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SMART READING SYSTEM FOR VISUALLY IMPAIRED PEOPLE

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Abstract - God gives best gift to human being. In which important aspect in our life is vision. But there are some people who lag this ability of visualizing these things. Global estimate of the number of visually impaired people according to World Health Organization survey made in year 2015 is 285 million people are visually impaired worldwide. Blind people use mainly Braille system for reading book. But all the books available in the market are not in this system and books will be more costly when comes in this system. In this project we are going to design a new system consisting of a camera attached to the microcontroller. This camera has to be placed over the book and it will read the pages and information's will be given by the loud speaker.

Keywords – Arduino UNO, Web Cam, Optical character recognition, Text to Speech Engine, Audio amplifier.

I. INTRODUCTION

Visually impaired people report numerous difficulties with accessing printed text using existing technology, including problems with alignment, focus, accuracy, mobility and efficiency [1-3]. We present a smart device that assists the visually impaired which effectively and efficiently reads paper-printed text. The proposed project uses the methodology of a camera based assistive device that can be used by people to read Text document. The framework is on implementing image capturing technique in an embedded system based on Arduino UNO board. The design is motivated by preliminary studies with visually impaired people, and it is small-scale and mobile [4], which enables a more manageable operation with little setup. In this project we have proposed a text read out system for the visually challenged. The proposed fully integrated system has a camera as an input device to feed the printed text document for digitization and the scanned document is processed by a software module the OCR (optical character recognition engine) [5, 6]. A methodology is implemented to recognition sequence of characters and the line of reading.

As part of the software development the Open CV (Open source Computer Vision) libraries is utilized to do image capture of text, to do the character recognition. Most of the access technology tools built for people with blindness and limited vision are built on the two basic building blocks of OCR software and Text-to-Speech (TTS) modules [7-9]. Optical character recognition (OCR) is the translation of captured images of printed text into machine-encoded text. OCR is a process which associates a symbolic meaning with objects (letters, symbols an number) with the image of a character. Optical Character recognition is also useful for visually impaired people who cannot read Text document, but need to access the content of the Text documents. Editing and Reprinting of Text document that were printed on paper are time consuming and labour intensive. It is widely used to convert books and documents into electronic files for use in storage and document analysis. OCR makes it possible to apply techniques such as machine translation, text-to-speech and text mining to the capture / scanned page. The final recognized text document is fed to the output devices depending on the choice of the user. The output device can be a headset connected to the Arduino UNO board or a speaker which can spell out the text document aloud.

II. BLOCK DIAGRAM OF PROPOSED METHOD

The figure 1 illustrates the block diagram of proposed method. The concept of proposed system is the idea of developing finger reader based text reading system for visually impaired persons. This illustrates the text reading system for visually impaired users for their self-independent. The problem stresses the high importance of visually impaired system is that self-dependency of visually impaired users. This extends the work towards the development of ease of collecting information, self dependent.

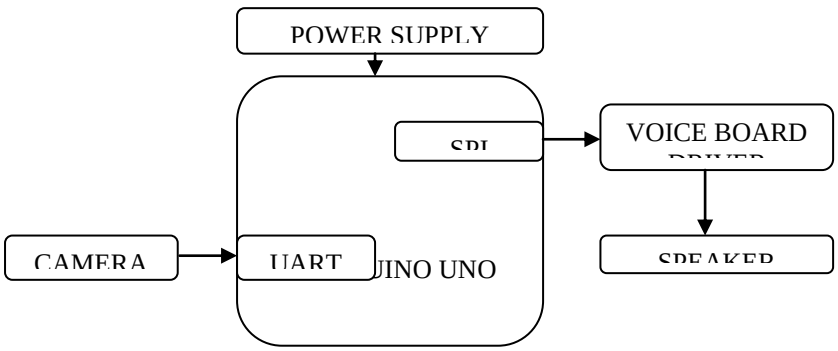

Fig 1.Block Diagram of Proposed System

To achieve the desired result, framework combines a set of different modules, such as finger reading device, TTS module and optical character recognition module. The block diagram of text reading system consist of three parts namely finger reading module, OCR process module & TTS module is shown in Fig The finger reader device is designed with camera, vibration sensor for finger position control.

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. In this proposed system the microcontroller is been attached to the voice board relay circuit. This relay circuit is been attached to the speaker. A high vision camera is also attached here. This camera is placed over the book or articles and this will read the entire contents and will be heard in the loud speaker.

APR 9600 is a low cost, high performance sound record/replay IC, incorporating flash analogue storage technique. The device offers true single chip voice recording and play back capability for 40 to 60 seconds. The IC is non-volatile; recorded sound is retained even after the power supply is removed from the module. The device offers true single chip voice recording and play back capability for 40 to 60 seconds. The replayed sound exhibits high quality with the low noise level. Sample rates are user selectable which allows the designers to customize their design for unique quality and storage time needs.

