Artificial Vision For The Visually Impaired People

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Abstract- *This project describes about the book reader for the visually impaired people using Raspberry pi controller. It is for controlling the peripherals like Camera, speaker and LCD which act as an interface between the system and the user. The image which is captured by the camera is processed by Optical Character Recognition in order to recognize the characters which are then read out by the system through a speaker. In this need, 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 is good lighting conditions. 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 into text format using the Text to Speech engine(TTS) in the system from processing the image of the paper. Therefore, the visually impaired peoples will be able to read out the books without the help of human assistance through the headphones or speaker..*

I. INTRODUCTION

Visually impaired people suffer in reading printed text using braile technology. We present a smart device that assists the visually impaired which effectively and efficiently reads paper-printed text. The proposed project uses the methodology of a camera based assistive device that can be used by people to read Text document. The framework is on implementing image capturing technique in an embedded system on Raspberry Pi board. In this project we have proposed a text read out system for the visually challenged. This system uses camera as an input device which captures the image and process it with the help of OCR(optical character recognition). A methodology is implemented in order to recognize sequence of characters and the line of reading. As part of the software development the Open CV (Open source Computer Vision) libraries is utilized to do image capture of text, to do the character recognition. Most of the access technology tools built for people with blindness and limited vision are built on the two basic building blocks of OCR software and Text-to-Speech (TTS) engines. Optical character recognition (OCR) is the translation of captured images of into machine encoded text. OCR is a process which associates a symbolic meaning with letters, symbols an number and the image of a character. It is defined as the process of converting scanned images of machine printed into a computer process able format. Optical Character recognition is useful for visually impaired people who cannot read Text document, but needs the content of the Text documents. It is used to digitalize and reproduce the texts. Digitizing texts also helps reduce storage space. Editing and Reprinting of Text document that were printed on paper are time consuming and labour intensive. This paper is on Methodology of a camera based evice that can be used by people to read any Text document. The output form of OCR is fed into Text to Speech Engine (TTS) where Text is converted into Speech. It is used for converting the input text into the corresponding speech using Raspberry-pi. The fastest and effective way of communication is language.This process includes Python coding which is done on Raspberry-pi board for the generation of speech signal based on the input text which is obtained after the completion of OCR process. It is then fed to the output devices depending upon the choice of the user. The output device can be a headphones or speakers connected to the Raspberry pi.

II. EXISTING AND MODERN TECHNOLOGIES

Blindness makes life rather difficult for people who suffer from this health problem, but the use of technology can help in some day-to-day tasks. The previously existing work focuses on the development of a image-to-speech application for the blind. With the help of a mobile application developed it allows a blind user to read text .To achieve that, a set of frameworks of Optical Character Recognition and Text to Speech Synthesis are integrated, which enables the user, using a smartphone, to capture the image and hear the text that exists in the image. The technology of optical character recognition enables the recognition of texts from captured image. After the recognition of texts, the output is fed into TTS engine(Text to Speech) which is heared with the help of output device either speaker or headphones according to the user's need.In order to overcome the user's existence for capturing the image using mobilephones, we are going with the method of Raspberry pi based technique in which the text is captured with the help of webcam and recognized with OCR and TTS Engine.The voice output is heared with the help of headphones or speaker.

III. BLOCK DIAGRAM

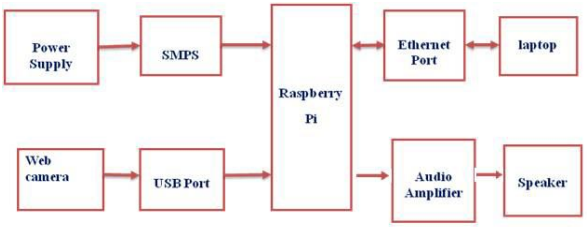

Fig.1 Block Diagram of the Proposed Model

The figure 1 illustrates the block diagram of proposed method.

The framework of the proposed project is the Raspberry pi board. The Raspberry pi B+ is a single board computer which has 4 USB ports, an Ethernet port for internet connection, 40 GPIO pins for input/ output, CSI 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. The power supply is given to the 5V micro USB connector of Raspberry pi through the Switched Mode Power Supply (SMPS). The SMPS converts the 230V AC supply to 5V DC. The web camera is connected to the USB port of Raspberry pi. The Raspberry pi has an OS named RASPION which process the conversions. The audio output is taken from the audio jack of the Raspberry pi. The converted speech output is amplified using an audio amplifier. The Internet is connected through the Ethernet port in Raspberry pi. The page to be read is placed on a base and the camera is focused to capture the image. The captured image is processed by the OCR software installed in Raspberry pi. The captured image is converted to text by the software. The text is converted into speech by the TTS engine. The final output is given to the audio amplifier from which it is connected to the speaker. The speaker can also be replaced by a headphone for convenience.

