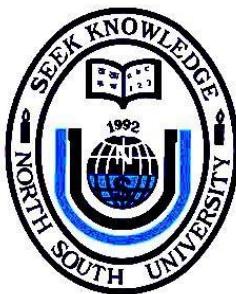


**Department of Electrical and Computer Engineering
North South University**



Senior Design Project

**Freelancing Mobile Application Development for
Low-literate and Semi-literate People:
A User-centered Approach**

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DECLARATION

This is to certify that this Project is our original work. No part of this work has been submitted elsewhere partially or fully for the award of any other degree or diploma. Any material reproduced in this project has been properly acknowledged.

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ABSTRACT

A large portion of our population is unfamiliar with tech-based services as computing and digital platform seem harder for unprivileged people. One of the prime challenges in developing a digital platform for the common people is to increase its usability. A large portion of launched mobile applications fail to sustain in the long run as a result of poorly researched audience. To overcome this barrier, understanding the cognitive ability of low literate people is a must before developing any service for this community. This project developed a freelancing platform intending to contribute to women empowerment, and also, it considers the common challenges often faced by low-literate people during different design and development phases.

Table of Content

	Page
Chapter 1: Project Overview.....	9
1.1 Introduction.....	10
1.2 Project Details.....	10
1.3 Project Goals.....	11
1.4 Summary.....	12
Chapter 2: Motivation.....	13
2.1 Introduction.....	14
2.2 Background Studies.....	14
2.3 Motivation towards Project.....	18
2.4 Reaching to the Common People	18
2.5 Case-studies.....	21
2.6 Summary.....	22
Chapter 3: Related Works.....	23
3.1 Introduction.....	24
3.2 Related Activities.....	24
3.3 Related Systems.....	27
3.4 Related Studies.....	29
3.5 Summary.....	32

Chapter 4: Theoretical Work.....	33
4.1 Introduction.....	34
4.2 Usability Metrics.....	34
4.3 Usability Evaluation	35
4.4 Goal-Question-Metric (GQM) Approach	36
4.5 Summary.....	37
Chapter 5: Usability Test.....	38
5.1 Introduction.....	39
5.2 Selection of Participants.....	39
5.3 Usability Test Planning.....	40
5.4 Equipment Used in the Test.....	40
5.5 Rural Data Collection.....	41
5.6 Urban Data Collection.....	44
5.7 Summary.....	44
Chapter 6: Design Methods.....	45
6.1 Introduction.....	46
6.2 Design Workflow and Procedure.....	46
6.3 Design Experiments.....	48
6.4 Quantification of Usability.....	59
6.5 Summary.....	61

Chapter 7: Statistical Analysis.....	62
7.1 Introduction.....	63
7.2 Participants Details.....	63
7.3 Data Analysis.....	64
7.4 Summary.....	71
Chapter 8: System Framework.....	72
8.1 Introduction.....	73
8.2 System Workflow.....	73
8.3 Design Evaluation.....	74
8.4 Comparison of Button Design Phases.....	78
8.5 Summary.....	80
Chapter 9: Technical Details.....	81
9.1 Introduction.....	82
9.2 Technical Tools.....	82
9.3 Software Designing Phases.....	83
9.4 Web Portal.....	93
9.5 Summary.....	95
Chapter 10: Discussion.....	96
10.1 Introduction.....	97
10.2 Usability Quality Components.....	97
10.3 Summary.....	98

Chapter 11: Future Works.....	99
Chapter 12: Conclusion.....	101
Bibliography.....	103

Chapter 1

Project Overview

1.1 Introduction

The growth of the internet and mobile technologies have become a powerful tool to improve the socio-economic status of people in many countries. For instance, mobile phones have brought a revolutionary change for the society being a source of better communication and information. Statistics of mobile phone usage show that about 45% and 43% of people from 40 countries in the world are using non-smart and smartphone respectively [1]. Smartphone users can contribute significantly in the socio-economic changes in our country. People using smartphones are not only confined in texting or phone calls but also involved in the usage of many other mobile applications. The usage of mobile phones is remarkable also in the context of Bangladesh. About 152 million people out of 163 million (2016, World Bank) are subscribing to different mobile operators according to the statistics of July 2018 of BTRC [2] and about 88 million subscribers of them are using the internet [3]. Our concern also covers the illiterate and rural people of Bangladesh where about 64% of people are living in a rural area [4] and the adult literacy rate is about 72.76% [5].

1.2 Project Details

One of the major challenges that hinders the widespread use of digital platforms is the inherent discomfort of low-literate and unskilled people about mobile applications. For instance, only a few of a large number of mobile applications find an adequate user base to sustain, which occurs, in addition to other reasons, due to the inappropriate user interface design of many mobile applications. A careful survey results that a large portion of the mobile applications used in Bangladesh are text-based and provide only the English language despite the presence of a large

number of literate or semi-literate people in our country. To use any mobile application, a user needs to possess a minimum knowledge of the terminology and the information flow of the application. Most of the people in rural areas lack sufficient academic training, resulting in a lower level of cognitive skills in them. This makes rural people less welcoming towards any technological tools. Inherent discomfort towards digital technologies in rural areas, thus, is one of the main issues to consider in this research work. The main objective of this research work is to create a framework of user interface design based on the feedback given by this particular community. To attain this research objective, an android based mobile application has been developed through which users could take orders of various authentic handmade products from customers.

1.3 Project Goals

The goal was to design a freelancing mobile application and a website for the rural housewives so that they could contribute to family incomes. A large number of apps are launched in our country every now and then, but a few of these have been successful so far. As a large portion of our population is not yet familiar with smart or touch phones using mobile apps. So, it is a big challenge to design for this particular community, who are mostly illiterate.

Previous project idea was modified to do a structured analysis to address the social barriers of social computing for low literacy and to improve the user interfaces accordingly. Surveying both urban and rural communities has been performed to understand and differentiate between their discomforts of using smartphones and mobile apps. The plan is to design a demo app in a few

different versions and bring them to the rural people. Then feedbacks would be taken from a definite set of people to understand their flexibility and comfort using those and the app development and design would be improvised based on the survey data. The particular sample of people would be asked again to use the modified app and further feedback would be taken about the updated version of the app. Thus, a comparison between the previous and present data could be found achieving a specific result of improvement from them.

1.4 Summary

The study conducts a structured analysis to identify the challenges of the target user group, and feedback are accommodated subsequently during the different phases of the user-interface design process. Precisely, this project implements a user-centered app development cycle and identifies a few issues that may be useful for the other app developers targeting rural or low-literate user group.

Chapter 2

Motivation

2.1 Introduction

Initially, the project aimed to develop an e-Commerce platform for rural women who generally suffer from lack of enough financial support. The process of mobile app and website development had been started with an intention to provide a platform for rural women to earn and support their families. While researching the target audience [6], it was realized that interacting with a mobile application or a website is very uncommon for them. It may seem very difficult in the long run, especially for the low literate or semi-literate community. Consequently, the project was branched out to find out and measure the difficulties of underprivileged community, and investigate the ways to reduce those.

2.2 Background Studies

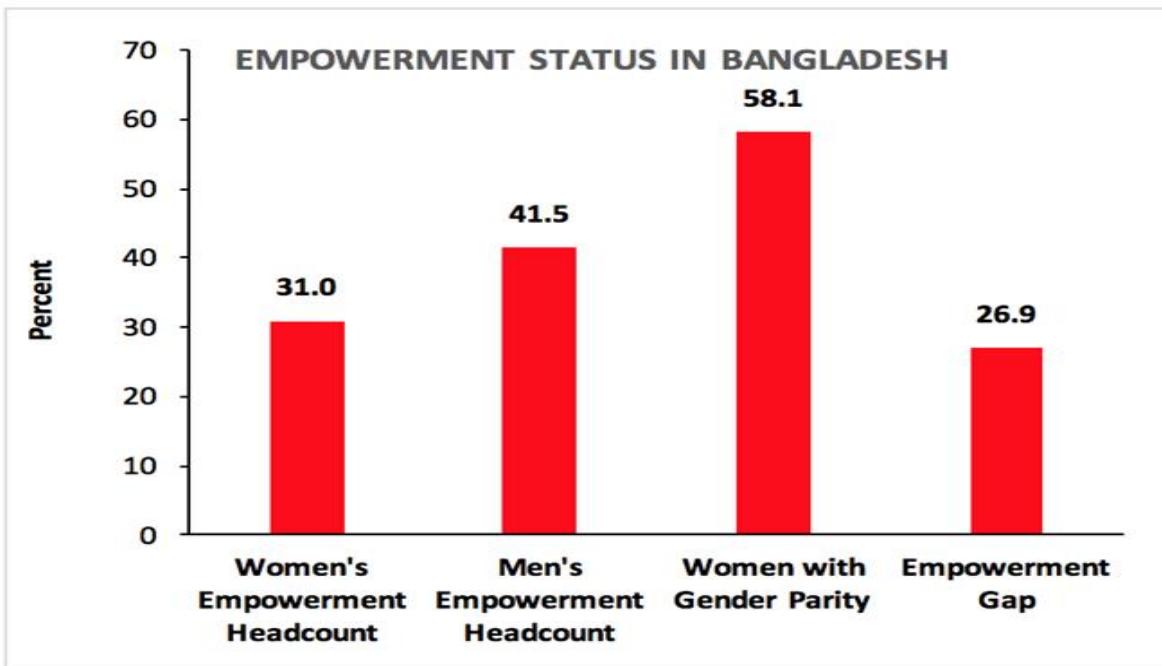
Status of literacy	5 years and over			7 years and over		
	Both gender	Male	Female	Both gender	Male	Female
Rural						
Total	100.00	100.00	100.00	100.00	100.00	100.00
Can write a letter for communication (Literate)	51.81	54.39	49.16	54.19	56.90	51.39
Can't write a letter for communication (Illiterate)	48.19	45.61	50.84	45.81	43.10	48.61
Urban						
Total	100.00	100.00	100.00	100.00	100.00	100.00
Can write a letter for communication (Literate)	65.83	68.09	63.54	68.40	70.84	65.95
Can't write a letter for communication (Illiterate)	34.17	31.91	36.46	31.60	29.16	34.05

Fig. 2.1: Literacy Rate over Gender and Place of Residence
(Source: The Bangladesh Literacy Survey, 2010)

There exist variations in the literacy rate by rural-urban residence. The literacy rate for the population 5 years and over by both genders was 51.81% in the rural areas compared to 65.83% in the urban areas. The corresponding figures for males and females were 54.39% and 49.16% in the rural areas compared to 68.9% and 63.54% in the urban areas. As regards literacy rate for population 7 years and over, literacy rate for both genders in the rural areas was 54.19% compared to 68.40% in the urban areas and male and female literacy rates in the rural areas were 56.90% and 51.39% respectively compared to 70.84% and 65.95% for urban areas [7].

The youth unemployment issue is crucial for the sustainable development of Bangladesh [8]. The youth unemployment has increased significantly over the years whereas the overall unemployment remained stable. The annual rise in population is increasing the share of the working-age population, as a mass of new employees joining the workforce of the country. The Bangladesh Bureau of Statistics (BBS) reported that, in 2016, the youth population in Bangladesh has been about 52 million which is more than 33 percent of the total population. Over the next 10 years, the working-age population structure has been expected to grow more than 2.2 million annually. As the employment is falling with a simultaneous slow response on job creation, it would be an issue for the Bangladeshi policymakers. Similarly, global youth unemployment is in a more critical situation than overall unemployment. ILO reported that one-third of the young people, 1.8 billion, was not involved in employment, education or training.

It is expected that around one billion youth would enter the job market and only 40 percent of them would be able to get jobs in the next decade. Educated women suffer from the highest level of unemployment in Bangladesh despite a quota for women in public service and many private organizations' claim of being equal opportunity employers.



IFPRI (Abbreviated Women's Empowerment in Agriculture Index)

Fig. 2.2: Empowerment Status in Bangladesh

The unemployment rate among female graduates is about 2.5 times more than their male counterparts: 16.8 percent, according to the Quarterly Labor Force Survey (QLFS) 2015-16 by the Bangladesh Bureau of Statistics. Such a high level of unemployment prevails at a time when an increasing number of women are enrolling at universities and economic activities are expanding, driven by the private sector, which accounts for about 80 percent of the economy [9].

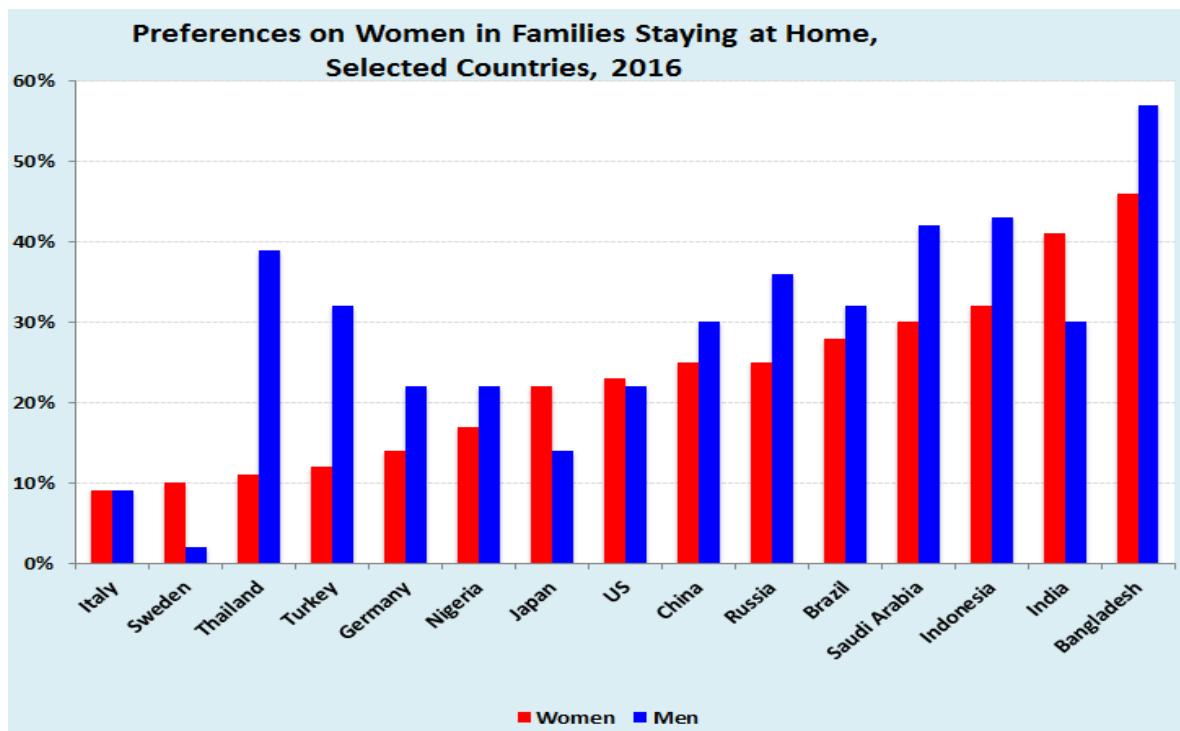


Fig. 2.3: Comparison of Preference for Women Staying Home among Different Countries
(Source: Yale Global Online)

There is a huge gap between the male-female employment ratio and the lion's share of working women are being employed in agriculture. According to the ILO report, in 2017, the total number of employed people in Bangladesh stood at 63.7 million, of which 28.4% or 18.1 million were women and 71.7% or 45.7 million were males. The total workforce at that time was 66.6 million, of which nearly 71% or 47.2 million are male, while only 29.1% are women. Male employment has seen a 25.44% rise, reaching 21.2 million workers, while the industry sector witnessed a 52.11% increase, reaching 10.8 million workers. From Figure: 2.3, it can be said that the percentage of women staying at home is the maximum. Both men and women prefer women to stay at home in our country [10].

