RESEARCH ARTICLE

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To Develop and Implement Smart Reader for Visually Impaired People

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Abstract

Authors have proposed a new device of automatic text reader for visually blind people, which is prepared using Raspberry Pi kit. The primary objective of this paper is to provide a smart reader using raspberry pi for visually challenged people. It is new, capable and cheaper method which enables the client to hear the contents of text images instead of reading through them. This technique combines the awareness of Optical nature Recognition and Text to Speech Synthesizer in Raspberry pi. It is a technique that scans and understands the English alphabets and statistics in the image with the OCR technique and converting to voices [1]. This device introduces the incorporation of an entire Text Read-out system. This device consists of two modules, the image processing module and a voice processing module. The device is made for the conversion of the printed document into a text file by using Raspberry Pi which uses Python programming. Investigational results have exposed the usefulness of the module.

Keywords: Image processing, OCR, Python, Raspberry pi, Voice processing, Webcam.

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Introduction

Blind people are an indivisible part of our human society. In the world, many citizens are affected from blindness, and the number is increasing daily. Even though there is a technique called Braille, which is the common and mainly significant technique of text reading for blind citizens to contact information and education separately, however many visually impaired, that is, those who are blind or partially sighted, find learning to read Braille difficult. Authors are looking at the difficulties that face visually impaired learners and focusing on and trying to overcome related problems. The proposed work introduced the combination of an entire text read-out system for visually impaired people. This uses the method of a camera-based assistive appliance, which the public can utilize to understand Text documents. In this paper, the authors are gone to build up a method to pull out text from type documents, convert them into machine-encoded text, create the text files and forward it with Digital Image Analysis to convert the content into the audio output. The framework implements an image capturing method in an embedded structure in the Raspberry Pi board. Authors have done Python programming for Raspberry Pi. A text-to-speech converter converts text into speech. The machine has to follow some procedure which is divided into two basic steps: the first step is character recognition in which we are using OCR, which is the optical character recognition method. It is implemented for the English alphabet. The next step is TTS, which is a Text to speech translation which convert recognized text from OCR into simply the speech file. The text information is transformed to an audio signal and is played through the headphones or speaker.

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Proposed System

Block Diagram

The input to the structure is a typed or printed copy image. A camera is used to capture the image of the text file. Input from the camera applied to raspberry pi module via USB cable. The captured images are transferred to Raspberry Pi

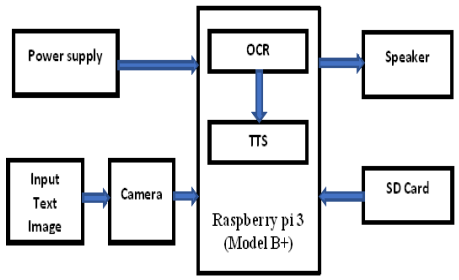

Figure 1: Block diagram of smart reader using raspberry pi.

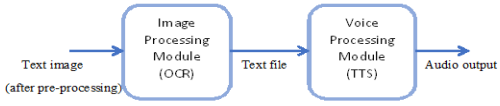

Figure 2: Text to audio conversion.

Figure 3: Image capturing.

for image processing. Raspberry Pi is a mini credit-card-size computer that can be programmed for particular tasks. Just add a keyboard, mouse, LCD, power supply, micro SD card with installed Linux Distribution can run the application.

A text-to-speech synthesizer is a computer-based algorithm which be able to understand every text and gives an artificial production of a human voice.[3] A Memory card is used for the installation of an operating system and the required software. Supporting files are stored in the same SD card.

Working Principle

The authors have used Raspberry Pi to control the module. The primary element is booting and installing the Raspberry Pi with Raspbian OS by necessary library packages. Another is that the image gaining method in the webcam is interfaced to take the text file image. When the capture button is pressed, it takes the product image located in the face of the web camera associated with Raspberry pi through USB. This information is then sent to the OCR Algorithm that translates the image information to text data which contents Background subtraction and Template

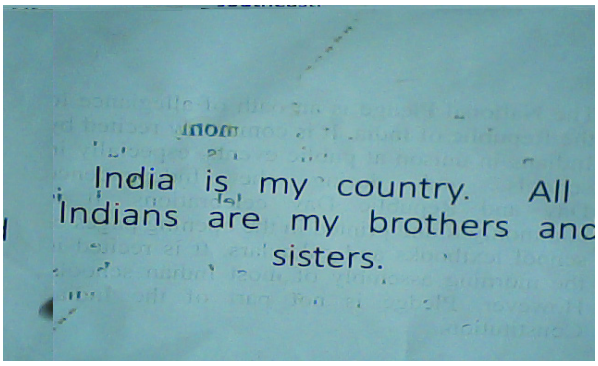

Figure 4: Captured image.

Figure 5: Pre-processed image.

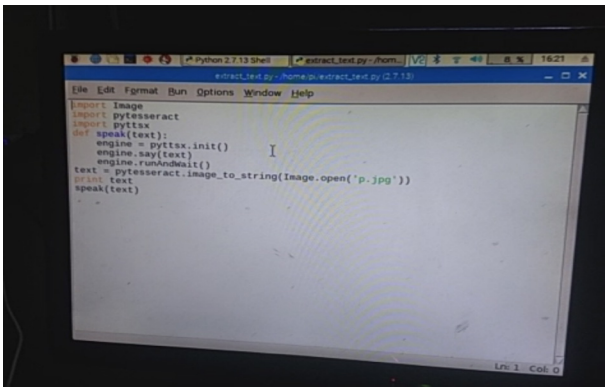

Figure 6: Image-to-Text Conversion Testing using Tesseract.

