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SMART BLIND READER USING RASPBERRY PI

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ABSTRACT

This project has been built around the Raspberry Pi processor board. It is controlling the peripheral Devices like the Camera, and speaker. Optical Character Recognition or OCR is implemented in this project to recognize characters which are then read out by the system through a speaker. It captures a full view of the paper into the system when the push button is pressed. Also, when the camera takes a snapshot of the paper. The content on the paper should be written in English or Hindi and be of good font size (preferably 24 or more as per MS Word). When all these conditions are met the system takes the photo, processes it and if it recognizes the content written on the paper it will announce to the speaker that the content on the paper has been successfully processed. After this, it speaks out the content that was converted into text format in the system from processing the image of the paper. In this way, Smart Blind Reader helps a blind person to read a paper without the help of any human reader or the help of a tactile writing system.

Keywords: Raspberry, Recognition, Character, Audio, Blind.

I. INTRODUCTION

In the proposed project -Smart Blind Reader for Blind Vision, we have successfully achieved the design and development of a working model which provides smart reading assistance for Blind and Visually Impaired people. The system provides an autonomous push button and interactive dictionary querying features, ultimately giving a feeling of comfort to the Blind Vision through the audio output. In our proposed method due to binarization, it gives better results over English and Hindi languages; also, there is no need for the internet.

The system not only supports Blind vision, even a person who wants luxury and comfortability, or an aged person can afford this. The system is a budget-friendly product. Once installed and configured can act as a perfect personal device for the user. The system even finds small-scale applications in Schools, Libraries, etc. We hope our work encourages the reader and brings them an inspiration to work on the advancements or a similar project that helps society.

II. METHODOLOGY

The block diagram of the setup consists mainly of two input parts. The first part is the text-to-speech conversion and the next is where the camera module converts the scanned image file into speech. The entire project is implemented on the Raspberry Pi 3 board which consists of USB ports, GPIO pins for input and output, a dedicated Pi camera for scans, a micro-SD card slot, and finally the speaker which will give the output.

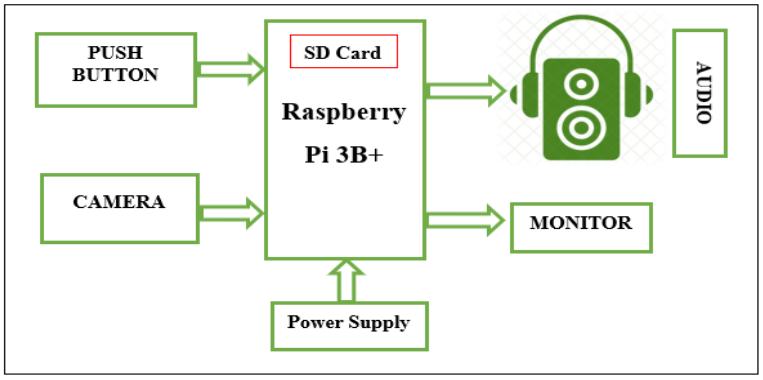

Figure 1: Block Representation

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Figure 1 shows the block diagram of the entire module with the input units, the processing unit, and the output unit. Raspberry Pi is the control unit that is responsible for all processing and conversion. The entire module is powered by a USB cable connected to a computer. The press buttons are used to activate the program and the speaker for output. The printed text to be scanned is then placed under the Pi camera to ensure a good quality image and a few numbers of distortions. The acquired image is then transferred to OCR numbers and characters and then gives a corresponding text output after comparing it with the pre-loaded database.

Hardware Components Used:

1. PI Camera - as an input device for capturing the image of the book's page.
2. Raspberry Pi 3 Model B - as a processing unit.
3. Speaker/Headphone - as an output device for listening to the speech output.
4. Push Buttons- as an interrupt button for BVI user interaction.
5. LED – Start and Stop indicator.
6. Bench support - rectangular plywood for hosting the mechanism, Camera, and RPI system all together tightly.
7. Book/Page containing text - the main source of knowledge, for capturing an image.
8. Monitor - as a display device for Verification and Debugging.

