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TECH ASSISTANCE FOR BLIND PEOPLE

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Abstract— **Throughout the world, there are 39 million blind people. They face issues in their day-to-day life, be it accessing any written script or even recognising their knowns. The proposed system helps them to recognise people (using face recognition), detect any obstacle in the path (thus providing an ease in their day-to-day life), and convert textual scripts into audio signals (text detection) that are provided to the blind person with the help of a microphone. A RPi camera is used to collect all the visuals and RASPBERRY PI 4Bboard. The conventionally used braille system of reading is not very efficient and also all textual scripts are not available in braille language. Therefore, this device can be a great assistance to a blind person as it is low weight, economical and efficient.**

Keywords— **RPi camera, Raspberry PI, face recognition, text detection, object detection**

I INTRODUCTION

The visual sense plays a primary role in guiding a sighted person through an unknown environment and assisting him or her to reach a destination safely. Unfortunately, people who are blind face difficulties in performing such tasks. Many people in our society are afflicted with various illnesses or disabilities. Globally, at least 2.2 billion people have near or distance vision impairments, according to the World Health
Organisation (WHO). To enable such individuals to live comfortably, certain amenities must be made available. For instance, if the atmosphere is suitable, students with vision impairments can study alongside their peers. We can employ computer vision technology to create customised aids that will allow visually impaired persons to live as comfortably as possible in order to resolve this issue. The majority has a notion that those who are blind or have vision issues cannot live alone and constantly require assistance from others. In actuality, they do not always require assistance; they have the ability to live independently most of the time. Using smart glasses for those who are visually impaired is one of the more well-liked solutions in this situation. These eyewear models employ software and hardware for computer vision (camera, image processing, image classification and speech processing) [1]. With such a method, visually impaired people can live comfortably among other people.
This was the motivation behind designing and developing smart glasses to make learning easier for visually impaired students. These glasses are designed to use computer vision technology to capture images and extract English text. The main goals of the proposed system can be summarised as follows. Capture images, extract text from images, identify correct text, and convert text to speech.
The rest of the article is organised as follows. Section II provides an overview of various solutions offered in the area of implementing smart glasses for the blind using deep learning-based computer vision techniques. Details of the design and implementation of the proposed system are given in Section III. Experimental results and their implications are discussed in Section IV. Section V describes the conclusions and future directions of the proposed solution.

II. PROPOSED METHOD

The proposed system has a fully functional model of smart glasses that are built to assist the blind person in several ways. The three assisting features in the device are face recognition of their family member, object detection, and text detection
These smart glasses come with three buttons on it for executing the three different tasks.

1. Button 1- It allows the user to get audio output of the detected texts in front of it.

It makes use of text detection techniques.

2. Button 2- It makes the user aware of the objects in front of it by using object detection techniques when the button is pressed.
3. Button3- When pressed, it allows the user to recognise the already trained dataset of family members and knowns.

The overall flow of events can be understood easily with the help of the diagram below,

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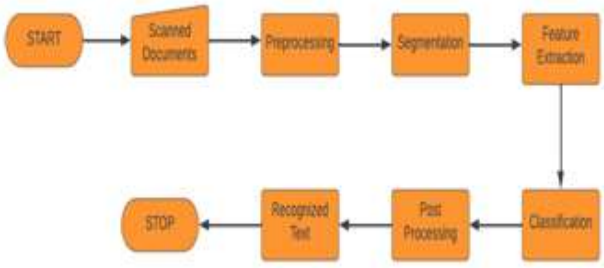
III. SYSTEM DESIGN AND IMPLEMENTATION

The proposed content consists of 2 parts, that is the hardware and the software part. Following is the elaboration of the hardware and software part and the diagram of the system flow.



1) **Hardware design**

The various components that were used to build the smart glasses are-

a) Raspberry Pi

Raspberry Pi is a pocket-sized minicomputer that is available in various models with the latest model of Raspberry Pi 4 B. The model that we are using in this system is Raspberry pi 4 B. It requires a connected keyboard, mouse, display, power supply and a memory card and installed operating system. It includes GPIO (General Purpose Input/output) pins to control various sensors. It is used for various educational purposes, coding and building software's. The operating system that we are going to use in this system is the Raspbian operating system.

