Third Eye Wearable Device for Visually Impaired

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ABSTRACT People with limited vision, impaired sight, or visual impairment cannot see or recognise people, objects, words, or letters. Offer visually challenged people a camera-based detection system so they can read names of trained people, products, objects, and texts. With the aid of facial recognition technology, the suggested system will enable them to recognise a person and some of the items in front of them, including (Bottle, chair, person, cat, dog, plant and etc.,). The printed text on books, magazines, and other printed materials can be read by employing optical character recognition technology. The proposed technology serves as a substitute for an artificial eye for persons who are blind. It doesn't require any oversight from people.

KEYWORDS Automatic image extraction, neural network, image recognition and audio output.

I. INTRODUCTION

The third eye is a metaphysical concept that represents a state of improved consciousness and perception rather than a physical structure that may be added to the human body. There are a variety of assistive technologies and devices that can be used to enhance the quality of life for blind people. These technologies include sensory substitution systems that change visual information into other sensory modalities and wearable devices and apps that provide aural or haptic feedback to help with navigation. It is important to be wary of statements that are not backed up by scientific evidence, despite the fact that some researchers or corporations may be looking into the concept of a "third eye" for those who are blind. To identify the ideal answers for particular problems, Speaking with medical experts and experts in assistive technology is always important. People with poor vision, blurred vision, or visual impairments are unable to perceive or recognise things, people, words, or letters. Give those who are blind a camera-based detecting system so they can read words, products, and trained people's names. The recommended method will enable them to recognise a person and some of the objects in front of them using face recognition technology, including (Bottle, chair, person, cat, dog, plant and etc.,). Using optical character recognition technology, the text on books, periodicals, and other printed items may be read. For people who are blind, the suggested technology can replace an artificial eye. It does not call for any oversight from people.

The intriguing and original concept of a "third eye" for people with vision impairment has been advanced by some people and organisations. The objective is to employ technology to create a new sensory organ or device that will enable the blind "see" the

world in a new way. The third eye wouldn't be a physical structure, but rather a device that could convert visual information into other sensory modalities, such sound or touch, allowing the user to interact and experience their surroundings in creative and unique ways.

Even while the concept of a third eye for those who are blind may seem tempting, it is important to keep in mind that this idea is still in the conceptual stage and has not yet been proven to be a practical means to enhance those who are blind's quality of life. However, there are many assistive devices and technologies available today that have been demonstrated to be helpful in helping visually impaired people navigate and engage with their surroundings. These technologies, which range from wearables to applications and sensory substitution devices, can all be used to increase the independence, mobility, and quality of life of those who are blind or visually impaired.

II. RELATED WORK

Recent advancements in invention are improving the standard of living for the average person[1]. According to World Health Organization (WHO) data, many people have visual impairments, which makes it difficult for them to do their daily tasks. Therefore, our objective is to provide a discrete, safe, wearable, and adaptable framework for visually impaired people to aid them in their daily activities. The idea is to create a useful system that can help visually impaired persons by identifying obstacles and categorising scenes. The suggested methodology makes use of a Raspberry-Pi 4B, camera, ultrasonic sensor, and Arduino that is mounted on the person's stick.[1] We capture photographs of the scene and then use Viola Jones and the TensorFlow Object Detection algorithm to pre-process them. The aforementioned methods are employed to find items. We also measured the separation between the blind person and obstacles using an ultrasonic sensor mounted on a servomotor. The research that is being presented uses straightforward mathematics to detect blockages quite effectively. In comparison to other frameworks, this one requires less effort and is convenient and easy to wear.