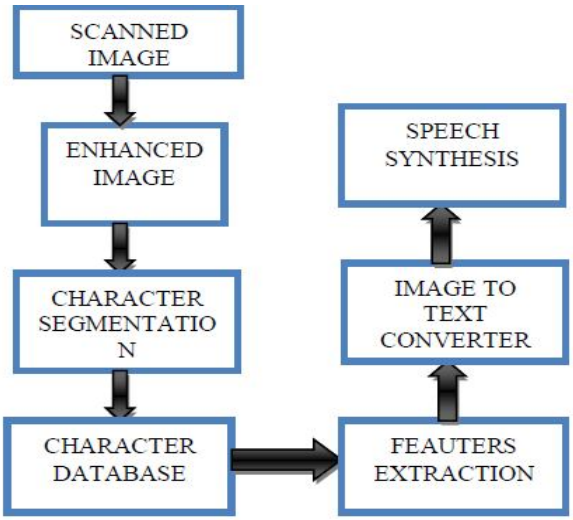

Fig.2 Flow Process

A. 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

B. PRE PROCESSING

After the image has been captured there involves Pre-processing stage which consists of Skew Correction, Linearization and Noise removal. The captured image is checked for skewing. There are possibilities of image getting skewed with either left or right orientation. Hence the image is first brightened and binarized. The noise introduced during capturing or due to poor quality of the page has to be cleared before further processing.

C. SEGMENTATION

After pre-processing, the next stage is the segmentation phase where decomposing an image for sequence of characters into individual symbol, the image is checked for line spaces. If any line spaces are detected then the image is segmented into form of paragraphs. The lines in the paragraphs are scanned for horizontal space intersection as well as vertical space intersection with respect to the background. Histogram of the image is used to detect the width of the horizontal lines as well as the vertical lines. Then the words are decomposed into characters with help of character width.

D. FEATURE EXTRACTION

After Segmentation process, Feature extraction which is the individual character being extracted for features. First a character is defined by the following attributes:

(1) Height of the character;
(2) Width of the character;
(3) Numbers of horizontal lines present
(4) Numbers of vertical lines present;
(5) Numbers of circles present;
(6) Numbers of horizontally arcs;
(7) Numbers of vertically arcs;
(8) Centroid of the image;
(9) Position of the various features;
(10) Pixels in the various regions.

E. IMAGE TO TEXT CONVERTER

The ASCII values of the recognized characters are processed by 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.

F. 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 converting the text to audible form. The Raspberry Pi has an on-board audio jack, the on-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.

IV. SIMULATION METHOD

The simulation of OCR is done in MATLAB.For that a sample image is taken and processed .It involves four processes in MATLAB

1. Binary Representation
2. Area and Edge process
3. Segmentation and labelling
4. Character skeleton

Binary representation converts the captured image to machine language which is represented in 0's and 1's.Binay0 represents the black colour of the characters and binary 1 represents the white colour of the characters. A boundaryfor each character is created in area and edge process. The boundary for each character is programmed and it can vary from 0 to 255 bits of characters occupying memory in database. The isolated blocks of characters are segmented and are automatically labelled. The character skeletonisation reduces the foreground regions in the binary image to a skeleton remnant.

V. HARDWARE SETUP

The hardware of the proposed work consists of a Raspberry pi board interfaced with a USB camera. Wi-Fi dongle is connected to the system for internet connection which is taken to Pi through LAN cable. A 5mp camera is connected to one of the USB port of Raspberry pi. 5V supply is given to Raspberry pi from the system through a power cable. Finally, an output device either headphone or a speaker is connected to the Raspberry pi in order to hear the voice output

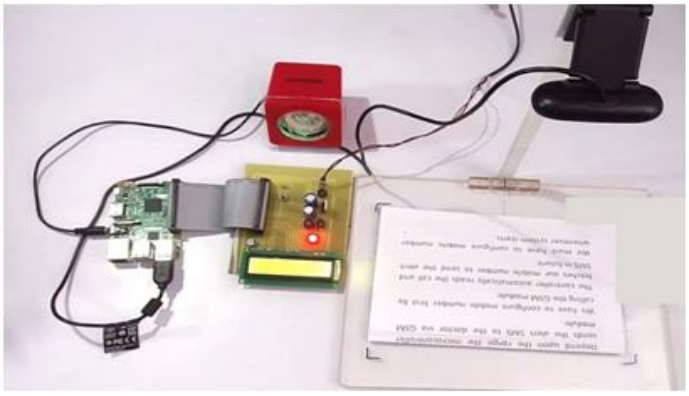

Fig.3 Hardware Setup

VI. CONCLUSION

Thus the image to speech conversion technique using Raspberry pi controller has been implemented. The simulation results have been carried out for different samples. We have applied our algorithm on many images and the simulation results have been monitored. This is an economical as well as efficient device for the visually impaired people. The device is compact and helpful to the society.

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