Smart Assistance System for the Visually Impaired

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Abstract- Physical movement is one of the biggest challenges for the visually impaired. People with complete blindness or low vision often have a difficult time in self-navigating unfamiliar environments. Traveling or simply walking down a crowded street may pose great difficulty. So, many people with low vision tend to bring a sighted friend or family member for assistance. It also becomes difficult for them to keep a track of their routine environments .This system proposes conglomeration of technologies like Image processing, Speech processing etc, so the problems faced by blind people can be reduced to certain extent. Object recognition methods in computer vision , Image processing, Text to Speech conversion can be embedded in a single object : SMART GLASSES (spectacles) .

Index Terms- Blind navigation, Image processing, Voice processing, Object recognition, object detection, Face recognition.

I. INTRODUCTION

Of the 36 million people around the world who are Visually impaired, from that about 15.0 million are found in India. India is now the world's largest number of blind visually impaired. India requires 2-2.5 lakh eyes every year, it has 109 eye banks manage to collect around of just 25,000 eyes, 30% of which can't be utilized. Many of the people cannot afford such eyes treatments. To be categorized as blind, there is a complete loss of vision. Blindness cannot be improved by simple visual aids such as glasses. For the indigents blindness is a drawback. So this paper present a system to aid the blind people. The Assistor Device is a device which is a passive type intelligent glasses that focuses on aiding the blind or people with low vision capabilities to move around from one place to another place without having to worry about anything around.

As a result, visually impaired people usually are dependent on other sensory information in order to avoid obstacles and to navigate . For instance, the movement of dynamic hurdle produces noise allowing blind people to decide the approximate/rough location using their auditory senses. The additional use of tactile senses is required for precise obstacle position. For this purpose a white cane is usually used by visually impaired , which has 2 disadvantages. It is comparatively short and the detection occurs only by making contact with the obstacle which could sometimes may be harmful. Another popular navigation tool for blind people is a service guide dog. Compared to white canes, dog guides are able to detect obstacles as well as moving around them, however they are expensive and have a very less working life.

However, many obstacle detection and avoidance systems have been introduced during the last decade to assist visuall impaired to navigate in known or unknown, indoor and outdoor environments. This navigation can mainly be categorized as vision enhancement , vision replacement and vision substitution. Vision replacement systems provide the visual cortex of the human brain with the information either directly or via the optic nerve. Vision substitution and Vision enhancement systems have almost same working principles with respect to environment detection process, however, each provides the environmental information differently. Vision enhancement puts the information in a visual manner, whereas vision substitution typically uses tactual or auditory perception or both.

We propose a Smart system to help such visually impaired people in their basic activities of life.

Our System mainly consists of two components:

1) Wireless Camera
2) Android Device

Our main objective is to simplify the system for the users and make interaction between the two entities as easy as possible.The entire project is dependent on the Smartphone App and its reliability. It performs all the computation and calculations. A separate database is designed, where the definition of the objects are found. In the system level we could say that the novelty lies in the real-time application working on the Smartphone.

II. LITERATURE SURVEY

There are a lot of devices which assist the visually challenged for navigation indoor and outdoor. All these devices rely mainly on Global Positioning System (GPS) alone, to navigate around.

1. A Stereo Image Processing System for Visually Impaired.

The above paper proposes a system utilizes stereo vision, image processing methodology and a sonification procedure to support blind navigation. The developed system includes a wearable computer, stereo cameras as vision sensor and stereo earphones, all molded in a helmet.

Limitations:

- Size of hardware required is extensive and voluminous.
- Musical stereo sound for the blind's understanding of the scene in front (No use of voice commands).

1. Blind Path Obstacle Detector using Smartphone Camera and Line Laser Emitter.

Two things are prominently used in this paper i.e. Mobile camera and laser. The laser and the mobile is kept at static distance. The image is captured from the camera and along with it the laser is also observed. Using the static distance and the

angle between the laser point and the camera the distance is measured.

Limitations:

- Distance between the camera and the laser must be constant.
- May not work efficiently on shiny surface as laser intensity may decrease.

2. Abandoned object detection via temporal consistency modeling and back-tracing verification for visual surveillance. This paper presents effective approach for detecting abandoned luggage in surveillance video. Here the camera is fixed at a position. Hence, the dataset of images captured is static. Therefore if any irregularity is observed in the surveillance the objects are detected.

Limitations:

- The surveillance is static
- Background should be known beforehand.

III. METHODS

A. Text-to-Speech

This module comprises of image and speech processing. The main aim of this module is to acquire a 3D world real image of any text constraints area and to convert this image into text followed by providing audio output using speech processing. We are implementing a dynamic system that makes use of Google API's for conversion of Text to Speech dynamically provided that good internet connectivity is present. 1)If a book or any write-up is held in front of the camera frame capture the image of the text to be read by the user by using the camera.

For instance, if a book or any write-up is held in front of the camera frame capture the image of the text to be read by the user by using the camera. Send the data to the android device via Bluetooth. Match each and every letter and provide the output to the user i.e. the name of the recognized face if available in the dataset through the ear piece.