The advancement of navigation and routing technology over the past few decades has made it difficult for researchers to create sophisticated guiding systems for the blind and visually impaired in both indoor and outdoor environments[2]. (BVIPs). The existing research needs to be examined historically, from early studies on the first electronic navigational aids through the usage of contemporary artificial vision models for BVIPs. Numerous methods are suggested for the navigation of BVIPs, including the use of an e-cane or guide dog, an infrared-based cane, a laser-based walker, and many others. However, the majority of these methods have drawbacks, such as the short-range object detecting capabilities of infrared and ultrasonic based methods. Despite the risk, laser-based assistance if it directly struck someone else's eyes or any other part of their body. [2]To put this technology into use, these trade-offs are crucial.to present an overview of the trends and empirical data in the suggested subject and to rigorously examine, analyze, and identify the major studies in this specialised field. This systematic study activity is carried out by creating a list of pertinent keywords, developing four research questions, establishing article selection standards, and synthesising the available empirical data. The

191 most pertinent studies in our database from between 2011 and 2020 are listed here. (a portion of 2020 is included). The researchers, engineers, and practitioners will be able to make more honest selections for finding To ensure the safety and precise guidance of the BVIPs, holes in the already available navigation aides are identified, and a new and improved smart assistant application is suggested. Numerous consequences of this research effort include a decrease in BVIP fatalities and serious injuries.

Our lives depend greatly on our eyes.[3] Most of us have seen visually impaired people and are aware of the difficulties they encounter on a daily basis. Blind people use sticks when they are walking to detect impediments, however this tool only helps them locate items on the ground. Obstacle detection is a branch of study that has greatly advanced primary safety systems and the interaction of primary and secondary safety systems.[3] An automated gadget for the blind is an obstacle detector. This tool's main goal is to make it easier for blind persons to navigate the walking environment. In this study, a device that aids blind persons through the use of an Android application is created. First, the device is made and then its performance is tested in three demanding conditions, for instance, normal, windy, and rainy conditions. The device shows a satisfactory level of accuracy in the three conditions. It helps the user to hear the distance and the location in an automated human voice. The device is first created, and then its performance is evaluated under three difficult settings, such as normal, windy, and wet weather. In all three situations, the instrument displays a fair level of accuracy. The ability to hear the distance and position in an automated human voice is beneficial to the user.

According to a WHO report, there are 39 million blind persons worldwide. It is a very depressing statement. The folks who are all affected by these visual impairments can use our project to get out of their predicaments. This project's use of an ultrasonic sensor is crucial. Within a given range, it can detect the thing in front of it.[4] The user is alerted by a buzzer sound when an object is found. They can identify a barrier in front of them as soon as they hear this sound.

Millions of people worldwide experience visual problems nowadays. A recent WHO survey estimates that there are 289 million visually impaired people worldwide. They become reliant on others because of this issue. [5]According to recent studies, 108 various techniques are utilised to help the movement of people who are visually impaired. In this research, we'll employ ultrasonic sound to improve blind people's ability to identify obstacles within a range of 3 to 4 metres. The project draws inspiration from the bat's innate navigational mechanism. Even though blind people can navigate using ultrasonic technology, we will only cover the hurdle detection method in this article. The project utilises UNO. [5] Ultrasonic sensors, a buzzer powered by 5 volts, an Arduino cable for burning, and some connecting wires. The vision impaired person will wear a headgear with all of this stuff on it. After being reflected by the obstacle and being received by the ultrasonic receiver, the high frequency ultrasonic sound that the ultrasonic emitter emits is then sent to the processor for further necessary action in the form of some sound.

The sense of sight is regarded as the most significant, and those who are blind are looked upon with sympathy by others [6]. Technology makes it easier for blind people to interact with their surroundings. Communication and information dissemination have accelerated and expanded

to encompass all regions of the globe, having a significant impact on human life. This has increased our access to entertainment and comfort and decreased suffering and hardship in many areas. Since blind people exist in our world, technology must have a substantial impact on their life in order to enable them to access what was previously out of reach. Before, talking canes and other specific hardware gadgets were used to help the blind.[3] OCR Due to the rapid change in hardware, OCR products, colour-identifying barcode scanners, and related gear were expensive and had limited functionality. People with disabilities or blindness encounter difficulties in daily life that are seldom understood. In this work, we attempt to introduce an application called [6] SMART SHOES, which uses technology to assist blind individuals in resolving some of their issues. The application's findings help to better understand the issues that blind people deal with on a daily basis and could inspire the development of additional initiatives to support their independence.

