

# PRABHA : (Picture Recognition Audio Book Helping Aid) for Blind

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**Abstract**—Throughout the evolution of human beings, engineers are leaving no stone unturned to ease the work of visually impaired who are deprived of the doors to this world, i.e., eyes. The proposed project involves text extraction from image with speech synthesis. It is an economical, user-friendly image-to-speech converter processed using Raspberry Pi where recognition is done using OCR (Optical Character Recognition) and then using TTS (Text To Speech) synthesizer, the audio is obtained. The Spell Corrector was proposed to avoid errors induced by the OCR. PRABHA enables the blind people to read the text and thus, pursue all their dreams and interests. Though they have lost their sight, PRABHA provides them their vision.

## I. INTRODUCTION

According to a key research by WHO, 253 million people live with vision impairment : 36 million are blind and the rest 217 million have moderate to severe vision impairment<sup>[1]</sup>. Among all the problems faced by the blind, reading is the sole concern of project PRABHA.

### A. Components Required

The major components which are constituted together to make this audio book reader are detailed below:-

TABLE I  
COMPONENTS USED

Sr. No.	Component	Specification
1	Raspberry Pi	3, Model B
2	Raspberry Pi Camera Module	5 Megapixel
3	Speakers	3.5mm Audio Jack, USB jack

TABLE II  
LIBRARIES USED

Sr. No.	Library	Purpose
1	<i>Tesseract</i>	OCR
2	<i>Flite</i>	TTS

1) *Raspberry Pi 3 Model B*: The Raspberry Pi is a cheap, portable board which serves as a tiny substitute to computers. It is basically a system on a small chip (SoC) that integrates several functional components into one. It is usually involved in robotics and hi-end computing. There are various models of it where Raspberry Pi 3 model B is the latest one. This model uses Broadcom BCM2837 processor with Quadcore ARM Cortex-A53, 64Bit CPU core. It has 4 USB ports and 2 x 20 Pin Header GPIOs (General Purpose Input Output).<sup>[2]</sup> It has 1 GB RAM. Its current capacity is 2.5 A. 802.11n wireless LAN (WiFi) and Bluetooth 4.1 are add-ons to this new model.



Fig. 1. Raspberry Pi 3<sup>[3]</sup>



Fig. 2. Raspberry Pi Camera module<sup>[4]</sup>

2) *Raspberry Pi Camera Module*: The Raspberry Pi NoIR Camera Board v2 is a high quality 5 megapixel image sensor designed especially for Raspberry Pi.<sup>[4]</sup> It possesses a fixed

focus lens. This model is capable of 3280 x 2464 pixel static images. It supports all the software within the newest versions of Raspbian Operating System.

### B. Motivation behind the idea

The major idea to the team came from visit to Blind Association Kullu. It was observed that despite the disabilities, the children were extremely talented but some loopholes of Braille Education hinders their higher education. The need to contact the Government Authorities for expensive high class Braille books posed a major problem. Sighting into few disadvantages of Braille, project PRABHA was realized.

#### 1) Disadvantages of Braille:

- Need to learn Braille makes it inaccessible to all.
- It gets difficult and expensive to print Braille books for higher classes.
- The errors cannot be erased.

#### 2) Advantages of PRABHA:

- It is user-friendly, cheap and portable.
- Font flexibility makes it suitable for all sizes and types of text.
- It can be used for many languages including few Indian Languages such as Hindi, Tamil etc.
- No specific text required for different books.

### C. Target Audience

PRABHA actually means light and thus it aims to bring light to the world of the blind. It aims at both : the blind and others with severe visual impairments. As the old age approaches the eyesight gets weak. Thus, it serves as the best aid for the old. Basically, PRABHA is a talking book which can also be used for educating kids with entertainment.

## II. MECHANICAL DESIGN

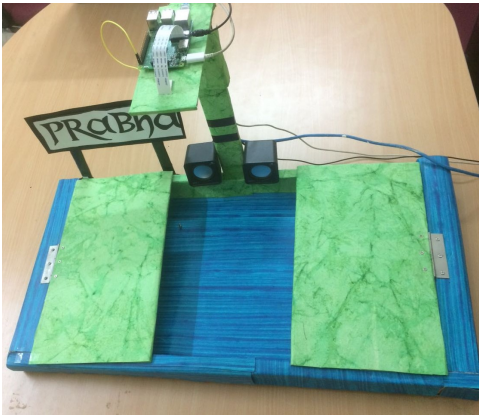


Fig. 3. Mechanical Model of the Project

Project PRABHA aims to able the disabled. Therefore, it was designed keeping in mind all the difficulties which are

faced by the blind. The stand for the Raspberry Pi Camera Module is given adequate height to ensure the focus of the camera which is mounted on the stand. We used two flaps on either sides which helps in reading book of any thickness. It also makes it easy for the user to locate the actual place where the book is to be placed. Thus, it makes the scanning efficient and easy. These flaps can be raised about the hinge thus helping in turning pages and changing books. The space available between flaps to keep the book helped in using books of different sizes from novel to A-4 size. The portability of the device is unprecedented. It is easy to carry thus portability makes it user-friendly.

## III. WORKING

The proposed project works on the basic principle of extracting text from image and then converting the text into speech. The overview of the processing is given in block diagram given in fig. 2.

