Face Recognition and Obstacle Distance Measuring System for Visually Impaired

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ABSTRACT

People who are visually impaired deal with numerous difficulties every day. They always require assistance. Independence from carers is increased through mobility. For persons who are blind or visually challenged, face recognition technology built into smart glasses may be a useful tool for recognizing people they contact with. Identification might be difficult when family members are mute. Blind persons can recognize their own family members rapidly, thanks to facial recognition technology. Using this method, the blind guy can hear the names of his neighbours and family members. With the use of worn eyeglasses fitted with an ultrasonic sensor, the blind can safely travel around various sites on their own, avoiding any potential risks they could run into, both fixed and mobile, and preventing any potential accidents. This system has an ultrasonic sensor that calculates the separation between two objects. The distance between the sensor and the item is determined by keeping track of how long it takes for the sound wave to produce and return after striking the impediment. The suggested smart glass solution is practical, light, very affordable, and very effective.

Keywords: Face Recognition, Ultrasonic Sensor, Smart glass.

1 Introduction

In recent years, there has been a significant increase in the number of applications that use face recognition technology. It has a great deal of promise to aid those who are visually impaired, for instance. With the introduction of face recognition technology, people who are visually impaired can benefit from increased facial recognition abilities, which can considerably improve their daily life. Visual impairment can have a substantial influence on a person's ability to distinguish faces, which can have significant social and practical implications in their day-to-day lives. However, face recognition abilities can be improved with the development of an assistive device that combines computer vision technologies to assist blind people in detecting and recognizing the faces of individuals around them. Using a built-in camera, an assistive device system designed to capture real-time videos of people's faces. The video is then cut into a number of frames. Sophisticated computer vision algorithms are then used to find and identify the faces in the frames. A facial recognition system can be trained to recognize faces using a data collection of images. The system can feed images to a server for analysis, or a distant computer might run this algorithm. The visually impaired user can then utilize the audio input, such as the name of the recognized person being said, to recognize the person in their near vicinity without the requirement for a visual signal. This technology has the ability to significantly enhance the quality of life for visually impaired persons by giving them more self-assurance and independence when navigating social situations. It can help individuals recognize familiar faces, such as those of family members, friends, or coworkers, and facilitate social interactions by providing them with real-time information about the people they are dealing with. Blind people can feel more secure and comfortable in public settings if they can recognize strangers. A system with face recognition technology can help the visually impaired recognize people and communicate with them more confidently by giving them real-time feedback and assistance.

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2 Objective

The goal of the project is to design an assistive gadget that will enable independence for blind persons. constructing a system that employs image processing to identify the family members and friends who are closest to a blind individual. The system classifies the image as either a person or an object using image processing. To recognize the items in front of the blind, an ultrasonic sensor is employed.

3 System Analysis

3.1 Proposed System

The suggested system can help someone with vision impairment recognize persons in front of them and learn about potential dangers along the route. Navigation is challenging for those who are visually impaired because they frequently lack the knowledge necessary to avoid hazards and obstacles [1]. This will be feasible thanks to features like distance detection and face recognition. This approach strives to eliminate the need for assistance for people with disabilities. Promoting autonomous mobility and removing dependence on any helper promotes a sense of self-reliance. Because they participate in fewer social activities due to their functional mobility concerns, people with these conditions tend to be distant. This leads to stress, loneliness, and a fear of being treated with less respect. Our objective is to create an advanced system that can imitate the human eye and transmit different sights and images to the brain. This project features an integrated sensor that scans a 30-degree field of no more than 5 or 6 meters while emitting ultrasonic waves in the direction the user is traveling. By using this innovative approach, some of the most important problems affecting blind people could be fixed.