People who are blind or visually handicapped face numerous obstacles when moving around and navigating. Their failure to adapt to or precisely identify their environment obstructs their everyday tasks and is the primary cause of accidents, falling off, and becoming lost in uncharted territory[7]. The design, implementation, and validation of [6] smart shoes will be discussed in this study as a practical approach to providing blind and visually impaired persons with safer movements. The purpose of this system is to identify impediments, moist floors, and patient falls. The user will be alerted acoustically by means of some voice alerts in the event that one of the aforementioned occurrences occurs. Additionally, a mobile phone app is created to alert the patient's parents in the event any problem and let you know where he is. [7]In order to decrease error and false alarms while also increasing accuracy, certain safety precautions, particularly electrical safety, were taken into account during the design phase of the system because it deals with human health. The system was tested on five different subjects, and the results showed minimal false positive rates, good accuracy and detection rates, and accuracy levels of up to 96%.

Others have compassion for visually handicapped people because they lack the most crucial sense—vision.[8] The speed and global reach of communication and information distribution made possible by technology make it easier for people who are visually impaired to interact with their surroundings. Because blind people live in this world, technology must have a significant impact on their life in order for them to benefit from things that were previously out of reach. Ultrasonic sensors connected to a Raspberry Pi board are used in the construction of an IOT-based smart shoe system for blind persons. We offer support to those who are blind, including specialised technology like conversational OCR barcode scanners, obstacle detectors, water sensors, GPS tracking, and wireless charging are some examples of the items. This is a way to use technology to interact with the blind and address some of their issues.[8] Due to their physical integrity, blind people's biggest issue is a lack of trust. The suggested approach aids in accident prevention for blind persons, builds confidence in those who are blind, and aids in the detection of obstacles for those who are visually impaired when walking. The major goal is to give visually impaired persons more self-confidence so they may live independently every day.

Blindness is a qualitative phrase used to describe the clinical condition in which people lose their ability to perceive light completely. Navigation and mobility problems have a significant impact on a blind

person's daily life.[9] The walking cane and guiding dogs are the most enduring and conventional mobility aids for those with visual impairments. Range of motion and the amount of information delivered are their shortcomings. This study suggests a smart shoe that aids the blind in navigation using voice commands that are transmitted by light sources in their path, taking into account the quick evolution of modern technology.[6] Any obstructions in their route are also detected by the shoe. This project's primary goal is to offer dependable mobility and navigation.

Our eyes are perhaps the most priceless asset we have and they play a significant role in our daily life. We are fortunate to have eyesight, which makes this world plain to us. However, some people have lost their capacity for imagination. They will therefore have a great deal of difficulty moving freely in public spaces.[10]. Such visually challenged folks should also have wearable technology built for them.[6] The idea of a wearable gadget that gives directional information to those who are blind is known as a smart shoe. This essay offers a reflection on how to handle the difficulties that blind people look for in smart shoes.[10] A sizeable fraction of the general population manages visual impairment. that it can be created for for blind persons to avoid using this navigational shoe with water and obstacle detection. To provide the best possible indications, such as right, left, front, and back, this design uses four vibration motors. As stated in the header, the motor will start to vibrate. As a result, people with vision problems can travel anywhere without any difficulty. The IR sensor is utilised in the project to identify obstacles; once an obstacle is identified, the buzzer will switch ON in the opposite direction.

One of the strongest senses among all the senses is vision[11]. People who are visually impaired struggle with a variety of mobility issues both indoors and outside. They depend on others for all of their everyday needs. Due to their inability to adapt to and recognise their surroundings, people who are visually impaired frequently have accidents, frequently stumble, and may become lost in strange places.[6] "Smart Shoes" are made to offer a better way for the blind to move securely and on their own. The shoes have a buzzer, speaker, vibration motor, and other sensors, microcontrollers, all developed utilising "Internet of Things" technology. When someone walks in front of the wearer, the shoe sounds an alarm of a barrier.[11] In addition, it notices damp floors and water bodies and alerts the user. Every time a visually impaired individual falls, a warning message is sent to the parent's or caretaker's Telegram bot to boost security and safety. Smart shoes are made to be a safe and cosy companion for people's daily activities. As a result, a full range of adaptive technology is being developed to raise the standard and comfort of living for people who are blind.