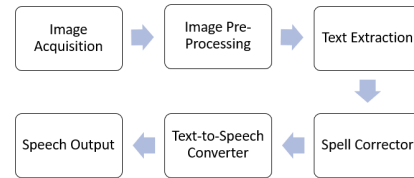


Fig. 4. Block Diagram of the steps involved in working

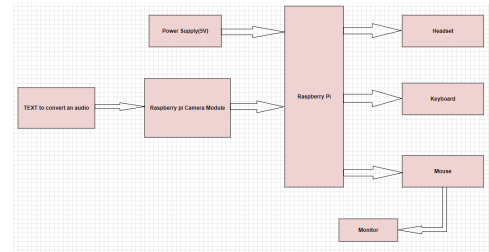


Fig. 5. Block diagram for arrangement of components

### A. Image Acquisition

In this step the image of text to be read is captured. The text is placed at bottom of the Raspberry Pi camera module. The acquired image is ready for pre-processing.

### B. Image Pre-processing

Both the input and output of this process is image but the quality is different. The major aim of this process is suppressing of unwanted noise and distortions. It also aims at enhancing some image features required for further processing. The captured image is firstly re-scaled, aligned, properly adjusted within the boundaries and then converted into gray scale image. This converted image is of better quality and easy for Optical Character Recognition.

### C. Text Extraction

The extraction of text from the pre-processed image is the goal. It is done using OCR.<sup>[5]</sup> OCR (Optical Character Recognition) is technique of extracting text from an image of handwritten or printed text into machine encoded language. This converted text can be now processed using computer programs. Tesseract library of python was used for OCR. It is a free OCR engine which can be used for almost every operating system. /textitTesseract is basically a command based engine which takes two inputs. One, the image containing text and the second is the output .txt file to store. This language flexible OCR engine returns the text in the output file. But OCR is not 100 % reliable. Thus, the spell corrector was implemented.

### D. Spell Correction

Spell Correction was proposed to avoid error by OCR. A database was implemented to check the output of OCR and thus correct the misspelled words. Edit distance was used for the purpose. It is a computer programming based technique to compare two strings by counting the number of operations required to convert first string into second. All these operations were performed and the misspelled output of OCR was converted to desired text.

### E. Text to Speech

The text is converted to speech using TTS (Text to Speech) synthesizer. It is a computer based program to read out any text loud. This makes the proposed project a Talking Book. Firstly, text is analyzed, normalized and linearized. The text is now ready for Acoustic Processing. Flite Library of Python Language is used for this purpose. This reads out the text loud. If the text is in capital letters, this library reads it word by word otherwise reads all other words with US accent. <sup>[6]</sup>

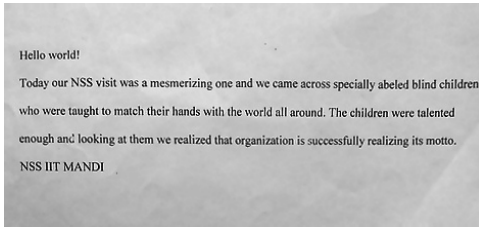


Fig. 6. Input Image to the camera module

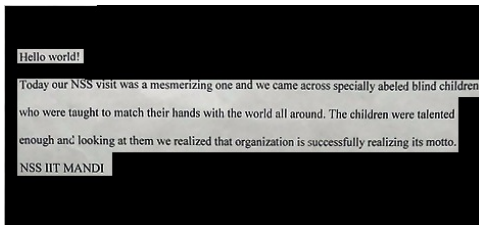


Fig. 7. Pre-processed image

```
Hello world!  
  
Today our NSS visit was a mesmerizing one and we came across  
specially abled blind children  
  
who were taught to match their hands with the world around.  
The children were talented  
  
enough and looking at them we realized that organization is  
successfully realized its motto.  
  
NSS IIT MANDI
```

Fig. 8. Extracted text from OCR engine

```
Hello world!  
  
Today our NSS visit was a mesmerizing one and we came across  
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The children were talented  
  
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successfully realized its motto.  
  
NSS IIT MANDI
```

Fig. 9. Spell Corrector Output

## IV. RESULTS AND DISCUSSIONS

The project PRABHA was made using cheap , economical and easily accessible components which add on to a total cost of Rs 4450. The softwares and python libraries used are open source. Thus, a book reader for any text may it be thesis, a project, a report , a comic or a novel was implemented at affordable price.

TABLE III  
TABLE SHOWING THE COMPONENT WISE COST

Sr. No.	Component	Cost in Rs
1	Raspberry Pi	3400
2	Raspberry Pi Camera Module	600
3	Speakers	450
4	Tesseract	Open Source
5	Flite	Open Source
	<b>Total Cost</b>	<b>4450</b>

## V. CONCLUSION

PRABHA is an advanced talking book that empowers the blind. It aims to bring the visually impaired closer to the society by giving them access to the best friends of man, i.e., books. By the use of economical components PRABHA reaches to the world of blind to bring them out to the world of their dreams and aspirations. The proposed project requires some more implementations trading off with the cost so as to bring out a better product. PRABHA is overall a finished and reasonable product ready to be used as a finished market product.

## VI. FUTURE IMPLEMENTATIONS

- 1) The presented project can be made more portable. By making the set up foldable.
- 2) Auto focus and high resolution camera can be used to get better quality image.
- 3) Auto turning of page can be introduced at increased cost.

Added Cost = 5000 Rs approx

TABLE IV  
COST ADDITION WITH FUTURE IMPLEMENTATIONS

Sr. No.	Component	Cost(in Rs)
1	PI NoIR CAM-ERA V2 8 MP	1950
2	Microcontroller PIC16F87A	200
3	Proximity Sensor	500
4	2-axis Analog Accelerometer	1200
5	Motors	1000

## VII. FUTURE AS A PRODUCT

The major goal of PRABHA as a product is to develop an automatic electromechanical page turner audio book reader for visually impaired. The advanced portable design will make it more superior, reliable and user-friendly for blind. At just 10,000 Rs a talking book with automatic page turning will be ready to sell in market.

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