3.2 Block Diagram

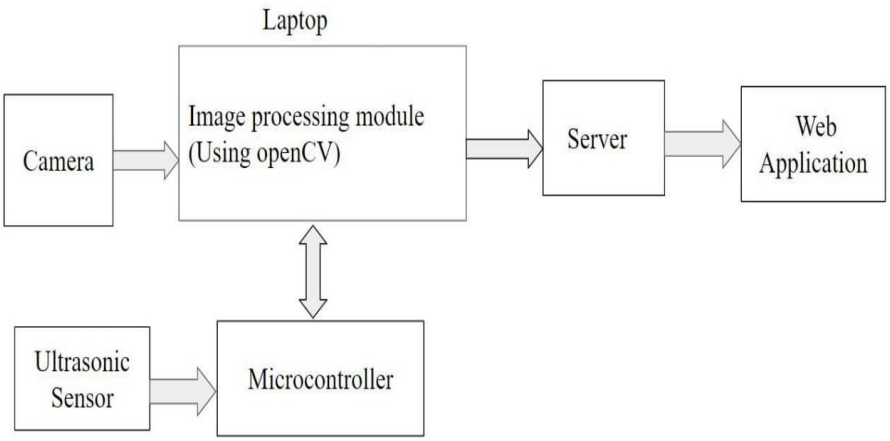

Figure 1: *Face Recognition and Object Detection System*

Figure 1 shows the basic block diagram of our proposed system. Database of facial photographs that is necessary for facial recognition technology to function properly. Typically, passport-sized photos or any other available images of people who need to be identified are used to build the database. Smart glasses with face recognition technology are being developed to help the blind identify others around them. A camera, a microprocessor, a power source, an ultrasonic sensor, a server, and a web application are some of the parts that make up the system. The microprocessor processes the video frame after it is captured by the camera. The main portion of the processor is used for object and face detection. The processor recognizes faces and objects in the video frame by utilizing sophisticated algorithms and machine-learning techniques. The processor generates associated name data and sends it to the server after identifying the

faces. This data is kept on the server and made available to the web application. The web application then reads out the person's name and other information to the blind man's ears using mobile phones. In this way, persons who are visually challenged can recognize the people around them with ease and learn their names and other pertinent information. The device has an ultrasonic sensor that can identify impediments in the user's path to make sure it is simple to use. The microprocessor receives signals from the sensor and warns the user via an audio signal or vibration feedback. The visually impaired individual can navigate securely and avoid hazards with this assistance.

3.3 Workflow And Algorithm

Figure 2 shows the algorithm, which consists of two sections: one deals with database creation, and the other is concerned with real-time recognition. Here, instantly recognize people and items in front of a blind individual. In order to do this, we set up the camera and take a video stream. The serialized model is loaded from the disc concurrently. The footage is then converted into frames. Then, we use the YOLO architecture to do object detection. The name of the item is provided to the server we are hosting when it is recognized. Face matching using the database's face photos is used to accomplish facial recognition at the same time. The name of the person is also sent to the server when a face matches one in our database. An ultrasonic sensor is also included. The ultrasonic sensor transmits and receives signals. The distance of an object can be determined by timing the interval between transmitting a signal and getting an echo [2]. It is used to figure out how far away things are from a person while the information is sent to our server. Additionally, a web application on the blind person's smartphone will read out the freshly added information on the server.

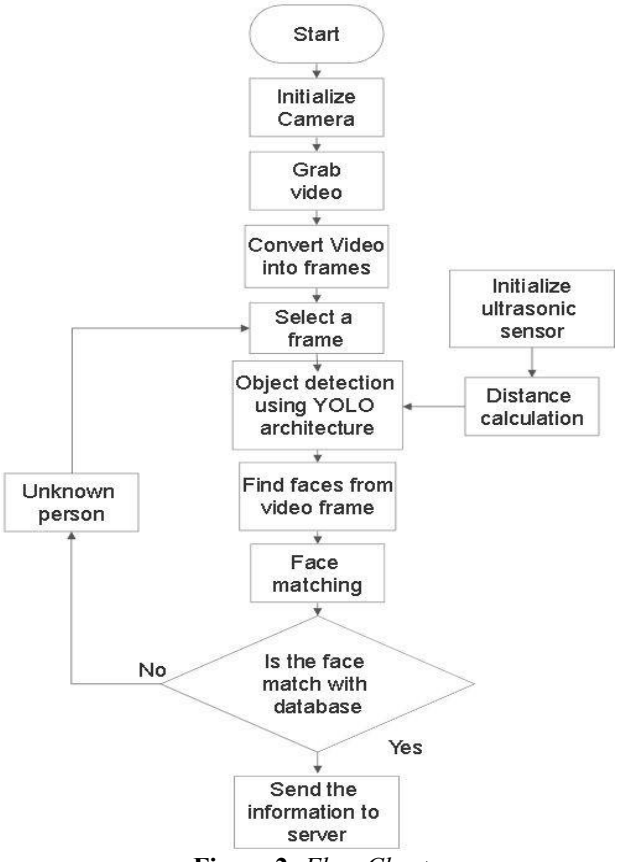

Figure 2: *Flow Chart*

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3.4 Creation Of Database

Required a database for this facial recognition. With the help of our passport-size images or an available picture of the individual. So, we created a database in this step. After that, give the photos a new name and save them all to the faces folder [3]. Fig 3 shows the database of face images that are used to train the model for face recognition.

