Virtual Guide

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Abstract

In this paper, we present a design for a wearable device that aids in both indoor and outdoor mobility and navigation for blind and visually impaired individuals. The traffic circumstances that our prototype can detect and recognise include street crossings, traffic lights, vehicles, cyclists, other persons, and low- and high-obstacles. Based on sensor and optical camera input data, real-time detection occurs, and aural signals help the user move around.

1 Introduction

This project is associated with the development of system to provide an aid to visually impaired people. It is a visual based project consisting of few main components such as camera, raspberry pi and earphones mounted together and additional working technologies of the internet interlinked. The input of the project will be an image/video (multiple frames), the image captured and analyzed with the help of the camera interfaced to the raspberry pi/IOT technology. Hence the object is detected and audio information is conveyed to the blind person through earphones.

We propose a virtual eye tool that utilizes the experience of the CASBlip projects regarding practical requirement of blind people. Our prototype tool consists of a camera mounted on a helmet, its image is processed with a portable computer carried by the user in real time. Earlier research prototypes were limited to 32*32 images and depth maps of similar size which results in heavy information loss making for instance traffic lamp detection impossible. In our work, we use full scale images, and yet process them automatically in real time. Out image processing algorithms cover the classification of hanging obstacles, road crossings, stairs, traffic lamps, which is much a broader spectrum than in previous virtual eye solutions could provide.

2 Related Work

Most of the projects and tools are focused on how visually impaired people can get from one point of a city to another. One is the replacement of the white rod with an electronic one. The two most influential projects with these aims:

1. **CASBliP**
2. **ARGUS**

- **CASBliP**:
  The EU founded CASBlip (Cognitive Aid System for Blind People) made an extremely useful survey based on personal interviews with blind people on their most important needs in navigation. The most critical ones, in descending priority are as following: poles, holes on the ground, vehicles, stairs, other people, hanging sunshades, traffic lamps, crossing. People, vehicles and holes should be detected from 20 meters away, for the rest a detection distance of 5 meters could be sufficient. They used stereo camera system or infrared sensors for object detection, help the navigation with GPS and accelerometers and use acoustic feedback for signaling.

- **ARGUS**:
  The ARGUS (Assisting personal guidance system for people with visual impairment) project was founded by the EU as well. This project focused on supporting blind people in autonomous movement and navigation. They use GPS and other radio frequency technologies such as WiFi, RFID and NFC for navigation, and produce feedback on acoustic and tactile interfaces.

  For the purpose of assisting blind persons with indoor and outdoor navigation, several prototypes have been created. Both the RFID-based approach in [4] and the WiFi-based solution in [5] show promising early navigational results, but due to their limited range, they are expensive to deploy. The camera and GPS data are delivered from the client device mounted on the user to a remote operator who analyses the data and delivers audible or tactile feedback to the user. Client-server architecture-based solutions are proposed in [6] and [7]. In [8] and [9] and [10], the GPS-based navigation is supplemented by a local database in a wearable computer that provides details on nearby points of interest and hazards.

  Within the detection range of sensors and cameras mounted on the user, virtual eye-based systems aim to identify and categorise objects. An FPGA-based gadget was created by Kanna et al. [12] that recognises things using data from laser and infrared sensors mounted on the user's leg and classifies them using an online picture database. According to the image acquired from a camera mounted on the user, Rao et al. [13] downsample it, classify objects into threat levels based on their size and location in the image, and provide acoustic feedback. In [14], a low resolution depth map is used to create stereo musical sounds from stereoscopic images based on object disparity.

3 Proposed Idea

We propose a virtual eye tool that utilizes the experience of the CASBlip projects regarding practical requirement of blind people. Our prototype tool consists of a camera mounted on a helmet, its image is processed with a portable computer carried by the user in real time. Earlier research prototypes were limited to 32*32 images and depth maps of similar size which results in heavy information loss making for instance traffic lamp detection impossible. In our work, we use full scale images, and yet process them automatically in real time. Out image processing algorithms cover the classification of hanging obstacles, road crossings, stairs, traffic lamps, which is much a broader spectrum than in previous virtual eye solutions could provide.

