



Mobile App Accessibility for Visually Impaired

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ABSTRACT

Technological innovation and breakthroughs in Android and iOS operating systems have made our daily life to be centered on the smart phones. The measure of success of mobile technologies and its applications is based on its ability to meet the needs of individuals within an entire population including visually impaired people. The creative innovation in current Mobile Technology allows Mobile Apps to be efficiently distributed and run on Mobile devices. Such as Text-to-Speech, navigation assistance, object identification, color identification, speech recognitions facilities are integrated with basic mobile services. It also providing the user-friendly user interfaces which includes fully automated speech recognition system for support of visually impaired users. Hence, the aim of this paper is to focus on surveying the latest developments in mobile technologies and mobile apps which are targeted at bringing back the zest and joy in the life of visually impaired people. Using the overview gained over this study, an agenda is proposed for future research work in mobile application and interaction design with respect to visually impaired and blind users.

Key words: Android Mobile Applications; Visual Impairment; Mobile Technologies; Blind Users

1. INTRODUCTION

Advancements in modern technologies have made a major technological transformation that has made mobile devices to become one of the most common consumer devices [3]. The prevalence of cell phones is obvious in today's modern life. Mobile phones are used not only to make calls, send messages, but also for using many mobile apps ranging from weather indicators to food booking at anytime from anywhere [5]. Blind and vision- impaired people have been facing many problems in using the smart phones. In various situations such as while driving, under the bright sunshine, etc., normal users also often face the problem in using mobile phones effectively [1].

Over 80% of visual impairment is either preventable or curable with treatment, according to the study of the World Health Organization (WHO) [3]. The majority of low vision people are in developing countries and over the age of 50 years. Currently people are affected by vision problems due to health reasons. Low vision people can increase the sight through advanced medical treatment. But, the people who are suffering with complete loss of vision requires assistance to survivor their life. In this regard, Computers and mobile technology introduced assistive technology such as screen readers, screen magnifiers and refreshable Braille displays allow blind use the computers or mobiles. It requires developing fully-accessible, high quality mobile applications for enhancing the quality of life, independence and employability of people with disabilities.

Hand held devices such as mobile or tablets have been an inevitable part of our life for almost a decade for doing communication, sociality and many others. Of all the mobile platforms, Android has been the most sought-after OS by a majority of mobile users. The people with disabilities require different accessibility needs in operating mobiles and that there are different ways to make technology changes [4]. Hence, researchers started finding various methods or techniques for providing assess ability assistance for visually impaired users. In this regard, various types of mobile apps are developed for providing different facilities. Text readers, object identification, color identification, tracking of objects, bar code readers and many other innovative services are provided in Google and Android applications to facilitate the usage of mobile apps by visually impaired people.

This paper is focused on surveying the existing mobile apps that facilitate visually impaired people to use mobile phones effectively beyond the sight barriers. This paper is structured into four sections. Followed by the introduction section, the second section reviews different communication methods/techniques available for blind or visually impaired people. The third section expounds various accessibility applications that improve the quality of life of blind people

through mobile phones. Conclusions and future research directions are briefed in the last section of this paper.

2. LITERATURE REVIEW

This section focuses on exploring communication methods/techniques available for blind or visually impaired people.

In [5], author implemented an android type mobile messaging application called as Voisee communicator, for communication between two disabled people. The customized voice commands are developed using build-in Java API. It is a user friendly and accurate in delivering messages. It also provides the facility to know the user expectation by analysing the results of the test survey and evaluation form.

In [6], authors provided a new system prototype name as Sharojan Bridge to make more effective communication between blind people, which is a wearable device build with Iot devices.

In [7], researchers have designed and developed a tool for blind or impaired people using Audio-Supported Reading (ASR) to access text. This tool for integrating multiple pedagogies and teaching the skill sets which are need to gain literacy of blind people.

In [8], authors presented outcome of survey on assistive technology for visual impaired users. They studied on evidence-based research for assistive technology which shows the good impact on education performance.

In [9], A portable communication aid was developed by authors for visually impaired people to communicate without any assistance. It consists of two parts, one for deaf-blind people and other for sighted people. It was an effective, reliable and inexpensive and proved with results.

