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Raspberry Pi Based Optical Character Recognition for Smart and Intelligent Book Reader

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ABSTRACT

This paper describes results obtained from smart book reader using OCR and Raspberry Pi. The blind people will be able to study the books from Raspberry module which voice out every line in the Book / Papers. This operation is performed by Raspberry Pi Camera which captures the image from the Book and inputs to Raspberry Pi B+ Processor which then translates the Image to text. The text messages are converted to Audio through C++ language in Qt creator. The reading process can be improved by adding the feature of repeating a sentence if demanded, by using flight algorithm. Any stored information from the SD card can also converted to audio by using voice recognition method.

Keywords: Raspberry Pi B+, Optical Character Recognition, document analysis, Flight Algorithm, Qt creator, Voice Recognition.

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INTRODUCTION

A Maximum number of the blind people use Braille for reading documents and books which are complicated to make and less readily available. This gives rise to the need for the improvement of devices that could bring relief to the excruciating tasks that the blind people have to go beginning to end. Due to digitization of books there are many excellent attempts at building a vigorous document analysis system in industries, academic circles and research labs, but this is only for those who are able to visible aided. This paper aims to learn the image recognition technology with speech synthesis and to develop a cost effective. We can convert user friendly image to speech conversion system with help of Raspberry Pi B+. The paper has a camera that scans the text printed on a paper, convert it to audio format using a synthesize voice for reading out the scanned text rapidly translating books, documents and other materials for daily living, mainly away from home or office. It is used to save time, energy and also makes life improved for blind people. It is not only in the blind people, the visually impaired people as it raises their independency.

To support the blind people to learn, we have much equipment around as but that it requires help to someone. In this paper, without any help to read the book themselves. The raspberry pi b+ as the main unit which has a camera that is used to scan any printed document and uses Optical character recognition (OCR) to translate the image into a digital text. We then use a text to audio system that will enable us to convert the digital text into a voice recognition method. We are using a raspberry pi b+ which is a credit card-sized single-board computer. It is a total computer in itself with a working operating system and the operating system is saved use of sd card. The operating system can totally differ as per the use of the device. In our document we have used Raspbian operating system within raspberry pi b+ and have written the code in C++ language. The scanned image undergoes image processing for obtain the region of interest and segmentation of the letters from the word. The segmented letters undergo OCR. The output is joint to obtain the individual words as it was present originally in the document. The words attained are given to a text to speech convertor. In the text to speech conversion process by use of the C++ coding in the Qt creator. That allows us to obtain the voice converted output according to the written document. The reading process can be improved by adding the feature of repeating a sentence if demanded, by using flight algorithm. Any stored information from the SD card can also converted to audio by using voice recognition method.

RELATED WORK AND LITERATURE SURVEY

As conditioned in [1], there are several ongoing researches on camera based document analysis which include text detection, extraction, recognition, enhancement and its uses. Few images to text and text reading system models for assistive text reading for visually impaired and blind people is also present in literature is given below.

P.Nagabhushan et al [2] the easy admittance to portable cameras as in Mobile phones, has made it probable to video capture even text documents and take out reading the text in leisure time. With this backdrop, here we have devise a microcontroller based mechanized video graphing of text. It is also proposed to voice text the video graphed text in real time. Subsequently for the reason of archival, video text is stored as a text file circumventing the large memory obligation because of text video.

Roy Shilkro et al [3] describes that visually impaired people description numerous complexities with accessing printed text using existing technology, as well as problems with arrangement, focus, accurateness, mobility and efficiency. We present a finger worn device that helps the visually impaired with in effect and competently reading paper-printed text. We introduce a novel, local-sequential method for scanning text which enables reading particular lines, blocks of text or skimming the text for significant sections while providing real-time auditory and tactile feedback.

Ajantha Devi et al [4] suggest that the Optical Character recognitions is utilized to Digitize and reproduce texts that have been formed with non-computerized system. Digitizing also helps decrease the storage space. To Edit and Reprint of Text document that were printed on paper are time consuming and labour ex haustive. Optical Character Recognition is also helpful for visually impaired people who cannot read text document need to access the content of the Text documents. A camera based assistive device method that can be employing by people to read Tamil Text document. Using image capturing technique in an Raspberry Pi board B+ based on the embedded system to implemented the framework.

