Homework Management System for the Blind Students

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***Abstract*—This study is the experiment research on making an invention for the blind students. It consists of the web application with PHP and HTML for teacher sending the text data of homework assignment to the student via embedded machine device for receiving questions and answers by pressing the buttons on the face machine box. The Braille characters of A, B, C, D answer choices which are beneath the press buttons for blinds can touch with the universal design purpose. This allows researchers to investigate the students' score and the date submitted. This homework management system can be reduced the difficulty that blind students confront nowadays since they must rely on other persons helping reading to them.**

Keywords—embedded system, controller and processing board, web application, Braille, blind students, homework management system

I. INTRODUCTION

Visual impairment, also known as vision impairment or vision loss, is a decreased ability to see to a degree that causes problems not fixable by usual means, such as glasses. Some also include those who have a decreased ability to see because they do not have access to glasses or contact lenses. Visual impairment is often defined as a best corrected visual acuity of worse than either 20/40 or 20/60. The term blindness is used for complete or nearly complete vision loss. Visual impairment may cause people difficulties with normal daily activities such as driving, reading, socializing, and walking [1].

As of 2015 there were 940 million people with some degree of vision loss. 246 million had low vision and 39 million were blind. The majority of people with poor vision are in the developing world and are over the age of 50 years. Rates of visual impairment have decreased since the 1990s.Visual impairments have considerable economic costs both directly due to the cost of treatment and indirectly due to decreased ability to work [2].

Currently there are many devices to assist the blind to read, such as JAWs, the most popular screen reader using text-to-speech conversation for people with visually impairments. A recent iPhone application using the augmented reality (AR) technology, Aipoly, helps visually impaired to see including to read text and recognize objects. Nevertheless, literacy is one of the most important skills to facilitate cognitive development and maintain cognitive process into old age [3]. Moreover, Ryles' [4] found that people with visually impairment tended to have higher level of employment if they were able to read Braille.

In Thailand after the blind children reach high school, the students have a chance to study together with normal eyes students. In common, blind students must rely on normal students to read, teach and help along their homework or lessons. While blinds students do the examinations, teachers read the exam questions and write the answers and take action every part instead of the blind students. When they go to university, the blind students use Braille books that according to the normal eyes persons books. Since the lessons of this education level are hard and have many details, of this cause the Braille book are very thick and made the readers hurt their fingers after read for very long time [5].

To make Braille book, the creator must uses specific paper and printer (Brailler). The creator must understand Braille too. These are many types of media such as low relief pictures, audio books, etc. but they are complicated method and they uses a lot of resources (such as man, time and high-level technology). One of the methods is to use recorded voice or text to speech for blinds learning or in the time examination. This method requires the current technology and vey efficient for using the best hearing sensory of the blind to read out or typing.

So, the goal of this research so called Homework Management System for the Blind Students is to provide the system which act as medium between the blind students and the teachers (who never learn Braille) to question and answer then summarize the score of the blind students to their teachers.

II. REVIEW LITERATURE

A. Research Concerning to Braille

The research namely "A Finger-Tracking System for Studying Braille Reading on a Tablet" [5] said that, in order to investigate Braille reading behavior. The researcher needs a device capable of tracking reader's finger movements in real-time. The paper presents software for tracking the finger of Braille readers. The software was developed to observe reading Braille-embossed paper on an Android tablet. It provided online visual information of finger movement patterns, reading durations on cell, total reading time, and the average reading rate. This allowed researchers to investigate braille reading in more depth in order to help improve the readers' Braille reading skills.

In 2015, Jitsodsaikul, Niyomphol, and Sirirungruang [6] compared the reading speed between sighted readers and readers with visually impairments and found that the average reading rate of sighted readers was twice as fast than those who read Braille: 122 words per minute in print and 52 words per minute in Braille. However, none of these studies used an online system to record the reading time, so their reading rates may not be entirely accurate.

B. *Users with Visual Disabilities*

When digital content and services can be flexibly presented in different formats, all users benefit [7]. However, flexibility is most appreciated by users with disabilities who now can access content and services using diverse input and output devices. Blind users may utilize screen readers (speech output such as JAWS or Apple's VoiceOver) or refreshable Braille displays, while low-vision users may use magnification.

There is a long history of research on how users with perceptual or motor impairments interact with technology, and research on intellectual or cognitive impairments is now also increasing [8,9].

