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Improving the Accessibility of Touch Screen-Based Mobile Devices for Blinds Using Android

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ABSTRACT: For visually disabled people interacting with touch screens can be very difficult because of the lack of hardware keys. This paper deals with the problem of interaction between blind people and Mobile. It deals with the problem of absence of a platform (Operating System) through which a blind person can work on Mobile. Using this application, a blind person can work on Mobile without any one's help. This application allows you to use the device even if you cannot visually read the screen. Information displayed on the screen is rendered in synthesized speech output generated using Text-To-Speech (TTS) technology and routed through the device's speaker or a headset and also Speech-To-Text technology(STT) is also used for giving the input for the Mobile. By this application, we have generated an efficient interface between a blind user and computer.

Keywords: Android, Text-to-speech, Speech-to-text, Speech recognition, Screen reader

I. INTRODUCTION

Touch-based phones have paved their way into the mobile scene and turned the richness of the user interfaces into a differentiating factor between brands. Further, multi-touch surfaces played a paramount role in these gadgets extraordinary adoption both by manufacturers and end-users. Touch-based devices present a wide set of possibilities but a comparable number of new challenges. These devices have incrementally decreased the number of tactile cues and simultaneously amplified the interaction possibilities, thus increasing the visual demands imposed to their users. While a blind person is likely to be able to interact with a keypad-based phone to place a call without the need for any assistive technology, it would be a herculean task to do so with today‟s touch screen devices. The magnitude of this problem increases as we load the screen with interface elements, as happens with text-entry interfaces, where all letters are placed onscreen. Assistive screen reading software, like Apple‟s VoiceOver, enables a blind person to overcome these issues by offering auditory feedback of the visual elements onscreen. Still, as aforementioned, mobile interfaces are extremely visual and a large amount of information is lost in this visual-audio replacement. Possible examples are the need of a good spatial ability to have a notion of the device and the interface components therein, or cognitive capabilities to memorize letter placement on screen. Visual feedback makes these attributes dispensable or less pertinent, while its absence makes them relevant and worthy of consideration. Our goal is to identify and quantify the individual attributes that make a difference in a blind user when interacting with a mobile touch screen. The mapping between individual capabilities and interface demands will then enable us to suggest the best interface for a particular individual or inform designers about the most promising methods and attributes, thus promoting inclusive design.. Spatial ability, pressure sensitivity and verbal IQ were revealed as determining characteristics to a particular user‟s performance and good indicators of the suitable methods for each person.

II. RELATED WORK

Existing system is a blind person can work on computer without any one's help. But a problem still persists. The applications are not made speech interactive, but the platform on which they would run (Operating System) is not speech interactive. Due to this problem, speech based applications are of no use. So to overcome this disadvantage the idea of a speech based Operating System that is fully operated via speech, and that can be operated easily by any blind person (who know a language) was developed and for mobile the existing system is that disabled people able to make a call by identifying the button 5 which is bulged by that he will be able to identify the other button. Skilled users provided useful suggestions on crucial aspects such as gestures and button position. Although the prototype developed is limited to only a few features for the Android operating system,

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the results obtained from blind user interaction can be generalized and applied to any mobile device based on a touch-screen [2]. The Mobile Lorm Glove: a mobile communication and translation device for the deaf-blind translates the hand-touch alphabet Lorm, a common form of communication used by people with both hearing and sight impairment, into text and vice versa [3].

The actuators are RMV (Rotary Mass Vibrator) motors enable vibration in many android mobile phones. The driver circuitry controls each motor independently. Each command received from the PDA encodes the state of the haptic interface, that is, for each motor, the on/off flag and the vibration frequency value [5]. The suggested new solution for Android mobile phones is to provide specialized ”talking touch” views, such as a ”talking touch list”, which allow fast input with audio feedback [6]. Voice Based Guidance and Location Indication System for the Blind Using GSM, GPS and Optical Device Indicator which basically works on the principle of the ultrasonic sound generation and alert mechanism.The system is however having a dual feedback mechanism. This enhances the overall feedback received by the blind user who receives the outputs generated in different formats of vibration ie high, low, medium and strong vibrations [9].