In [10], authors have addressed the problems of child disability, and how to overcome with these disabilities through technology in wide range.

In [11], authors have discussed about Technological assistance available for physically impaired people by various countries. They have also suggested some of the features provides by engineering techniques in the process of assistance given to these people.

In [12], design and developed a navigation aid for visually impaired people named as POSE with a foot-mounted pedometer and a white cane mounted sensing package. They developed an algorithm for building map to update the person's position and exploits orthogonal in the building layout as a 3D structural compass. The system was analysed and evaluated in the real time environment.

In [13], authors have taken the challenge of identifying objects and reading hard copy documents by blind people. In this regard, they designed and developed an efficient Android device which can download and install in their smart phones. It provides camera, the voice processing unit and internet access.

In [14], the presented a blind assistive and tracking embedded system to help a blind person navigate and also to provide the facility to track the movement of a blind person and secure if it is lost. It was implementing with an Android application using

GPS system. The proposed system was experimented with very minimal error rate.

3. ACCESSIBILITY APPLICATIONS

The current development of Mobile computing technologies provides assistive technologies which increase user's quality of life. It is providing best working environment to implement a specialized software or hardware for own problems. User can develop an application for difference purposes such as general purpose computing, advanced sensor systems, crowd sourcing and data integration and many more. These assistive technologies also used to develop application for visually impaired users [15]. The most popular Mobile Operating Systems, Android and iOS has been implementing various mobile applications for blind people with unique features [17].

Each mobile app has to be used by all types of users who also having impaired problems such as vision, color blindness, hearing, dexterity, cognitive disabilities and many other [16]. Google accessibility provides the document for improvement in design of these mobile apps. Some the principles applied in development of apps are increasing text visibility, use large simple controls, describe each UI element and etc.

3.1 Android Associability applications

Android is a one of the most popular mobile operating system where we can develop app for each applications. At present, various apps are available for finance, marketing, communication, utility, gaming, navigation and many others. In market, few special Android apps have been developed to provide assistance to visually impaired people for communication purpose. This section gives the details of some of Mobiles apps implements for blind people using Android application.

TalkBack: TalkBack is one of the accessibility service which assist blind and vision impaired users. It provides the text readers, through which user can interact with their devices and it provides spoken, audible and vibration feedback facilitates .
Classic Text to Speech Engine: This application was developed to generate and store different male and female voices. It read out text, translations, and navigation. It also support reading PDF document, e-books and help in pronunciation .

BrailleBack: BrailleBack is an accessible service for blind users and it makes use of Braille devices. To give a combined Braille and speech experience it works with TalkBack app in conjuncture. Through Bluetooth, a supported refreshable Braille display to user device using this application. The screen content presented on the Braille display device and user can interact with and navigate within the device with help of keys on the display. Using the Braille keyboard, the user can give input text.

ScanLife Barcode and QR Reader: ScanLife Barcode and QR Reader can be integrating with Android application for read QR and UPS code by clicking a picture. This facility can be benefit to the blind users.

Dolphin EasyReader: EasyReader is an open accessible reading app for people with low vision or blind. The app reads the given text and provides the choice for selecting human sounding; choose colors, text size and highlights to suit your visual needs.

Voice Dream Reader: It is an accessible reading tool for mobile devices. It was implemented by advance text-to-speech and a high configure screen layout to read any style of text. The blind people get ability to hear documents read in their favorite voices.

KNFB Reader: This app is an essential tool for anyone with low vision, visual impairments, difficulty reading, and visual impairments. It reads text from different sources such as bills, documents, signs, mails, PDF and JPEG files. User can read only twenty five documents using trail version. User has to purchase this app to get access to all facilities.

Nearby Explorer: It is complete GPS app designed for blind people. It provides the directions with description about surrounding environment and also provides the information about the roads position. User required more storage capacity in their mobile to run this mobile app.

Ideal Accessibility Installer: This application provides the various packages such as Kick Back, TalkBack and SoundBack applications for visually impaired and blind people. These packages are used to provide facilities like audible, vibration and spoken feedback to Android devices.

