

# Raspberry Pi 3 Model B Based Text to Speech Converter for Visually Impaired

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**Abstract**— Visual impairment, also known as Visual loss which is one of the biggest limitations for humanity, especially in this century where information is communicated a lot by electronic messages such as e-mail. The device we have presented aims to help people having problem regarding vision loss, blindness. The present paper has introduced a device that converts an image's text to speech. The basic structure underlying a system is the camera captures an image, OCR helps to extract only the region of interest (i.e. region of the image that contains text) and converts that text to speech. It is implemented using a Raspberry Pi and a Raspberry Pi camera. The captured image undergoes steps of image pre-processing steps to identify only that part of the image that contains the text and removes the background. Two modules are used to convert the new image (which contains only the text) to speech i.e. Optical Character Recognition software and Text-to-Speech engines. The programming language used is Python. The audio output is heard through the raspberry pi's audio jack using speakers or earphones. This device consists of three modules, image processing for written text count, cropping of the image and reading an image.

**Keywords:** OCR (Optical Character Recognition), TTS (Text To Speech), PIXEL (Pi Improved X Window Environment, Lightweight.), DSI (Display Serial Interface), HDMI cable, USB (Universal Serial Bus), GPIO (General Purpose Input Output Pin)

## I. INTRODUCTION

It is known that technological developments are increasing at a faster speed. But the uses of technologies in various sectors are very less. It is known that most of the people with low vision or people suffering from blindness find it difficult to detect the text from the paper and books. The application depending on image and voice with a parallel functioning is suitable to help visually challenged people. So that the dependability of a challenged person is reduced to an improved level. Here we have built a project which is based on Raspberry pi 3 Model B board and coding has done in Python language. In this project, we have developed a code to read text using command prompt for visually challenged and illiterate. The proposed model fully included system has a Raspberry PI camera that captures the image or you feed the printed text or image reading or object counting process. The faded image internally works with the software module i.e. OCR automatically works on the faded image. It is the conversion of the images of typed, handwritten or printed text captured by the camera into a digital text or computer format text.

## II. LITERATURE REVIEW

The existing systems meet the issues while performing scans on documents with critical backgrounds and the output is expected to have the least accuracy. The proposed model ensures to read text present in the image for assisting blind people. The pre-processing part of the system ensures efficient background separation with an improved algorithm.

T. Rubesh Kumar proposed reading is very important in day to day life. As we can see the printed text is everywhere in the form of receipt, bank statement, medical reports, tickets, etc. He proposed a system to read barcode present on the product label. For a blind person, it is a big limitation to locate the barcode position and read it properly. T. Rubesh Kumar, C. Purnima has presented a camera-based assistive text reading framework to assist blind persons to read text labels and product packaging and label from hand-held objects in their daily lives. [1]

Nagaraja L proposed an embedded model which is a camera-based assistive text reading to help blind people in reading the text present on the text labels, printed notes and products. The system which he has proposed involves Text Extraction from an image and converting it into speech, a process that makes blind persons read the text. This requirement is carried out by using Raspberry pi, where portability is the main goal which is achieved by providing a battery backup and can be implemented as a future technology. Due to portability user can carry the device anywhere and anytime.[2]

Anusha Bhargava has proposed that most blind people or visually impaired people use braille language for reading but when it comes to printed text it is impossible for them. The model which she has proposed has the ability to convert the scanned image into voice output. The goal of their project was to study the image recognition technology with speech synthesis which should be easily available and having less cost using raspberry pi.[3]

Pooja Sharma proposed Blindness is a state of vision loss due to physiological or neurological factors. Pooja Sharma and her team proposed a simple, cheap, friendly user, the virtual eye will be designed and implemented by virtue of which blind people will find it easy to interact with the surrounding world. [4]

