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Digital Talking Book

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ABSTRACT

This paper, presents user friendly ways to read books for print disable individuals. "Reading" is the process of looking at a series of written symbols and making meaning from them. However, there, the print disabled who are, the blind, partially sighted, dyslexics, those with visual impairments, physically disabled, and learning-disabled who have difficulty in accessing print media information. Digital talking books are the significant technology for the print disabled community to access printed media information. The Digital Accessible Information System (DAISY) technology; it is an open international standard for accessible multimedia developed by libraries serving persons with print disabilities in collaboration with the target users around the globe. The proposed "Talking Book" improves the blind users' ability to read digital daisy books. The main function of the talking book player; computer memory and retrieves bookmarks, automatically unzip downloaded zip files and convert them into readable manner. Additionally, it consists predefined gestures and voice commands to navigate through the pages in the diligence. This paper presents a user interface with an easy-to-distinguish layout, auditory output and gestural input that enables visually impaired people to interact with an Android smartphone device.

Keywords

Vision Impaired, DAISY, Gesture Recognize, Voice Control, Digital Book Player

1. INTRODUCTION

Over 7 billion, 285 million [1] are vision impaired, according to the world health organization. One of the major problems these blind people facing is the difficulty of reading books. On that point are some technologies proposed [2] and available [3] to overcome this trouble. One of the most popular solution is Digital Talking Book [4]. Considering requirement analysis, portability, cost & user friendliness mobile based digital talking books are more beneficial to blind people.

An auxiliary tool [5] is very important for blind students and vision impaired people to learn, work or in their leisure time. However, the education, training and auxiliary tools are insufficient for them so that they have no aspiration to go outside to work. In spite of there are some auxiliary tools, such as a Braille script or a talking book [6]. How to apply these tools still has some problems [7-10]. For instance, it is difficult to search a specified paragraph or a chapter in a volume. Thus, the DAISY Consortium develops, preserves and promotes international DAISY (Digital Accessible Information System) Standards [11], which is a standard for digital talking books (DTB).

DAISY digital format assists people who, for diverse reasons, have challenges using regular printed media, including blindness, impaired vision, and dyslexia. DAISY digital talking books offer the benefits of regular Audiobooks, however, they are superior because DAISY includes navigation. While reading a DAISY book, a reader can proceed to the next or previous page, chapter or sentence, it is impossible using conventional audio recordings because they lack search and navigation characteristics. Although at that point are some DAISY DTB players [12] [13] on the market, yet, few devices can support only Chinese words.

Besides, smartphones have been the important tools in our society for the rich functions, including communication, entertainment and online office, etc. as the essential devices of mobile computing. Smartphone software development has also become more significant than before [14] [15]. It holds the possibility of an install or remove applications arbitrarily. With the speedy progress of smartphone give us a new opportunity to evolve a useful supporting tool. Most smartphones use the touch screen as their main user interface. Although the touch technology in nowadays has increased the usability for sighted users, nonetheless, they are even inaccessible to blind people. More solution at this time is to use other interaction channels such as audio [16] [17] and vibration feedback [18] together with gestures. In this paper, proposed and demonstrate an Android-based DAISY DTB player using the smart mobile device.

The suggested plan for an application program “TALKING BOOK” integrated the functions of the DAISY DTB player, bookmark, add and access, and an easy to-use interface and additionally with voice command, auditory output and gestural input to enable blind people to interact with the touch screen on an Android smartphone to read books as a sighted individual

1.1 Digital Talking Book and DAISY Standards

The Digital Talking Book is an audio representation of a print publication which is planned to further enable people with print impairments [19]. A DTB is intended to provide enhanced access to documents above and beyond the standard audio book. DTBs have all the benefits of regular audio books, but they are superior when it totals up to navigating the content and displaying synchronized text [20]. Whereas analog audio books must be manually manipulated to find specific sections, DTBs provide enhanced multimedia access to the content for people who are blind or otherwise vision impaired, giving them quick access to particular parts of the script.

Most of DTB’s using Daisy format audio books. DAISY stands [21] for Digital Accessible Information System. The DAISY Consortium was formed by talking book libraries to lead the worldwide transition from analog to Digital Talking Books [22]. The DAISY Standard allows for full flexibility in the mixing of text and audio ranging from audio-only, to full text and audio, to text-only.

