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Research paper

Implementation of Optical Character Recognition Using Raspberry Pi for Visually Challenged Person

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Abstract

Blind people are unable to perform visual tasks. The majority of published printed works does not include Braille or audio versions, and digital versions are still a minority. In this project, the technology of optical character recognition (OCR) enables the recognition of texts from image data. The system is constituted by the raspberry pi, HD camera and Bluetooth headset. This technology has been widely used in scanned or photographed documents, converting them into electronic copies. The technology of speech synthesis (TTS) enables a text in digital format to be synthesized into human voice and played through an audio system. The objective of the TTS is the automatic conversion of sentences, without restrictions, into spoken discourse in a natural language, resembling the spoken form of the same text, by a native speaker of the language.

Keywords: *Optical Character Recognition (OCR), Raspberry Pi, Text-to-Speech (TTS)*

1. Introduction

Visually challenged individuals confront different challenges to get to printed content through utilizing existing systems, incorporating issues with center, arrangement, exactness, versatility and viability. Here a smart system that helps the visually challenged which productively and successfully peruses printed content. The task utilizes the strategy, in which a camera based assistive device is utilized by individuals to peruse printed articles. The skeleton is to execute picture catching technique in an installed framework in view of Raspberry Pi board. The plan is urged by bringing together with visually challenged individuals, which empowers a more helpful activity with little system. This system has a camera input to catch the printed content report for digitization [2]. The scan document is processed by a software component the OCR (optical character recognition). A pytesseract (python tesseract) technique is executed to acknowledgment succession of characters and the line of scanning. The Open CV (Open source Computer Vision) libraries are utilized to do character acknowledgment from the scan document. A larger portion of innovation worked for individuals with visual deficiency and restricted vision are based on the two essential building modules of OCR programming and Text-to-Speech engine (TTS) [1]. OCR is the interpretation of scanned document of printed content into machine encoded content. OCR is a procedure which connects a symbolic importance with objects (letters, images, number) with the picture of a character. It is defined as the method of translating scanned documents or images of printed text into a computer process able format. OCR is also useful for visually challenged individuals who was not able to read Text document, but need to access the contents of the Text documents. It is utilized to digitize and reproduce messages that have been developed with non-computerized system. Digitizing writings likewise lessens storage room. Altering and reprinting of text archive that were imprinted on paper are tedious and work escalated. It is broadly used to change over books and reports into electronic records for use away and document analysis. OCR makes it conceivable to apply methods, for example, machine interpretation, content to-discourse and content mining to the catch/checked page. The final output text document is given to the output devices subject on the choice of the user. The output device can be an earpiece associated to the raspberry pi board or a speaker which can read out the text document aloud.

2. Existing System

A screen reader is a PC program that empowers a visually impaired PC client to recognize what's on the screen through discourse. Be that as it may, to make it clear, it can just read message yet not pictures. As such, there's no chance to get for it to portray a picture in any event (not yet conceivable). Utilizing the console, he explores utilizing bolt keys and a screen reader deciphers what's being appeared on the screen. What's more, in the event that he needs to associate with a particular symbol or a connection for instance, he will press enter [4]. Or on the other hand if a visually impaired is writing, a screen reader declares each character; and on the off chance that he for example heard that he wrote a wrong character, he would squeeze delete to eradicate it. This is only one case of the advantages that visually impaired PC clients get from a screen reader.
Here visually challenged individuals just tune in to a screen reader perusing the content showed on the screen, they don't as a rule have the opportunity to know the right spelling of a specific word particularly when it isn't so much that normal like medicinal terms and so forth [2]. Beyond any doubt they can make a screen reader to peruse character by character after they hear a word that they

don't have the foggiest idea about the spelling yet, so that it's extremely tedious.
Screen readers utilize a PC sounding voice and a few people locate this extremely exhausting. A few organizations are doing their best to make discourse synthesizers that can mirror how human read a sentence [6]; like the best possible sound, yet so far I would state that even we see some huge upgrades for as far back as years, they are still a long way from accomplishing their objectives.

