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# An Ergonomic Smart Eye Designed for Reading and Object Detection for Blind People using IOT

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***Abstract***

*The ability to see is a wonderful blessing.Vision helps people to see and understand their surroundings.Blind people have trouble reading books and detecting objects in front of them reading books and detecting objects in front of them. This research paper focuses on the development of an artificial eye that uses a web camera to enhance text reading and for object recognition. A system with additional functionality is designed to support blind people.It is a visual design composed of a few key components such as a camera, Raspberry Pi, and earphones installed together, as well as additional web-based operating technology intertwined. The image collected and processed with the aid of the camera interfaced to the Raspberry pi/IOT technology is the project's input. As a result, the text and objects are detected, and audio information is sent to the blind man through earphones. The objective of this research is to make a low-cost, easy-to-use portable device that can be used anywhere while walking avoiding hurdles and that can also facilitate blind people in reading articles, books, and gaining knowledge.*

**Keywords:** *TensorFlow,YOLO,COCO,RaspberryPi Model B+,Tesseract*

## 1. Introduction

Vision deficiency is a condition in which the ability to distinguish objects is impaired due to physiological or neurological causes.People with virtual disabilities can find it challenging to carry out day-to-day activities. Partial visual disability is described as a loss of operation of an optic nerve or visual focus of the eye. The inability to see causes enormous human suffering for those who are affected and their families. In earlier times blind people can just read Braille. Braille is a reading device used by impaired Persons shown in Fig.1.Braille Folks can use Braille board to read digital displays and other electronics. The vocabulary of the Braille system can be read from left to right through the page, much like written words. The symbols for each letter are made up of between one and six dots backed by the figure of six dots that we could see on a dice or a domino.

**Fig 1:** Braille script

Finger Reader is the next technology that is useful to the BVI shown in Fig.2.It is a finger-worn unit.It allows the BVI to obtain access to plain written text.People who use this gadget scan a text line with their finger, resulting in auditory input of the words as well as a haptic understanding of the layout.These senses could be the beginning or end of a line, a new line, and so on.It even warns the reader if he deviates from the baseline, assisting him in maintaining straight scanning. Blind people require the help of other people to use braille writing, which is time intensive and require lot of practice, and finger reader, which is not a language independent device and is only restricted to the English language and it is not comfortable to wear it for long time.

**Fig 2:** FingerReader device

**Literature Survey**

In this paper,a walkable stick with ultrasonic sensors and buzzer helps to identify the obstacles with warning sound[1]. In this paper navigation system with ultrasonic sensors along with GPS is designed so that blind people move without fear anywhere[2]. In this paper,white cane based on Arduino and ultrasonic sensors detect the obstacles using mobile smartphone application[3]. In this paper, prototype allows for an effective and compact image to braille display conversion, so as to view text on paper by simply taking an image[4]. In this paper the key goal of this project is to improve communication for people with disabilities. It comes with a unique keyboard that is integrated with the braille. It translates the message that a person wishes to send to another person into speech and text, allowing him to hear whatever the blind and deaf want to convey[5]. In this paper suggests a efficient wearable device for the blind that uses IOT to process a Raspberry Pi camera with ultrasonic sensors to provide feedback about objects in the region, with the aid of voice support[6]. In this paper work aims on the Tensor flow API to train a model by using Faster R-CNN methodology for implementation[7]. In this paper OCR is used for converting text in to voice[8].

**Problem Definition**

In previous models the ultrasonic stick was used by blind people for navigating and detecting objects and Braille script was used for reading but by proposing our new system visionless people can identify surrounding objects and know name of object and read text from a picture. By merging the Reading and Object detection models, we could maximise the advantages of both models for blind people.After minimizing the train data to our everyday objects and focusing on a simpler and faster process, we are helpful in improving the frame rate of object identification

**Proposed Sysytem**

The Proposed system developed for visionless people consists of Raspberry pi model B+ and Webcamera shown in Fig. 3.Image capture is done with Webcamera. This System Performs:

*A. Reading of Text*

*B. Object Detection*

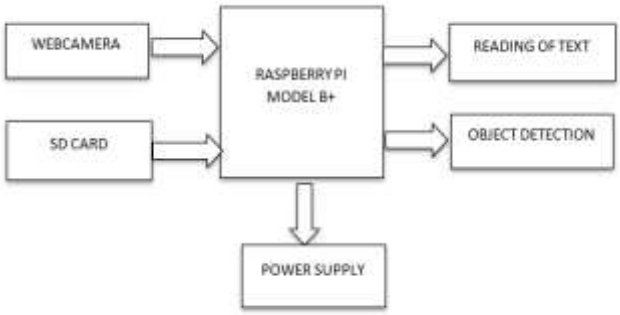


**Fig 3:** Proposed system

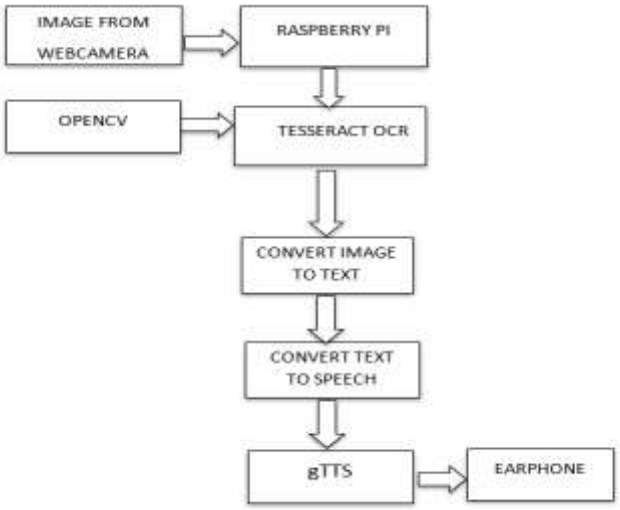


**Fig 4:** Reading of text

*A. Reading of Text*

Reading of text is shown in Fig.4.The image which is to be read is captured using Webcamera. The captured image is in the jpg format. The Image is then fed into Raspberry Pi.Tesseract OCR software converts the image from BGR2GRAY. The text is then converted into speech by gTTS and it is audible through earphones attached.

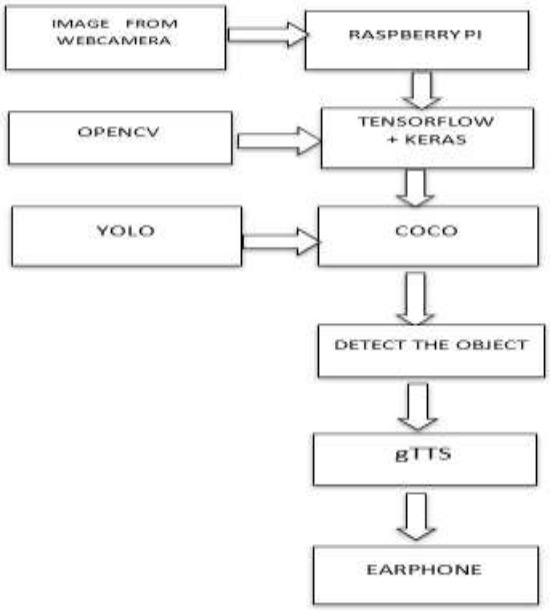


**Fig 5:** Object detection

*B.Object Detection*

Object detection is shown in Fig.5.When the image is catched by Webcamera ,the image is fed into Raspberry Pi.OpenCV is used for image processing. For Object detection, the TensorFlow framework is used. The name of the object is displayed and that text is transformed into sound output through gTTS and it is audible through earphones attached. The key benefit of this study is that it can identify text and recognize object and provide speech output to visually impaired individuals

**Implementation**

1) *Raspberry Pi OS*

Debian OS built exclusively for the hardware of Raspberry Pi with a set of simple programmes and services that enable your Raspberry Pi to run.

2)*Python*

Python is a general purpose, structured, flexible, and object-oriented scripting language. Python is a very readable language.

3) *OpenCV*

OpenCV is a Python open-source library used for computer vision in applications such as artificial intelligence, machine learning, and facial recognition.