DTB's are played backward on either hardware or software players. Thither are many hardware players available for a high cost. Victor Reader ClassicX [23], Book Courier, Icon, Telex Professor are some of them. When it comes to software players, they are usable in several platforms. Such as Windows, Mac, Mobile platforms [24].

2. METHODOLOGY

2.1 Mobile Android Platform

Used an Android platform to develop the application program. The “HTC Incredible S” was chosen for testing purpose. The specification of the Android smartphone is shown in the Table I.

Table 1. Specification of smart phone platform

Item	Specification
Android smartphone model	HTC Incredible S
CPU speed	1GHz
Memory	768MB RAM; 1.1GB ROM
Display screen	4-inch, 480_800 SLCD with capacitive, multi-touch screen
Weight	135.5g with battery
OS	Android 2.2

2.2 Invention of the BEST DAISY

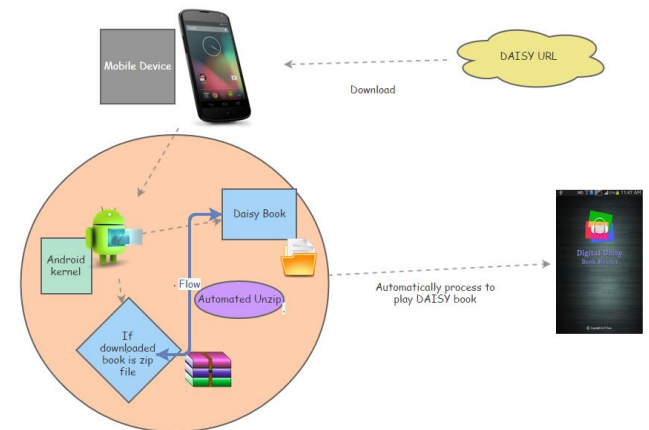


Figure 1. The process of “Talking Book”

The implement of a Talking Book based on the smartphone with an Android operating system and utilize the Eclipse IDE and Java language to make this application program and user interface. The touch screen of the smartphone is used for gestural input and there are two physical buttons on the side of smartphone allow user to adjust audio volume. A fundamental aspect of input design is that the user can recover out the auditory output when touch the screen or presses the physical buttons. Likewise, the most middle area of the touch screen is used for user to pick out/enter though gestural input. This application can open through voice command. It has two modes of operation as follows.

- Normal mode
- Gestures with voice mode

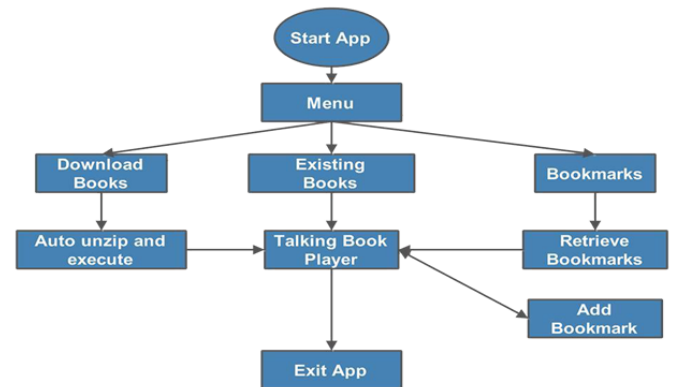


Figure 2. The hierarchical structure of “Talking Book”

2.2.1 Normal Mode

For the general users to access digital audio books, normal mode is designed. It uses buttons to navigate through the application.

User can choose one of these modes by drawing number 1 for Gesture Mode and number 2 for Normal Mode (figure 1).

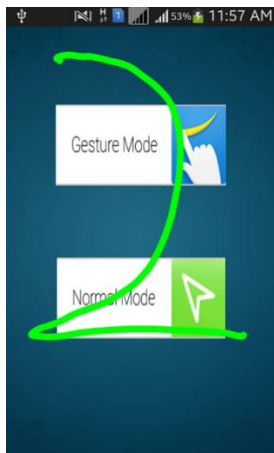


Figure 3. Selecting a mode using gesture

Normal mode is designed for ordinary user to use the application & as a developer mode.

2.2.1.1 Dashboard

This application has a dashboard which consist of 8 buttons (figure 2).