III. FLOW OF PROCESS

A. Image Capturing

The first step in which the device is moved over the printed page and the inbuilt camera captures the images of the text. The quality of the image captured will be high so as to have fast and clear recognition due to the high resolution camera

B. Pre-Processing

Pre-processing stage consists of three steps: Skew Correction, Linearization and Noise removal. The captured image is checked for skewing. There are possibilities of image getting

skewed with either left or right orientation. Here the image is first brightened and binarized. quality of the page has to be cleared before further processing

C. Segmentation

After pre-processing, the noise free image is passed to the segmentation phase. It is an operation that seeks to decompose an image of sequence o characters into sub-image of individual symbol (characters). The binarized image is checked for inter line spaces. If inter line spaces are detected then the image is segmented into sets of paragraphs across the interline gap. The lines in the paragraphs are scanned for horizontal space intersection with respect to the background. Histogram of the image is used to detect the width of the horizontal lines. Then the lines are scanned vertically for vertical space intersection. Here histograms are used to detect the width of the words. Then the words are decomposed into characters using character width computation.

D. Feature Extraction

Feature extraction is the individual image glyph is considered and extracted for features. First a character glyph is defined by the following attributes:

(1) Height of the character;

(2) Width of the character;

(3) Numbers of horizontal lines present—short and long;

(4) Numbers of vertical lines present—short and long;

(5) Numbers of circles present;

(6) Numbers of horizontally oriented arcs;

(7) Numbers of vertically oriented arcs;

(8) Centroid of the image;

(9) Position of the various features;

(10) Pixels in the various regions.

E. Image to Text Converter

The ASCII values of the recognized characters are processed by Arduino UNO. Here each of the characters is matched with its corresponding template and saved as normalized text transcription. This transcription is further delivered to audio output.

IV. Simulation Result

The text to speech conversion is done by the voice board driver. The conversion which is done in OCR can be simulated in MATLAB. The conversion process in MATLAB includes the following processes.

1.Binary image conversion.

2.Complementation.

3.Segmentation and labeling.

4.Isolating the skeleton of character.

A. Sample Image

The following image which is captured by the camera contains the following word. This image is in the jpeg format which has to be converted into text as shown in figure 2.

Figure 2 Sample Image

B. Binary Conversion

As shown in figure 3 & 4 in this section sample image is converted into binary format. The image which was a 3D image initially is converted to 2D image. Binary 0 represents black color of the characters. Binary 1 represents white color of the characters.

Figure 3 Binary 0 text representation

Figure 4 Binary 1 text representation

C. Boundary Marking

The area of the text is bordered and the boundary for each character is isolated. The boundary for each character is programmed and it can vary from 0 to 255 bits of characters occupying memory in the database.

D. Segmentation and Labelling

The isolated blocks of characters are segmented and are automatically labelled for identity. Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels) are given as shown in figure 5.

The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image (see edge detection). Each of the pixels in a region are similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristics.

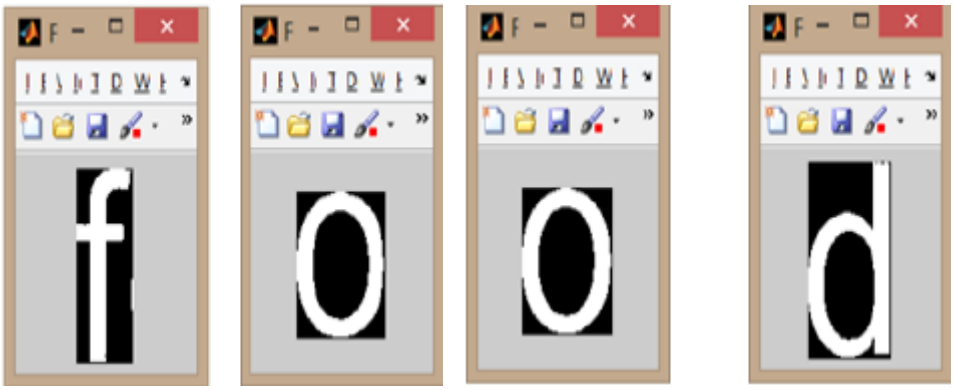

Figure 5 Segmentation and labelling

Connected-component labelling is used in computer vision to detect connected regions in binary digital images, although color images and data with higher dimensionality can also be processed. When integrated into an image recognition system or human-computer interaction interface, connected component labelling can operate on a variety of information. Blob extraction is generally performed on the resulting binary image from a thresholding step. Blobs may be counted, filtered, and tracked.

E. Forming Character Skeleton

Skeletonization is a process for reducing foreground regions in a binary image to a skeletal remnant that largely preserves the extent and connectivity of the original region while throwing away most of the original foreground pixels as shown in figure 6. To see how this works, imagine that the foreground regions in the input binary image are made of some uniform slow-burning material.

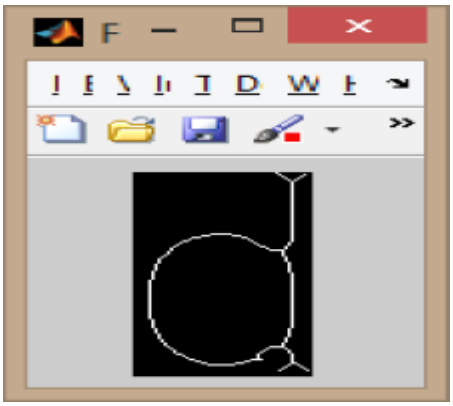

Figure 6 Character Skeleton

Light fires simultaneously at all points along the boundary of this region and watch the fire move into the interior. At points where the fire travelling from two different boundaries meets itself, the fire will extinguish itself and the points at which this happens form the so called “quench line”.

