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DESIGN ASPECTS: A SMARTREADER FOR VISUALLY IMPAIRED DEVICES

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INTRODUCTION-Machine replication of human functions like reading is an ancient dream. However, over the last five decades, machine reading has grown from a dream to reality.Visually impaired people report numerous difficulties with accessing printed text using existing technology, including problems with alignment, focus, accuracy, mobility and efficiency. We present a smart device that assists the visually impaired and travellers 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 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 system for the travellers and visually challenged. The proposed fully integrated system has a camera as an input device to feed the printed text document for digitization.Speech is probably the most efficient medium for communication between humans.To extract the text from image we use optical character recognition technique (OCR). Optical character recognition has become one of the most successful applications of technology in the field of pattern recognition and artificial intelligence. Optical character Recognition (OCR) is a process that converts scanned or printed text images, handwritten text into editable text for further processing. Speech synthesis is the artificial

synthesis of human speech. A Text-To-Speech (TTS) synthesizer is a computer-based system that should be able to read any text aloud, whether it was directly introduced in the computer by an operator or scanned and submitted to an Optical Character Recognition (OCR).

ASPECTS- Human communication today is mainly via speech and text. To access information in a text, a person needs to have vision. However those who are deprived of vision can gather information using their hearing capability. The proposed method is a camera based assistive text reading to help blind person and the travellers in reading the text present on the text labels, printed notes and products in their own respective languages. It combines the concept of Optical Character Recognition (OCR), text to Speech Synthesizer (TTS) and translator in Raspberry pi. Optical character recognition (OCR) is the identification of printed characters using photoelectric devices and computer software. It converts images of typed, handwritten or printed text into machine encoded text from scanned document or from subtitle text superimposed on an image.Text-to-Speech conversion is a method that scans and reads any language letters and numbers that are in the image using OCR technique and then translates it into any desired language and at last it gives audio output of the translated text. The audio output is heard through the raspberry pi's audio jack using speakers .

BLOCK DIAGRAM-The block diagram of the book reader system is shownin Figure 1. The written text is placed underneath a cameraby the individual to check for fine quality of the image. Anassistive system provides text localization algorithm withsomeprecision.Onstartup, the system checks if all devicesand their connectivity is correct. The graphical user interfaceshows the status of the clicked image. The Raspberry Pi isan embedded system which has integrated peripheraldevices like Bluetooth, Wi-fi USB, analog-digital conversion etc.,

