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OCR based automatic book reader for the visually impaired using Raspberry PI

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ABSTRACT: Optical character recognition (OCR) is the identification of printed characters using photoelectric devices and computer software. It coverts images of typed, handwritten or printed text into machine encoded text from scanned document or from subtitle text superimposed on an image. In this research these images are converted into audio output. OCR is used in machine process such as cognitive computing, machine translation, text to speech ,key data and text mining. It is mainly used in the field of research in Character recognition , Artificial intelligence and computer vision .In this research , as the recognition process is done using OCR the character code in text files are processed using Raspberry Pi device on which it recognizes character using tesseract algorithm and python programming and audio output is listened. To use OCR for pattern recognition to perform Document image analysis (DIA) we use information in grid format in virtual digital library's design and construction. This research mainly focuses on the OCR based automatic book reader for the visually impaired using Raspberry PI. Raspberry PI features a Broadcom system on a chip (SOC) which includes ARM compatible CPU and an on chip graphics processing unit GPU. It promotes Python programming as main programming language with support for BBC BASIC.

KEYWORDS: Energy efficient Character recognition , document image analysis(DIA), Raspberry PI, audio output, OCR based book reader, python programming.

I. INTRODUCTION

[1] Gives an algorithm for detecting and reading text in natural images for the use of blind and visually impaired subjects walking through city scenes. The overall algorithm has a success rate of over 90% on the test set and the unread text is typically small and distant from the viewer. [2] have proposed a novel scheme for the extraction of textual areas of an image using globally matched wavelet filters. A clustering based technique has been devised for estimating globally matched wavelet filters using a collection of ground truth images.[3] proposes a support vector machine (SVM) is used to analyse the textual properties of texts. The combination of CAMSHIFT and SVM's produces both robust and efficient text detection.[4] tells about the navigational technologies available to blind individuals to support independent travel, our focus is on blind navigation on large scale.[5] presents an approach to automatic detection and recognition of signs from natural scenes and its application to sign translation task that further propose a local intensity normalisation method to effectively handle lighting variations followed by a gabor transform to obtain local features .[6] presents a comparative survey among portable/wearable obstacle detection/avoidance systems to inform about the progress in assistive technology for visually impaired people.

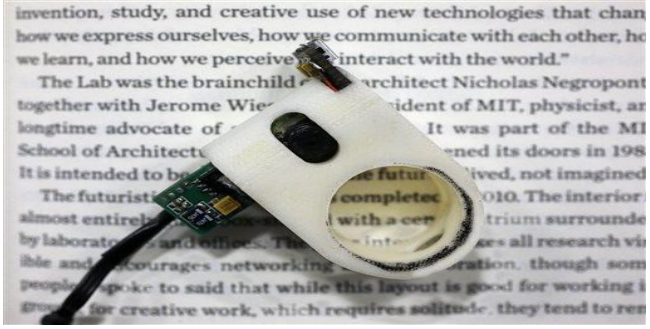

Figure 1: OCR based reader.