B.Object Recognition

Object Recognition is a process in which Real world objects are identified using Image processing. Object Recognition is a important process which will aid visually impaired persons to locate their frequently used day to day objects. It becomes a tedious task for visually impaired person to locate these objects. Our system gives sort of visual aid that dynamically identifies objects and locates them.

Our algorithm analyses the position of the object, size of the object, shape of the object, etc. For Example, a visually impaired person is sitting on his study table. He has multiple objects in front of him such as Water Bottle, Walking Stick, Fruits ,etc. So our System will help him locate all his objects.

B. Face recognition

Some face recognition algorithms identify facial features by extracting landmarks, or features, from an image of the subject's face. For example, an algorithm may analyze the relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw.

These features are then used to search for other images with matching features. Other algorithms normalize a gallery of face images and then compress the face data, only saving the data in the image that is useful for face recognition. A probe image is then compared with the face data. One of the earliest successful system is based on template matching technique applied to a set of salient facial features, providing a sort of compressed face representation.

Recognition algorithms can be divided into two main approaches, geometric, which looks at distinguishing features, or photometric, which is a statistical approach that distills an image into values and compares the values with templates to eliminate variances.

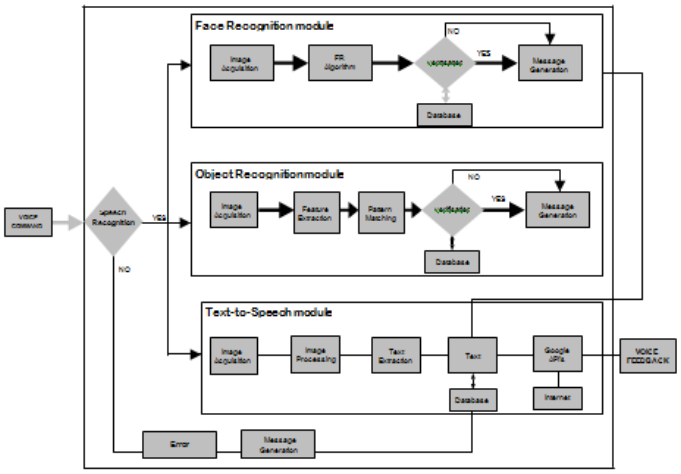

Fig 1 :System Architecture

IV. ALGORITHMS

5.1.1 Face Recognition

1) Prepare a dataset of known/recognized faces.
2) Reading this dataset in our program.
3) Calculate the eigenfaces from the dataset (Training set), keeping only m images that correspond to highest eigenvalues. These m images define the face space.
4) Calculate corresponding distribution in m- dimensional weight space for each known individual, by projecting their face images in face space.
5) Loading any image format (.bmp, .jpg, .png) from given source. Detecting the faces present in the images using the CascadeClassifier in opencv.
6) We will use Face Recognizer for face recognition.
7) Calculate set of weights based on input image and the m eigenfaces by projecting the input image onto each eigenface.
8) Determine if image is known or unknown by checking to see if the image is sufficiently close to face space.
9) Text to Speech conversion using known description of person and output through earpiece.

Object recognition

1) Prepare a dataset of known/recognized objects.
2) Reading this dataset in our program.
3) Loading any image format (.bmp, .jpg, .png) from given source. Detecting the objects present in the images using Edge detection, line detection, and pattern detection algorithms.
4) Extracted objects are than compared with the know dataset.
5) Decision is based on this comparison if the object is recognized or not.
6) Once the object is recognized its respective description is extracted .
7) Text to Speech conversion using known description of object and output is provided through earpiece.

Text-To-Speech

1) Loading any image format (bmp, jpg, png) from given source. Then convert the image to grayscale and binarise it using the threshold value.
2) Detecting image features like resolution and inversion. So that we can finally convert it into a straightened image for further processing.
3) Lines detection and removing. This step is required to improve page layout analysis, to achieve better recognition quality for underlined text, to detect tables, etc.
4) Page layout analysis. In this step we are trying to identify the text zones present in the image.
5) So that only that portion is used for recognition and rest of the region is left out.
6) Detection of text lines and words. Here we also need to take care of different font sizes and small spaces between words.
7) Recognition of characters. This is the main algorithm ; an image of every character must be converted to appropriate character code.
8) Saving results to selected output format, for instance, searchable PDF, DOC, RTF, TXT.
9) Text to Speech conversion using Google API's and output through earpiece.

V. CONCLUSION

This parer puts forward a system which allows blind people or people with low vision to detect and avoid hurdles/obstacles was implemented as an android app. The obstacle detector/recognition application provides a high detection rate on selected surroundings. The limitations of the system is the stability of glasses and using an android phone. In order to improve the robustness of this system a powerful camera could be used, allowing an improved obstacle detection. The proposed system could be also applied to smart phones that have android OS and infrared emitter & sensor, thus enabling us to measure a depth map of the environment. This system could be advanced with GPS data, a trival feature to most of the android smart phones. Additionally, if the processing performance is improved it will allow the processing of a higher frame resolution, and thus allow more precise acquisition of the environment.

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