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IMPLEMENTATION OF WEARABLE READER FORVISUALLY IMPAIRED PEOPLE

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ABSTRACT
This project has been built around Raspberry Pi processor board. It is controlling the peripherals like Camera and speaker which act as an interface between the system and the user. Optical Character Recognition or OCR is implemented in this project to recognize characters which are then read out by the system through a speaker. The camera is mounted on a stand in such a position that if a paper is placed in between the area marked by angular braces, it captures a full view of the paper into the system. Also, when the camera takes the snapshot of the paper, it is ensured that there are good lighting conditions. The content on the paper should be written in English (preferably Times New Roman) 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 on the speaker that the content on the paper has been successfully processed. After this it speaks out the content that was converted in to text format in the system from processing the image of the paper. In this way Raspberry Pi Based Reader for Blind helps a blind person to read a paper without the help of any human reader or without the help of tactile writing system.

Keywords- Raspberry pi, Web Cam, Optical character Recognition, text to speech Engine, Speaker, switch.

I. INTRODUCTION

In the modern era of information and communication technology, the lifestyle and independent movement of blind and visually impaired people is among the most significant issues in society that need to be addressed. Governments and various specialized organizations have enacted many laws and standards to support people with visual disabilities and have organized essential infrastructure for them. According to the World Health Organization, at least 2.2 billion people worldwide suffer from vision impairment or blindness, of whom at least 1 billion have a vision impairment that could have been prevented or is yet to be addressed in 2020. Vision impairment or blindness may be caused by several reasons, such as, cataract (94 million), unaddressed refractive error (88.4 million), glaucoma (7.7 million), corneal opacities (4.2 million), diabetic retinopathy (3.9 million), trachoma (2 million), and others. Theprimary problems that blind and visually impaired (BVI) people encounter in their routine lives involve action and environmental awareness. Several solutions exist to such problems, employing navigation and object recognition methods. However, the most effective navigation methods, such as a cane, trained guide dogs, and smart phone applications suffer from certain drawbacks; for example, a cane is ineffectual over long distances, crowded places, and cannot provide information regarding dangerous objects or car traffic when crossing the street, whereas training of guide dogs is cumbersome and expensive, and dogs require special attention when caring for them. Further, although

smart phone applications such as voice assistance and navigation maps for BVI people are evolving rapidly, proper and complete use is still low.

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II. LITERATURE SURVEY

- Ray Kurzweil proposes K-Reader Mobiles, specially designed movable reading assistant for visually impaired people. "K-Reader Mobile" runs on cell phone and allows the user to read mail and many other documents. But this fails to give an economical solution.

- Athira Panicker proposes a smart shopping assistant label reading system with voice output for the blind using the raspberry pi. This system only reads documents from clear flat surface and it does not read from complex backgrounds.

- Marut Tripathi proposes a Navigation System for blind people to navigate safely and quickly. In the system, ultrasonic sensors and USB camera are used to detect and recognize obstacles. Once the obstacles detected via ultrasonic sensors, it sends feedback in the form of beep sound through an earphone to inform the person about the hindrance.

- Dimitrios Dakopoulos proposes a Wearable Obstacle Avoidance Electronic Travel Aids for Blind that presents a comparative survey among portable or wearable obstacle detection or avoidance systems to aware users about the progress in assistive technology for blind people.

- X. Chen proposes Automatic Detection and Recognition of signs from natural scenes, here they

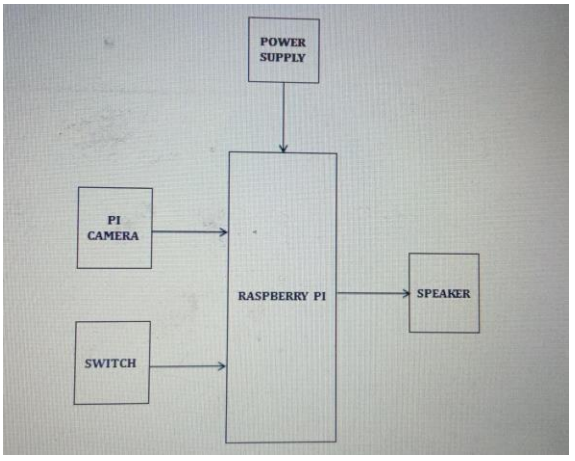
  presented with an approach for automatic detection and identification of signs from natural scenes and it's given to a sign translation task. The system fails because it works only in the Chinese language.

- William A Ainsworth proposes a system for converting English text into speech using an inexpensive computer but it is not suitable for all memory range of computers as only small amount of stored data has scrutinized.

- Michael McEnancy Finger Reader is an audio reading gadget for Index Finger. Even Though this system doesn't help blind people to aim the letters accurately, finger-worn device assists the visually impaired in reading the paper-printed text.

- Vasanthi G proposes a Vision Based Assistive System for Label Detection with Voice Output. This camera-based assistive system help blind persons read text labels and product packaging from a hand-held object.