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Block Diagram

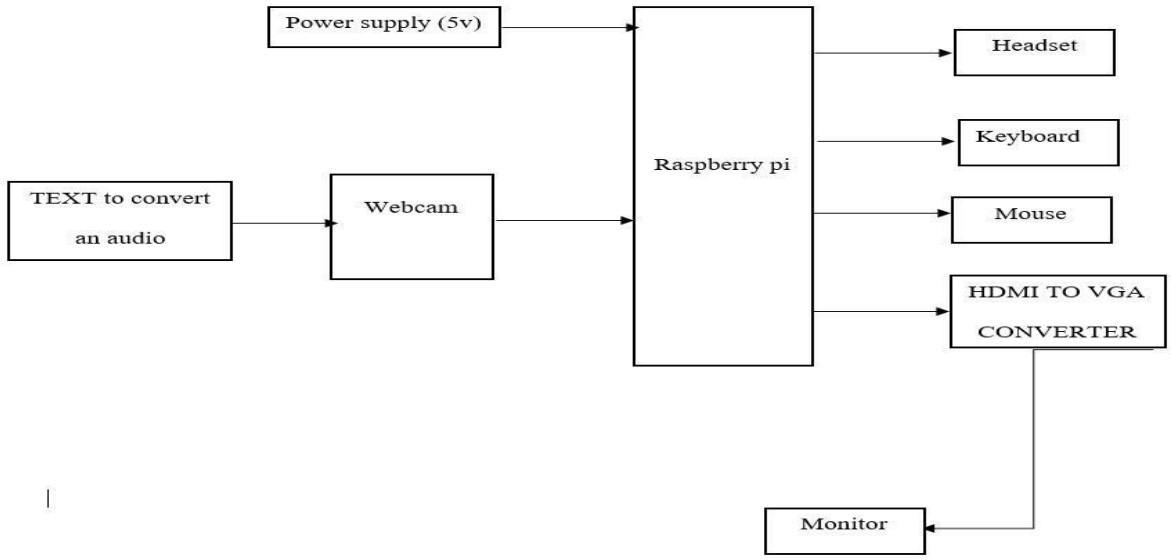

Figure 2: Block diagram of book reader with Raspberry pi.

The above figure shows the block diagram of a book reader, a proto typed system, which reads the printed text on hand held objects on assisting the blind persons. In the prototype systems two calibration were done to prepare for the system test. First we instruct the blind person to place the hand held objects within camera view. Second, in an applicable blind-assistive system, a text localization algorithm might prefer higher recall by sacrificing some precision. When the application is started first it checks whether all the devices are available and also it checks for the connection. The graphical user interface (GUI) has than optional label for displaying the image from the camera, a status box for representing the image. The Raspberry board comes with integrated peripherals like USB, ADC and Serial. On this board we are install the LINUX operating system with necessary drivers for all peripheral devices.

1.1. Working principle

When capture button is clicked this system captures the product image placed in front of the web camera which is connected to ARM microcontroller through USB .After selecting the process button the captured label image undergoes Optical Character Recognition(OCR) Technology. OCR technology allows the conversion of scanned images of printed text or symbols into text or information that can be understood or edited using a computer program. In our system for OCR technology we are using TESSERACT library. Using Flite library the data will be converted to audio. Camera acts as main vision in detecting the label image of the product or board then image is processed internally and separates label from image by using open CV library and finally identifies the product and identified product name is pronounced through voice. Now it identifies received label image is converted to text by using tesseract library. Once the identified label name is converted to text and converted text is displayed on display unit connected to controller. Now converted text should be converted to voice to hear label name as voice through ear phones connected to audio jack port using flite library.

1.2. Raspberry Pi – description

Raspberry Pi is a low cost, credit card sized computer that plugs computer monitor and TV and uses standard keyboard and mouse that uses python programming.

There are two models of Raspberry Pi, model A and model B. These two are bit similar with few advance features on model B compared to model A. Model B has512 MB RAM, two USB port whereas Model A has 256 MB RAM and just a USB port. Besides, Model B has Ethernet port while Model A does not.

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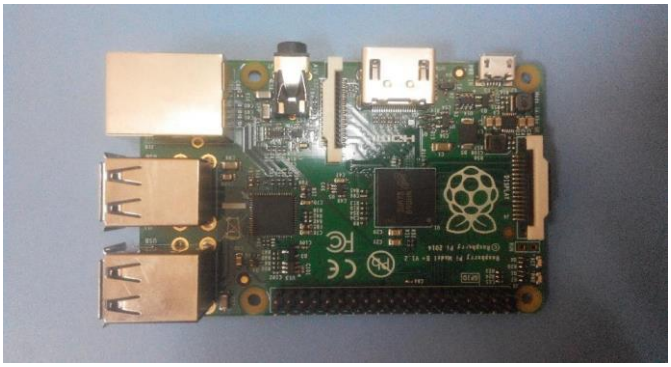
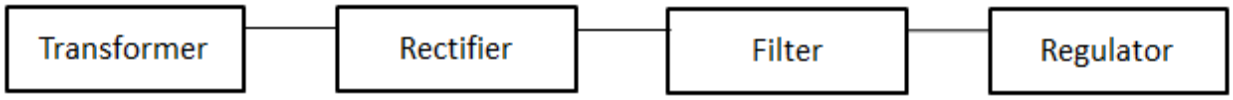


Figure 3: Raspberry Pi Model B.

