Artificial Eye for Blind to Read Translate and Navigate

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Abstract—This Paper Artificial Eye is one of the Modern Computing Device that Unite Human and Machine to Explore Possible Applications mainly in Education sector. It Guides them with multi discipline subject like Electronics Engineering and Health Science which guide blind people to read translate text which is written in English language and also to navigate with speed and confidence this consider a solution to motivate blind people to excel in their Education despite of all difficulties. Here we are using Raspberry pi for processing text. The camera captures image of a handwritten or printed text it uses OCR(Optical Character Recognition) Software to perform conversion of image to text and gtts (Google Text to Speech) to convert text to voice. To translate the text we use Google Translate API. To Navigate and assist the user to find the class room or halls or lab we use RFID sensor where by Digital data encoded in RFID tags are captured by reader with radio waves when the user passes by .The Speech Output is heard by the blind through earphones connected to the glass.

Keywords—Text to Speech, Image to Text, OCR, Raspberry pi, Speech Output, Raspberry Pi, Ultrasonic Sensor, RFID Sensor

1. INTRODUCTION

All over the Globe there are 285 million people who are visually impaired of whom 39 million are blind. These people need some help to make their life easier and the best way to do so is by using Technology. There are special schools and universities for people with special needs but these institutes are not available everywhere and moreover most of them are private and very expensive. The main reason for bringing in Artificial Eye for blind people is to help people with vision difficulties to live a normal life and to study in any school or university without the need of help from others all the time.

2. BLOCK DIAGRAM

The Block Diagram of Artificial Eye is shown in fig1 The Image is captured by using a webcam when the distance between the image and the camera is in the range of 40-150cm. And then the Text detection and recognition takes place by extracting the text from the region of interest.Then finally the recognized text is converted to voice which can be heard by the user through hear phones connected to the glass. The RFID sensor has the RFID reader which reads the RFID tag installed on the doors of classrooms or labs or halls when the user passes by and notifies the user by a voice message.

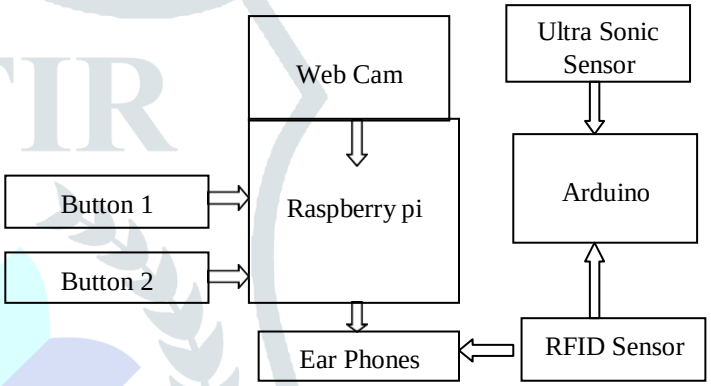

Fig1: Block diagram of Artificial Eye

3. OBJECTIVE

The first main objective of this project is to assist the blind people to read any text from any printed image of books or materials which is in English language. The image containing text which can be of many kinds of patterns with different fonts, colors, scales and multiple orientations and also the device allows the user to translate the text from English to Tamil language if the user wants to do so.

The Second main objective is to guide the blind people to navigate on their own with much self confidence and to assist them to find their respective class room by a voice message to the user when they passes by the class room and we are also bringing in features like battery level message and direction warning message to the user.

On the whole the project objective mainly focus in fulfilling the need of visually impaired people by assisting them in school and college places so, that they can excel in their education and many other different fields on their own without the need of any other person to help them all the time

This is done by implementing a cam-based text reading and translating framework which looks for the area containing the text in the image and extracts them and recognition of text is done by using some machine learning methodologies like open CV OCR and EAST . finally the text is converted to voice which is heard by the user through earphones. RFID based frame work is implemented to navigate and find the classroom or labs or halls.

4. METHODOLOGY

The design consists of an integrated system which passes the printed text as input through camera for digitalization and text recognition is done by open CV OCR with Tesseract and to detect text EAST (Efficient and Accurate Text Detector) is used [1].