Figure 1: Architecture of Android

New indoor navigation system for visually impaired people using visible light communication we propose an indoor navigation system that utilizes visible light communication technology, which employs LED lights and a geomagnetic correction method, aimed at supporting visually impaired people who travel indoors. To verify the effectiveness of this system, we conducted an experiment targeting visually impaired people [7]. New applications support mobile users with location-aware information. Meeting the different user requirements they designed a multimodal user interface to support different user groups – each in their suitable fashion. The introduced AccesSights system is based on our highly flexible and modular Niccimon platform [10]. Figure 1 shows the major components of the Android operating system Android includes a set of core libraries that provides most of the functionality available in the core libraries of the Java programming language. The drawbacks of existing system are

- No Touch Navigation.
- No voice Synthesis.
- No possibility of transferring and receiving message.
- No possibility of identifying location latitude and longitude.
- Difficult to use the system.

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III. BLIND INTERACTION WITH MOBILE USING ANDROID

Developing applications for the Android Mobile Phone Operating System does not require as much preliminary work or in depth learning as one might initially assume. A working knowledge of programming and a willingness to try new things are the two main prerequisites. In this system meets all the requirements what the user expecting in the current world. The system support all the user requirements and user needs that are sending message, receiving message, making and receiving calls, identifying location , listening music etc. Handling mobile is very easiest way by using TextToSpeech and SpeechToText Technology. This application includes an easy-to-use and powerful speech recognition feature.

Using touch, the application will guide the user to identify the icons using voice guidance. To improve the efficiency of text entry, modern "smart" keyboards are becoming intelligent: they are able to correct users' erroneous input (i.e., correction) and complete words based on partial input (i.e., completion). For example, the Google keyboard on Android corrects "thaml" to "thank", and completes the word "computer" after the user types "comput"[4]. Using this application the user can answer a call, manage contacts, and shoot out a quick text message, accessing GPS to get an update on their current location, and included Music Player app and will automatically list all the music files that are installed on the memory card of the phone and sorts them according to artist and album. Features are

- In this system the user can send message using the voice recognition system which has been introduced by which the user can speak the sentence of what he want to send to other users.
- Then the user can read the received message from their inbox.
- The user can make a call in two ways: one by using dial pad option and next by retrieving contacts of the other user from the database which is stored.
- The user can listen to music for their entertainment.
- The user can identify their current location latitude and longitude.
- The user will know the current date and time.

The new application called Blind Interaction with mobile that allows for those Android users who are blind, to get their Android devices and use common features found on smart phones. This application includes five features like Contacts, SMS, Music Player, Time and Location. Using touch, the application will guide the user to identify the icons using voice guidance. Using this application the user can answer a call, manage contacts, and shoot out a quick text message, accessing GPS to get an update on their current location, and included Music Player app and will automatically list all the music files that are installed on the memory card of the phone and sorts them according to artist and album. Most touch screens provide no audio or tactile feedback, making it difficult or impossible to locate items on the screen. Because of these difficulties, blind users may need to be shown the locations of on-screen objects by a sighted person, may need to use an alternative accessible interface [1].

BrailleType takes advantage of the capabilities of those who know the Braille alphabet. The touch screen serves as a representation of the Braille cell, having six large targets representing each of the dots positions. These targets were made large and mapped to the corners and edges of the screen to allow an easy search [8]. Blind interaction with mobile allows the user to choose the icon which is placed at the four corners and at the middle. The screens analyze the user input and give the output as speech of that input. Message icon allows the user to send and receive the message. The send message icon allow the user can send message using voice recognition where the user can say the message of what he want to send to other users. The receive message icon allow the user to listen to received message by clicking on that message. Contact icon allow the user to make a call to other user using two options one by dialing the number to whom he want to make a call and other by retrieving the contact from the database and making the call. Music icon allow the user to listen to music for their entertainment which is stored in the SD card, and the sort the list according to albums and the time icon at the middle allow the user to know the current time and date. WhereAmI icon allows the user to know the location name, latitude and longitude of the current location.