3. Proposed System

To overcome from the problems in the existing system we have developed a project for Blind People using neural OCR in Open CV. The proposed system is to assist blind persons to read text from challenging pattern and background for the purpose of reading document. The main objective of our system is to identify the text in the documents. Firstly the object image is captured by using a webcam which is embedded within Raspberry Pi and is followed by the image processing [4]. To execute an automated system, which check a document and read out its substance to the individual on click of a button. The vocal is delivered with the assistance of speaker which would help the individual to readout the content in the scan document. Our system helps the blind people to for the purpose of reading without consuming much space.

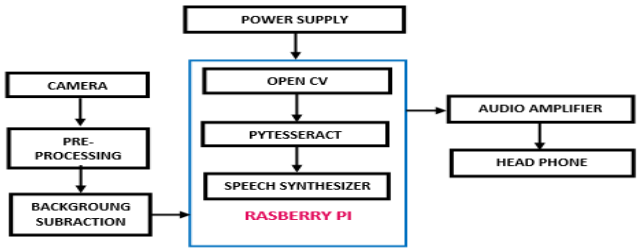

Fig.1 : Block Diagram

3.1. Image Capturing

The initial phase in which a device is moved over the printed page were an inbuilt camera captures the pictures of the content. The nature of the picture captured will be high in order to have quick and clear recognition because of the high definition camera

3.2. Pre-Processing

In pre-processing Skew Correction, Linearization and Noise removal was carried out in which the captured picture is checked for skewing. There are conceivable outcomes of picture getting skewed with either left or right orientation [5]. Here the picture is brightened and binarized. The skew identification checks for a point of orientation between ±15 degrees and if recognized then a small image rotation turn is done till the lines coordinate with the genuine horizontal axis, which delivers a skew corrected picture[9]. The acquainted noise during capturing or due with low quality of the page must be cleared before further processing

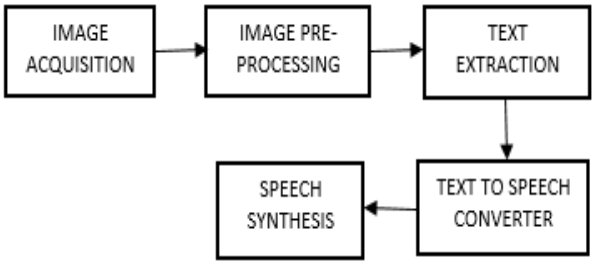

Fig.2 : Flow of process

3.3. Segmentation

Next to pre-processing, the noise free scanned image is passed to the Segmentation stage. It is a process that breaks down a scanned image of sequence to characters into sub-images of individual symbol (letters). The scanned image is binarized and inter line spacing is checked. Next the inter line spaces are distinguished, then the image is divided into sets of paragraphs over the interline gaps. The lines in the paragraphs are examined for level space point crossing horizontally with regards to background. Histogram of the scanned image is utilized to recognize the width of the horizontal lines. At that point the lines are checked vertically for vertical space convergence. Here histograms are utilized to recognize the width of the words. At that point the words are disintegrated into characters utilizing character width computation.

3.4. Feature Extraction

The feature extraction over individual scanned image glyph is taken into account and extracted for features. A character glyph is well-defined through subsequent aspects, such as width and height of the character, numbers of horizontal and vertical lines present (short and long), number of vertically and horizontally oriented arcs, numbers of circles present, centroid of image, position of the various features and pixels in the various region[8].