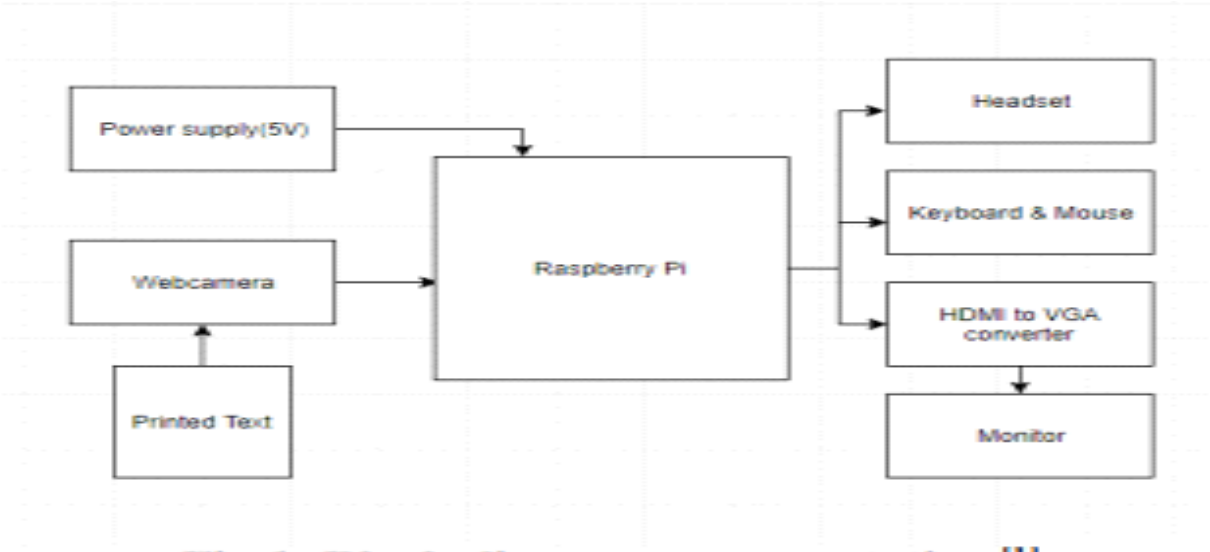

Fig 1: Block diagram representation [1]

METHODOLOGY- The design usually involves a fully integrated systemwhich feeds the printed text as input through camera fordigitization and the OCR (Optical Character RecognitionEngine), a software module processes the scanned document A methodology for recognizing the sequence ofcharacters present and also to indicate the current readingline is enabled. OpenCV (Open source Computer Vision)libraries are used for capturing the image of text and toperform the character recognition etc.The

architecture of the smart reader is shown in the Fig: 1 where the plastic sheet indicates the text to be read. Opticalcharacter recognition (OCR) is the technology used fortranslating a captured image of written text into machineencodedtext.In order to reduce storage space digitizing texts ishelpful. As the editing and publication of text documentswritten on a paper are time taking, it is widely used instorage and document analysis, especially to convert thedocuments into electronic files. The OCR technology thenmakes use of methods like machine translation, text-tospeech, etc to capture a page. Finally the recognized textdocument is fed to the output device.

FLOW OF PROCESS-Figure 2 illustrates the flow of process of the method. Theprocess flow describes the steps concerned in recognizingthe text from the given image and process the text to get thespecified output within the form of voice as shown in Fig: 2.1.The built-in camera captures the text image by movingthe device over the printed page that is thus known as imagecapturing.2. There are three steps in Pre-processing[5]: they area.Skew correction, b.Linearization and c.Noise removal. Thecaptured image is initially checked for skewing. There aretwo possibilities of orientation i.e., left or right orientationfor image skewing, during which the image intensity isincreased and then it is binarized.