Figure 3: *Face Database*

3.5 Face Recognition

In order to recognize faces firstly, we built the database to use for face recognition. The processor first loads, examines, and performs face encoding, which will locate facial landmarks on each image in the faces folder. The video stream is then converted into frames. The frames are then scaled to a 1/4 size for quick processing. then use face landmarks to accomplish face matching. Print the name of the image if a face matches. If not, the printout is unknown [3]. The process of a face recognition system for visually impaired people typically involves several steps:

1) Capturing Facial Images: People's faces in the wearer'sfield of vision are photographed by the cameras. The face recognition program then processes these photos.

2) Face Detection: Advanced algorithms are used by facialrecognition software to identify human faces in the images it has taken. To find probable faces in the photographs, it analyzes many facial traits, including the shape of the face, eyes, nose, and mouth. The face detection process is shown in Fig 4.

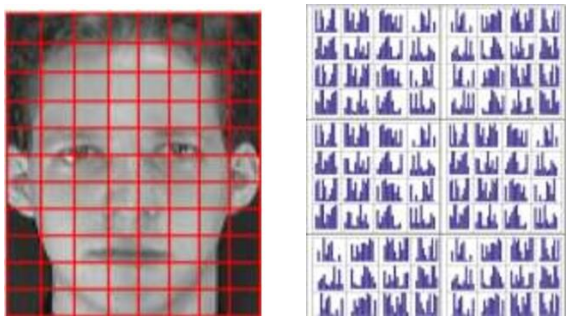

Figure 4: *Face Detection [4]*

3) Feature Extraction: The face recognition program first recognizes faces in the photographs and then extracts important facial elements from them, such as the size and placementof the eyes, the shape of the nose, and the curves of the face. Then, each person's particular facial template is made using these features [5]. Fig 5 shows the feature Extraction in theface recognition process.

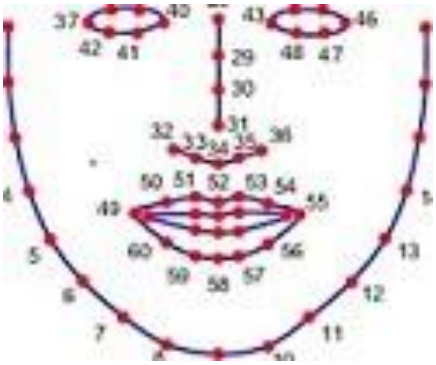

Figure 5: *Feature Extraction*

4) Face Matching: The facial templates of the discovered faces are contrasted with a database of already registered, well- known people. The visually impaired person who can register the faces of persons they frequently interact with, such as friends, relatives, or caretakers, can build this database. The best match is determined by comparing the facial templates using face recognition software. Fig 6 shows the face encoding technique.