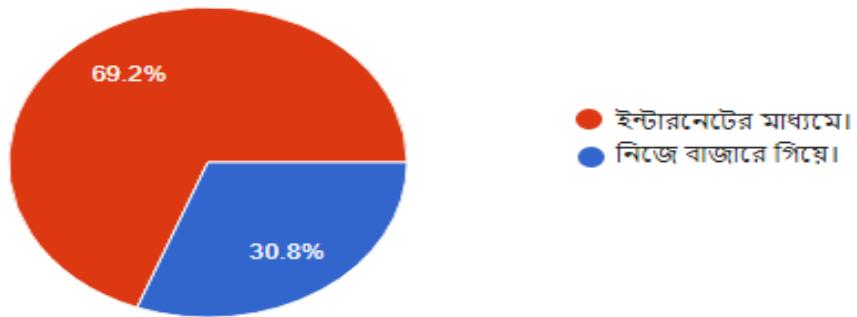
2.3 Motivation towards Project

Intentional diversion took place after wanting to find out the difficulties of unprivileged women and men while using technology-related services. The first attempt was to find out the difficulties of rural people who have digital discomfort while using these types of services. This was solved by divide and conquer strategy. We had decided to start from the very bottom and lead up to the top through step by step. If we look at the developed countries, we will notice that not only old but also low literates are using technology-based services [11]. Because hiring a human-powered service in those regions is very costly. Rather it is easy to maintain and monitor if the system is automated and internet-based, and providing customer service and support using the internet and chatbots are very common nowadays [12]. When the reasons behind discomfort towards digital services are identified, we could be able to cross-match them and get a clear concept about what is making them uncomfortable before using these digital tools.

2.4 Reaching to the Common People

There is no alternative to taking public opinions in concern before designing any customer-based service. Reaching to the general people and collecting user's information and opinions on this particular issue seemed very legit. A short survey on common people about buying handicrafts through mobile applications had been conducted at the very beginning of this study.

আপনি কোন মাধ্যমে কেনাকাটা করতে আগ্রহী?



আপনি যদি ইন্টারনেটের মাধ্যমে বিভিন্ন ঘরোয়া পণ্য
কেনার সুযোগ পান আপনি কি আগ্রহী হবেন?

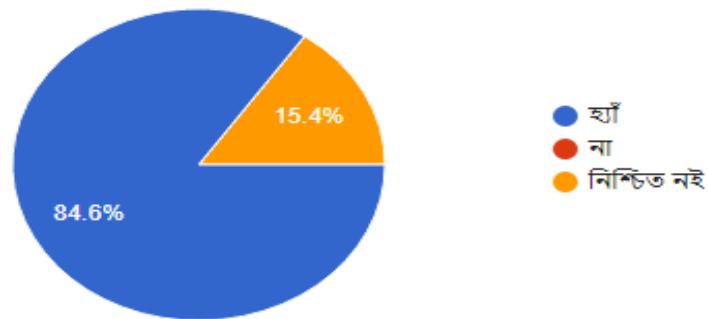


Fig. 2.4: Motivation through survey

কোন ধরণের হস্তশিল্প বা হাতের তৈরি জিনিস ঘরে বসে অর্ডার করার উপযোগী
বলে আপনি মনে করেন?

15 responses

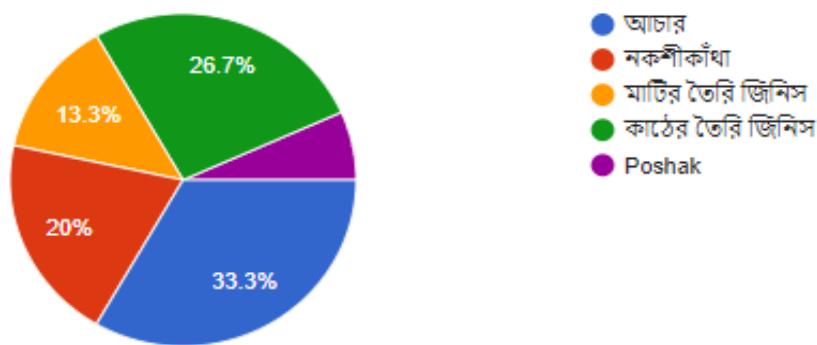


Fig. 2.5: Motivation through survey

Findings:

- 69.2% of people preferred internet-based shopping, 84.6% of them liked to buy household products online.
- Among the list of products, pickles are found as the most suitable handmade product to order online.

As evident from Fig. 2.4 and 2.5, almost all of our participants appreciated the concepts of buying products online.

2.5 Case-studies



Fig. 2.6: Motivation through case-study

An interview of a real-life entrepreneur was conducted aiming to have a good understanding of the sufferings of the workers. We have also interviewed some of the entrepreneurs of ‘Joyeeta Foundation [13]’ to understand their market and selling policies. Their permissions were taken before any publication of the interview and opinions. Conversation with them had motivated us to work for them.

Findings:

- Women entrepreneurs have to struggle a lot initially to promote their handmade products.
- Transportation problems, family issues, etc. are the main barriers for them while running business on their own.
- Most of the entrepreneurs give up their business when they fail to profit and eventually stay home being jobless.

2.6 Summary

Inquiry about the target users is one of the prior sources to get the motivation for this project. After the study, we hope to develop a well-maintained framework for the app development community of our country so that, these low or semi-literate users could overcome their discomforts and make their life better through the help of digital platforms.

Chapter 3

Related Works

3.1 Introduction

As our focus is on both the feedback-based research on low literate community and app development framework creation for them, our study relates to different subjects at a time. Considering the existing e-commerce platforms, previously designed systems for underprivileged people and various studies conducted in this area, related works have been divided into different sections.

3.2 Related Activities

There are a lot of organizations trying to achieve what actually our initial goal was. Aarong, Joyeeta is doing something like that but they don't provide any platform where women can directly contact with clients. Aarong is basically a chain shop specialized in Bengali ethnic wear and handicrafts [14]. It is owned by the non-profit development agency BRAC. They employ thousands of rural artisans across the country. Aarong is sourcing very authentic and local items from all over Bangladesh and selling them in their very fancy showrooms and website. But eventually, these types of programs are not benefiting local producers and workers. On the other hand, Joyeeta is a governmental foundation which was mainly established for building gender equality-based society in Bangladesh [13]. Their focus is on empowering women economically and marketing network from rural to urban. Joyeeta Foundation which had very good potential at the beginning but could not fulfill their goals properly. They started with 40 individual leader based regional collection groups, but providing different types of items and cope up with the current trend was not possible for them. They had been said they had to shut down 12 to 15 groups due to financial problems and proper payment benefits.



Find A Store | Customer Service | Club Taaga | My Aarong Rewards

Search Products LOG IN MY BAG(0)

Home WHAT'S NEW MEN WOMEN KIDS HOME DÉCOR NAKSHI KANTHA WEDDING JEWELLERY TAAGA TAAGA MAN HERSTORY SALE

ELEVATE YOUR LIVING
PLUSH FESTIVE BED COVERS AND DECOR

SHOP NOW Facebook Instagram Twitter Messenger

বাংলাদেশ জাতীয় সংগঠন | অধিকারীর ধরণ | Go | Search | English

জয়িতা ফাউন্ডেশন | joyeeta জয়েতা

নোটিশ বোর্ড

- জয়িতা ফাউন্ডেশনের ১৩ তম বোর্ড গভর্নরস এর সভার নোটিশ
- আন্তর্দেশীয় পক্ষিতে জনবল সরবরাহের জন্য দরপত্র বিজ্ঞপ্তি
- ১২/০৫/২০১৯ ইং তারিখ দ্বারা ১২ ঘটিকায় সভার নোটিশ
- ফিলিপাইন গমান্দের জিও

মহানীয় প্রতিমন্ত্রী

মেধাম ফজিলাহুস মেসা ইমিদ্রা, এমপি

নথৰ: জয়িতা বৈশাখী আয়োজন (২০১৬-০৩-২৯)

Fig. 3.1: Existing Platforms (Aarong and Joyeeta; images are from their respective web portals)

'Dorpon'- is another e-Commerce marketplace for unique and creative handmade goods which is quite similar to ours. They provide a platform where any creative entrepreneur can set up their shops. Sellers can open a shop free of cost and list their products and set the product price. Buyers can order online [15].

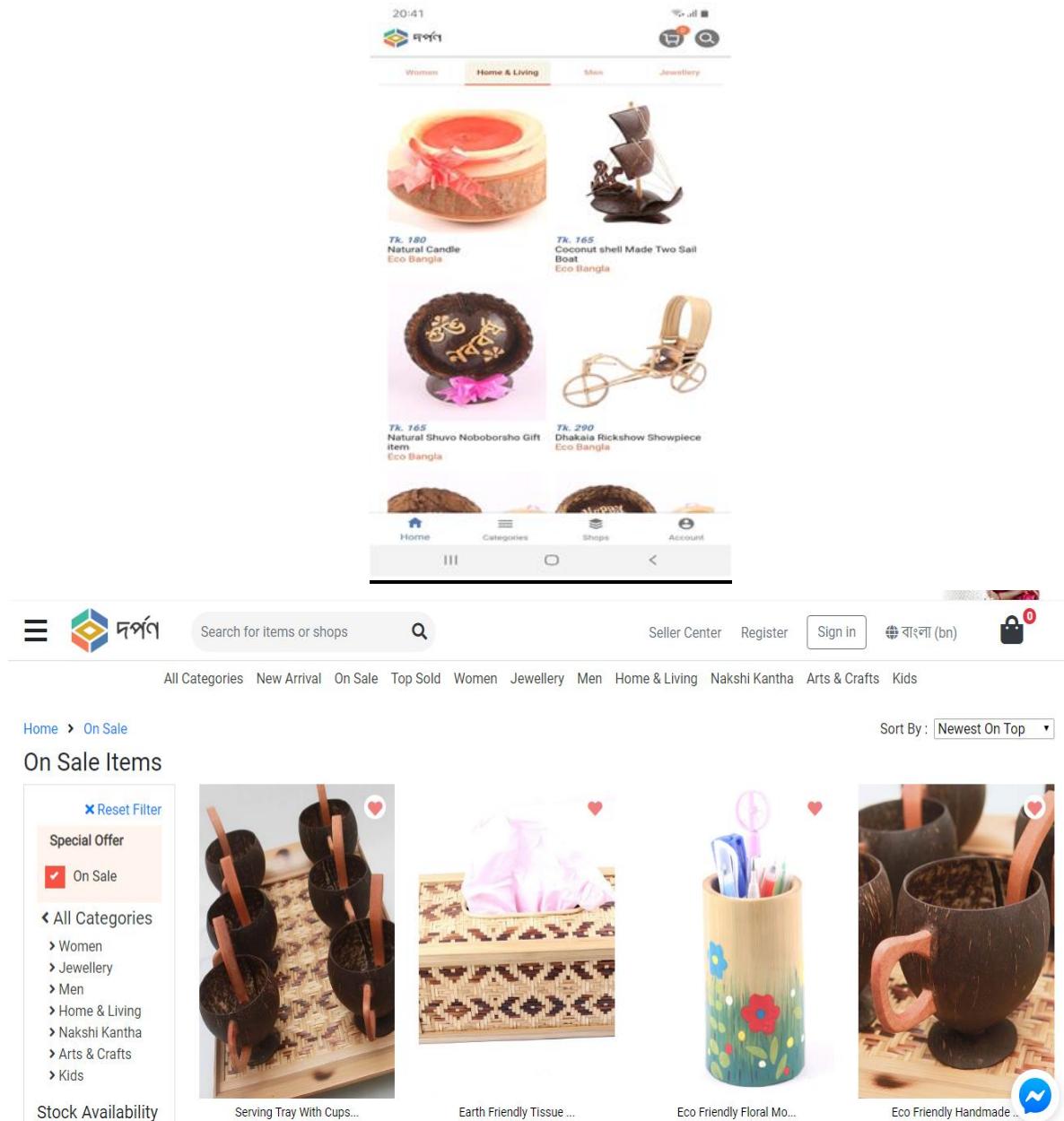


Fig. 3.2: Existing Platforms (Dorpon)

3.3 Related Systems

Bkash is one of the most popular services used by people all over the country. The old version of the Bkash app could have been followed as a standard because it was targeted for rural people and underprivileged users.

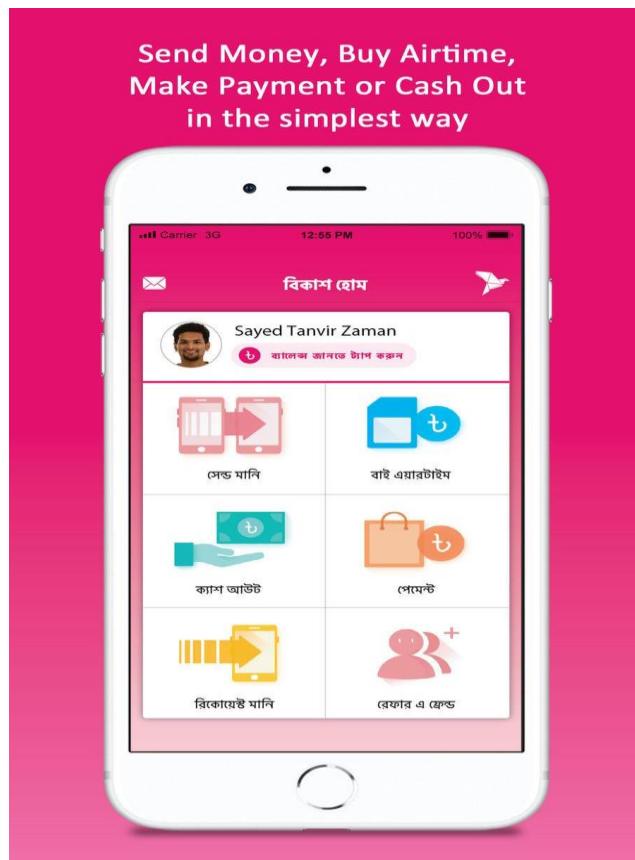


Fig. 3.3: Existing Systems (U/I of Bkash)

But on their second iteration, they changed the whole app and started using typical app development criteria for their user interfaces. Eventually, the service is becoming more and more dependent on popup SMS based.

Some existing companies are also trying a different approach, for instance, Rocket is in the market for a long time, but not having a good amount of audience. Their app is in the store and they also have a good amount of user data to study. But still, their popularity is not as high as Bkash. Nagad, another payment-based app is in a good position nowadays. All the apps discussed here are created for money transfer and online payments, but our main focus is on standardization of user interfaces for rural communities. We had taken them into account because all these apps are designed to reach every kind of user in Bangladesh.