We all agree that God gave us eyes as the best gift.[12] Due to the presence of eyes, we are able to see everything that occurs around us. However, some people are either blind or have permanently lost their vision, making it impossible for them to perceive what is going on in their immediate surroundings. These people deal with numerous difficulties on a regular basis. They moved and detected objects by using walking sticks or canes. However, a stick only has a small range and does not produce accurate results[12]. There are many different kinds of sticks and other items on the market, but because they are quite expensive, only wealthy people can afford them. This paper presents smart shoes for blind person.[6] This smart shoe is easy to use and it creates user-friendly environment for blind person. It is wearable system. And it is not expensive. In this ultrasonic sensor, buzzer, battery, Arduino Uno and jumper wires are used This essay offers blind people

smart shoes.[6] This smart shoe is simple to use and makes a world that is accessible to the blind. The system is wearable. And the price is reasonable. Buzzer, battery, Arduino Uno, and jumper wires are used in this ultrasonic sensor.

To feel secure when moving, blind persons require some assistance.[13] The smart stick is a suggested method for enhancing blind and visually impaired people's movement. Stick solutions involve a variety of technologies, including laser, infrared, and ultrasonic, but they still have limitations. In this study, we suggest a smart stick based on infrared technology that is lightweight, affordable, user-friendly, quick to respond, and low power consuming.[13] Within a two-meter range, a pair of infrared sensors can identify the existence of stairs and other obstacles in the user's route. The experimental results are accurate, and the stick can find every barrier.

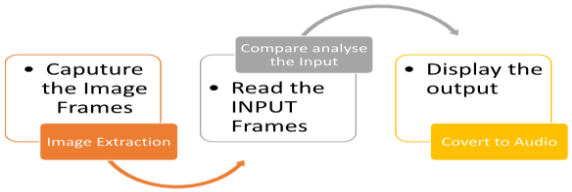
People who are blind have a full life of responsibilities. Blindness, however, makes it difficult for them to carry out their duties[14]. Many blind people walk around and carry out their jobs with a conventional stick. Traditional sticks, however, do not detect impediments, making them useless for those who are blind. The blind individual is unaware of the kind of items or barriers in front of them. The blind person is unaware of both the object's size and the distance between him or her and it. Being blind makes it challenging to move about. They will be able to identify ways to help people with vision impairment by streamlining, making more comfortable, and organising many of their everyday duties. anything (an obstacle for blind people[13]). You can utilise a smart stick with a smartphone app. One of the ideas is a mobile Internet of Things stick designed to help persons with vision impairments navigate more easily. People who are blind or have low eyesight can use it to comfortably and easily navigate and complete their everyday duties. a highly enhanced blind stick that makes it simple for those with vision impairments to move[14]. The system of hardware and software suggested in this research enables people with visual impairments to navigate environments in a simple and comfortable manner. The suggested system makes use of a smart stick and a mobile application to assist blind and visually impaired individuals in recognising items in their environment, such as walls, tables, cars, and People can avoid these items by staying in their ways as a result. As a result, the system would also alert the user by playing sound on the smartphone. Finally, he or she would be able to send an SMS with their GPS location if they become lost.

In their lifetimes, blind persons must do numerous tasks[15]. However, being blind makes it difficult for them to carry out their duties. Many blind people walk around and carry out their jobs with a conventional stick. Traditional sticks, however, do not detect impediments, making them useless for those who are blind. The blind individual is unaware of the types of obstructions or items in front of them. The blind person is unaware of both the object's size and the distance between him or her and it. Being blind makes it challenging to move about. They will be able to recognise anything (a barrier) to help persons with vision impairment by making many of their daily tasks easy, comfortable, and organized for the blind).[13] It is possible to use a smart stick with a mobile application. One of the ideas is a mobile Internet of Things stick designed to help persons with vision impairments navigate more easily. People who are blind or have low eyesight can use it to comfortably and easily navigate and complete their everyday duties. a highly developed blind stick that makes it simple for those with vision impairment to navigate around.[15] The system of hardware and

software suggested in this research enables people with visual impairments to navigate environments in a simple and comfortable manner.[13] The suggested system makes use of a smart stick and a mobile application to assist blind and visually impaired people in recognising items in their environment, such as walls, tables, vehicles, people, etc. this can enable them to avoid these objects. In addition, as a result, the system will notify the user through sound from the smartphone. Finally, if he/she gets lost, he will be able to send an SMS with his/her GPS location this may help them avoid these things. The system would also alert the user by playing sound from the smartphone as a result. Finally, he or she would be able to send an SMS with their GPS location if they become lost.

