Issue 9 vol 3 ISSN: 2321-8134

IJFEAT

INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

FINGER-EYE: A WEARABLE TEXT READING ASSISTIVE SYSTEM FOR THE BLIND AND VISUALLY IMPAIRED

Vaishnavi S. Rathod[1], Afsha T. Z. Sayyed[2], Vrushali S. Bhavsar[3], Kalyani B. Korche[4]

[1]*Student,computer science & engineering department, J.D.I.E.T, Yavatmal,***rathodvaishnavi16@gmail.com**

[2]*Student, computer science & engineering department, J.D.I.E.T,Yavatmal,***afshathareen@gmail.com**

[3]*Student, computer science & engineeringdepartment, J.D.I.E.T, Yavatmal,***vrushalibhavsar13@gmail.com**

[4]*Student, computer science & engineering department, J.D.I.E.T, Yavatmal,***kalyanikorche@gmail.com**

ABSTRACT

This wearable system presents our recent research work in developing a portable and refreshable text reading assistive system called Finger-eye. The current day scenario of reading for blind people is with the help of Braille. Braille is a code- a system of dots that represent letters of an alphabet. In the system, a small camera is added to the Fingertip-Electrode Interface of the current Electrotactile Braille Display and placed on a blind person's finger to continuously process images using an Optical Character Recognition (OCR) method. A camera is mounted on the device which is added on the finger of the reader. This system allows translation of text to Braille or audio. The Braille system that is used as a portable electrical-based Braille system that is also eliminate the problems associated with refreshable mechanical Braille displays. The goal of the research is to aid the blind and visually impaired (BVI) with a portable means to translate any text to braille. So this Finger-Eye technology motives visually impaired people and also reduces effort and disruption to a sighted users.

Keywords*: Braille Code System, Text Reading System, Optical Character Recognition, Wearable Camera.*

1. INTRODUCTION

According to the estimates from World Health Organization (WHO) about 285 million people are visually impaired worldwide: 39 million are blind and 246 million have low vision (visually impaired). So, basically what is a Finger Eye? Finger Eye is a device that assists visually impaired users with reading texts or words. It's basically a ring the user wears on their index finger that houses a small camera and some tactual actuators for feedback. When a visually impaired person wants to read some text, for example a newspaper, a paper book, and any document, they point their finger at the text that they wish to read and the device will read each of the words separately out loud& voice clipped out through system. They can go faster, slower, go back, etc. That is the wearer can move over the text at whatever pace he wants to and the device will read it aloud.

The concept of Optical Character Recognition is used in this device. Optical Character Recognition (OCR) is mechanical or electronical conversion of typed, handwritten or printed text into machine-encoded text. It widely accepts data from any sort of document. It is a common and simple method of digitizing printed texts so that it can be displayed on-line, and used in machine processes such as text to speech, machine translation, key data and text mining. By using that wearable system blind person can continuously recognize the given image with the help of that OCR.

The device reads printed text out loud with a synthesized voice. One of the important concerns can be the weight of the device as it should be easily wearable and comfortable for the user. But, the weight of the device is nearly same as that of any regular ring. Braille has constantly evolved to make life easier for the blind and visually impaired. From the inception of Braille in 1824 to current day, Braille has changed drastically and is widely available to the BVI [3].

A small camera is added to the Fingertip-Electrode Interface of the current Electrotactile Braille Display and placed on a blind person's finger to continuously process images for Optical Character Recognition (OCR). This system allows translation of text to Braille or audio with natural movement as if they were reading any Braille Display or book. The Braille system is used as a portable electrical-based Braille system that also eliminate the problems associated with refreshable mechanical Braille displays [4]. The goal of the research is to aid the BVI with a portable means to translate any text to Braille.

The technology that will be investigated includes developing an in expensive, wearable light weight glove that contains the Electrotactile Braille Display and that can be placed on the hand of any user. To ensure that the refreshable Electrotactile Braille Display is stable and performs with minimal error. There is to test the effectiveness of the electric based refreshable Braille display. This will require experiments that include sighted and BVI to test the effectiveness of electrical stimulation. It will be designing a camera to be placed on the fingertip-electrode interface that would be fast enough to capture the quick reading speeds of the Braille Reader.