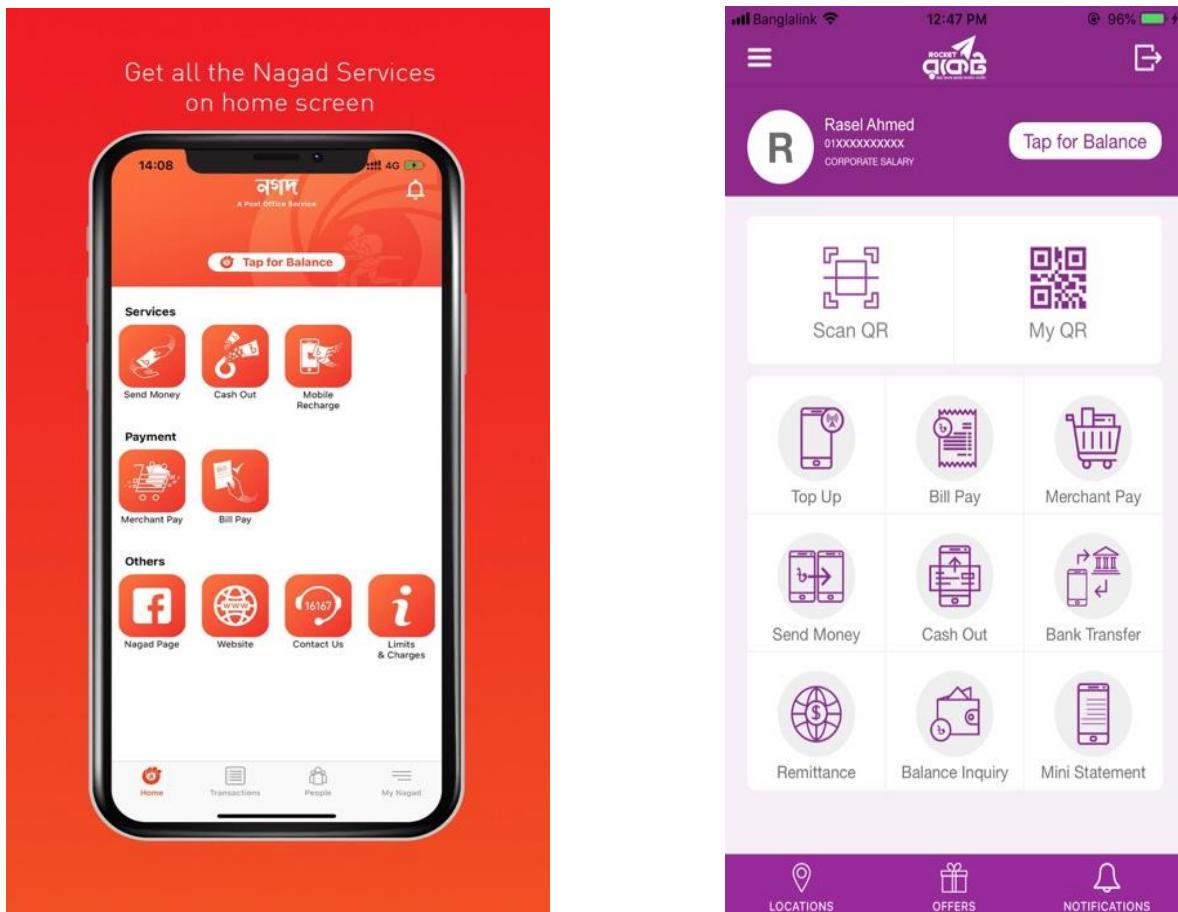


Fig. 3.4: Existing Systems (U/I of Nogod and Rocket)

Features	Bkash	Rocket	Nogod
Bangla language availability	Yes	Yes	Yes
White background	Yes	Yes	Yes
Images used in buttons	Yes	Yes	Yes
Monochrome	No	Yes	Yes
Abstract drawing	Yes	Yes	Yes
Sample icons	 ক্যাশ আউট	 Cash Out	 Cash Out

Fig. 3.5: Comparison of U/I design approaches

It seems that, these are kind of more abstract representation of the tasks to be done, which are often difficult for the rural people to understand, because of their low cognitive skills.

3.4 Related Studies

Ethnography is a qualitative study approach that comes from the subject of anthropology however is relevant to different disciplines. Ethnography is used throughout a wide variety of social sciences. It is the in-depth examination of a lifestyle or a side of a lifestyle. Because of this, ethnographic research often seems very unique compared with other research designs.

Ethnography is different from other research approaches like phenomenology and case studies from various aspects. The first distinction is that ethnography takes long periods of time. Ethnographers spent minimum one year residing among participants of the lifestyle they are researching. This prolonged length of information collection allowed local humans a risk to realize and get used to the ethnographer, and this additionally allowed the ethnographer to construct rapport with local people. Today, ethnographers still spend as tons as possible collecting records, though no longer necessarily an entire year or extra like in the past. The second difference is that ethnography is based on player remark as its key records series method. This is whilst the ethnographer turns into absolutely immersed in another tradition and way of lifestyles. An ethnographer not only observes the phenomenon under has a look at, but also becomes a player in daily existence. The goal is to apprehend an exercise or set of practices within a tradition; that is, why a practice might make sense within the context of the everyday existence of a group. For example, an ethnographer analyzing the spiritual practices of a way of life would not simply attend religious services but also take part in them, due to the fact this would allow them to sincerely understand these practices from an insider's point of view. Finally, a third distinction is that this extended length of participant observation within the subject (the time spent residing in another subculture) is regularly used along with other statistics collection techniques, like interviews, awareness groups, or surveys. However, a whole lot of ethnographic facts come from the ethnographer's subject notes. Field notes are written day by day logs, nearly like journals, that describe day by day existence and events that the ethnographer witnessed and participated in. Field notes are special and descriptive enough in order that another individual could examine them and feel like they were there with the ethnographer [16].

Ethnographic studies faucet the social factor of product layout. They look at the challenges human beings cope with as they interact with and warfare with their environments, or with their existing tools [17].

Two text-free user interfaces are offered to offer employment information with a place map for illiterate and semi-literate domestic slum labors in Bangalore (in India). An ethnographic approach was followed to design the consumer interface (UI) to make the system intuitive to the focused users. This work additionally compared among the text-free and text-primarily based UI and determined that the text-loose designs are strongly desired over general text-primarily based interfaces by means of the test-participants. To layout the text-free UI, they had to bear in mind the functions of graphical icons, voice feedback, semi-abstracted capabilities rather than basically iconic graphics, minimal use of text, and ‘help’ on each page [18].

Research on an ethnographic approach to redecorate user interfaces are furnished by other research where realistic designs are counseled for reaching the person’s comfort. They proposed some strategies of discipline tests and survey to get high-quality outcomes. Ethnographic strategies based on concepts of participatory design have been established to be an effective device in person interface redesign. Their technique is primarily based on an iterative approach that starts off evolved with appropriate preparation. The data wished for analysis is collected in the course of the sphere visits. The statistical analysis begins as early as feasible to permit refinement of the project goals and the strategies for reaching those [19].

In another examine, a non-text based totally graphical interface component has been advised. The navigation structure for low literacy must be different from different structures. They would decide upon a linear structure in preference to any complicated structures. Their important findings are that a low-literacy populace performed first-rate when navigating a linear structure. They

characteristic the higher overall performance with participants' preference to always begin a new assignment at the identical vicinity and having the capability to start over every time they wanted. Participants had issue navigating systems where they might go from side to side among the next screens, but they liked the ability to jump to any screen as provided with the aid of the cross-linked navigation. Following is the particular analysis that led to these results [20].

3.5 Summary

A lot of studies have been done in this area until now. We aim for a better outcome, especially by improving our system through continuous feedback from the target community. Following the standard methods of field survey and approached by the standard norms of the existing systems, a framework of user-friendly interface designing for low literates could be achieved.

Chapter 4

Theoretical Work

4.1 Introduction

Measuring usability is an essential task to ensure the application is valid and accurate to use. Usability is the ease of use and learnability of a human-made object such as a tool or device. In software engineering, usability is the degree to which a software can be used by specified consumers to achieve quantified objectives with effectiveness, efficiency, and satisfaction in a quantified context of use [21].

4.2 Usability Metrics

To create a successful and high-quality mobile app, focusing on usability and user experience is a must. For instance, QUIM, MUSiC, AIDE, SANe, etc. are different models that are provided with methods of usability using different metrics [22]. Task-sensitive metrics refer to the development process based on the user interface design, where users tasks are prioritized. On the other hand, task-independent metrics are the development criteria based on aesthetic and eye-pleasing user interface design.

Effectiveness	Efficiency	Satisfaction
Tasks completed	Task time	Overall satisfaction
Objectives achieved	Time efficiency	Satisfaction with features
Errors in a task	Cost-effectiveness	Discretionary usage
Tasks with errors	Productive time ratio	Feature utilisation
Task error intensity	Unnecessary actions	Proportion of users complaining
	Fatigue	Proportion of user complaints about a particular feature
		User trust
		User pleasure
		Physical comfort

Fig. 4.1: Quality characteristics of measurement by ISO
(Source : Human-Computer Interaction. Theory, Design, Development and Practice)

Standard measurements of usability set by the International Organization for Standardization (ISO) have been chosen as the foundation of the framework. Effectiveness, efficiency, and satisfaction are the three key quality characteristics mentioned in almost every journal reviewed for this study [22].

4.3 Usability Evaluation

Common Industry Format for usability (CIF) – Evaluation reports were developed to cover a wider range of approaches to usability evaluation, rather than focusing on the summative or formative purpose of evaluation. The approach taken was to specify the content that should be included for different types of usability evaluation:

- a) Inspection to identify usability defects and the corresponding potential usability problems.
- b) User observation
 - Qualitative: Observing user behavior to identify actual usability problems.
 - Quantitative: Measuring user performance and responses to obtain data on effectiveness and efficiency.
- c) Obtaining subjective information from users including:
 - Qualitative: Problems, opinions, and impressions given during or after a usability evaluation.
 - Quantitative: Measures of user satisfaction or perception [23]

Usability evaluation can help the developers to understand the needs of users and design accordingly. The survey process has to be focused on six external quality characteristics: functionality, reliability, usability, efficiency, maintainability, and portability. Field tests are much more effective than laboratory tests, but 71% of tests are held on the laboratory as the complexity

of data collection is higher in a realistic environment. Experiment subjects should be taken from different backgrounds to get variety in distributions of results. Tasks should be specified for all the participants to get accurate data [24].

4.4 Goal-Question-Metric (GQM) Approach

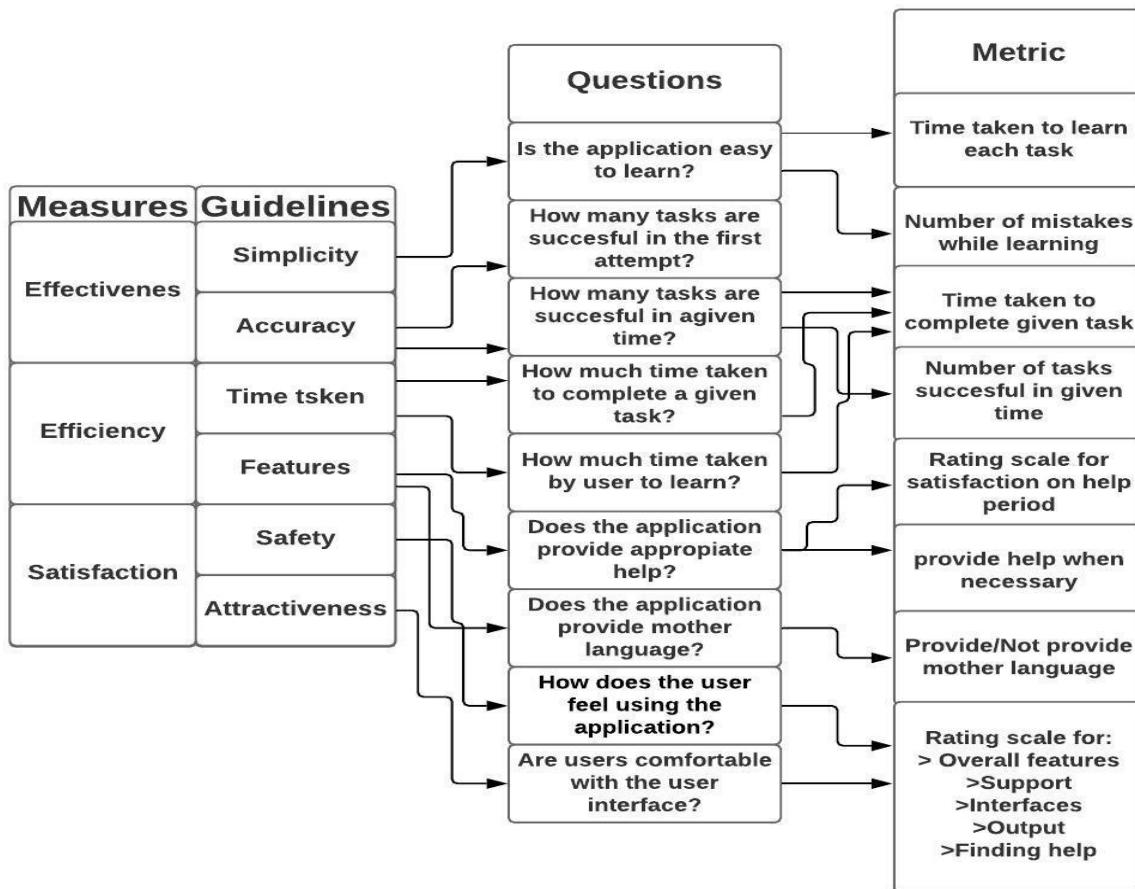


Fig. 4.2: GQM model to Evaluate Mobile Usability related to our research

GQM approach defines three consecutive steps of usability measurement: i) Goal, ii) Question, and iii) Metric. Initially, the goals should be set according to the guidelines, and then questions should be prepared to assess those goals. Finally, a set of metrics should be developed providing the answers to the questions. Considering all the relevant guidelines of a quality characterization, few goals have been set for the GQM model, and those are Simplicity, Accuracy, Time taken, Features, Safety, and Attractiveness. To assess these goals, a few questions have been demised and a set of answers have also been assumed to develop the necessary metrics. While examining the questions from qualitative to quantitative level, it has been observed that objective answers would not be applicable for all queries. Rather, some measurements should be taken using particular questionnaires for assessing user satisfaction. Thus, a complete GQM model as in Figure 4.2 could be developed providing a usability metric following the quality characteristics of ISO [22].

4.5 Summary

Involving users in the development process of a system to develop a system according to their requirements is proved to be an efficient approach. This is assured through the usability study, which deals with the fact that, if a user can perform tasks with the designed system efficiently or not. Users often prefer systems that are simple, interesting and satisfying. If they feel uncomfortable with the interface or the system is too complex [25], it may force them to discard the system. Consequently, an app may fail in the market.