4) *NumPy*

NumPy is a Library of python that is used with massive matrices and arrays and in performing large number of high-level mathematical functions.

5) *Tesseract OCR*

Tesseract is an optical character recognition tool that transform image to text form.

6) *CNN*

is a deep neural network class that can take an image as input and apply biases and weights to the image, and differentiate between them.

7) *TensorFlow*

TensorFlow is a software application or tool developed by Google that uses Mathematical algebra and optimization methods to track real time objects.

8)*Keras*

Keras is a Library for python that runs on framework of TensorFlow. It is used for layering neural networks and features mathematically.

9)*YOLO*

YOLO stands for "You Only Look Once". YOLO is a algorithm for detecting objects in real time. This algorithm looks at the entire image in one go and detects objects.

10) *COCO*

COCO is Common Objects in Context. One of the most prominent object detection databases used to train programmes of deep learning is the (COCO) dataset. contains hundreds of pictures of labelled trained objects.

11)*gTTS*

gTTS is Google Text to Speech which is library of python used to convert the text into speech output in real time.


**Fig 6:** Colored image

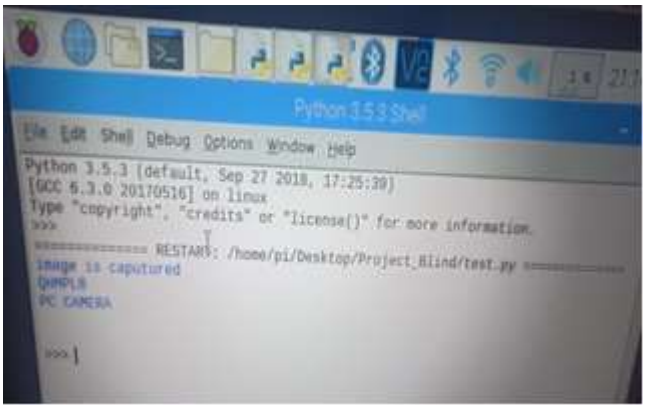


**Fig 7:** Image after conversion into gray scale

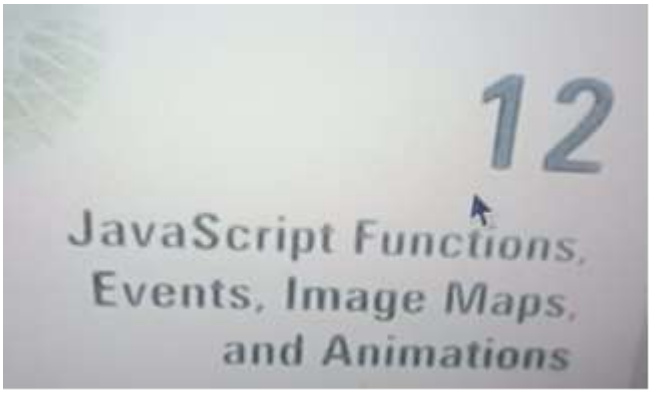


**Fig 8:** Black and white image

## 3. Results and Discussion

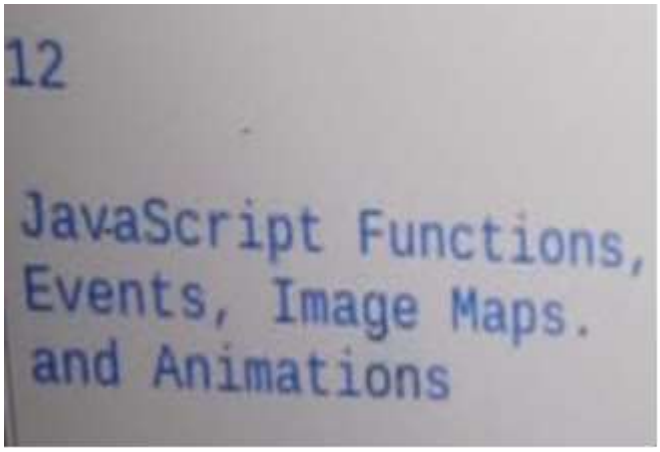


**Fig 9:** Gray scale image

The Fig .6 and Fig. 8 shows the Colored Image and Black and White Image captured by Webcamera.These images are converted into grayscale image (Fig .7 and Fig. 9)using Tesseract OCR.Then the text is changed into audio output using gTTS and audible through earphones attached.During the execution of this method, we discovered that all fonts can be readable.A white backdrop behind the text provide more precise results. Owing to poor lighting conditions the image that is captured by webcamera will often yield incorrect results.

