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# Smart Reader

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**Abstract -** *In this paper, we have presented an ingenious, efficient, economic system which enables the user to hear the contents of an image. It uses two algorithms, Optical Character Reading (OCR) and Text-to-speech- Synthesizer (TTS), in raspberry pi. We developed this system to help visually impaired people who may not have access to braille scripts. OCR engine extracts the text from the image and sends it to the TTS, which reads it in the preferred language. This paper describes the design, implementation and experimental results of the device. It consists of two modules, image processing module and voice processing module. The tool was developed based on Raspberry Pi v3.*

***Key Words*: OCR, pre-processing, Raspberry Pi, TTS, tesseract**

## 1. INTRODUCTION

The adroitness profundity of the innovation chooses the quantity of individuals who might want to put resources into it. If our ordinary routine, for example, "Reading a book" consolidates such innovation, everybody would appreciate reading it regardless of the age group. People usually confuse visual impairment with blindness. Visual impairment is a decrease in the ability to read the contents from the printed documents, whereas blindness is the complete loss of sight. Most of distributed, printed works does exclude braille or audio versions and digital versions are as yet a minority. As Reading is of prime significance to people, visually impaired individuals experience a great deal of obstacles. Existing technology has certain disadvantages such as, it cannot detect the text from the complex background, and it does not support the multilingual feature. So, our prime motive is to overcome both these disadvantages. Optical Character Recognition (OCR) and Text-to- Speech (TTS) are two effective technologies used in our project.

## 2. PROPOSED SYSTEM

To fix the perils in the existing system we have developed a system for visually impaired People using neural OCR implementing Tesseract. The proposed system is to assist people to read text from challenging pattern and noisy background. The chief aim of our system is to identify the text in the documents and then speak out the retrieved text. Firstly, the webcam embedded in Raspberry Pi captures the image and followed by the image processing. The image has to go through various implicit processes like image smoothening, image shortening, grey scale conversion before being fed to the tesseract algorithm. To start the process, the user is expected to press the push button. Upon the push button hit, the webcam captures the frame at that instant and then the vocal is delivered with the assistance of a speaker which would help the individual to readout the content in the scanned document.

### 2.1. BLOCK DIAGRAM

The framework of the proposed system is the raspberry pi3 board. The raspberry pi B+ is a single board minicomputer which has 4 USB ports, an ethernet port for internet connection, 40 GPIO pins for ip/ op, camera interface, HDMI port, DSI display interface, SOC (system on a chip), LAN controller, SD card slot, audio jack, and RCA video socket and 5V micro USB connector.

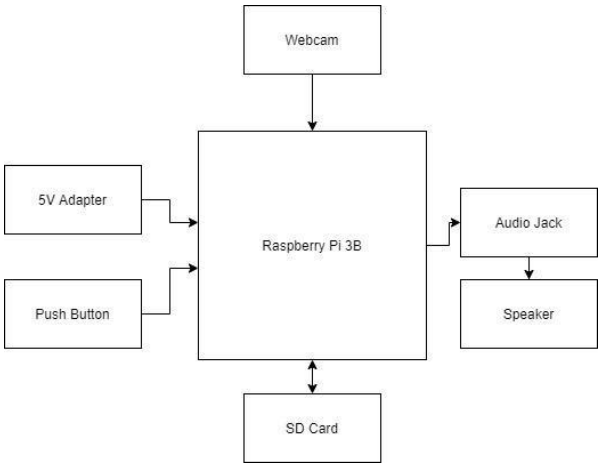


**Fig -1**: Block Diagram

## 3. Methodology: Optical Character Recognition (OCR) , Text-To-Speech

Optical Character Recognition (OCR) is a software that converts the physical instance of printed text and images into digitized form so that machines can manipulate it. OCR is a complex problem due of the variety of languages, fonts, sizes and styles in which we can write text, and the complex rules of languages. c. Hence, techniques from different disciplines of computer science (i.e. image processing, pattern classification and natural language processing etc) are employed to address these challenges.

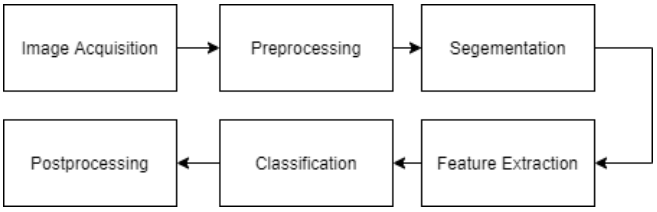


**Fig -2**: OCR Flow Chart

### 3.1 Image Acquisition

This is the initial phase wherein the text is kept beneath the camera and it captures the image when the user hits the push button. Given a good camera resolution of Raspberry Pi camera, it captures a prime quality image.