Chapter 5

Usability Test

5.1 Introduction

To understand and improve the usability of any user some usability tests and measurement of discomfort had to be conducted. With this goal in mind, user and interface interaction data was collected to measure the usability for the user. This usability data must have been very diverse and almost all kinds of user groups have to be included into it. It is a must to analyze these data to quantify what kind of user interface should be developed targeting particular communities. The results will indicate what changes have to be done in the existing system and how to cooperate with the user's usability behavior. Planning and conduction of usability tests are discussed in this chapter.

5.2 Selection of Participants

In the usability test, 20 people from rural area and 10 people from the town area have been participated. Urban living people were selected from university zone, whereas the rural people were selected randomly from the outskirts of Dhaka city. All the participants could be marked by low literacy. To communicate better about the usability test and tasks, we have chosen Bangla as a mode of communication. Participants who were able to express themselves were selected so that we would be able to collect the observations easily during the usability test.

5.3 Usability Test Planning

The direct involvement of users had helped us to collect information about the prototype application. The evaluation of this application was conducted in an organized way. Usability testing guidelines were followed when conducting the usability test. The participants were given a brief introduction to what they were going to perform and they were also provided with the details about the tasks that they had to perform at the start of the usability test. Some participants had got demonstration before test and some were not given any. The actual test was conducted where the participant's interaction with the system was observed and noted down by us. A total of 30 (20 rural and 10 urban people) participants participated in this test. Each individual was asked to navigate the app till the last page of the mobile application. Their movements had been recorded for further analysis. Then, 7 people from each sample (rural and urban groups) were selected for the task-based usability test, conducted later.

5.4 Equipment Used in the Test

All the participants had taken the test individually. The urban people had taken the test in their respective workplaces and rural people have taken the test at their respective homes. The test was conducted in an environment where the participant was free to move around in the room while using the application. The equipment used for the survey is a mobile phone, screen recorder and stopwatch included in it.

5.5 Rural Data Collection

In Bangladesh, people in rural areas often get things done with the help of a young family member or any digital expert, whenever they have tasks related to internet service. For example, creating an email account or submitting an online form to a government office etc. have become frequent practice nowadays, and senior people often seek help from others.. The initial goal was to collect data from outside of the city area as far as possible. Because, how much change in technological uses and services are differing is clearly noticeable in the rural areas of our country.

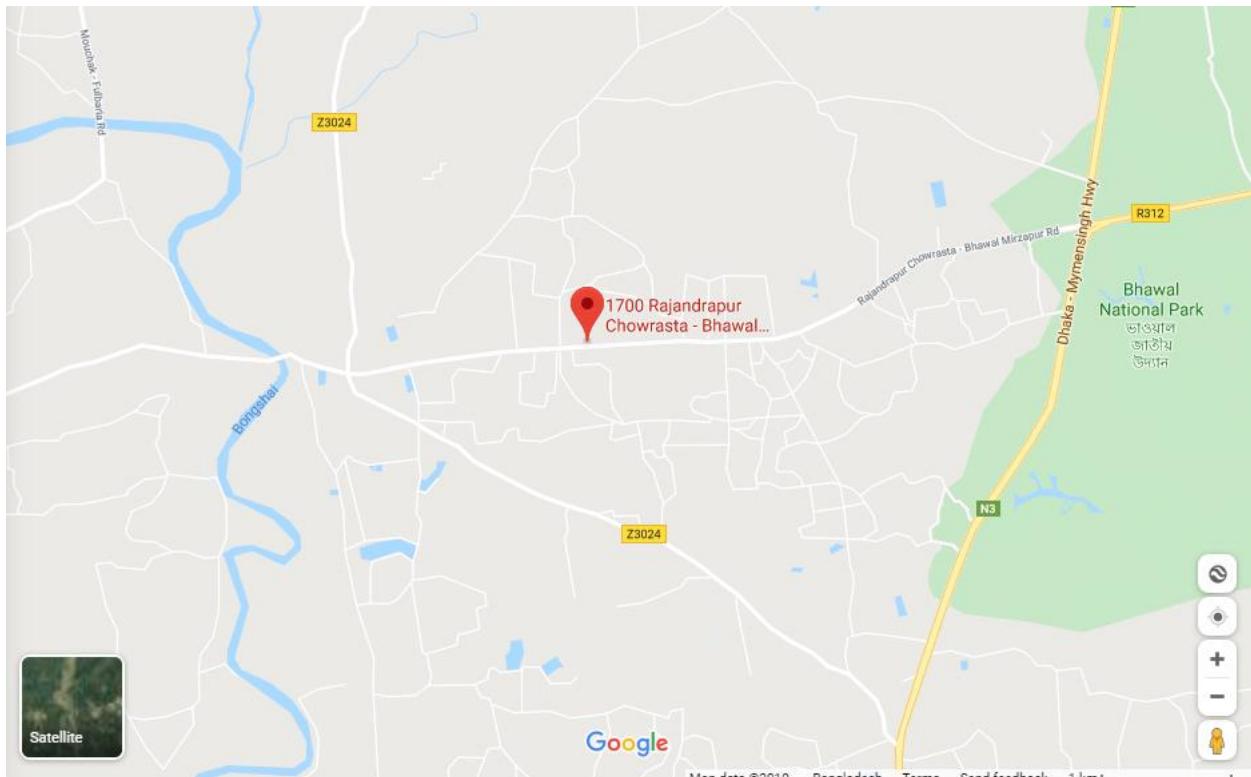


Fig. 5.1: Location of the Survey Area

The target area of the rural data collection was 43.2 km away from Dhaka city. The visited place was a remote town of Gazipur district, located just behind the Bhawal National Park. The locality was a highly populated community and people are very friendly. Door to door visits were done to conduct the survey and collect the user's reviews. They helped a lot during the whole process. Each and every person was asked before starting the data collection to know if they are comfortable with the process or not. The age range of the participants was from 12 to 55 years. Also, there was an educational diversity among the participants. For instance, some of the participants never went to school or received any education from any institute, whereas some of them went for a few years. There are a few participants with no educational background, but they were able to read and write fluently. Some are not comfortable with digital devices, but can do official works such as: banking activities or activities done in the government offices.

Process

We went to Bhawal Mirzapur in Gazipur district to conduct our survey. We took our data from 20 random people living in that area. Though our maximum samples were female but we also tried to collect data from males as well. Firstly, permissions had been taken from different people before starting the survey process. Surveys were conducted only when the consent is assured. In the first phase, we had tried to explain to them about our purpose of coming, so that they could be able to cooperate with us. After that, their basic information were taken verbally. Then we had showed them the first version of our app giving an instruction about how to use it. After showing the app process, they were given it to use. We used a stopwatch to calculate the time and kept a record of their movements while using. Upon finishing a task, they were asked for their opinions about the app.

Then, they had to go through a questionnaire through which we could understand their perspectives about different pictures and writing styles. Here the first phase was ended and a few of them were selected for the next phase of the survey. In the second phase, the participant was given the app again and asked to perform particular tasks. We had calculated the time required to complete certain tasks and noted the corresponding difficulty levels for further analysis.

Observation

We had found them very welcoming and hospitable towards us. Most of them were treating us as guests and wanted to serve us with foods they could afford. We were offered snacks at almost every home we got in. But all of them were not willing to take part in our survey. We were feeling like we were guests to them. Almost all of them reported technology fear and some of them were very shy and hesitant to participate in the study we explained. Many of them did not use smartphones or touch phones ever. But when we instructed them, they used it quite easily and felt confident. We realized that after a little briefing, and introduction they felt very familiar with the app. Due to low literacy, they had some superstition and negative views about technological gadgets. Some of the women have very high-level of conservativity that, they did not want to disclose their identities to us and wanted their husbands to give answers on behalf of them. Again, if they had admitted to give opinions, their answers might be followed by their husband's ones. Some of them also did not give their honest opinion. Precisely, some of them took a lot of time to complete a task, but they did not admit, maybe, because of shyness or their family members were present with them.

5.6 Urban Data Collection

Users from the urban area tend to be familiar with the common mobile applications using the environment. For this reason, usability measurement with them was comparatively easy. However, in the urban area, some people do not use mobile application-based services even with full access for them. The main intention was to find out which group of people is feeling uncomfortable and what the reason for their discomfort is. We had chosen another sample from urban areas who were mostly low literate and not so familiar with digital platforms. They were selected on the basis of their availability, as it is easy for us to trace them whenever further query is needed. In future, data collection locations would be much more diversified for getting improvements in the results.

5.7 Summary

From the study on both the samples we had taken into account, we had found some basic criteria about designing the user interfaces. Survey findings were later used to improve the user interface designs. Thus, feedback from the user helped us in the whole app designing process. The improvement in usability of an app could be achieved by performing usability test repeatedly and modifying the design accordingly.

Chapter 6

Design Methods

6.1 Introduction

Few case studies had been done before preparing the survey queries and selecting procedures. An online survey had been conducted in an urban community to understanding the barriers of using digital platforms among older people. Survey of rural people must be conducted manually as they are not comfortable with digital devices. The whole process had been divided into two phases - i) all participants had to take part in phase-1, and ii) a few selected ones among them were taken for the phase-2.

6.2 Design Workflow and Procedure

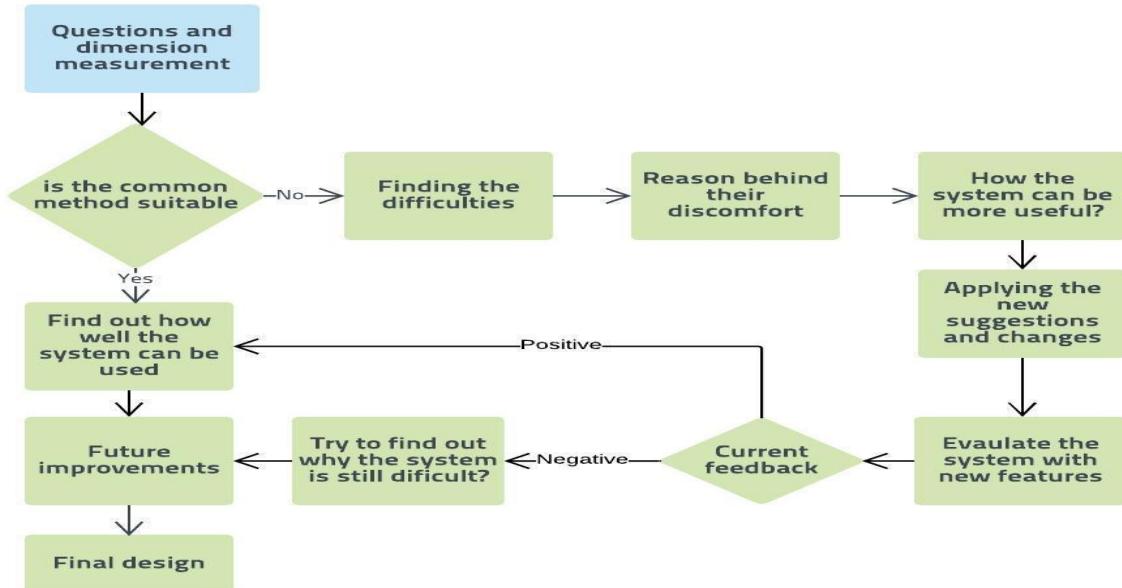


Fig. 6.1: Feedback based U/I design workflow

Background study	Why any change is needed to the current system and how this study fits in future
Finding difficulties	Detection of problems which could be solved by this study
Planning through research	What could be the possible optimal solutions and how to achieve them
Primary version design	Usable first version for the survey
Taking feedback	Get to know users' opinions and needs
Data analysis	Statistical analysis of the results
Improvisation	What features should be added for better result
Taking feedback again	How the improvised version helps
Optimization	Is the current version optimized or not
Development	Finalize design

Fig. 6.2: Feedback based U/I design procedure

6.3 Design Experiments

In the first phase of the survey, some questions were manually asked to the participants and their opinions were recorded. Queries were based on their understandings and cognitive abilities. Then, they were given demonstrative instructions about how to use the mobile app. After that, they had to navigate the app randomly to the last page and the time was recorded for each participant. If a participant was chosen for the second phase, two tasks were given to complete. Time taken for each task and difficulty levels had been measured through this phase as well.

Survey Questions: Phase 1

□ Q.1: Which of the following pictures gives you the clearest idea of a house?



A (କ)



B (ଖ)



C (ଗ)



D (ଘ)

Which of the following pictures gives you the clearest idea of a house?

30 responses

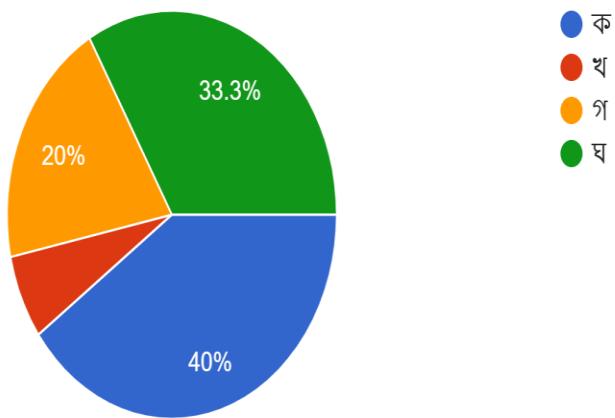
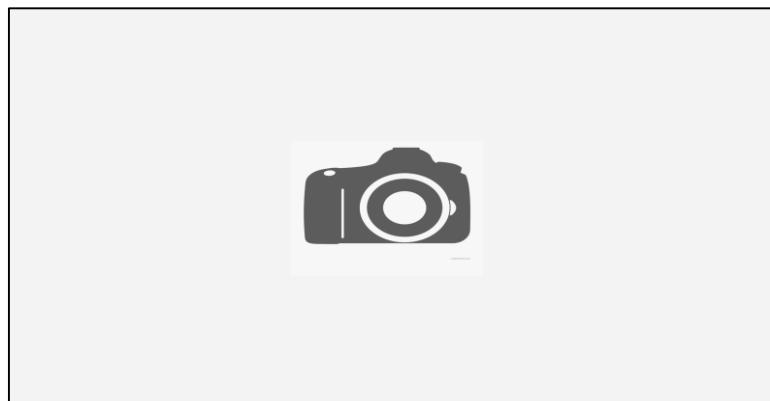


Fig. 6.3: Pie-chart for responses of Q.1

Findings:

- In Q.1, only 6.7% of people responded for option B, which is an abstract drawing.
- Line drawings and schematic shapes are less comprehensible for low literate people.
- Rather, they prefer natural-looking designs and understand them quickly.
- Colors also help them to perceive better.
- Most of the participants appreciate colorful images instead of a pale image.



□ Q.2: What is being asked to do with the pictures above?

→ Right (সঠিক)

→ Wrong (ভুল)

What is being asked to do with the pictures above?