Appropriate design principles for children's software recognize young people's intense desire for the kind of interactive engagement that gives them control with appropriate feedback and supports their social engagement with peers [10,11]. Designers also have to find the balance between children's desire for challenge and parents' requirements for safety.

Some designers work by observing children and testing software with children, while the innovative approach of "children as our technology-design partners" engages them in a long-term process of cooperative inquiry during which children and adults jointly design novel products and services [12].

C. *The English Braille Writing System in Thai*

Braille is a system that enables people with visually impairments to read and write through touch. A Braille cell on paper comprises six dots allowing for 64 distinct patterns Fig. 1 The English Braille system includes contractions, helping to reduce the size of Braille books.

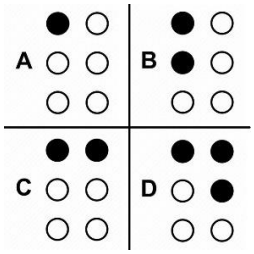

Fig. 1. The Braille dot of alphabet characters

III. THE DEVELOPMENT OF THE INVENTION

A. *Hardware that Provide Sound of the Questions*

The system consists of two parts as in Fig. 2.

The first part is embedded machine device which use small size computer board (Raspberry Pi). The second part is a web application. Namely "Homework Management System for the Blind Students". The web application allows teachers to assign homework and investigate both student homework score and students submitted date.

The device interacts with the blind students by the voice questions and answer choices that are provided by teachers via the website. Once the blind student hears the question and the four answer choices then he chooses an answer by pressing the button which tagged Braille character.

The computer embedded system is a box with the controller and processing board, the Raspberry Pi, that integrated with battery, power switch, speaker and buttons (answer choices A, B, C, D and listening to the same question and four answer buttons.)

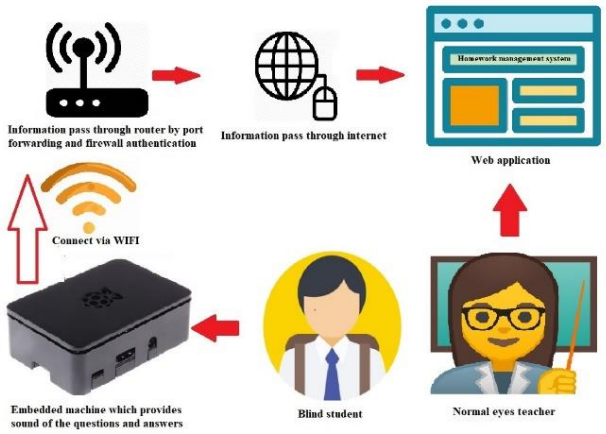

Fig. 2. Homework management system for the blind students

The development process of the machine device is in this step:

1. Designing answer buttons on the top front of the device box and attaching Braille characters (A, B, C and D) on the box.
2. Tightening Raspberry Pi board, speaker, and battery in the box, ensuring that the charger socket appear out of the box.
3. Wiring buttons which are for receiving the pressed to the Raspberry Pi plugging audio jack to the speaker.
4. Installing operating system, Raspbian to the SD card and inserting SD card to Raspberry Pi
5. Setting up the GPIO pins to the Raspberry Pi for input or output using.
6. Writing the program into SD card with Raspberry Pi connecting to the webserver side and then for providing sound from speaker.

B. *The Homework Management System Website Part*

The website that provided the synchronized is written using PHP and HTML the written program is followings and the steps that written program (PHP and HTML) access the Python program for creating MP3 files is as follows.