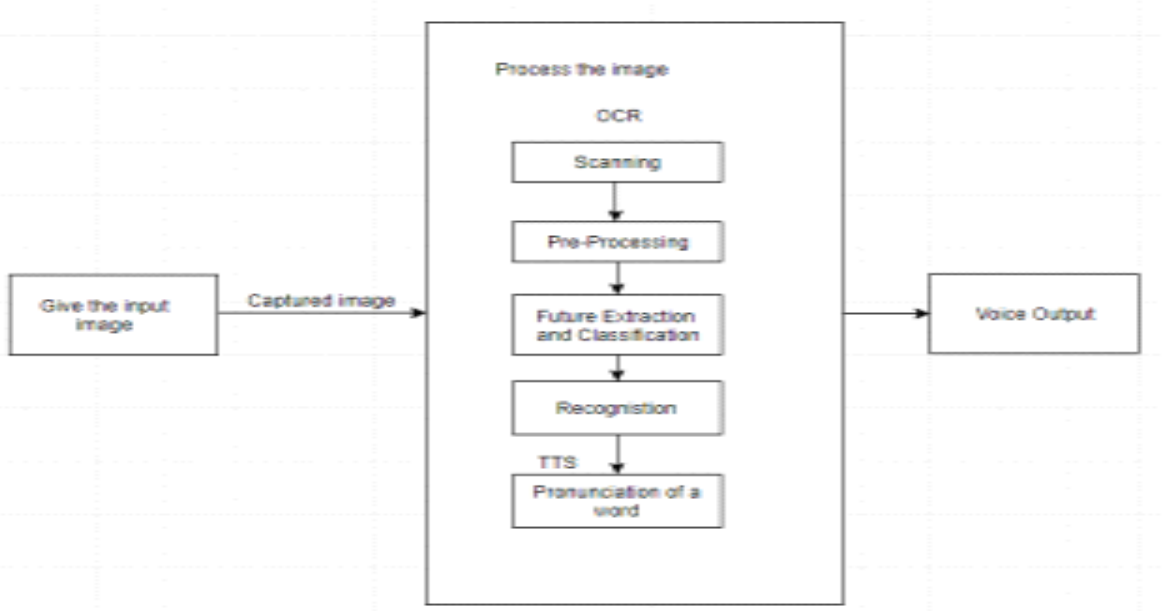

Fig 2: Process Flow

The process of skew detection is implemented to perform certain functions like angle of orientation which isto be between ±15 degrees, and if the result is true then asimple image rotation is applied, that successively produces a skew corrected image. 3. In Segmentation, the inter line spaces is checked for the binarizedimage. On detection of inter line spaces present in the image, across the interline gap it is divided into sets of paragraphs. With regard to the background, to sight the width of horizontal lines, histogram of the image is employed. For vertical space intersection the lines are scanned vertically. 4. Feature extraction, here the first character glyph is defined with a set of attributes such as Height and width of the character, Numbers of horizontal and vertical lines present, Numbers of circles present in the various regions.5. The Raspberry Pi board processes the ASCII values of the characters for Image to Text conversion. The normalized text transcription is saved by matching each of the character with its corresponding template. 6.A minimally filteredPWM output generates the image to speech conversion output. To improve the sound qualityand volume a USB audio card can also be used. There are two options of attaching a microphone into Raspberry Pi. One is through USB mic, another to have an external USB sound card.

HARDWARE IMPLEMENTATION-The system setup includes specific set of hardwarecomponents which include: Raspberry Pi which can be thought of as a small computer that plugs into the monitor and connects to a keyboard. The basic hardware components in Raspberry Pi are the power source, memory and I/O. The common features included in different versions of raspberry pi are 1.2GHz 64-bit quadcore ARMv8 CPU, Camera interface (CSI) and Display Interface (DSI). One example for hardware setup is shown in fig-3. A cameracaptures the images in real time and feeds it to a computer. A power supply device supplies or voltage to the output loads. A-regulated output voltage of +5v with output current of 100 mA is generated.

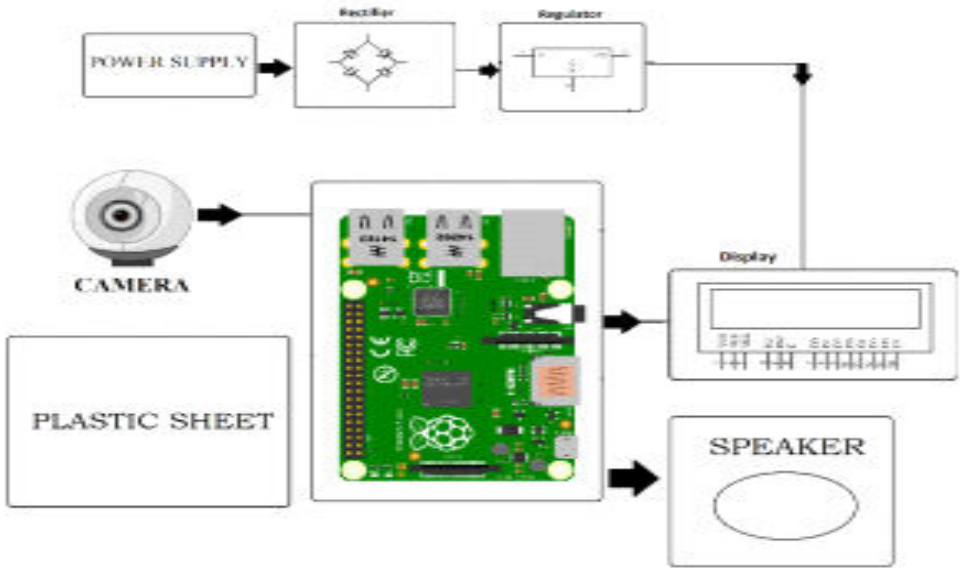

Fig- 3: Architecture diagram

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