30 responses

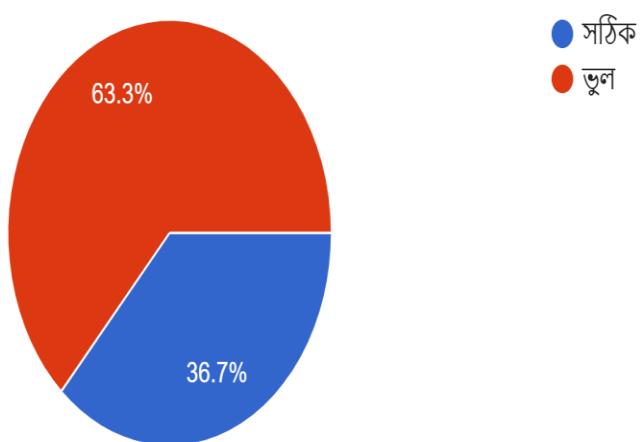


Fig. 6.4: Pie-chart for responses of Q.2

Findings:

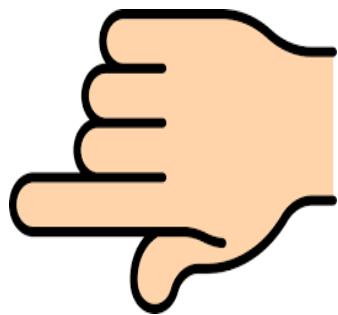
- Low literate people hardly understand any instructions through images without any text provided.
- They usually do not have a sense of assumption without a clear indication given.
- Only 36.6 % of people could realize that they had been asked to take a photo of NID.
- Though the icon of the camera and NID were easy for them to recognize, most of them could not find the relation between these two.
- Instruction through only image seems complicated to low literates.



A (କ)



B (ଖ)



C (ଗ)



D (ଘ)

- Q.3: From which of the following instructions you understand you're being asked to go to the back page?

From which of the following instructions you understand you're being asked to go to the back page?

30 responses

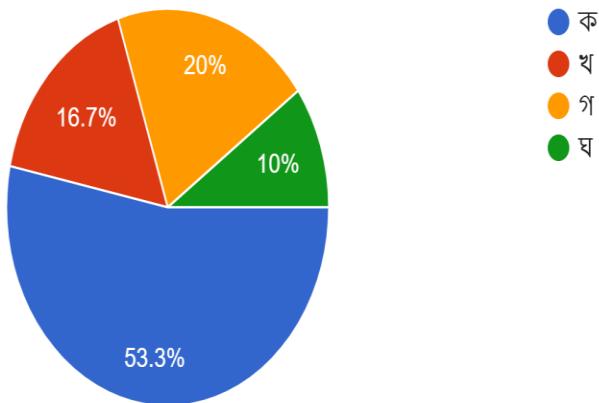


Fig. 6.5: Pie-chart for responses of Q.3

Findings:

- Four options of sample buttons were given.
- 53.3 % of participants preferred commonly used icons among them.
- Low literate people are familiar with previous button phones, where this kind of arrow sign was frequently being used.
- In highways and public places, back arrow signs are seen also.
- They could understand better if button designs are simple and ordinary.



#220687136

A (କ)



B (ଖ)



C (ଗ)

D (ଘ)

Q.4: “Tap below” - which image does the instruction clearly indicate?

“Tap below” - which image does the instruction clearly indicate?

30 responses

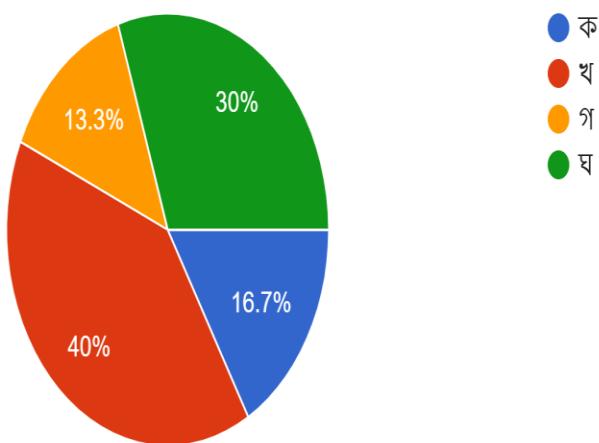


Fig. 6.6: Pie-chart for responses of Q. 4

Findings:

- 40% of people have chosen the natural-looking pictures.
- Abstract designs are not welcomed; instead, pictures such as rickshaw painted images are more preferable for them.
- Pictures using brighter colors are easier for them to perceive.
- Red could be marked as an indicating color in case of pointing something.
- 30% of people responded for option D where button is clearly visible.

□ Q.5: Which of the following articles can you read most easily?

A (ক) আপনার একাউন্টে প্রবেশ করুন

B (খ) আপনার একাউন্টে প্রবেশ করুন

C (গ) আপনার একাউন্টে প্রবেশ করুন

D (ঘ) আপনার একাউন্টে প্রবেশ করুন

E (ঙ) আপনার একাউন্টে প্রবেশ করুন

F (চ) আপনার একাউন্টে প্রবেশ করুন

G (ছ) আপনার একাউন্টে প্রবেশ করুন

H (জ) আপনার একাউন্টে প্রবেশ করুন

I (ঝ) আপনার একাউন্টে প্রবেশ করুন

Which of the following articles can you read most easily?

30 responses

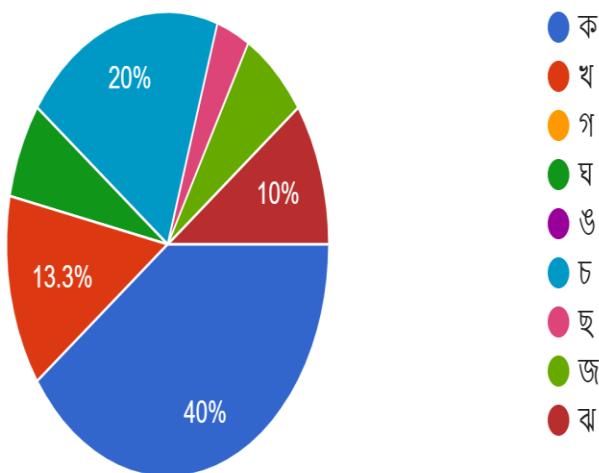


Fig. 6.7: Pie-chart for responses of Q. 5

Findings:

- 40% of people responded for option A, where only black font is used.
- Simple black font is easier for them to understand and follow.
- 20% of people have chosen option H, where stronger contrast is found.
- Strong contrasts and brighter colors such as red, magenta is more liked by them.
- Low literate people have fascination about eye-catching contrasts and regular fonts.

6.4 Quantification of Usability

Phase-1:

Phase-1 quantification has been done through random navigation of the mobile app. Participant were instructed with explanation for the first time. The time they had taken to reach through the last page was counted. They were asked some questions manually about their experience using the app. This process was repeated later with another sample who were unexplained about the app.

Sample no:

- নামঃ
- লিঙ্গঃ পুরুষ / মহিলা
- বয়সঃ (আনুমানিক) -
- শিক্ষাপাত্র যোগ্যতাঃ
- কেন কঠিন লাগছে?

- কেমন হলে ভালো হতো?

জরিপঃ

১. ক / খ / গ / ঘ

২. সঠিক / ভুল

৩. ক / খ / গ / ঘ

৪. ক / খ / গ / ঘ / ঙ / চ / ছ / জ / ঝ

৫. ক / খ / গ / ঘ

Fig.6.8: Phase-1 survey form

Phase-2:

Phase-2 quantification had been divided into two tasks. First task was to open an account and second task was to accept a job offer. Participants were asked to use the app task wise and time taken for each task had been recorded. For every task, difficulty level on a scale of five had been measured through the user's opinion. This process was also repeated second time by another sample without giving any demonstration of the app. Time required for each task and difficulty measurements were noted so that the difference with the previous sample could be noticed.

Sample no:

Contact no:

→ কাজ - ১ (একাউন্ট খোলা)

গৃহীত সময়ঃ

কঠিন সীমাঃ ১ / ২ / ৩ / ৪ / ৫

→ কাজ - ২ (কাজ গ্রহণ করা)

গৃহীত সময়ঃ

কঠিন সীমাঃ ১ / ২ / ৩ / ৪ / ৫

Fig. 6.9: Phase-2 survey form

6.5 Summary

Two phases of survey had been conducted for two different samples. Thus, the variety among data could be observed properly. The participants who were chosen for the second phase had to share their details for further quantification. Through their feedback on the first version of the app, the second version was modified. The sample chosen for second phase would use this version and give feedback again. Comparing time taken and difficulty measurement of the same person in two versions, significant improvement could be achieved.

Chapter 7

Statistical Analysis

7.1 Introduction

For the phase-1 survey, a sample size of 20 had been considered. Among them, 7 people had been chosen for the phase-2 survey. All of them were explained about the app before the survey tasks are performed. After that, the same process in two phases was repeated on another sample size of 10. On this occasion, no description was given to the participants. Some changes in the results had been found and the relevant results and data analysis are presented in the subsequent sections.

7.2 Participants Details

As our target users are mainly females, most of the participants chosen for the survey were rural housewives. But there were some male participants too. Among a total of 30 participants, 11 were male and 19 were female. They were of different ages from 12 to 55 years approximately. Academic qualifications of them were lower, or equal to 8th to 10th standards on average. But there were some exceptional cases also, for instance, 2 or 3 participants never had any education. Some hardly manage to read Bangla. The male members were mostly day-laborers such as van-drivers, construction workers, security guards, etc. Many of them did not ever use any touch phones. Almost all of them were hesitated before using the app. From both the explained and unexplained samples, two samples size of 7 were chosen for the phase-2 survey. Subsequent design phases will collect feedbacks and other suggestions from these selective participants. It is worthwhile to mention that none of the participants in this study were invited or forced. Interviews and surveys are conducted only if consents were provided.

7.3 Data Analysis

Sample-1 (With demo)

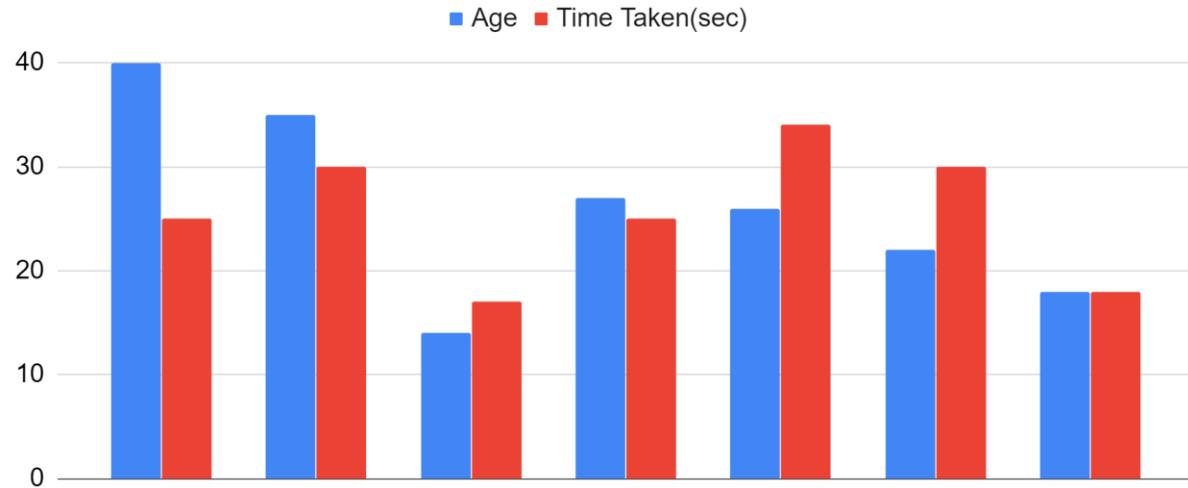


Fig. 7.1: Age vs Time taken to open an account

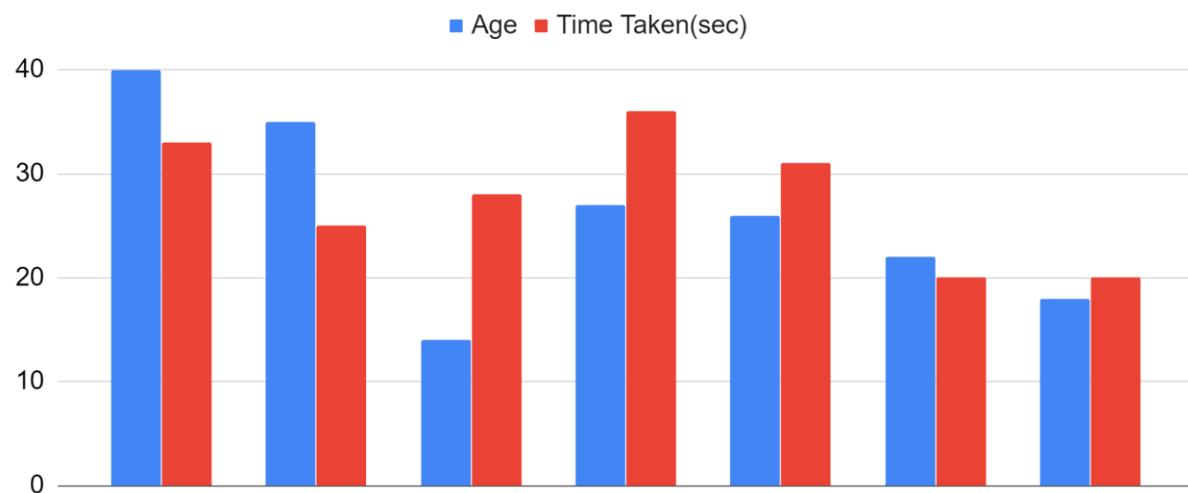


Fig. 7.2: Age vs Time taken to accept a work

Sample-2 (Without demo)