### III. BLOCK DIAGRAM

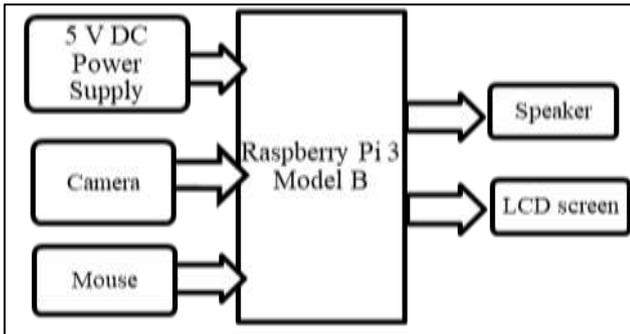


Fig. 1: Block diagram of process among hardware component

### IV. PROJECT OVERVIEW

This proposed model is designed for people with mild or moderate visual impairment by providing the capability to listen to the text. It can also help people suffering from dyslexia or other learning disabilities that involve difficulty in reading or interpreting words and letters. We would like to enable these people to be self-dependent and self-reliant as they will no longer need others to understand the printed text.

#### A. Raspberry Pi 3(Model B)

The raspberry pi is classified into two models, such as model A and model B. The important difference between model A and model B is USB port. Model A board will require less power and that does not include an Ethernet port. But the model B board does include an Ethernet port. The raspberry pi board consists of program memory (RAM), processor and graphics chip, CPU, GPU, Ethernet port, GPIO pins, Xbee socket, UART, power source connector. It does not have onboard space for storage because of the SD flash memory card is required to insert externally for storage purposes. Absolutely necessary hardware specifications of the raspberry pi board mainly include SD card holding within Linux OS, US keyboard, monitor, power supply and video cable.[5]

#### B. LCD display

An LCD screen used in the proposed project is 7-inch Touchscreen Monitor with DSI ribbon cable for Raspberry Pi connection which assists the users to create desegregated projects such as tablets, commercial systems, and embedded projects. The dimension of the screen is 800x480 that connects with the help of an adapter board that has the capacity to handles power and signal conversion. The advantage of installing Raspberry Pi software one can interact with the on-screen keyboard very easily. There is no need to connect keyboard and mouse externally.[6]

#### C. Power Source Connector

The latest version of Raspberry Pi 3 can be powered using a 5.1V micro USB supply. How much current supply Raspberry Pi 3 model need is dependent on what types of the load is we are connecting? Usually, model B used 700-1000mA depending upon what peripherals we are connecting. The important point to note is Raspberry Pi

model need a continuous power supply to make any project work. USB power supply will keep feeding 2.5A which is required for proper functioning.[7]

#### D. Cables and Connectors

To connect Raspberry Pi with power supply, speaker, display screen cables such as HDMI cables are required.

#### E. Speaker

Speaker is used for voice output. Processed images can be heard through the speaker after the conversion process is done.

#### F. Peripherals

Peripherals such as Mouse, Keyboard are required to feed coding into the Raspberry Pi board.

#### G. Raspberry Pi Camera

Raspberry Pi Camera Module V2-8 possesses a high-quality 8-megapixel Sony IMX219 image. Raspberry Pi camera has a fixed lens that helps to capture stable images. It has the capability of 3280x2464 pixels. This camera has a CSI interfacing end which used to connect the camera to Raspberry Pi Board. It has a long ribbon-like cable. Raspberry Pi camera needs continuous 2A Power Supply.[8]

### V. SOFTWARE SPECIFICATIONS

#### A. Operating System

Raspbian –An operating system for Raspberry Pi does not present in itself. For that, one needs operating system managers such as NOOBS, short for New Out of the Box Software. Which helps to download, install, and set up your Raspberry Pi. The official operating used for Raspberry Pi used is Raspbian. From its latest update, Raspbian uses PIXEL, short for Pi Improved X Window Environment, Lightweight, as its main desktop environment.[9]

#### B. Language

Python – the Programming language used is Python (version 2.7.13) and the functions are called from Open CV.