*B. Object Detection*

Images are captured by Webcamera and it is detected by Tensor flow model using YOLO and COCO Dataset. The object name is converted into speech using gTTS and is audible through earphones attached.

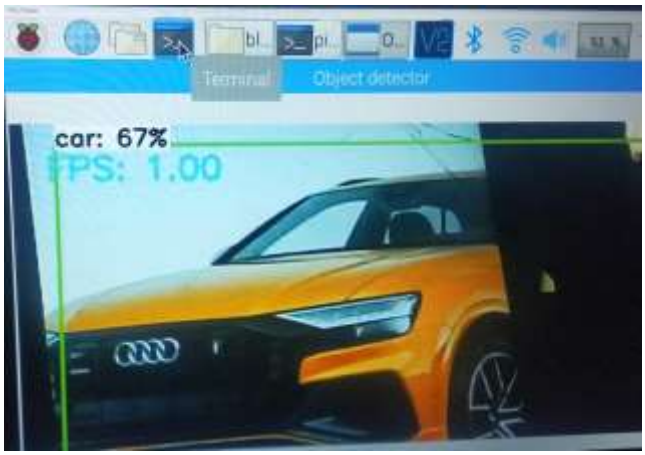


**Fig10:** Car detected

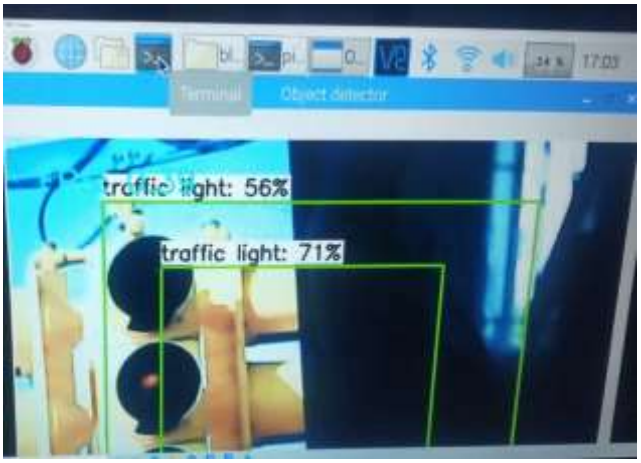


**Fig 11:** Traffic Lights detected


**Fig 12:** Clock detected


**Fig 13:** Banana detected


**Fig 14:** Motorcycle detected

All above Figures(e.g Fig. 10 to Fig. 14) shows objects such as Car ,Traffic Lights,Clock, Banana, Motorcycle detected by Tensor Flow Model. During the execution of this method, we observed that while walking or moving only objects which we trained using TensorFlow model are recognized. Other new objects may be used to train the model for a broader detection range. Due to the Raspberry Pi's limited computing capacity, the fps for object detection is not very fast. We would be able to improve the speed and precision of object identification with more computing power. we cannot achieve 100% accuracy in either reading of text or object detection methods [9-14].

**Viii.Future Work**

1) The data can also be used in form of video recording, which are separated in frames before being translated to text.

2) By integrating this device into a cell phone, it can be made more convenient.

3) For all language groups, the system may be more effective.

## 4. Conclusion

We have designed the prototype model for blind people into a single compact device. The advantage of this device is that it can be easily carried (portable) due to its less weight and size. This portable device help blind people to read the text from Image and read Newspapers, Books etc. Object Detection can assist blind persons in object identification in their surroundings easily.It is developed to assist the blind in their everyday lives and to help them become independent This paper assists the blind in their everyday lives and to help them become independent and live a healthy and comfortable life in society.

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