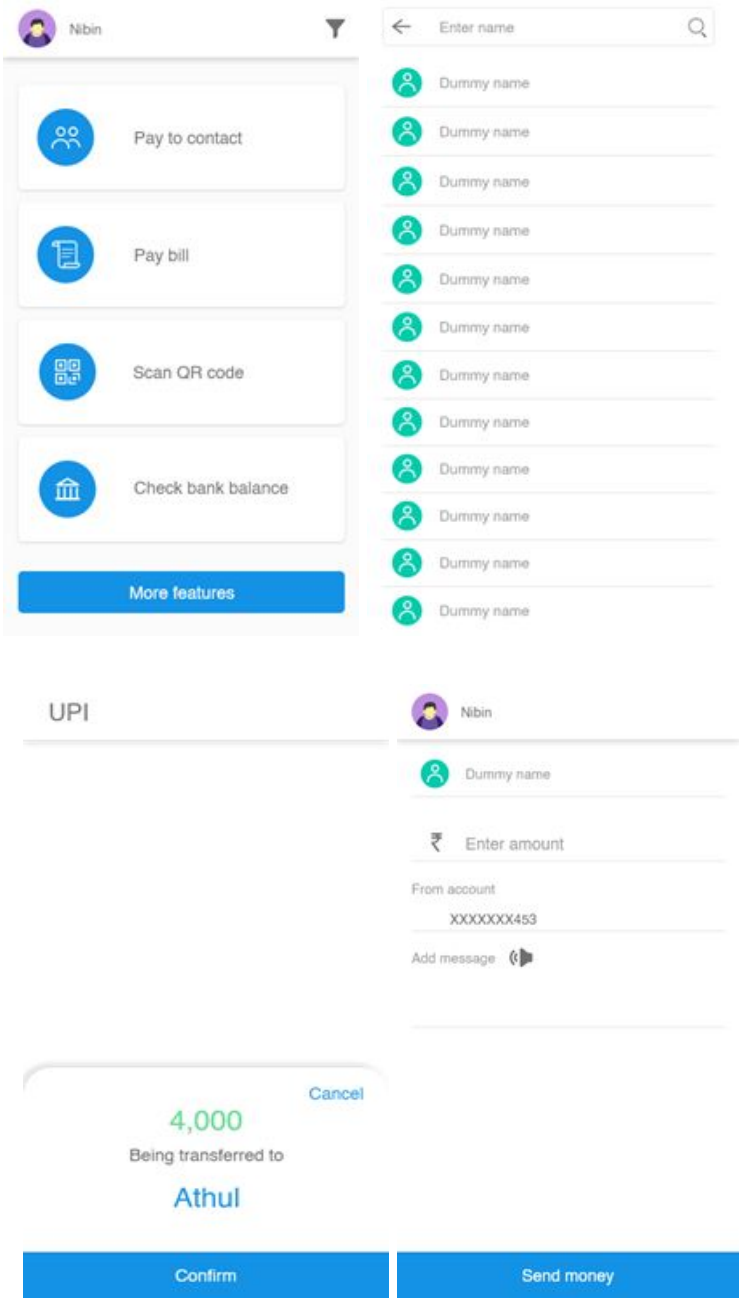


4.After selecting a contact number the user has to enter the amount and then he can add message. The message can either be a text message or an audio message. Since it would be

time-consuming and laborious for a VI person to enter a text message we found it essential to include an audio message feature for the screen.

4.2. High fidelity prototype (Adobe XD)

- We performed only one iteration on a high fidelity XD prototype.
- We tested usability,understandability of the interface using this prototype for sighted participants.
- We used only 2-3 colours throughout the interface to maintain color consistency.



4.3 High fidelity Prototype (HTML Version)

To check the accessibility of the high fidelity prototype, we planned to make it on HTML however it has not been completed yet. HTML was chosen because of its semantic structure that can be easily read by the screenreader making it accessible for the visually challenged.

CHAPTER 5: EVALUATION PLAN AND OUTCOME

5.1.User Evaluation Plan

After making the prototype we had to come up with a plan to test it with the target audience. Without testing a prototype it would be difficult to conclude on any findings.

Goal

- To ensure the new interface is working well for the intended audience ie visually impaired people and to get feedback regarding the same.
- Along with visually impaired people, the plan is to even test with sighted users to include a bigger audience. These can be the secondary user of the application.

5.2.Evaluation Method

We performed the following evaluation methods in a controlled environment because of the time constraints.

- Hawk evaluation
- Speak aloud with low fidelity prototype (Visually impaired)
- Speak aloud with high fidelity Html prototype (Visually impaired)
- Speak aloud with high fidelity prototype (Visually sighted)
- Interviews

5.3.Practical issues

- Since we are dealing with the visually impaired audience we had to very creative while building a prototype. For the low fidelity prototypes, we used braille tags on a cardboard sheet.
- The high fidelity would have two versions. One for sighted users and another for visually impaired users. The Adobe XD version of prototype with visual design for sighted users and a barebone Html structure of app which could be read by screen readers for Visually impaired people.
- Recruiting the audience for users testing tunned out to be a difficult task. Since one of the members of the group is visually impaired he performed the hawk evaluation.

5.4.Method of collecting data

With the consent of the participant, we recorded the speak aloud activity as well as the interview after it.

5.5.Outcomes of low fidelity

Version 1:

After low fidelity heuristic evaluation, we realized that the number of steps to make a peer to peer payment can be optimized. So we reduced the number of steps by one for better user experience.

Version 2:
After testing it with a participant the suggestion we realized the sound cues might not be desirable features for all the users. It can be a feature that can be enabled and disabled by the user depending on his preference.

5.6 Outcomes of high-fidelity

People find it easy to use more visual design elements could have been added to the prototype for sighted person.

CHAPTER 6 FUTURE RECOMMENDATION AND LIMITATIONS

6.1 Future Recommendations

During the course of this research, we found that one striking feature that has been missing from all the mobile payment apps is the customized view or an option to personalize the app. For instance, visually impaired people are interested in making the mobile payment interface neat and well organized as it is hard for them to work with a messy interface using a screen reader. All the popular apps such as Paytm, Google Pay, PhonePe, etc. are lacking this feature.Hence, we would like to focus on how to improve the user experience of these payment interfaces with the help of personalization by offering customized options.

6.2 Limitations of the Project

1.People find it difficult to use Initial configuration, but we couldn't do much about it in this project. Initial configuration is the initial hurdle for the new visually challenged user who wants to use the platform
2.We were not able to recruit many participants.
3. Technically there was no video interview because majority of the participant did not give consent for it, in some there was network issues while some were unable to adjust the webcam properly.
4.The inspiration card workshop happened in the form of interview since there are many visual cues in it.
5. Because of time constraint, we couldn't develop an app that makes the payment accessible for the VI people.
6. Limited scope to study the participant in their natural environment because of logistic constraints.
7. We were not able to successfully convince the participant to keep a diary record after every transaction.