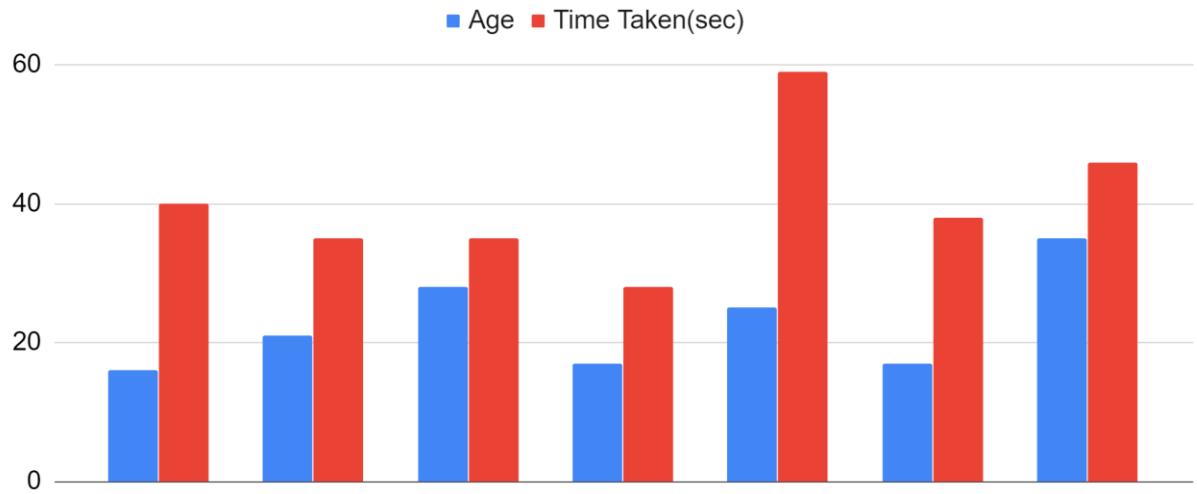


Fig. 7.3: Age vs Time taken to open an account

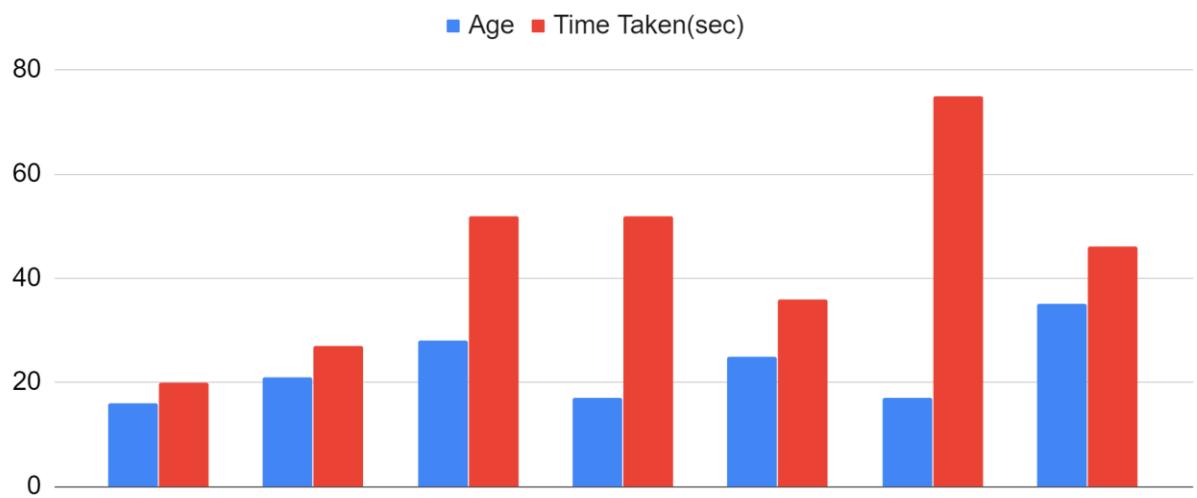


Fig. 7.4: Age vs Time taken to accept a work

Findings:

The above graphs (Figure 7.1 - 7.4) show the time taken by all phase-2 participants for individual tasks. It is observed that elderly people takes longer than the youngers to complete the tasks. This may be due to a combination of the degradation of cognitive, physical and sensory abilities as people grow older and the fact that most of the older people of today have lived most of their lives in the pre-mobile-phone-age and thus, isn't as proficient as the young people. Young have actually exposed to this kind of digital framework for a longer time than aged people and their learning ability is better. Therefore, begins educated or low-literate, aged people have grown discomfort to digital technologies. Their learning process is slow as well.

Task-1 (Opening account)

Sample-1 (With demo)

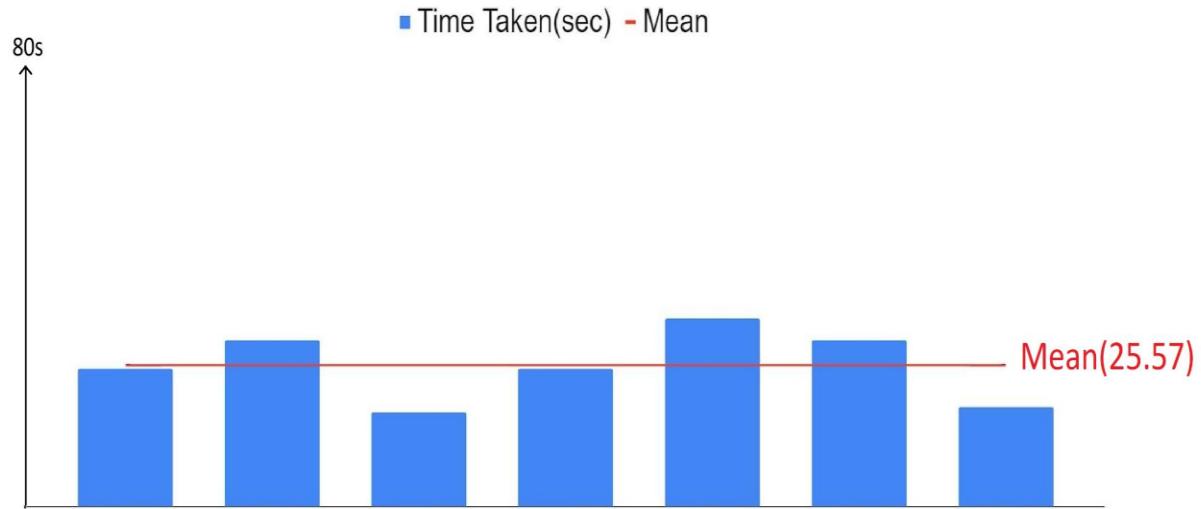


Fig. 7.5: Average time required for Task-1

Sample-2 (Without demo)

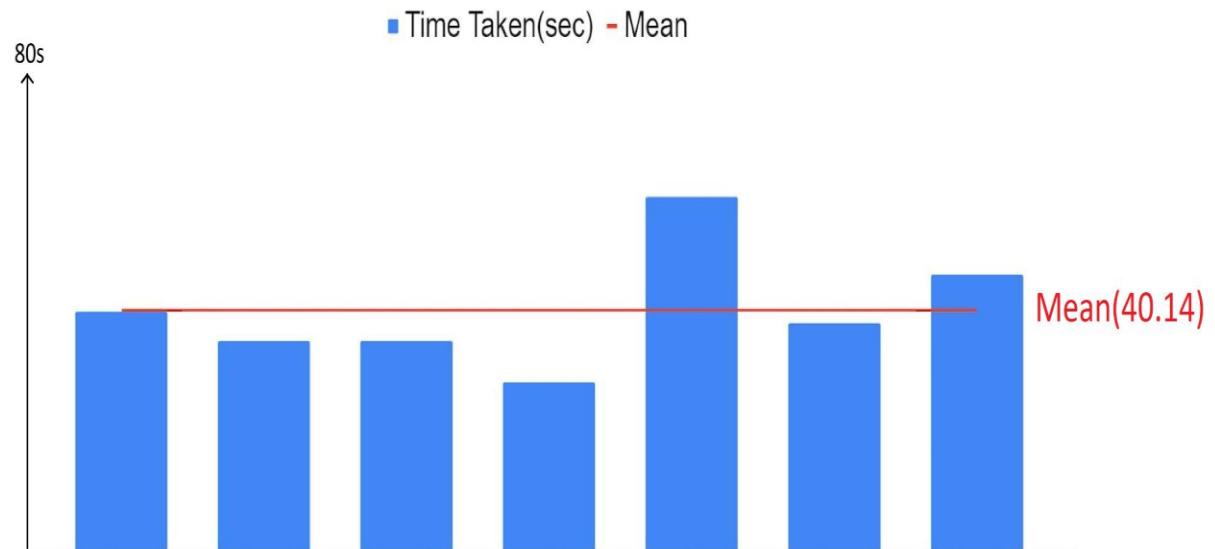


Fig. 7.6: Average time required for Task-1

Task-2 (Accepting work)

Sample-1 (With demo)

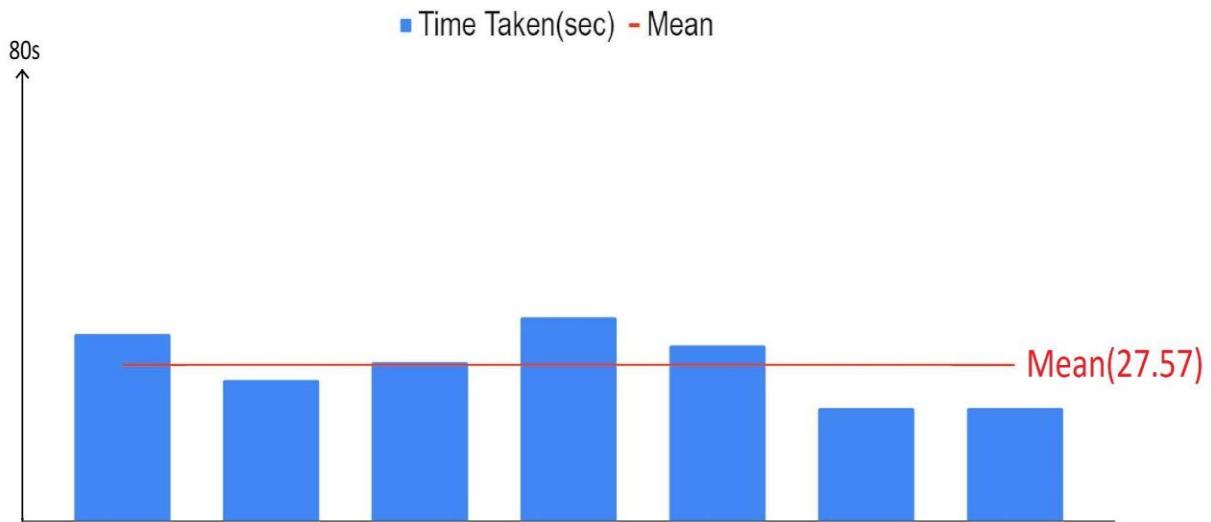


Fig. 7.7: Average time required for Task-2

Sample-2 (Without demo)

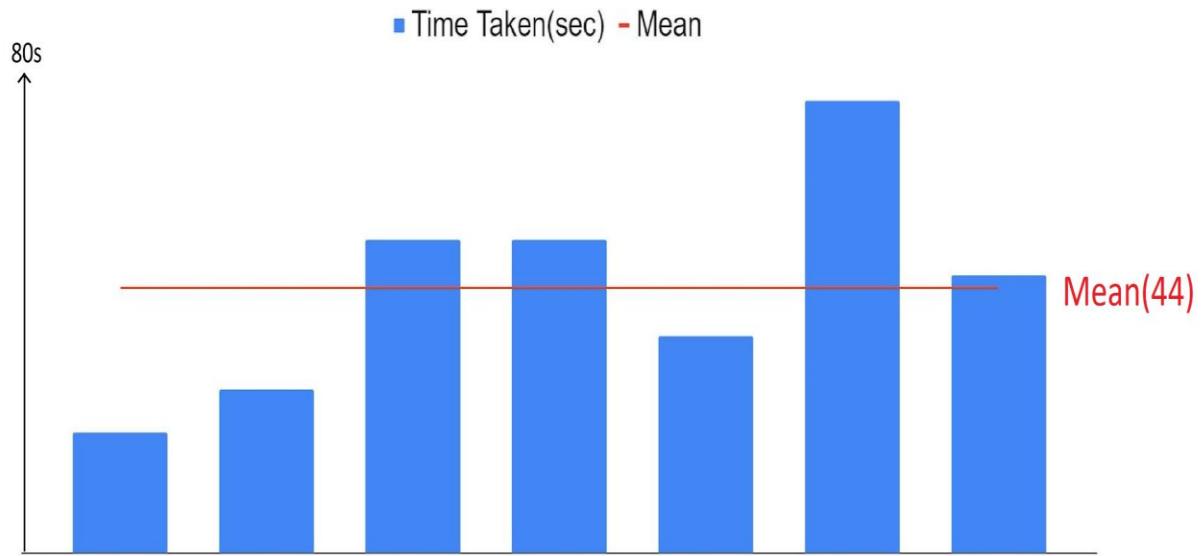


Fig. 7.8: Average time required for Task-2

Findings:

The above graphs (Figure 7.5 - 7.8) show explaining to them how to do it helps them to navigate better.

- In Figure 7.5 & 7.6, both the samples were asked to open an account. Sample-1 took less time (25.57s on average) than sample 1 (40.14s on average).
- In Figure 7.7 & 7.8, both the samples were asked to accept a job offer. Sample-2 took higher time (44s on average) than sample 1 (27.57s on average).
- Sample 2 took almost 50% more time than sample 1 in each task.
- It took a higher time when the app is not demonstrated before them.
- Video demonstration could help.

Navigation through the last page randomly

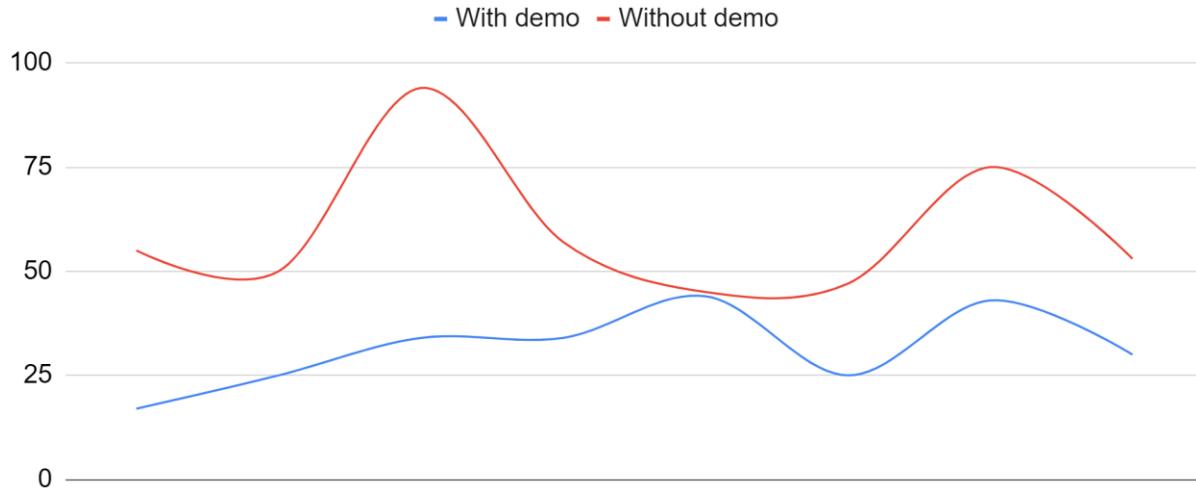


Fig. 7.9: Comparison of time required between Sample 1 & 2

Findings:

- Both the samples were asked to navigate the app till the last page following the instructions given in each button. Most of the participants reached the last page. Sample 1 took less time than sample 2. (Figure 5.9)
- If a demo is presented before them, they take less time to navigate, as compared to when there is no demo provided to them.
- Inclusion of demo video explaining the app navigation steps tend to reduce users' discomfort.

7.4 Summary

A small-scale survey has been done; we will improve the results by increasing the sample size later. It is found that elders have less cognitive ability than younger ones in case of the use of mobile applications. Moreover, it is not possible for any developer to go to each and every user and explain the process like we had done for the first sample. The study conducts that, developers need to come up with a video demonstration about the mobile applications for reducing digital discomfort of the rural community.

Chapter 8

System Framework

8.1 Introduction

A step by step feedback-based system have been constructed until now, and the next tasks will be continued according to this as well. At the initial stage, regular norms of mobile phone applications were followed. After that, the first feedback was taken based on the initial design. Then, according to the user's suggestion, some changes were made in the user interface. The phases of design improvement will be continued until the desired standard of framework would be created.

