BOOK READER FOR VISUALLY IMPAIRED USING RASPBERRY PI

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Abstract - Blind Reader is a portable, low-cost, reading device made for the blind people. The Braille machines are expensive and as a result are not accessible to many. In particular, there is a need for a portable text reader that is affordable and readily available to the blind community. Blind Reader overcomes the limitation of conventional Braille machine by making it affordable for the common masses. This work proposes a smart reader for visually challenged people using raspberry pi. This work addresses the integration of a complete Text Read-out system designed for the visually challenged. The system consists of a webcam interfaced with raspberry pi which accepts a page of printed text. The system uses OCR technology to convert images into text and reads out the text by using Text-to-Speech conversion. The system supports audio output via Speakers.

The OCR (Optical Character Recognition) package installed in raspberry pi scans it into a digital document which is then subjected to skew correction, segmentation, before feature extraction to perform classification. Once classified, the text is readout by a text to speech conversion unit (TTS engine) installed in raspberry pi. The output is fed to an audio amplifier before it is read out.

Key Words: *Raspberry pi, Web Cam, Optical Character Recognition, Text to Speech Engine, Audio Amplifier.*

1. INTRODUCTION

Visually impaired people report numerous difficulties with accessing printed text using existing technology. We present a smart device that assists the visually impaired which effectively and efficiently reads the 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 for implementing image capturing technique in an embedded system based on Raspberry Pi board. The design is motivated by preliminary studies with visually impaired people, and it is small-scale and mobile, which enables a more manageable operation with little setup. In this project, we have proposed a text read out a system for the visually challenged. The proposed fully integrated system has a camera as an input device to feed the printed text document for digitization and the scanned document is processed by a software module the OCR (optical character recognition engine). A methodology is implemented to the recognition sequence of characters

and the line of reading. 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 printed text into machine-encoded text. OCR is a process which associates a symbolic meaning with objects (letters, symbols an number) with 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 also useful for visually impaired people who cannot read Text document, but need to access the content of the Text documents. Optical Character recognition is used to digitize and reproduce texts that have been produced with the non-computerized system. Digitizing texts also helps reduce storage space. Editing and Reprinting of a Text document that was printed on paper are time-consuming and labor intensive

2. METHODOLOGY

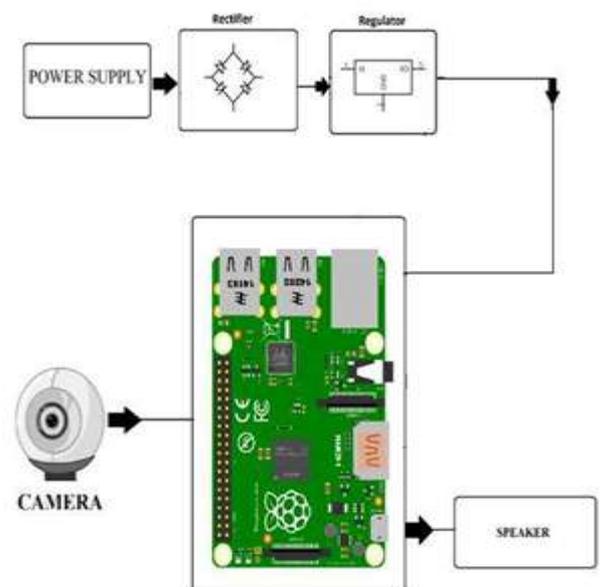The block diagram and circuit diagram for that project is as follow

Fig.1: Circuit diagram of book reader using raspberry pi

The framework of the proposed project is the raspberry pi board. The raspberry pi zero is a single board computer.

The above diagram shows the complete architecture of the proposed work Reader for Blind Peoples. The system is designed around raspberry pi which is nothing but a mini computer used to control the complete circuit action of the system .In this system we have designed a power supply unit to provide the required power supply to the circuit components of the system. The power supply is designed to provide regulated power supply as per the requirement. The architecture of the system consists of a camera which is used to scan the printed text image which is to be read by the system. This camera captures the image of the text printed on the paper for reading purpose. 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 audio output is taken out from the speaker which is also interfaced with the raspberry pi controller.
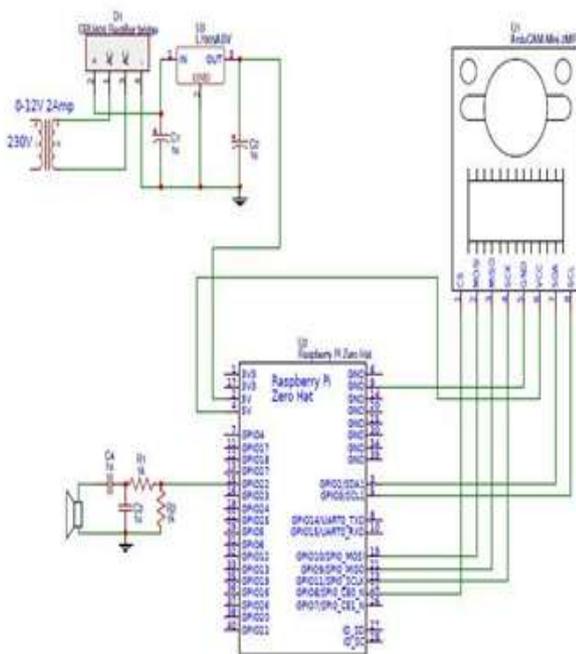
2.1 BLOCK-DIAGRAM