Rubesh Kumar et al [5] described a prototype system, by use of that system to read printed text on hand-held matter for assisting blind persons. In the way of solve the common aiming problem for blind users, we have planned a motion-based method to notice the object of interest, while the blind user simply shake the object for a couple of seconds. In this method can effectively differentiate the object of curiosity from background or other objects in the camera view. To remove text regions from complex backgrounds, we have been proposed a novel text localization algorithm based on models of stroke direction and edge distributions.

Khalaf S. Alkhalaf et al [6] says that Optical character recognition (OCR) is one of the newest technologies adopted in a lot of areas such as management, business, criminal and social networks. It can be consists of recognizing image-based characters and transforming them to real digital character that can be correcting, written and viewed. In this paper we will demonstrate our experience on utilizing OCR technology to identify some key information in chosen management documents in Arabic language.

Vinod H. C et al [7] the aim of this paper is Automatic text detection in video is an significant task for efficient and accurate indexing and retrieval of multimedia data such as proceedings identification, proceedings boundary identification etc. This paper uses method supported on edge and connected component analysis, and perform quantification, analysis with the help of mathematical arithmetical method, then get the candidate text regions, joint with the trait of the text texture remove some non-text areas from candidate areas, and lastly do binary processing and segment the text for better understanding in complicated backgrounds and identify the text with OCR software package.

Aisha Mousa, Hazem Hiary et al [8] states that the Braille is a system that allows visually impaired people to read and write. Usually the Braille method is finger touch on raised dots and identify the letters. But here implement of the specialized machine the person will be identify the raised dots. We suggest a fully system to recognize characters for a only one side Braille document. This method ensures we recognize standard letters and words. The normal books are converted in the Braille books then only it is possible and it is not turn the pages automatically.

Er. Kavneet Kaur et al [9] suggest that it is an image processing technology which identifies the vehicle from its number plate mechanically by digital pictures. OCR is used to recognize an optically processed printed character number plate, which is based on template matching. This algorithm is experienced on different ambient illumination vehicle images. Optical Character Recognition is the final stage in vehicle number plate recognition. In recognition stage the characters on the number plate are rehabilitated into texts. The characters are then recognized using the template matching algorithm.

Amarjot Singh et al [10] the Optical Character Recognition or OCR is the electronic conversion of handwritten, typewritten or printed text into machine translated images. The paper presents a survey of applications of OCR in different fields and additional presents the experimentation for three significant applications such as Captcha, Institutional Repository and Optical Music Character Recognition (OMCR). We make use of an improved image segmentation algorithm based on histogram equalization using genetic algorithms for optical character recognition (OCR).

Ayatullah Faruk Mollah et al [11] presents a complete Optical Character Recognition system for camera captured image or graphics embedded textual documents for handheld devices. At first, text areas are extracted and slant corrected. Then, these areas are binarized and segmented into lines and characters. Characters are passed into the recognition unit. Experimenting with a set of 100 business card images, captured by cell phone camera.

Carlos Merino-Gracia et al [12] has reported a wearable text recognition tool that employs MSERs as the basis for real-time text detection. The proposed method process our previous real time algorithm by exploiting hierarchical structure obtained from MSERs to yield more steady regions compared to the previous adaptive threshold method. It outperforms other published approaches computationally while maintaining equivalent text detection performance on the ICDAR dataset.

Xin Fan et al [13] has formulated the issue of joint image Segmentation and recognition as an integrated statistical inference problem. The proposed model is a two-layer graphical model. That is supports the optimal segmentation and recognition in an unified Bayesian framework. Due to the definite modeling of

two tasks in the graphical model, an efficient non-iterative belief propagation algorithm is used for state estimation.

Terri Hedgpeth et al [14] reported the iCare-Reader is a device that can be used by blind or visually-impaired people to read printed material, such as newspapers, magazines and books, in real time. It was employs a collection of commercial off-the-shelf hardware, with a video camera, OCR software, text-to-speech and voice synthesis software, which is amplified and integrated with custom software to compensate for image distortions and lighting variations.

The two people then collaborate verbally, via their 2-way voice link, the camera is used to read the book and the contents of the page. As they work together to achieve this task, the video and the audio streams for the whole session are recorded and archived for later on study. It is only the two people then collaborate verbally, and share something about our studies. It is not a indutual person reader.