OCR is a system designed to detect and extract any text from any image by using machine learning techniques this method is most accurate and robust for detecting text in natural scene image [4] .It is used as an Algorithm to detect almost all the character from any image . Tesseract is an open CV engine very popular for text detection version used here is 4 the package contains OCR Engine and Command line program. Tesseract 4 adds a new neutral net (LSTM) Long Short Term Memory based OCR engine which focus on line recognition it has the ability to recognize more than hundred languages. It can be trained to recognize other language. It is a kind of Recurrent Neutral Network. LSTM's are special kind of RNN, capable of learning long term dependencies. They are design to avoid long term dependencies problem. Remembering information for long term is practically their default behavior not something they struggle to learn so that it enables to read a sequence of character together or word.

OCR MECHANISM

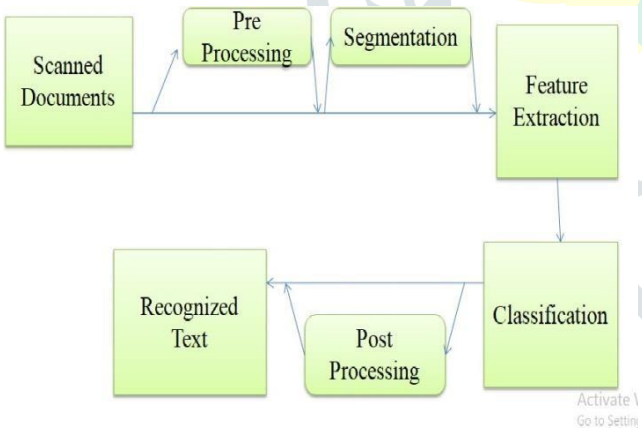

Fig 2: OCR Mechanism [1]

EAST (Efficient and Accurate Scene Text Detector) is a text detector. It is a simple and powerful pipeline that allows detecting a text in natural scenes, and it achieves high accuracy and efficiency. The pipeline directly predicts words or text lines of arbitrary orientations and quadrilateral shapes in full images eliminating unnecessary intermediate steps with a single neural network. The simplicity of this pipeline allows concentrating efforts on designing loss functions and neural network Architecture. The pipeline consists of two stages fully convolution network (FCN) and Non Maximum Suppression (NMS) merging state. FCN directly produces text regions, excluding redundant and time – consuming intermediate steps. NMS adopted as a post – processing step to merge the nearby detection around one object.

The pipeline is flexing to produce either word level or line level predictions, whose geometric shapes can be rotated boxes or quadrangles depending on specific applications. The proposed algorithm significantly outperforms state-of-the art methods in both accuracy and speed [8].

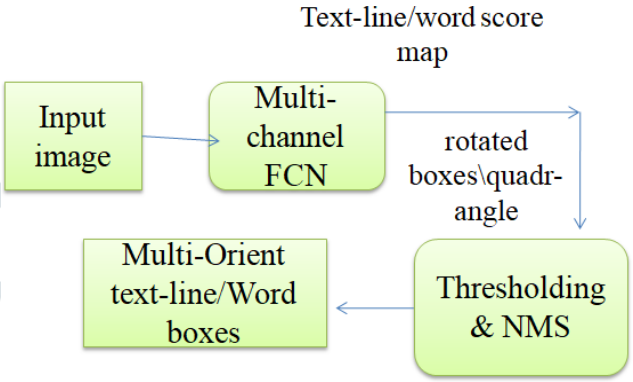

Fig 3: EAST pipeline diagram

5. HARDWARE

Raspberry pi is a system setup which includes specific set of hardware components. It is a credit card size single board computer or programmable pc. It was developed in United Kingdom. Here we are using raspberry pi 3 model B. This model was released in February 2016 with a 1.2GHz 64bit quad core ARM cortex A53 processor, on board 802.11n Wifi, Bluetooth and USB boot capabilities. The Raspberry pi hardware has ended through several versions that features variations in the type of central processing unit, amount of memory capacity, networking support, and peripheral device support.

Radio Frequency Identification technology that uses radio frequency waves to transfer data between a reader and a movable item to identify, categorize, track. It is fast, reliable, and does not require physical sight or contact between reader/scanner and the tagged item. It is a microchip in a label used to transmit data when the label is exposed to radio waves.

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. It uses a transducer to send and receive ultrasonic pluses that relay back information about an objects proximity high frequency sound waves reflect from boundaries of produce distinct echo patters .sound waves are having specific frequencies or number of oscillation per second humans can detect sounds in a frequency range from about 20KHZ.

Arduino is an open source electronics prototyping platform based on flexible, easy-to-use hardware and software. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators.

