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SMARTPHONES FOR VISUALLY CHALLENGED: ANALYSIS AND POSSIBILITIES

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ABSTRACT

The Smartphone era has evolved tremendously and given the access to information services that could only be dreamt of a decade ago. The aim is to bring the same level of lifestyle improvements to the visually impaired and blinds community enhancing the ways for them to gain access to highly advanced features on a Smartphone with just their touch and sound. All this packed within a single, affordable Smartphone device has been faced as a major challenge in the field of technology. The first problem in applying the potential of the computers to severely physically handicapped individuals involves providing an interface which they can control efficiently. There are basically three approaches that have been used to allow them some measure of control: encoding techniques, scanning techniques, and techniques employing a direct selection such as a keyboard. The encoding systems utilize one or more switches which the person operates in a repetitive fashion to encode his output. The Morse code, for example, might be used in such an encoding system. This approach works best with people who have small but quick and well controlled movements such as might be found in the breath control of a para- or quadriplegic.

Keywords: information services, visually impaired, Morse code, encoding, para- or quadriplegic.

INTRODUCTION

Mobile phones play a significant role in our lives. While owning a mobile phone was once considered as a luxury, but these days mobile phones have taken a critical place in our lives and has become a necessity for majority of the people [1]. In this regard, Pew study [2] found that over 75% of the adults living in USA owns a mobile phone and in addition, majority of the people among them were of view that it is nearly impossible to give up and stop using their cell phones. Further, with increasing development mobile technology, various IT-dependent technologies have surfaced with the main of providing better and convenient life specifically for the people having certain disabilities such as hearing or visual impairment [3]. Such technologies have additionally contributed towards helping the blind people enabling them to interact with

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different social activities much efficiently and also increasing their capability to live independently. This has become possible via development of different applications used for obstacles detection, path guiding, searching as well as identifying objects [4].

Moreover, for people having certain disabilities along with the older users, smart phones these days can provide greater freedom by simply allowing the users to independently act at the same time, remain connected to their family, friends, and also their caregivers [5, 6]. Another use of mobile devices for them is employing assistive software for the people having special needs [7]. Despite this, smart phone interfaces are quite often inaccessible to the people having either visual or motor disabilities because of certain problems like small form factors, small or undifferentiated keys, or even smaller, unreadable on-screen text [8]. To make it worse, mobile manufacturers, being aware of such issues, are continuing to develop much smaller and much thinner devices without even considering such accessibility issues which are faced by the disabled population. Even though majority of other companies have successfully attempted to eliminate such issues via developing specialized technologies such as Mobile Speak screen reader, PAC Mate accessible note taker, Ray, Gerogie Interface, Voice over, Siri, etc., yet such innovative technologies still have multiple limitations and most importantly include increased prices with reduced features [9]. Hence, considering the challenges which are typically faced by hearing and visually disabled people mainly in performing their day-to-day daily tasks, there is a dire need to develop effective technologies and solutions which can help them in living independently. Considering this, the current paper attempts to critically evaluate the existing application for disabled people and lastly, propose a better mobile interface based on more code which hasn't been used up till now for such purposes.

RELATED WORK

Blind individuals are considered to be either sub-human or unfit to participate in normal public exercises. [10]. Visual deficiency is thought to be the most dreaded inability among all others. In the course of the most recent couple of years, entertainment industry along with modern innovation has been on the ascent for encouraging learning as well as rehabilitation environment to such visually challenged individuals. In this regard, Orly [11] and David [12] formulated a virtual environment framework with the main aim of helping disabled individuals in their investigation and mapping for unusual surroundings. Moreover, for the sensory substitution frameworks, numerous endeavours have been made to assist the blind individuals in order to provide them with visual data such as content, illustrations, or even pictures [13], [14]. Both Avizzano and Marcheschi [15] deciphered visual data of screens and managed to make it accessible for the hearing and visually disabled individual, by simply employing prototype two-axis HI, which is basically the Moose. From this, majority of the visually challenged people in their study obtained information mainly in the form of clear audio with the help of using various technologies in association to Text To Speech framework as well as mobile based database for supporting the visually impaired individuals.

Une [16] developed information presentation device specifically for active understanding which could help the blind people. Furthermore, Imai, Tazawa [17] developed a touch screen application which could be used for accessing speed data helping both the health and

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additionally blind individuals. Apart from this, "Ray" was basically the first ever smart phone which was mainly developed with no eye operations. Ray as a result propelled to change the lives of numerous blind people to see the world in which they lived in. Ray was basically intended for persisting in the life of blind people. It additionally gives the eyes free shell ultimately permitting blind people individuals to employ Ray's speech functions.

Jethjarurach et al. [18] built up an application which was aimed at supporting self-overseeing of blind people's lives. They recommended utilizing the application which has the basic function of taking pictures bringing with mobile phone. They additionally exhibited a procedure to build up barcode reader utilizing advanced smart phones which efficiently vocalized the minor and major details and also helped in taking pictures to assist visually impaired for the acquirement of goods.