III. MODELING AND ANALYSIS

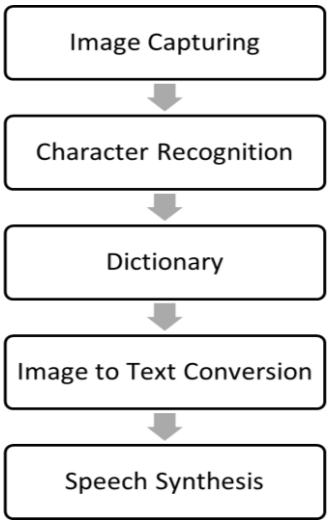

Figure 2: Flow of Process

Image Capturing:

Image capturing is the first step. It is achieved by using the press button interfaced with the Pi. To improve the quality of the image high-resolution camera is used. done using the Flite algorithm. The final audio output is heard using a headset. Image is captured and processed using OCR technology and Google Cloud Vision. Text-to-speech conversion is done using the flite algorithm.

Character Recognition:

The captured image is first enhanced, and character recognition is done either by online or offline methods. In the offline method, Tesseract library and Python programming are used. Here the text files are processed by various libraries like OpenCV and NumPy. In the online method, Google Cloud Vision is used.

Dictionary:

The recognized characters are cross-checked with the database provided. The database used for the online process is taken from the cloud library whereas for offline we use a trained dataset.

Image to Text Conversion:

Here, the image is converted to machine-encoded text. In the online process, we use the Google cloud vision as the platform for the conversion where Application Program Interface (API) is used.

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Speech Synthesis:

This module performs the task of conversion of the transformed machine-encoded text to the audible form. It is here, that we represented a system to scan written text, for helping blind individuals. Word recognition on the text regions is performed using OCR. For this methodology, the camera acts as the input. As the Raspberry PI board is high-powered it makes the camera stream. The image is captured by pressing the button when the item for text reading is positioned ahead of the camera. The image is converted to the document using the Tesseract library. Text-to-Speech synthesis is used to pronounce the document through the earphones.

IV. RESULTS AND DISCUSSION

The Result of this project is shown below photos: - Image is successfully captured by the system; it saves the first image as page_1.jpg and the captured image is shown below. Text is converted by the system, even though there exists some 2% error, Google Cloud Vision has perfectly converted the image to text.

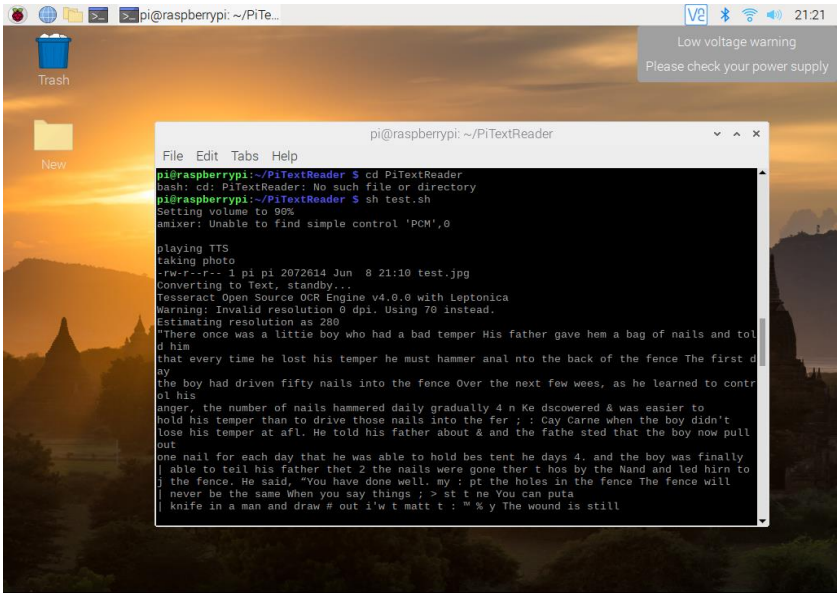

Figure 3: Sample Output in Monitor

In the next step,

Google TTS engine successfully converted text into speech. The speech cannot be displayed so not attached here. The next stage is the Interactive Dictionary query session. The results for the dictionary query being made are shown below.