1. Researcher put the sound audio of every questions and the answers in the form of MP3 format by Google text-to speech web service will provide out from the machine box.
2. The SD card of Raspberry Pi consists of sound files that coherent (or accordingly the same) to the server side, so researchers checked the titles of two sides that when the machine box is connected to internet (via WIFI) then two side will automatically be synchronized for providing the new questions from teachers. The program of translating the text of questions and answers to MP3 format is as follows:

```
    from gtts import gTTS
    import os.path
    import sys
    path = 'C:/xampp/htdocs/voice/'

    q=str(sys.argv[1]).replace("_",".")
    a=str(sys.argv[2]).replace("_",".")
    b=str(sys.argv[3]).replace("_",".")
    c=str(sys.argv[4]).replace("_",".")
    d=str(sys.argv[5]).replace("_",".")
    p=str(sys.argv[6])

    if not os.path.exists(path+p):
        os.mkdir(path+p)
    tts= gTTS(text="Question number"+p+' '+q,lang='th')
    nameoffile = 'q'
    savefilename=
os.path.join(path+p+"/",nameoffile+".mp3")
if os.path.exists(savefilename):
os.remove(savefilename)
tts.save(savefilename)

tts = gTTS(text="Choice A"+' '+a,lang='th')
nameoffile = 'a'
savefilename = os.path.join(path+p+"/",nameoffile+".mp3")

if os.path.exists(savefilename):
os.remove(savefilename)
tts.save(savefilename)
tts = gTTS(text="Choice B"+' '+b,lang='th')
nameoffile = 'b'
savefilename = os.path.join(path+p+"/",nameoffile+".mp3")
if os.path.exists(savefilename):
os.remove(savefilename)
tts.save(savefilename)
tts = gTTS(text="Choice C"+' '+c,lang='th')
nameoffile = 'c'
savefilename = os.path.join(path+p+"/",nameoffile+".mp3")
if os.path.exists(savefilename):
    os.remove(savefilename)
tts.save(savefilename)

tts = gTTS(text="choice D"+' '+d,lang='th')
    nameoffile = 'd'
    savefilename                                    =
os.path.join(path+p+"/",nameoffile+".mp3")
    if os.path.exists(savefilename):
      os.remove(savefilename)
tts.save(savefilename)
```

3. The Homework Management System Run on Server Side, researcher set up the web server with XAMPP3 in “Fig. 3”, do router port forwarding and do firewall authenticating in “Fig. 4”

IV. Practical implementing and result

A pilot study was conducted for testing the application. The web application side consists of the database of one teacher, one student and 10 number of questions-answers. The “Fig. 5” shows the screen of web application while sending the questions and answers (by teachers) to the Raspberry Pi box.

V. Conclusions and futurework

This paper presents a new “Homework Management System for the Blind Students” developed on embedded system using Python. To blind students via sound and Braille characters of answer choices: A, B, C and D. The box device used is Raspberry Pi with the stalled program provide homework data using only a web application. The homework data logged to a relational database of web server. The pilot study revealed that the embedded system is activated with WIFI connection and synchronized to the web server. The teacher can put the questions-answers assignment via web application and the blind students can listen the sound of questions-answers when blind students turn on the machine box, and also, they can do homework by choosing the answer button. Of this time if teacher open the web application, teacher can receive all the data that the student submitted to him. In the researcher point of view, this research can be used practically in the secondary schools if the number machine boxes must be produced according to number of blind students in the class.

VI. Acknowledgement

I am grateful to the National Science and Technology Development Agency and Sirindhorn International Institute of Technology Thammasat University for providing materials and being consultant on this research. Finally, I would like to thanks to Miss. Mareena Vongngenyoung the former principal of Bangkok school for the blind to investigate study habits of the blind students.

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Fig. 3. The screen of XAMPP3 controller panel

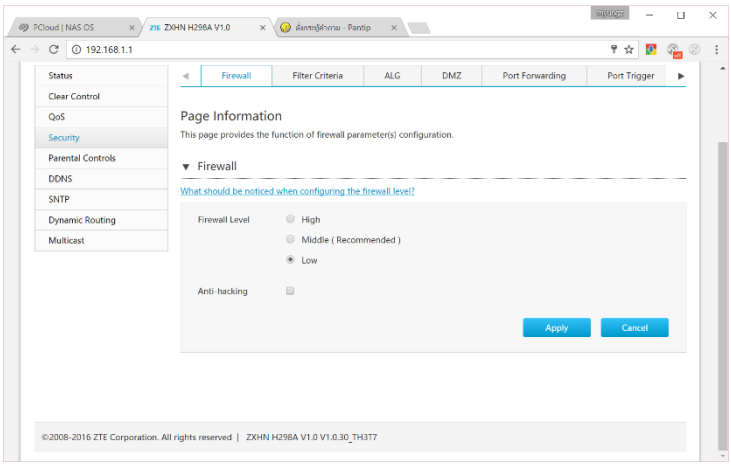

Fig. 4. The screen of router configuration of port forwarding

Fig. 5. The screen of website while adding text and synchronizing audio files