Magnify: It helps visually impaired users to read small fonts. To achieve this, user has to keep their phone at least at a distance of four inches from the text to read. They can also use on the flashlight on or off manually to save battery. The app also supports facilities like double tap to zoom in and out, long press to turn lights on and off and single tap to maintain focus.

Messages Keyboard: user can type message by using single finger, change colors as desired, use swipe gesture and etc.

NoLED: it provides a display of custom notification dots or icons over the screen and user find immediately about notification. It supports various notifications such as text messages, voice messages, GoogleTalk messages, missed calls, emails and many others.

3.2 iOS accessibility applications

iPhone Operating Systems provides solutions for implementation of mobile apps for visually impaired users. In exiting, mobile applications are developing for text to speech translators, text readers, text typing, navigation assistance, gaming and others. Some of these apps are presented here.

VoiceOver: This mobile app consists capabilities of screen reading, auditory feedback, supports Apple’s Safari web browsing and navigation.

Voice Brief: This app is for reading emails, weather, feeds, news and others for visually impaired people.

Dragon Diction: Dragon Diction app can translate voice into text.

BrailleTouch: It is developed with special Braille split – keyboard design like Braille cell to make user to access freely.

Recognizer App: User can recognize packages, ID cards and cans by through camera based barcode scanners. It uses object

reorganization and it does not required internet connection as it stores the images locally in the mobile itself.

LookTel Money Reader: This app identifies the currency and spell the denomination, which is useful for the visually impaired people.

ColorID Free: This app is developed for visually impaired people for identification of colors.

TapTapSee: It is designed for blind and visually impaired people. User can identify objects through this app. For that, user has to double tap the screen to take photo of anything, at any angle and here the name of object.

Light Detector: This app is for detecting the light source and converts into voice. The visual impaired people can hear voice where ever light is available and he can detect strength of light based on voice pitch.

Video Motion Alert (VM Alert): This app is developed using advanced video processing technology, which can able to detect motion as recorded by the mobile camera.

Ariadne GPS: This app is developed for navigation assistance which was built with VoiceOver app. The visually impaired user can listen the locations as user move the finger over the map.

GPS Lookaround: It is developed to spell the name the street, city and cross-street with help of VoiceOver app and GPS system.

BlindSquare: This is for identification of surroundings through GPS system. The visually impaired people can know the routes to walk and feedback provide while walking.

3.3 Categories of blind Accessibility apps

For visually impaired mobile users, the exiting mobile operating systems have been developing accessibility applications by considering any one of following features:

1. Text- to – Speech conversion: Text To Speech (TTS) process and spell out the text.
2. Speech-based: it takes the data in form of voice from the user and converts in to text. Also it reads the text and spell out to user.
3. Navigation: Using GPS system, it provides the facilities for tracking locations, identification of environment, walking directions and many others through voice assistance [18].
4. Color Identification: for identification of colors and spell out.
5. Object Identification: for barcode readers and image identification through voice assistance.

Table. 1: Category wise assistance mobile applications

Category	Android	iOS
Text-to-Speech	TalkBack, BrailleBack, Dolphin EasyReader, KNFB Reader, Magnify	VoiceOver, oMody, Voice Brief, BrilleTouch,
Navigation	Nearby Explorer, Talking Location, Guard My Angle, WalkyTalky, Intersection Explorer,	Ariadhne GPS, GPS Lookaround, BlindSquare

	vOICe	
Speech-based	Classic Text to Speech Engine, Voice Dream Reader, KNFB Reader, Ideal Accessibility Installer, NoLED, Eyes-Free Shell, JustSpeak	Dragon Dictation, Tap TapSee, VizWiz, IQ Engine, Light Detector, Vido Motion Alter
Color identifier	Color Picker	Color ID Free
Object identifier	ScanLife Barcode and QR Reader	Recognizer, LookTel Money Reader

4 CONCLUSION

At present, mobile apps in smart phones are used to perform the most of our daily activities. But the people with vision impairment require assistance to access these mobile apps through handheld devices like mobile and tablets. Google, Android applications has been developing various mobile apps for visually impaired people. The paper is focused on mobile app accessibility for blind user provided by Android and iOS platforms. Still it need to provide more effective facilities in app by adopting and synergizing suitable techniques from Artificial Intelligence, Machine Learning and Deep Learning.

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