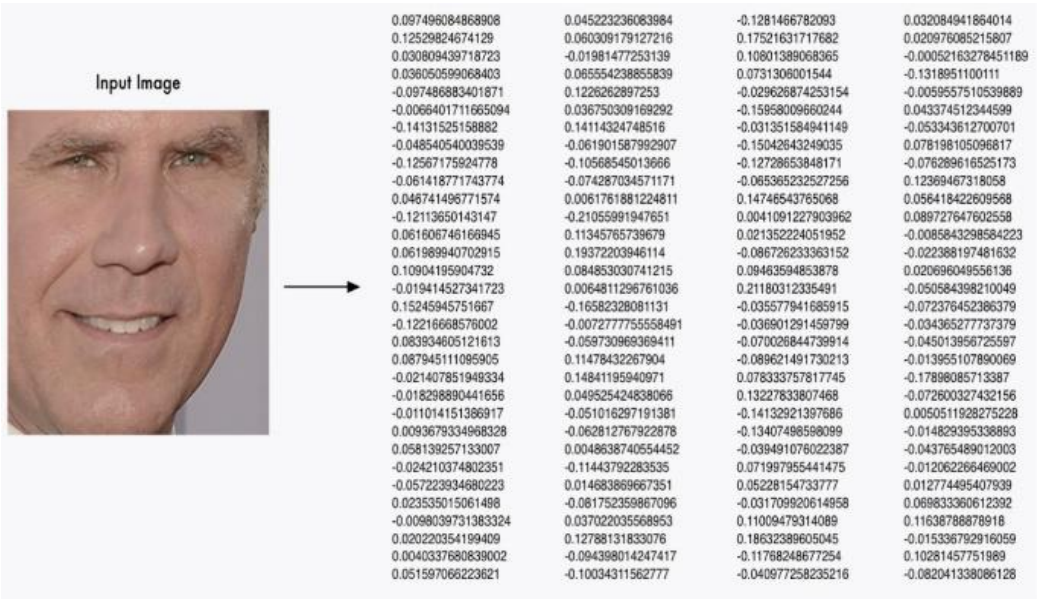

Figure 6: *Face Encoding*

5) Real-time Feedback: Once a match is made, the system gives the visually impaired wearer immediate input, such as audio signals and speech instructions, identifying the person in front of them.

6) User Interaction: The user who is visually challenged might use them to affirm or deny the identity of the individual being detected. For instance, they can ask the system to confirm the person's identification or disclose further informationabout them using voice commands or touch gestures.

7) Privacy and Security: The face recognition software in the system should be created to secure the user's data and adhere to pertinent legislation, such as data protection laws and privacy standards, in order to assure privacy and security. The only use of the user's facial information should be for real-time facial recognition.

4 Result

This is our paper's results section. We put the software that comes with a system into practice. When the blind man wires it and plugs it into the power button, the device initializes the program and recognizes the user almost exactly. The blind man's ears are then provided with corresponding voice information.

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Accuracy and accompanying audio instructions for detecting friends and relatives in real-time.

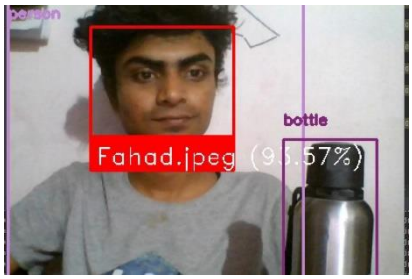

Figure 7: *Identification of a person and other objects*

Figure 8: *The objects detected are printed on the server*

Figure 9: *Web App reading what is written in the server*

Figure 10: *Web App if no object is detected*

We discovered that the accuracy was great when we compared it to earlier studies. In real-time recognition, we take samples of each person at varying distances. Its accuracy is really great. Fig. 7 shows the identification of objects from the video captured. Fig. 8 depicts the objects detected that are printed on the server. Fig. 9, fig. 10 shows the output from the web application. Whatever the thing that is written in the server is read by the user.

5 Future Scope

Enhanced navigation: Assistive device system with an in- built facial recognition system can improve navigation for people who are blind or visually challenged. Face recognition technology can be used with additional accessibility features in order to provide visually impaired people with an even more comprehensive solution. The system can be educated to understand the user's preferences and offer individualized help. For instance, it can learn the user's favourite dining establishments, retailers, or modes of public transit and offer choices or directions in accordance with the user's preferences and previous interactions. It can also provide a biometric security precaution by providing a multi-factor authentication solution that is usable by people with visual impairments, it can be coupled with other authentication techniques like voice recognition or fingerprint recognition. In order to give extra safety and health advantages for visually impaired users, the smart glasses may additionally include health monitoring features, such as heart rate monitoring, temperature sensing, or fall detection. In the event of any potential health problems or crises, the system can notify the user or carers. As augmented reality (AR) technology is fast developing, face recognition systems can be combined with AR programs to give more immersive and interactive experiences. Future advances in technology are anticipated to bring about even more imaginative and inclusive options for people who happen to be blind or visually impaired.

6 Conclusion

In conclusion, face recognition and obstacle distance measuring systems can be very beneficial for visually impaired people by providing them with more security and independence in their daily life. Users will receive personalized real- time audio feedback from the system and it will help the user to identify the person in front without any help from others. This kind of device can make it easier for persons who are visually impaired to move around in public areas, recognize people around them, and avoid obstacles. By warning the user of potential threats and averting collisions, it can also add an extra degree of protection. As a whole, the proposed system can greatly enhance the quality of life visually impaired and make them live more independently and confidently.

7 Publisher's Note

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