III. PROPOSED SYSTEM

To solve the current drawbacks, we created a flawless system in the system that is being presented. We suggest a camera-based detection system that allows visually impaired people to read names of trained people, products, objects, and messages. The proposed technology serves as a substitute for an artificial eye for persons who are blind. It doesn't require any oversight from people.



Modules:

Module (i):

i. **Family Member Recognition**

These are the measures that were taken for the project:

Data collection: Gather shots of family members' faces taken at various angles and under varied lighting situations. Make sure the pictures are sharp and well-lit.
Data preprocessing: To guarantee consistency, convert the photos to grayscale and resize them to the same size. Extract facial features by applying the Haar Cascade and LBPH. While LBPH records the local texture patterns of the face, Haar Cascade detects facial characteristics like the eyes, nose, and mouth.
Model training: Use the retrieved features to train the model and label the data with the names of the family members.
Face Recognition: Use the model to identify faces in a live or recorded video feed to gauge its accuracy. The programme should be able to recognise the faces and label them with the appropriate their corresponding family member names.

Module (ii)

The Module focuses at developing a real-time object identification system for visually impaired people utilising Python, Open CV, and a Caffe model file. To notify the user of the existence of an object in the video feed, the system will use auditory cues.

The following are the steps involved in the project:

1. **Data Gathering:** Gather information for the system of object detection. Use an existing dataset or

take a video of the object or objects of interest to accomplish this.

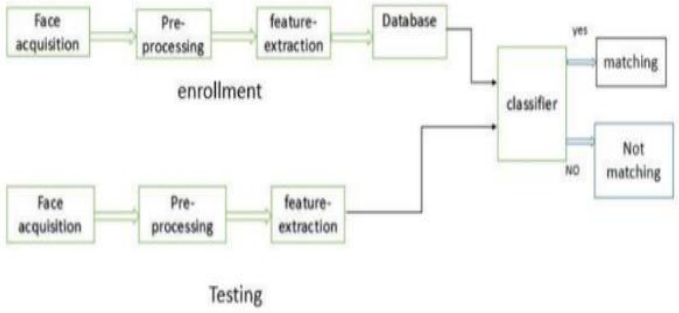
2. **Model Selection:** Select a Caffe model file that has been previously trained and is suitable for users who are blind. The model ought to be capable of identifying typical items like doors, chairs, and people.
3. **Data Preprocessing**: To ensure consistency, convert the video feed to grayscale and resize it to a standard size.
4. **Object Detection:** To find items in the feed, use the Caffe model file. Create an audio cue to notify the user when an object is discovered. Each object's auditory cue should be distinctive, enabling the user to recognise the thing.
5. **Real-time Processing:** Check to make sure the system can process the feed in real-time with the shortest possible lag between object identification and audio cue creation.
5. **Audio Cues:** Produce audio cues to read the user's recognised text. There should be a playing speed adjustment option and the audio should be understandable and crystal clear.
6. **Real-time Processing:** Ensure that there is little to no lag between text identification and audio cue creation so that the system can process photos and documents in real-time.The LBPH algorithm is a part of OpenCV.

Module (iii):

The goal of the module is to develop an OCR (Optical Character Recognition) system specifically for visually challenged people using Python and OpenCV. The technology will read out text from photos or documents using audio triggers.

The following are the steps involved in the project:

1. **Data collection:** Gather photos or documents with text for the OCR system to read.
2. **Image preprocessing:** To improve the text's quality, use OpenCV to preprocess the photos. The images' brightness, contrast, and sharpness can be changed to achieve this.
3. **Text Detection:** Using OpenCV, locate any text-filled areas in the image.
4. **Text Recognition:** To identify the text in the detected regions, use a pre-trained OCR model. A substantial dataset of text in various fonts and sizes should be used to train the OCR model.