8.2 System Workflow

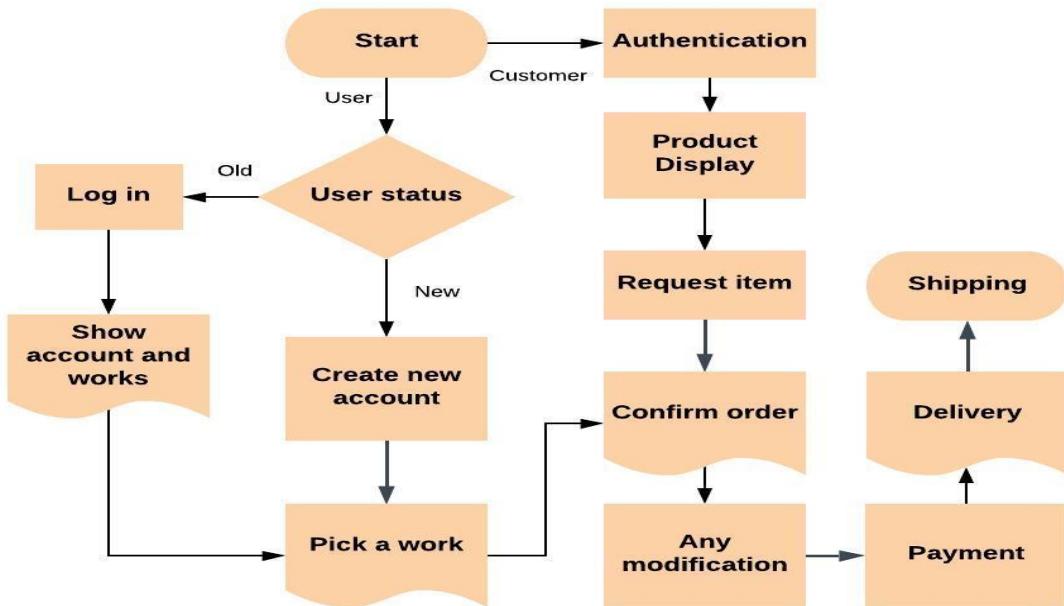


Fig. 8.1: System Workflow Design

Our system will work with multiple interactions with the user and the employees. A common product display section will be available for everyone on the mobile application and on the website. A user will first pick a service or a product from the displayed section and then he will decide to order the exact product or a customized version of it. After that, the orders will be received by the admin team. To ensure security, our agents will contact the employees. Once the communication is built between both ends, a small portion of the payment will be received from the customer. Given that payment is already done, upon completion of the preliminary process, the product will be delivered to the user.

8.3 Design Evaluation

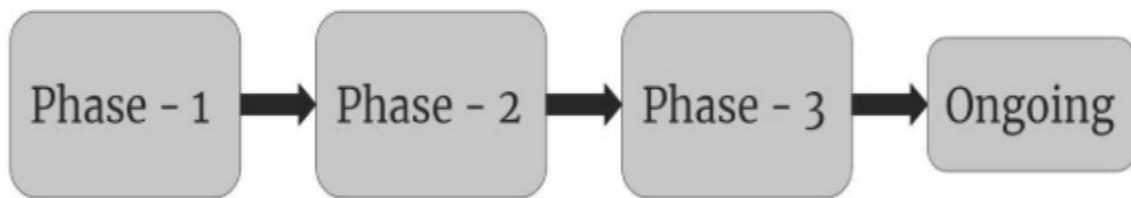


Fig. 8.2: Design Phases User Interfaces

Only Text Version (Phase - 1)

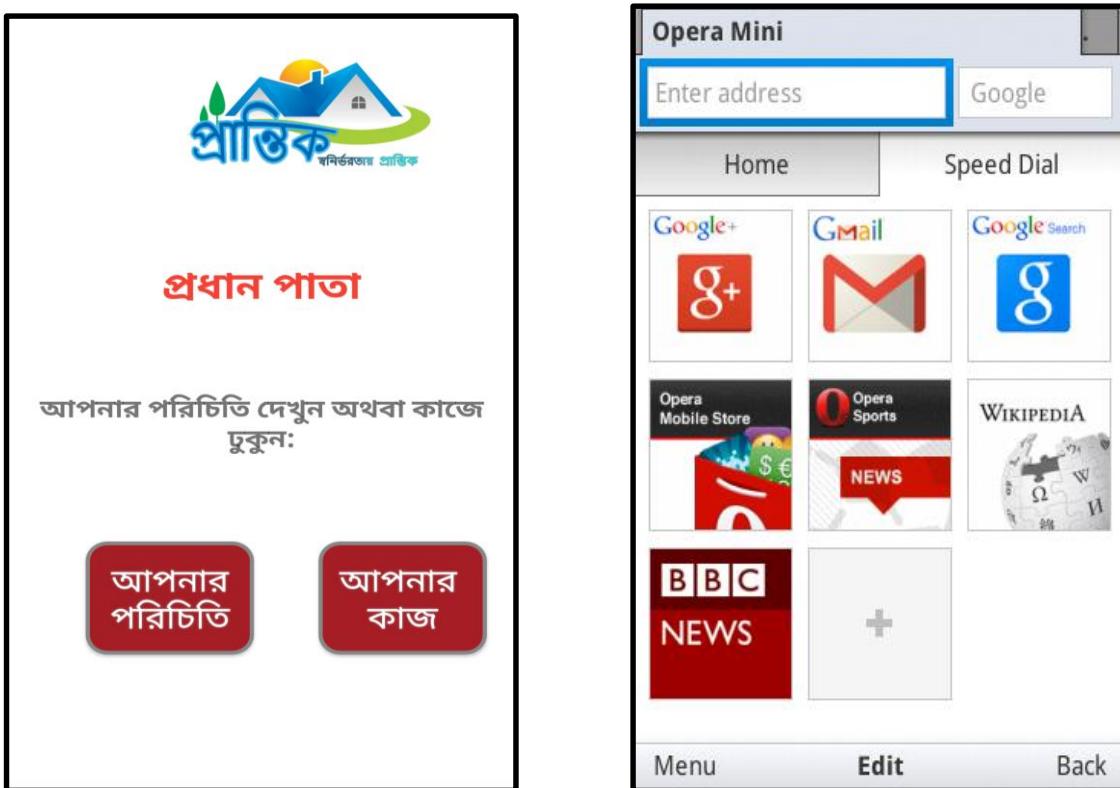


Fig. 8.3: Text-Only Version following the Opera Mini Button Layout

At this stage, the whole interface was developed based on text instructions. Only Bangla text was provided as the medium of communication. Some of the users had struggled a lot to understand and navigate through the user interfaces. But most of them (17 out of 30) had found them easier to understand. Especially, users with no educational background struggled the most. Brighter contrast was chosen, as in the popular mobile app Opera Mini. Standard norms had been followed while developing the first version of the app.

Abstract Image Version (Phase - 2)

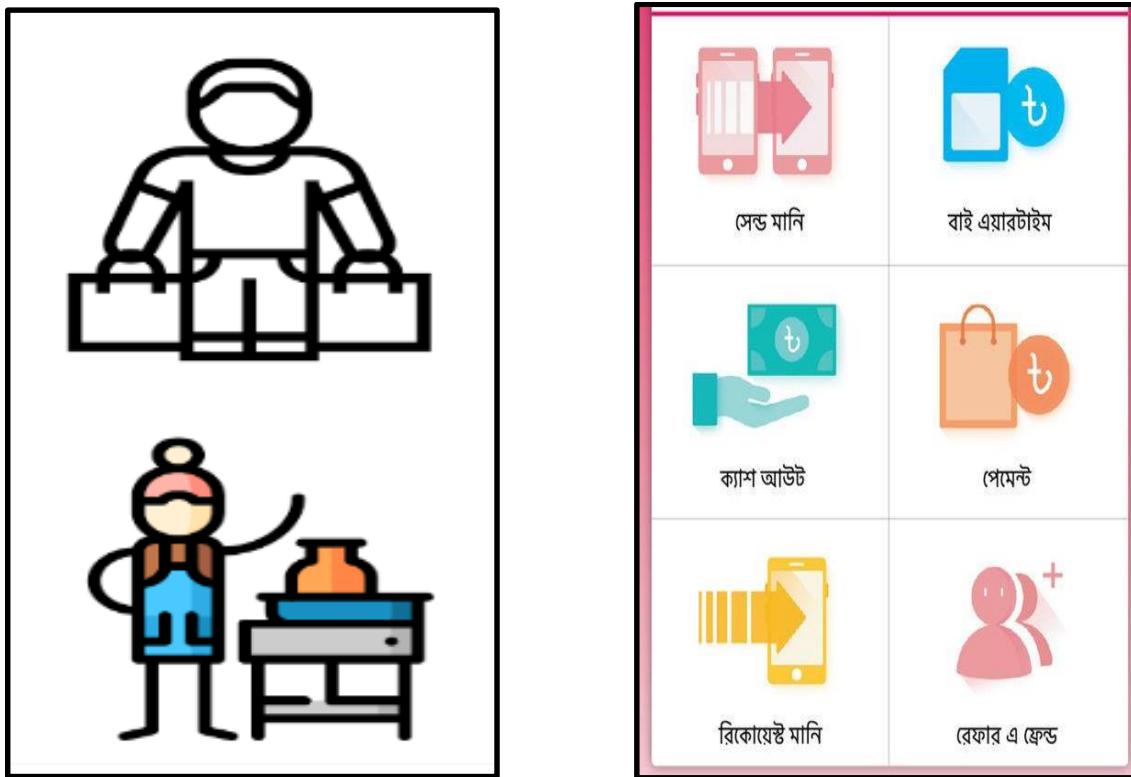


Fig. 8.4: Abstract Image Version following Bkash Button Layout

Abstract icons corresponding to each of the activity buttons of phase 1 are taken into consideration and replaced with the previously designed text version. In this stage, all the buttons have both text and abstract images according to the assigned task. A lot of common apps in our country use this type of images to describe a task in their apps. For example: Bkash, Rocket and others. But according to the user's statement (discussed in chapter 7), common users of the rural area do not tend to like these types of icons. The message these images are trying to deliver is not clear to them as they demonstrate lower cognitive ability to comprehend them.

Drawn Image Version (Phase - 3)

Image-based customized buttons are designed as per the preferences in the survey. Non abstract painted images are designed based on the feedback given by the rural community. Though the survey was done on a small scale, it reflects a very important understanding aspect of the users of the rural community. They preferred brighter and colorful contrast image representations during the survey. Bangla movie posters or rickshaw paintings could be good examples of their color choice and understandings. Survey result shows that, they usually interpret better when images are natural looking.

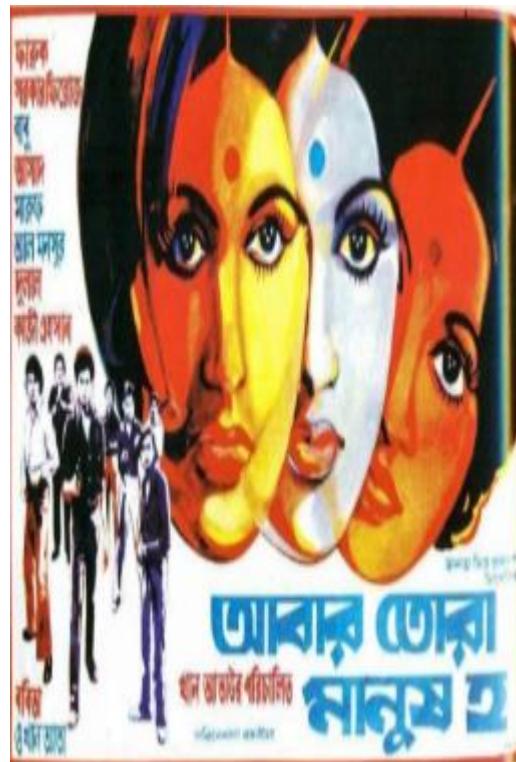


Fig. 8.5: Example of Rickshaw Paint and Movie Poster Drawings



Fig. 8.6: Customized Image Version following Rickshaw Paint and Poster Drawings

8.4 Comparison of Button Design Phases

Buttons of phases- 1, 2 and 3 had been designed based on the feedback we got during several surveys. But designs are not fully optimized yet. We will modify the phase-3 version by our next survey, where users will use the version with natural image buttons and Bangla texts. Then, we will measure the improvement comparing the time taken of it with the previous version. We will also take feedback on the button designs and try to understand their preference of colors and designs, so that we could further provide them with more efficient designs than existing one. The user interface design process will continue until we would be able to optimize maximum satisfaction.

Phase - 1



Phase - 2



Phase - 3



Fig. 8.7: Button Design Phase 1, 2 and 3

8.5 Summary

After phase 3 there will be more iterations of this system framework as it is a continuous process.

Those modifications will be based on a larger and more diversified sample, will reflect a better discomfort solving indication. The framework we are aiming to create would be used by other existing systems to increase the user range of any existing and future digital platforms.

Chapter 9

Technical Details

9.1 Introduction

In this chapter, we will discuss the technical design of our system by going through the system-level design phases. Our system has both web and android app version. Web-version is mainly focused on the clients who are educated or familiar with the technology. In our project, we do not give priority to the optimization of the client site. We make a standard design for our client where we optimize and give priority on the worker site who are generally low literate or semi-literate. For that, we have to go through several phases for our android application for the worker. A well-designed mobile app can perform actions much quicker than a mobile website. Apps usually store their data locally on mobile devices, in contrast to websites that generally use web servers. For this reason, data retrieval happens farther in mobile apps.

9.2 Technical Tools

We are developing different versions of our application in the android platform. It is going to be developed by Android Studio, which is a java-based IDE from Google (Internet Development Integration). Our website will be a combination of different tools like Bootstrap, Html, PHP, MySQL, JavaScript, etc. For the front end, we are using Html, JavaScript and bootstrap framework. We will use PHP and MySQL as back-end. For the application development, we are using Android Studio, Java, XML, Adobe Illustrator, Firebase Cloud Server, etc.



Fig. 9.1: Different Technical Platforms

9.3 Software Designing Phases

Improvement of an application can be done by continuously updating the application. We designed our application in three different phases until now:

- Phase1 (Text Based)
- Phase2 (Abstract Image Based)
- phase3 (Imaged Based)

We had to update the design of the application in every single phase. Phase 1 is only text-based designing, all icon is designing only text based. The 2nd phase is designed by abstract designing where the line image was used to design the buttons of the application. Finally, phase 3 is designed based on customized images.

Phase 1 (Text Based)

This phase is the basic version of the system. Initially, we followed “The minimalist approach”. In this approach, we had to care about a number of issues while designing this version, and the issues are as follows:

- Language- Bangla language used for an easy understanding of the user.
- App Background- White background is easy and does have better visualization properties.
- Button Design – We select a strong red type color for button design.
- Flat design, a particular style that involves the use of flat two-dimensional visual details in UI elements like icons and buttons.
- Monochrome or limited color palettes, which help avoid distracting users from core elements such as content.
- Typography—color, fonts, and typefaces are often bold and expressive, serving as a core visual element.
- Choice limitation, this involves eliminating unnecessary elements or functions to guide the user’s attention to the core feature of a given view.