4 Methodology

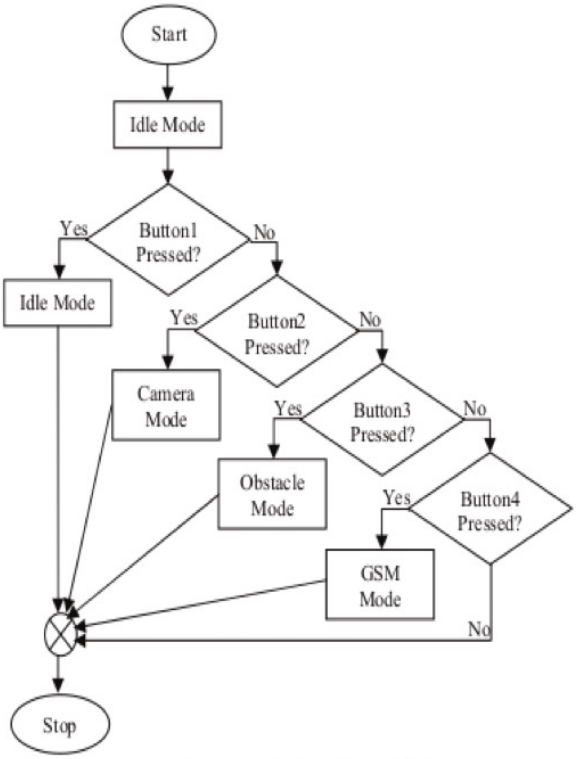
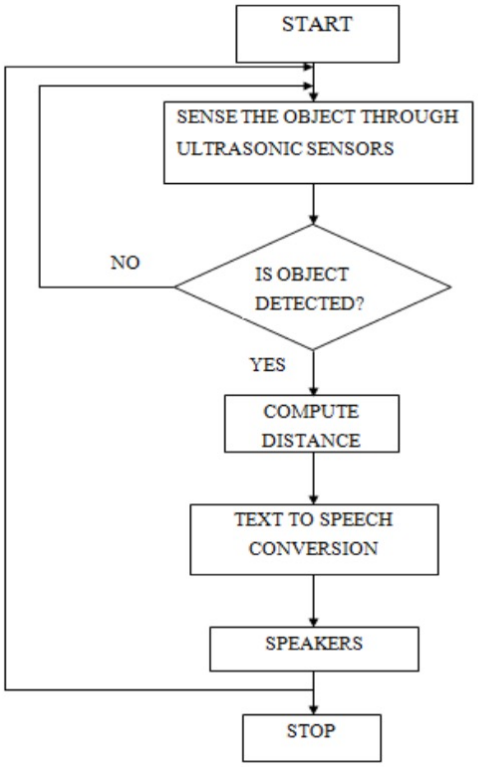


Fig. 2. Flowchart of Mode Selection



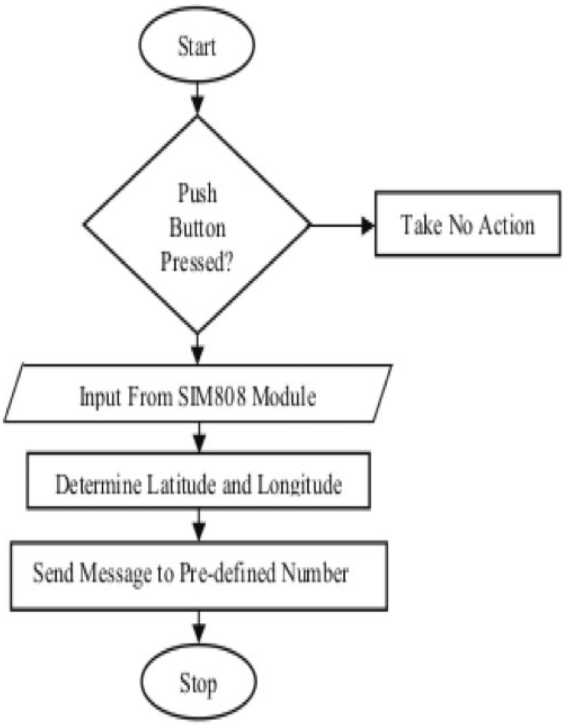


Fig. 5. Flowchart of Emergency SMS

5 Working Module

Object Detection: In this phase we detect the real world objects. Like humans in still images or Videos. Diagram shows the examples of the how to object are detected easily.