The LBPH uses the following four parameters:

Radius: Radius: The radius represents the area surrounding the centre pixel and is used

to construct the circular local binary pattern. Typically, it is set to 1.

binary pattern. Keep in mind: the more sample points you include, the higher the computational cost. It is usually set to 8.

Grid X: The quantity of cells arranged horizontally. The resulting feature vector has a higher dimensionality the more cells there are and the finer the grid is. Usually, it is set to 8.

Grid Y: The quantity of cells arranged vertically. The resulting feature vector has a higher dimensionality the more cells there are and the finer the grid is. Usually, it is set to 8.

2. Training the Algorithm: We must first train the algorithm. In order to do this, we need a dataset that contains the facial photographs of the persons we want to identify. For each image, we must additionally include an ID (which may be a number or a person's name), which the algorithm will use to identify an input image and provide an output. The same ID must appear on all images of the same person. Let's look at the LBPH computational steps with the training set previously built.

Neighbors: how many sample points will be used to construct the circular local

IV. OUTCOME

Face Detection System Architecture

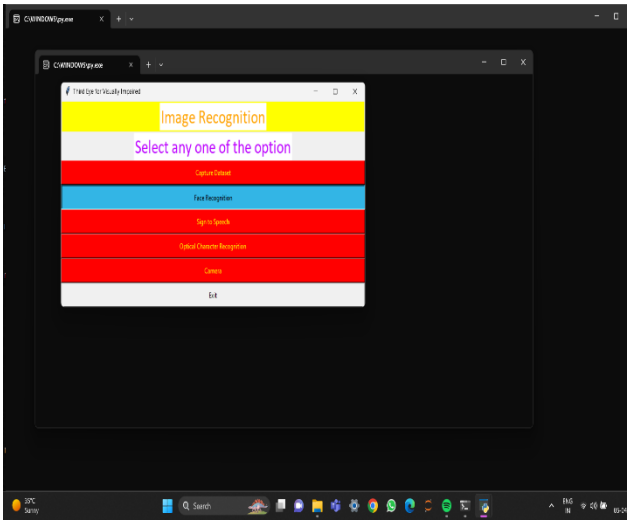
Local Binary Patterns Histogram (LBPH)

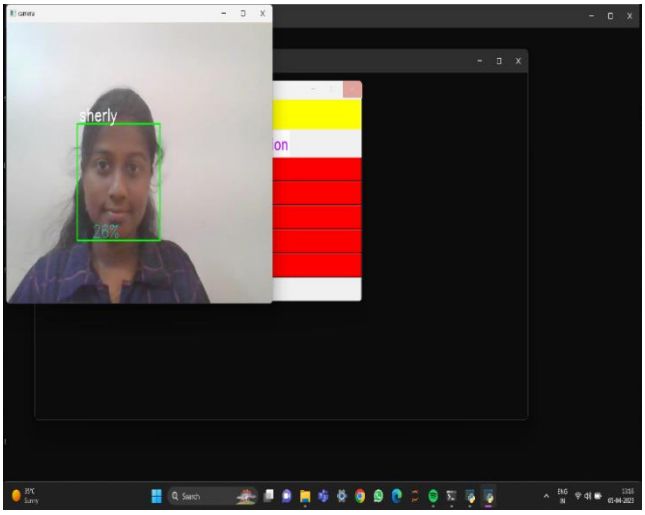
Local Binary Patterns The histogram algorithm was proposed in 2006. depending on the local binary operator. It is frequently used in facial recognition due to its powerful discrimination capabilities and simple computational design.

3. Applying the LBP operation: The initial computational step in the LBPH is to produce an intermediary image that more accurately describes the original image by emphasising the face features.