2. ANALYSISOF PROBLEM

In this system the voice is clipped but work is going on in order to improve the quality of sound. It doesn't work with text as small as, say, on a medicine bottle, but it can read 12-point printed text. Certain issues are observed associated with text alignment, inaccurate word recognition. Blind people had great difficulty to accomplishing necessary things. So this system needed to accomplish such type of tasks. There are still many limitations with modern Braille equipment such as the complexity of use and physical size of the machine. Existing technology allows the blind and visually impaired to download and translate various books and literature to Braille or as audio [4]. However, there are many books and articles that do not have an audio or Braille translation. This limits the resources that are available to the BVI and thus, their independence. This proposal will not only solve this problem to aid the BVI user

3. PROPOSED WORK

3.1 Eye in the Finger: A Finger-Eye System

Braille has constantly evolved to make life easier for the blind and visually impaired. From the inception of Braille in 1824 to current day, Braille has changed drastically and is widely available to the BVI community. Refreshable Braille displays are electro-mechanical bi-directional machines that allow for the translation of text to Braille or Braille to text. There are still many limitations with modern Braille equipment such as the complexity of use and physical size of the machine, which can limit the use of refreshable Braille displays to younger persons and can be tedious to use and carry around. A small camera is added to the fingertip-electrode interface of the current Electrotactile Braille Display and placed on a blind person's finger to continuously process images for Optical Character Recognition (OCR). This will allow translation of text to Braille or audio with natural movement as if they were reading any Braille Display or book.

3.1.1 Electrotactile Braille Display

The first step of that system is to test the refreshable Electrotactile Braille Display. The E-Braille Display, shown below, was developed at the University of Nevada Reno. Fig. 3.1 is the Fingertip-Electrode Interface. This is where the Braille reader's finger will be placed for electrical stimulation. The lines coming out of the fingertip interface connect to the High Voltage Converter (-300 volts to 300 volts).

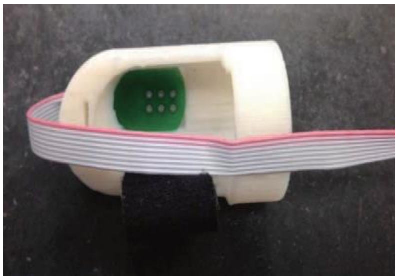

Figure 3.1: Fingertip Interface System

3.1.2 Finger-Eye System

The Finger-Eye system is illustrated in Fig. 3.2 In the system, the Fingertip-Electrode Interface with the added camera was designed by experimenting with the quality of the camera. It was found that the minimum distance between the surface and the camera. The vertical and horizontal angles of view for the camera were also considered in designing this preliminary sketch of the Fingertip-Electrode Interface. The programming method that will be implemented will be designed to obtain maximum efficiency since the speed and memory of single board computer are limited. This will prevent the single board computer (SBC) from overheating. When an unexpected image is received.

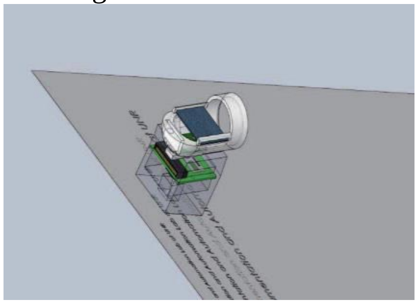

Figure 3.2: Finger-Eye model: The fingertip-electrode interface with a camera added for optical feedback.

3.2 The Optical Character Recognition System

This system presents a new method for Optical Character Recognition (OCR) based on Pan-Tilt-Zoom (PTZ) camera to capture text image, because PTZ camera has the advantage of zooming in to capture high-resolution images, which definitely helps improve the accuracy of OCR. In experimental setup, a text page is placed on a planar table, which a PTZ camera looks at (see Fig. 3.3). A set of images are taken from the text page for OCR

Figure 3.3: OCR system setup.

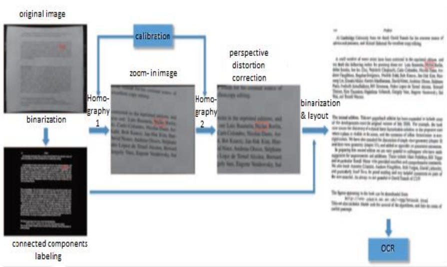

Figure 3.4: OCR system based on PTZ Camera

Fig. 3.4 shows the OCR system. First, the lowest resolution image is obtained to contain whole text region within the image. Adaptive thresholding transforms the grayscale image to a binary image. Connected components are then found and their locations and bounding boxes are recorded. Second, a set of zoom-in images are obtained to get closer and clearer views of text area by varying camera's pan-tilt- zoom.