IV. RESULTS

The Android emulator is an application that provides a virtual mobile device on which you can run your Android applications. It runs a full Android system stack, down to the kernel level that includes a set of preinstalled applications that you can access from your applications. We can choose what version of the Android system you want to run in the emulator by configuring AVDs, and you

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can also customize the mobile device skin and key mappings.

- **Touch friendly**: You can use this application with the touch screen technology. You will only have to move around the screen and the voice synthesis will read the text under your finger. This includes typing number using the touch screen with our new virtual keyboard. In fact, no physical keyboard is required.

TABLE 1 MODULE FUNCTIONS

MODULES	SUB MODULES	DESCRIPTION
Message	Send Message	The user can send message to other user.
	Receive Message	The user can receive message from other user.
Contacts	Dialing through dial pad	The user can make a call to other user by dialing.
	Dialing through contacts	The user can make a call to other user by retrieving contacts from the database.
Music		The user can listen to music for his entertainment.
Location		The user can know the current location's latitude and longitude.
Time		The user can know about the current date and time.

- **Speech Recognition**: If you have an Android phone with version 2.2 and above you'll be able to activate the speech recognition from anywhere inside this application and type text. Imagine writing an SMS using your voice only.
- **Screen Reader**: This application helps you to know the icons name where you have touched in mobile phones.

Figure 3 describes main menu of the system that consists of message, contacts, time, music and location. Table 1 describes the modules and its descriptions.

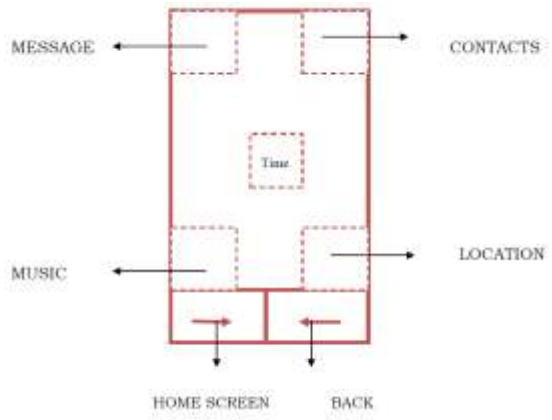

Figure 2: System Model

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MESSAGE: The user can send the message to other user using speech to text technology and also allow the user to read the recently received message using text to speech technology.

Figure 3: Main Menu

The important domain these modules are send message (Figure 4) and receive message. Figure 2 defines the system model of the system.

After dialing the message and number click on SEND button to send message by keypad(Figure 5) to other user.

Figure 4: Sending message through recognizer

CONTACTS: The user can make call to other user or receive call from other user. The important domain this module are making call and receiving call. Figure 6 describes contact records.

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Figure 5: Sending message through keypad

Figure 5: Contacts dialling through dial pad

MUSIC: The user can listen to music which is stored in SD card.

LOCATION SPECIFICATION: The user can know the location name and latitude and longitude of the current location.

TIME: The user can know the current time and date.

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Figure 6: Contact Retrieval

V. CONCLUSION

The Application was developed using android as operating system, XML as front end and Sqlite for the back end. This paper is mainly used for the disabled user who will be feeling easy to use it**.** The design page is implemented XML. This application provides a user friendly approach towards the mobile. This application is well developed and is found to satisfy all the requirements for the Blind people for using mobile. The software is developed in Android, as it is open source it will makes the system more reliable and compatible with the other environments. The application proves better extensibility and flexibility for future enhancements. Any further requirement application is possible with the same features guaranteed. The design of this software is in such a way that the addition of any new module if necessary is possible without affecting the integrity of the present system.

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