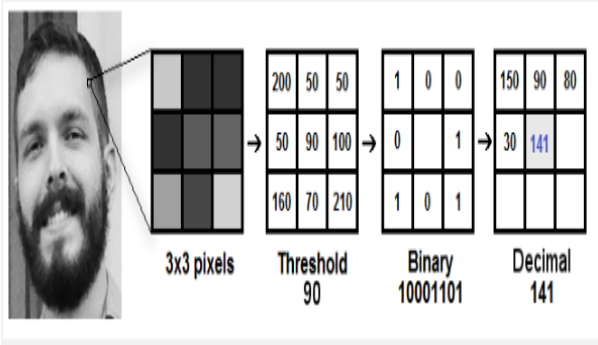
To do this, the following steps are necessary:

- Face Extraction
- Feature Acquisition
- Collecting
- Classifying Datasets





The image below shows this procedure:



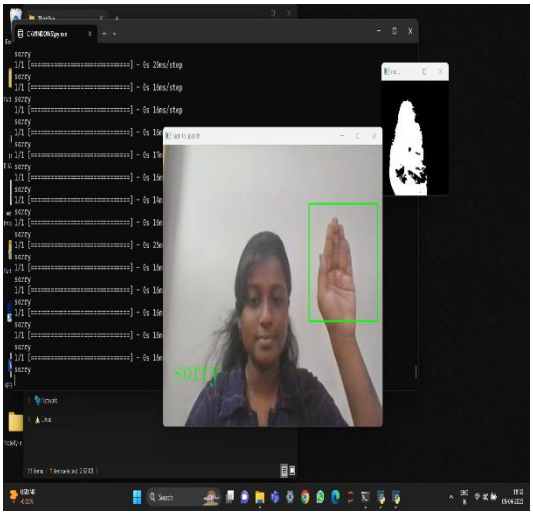
Based on the image above, let's break it into several small steps so we can understand it easily:

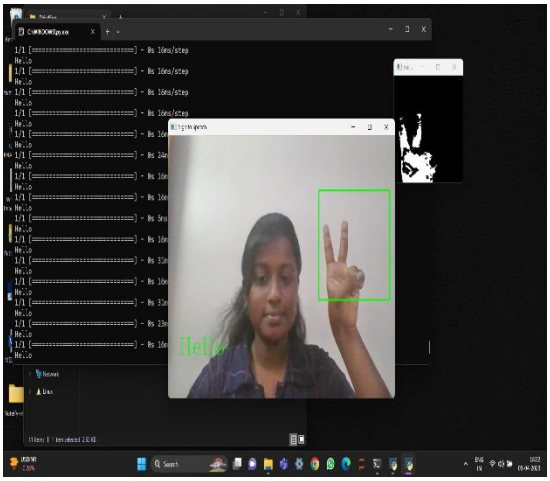
- Assume we have a grayscale image of a face.
- A 3x3 pixel window will give us a portion of this image.
- A 3x3 matrix with the intensity of each pixel (0–255) can likewise be used to represent it.
- The matrix's central value must then be used as the threshold, which is what we must do next.
- The new values from the eight neighbours will be defined using this value.
- We establish a new binary value for each neighbour of the threshold value. We set the threshold at 1, with 0 denoting values below it, and 1 denoting values equal to or higher than it.
- The matrix will now only have binary values. (ignoring the central value). Each binary value from each place in the matrix must be concatenated line by line to create a new binary value. (e.g. 10001101). Note that while various authors concatenate the binary values in different ways (such as in a clockwise direction), the outcome will be the same.
- The central value of the matrix, which is actually a pixel from the original image, is then assigned to this binary value once it has been converted to a decimal value.
- After this process (the LBP technique), we obtain a new image that more accurately captures the qualities of the original image.
- It should be noted that the LBP technique has been expanded to employ a varied number of neighbours and radius.

Real time Object Detection using SSD Mobile net

Finding instances of semantic objects that belong to a particular class (such as people, buildings, or cars) in digital photos and videos is the aim of the computer science discipline of object detection, which is connected to computer vision and image processing. Face and pedestrian detection are two well-researched object detection fields. Image retrieval and video surveillance are just two computer vision applications that make use of object detection.

As the name suggests, object detection is a technique for finding items in the physical world. Examples include humans, dogs, cars, and birds. This technique allows us to swiftly ascertain the presence of any immovable objects. It also makes it easier to differentiate a variety of objects in a single frame, which is an outstanding benefit. The SSD model in the image below recognised the glasses, laptop, coffee, and mobile phone all properly in a single scan. In a single photograph, it might discover numerous different objects.