Some of the components of the raspberry Pi include the SD card, Micro USB power, HDMI out, Ethernet and USB port, RCA video out and audio out, GPIO headers and chips.

1.3. Hardware required for the Raspberry Pi

Transmitting, the hardware components of the Raspberry Pi include power supply, storage, input, monitor and network. POWER SUPPLY UNIT- It is the device that supplies electrical energy to the output loads



It gives a well regulated power supply of +5v with a output current compatibility of 100 mA

1.4. WEB CAM

A webcam is a video camera which feeds its images in real time to a computer or computer network, often via USB, Ethernet or Wi-Fi.

1.5. LENS

Webcams typically include a lens, an image sensor, support electronics, and may also include a microphone for sound.

II. FEATURES OF LOGITECH WEBCAM

- Plug-and-play setup (UVC)
- Video capture: Up to 640 x 480 pixels
- Photos: Up to 1.3 megapixels (software enhanced)
- Frame rate: Up to 30 frames per second (with recommended system)
- Hi-Speed USB 2.0 certified
- Fixed focus
- Universal clip fits notebooks, LCD or CRT monitor

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Figure 4: Logitech webcam.

III. ARTIFICIAL INTELLIGENCE

It is the field of computer science which makes the system to behave intelligently by various process of training and cognitive learning. It is the one of the branch of computer science which aims to imitate human vision and form the basis of image acquisition, processing, document understanding and recognition.

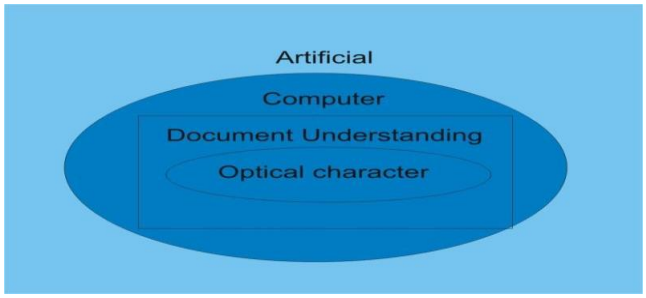

Figure 5: Sub fields of artificial intelligence.

A far more streamlined field of Document Recognition and understanding is Optical Character Recognition which attempts to identify a single character from an optically read text image as a part of a word that can be then used to process further information on. The area gains rising significance as more and more information each day needs to store processed and retrieved rather than being keyed in from an already present printed or handwritten source.

IV. CHARACTER RECOGNITION

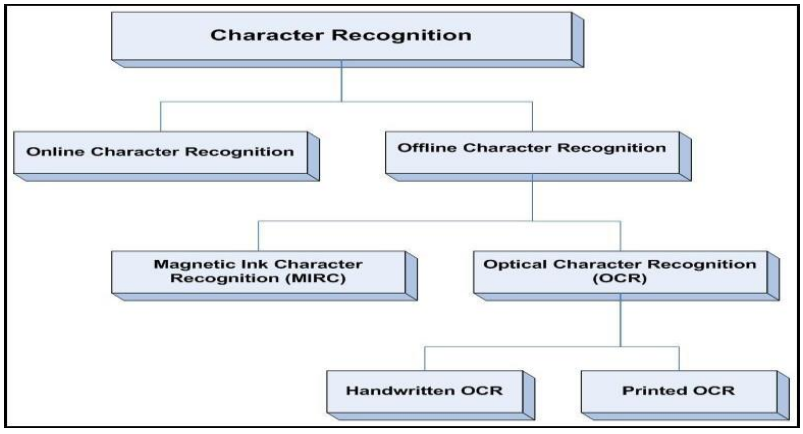

Figure 6: Types of character recognition.