2.2 CIRCUIT DIAGRAM

Fig. 2: Circuit diagram of book reader using raspberry pi

To drive all the components in this circuit 5V dc and 12V dc are required. The mains give the 230V ac. The 230V ac is stepped down to 12V ac by using step down transformer. Then the output is given to the full wave rectifier. The rectifier eliminates the negative peak voltage of the input voltage. The output of the rectifier is the pulsating dc. The error pulses are eliminating by using capacitor filter. Then the output at the parallel of the

capacitor is the 12V dc. But the Micro Controller works on 5V dc. To convert the 12V dc into 5V dc a regulator is used. The output of the regulator is constant irrespective of the input voltage. An LED is connected in between theregulator and the controller to indicate whether the power is on or off. The power supply is provided to the pin number 2 which is VCC pin of the raspberry pi as shown in circuit diagram. The hardware of the system consists of a camera interfaced with the raspberry pi as shown in the circuit diagram above. The VCC pin of the camera module is connected to the pin number 4 of the raspberry pi controller which has a 5V supply. And the ground supply is provided by pin number 9 of the raspberry pi controller as shown in the above circuit diagram of the system. This pi camera is used to scan the document which is to be readout. The camera scans and captures the text data from the document and sends it to the raspberry pi controller for processing symbol generated is assigned a phonetic. The back end then converts the phonetic into sound. In The raspberry pi controller processes the data and with the help of OCR installed in raspberry pi the characters identification in the text data is carried out. OCR engine the extraction of the text in the image is done using optical character recognition (OCR). OCR is a field of research in pattern recognition, artificial intelligence and computer vision. It is the conversion of the images of typed, handwritten or printed text into a digital text or computer format text. Earlier OCR versions had to be trained in each character of a text with its specific font. Today, advanced OCRs are available that have a high degree of accuracy, support a wide variety of image formats, languages and fonts. For our project, we have used Tesseract OCR. It is the most accurate open source OCR engine and is powered by google. It can be used on the Linux, mac and windows platform. The newest Tesseract version, 3.4 supports a hundred languages. However, images must undergo a number of pre-processing stages like noise removal, scaling etc. otherwise the output will be of low quality. The raspberry pi then converts this data into audio form with the help of TTS (text to speech) converter.TTS software The process of converting text to speech by a computer is called speech synthesis. A text to speech system (TTS) is used to perform speech synthesis. A TTS is composed of two parts: front end and back end. The front end converts the text to a symbol, for example, a number. Each our project, we have used Festival TTS. Festival is the most widely used open source TTS. It has a wide variety of voices and support English, Spanish and welsh language. We have used the English language. And the system then outputs the data in audio form through speaker. This speaker is interfaced with the pi controller as shown in the circuit diagram of the system. This speaker is connected to the GPIO pin 22 of the raspberry pi controller.
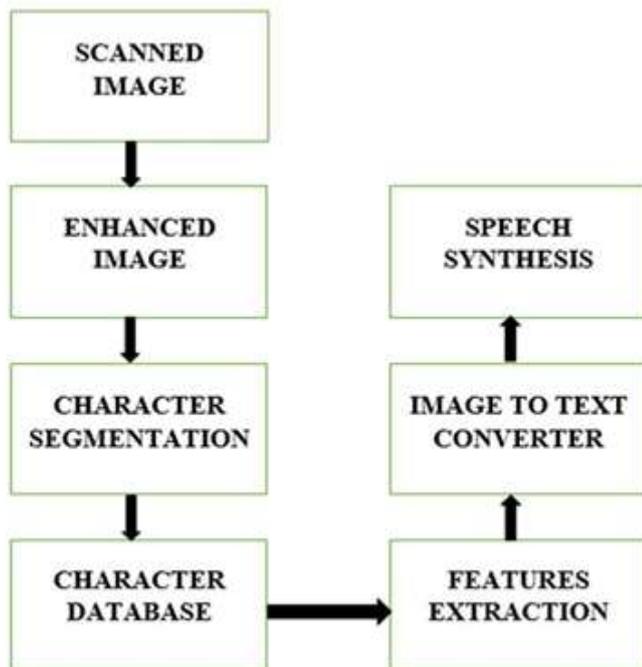
2.3 FLOW CHART

Image Capturing

The first step in which the device is moved over the printed page and the 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

The pre-processing stage consists of three steps: Skew Correction, Linearization, and Noise Removal. The captured image is checked for skewing. There are possibilities of the image getting skewed with either left or right orientation. Here the image is first brightened and binarized. 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 during capturing or due to the 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 o characters into sub-image of individual symbol (characters). The binarized 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:

1. Height of the character;
2. Width of the character;

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