BACKGROUND

The main objective following the design of the text model is to simulate the document reading process of human beings. To given a document text the normal human tendency is read the text before the eyes will be capture the document, like image and the mind will be convert the image to text and the text to speech.

To propose such a system, we shall assume that we have a text document that the camera capture the picture or image format. The captured images are send to the processor board. In this board already we are writing the coding for image to text conversion and text to speech or voice conversion. So the images are convert to speech. And the output is let out from the speaker. But this type of audio output sometime the person will be not properly capture the voice. In this time the particular image is repeated by pressing the push button switch. In this process here we are written the coding. The entire description of the design and its working is accessible in the consequent sections.

PROPOSED SYSTEM

The design of the document reading system comprises of the electronic and programming components. The advantages is the it will read in any type of the documents. And here no need the computer. Figure 1 illustrates the proposed model of the image to speech conversion and developed document reading system designed and developed for the purpose.

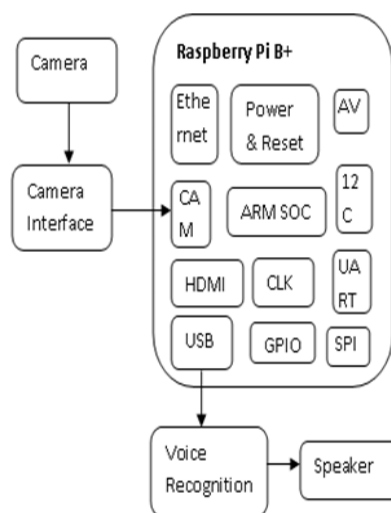


Figure 1: Proposed design of the mechanized document reading system

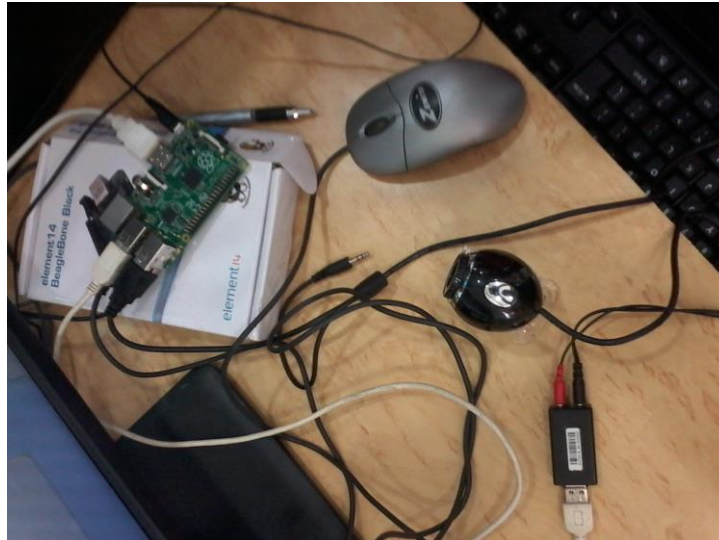


Figure 2: Prototype model for document reading system

Raspberry Pi Processor

The Raspberry Pi is a low cost credit-card sized computer that plugs into your TV and a keyboard. It is a capable little computer which can be used in electronics projects, and for many of the things that your desktop PC does, like spreadsheets, word-processing and games. There are currently four Raspberry Pi models. They are the Model A, the Model B, the Model B+ and the Compute Module. All models use the same CPU, the BCM2835, but other hardware features differ.

THE MODEL B+

Released in July 2014, the Model B+ is a updated revision of the Model B. It increases the number of USB ports to 4 and the number of pins on the GPIO header to 40. In addition, it has improved power circuitry which allows higher powered USB devices to be attached and now hot plugged. The full size composite video connector has been removed and the functionality moved to the 3.5mm audio/video jack. The full size SD card slot has also been replaced with a much more robust micro SD slot.

Head phone speaker with microphone

A Logitech wired on-the-ear headset speaker along with microphone has been used in this work. The blind person can choose the desired topic by speaking through the microphone and listen the details through the headset speaker. The headset has the frequency response of 20Hz to 20KHz and the frequency response of the microphone is 100Hz to 16kHz.