b) R-pi camera

The Raspberry Pi camera, also known as R-pi camera is also available in various variants such as V1, V2, etc. But the model used in this proposed system is R pi V1. With a field view of 160 degrees, the R-pi V1 stands out from other normal cameras which have merely 72 degrees of field view. It captures pictures in 1080p resolution and is compatible with major OS available in the market such as Linux, Windows, Mac. The OCR flow can be understood more easily with the help of the diagram below

c) Ultrasonic Sensor

An ultrasonic sensor of range 150-200 cm is used in the system. This ultrasonic sensor radiates out ultrasonic waves that are captured back in the form of echo to measure the distance between objects as it is important before any of the three tasks. According to experimental observations, the distance between objects and the camera must be 40-150cms so as to capture a clear image [6].

d) Earphones

Standard earphones are used in the given system. The Raspberry pi model 4B has a dedicated headphone jack which gives us an extra USB port for use for some miscellaneous. The headphones are given so that the person can hear the converted audio message of the text file and also listen to the messages of obstacles in their path and names of recognised family members. The headphones are chosen as a lightweight and efficient one as they have been connected to the glasses so the blind person does not lose them.

2)**Software design**

The various software components used to build the smart glasses are stated below

a) Google text to speech

Google text to speech is an application developed by Google for its users for obtaining audio files of the detected texts. There are many other TTS applications available for open-source use such as Festival TTS, Pico TTS, Speak TTS, etc. gTTS is widely used and stands above all other applications because it has many features such as converting large text files into audio files, providing correct pronunciations of the words, multiple voice modules, and many languages[12].

b) Open CV library

Open CV stands for OPEN-SOURCE COMPUTER VISION that is used for machine learning projects [11]. Released under the BSD 3 Clause licence, it is free to use. It is compatible on both desktop and mobile devices and supports all major operating systems. Here we are using it on the Raspbian operating system [4].

c) Mobile net SSD

In the proposed system, object detection is carried out using the mobile net SSD algorithm. This Single Shot Detector model uses mobile net as a backbone for faster and efficient object detection. The SSD architecture is based on CONVOLUTIONAL NEURAL NETWORK and follows the following two stages

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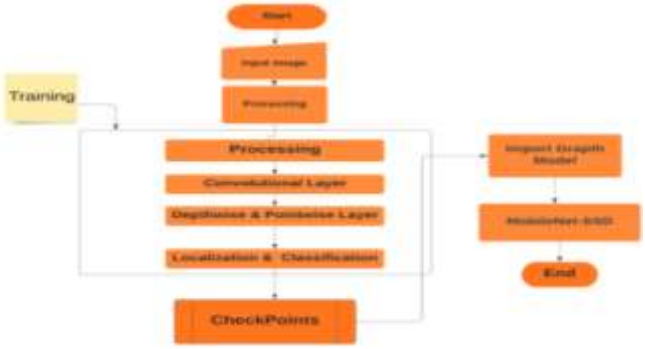
1) Extracting features
2) Applying convolution filters for object detection.

It can be understood easily from the following figure [10]



d) Google teachable machine:

We are going to use Google's teachable machine for face recognition. It is designed by Google for training and testing machine learning models with various images and videos data sets. It is web-based tools that has user friendly interface 3 steps:

1. Data collection
2. Train of model (in which we can select batch size, Epochs, learning rate)
3. Testing the model

After training the model Google teachable machine provides the option of exporting the model which we can use in Raspberry pi 4[9]

IV. RELATED WORK

Tesseract is an optical recognition engine wherein development is sponsored by Google Inc. The version 4 of Tesseract is based on a deep learning-based Artificial Recurrent Neural Network called as Long Short-Term Memory (LSTM) architecture. This OCR engine has high character recognition rates and supports 116 languages [13].

For accurate and robust solution of text detection from scene images MSER algorithm is used as it detects all the characters from any image. The datasets used for this system are ICDAR 2011 and Multilingual datasets. According to results it has 88.52% accuracy in character level recall[14].

An Efficient and Accurate Scene Text (EAST) detector method is a simple and powerful pipeline that allows detecting a text in natural scenes. It has high accuracy and efficiency. In this study, three datasets have been used, that are ICDAR 2015, COCO- Text and MSRA-TD500. According to experimental results, this method has better result as compared to the previous method in terms of accuracy and efficiency [15].

V. CONCLUSION AND FUTURE WORK

This technical paper has proposed and explained implementation of smart glasses to assist the blind people. It recognises faces, detects objects and recognises texts and provides processed output in the form of audio output. Also, according to the market survey, the system here is much more dynamic, efficient and low in cost. Approximate value of the manufacturing costs 5000 INR. Although the system has certain limitations, those limitations can be covered in future scope.

The paper has covered the basic requirement of a blind person. But certain additional upgrade can be added to it.

- A wide-angle camera can be added for more space visibility.
- For a better and more Real-time experience, video processing can be implemented.
- Multi-lingual feature could be added for people with no knowledge of English.

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