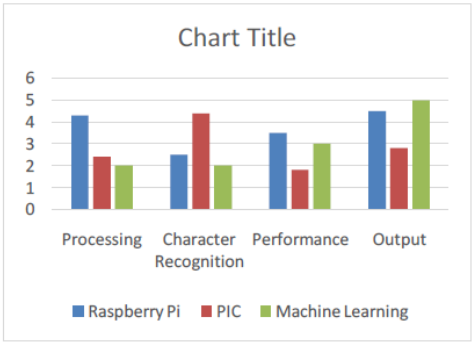

Figure 7: Comparison analysis

Identification, where the characters are detected and obtain the individual alphabets. Background subtraction is known as foreground detection. It is a technique in the fields of image processing where an image foreground is extracted for further processing.

Methodology

Image Acquisition

Initially, inbuilt camera captured the images of the text. Quality of the images depends on the camera. It will be higher and clear recognition due to the high-resolution camera. Authors have utilized the Web camera with a resolution of 640x408.

Image Pre-processing

After the achievement of the image, various operations are needed to be performed to take out text from the image. Firstly pre-processing steps are performed in which filtering of the image and removal of noise is done. After filtering, it converts the image into grayscale image and threading operations are performed. Thresholding is the simplest method of image segmentation from a grayscale image. Thresholding is used to create a binary image.

Image Processing Module using OCR

OCR is the software device used to read the typed or handwritten content into machine-encoded text. OCR is a text recognition technology which permits the written text or printed copies of the text into editable soft copies or text documents. It is steps through which identification and separation of the text patterns from the background will be done. It converts the pre-processed image which is in .png form to a .txt file.

Voice Processing Module using TTS

This module transforms the text into speech using a speech synthesizer. The output of OCR is the text. Speaking software is utilized to convert the text into speech. The English TTS method is used for understanding the contents and the speech is artificial and robotic.

The programs are written using the python language which is a scripting language like PHP or ASP for increasing applications. Python is a multi-pattern programming language, object-oriented programming and structured programming are fully supported, and many language characteristics support functional programming and aspect-oriented programming. Many other models are supported via extensions, with design by agreement and logic programming. Python uses dynamic typing and a mixture of reference counting and a cycle-detecting waste collector for memory management.

Result

This module is helpful to blind people in reading the printed notes, books and typed or handwritten text as a camera-based assistive smart text reader. All the ideas of this module have been implemented and working properly. Testing results are found correct. Figure 3 depicted the image capturing using the webcam.

The results obtained from the process described above are indicated in the figures below. Figure 4 indicates the captured image. Figure 5 indicates the pre-processed grayscale image which is given to the Tesseract OCR engine to extract the text from it. An image-to-text translation is depicted in Figure 6. Tesseract software is used to realize the image-to-text translation. The finishing stair is converting the text to voice as an output using eSpeak which is played through the speaker.

The various book readers has been evolved from using various technologies. The Book reader has been developed using neural technologies and machine learning has a disadvantage of recognizing the handwritten style. It was difficult to understand the pattern of a character or number. But using Raspberry Pi it was easy to recognize the correct format. The pic microcontroller has been used to develop the book reader, which was unable to tune the sound, recognize the shape used in the image. It has been solved by a Raspberry Pi Microcontroller with its inbuilt feature of sound tuning.

The Figure 7 depicted the comparison between microcontroller Raspberry Pi with the other controllers and existing systems such as PIC, machine learning with various features such as processing, character recognition, performance, output.

Conclusion

The Authors have presented the IOT-based smart readers for visually impaired people using Raspberry pi and implemented a low-cost and efficient camera-based assistive smart text reader for those who are facing difficulties in reading textbooks and printed or handwritten documents. As in the existing system, a blind reader has some of disadvantages, to overcome that, authors have proposed a handheld computer system for visually impaired readers. By using this smart reader, most of blind and visually impaired people can enjoy various books just as much as ordinary people, without being concerned with the Braille system The device helps the visually impaired person in the following ways: Text extraction from the scanned image with Optical Character Recognition and translate the text to voice as an output using eSpeak Text-to-Speech (TTS) tool which is played through the speaker. The model is tested and all the parameters are verified. However, due to the less resolution of the webcam, the output obtained is 100% accurate.

References

[1] Gurav, Mallapa D., Shruti S. Salimath, Shruti B. Hatti, Vijayalaxmi I. Byakod, and Shivaleela Kanade. "B-LIGHT: A Reading aid for the Blind People using OCR and OpenCV." International Journal of Scientific Research Engineering & Technology (IJSRET) 6, no. 5 (2017): 546-548.

[2] Jadhav, M. S. "Raspberry pi based reader for blind." Int. J. Innov. Emerg. Res. Eng 5, no. 1 (2018): 1639-1642.

[3] P. Sabin Prasanna, B. Bernadine Infanta, S. Maria Keerthana, Sherril Sophie Maria Vincent " Book Reader using Raspberry Pi" International Journal of Computer Sciences and Engineering, April 2018.

[4] Sonal I. Shirke, Swati V Patil " Portable Camera-based text Reading of Objects for blind People " International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 17,2018.

[5] James, S. Aaron, S. Sanjana, and M. Monisha. "OCR based automatic book reader for the visually impaired using Raspberry PI." International Journal of Innovative Research in Computer and Communication Engineering 4, no. 7 (2016): 1111-1118.

[6] Hay mar Htun, Theingizin, Hlamyotun "Text to speech conversion using different speech synthesis" International journal of scientific & technology research volume 4, issue 07, July 2015.

[7] Mithe, Ravina, Supriya Indalkar, and Nilam Divekar. "Optical character recognition." International journal of recent technology and engineering (IJRTE) 2, no. 1 (2013): 72-75.