#### C. Platform

OpenCV – Open CV, which stands for Open Source Computer Vision, is a library of functions that are used for real-time applications like image processing, Air Traffic Control Systems, Networked Multimedia Systems, Command Control Systems, and many others. The version used for our project is OpenCV-3.0.0. Open CV's has various application areas such as Facial recognition system, Gesture recognition, Motion understanding, Object Identification, Segmentation and recognition, Motion tracking.[11]

#### D. Library

OCR engine – Optical character recognition (OCR)- It is a process that converts scanned or printed text images, handwritten text into editable text for further processing. For our project, we have used Tesseract OCR to be the best Open Source solution for converting images to text. It can be used on the Linux, Mac and Windows platforms. The newest Tesseract version, 3.4 supports a hundred languages.[12]

TTS engine – (Text to speech) - Speech Synthesis the process of generating audio output by machine on the basis of written input. In our project, we have used the Festival TTS. The text-to-speech device consists of two main modules, the image processing module, and voice processing modules. [12]

- 1) Image processing module –The image processing module captures an image using a camera and converts that image into text. And text file gets store as .txt file.
- 2) Voice processing module – The voice processing module changes the saved .txt file into sound and processes it with specific physical characteristics so that the sound can be understood.

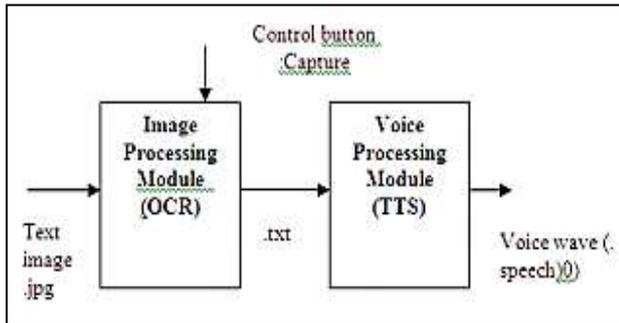


Fig. 2: Processing system module flow chart diagram.[10]

## VI. METHODOLOGY

Before you start your raspberry pi, you need to connect an LCD display, keyboard, mouse to Raspberry Pi board. Attach power supply. These peripherals are required to feed coding into the Raspberry Pi 3 Model B board. Attach Camera and speaker to Raspberry pi board and switch on the power supply. After capturing an image data goes through a series of steps to get audio output.

## VII. FLOW CHART

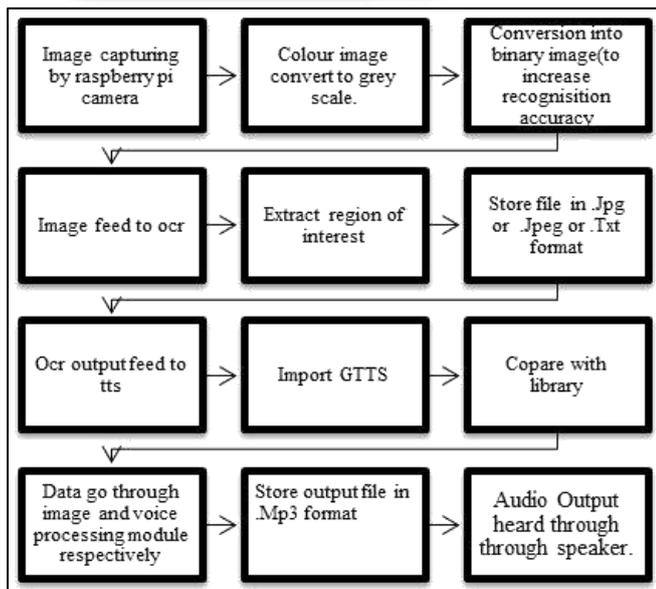


Fig. 3: Conversion Description

## VIII. CONCLUSION

Thus, this paper proposes a device that converts text to sound. Through the implementation of this system, the visually impaired would be able to interact with the surrounding world and not feel at a disadvantage. To carry this device, a battery may be used to power up the system.

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