Cesarano et al. [19] stated the contents of a web are of great importance to the normal individual and also to the visually impaired. W3C likewise proposed the rules for web engineers to make the web content easily accessible, however it is quite unfortunate that the visually impaired individuals cannot fully use and access the available web content. In this regard, they developed an approach that changes the website pages vigorously into aural site pages eventually giving heuristics procedures for improving usability for the visually impaired clients.

Even though many researchers have in the past worked on eliminating accessibility issues of such applications and devices, despite this, only limited studies and approaches have been made possible which point out actual limitations as well as issues of the android applications that were developed for visually impaired and thus, considering this, the major contribution of this study is to evaluate effectively the accessibility flaws as well as other limitations in below mentioned applications in order to provide a new, yet successful mobile interface for the blind people [20].

EVALUATION OF APPLICATIONS

Name of Application/ Device	Advantage	Disadvantage	Reference
Talkback	• Less robotic and digestible • Has an appealing Layout • Effective mode for sound backing • Easy accessibility	• Limitation of number of installation. • Limitation for Text to Speech. • Ineffectual to reading. • Naming of the unnamed button.	[10]
VizWiz	• Accurate and very fast. • Fully and easily accessible. • Highly responsive I.Q engine. • Twitting question. • Provides multiple answerers. • Effective and clear mode of audio.	• Rapid Drain of Battery. • Limited availability of Internet. • Rely on the Volunteer. • No tutorial help.	[10]

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Blind navigator	• Feedback is easily provided showing the visibility of System Status. • Speaking words or different phrases which the user can easily understand. • User can read messages prior to sending.	• Lack of feedback. • N is pronounced as 'yen' causing confusion. • Absence of a home button • Absence of read numbers prior to making a call. • Lacks overall efficiency as a system.	[1]
Easy phone for blind	• Gives feedback when finger is slides over the screen. • Speak words or different phrases easily understood by the user. • Use can read messages prior to sending. • Provides greater efficiency than majority of other devices.	• Gives continuous feedback but absence of feedback on the home button. • Feedback is available only after a long tap. • Number cannot be read prior to making a phone call. • Limited customization options. • Absence of documentation required for help.	[1]
Phone dialler	• Speak words or different phrases easily understood by the user. • Numbers are pronounced clearly • Has only one screen with one phone dialer • Home button is not needed.	• Not efficient and users have to try and press multiple times to locate required number. • Absence of documentation required for help	[1]
Blind launcher	• Gives feedback when finger slides from up towards down or vice versa. • Speak words or different phrases easily understood by the user. • Options are selected by double click making it consistent to the talk back software.	• Absence of feedback when dialling numbers. • Absence of home button. • Not consistent with the Talkback software. • Time consuming	[1]
Object Identification technology: Image processing	• Don't need special tags for recognizing the near-by object. • Has a faster response time • Better availability	• Performance is affected with built-in camera as well as lighting conditions [4]. • Predefined database of pictures is required for comparing the picture taken. • Very Complex. • Limited in scope as well as highly error-prone. • Lower recognition rates.	[3]
Object Identification technology: RFID	• Simple and an efficient technology. • Easier to implement.	• Needs attachment of special tags to objects. • Very costly • Regular update is required. • RFID tags are removed easily. • Signal from other readers can possibly	[3]

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		interfere with its signal.	
Object Identification technology: Barcode	• Very inexpensive and effective	• Hard to locate the position of bar code	[3]

The study of various articles and journals leads to the fact that Morse code hasn't been used as proactive interface to electronic devices. Also the study based on different existing products for the visually impaired face certain drawbacks which may be rectified with the help of Morse code technology. It is proven that Morse code user can type faster than a QWERTY user. And it has only been used in computer systems as an assistive technology to help the visually handicapped. Hence there is a dire need of applying similar concept in smart phones which would possibly enable the blind users to interact easily without needing any kind of hardware or software modifications. Furthermore, Morse code systems utilize a binary input procedure which represents different characters as well as commands in the form of a series of specific dots and dashes. One of the most important benefits of applying Morse code is its capability of becoming a sub-cognitive process. When someone uses Morse code for a considerable period of time, the user will no longer think about the code which they are typing. This is a similar procedure since it is employed by many touch typists due to its significant impact on the overall speed, accuracy as well as quality of the work which is being produced.

CONCLUSION

In conclusion, it can be said that the current study conducted a survey based analysis of different applications which are present for Blind people. The most common interfaces for the visually impaired are based on hardware interfaces, software applications and even hybrids. These options provide feasible solutions to assistive technology domain. But when it comes to target audience and reachability these products fail to achieve one or more issues for which a better solution should be evolved or replaced in order to cater the requirement of best possible interface for the visually impaired. Hence, in this regard, it is proposed that an alternative Smartphone interface must be developed on the basis of Morse code by which a user can type faster than a QWERTY user. Hence there is a need of the same concept being used in smart phones as well which will enable the blind users to easily interact with the smart phones without any hardware or software modifications.

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