Fig. 9.2: User Interfaces of Phase 1

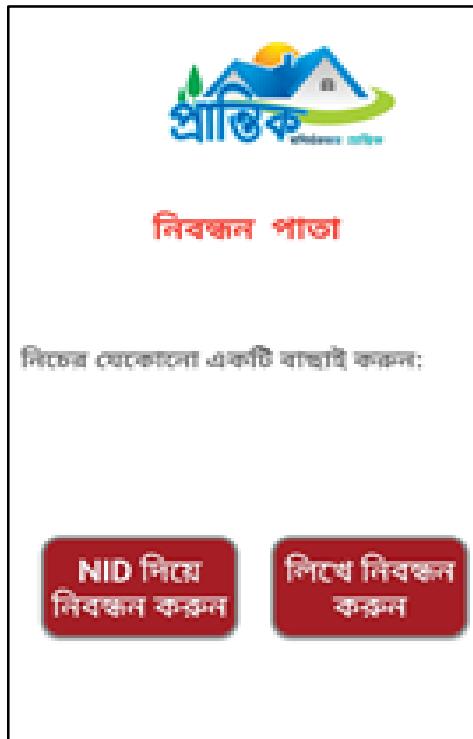
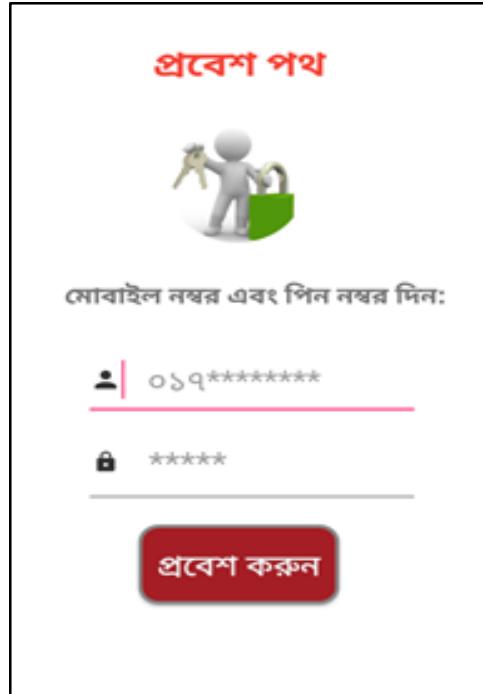


Fig. 9.2: User Interfaces of Phase 1



Fig. 9.2: User Interfaces of Phase 1

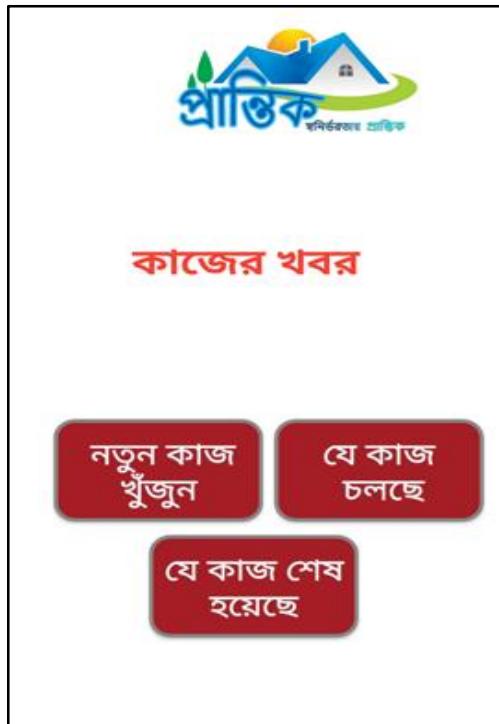


Fig. 9.2: User Interfaces of Phase 1



Fig. 9.2: User Interfaces of Phase 1

Phase 2 (Abstract Image Based)

After Phase 1, we had to survey on that design. After that we transferred into our next phase “Phase 2”. In phase 2 we were using abstract images to design our buttons of the application. In our phase 2, we also care about the simplicity of our application design. For designing phase 2 we considered “CHARACTERISTICS OF MINIMALISM”. We followed the following characteristics:

- Simplicity
- Clarity
- Expressive visual hierarchy
- High attention to proportions and composition

- Functionality of every element
- Big amount of spare space
- High attention ratio to core details
- Typography as a significant design element
- Eliminating non-functional decorative elements

We had to fix the button positions in such a way that workers can navigate using only one hand. The buttons should be organized near thumbs to make the navigation process more comfortable and easier for the users [26].

Phase 3 (Image Based)

Phase 3 is our final version of the application designing phase. After taking the feedback from the end-user we have to change the abstract image to the painted image on the button. Our main focus was on the picture of the buttons. We wanted to use such images so that the end-user can easily understand just seeing the pictures. We had also given the bangle text under the button picture. We had been studied, researched about color choice, image from the end-users and then we designed our painted buttons. The button images reflect the functionalities of the buttons. Images are related to the button. We designed aiming that illiterate people also can use our application who cannot read at all. We have to choose a simple design, simple Bangla words, button positions, etc.



Fig. 9.3: User Interfaces of Phase 3

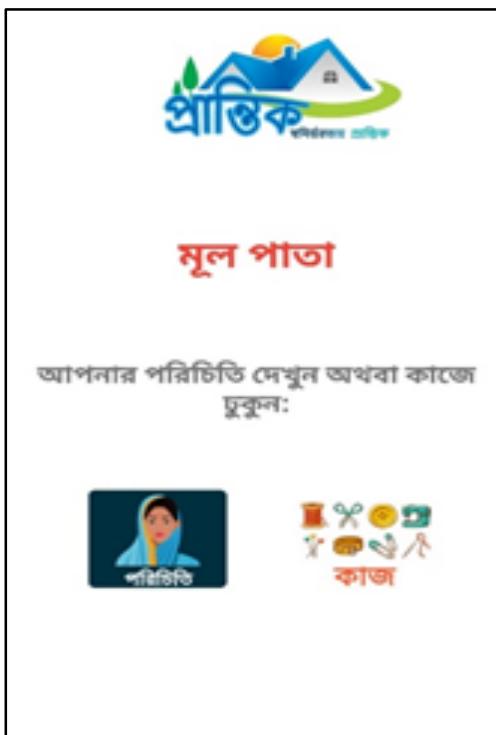
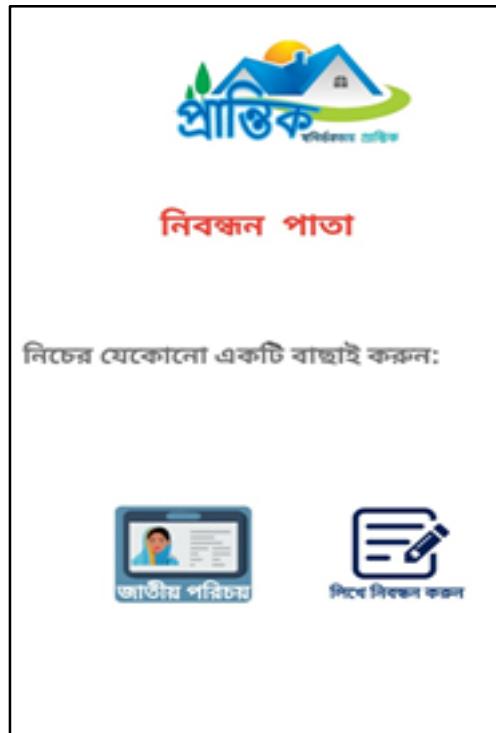


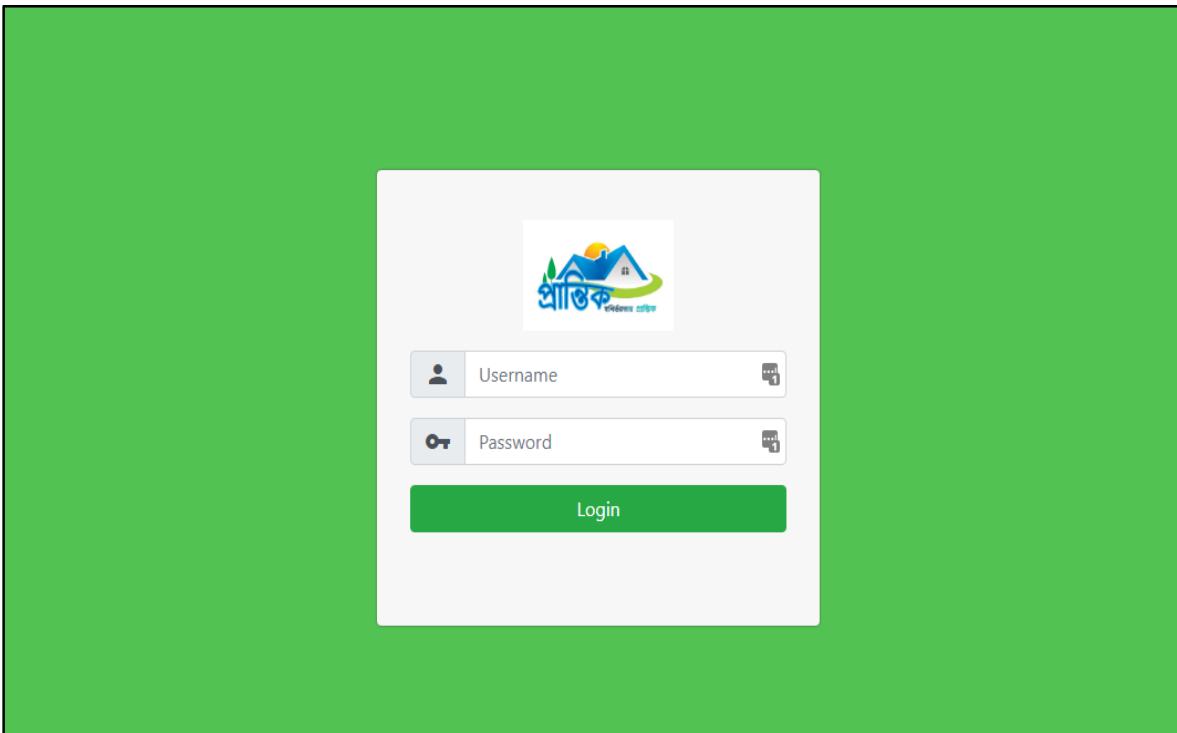
Fig. 9.3: User Interfaces of Phase 3



Fig. 9.3: User Interfaces of Phase 3

9.4 Web Portal

A website is developed to serve the users, basically customers so that it can be more convenient to them. The fonts and pictures were encoded in Bangla. The website will also be served as a buyer's section on the mobile application. The web view of this site will be used for viewing the products, and will allow to give orders from the customer's end. The worker will receive the orders using the mobile application and proceed further.



The screenshot shows a client dashboard with a sidebar on the left and a main product listing area on the right.

Left Sidebar:

- Logo: প্রাতিক
- নির্বাচিত দেশ: বাংলাদেশ
- কাজের বিভাগ: (dropdown menu)
- আমদের সবিয়ৎ পরিকল্পনা
- আমদের অনুষঙ্গ হোন
- যোগাযোগ

Top Right:

- বিজ্ঞাপিত মেখুন
- বের হয়ে যান

Product Listings:

Image	Name	By	Price	Action
	আখের গুড়ের পিঠা ৬ পিস	By রাজিয়া	\$৮০	অর্ডার করুন
	নকশি কাষা ফুল সাইজ	By আমেনা	\$১২০০	অর্ডার করুন
	জলাইয়ের আচার ৩০০গ্রাম	By আমেনা	\$২০০	অর্ডার করুন
	মেহগনি কাটোর ফুলদানি	By সিরাজ	\$৪০০	অর্ডার করুন
	পাটের টেবিল ম্যাট ৬ পিস	By মিজান	\$৩০০	অর্ডার করুন
	খাদিয় ব্যাগ	By রাহিমা	\$৫০০	অর্ডার করুন

Fig. 9.4: Web View for the Clients

9.5 Summary

Though our main focus on this study is standardized user interface designs for app development for the underprivileged community, we must provide all necessary services for making the system work properly. Different versions of the app and the web portal are basically developed due to optimizing our main goal. With the help of these prototypes, we could try to improve the designs and make them more efficient and comfortable for the end-user's community.

Chapter 10

Discussion

10.1 Introduction

This chapter contains the discussion and outcomes of this project based on the results of the study. The purpose of this study was to explore the usability issues that occur in a mobile application that targets low literate users. For this purpose, a few prototypes designed based on the target users were selected for this case study. We used a systematic approach to evaluate the application and identify usability issues.

10.2 Usability Quality Components

- **Learnability and Memorability**

While performing the tasks, the user should be able to learn the procedure to use the application with ease. We have observed that there is a variance in the completion time of the participants. However, all participants were able to learn and memorize the application once used. Explanation about how to use it helps them a lot to navigate the app better. It took more time when it was not demonstrated before them.

- **Efficiency**

Most of the participants were able to navigate and find the required options when performing the tasks. Mostly reach through the last page, a few of them (7 out of 30) failed to reach through the last page. Although they have taken more steps to perform the task than the ideal steps, they might have been able to follow. With the increase in the steps to perform the task, time to achieve the task has also increased.

- **Error rate**

Some of the participants felt lost after navigating for a few moments. A few of them (5 out of 30) could not perform the task without help. If they made any mistakes while doing particular tasks, they felt perplexed.

- **Satisfaction**

Participants showed overall satisfaction regarding the application. The participants felt that the structure of the mobile application is simple and the terminology is consistent and it is easy to use. Many of them (17 out of 30) had mentioned it easy to use because of Bangla's instructions.

10.3 Summary

The purpose of this thesis was to explore the usability issues that occurred in our application that targets low literate or semi-literate users. For this purpose, a few versions of application were selected for this case study. We have achieved some spectacular findings till now. By analyzing those findings, we could further progress with better results.

Chapter 11

Future Works

- Till now we have developed our android application in three phases. But this is not sufficient enough. We have to develop or optimize it further.
- In phase 3, we implemented the button images as usual. We could not complete our survey on that version. We have to optimize on that picture version by conducting a survey on it.
- We will further improve to optimize picture color, picture background, button text, button text color, button size, etc.
- We are trying to introduce voice assistance on some pages of the application. Audio and video instructions could reduce their digital discomfort.
- We have done a small-scale survey. We need to increase the sample size to improve the results. A large number of feedback would be beneficial for the improvement of our design of the application.
- For finding a job, we will give a location-wise list view with pictures which would be easier to look and understand.
- We must identify a good balance between features and application complexity.

Chapter 12

Conclusion

The major objective of our project is to develop such a user interface that can be useful to the low literate or semi-literate people and especially for rural women. In our country, most of the rural people do not use smartphones. There are many failings behind it. According to research, most of the people are afraid of digital technology. They aren't used to smartphones. So, designing an application for them isn't easy enough. We have to consider various issues before making the prototype versions for them. The designs of the user interfaces of the application should be made as simple as possible. We have to keep less information on every page so that they do not become afraid and uncomfortable before using the service. Again, we have to design button images so that it becomes relevant to the button functions. We have to choose carefully the colors of the button images. If we can improve the study further by increasing the sample size of the survey and designing, we hope we can make a framework that can be followed for application UI designing for low-literate people. The work presented here is just the beginning of what is required to identify the interface needs of low-literacy populations. Indeed, our results indicate that more research is needed to help low literacy users establish a sense of location within the application.

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