Text to Speech

GTTS

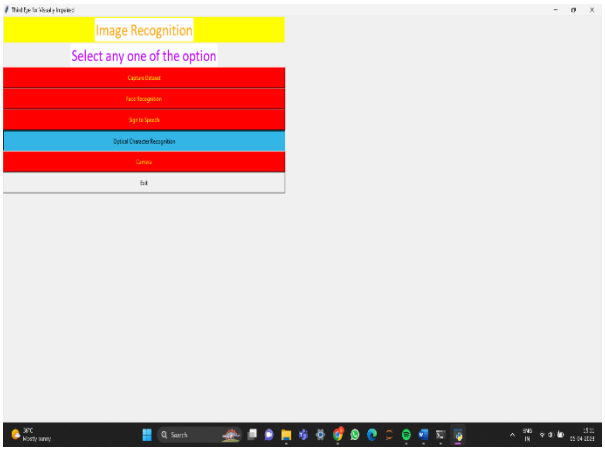
The Python library and CLI tool gTTS are used to connect with Google Translate's text-to-speech API. (Google Text-to-Speech). For further audio editing, send spoken mp3 data to stdout, a file, or a byte string. Perhaps you could simply prepare Google Translate TTS request URLs beforehand and send them to external applications.

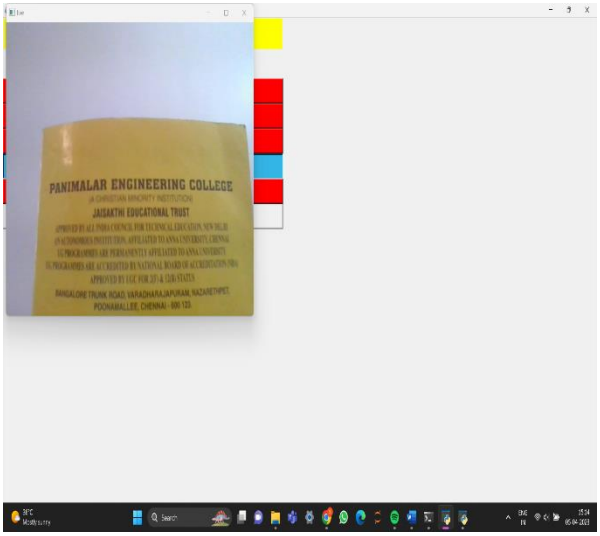
Features

A sentence tokenizer designed specifically for speech that can be altered to read sentences of any length while keeping punctuation, abbreviations, decimals, and more; text preprocessors that can be customised and, for example, correct pronunciation.

Audio Player

AudioPlayer is a cross-platform Python 3 module for playing sounds. (mp3, wav). Opening media files, playing (looping/blocking), stopping, picking up where you left off, halting, and modifying playback volume are all included in its list of fundamental audio player features.





V. CONCLUSION

It's a fascinating idea, but it's important to approach the development of a "third eye" for blind or visually impaired people seriously and realistically. It is exciting to imagine a new sensory organ or tool that could help visually impaired people navigate and interact with their surroundings in creative and novel ways, but it is important to understand that this concept is still in the conceptual stage and has not yet been proven to be a practical solution.

The quality of life for those who are blind or visually impaired has been shown to be improved by a number of assistive technologies and devices that are now in use. The goal of these technologies is to increase freedom of movement, independence, and overall quality of life. They range from wearable technology and apps to sensory substitution devices. It is essential to interact with medical professionals and experts in assistive technology in order to find the best solutions for particular requirements and to approach new ideas with a critical eye while being open to new possibilities for improving the lives of persons who are visually impaired.

Python-tesseract is a tool for optical character recognition (OCR). To put it another way, it will recognise and "read" any text that is present in images.Python-tesseract is used to encase Google's Tesseract-OCR Engine. It is useful as a standalone invocation script to tesseract since it can read any image type supported by the Pillow and Leptonica imaging libraries, including jpeg, png, gif, bmp, tiff, and others. Additionally, when used as a script, Python-tesseract will print the identified text rather than saving it to a file.

VI. REFERENCE

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