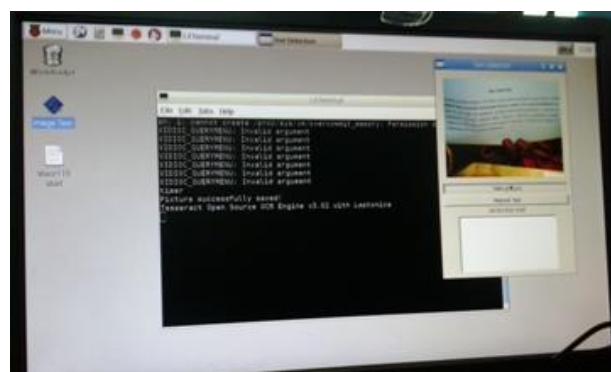


Figure 3: Command window for Image to speech

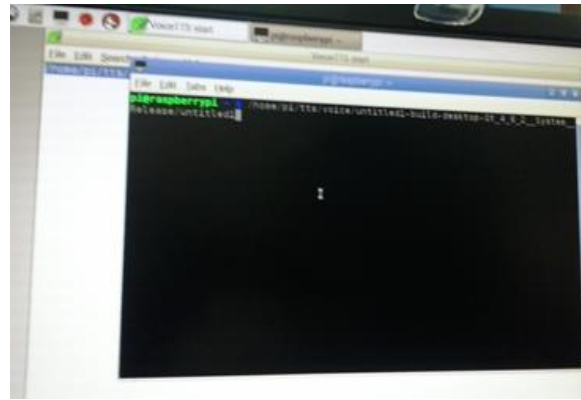


Figure 4: Command window for text to speech

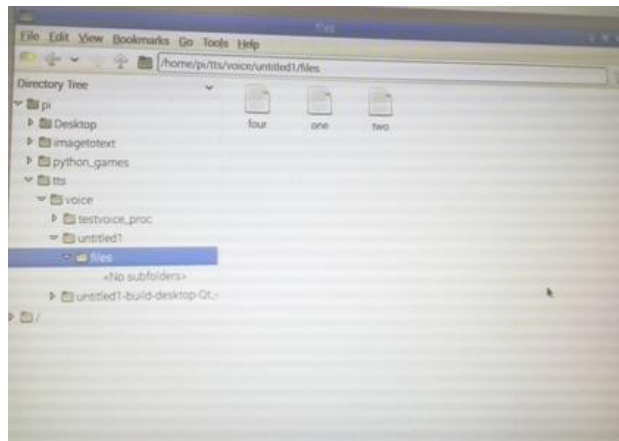


Figure 5: Text document Directory

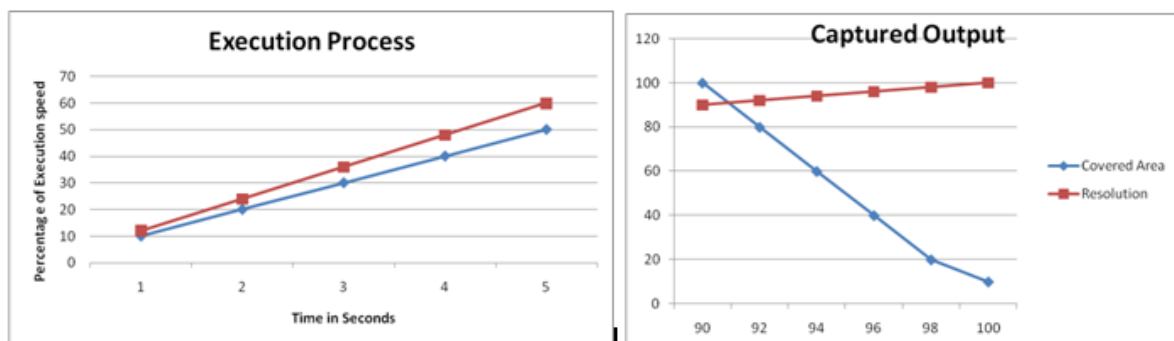


Figure 6: Performance Analysis

CONCLUSION

The 'Smart Book Reader for Blind People using OCR and Raspberry Pi' is not just a project that empowers the blind to become independent, but is also a reserve investor. It cuts down the cost of printing Braille books along with the time and energy exhausted into doing so. This is a less costly solution to one of the many challenges that the blind and visually impaired face.

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