7. CODE IMPLEMENTATION

Similarly the code implementation shares some common feature such as operating system, language, image extracting process and the library for further processing

Operating system - Raspbian

Library - OPEN CV 4 is a library of programming functions for real time computer vision .The library is cross platform and free for use under the open source BSD license and importing the GPIO library.

Language- Python 3.6

Text Detection and Recognition - OCR and EAST

Translation - Google translate API

Text to voice - gTTS (Google text to speech)

Virtual Networking Computing (VNC) - To Share screen in different operating system.

Wireless Network Watcher (wnetwatcher) - It scans our wireless network and displays list of all computers and devices that are currently connected to our network.

These are the software we are using in our project.

8. PROCESS FLOW

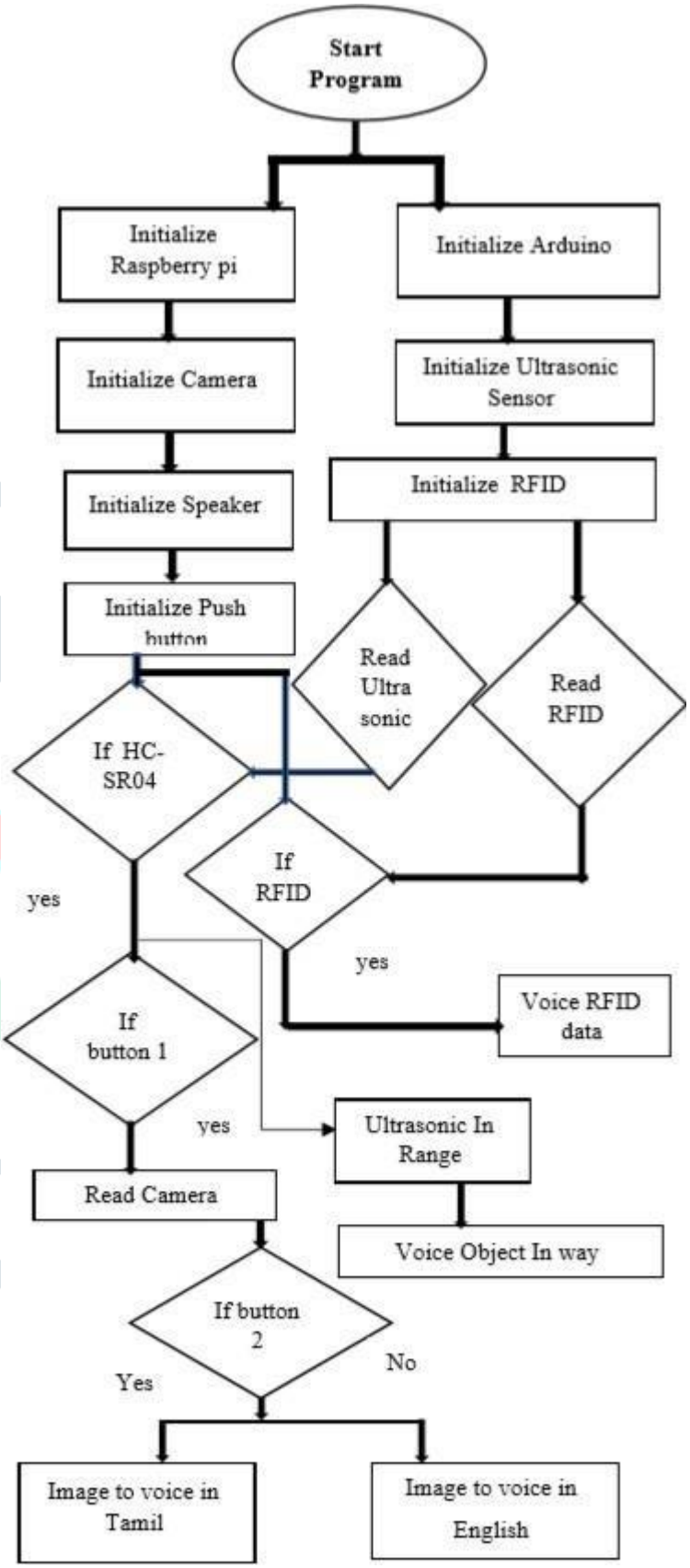

Fig 4: Flow process diagram

9. OUTPUT RESULTS

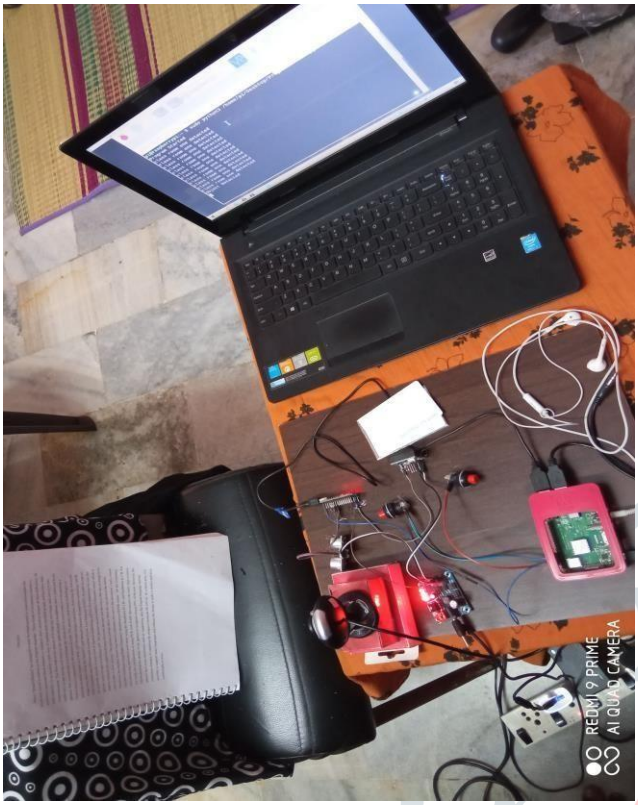