The programming codes are run in MATLAB and corresponding output is generated. As shown in figure 7 the output is in the form of audio. The audio is heard using speaker connected to the system. Each character of the word is spelled out first and then the entire word is read out.

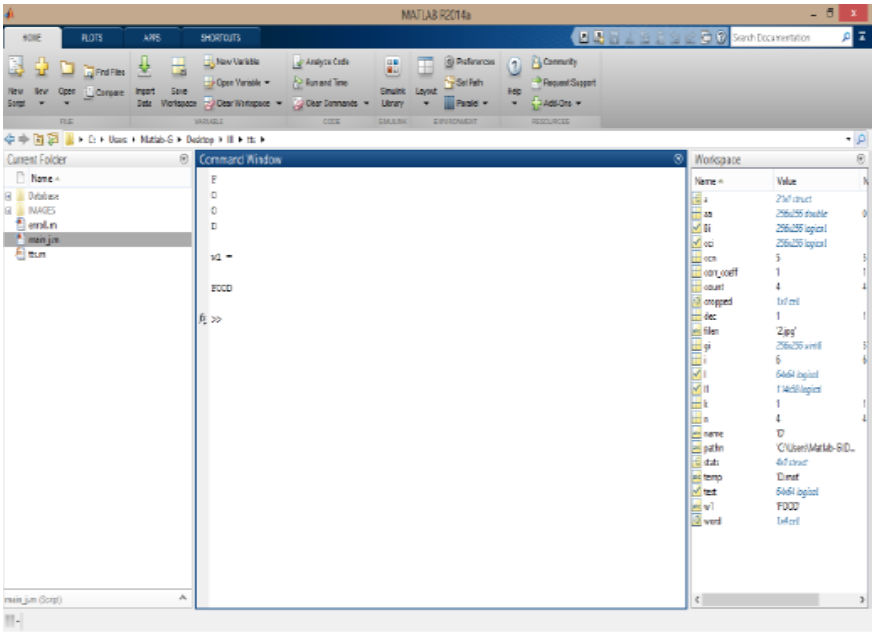

Figure 7 Audio Output

V. CONCLUSION

We have implemented an image to speech conversion technique using Arduino UNO. The simulation results have been successfully verified and the hardware output has been tested using different samples. Our algorithm successfully processes the image and reads it out clearly. This is an economical as well as efficient device for the visually impaired people. We have applied our algorithm on many images and found that it successfully does its conversion. The device is compact and helpful to the society.

REFERENCES.

[1] Kumar, A., Patra, R., Manjunatha, M., Mukhopadhyay, J. and Majumdar, A.K., 2011, January. An electronic travel aid for navigation of visually impaired persons. In Communication Systems and Networks (COMSNETS), 2011 Third International Conference on (pp. 1-5). IEEE.

[2] Shamsi, M.A., Al-Qutayri, M. and Jeedella, J., 2011, February. Blind assistant navigation system Biomedical Engineering (MECBME). In 2011 1st Middle East Conference on (pp. 21-24).

[3] Calder, D.J., 2011, May. An obstacle signaling system for the blind. In Digital Ecosystems and Technologies Conference (DEST), 2011 Proceedings of the 5th IEEE International Conference on (pp. 62-67). IEEE.

[4] Dunai, L., Fajarnes, G.P., Praderas, V.S., Garcia, B.D. and Lengua, I.L., 2010, November. Real-time assistance prototype—a new navigation aid for blind people. In IECON 2010-36th Annual Conference on IEEE Industrial Electronics Society (pp. 1173-1178). IEEE.

[5] Sadato, N., Pascual-Leone, A., Grafman, J. and Ibañez, V., 1996. Activation of the primary visual cortex by Braille reading in blind subjects. Nature, 380(6574), p.526.

[6] Shilkrot, R., Huber, J., Liu, C., Maes, P. and Nanayakkara, S.C., 2014, April. FingerReader: a wearable device to support text reading on the go. In CHI'14 Extended Abstracts on Human Factors in Computing Systems (pp. 2359-2364). ACM.

[7] Patra, T.K., Patra, B. and Mohapatra, P., 2012. Text to speech conversion with phonematic concatenation. International Journal of Electronics Communication and Computer Technology (IJECCT) Volume, 2, pp.223-226.

[8] Kain, A. and Macon, M.W., 1998, May. Spectral voice conversion for text-to-speech synthesis. In Acoustics, Speech and Signal Processing, 1998. Proceedings of the 1998 IEEE International Conference on (Vol. 1, pp. 285-288). IEEE.

Pollok, B., Schnitzler, I., Stoerig, P., Mierdorf, T. and Schnitzler, A., 2005. Image-to-sound conversion: experience-induced plasticity in auditory cortex of blindfolded adults. Experimental brain research, 167(2), pp.287-291.