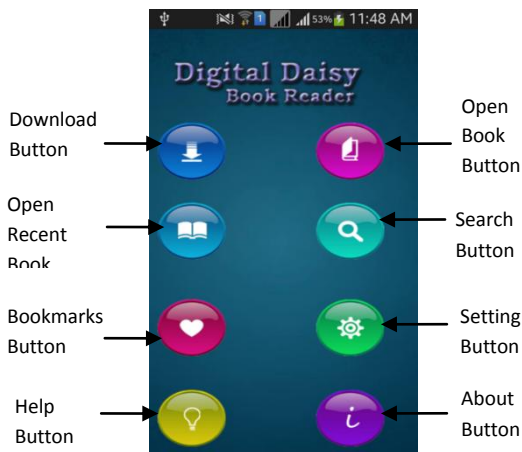


Figure 4. Dashboard

2.2.1.2 Download

This will use for, search and download the daisy books that the user has requested. Downloaded daisy books will be automatically unzipped to a default location. Then the user can direct access to them.

2.2.1.3 Open Book

User can open a book manually by going through the directory structure of the phone. It requires less time than the search if the user recognizes the location of the daisy book that downloaded or copy to the phone.

2.2.1.4 Open Recent Book

Open the last book that the user has played.

2.2.1.5 Search

This will search & show all the daisy books that are used in the phone. User can directly access to the book & play any of them.

2.2.1.6 Bookmarks

Bookmark page consists of a list of all bookmarks added.

2.2.1.7 Settings

The settings interface allows user to change the root folder for the search.

2.2.1.8 Help

The help interface shows instructions how to navigate the player.

2.2.1.9 About

About interface shows information about the phone and languages available.

2.2.2 Gestures with Voice Mode

Talking Book application is specially designed and produced for visually impaired person. Therefore, all the functions of the applications can be used by gestures and the system will output voice instructions. In normal mode there will be a visible dashboard and in gesture mode user has to navigate the app by using gestures according to the voice instructions.

2.2.2.1 Dashboard

If the user previously selects the gesture mode, the system will output voice instructions to use gestures. User can draw 1, 2, 3, 4 on the screen and search, open recent book, bookmarks interfaces will be open accordingly. If user wants to go back to the mode selection user can draw 5 on the screen.

2.2.2.2 Search

When a user enters to search, all the books that have founded will be notified to the user with the relevant gesture to access them & play. Relevant gesture to move back to dashboard also be notice to the user through voice.

2.2.2.3 Player

Gestures are used to manipulate the player. Below table shows the player functions and relevant gesture commands.

Table 2. Player functions and gesture commands

Player Function	Gesture Command
Play/ Pause	Tap the center of the screen
Move to previous audio segment	Swipe Up
Proceed to next audio segment	Swipe Down
Increase the book depth	Swipe Left to Right
Decrease the book depth	Swipe Right to Left
Rewind	Swipe Diagonally Down and Left
Fast-forward	Swipe Diagonally Down and Right
Add a Bookmark	Swipe Diagonally Up and Right

2.2.2.4 Open Recent Book

When user Navigate to this, the recent daisy book that has played by the user will automatically run.

2.2.2.5 Bookmarks

Bookmarks that are available & the relevant gestures to access them will be notice through voice & user can select them by using the relevant gesture.

2.2.2.6 Instructions

All the instructions that are needed to handle the player will notice to the user via voice. If user wants to move rearward to the dashboard the relevant gesture should be input as instruct.

2.3 Usability Study

2.3.1 Subjects (S1,S2,S3,S4,S5)

There were five (S1... S5) individuals participated in the usability study, and among them two were sighted, two were sighted with eye-shade, and one blind. According to the given questioner table III depicts an analysis details according to their responses that their ability to use smartphone and touch screen.

Table 3. Summarized questions results

Subject	Gender	Age	Sight	Experience in Smartphone and touch screen	Experience in Daisy Books
S1	M	23	Sighted	No	No
S2	F	22	Sighted	No	No
S3	F	24	Sighted with eye shade	Few	No
S4	M	24	Sighted with eye shade	Few	No
S5	M	40	Blind 8 years	No	3 years

2.3.2 Usability Analysis Procedures and Tasks

There were four tasks to fulfil the end user to test the proposed study. Participants have to perform task 1 to task 4 for five trials.

During that time it was recorded the executing time and the number of steps through video analysis.

Task 1 (T1): User needs to read a specified chapter of a digital talking book, add a bookmark, and then go back to the Main Menu.