II. BLOCK DIAGRAM



The basic working of the prototype can be given as capturing the images using OCR based raspberry pi module, conversion of the images into text by image processing, conversion of the text to speech using the Google text to speech (GTTS) converter and haptic feedback for orienting in-text-line. The block diagram as shown. Represents the methodology. The acquisition of images from a book and recognizing printed text from the image is performed using Raspberry Pi

Microcontroller and Raspberry Pi camera. The raspberry pi microcontroller was instructed via the rasping OS and instructions were given using the python language.

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IV. FLOW CHART

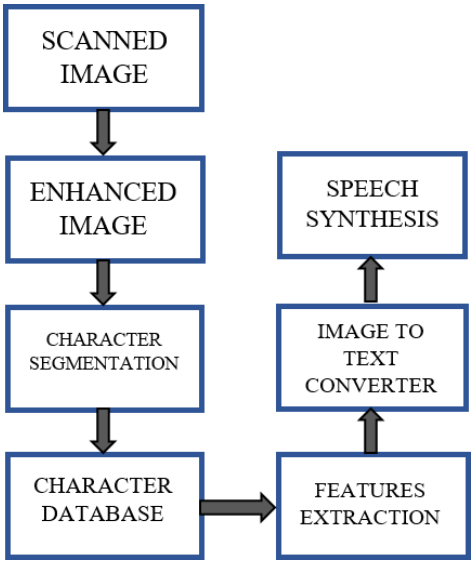


IMAGE CAPTURING:

The first step in which the device is moved over the printed page and the inbuilt camera captures the images of the text. The quality of the image captured will be high so as to have fast and clear recognition due to the high resolution camera.

PRE – PROCESSING:

Pre-processing stage consists of three steps: Skew Correction, Linearization and Noise removal. The capturedimage is checked for skewing. There are possibilities of image getting skewed with either left or right orientation. Here the image is first brightened and binaries. The function for skew detection checks for an angle of orientation between ±15 degrees and if detected then a simple image rotation is carried out till the lines match with the true horizontal axis, which produces a skew corrected image. The noise introduced duringcapturing or due to poor quality of the page has to be cleared before further processing.

SEGMENTATION:

After pre-processing, the noise free image is passed to the segmentation phase. It is an operation that seeks to decompose an image of sequence of characters into sub-image of individual symbol (characters). The finalized image is checked for inter line spaces. If inter line spaces are detected then the image is segmented into sets of paragraphs across the interline gap. The lines in the paragraphs are scanned for horizontal space intersection with respect to the background. Histogram of the image is used to detect the width of the horizontal lines. Then the lines are scanned vertically for vertical space intersection. Here histograms are used to detect the width of the words. Then the words are decomposed into characters using character width computation.

FEATURE EXTRACTION:

Feature extraction is the individual image glyph is considered and extracted for features. First a character glyph is defined by the following attributes:

- Height of the characte;
- Width of the character
- Numbers of horizontal lines-short and long
- Numbers of vertical lines-short and long
- Numbers of circles present
- Numbers of horizontally oriented arcs
- Numbers of vertically oriented arcs
- Position of the various features
- Pixels in the various regions.

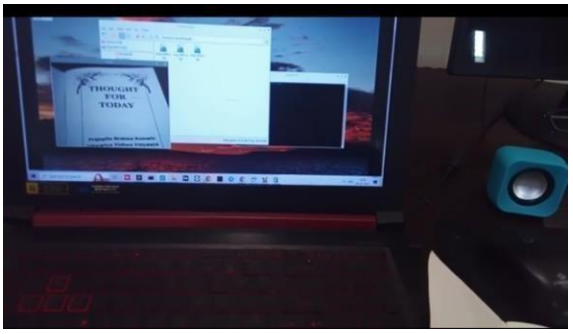
IMAGE TO TEXT CONVERTER:

The ASCII values of the recognized characters are processedby Raspberry Pi board. Here each of the characters is matched with its corresponding template and saved as normalized text transcription. This transcription is further delivered to audio output.

TEXT TO SPEECH:

The scope of this module is initiated with the conclusion of the receding module of Character Recognition. The module performs the task of conversion of the transformed text to audible form. The Raspberry Pi has an on-board audio jack, theon-board audio is generated by a PWM output and is minimally filtered. A USB audio card can greatly improve the sound quality and volume. Two options of attaching a microphone into Raspberry Pi. One is to have USB mic, another to have an external USB sound card.

V. RESULT



VI. CONCLUSION

By this we conclude that we have implemented text to speech conversion technique using raspberry pi. The simulation results have been successfully verified and the hardware output has been tested using different samples. Our algorithm successfully processes the image and reads it out clearly. This is an economical as well as efficient device for the visually impaired people. We have applied our algorithm on many images and found that it successfully does its conversion. The device is compact and helpful to the society.

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