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Character recognition is a sub-field of pattern recognition in which images of characters from a text image are recognized and as a result of recognition respective character codes are returned, these when rendered give the text in the image. The problem of character recognition is the problem of automatic recognition of raster images as being letters, digits or some other symbol and it is like any other problem in computer vision

V. OPTICAL CHARACTER RECOGNITION (OCR)

Optical Character Recognition or OCR is the text recognition system that allows hard copies of written or printed text to be rendered into editable, soft copy versions. It is the translation of optically scanned bitmaps of printed or written text into digitally editable data files. An OCR facilitates the conversion of geometric source object into a digitally representable character in ASCII or Unicode scheme of digital character representation.
OCRs are of two types: for recognizing printed characters and for hand written text OCR PROCESS

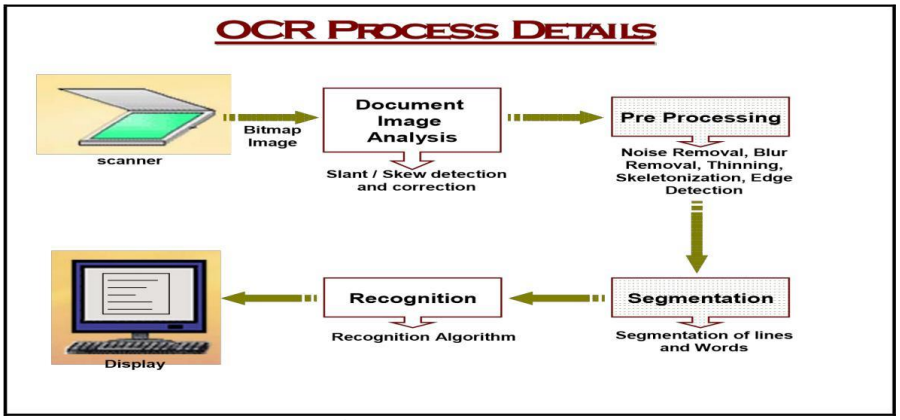

Figure 7: OCR process.

The process include scanning, document image analysis (DIA), pre-processing ,segmentation and recognition.

VI. SOFTWARE DESCRIPTION

6.1. Installation Of Operating System On Raspberry Pi

Raspberry Pi is a small computer; hence operating system (OS) should be installed. As the Raspberry doesn't have hard drive, OS is installed in the external memory. For that, memory card (SD card) is used for the installation of operating system and all the required software and supporting files are stored in the same SD card.

6.2. Use Of Desktop Screen, Keyboard And Mouse For Raspberry Pi

This is the first software need to be installed which can be downloaded from the link, Download Xmingand install it in the laptop. After completion of installation, run the application called 'XLaunch'

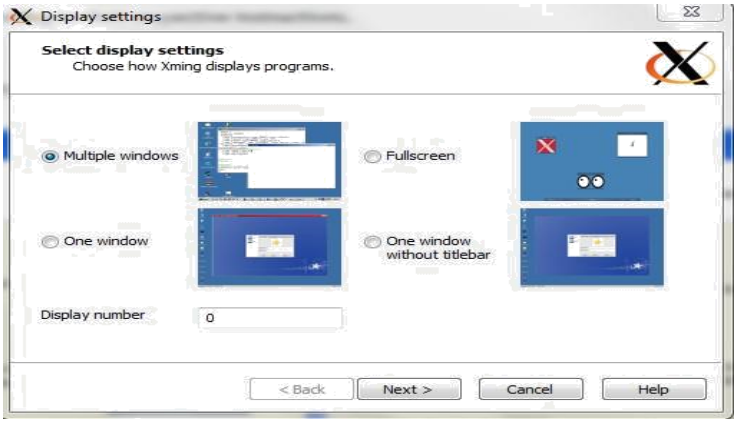

Figure 8: Xming configuration Step 1.