Task 2 (T2): User needs to read a specified digital talking book and access a bookmark which is added in task 1.

Task 3 (T3): User needs to read a specified digital talking book and add the bookmark

Task 4 (T4): User need to play a specified bookmark which is stored in Task 3 and then delete it.

- Each task was running with a single subject and three experimenters in the room. The experimental procedures were shown as follows:
- One experimenter read the study introduction and then the subject fill out a pre-questionnaire and sign the consent form.
- The subject has 10 min to familiar with this device.

- The participant performs task 1 to task 4 for five trials.
- The subject fill out a post-questionnaire.

3. RESULTS & DISCUSSION

The average consumed time and operating steps of five trials on the four tasks are presented in Table III. The sighted subjects with eye-shade and the blind subject consume more time than sighted one. However, they can reduce the consumed time through exercise. Fig. 5 depicts the consumed time of the first test and final trial in task 3. It is obvious to see that the sighted subjects with eye-shade and the blind subject can greatly reduce the consumed time after 4 trials exercise. Table IV presents the post-study results. As a solution, the easy-to distinguish the layout of the user interface with auditory output and gestural input could enable visually impaired subjects to interact with the touch screen on the smartphone. The user interface of this Talking Book is easy-to-use and acceptable for the visually impaired.

Table 4. Average consumed time and operation steps on the four tasks

Task	t1 (seconds)	t2 (seconds)	t3 (seconds)	t4 (seconds)	t5 (seconds)
T1	18.46/14	19.14/14.8	35.46/15.6	36.7/19.4	37.8/17.2
T2	13.92/9.6	11.8/9	31.2/15	23.02/11	37.44/15
T3	15.06/12.2	15/12	37.7/15.2	25.42/13.2	37.32/18.4
T4	10.22/6.2	10.2/6.4	15.72/5.8	13.22/6	17.42/6.6

With the intention of overcoming the limitation of the existing system, the authors have done lots of enhancement by using the specific standard. There are several approaches for a solution to the research problem which is to develop as a solution to address reading problem of the blind people using digital technologies.

3.1 Solution 1

By developing a mobile application which can run on an Android operating Systems. Using that application DAISY audio books can be played. Develop a fully voice commands keyboard application to get blind user's participations for the main applications.

3.2 Solution 2

Design and Develop an Android mobile application to download and play daisy audio books. To navigate through the application develop voice recognition system and gesture identifier.

By considering above two solutions (solution 1 & 2) chosen the first result as the best one by considering several facts. At present, smart phones are more popular among many sited as well as vision impaired individuals. Among those people Android smart phones are the most highly used mobile devices with the nation.

To test and demonstrate the "Talking Book" is providing required functionalities according to its specified requirements, Project outcomes had been analyzed according to qualitative and quantitative measurements. Quantitative measurements

depend on the quality and accuracy of the system in parliamentary procedure to ensure the operation.

To survey the capabilities or features on a certain occasion, a lot of test cases would be made. This would be a set of conditions or steps, and inputs accomplish a particular goal. To see the exact requirement or objective of a functionality of the application more than one test case would be taken.



Figure 5. Devices performance details of "Talking Book"

Talking Book was tested on 7 different smart phones using an online tool AppThwack [25] to find out performance details, compatibility issues, mistakes that could extend across the mobile devices.

4. CONCLUSION & FUTURE WORKS

Currently there are some Android based digital talking books available in the current marketplace. All most all of these applications are not available for free. Major problem of these applications is blind, person need an assistance of another person to navigate through the application. Talking book is an Android based mobile application which is develop specially address those problems. Using voice commands & predefined gestures blind user can navigate through the application to use daisy audio books to acquire knowledge.

During the development of Talking Book, the various challenges were confronted. Among them the major challenge is identifying the blind person's requirements regarding to the digital talking books. The authors discussed the challenges with the educated persons among the blind community in Sri Lanka. According to their requirements gesture identification system and the player was developed. All the gestures used in the Talking book application can be used by a blind person without any difficulty. When developing gesture identification team faced a vast challenge to separate each gesture from each other without overlapping gestures.

In future proposed to identify voice commands more accurately even in a noisy environment as easily. Currently the prototype work on the Android operating system and in future proposed to develop other programs as well as Talking book application in Sinhala language.

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