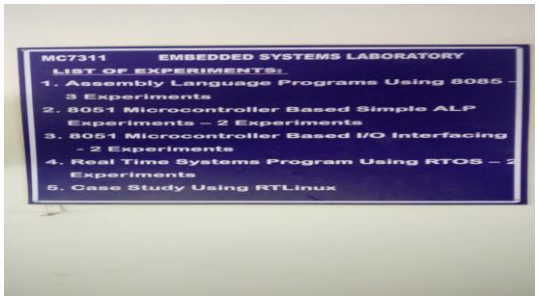

Fig.4 : Captured Image

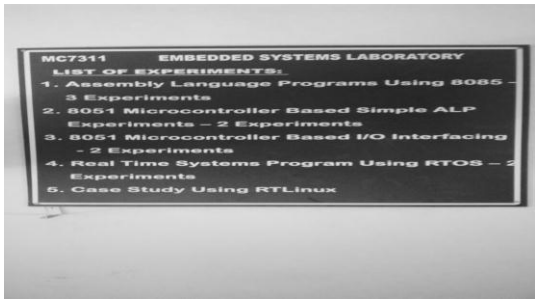

Fig.5 : Grey scale converted image

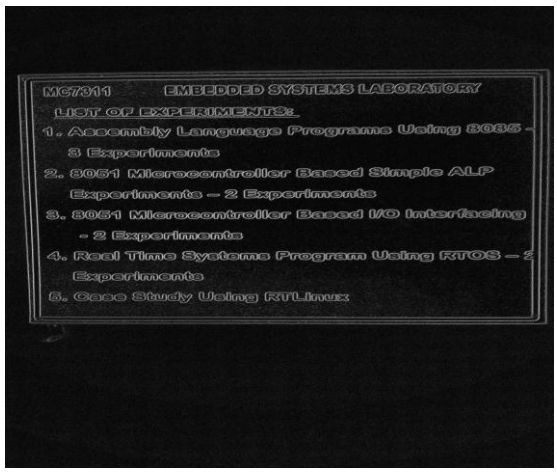

Fig.5 : Edge Detection

3.5. Text Extraction

In this stage the perceived content present in the scanned image are separated utilizing OCR engines. Here we utilize tesseract OCR engine which separates the recognized characters.

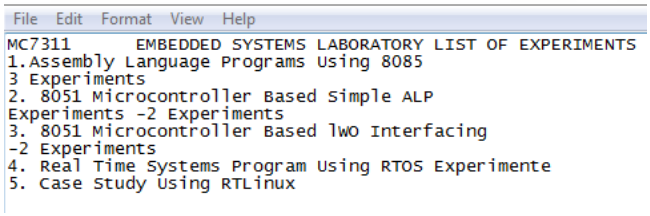

Fig.6: Tesseract Output

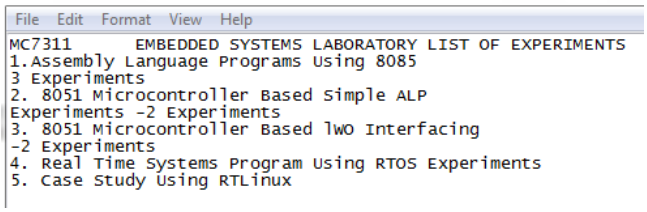

Fig.7: Spell Corrected

4. Software Specification

The OS under which this project executed is Raspbian, which is acquired from the Debian operating system. The algorithm is composed by utilizing the script language in python. OpenCV library functions are used to for the functions in the algorithm. OpenCV [4] is an open source Computer vision library, which is composed under C and C++ and keeps running under Linux, Windows and Mac OS X. OpenCV was intended for computational productivity and with a solid spotlight on ongoing applications. OpenCV is composed in enhanced C and can take advantage of multi-core processors. The OpenCV library contains more than 500 functions that traverse numerous regions in vision, including manufacturing plant item investigation, medical imaging, security, UI, camera adjustment, stereo vision, and robotics. Since computer vision vision and machine learning frequently go as an inseparable unit, OpenCV likewise contains a full, universally useful Machine Learning Library (MLL). To help OCR and TTS tasks we have to introduce OCR and TTS engines with predefined libraries.

5. Hardware Specification

The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B [12]. Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processer, 10x faster than the first generation Raspberry Pi. Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs.

6. Conclusion

The outcomes from the procedure described above are demonstrated in the figures below. Fig.4 demonstrates the picture caught utilizing the camera, Fig.5 shows the pre-processed scan image which is given to tesseract OCR engine to remove the content in the picture. The exactness can be enhanced by making utilization of a high resolution camera. Fig.6 demonstrates the output of the tesseract OCR engine. Fig.7 demonstrates the output of the spell corrector to adjust the incorrectly spelled words from the OCR engine.

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