Assisting the Visually Impaired using Computer Vision

Shreyash Patil[1], Oshin Gawande[2], Shivam Kumar[3], Pradip Shewale[4]

[1]Shreyash Patil, Dept. of Computer Engineering, D Y Patil Institute of Technology, Pimpri, Maharashtra, India
[2]Oshin Gawande, Dept. of Computer Engineering, D Y Patil Institute of Technology, Pimpri, Maharashtra, India
[3]Shivam Kumar, Dept. of Computer Engineering, D Y Patil Institute of Technology, Pimpri, Maharashtra, India
[4]Prof. Pradip Shewale, Dept. of Computer Engineering, D Y Patil Institute of Technology, Pimpri, Maharashtra, India

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Abstract - *One of the main concerns of visually impaired people is the physical movement. People with complete blindness or low vision often have a difficult time in navigating unfamiliar environments. Simply walking down a crowded street may become a great difficulty. So, many people with low vision tend to bring a friend or family member for assistance. It also becomes difficult for them to keep track of their routine environments. In this way, blind people are always dependent on someone or the other. This system proposes integration of technologies to reduce the difficulty faced by blind people to a bearable extent. Hence, we are going to build an application where object recognition methods using computer vision, image processing, auditory assistance are all embedded in one that will help blind people to recognize obstacles in front of them without any external help.*

Key Words: Computer Vision, Visually Impaired, Assistance Systems, Obstacle Detection, Object Tracking

1. INTRODUCTION

Globally, it is estimated that at least 2.2 billion people have a vision impairment or blindness, of whom at least 1 billion of them have a vision impairment that could have been prevented or has yet to be addressed. These people include those with moderate or severe distance vision impairment or blindness due to unaddressed refractive error, cataract, glaucoma, corneal opacities, diabetic retinopathy etc. Population growth and ageing will increase the risk that more people acquire vision impairment. Nowadays everyone and even blind people are familiar with the technology and are using it on a daily basis. We can use this technology to help them in recognizing obstacles and help in navigation.

Our project proposes a wearable system that uses an android phone and a camera that will generate instructions which, in the form of audio commands transmitted through headphones, will assist the user in taking appropriate actions.

2. MOTIVATION

The motivation behind the project is to provide the visually impaired with cost efficient technology to help them navigate the real world more safely.

3. PROPOSED SYSTEM

Proposed methodology of object/obstacle detection works in a way that it involves several processes from extracting frames to the recognized output in the binary image.

3.1 Video Frame Extraction

The system will take real world visual data through the video camera. The camera will convert it into a digital format so that our system can pre-process it for further phases of implementation. The exact format and resolution of the video is undecided. These factors will depend on the limitations posed on us by the mobile phone that will be used for testing the implementation of the system.

3.2 Pre-processing

The initial task of pre-processing is to drop frames from the video data. A modern camera can record videos that have at least 20 – 30 frames per second. Since the person is not moving at a high pace, we can drop frames from the video to minimize the processing.

3.3 Object Classification

After the data is primed and processed, we will implement our object detection algorithms on it. The object will be classified as an obstacle after being judged upon its proximity to the user. The database will store the conditions in which respective instructions shall be generated.

3.4 Generating Instructions

We will be generating instructions according to the nature of the objects in the frame. These instructions will be sent to the text to speech API and then communicated to the user using audio output.

