Difficulties of Using Digital Devices For People With Blindness (Thesis Abstract)

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ABSTRACT

According to estimates from the World Health Organization (WHO), there were 2.2 billion people with visual impairment in 2021. In this paper, we will discuss the challenges ahead of using smartphones for visually impaired people, the improvements needed for their design, and their advantages and disadvantages. As a result of interviews with ten visually impaired people, these challenges are outlined here to help you understand how they used their smartphones and what challenges they faced on a daily basis.

KEYWORDS

visually impaired, accessibility, voice user interface

1 INTRODUCTION

In recent times, technological advancements have significantly transformed the everyday lives of individuals. Many people accomplish their daily tasks and responsibilities using smartphones, smartwatches, and other similar gadgets. Consequently, these devices must feature a well-suited design to meet the varied requirements and preferences of different user groups. The World Health Organization (WHO) estimated that 2.2 billion people had a visual impairment worldwide in 2021 [3]. Despite all the advances in smartphone technology, the design of user experience and accessibility now faces new challenges in creating digital products that are accessible and useful for people who are blind or visually impaired.

Modern smartphones are now equipped with essential features such as a voice user interface, haptic interface, face detection, etc making it possible to design products that offer improved accessibility options for individuals with visual impairments. Among all the new features offered by smartphones, the voice user interface is essential for visually impaired people because it enables them to interact with their cell phones without looking at them. In this paper, we focus on the voice user interface and what challenges it faces.

2 BACKGROUND

Globally, at least 2.2 billion people have near or distant vision impairment. They are mainly over the age of 50 years, but people of all ages can be affected by vision impairment [3]. It is necessary to notice the difference between the different intensities of visual impairment because they cause different kinds of problems.

2.1 Mobility

Usually, everyone moves within their houses and public places. It is possible for them to do whatever they want, like traveling and shopping, without the need for outside help. However, visually impaired people might not be able to follow the right direction or distinguish the obstacles. Each blind person has a particular way of finding out what works best for them. The most common tool aids are a white cane and a guide dog [2]. These help blind people with straightforward and direct navigation, these tools, however, are not helpful when visually impaired people want to navigate in more challenging and complicated environments.

2.2 Tools

For reading, the two most common tools are screen readers and Braille. Braille is challenging to learn, so just a few percent of visually impaired people know how to use it [5]. Screen readers are handy applications that enable blind people to use computers [1]. They mostly use the Text-To-Speech engine to work, like the Voiceover on Apple devices and the Talkback on Android devices. Blindsquare is also getting used as a navigation application on Apple devices.

3 METHOD

The method was conducted in two phases: understanding and exploration.

In the understanding phase, the focus was on understanding the current user situation, their needs, their challenges, and how they use digital tools and voice interfaces in their daily lives, which was conducted by a literature study followed by a series of interviews with visually impaired participants.

The goal of the exploration phase was to use the research found during the understanding phase to explore new areas by analyzing the data, which has been obtained during the interviews.

3.1 Literature Study

The main goal of this study is to get a vast understanding of the field through books, articles, previous interviews, videos, magazine posts, and blog posts at the beginning of the work. The study was done by searching keywords and phrases, such as "voice user interfaces," designing for the visually impaired, and "visually impaired" through Shahid Beheshti University online library.

3.2 Interviews

This qualitative research and interviewing with visual impairments aimed to investigate and identify the most significant obstacles and problems in everyday life, the most common tools, and the subjects' thoughts and feelings towards the voice user interface. According to Rowley[4], semi-structured interviews are good for collecting data when:

- The research aims to understand experiences, opinions, attitudes, values, and processes
- The potential interviewees might be more receptive to an interview than other data-gathering approaches.
- It is insufficient to know about the subject to be able to draft a questionnaire.

Table 1: Gender and age group of interviewees

Name	Gender	Age	Vision
A	Male	10-20	Blind one eye, From birth
S	Male	20-30	Blind, From birth
J	Male	20-30	1 percent eyesight, gradually lost
M	Male	40-50	Less than 10 percents , From birth
H	Male	40-50	6 percents eyesight, From birth
D	Female	40-50	Blind, From birth
F	Male	60-70	Less than 10 percent, From birth
B	Female	60-70	From age 55, Only see sun and bright lamps
A	Male	70-80	Losing sight from age retirement
R	Male	80-90	Losing sight from age retirement

A questionnaire can only be created if there is more information. Interviews may be the most effective method for data gathering and open up more detailed insights that might be missed in a questionnaire.