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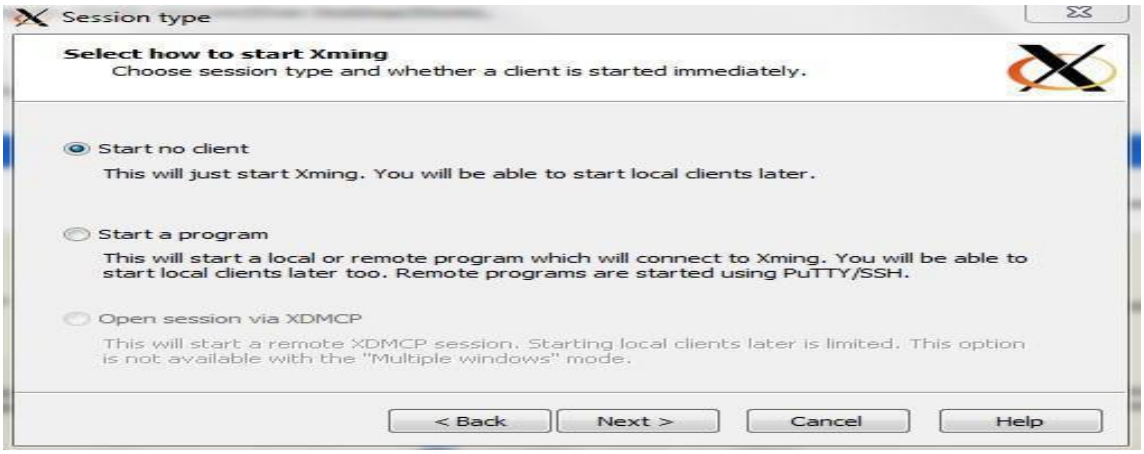

Figure 9: Xming configuration step 2.

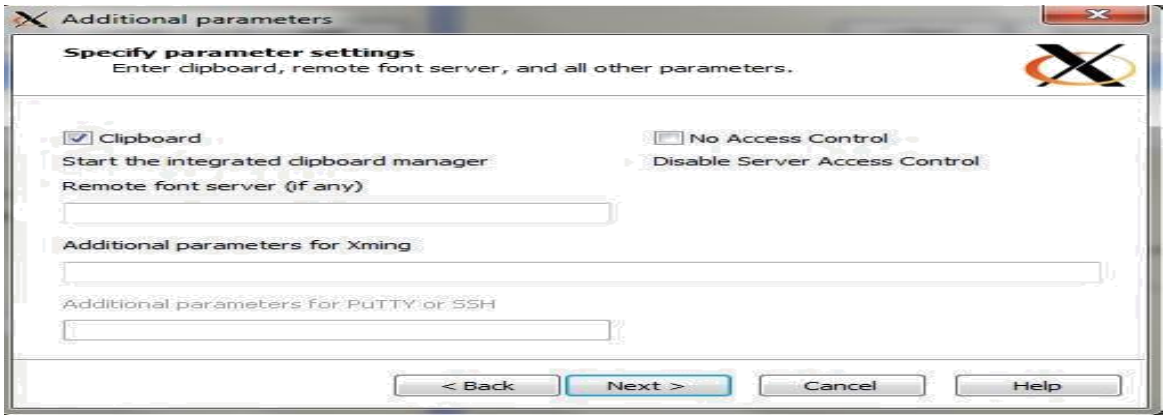

Figure 10: Xming configuration step 3.

Click NEXT button where FINISH button is needed to be clicked for the completion of the setting.. After Completion of configuration, double click the application named as "Xming".

6.3. PUTTY

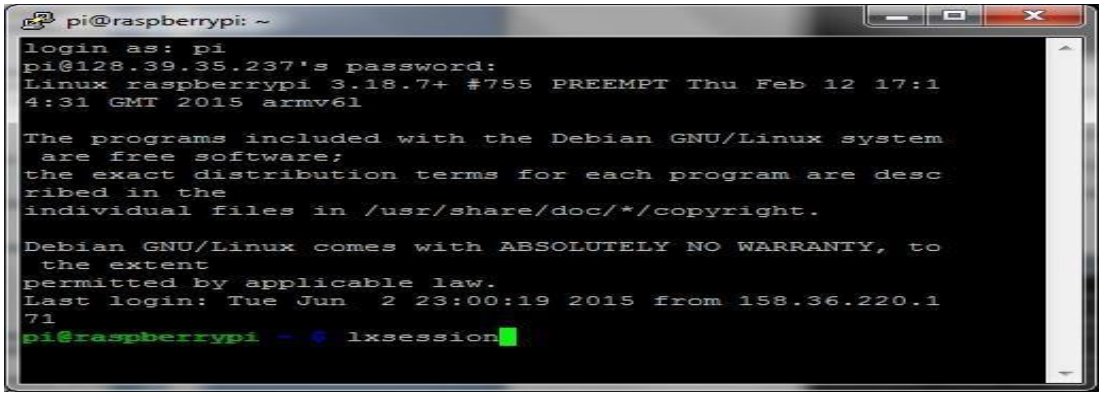

Figure 11: PUTTY success windows.