Obstacle Detection: In the proposed method, an ultrasonic sensor is used for obstacle detection in front of the users. Another ultrasonic sensor is used to detect humps on the ground or on the road. A PIR motion sensor is used for detecting the moving objects in front of the user. A 3-axis analog accelerometer is used for monitoring if the user has fallen. All the sensor data will be sent to the user's smartphone using a Bluetooth mod- ule. The user will be notifed if there is an obstacle or a hump or a moving object in front of him/her by speech instructions from his/her smartphone. If the user falls down, the guardian will be instantly notifed by the smartphone module. The user also can send an emergency signal if needed. The block diagram of our proposed system is depicted in Fig. 2. The proposed system contains of two modules named as a sensor module and a smartphone module. Each of the modules is described in the following steps.

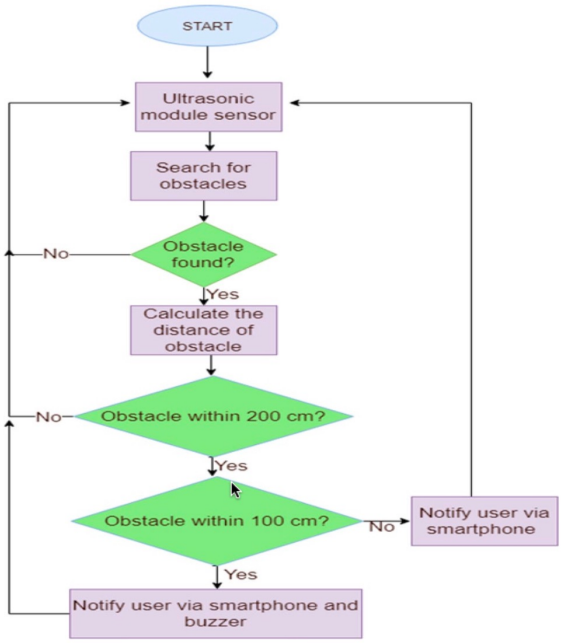
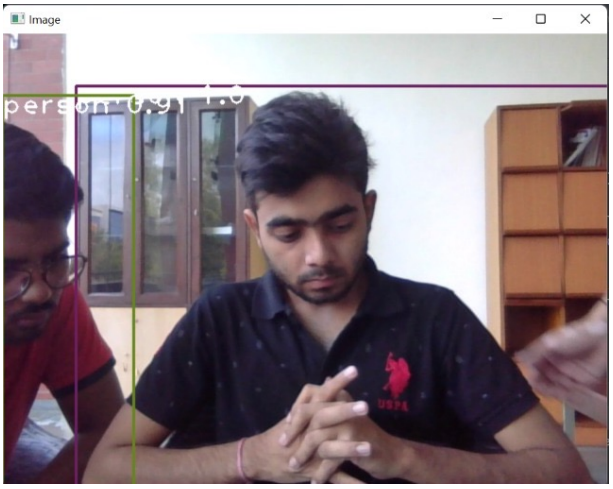


Fig. 3 The working flow of the ultrasonic sensor module for our proposed system

Sending emergency message

Virtual guide sends an emergency message in the form of mail with the help of arduino

6 Results



The libraries used in this project are OpenCv, tensor flow and pyttsx3.

7 Discussion and Scope

Around 3 percent of the world's population is visually impaired. There exist a few projects to help them but are not very efficient and compatible to many people. Additionally we are thinking to add a GPS Tracking feature in our model which can send emergency signals whenever a visually impaired person met an accident.

8 Conclusion

In this project we present a visual system for blind people based on object like images and video scene. This system uses Deep Learning for object identification. In order to detect some objects with different conditions. Object detection deals with detecting objects of inside a certain image or video. The TensorFlow Object Detection API easily create or use an object detection model Blind peoples they have a very little information on self-velocity objects, direction which is essential for travel. The navigation systems is costly which is not affordable by the common blind people. So this project main aim is to the help of blind people.

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