3.2.1 Participants. The total number of participants included in the study was ten people; their information can be seen in Table 1. Their age range is between 13 - 87 years of age. In total, two female and eight male subjects were recruited through organizations for the visually impaired and acquaintances. Some participants were utterly blind, while others had visual impairments ranging from 10 percent vision to varying degrees of impairment. Two in-person interviews and the rest over the phone using Zoom software to record. The lack of visual cues during phone interviews may affect the interpretation of potential visual cues, as per research from the University of Geneva.[6]

3.2.2 Interview themes. The interviews were conducted with four main themes, with an additional theme if time permits. The themes included background, today's tools, new places/environments, and contextual information. The length of the interviews was around 30 minutes. The questions were open-ended and ordered from easy to more challenging questions. A scenario was used to provide a frame without priming the subjects.

3.3 Data Analysis

The interviews aimed to identify user needs and goals through semi-structured questions. The data was transcribed, concepts and findings were highlighted, and each point was written on Post-it notes with the speaker's name. The notes were grouped into similar themes, analyzed, and divided into "nice to have," want, and required categories. The results were compiled.

4 RESULTS AND DISCUSSION

Each interview took approximately 30 minutes, with general questions. Interviews started with easier questions. The goal was to find out about their most critical daily problems. A number of mutual and common problems were then identified based on the responses.

4.1 Voice User Interface

Each participant tried to use the voice user interface that they had on their phone at least once. Generally, They were optimistic about this interface. The most common uses of the voice user interface include the list below.

- Setting an alarm clock
- Calling someone
- Writing emails
- Checking the time and weather
- Opening an application
- Checking the location that they are in

The participants have mentioned that they face problems with using the voice user interface: it is not able to respond to their requests, it is not easy to use in public places, and sometimes it does not understand the request right. The more experienced users mentioned that adding an option to these interfaces that allows for increasing and decreasing the pace might result in better understanding for each user.

4.2 Main Problems

This study focused on three main problems that visually impaired people are dealing with in their daily lives.

4.2.1 Navigation. Blind people usually choose ways they already know and avoid trying new ways and directions. They want to know where they are now and how they can get to where they want to go. Also, avoiding hitting obstacles is very important. They use Snapp and Tap30, the two most used Iranian ride-sharing apps, to go to places they are unfamiliar with. Participants find the accessible GPS applications handy; Specifically, they think the way these apps give them directions according to the clock is helpful. The problem with these apps they are dealing with is that the default is for car riding, and changing it to walking is challenging. Participants with low vision also mentioned that they benefit from zooming for maps and pictures to get information more easily.

4.2.2 Public Transportation. Participants mentioned they usually use the public transportation system and prefer the subway to buses. Different buses come to a specific bus station, and they can not understand where the bus is going, but with the subways, it is always evident. They have a good voice user interface that announces the current and the next station, so blind people can be sure where they are going.

4.2.3 Shopping. Shopping is one of the most challenging activities for visually impaired people. Participants stated that they experienced a better feeling whenever they shopped online because, in the stores, they are not sure where they can find the items they are looking for and how much they cost. In addition, they may lose special offers. Too much information can be confusing as well.

4.3 Limitations

This study's limitations include the small group of participants, limited time, and lack of budget. The participants mostly know the Farsi language and have basic familiarity with English. The Covid-19 situation lowers the chance of talking to the participants in person and not online. Due to Iran's political and economic crisis, Apple products and others are expensive and hard to access for most participants. Therefore this study did not focus on a particular product to decide which works the best.

5 FUTURE WORK

To further advance the development of accessible and user-friendly mobile and web applications for visually impaired individuals, future research should focus on implementing the best practices identified in this study. This can be accomplished by conducting user testing and gathering feedback from visually impaired individuals to ensure the applications are optimized for their unique needs. Additionally, exploring the potential applications of wearable technologies such as smart glasses and activity trackers can offer new opportunities for visually impaired individuals to navigate their environments more efficiently. Research in this area can focus on identifying the most effective ways to integrate wearable technology into the daily routine of visually impaired individuals and identifying which functionalities would be most beneficial. Overall, continued research in this area can significantly enhance the quality of life for visually impaired individuals, improving their independence and allowing them to live their lives to the fullest.

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