### 3.2 Preprocessing

Pre-processing consists of series of operations and it used to enhance an image and make it suitable for further segmentation. It is always advisable to first resize the images to reduce the dimensions, improving speed of processing. Images are vulnerable to noises, which are introduced during document generation. Many filtering techniques like mean filter, min-max filter, Gaussian filter etc. are applied to get rid of it. Noise removal is then followed by binarization which converts coloured image to grey scale image. To enhance visibility and structural information of characters, binary morphological operations like opening, closing, thinning, hole filling etc. may be applied on image. It may happen that the image is not perfectly aligned, so we need to align it by performing slant angle correction.

### 3.3 Segmentation

Character segmentation decomposes images into sub images of individual symbols. It is responsible for making decisions that a pattern isolated from the image is that of a character or some other identifiable unit. Generally, document is processed in hierarchical way. At first level, it segments individual lines using row histogram. From each row/line, words are extracted using column histogram and finally characters are extracted from words.

### 3.4 Feature Extraction

Feature extraction is an important part of any pattern recognition application. Feature extraction techniques like Linear Discriminant Analysis (LDA), Principle Component Analysis (PCA),Independent Component Analysis (ICA), Chain Code (CC), Scale Invariant Feature Extraction (SIFT),Gradient based features, Histogram might be applied to extract the features of individual characters. These features are used to train the system and aid it to reach the desired objectives.

### 3.5 Classification

Classification more or less works like a supervised machine learning algorithm. Classifiers compare the input feature with stored pattern and find out the best matching class for input. The trained classifier used can be artificial neural network (ANN) and Support Vector Machine(SVM).

### 3.6 Postprocessing

This step is an optional step; it helps to improve the accuracy of recognition. Syntax analysis, semantic analysis and other concepts might be applied to check the context of recognized character and maybe use it for domains like Natural Language Processing.

### 3.7 Text-to-Speech

After successful text detection, extracted text is taken as the input by the TTS engine. TTS is a device that scans and read the alphabets of any language by converting into the corresponding voice output. The output device is the speaker connected to the Raspberry Pi board.

## 4. Experimental Results

### 4.1 Hardware: Raspberry Pi

**Fig -3**: End System Observed outcome of project:

- Text is extracted from the image and spoken out.
- It recognizes alphanumeric characters
- Range of reading distance was 30-35cm.
- Character font size should be minimum 12pt.
- Maximum tilt of the text line is 6-7 degree from the vertical.
- Maximum font styles are compatible.
- Multi accent text support