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This is the primary software need to be installed. It can be downloaded in the provided link as follow, Download Putty. As, it is downloaded, it needs to be installed following some few normal steps of installation. For Configuration, double click the icon of Putty after the completion of installation and enter the IP address of Raspberry Pi as shown in the below figure.

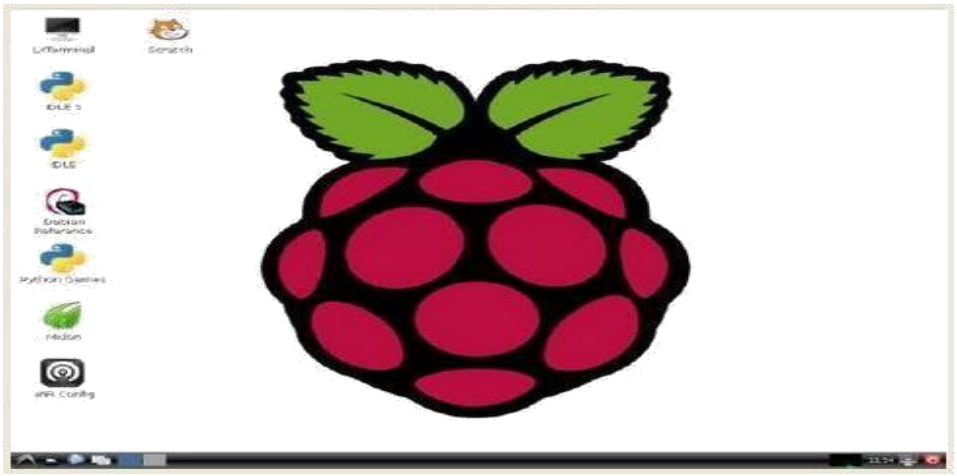

Figure 12: Raspberry Pi.

VII. RESULT

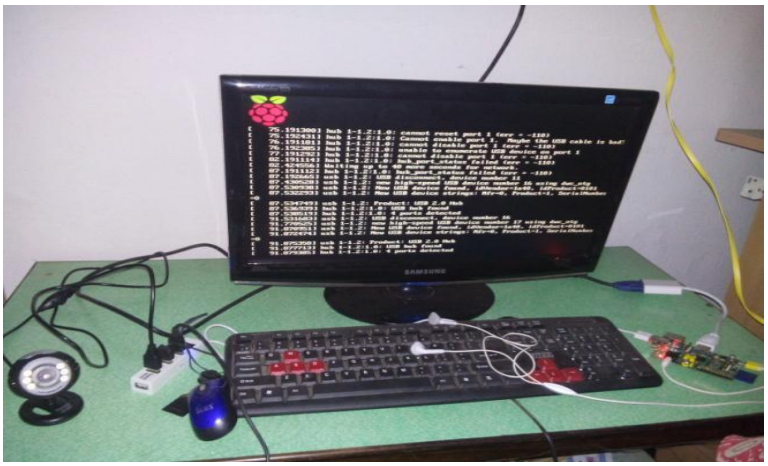

Figure 13: Whole set up with Raspberry pi, keyboard, mouse, webcam and monitor.

VIII. CONCLUSION

In this research, we have described a prototype system to read printed text and hand held objects for assisting the blind people. To extract text regions from complex backgrounds, we have proposed a novel text localization algorithm based on models of stroke orientation and edge distributions. The corresponding feature maps estimate the global structural feature of text at every pixel. Block patterns project the proposed feature maps of an image patch into a feature vector. Adjacent character grouping is performed to calculate candidates of text patches prepared for text classification. An Adaboost learning model is employed to localize text in camera-based images. Off-the-shelf OCR is used to perform word recognition on the localized text regions and transform into audio output for blind users. In this research, the camera acts as input for the paper. As the Raspberry Pi board is powered the camera starts streaming. The streaming data will be displayed on the screen using GUI application. When the object for label reading is placed in front of the

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camera then the capture button is clicked to provide image to the board. Using Tesseract library the image will be converted into data and the data detected from the image will be shown on the status bar. The obtained data will be pronounced through the ear phones using Flite library.

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