Fig 5: Project Setup

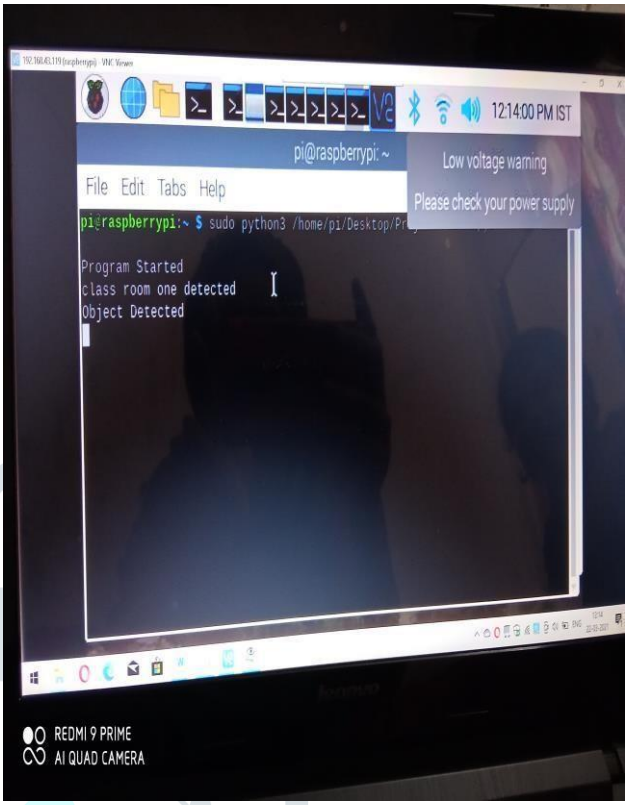

Fig 7: Object Detection output image

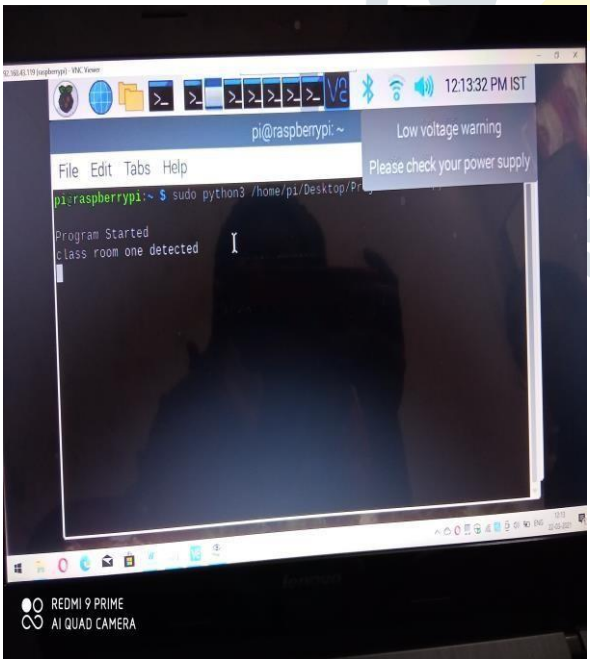

Fig 6: Class room number detection output image

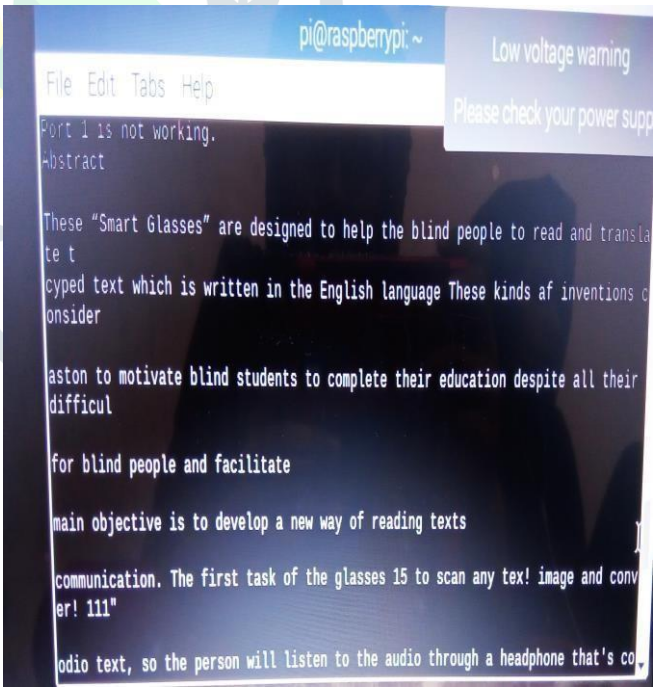

Fig 8: Reading of text from image output image

8. PROJECT DESIGN

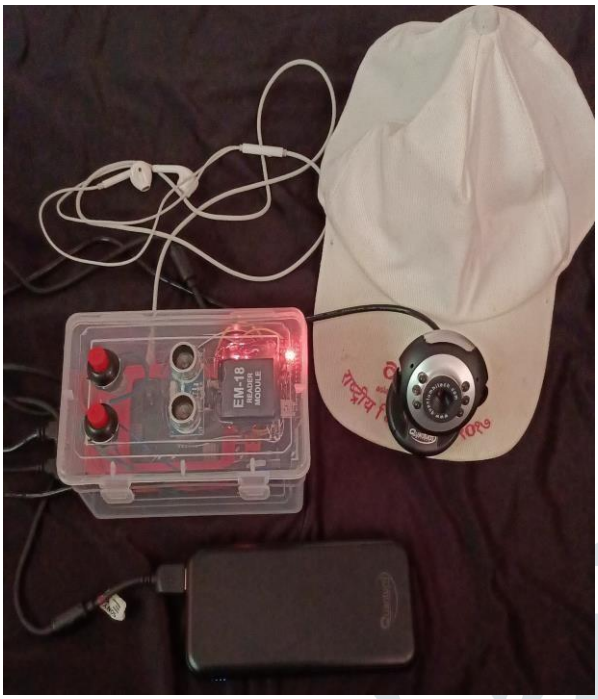

Fig 9: Project Design Image

The Design of our project consists of a box which holds the Raspberry Pi, Arduino Nano, power board, Ultrasonic sensor, RFID sensor, and Buttons which the user hangs around his neck. The WEB Cam is attached to a cap which the user wears it and connects the camera to the Raspberry Pi with the help of a USB cable. The Ear phones are connected to the Raspberry Pi through which the user hears the voice output. And finally the power is supplied to the Device by using a power bank which is connected to the Raspberry Pi.

On the front part of the box we have attached the Buttons, RFID Reader and Ultrasonic Sensors. The RFID Reader detects the Tag which is Installed on the doors and passes the classroom number to the user. The Ultrasonic Sensor warns the user when they detect obstacles around them. The Button 1 is pressed to Read the text from the printed image and the Button 2 to Translate the text from English to Tamil. The user also gets the Battery level message when the Battery level goes low.

9. CONCLUSION

Technology plays a very important role in our day today life. Everything is made simple and less time consuming process with the help of technology. It is growing very rapidly and we are growing with it by adapting the changes. So with this Technology we can easily tackle up every problem by finding significant solution to our problems. Our role is to make the best use of it which will lead to the benefit of Individual, Society and our country.

The Future implementation may include video detection, developing mobile Applications, use of camera with wider view angle, Glasses with GPS notification and less weight.

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