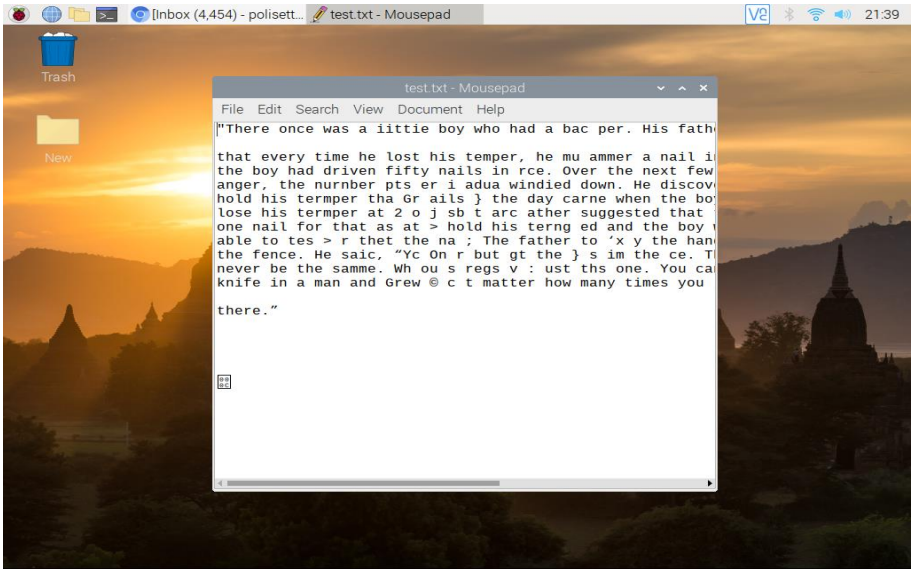

Figure 4: Test Case Result

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The observed outcome of the project:

- Text is extracted from the image and converted to audio.
- It recognizes both capitals as well as small letters.
- It recognizes numbers as well.

Advantages:

- This device helps blind people.
- No internet connection is required.
- For visually impaired
- For luxury and comfortable

Disadvantages:

- OCR can be limited due to fonts, colors, text size, etc.

The observed outcome of the project:

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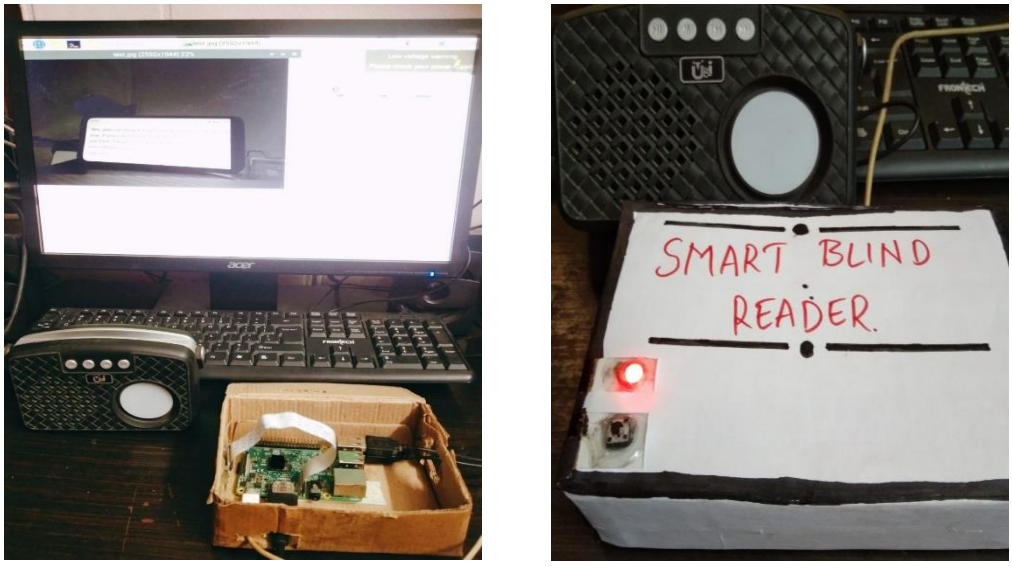

Figure 5: Complete Project

V. CONCLUSION

In this project, we have successfully achieved the design and development of a working model that can make blind person listen and understand the content they want to read without the help of another person. This cost-efficient Device can provide accurate data of all the data provided on paper or book. Sometimes OCR gives incorrect text due to processing problems and for that reason, the result represents a meaningless text. Due to this reason preprocessing is an important part of the whole system. If characters are cleared, big then there is no problem, but, due to light issues or small characters or the presence of images in between text gives little bit unexpected results.

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