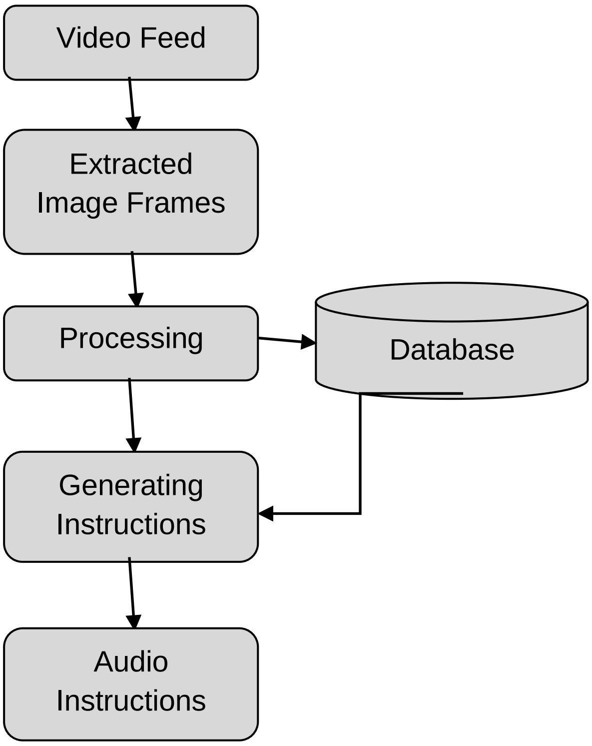

Fig -1: System Architecture

4. IMPLEMENTATION AND RESULTS

4.1 Taking the input of the real world visual data

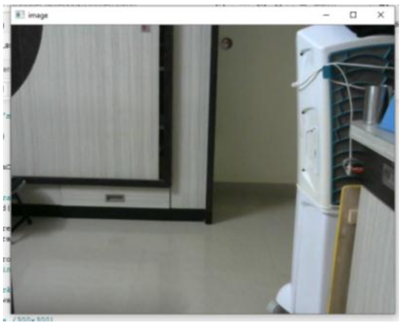

Fig -2: Video Input

The code takes image data through the camera using OpenCV. The camera can be a simple webcam or a dedicated camera.

4.2 Object identification

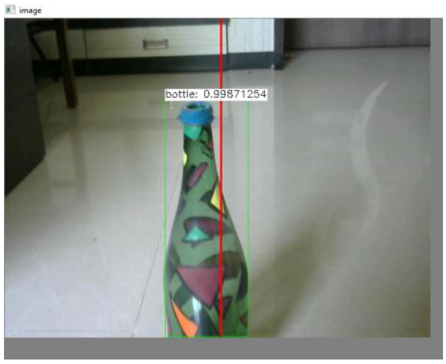

Fig -3: Identifying an object

Objects are identified as entities to be taken for classification. Before classifying them, they need to be properly verified if they are an obstacle or not.

4.3 Object classification

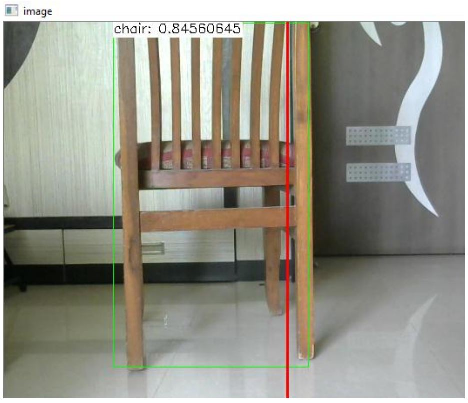

Fig -4: Classifying the object type

The recognized obstacle is taken into consideration and classified according to the caffe model. The caffe model is a deep learning framework that is used for classifying objects.

4.4 Generation of instructions

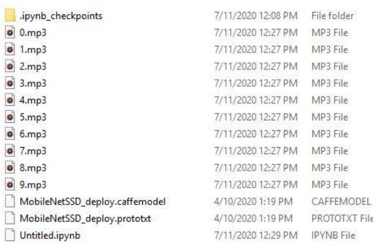

Fig -5: Audio files generated

Depending on the position of the object in the frame, the program tells the user whether he should move left or right. For this, Google's Text-To-Speech(TTS) API is used.

4.5 Results

```
left=bottle
train: 0.9680989
left=train
bottle: 0.92845297
left=bottle
bottle: 0.93413717
Right=bottle
bottle: 0.92753667
left=bottle
bottle: 0.8680546
left=bottle
```

Fig -6: Log of objects being identified and classified

The program is found to be identifying as well as classifying objects according to their type and position thereafter generating audio instructions that are stored in the form of .mp3 files that instruct the user to move left or right.

5. CONCLUSION

The system generates instructions to assist the blind person. The instructions include performing actions of "Move Left" and "Move Right".

REFERENCES

[1] World Health Organization, "Visual Impairment and Blindness," WHO Factsheet no. FS282 , Dec. 2014

[2] Pooja Nawandar, Dr. Vinaya Gohokar, "Design and development of multisensory smart assistive technology for blind persons", IEEE, 2018

[3] Liang – Bi Chen, Ming-Che Chen , "An implementation of an intelligent assistance system for visually impaired/blind people,"IEEE, 2018

[4] Gaurav Mishra, Urvi Ahluwalia et. al, "Rf and rfid based object identification and navigation system for the visually impaired," unpublished, 2019

[5] Dimitrios Dakopoulos, Nikolaos Bourbakis, "Wearable obstacle avoidance electronic travel aids for blind: a survey", IEEE, 2010

[6] Amit Kumar, Rusha Patra et. al, "An electronic travel aid for navigation of visually impaired persons, IEEE, 2011