The bounding box of a word (connected component) in the lowest-resolution image is transformed a holography to one of the zoom-in views, where the transformed word area should appear completely. Then the second homography is used to correct the perspective distortion of the image. Note that these two homographies are pre-computed in an offline calibration stage. Third, in the corrected image, a high resolution word is first transformed to binary form. According to its position in the original image, a layout procedure then figures out where the binary form should appear in a large output image.

3.2.1 Image Preprocessing

The lowest-resolution image is obtained by PTZ camera at zero zooming level. The image should include whole text region to be recognized. First, Gaussian smoothing is used for attenuating image noise. Second, the adaptive thresholding with Gaussian window partitions the image into objects (text) and background even there is large illumination variation in the image. Third, each connected component among objects is labeled and its shape descriptors such as bounding box and centroids are obtained.

3.2.2 Estimation of Homography

Acquiring multiple images with different orientations by PTZ camera needs to pre-compute multiple pan-tilt angles. In this method, a chessboard attached to the planar table is first used to estimate its relative position to camera. A total of 18 anchor points on the chessboard are selected cautiously so as to the field of view of the resulting 18 zoom-in images can cover the whole area of the chessboard. Each zoom-in image and the whole chessboard image are related by a homography. If the PTZ camera at different zoom levels can be accurately estimated and the rotation of camera in pan tilt can be accurately controlled, the homography between any two images at different viewpoints.

3.3 Output Layout and OCR

Having obtained the high-resolution image of the words, the adaptive thresholding transforms gray image to binary form for suppressing the effect of large lighting variations on each word. These "enlarged" binary words should appear at appropriate locations in a larger output image, where the text layout is similar to one in the original image. First of all, the enlargement factor is computed by averaging factors of all transformed words with their original ones. In the original text image, the first word is considered as the anchor and the relative positions between it and other words are obtained in terms of the top-left corner of bounding box.

3.3.1 Issues of converting to finger-wearable system

The key point is establishing a whole-to-part mapping with the help of calibration using chessboard, so that any word in zoom-in image can be associated with its position in low resolution but whole-text image. This significantly affects the output of OCR. When the system is transferred to a finger wearable device, we have to know where the fingertip is on the page surface.

4. APPLICATIONS

- Shopping assistant (e.g. price tag recognition).
- Reading Braille text.
- Smart assistant (get personalized information by pointing at objects).
- A tool to empower children in prereading stage (read text on their own).

5. Advantages

- This method can be considered as a kind of special image stitching for OCR, in the sense of combing multiple images to produce a high-resolution binary image.
- This method is time consuming. can be tedious to use and carry around
- By using this wearable system blind people becomes independent.

6. Disadvantages

- The voice is clipped out but it is not cleared.
- It doesn't work with small as say, on medicine bottle
- Certain issues are observed associated with colour image & inaccurate word recognition.
- Difficulties were observed associated with reading minute texts such as text on a screen.

7. CONCLUSION & FUTURE SCOPE

This is a portable and refreshable text reading system, called Finger-Eye is proposed. In this system, a small camera is added to the Fingertip-Electrode Interface of the current Electro-tactile Braille Display and placed on a blind person's finger to continuously process images using Optical Character Recognition (OCR) method. This will allow translation of text to Braille or audio with natural movement as if they were reading any Braille Display or book.Braille system that will eliminate the problems associated with refreshable mechanical Braille displays. The goal of the research is to aid the blind and visually impaired (BVI) with a portable means to translate any text to Braille, whether in the digital realm or physically, on any surface.

Blind people can be able to recognise colour image & also they can be able to read text from computer screen by adding some advanced features in this wearable system.

REFERENCES

[1] Zhiming Liu, Yudong Luo, Jose Cordero, Na Zhao. “Finger-Eye: A Wearable Text Reading Assistive System for the Blind and Visually Impaired” Proceedings of The 2016 IEEE International Conference on Real-time Computing and RoboticsJune 6-9, 2016.

[2] Pooja Deole and Shruti Kulkarni, “Finger Reader: a wearable device for the visually impaired” International Journal of Infinite Innovations in Technology, 2015-2016 October.

[3] Braille Authority of North America. “Evolution of Braille”.Brailleauthority.org, retrieved 25 February 2014.

[4] Loewen, G., and V. Tomassetti. "Fostering independence through refreshable Braille." Presentation at the Developing Skills for the New Economy: International Conference on Technical and Vocational Education and Training, Manitoba. 2002. Retrieved 25 February 2014.

[5] H. Richard and A. Zisserman. Multiple View Geometry in Computer Vision, 2003