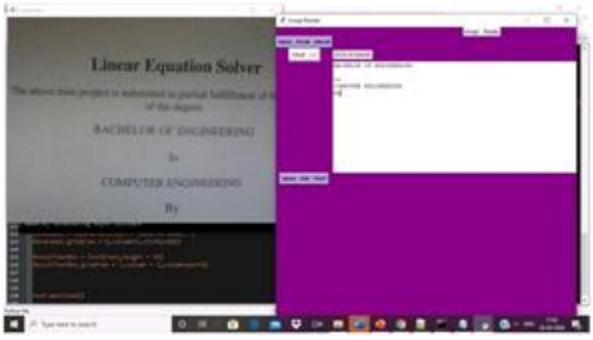


**Fig -4**: Captured Frame and Text. Speech o/p

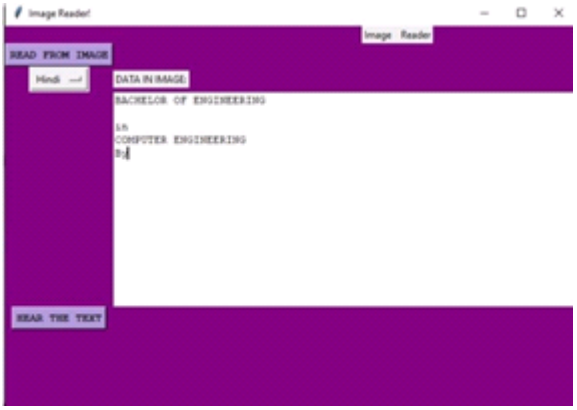


**Fig -5**: Extracted text

### 4.2 Software: Android Application

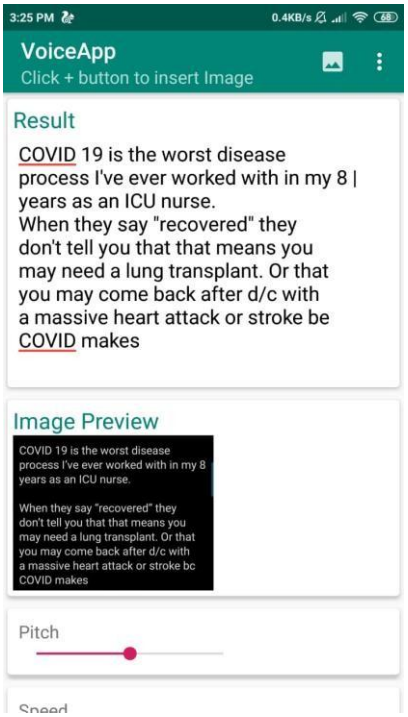


**Fig -6**: Galley input and extracted text

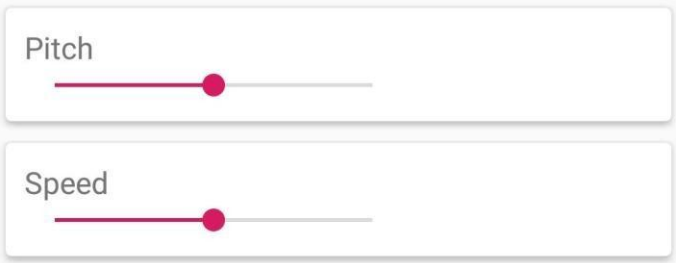


**Fig -7**: Pitch, Speed control

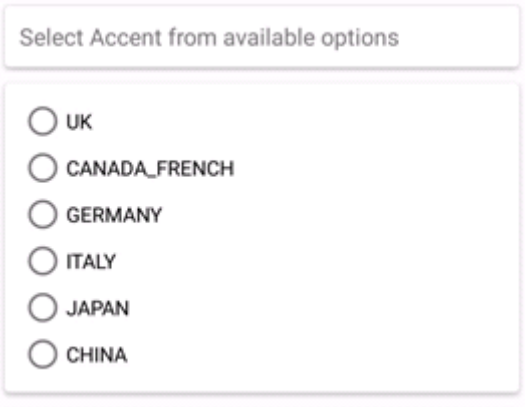


**Fig -8**: Accent selection

## 5. Literature Review

### [1] Hardware implementation of smart reader for Visually impaired people using Raspberry Pi authored by Velmurugan.D, Srilakshmi, Umamaheswari.S, Parthasarathy.S, Arun.K.R

This paper proposes the implementation of lightweight text reader for the blind community. The proposed system makes use of the Raspberry Pi B+ model, which has the following ports connected to it, namely, Ethernet Port for connecting laptop, Logitech 5MP camera attached to the USB port, a speaker connected to the audio jack and power supply. The authors also used an audio amplifier for amplifying the output. An image is captured by clicking on the "Click to Capture" button. Extracted text can be visible in the "Form1" window. Tesseract and espeak used for image processing and audio processing conversion.

### [2] A smart Reader for visually impaired people (Standard image vs Real Time image: A comparative study) authored by Ram Nivas Duraisamy, Sathya Manoharan

In this paper, the proposed model consists of a camera, speaker, and pi board. Here, the authors have stored each intermediate result in a separate image or text file. The camera captures the image within 10 seconds and saves that image in .jpeg format. The background data is eliminated and converted into a binary image. It stores that image as process.jpg. The authors have presented this model by using two advanced technologies, such as tesseract tool for the conversion of image to text and a festival tool for speech synthesis process. The festival tool is a multilingual speech synthesis module that consists of languages such as British, Italian, Czech, and Spanish.

### [3] Text Recognition using Image Segmentation and Neural Network authored by

### Ammar A. Radhi

The authors have proposed an efficient algorithm for the conversion of image to text. The proposed model works in two stages, first to extract the letters from the image and second, to output letters from the neural network. For the extraction of text, it applies some morphological processes, such as preprocessing, segmentation, labelling the content by calculating the mean and threshold of letters and resizing of the image. Input to the neural network consist of the extracted text. The output comprises the letters identified by the neural network. It then compares this output with the original template that comprise the standard images of the alphabet letters and numbers. Ultimate stage add the letters identified by the image in the text file.

### [4] An English text to speech conversion system authored by Kaladharan N

This paper focuses on the text to speech system. It also mentions about the different techniques of Speech Synthesis. The authors have designed the speech synthesizer tool in Microsoft.Net framework using C# language. The proposed system is the desktop application with the following key functionalities like, Editor to type the text or load the folder, speech wave editor, volume and speed key to increase the speech and its quickness. The system is useful in email readings, web and mobile applications.

## 6. CONCLUSION

There are millions of people worldwide who lost their eyesight at an early age or as they grow older. For them, reading a printed word is a troublesome task. There are plenty of softwares that are available online and does the conversion of text to speech. But most of those applications require a powerful internet connection. The internet connection may be a hindrance for those people who live in rural areas. Hence, we have executed a photo-to-speech application with the help of raspberry pi. The results are strongly verified by taking white and the noisy background samples. Our algorithm successfully process the image from distinct languages and provides the corresponding voice output. The device developed will be favorable for the visually impaired people to access the printed text document.

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