

Smart Vision Glasses for Poor Eye Sight

M Ganesan, Department of EEE, R.M.K. Engineering College, Kavaripttai, India . Email: mgn.eee@rmkec.ac.in
Geetha Ramadas, Department of EEE, R.M.K. Engineering College, Kavaripttai, India . Email: grs.eee@rmkec.ac.in
Y Sukhi, Department of EEE, R.M.K. Engineering College, Kavaripttai, India . Email: ysi.eee@rmkec.ac.in

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Abstract:

This paper provides technical method for poor eye sight persons and the blind to walk around the required places comfortably. The main parameters considered here are Face detection, object detection and audio assistance. The aim to design proposed smart glass is to provide safety and security to the user and help them in going out with improved confidence even in an unknown environment. This is done with the help of a Picam (camera module that can be interfaced with Raspberry pi) on the body of the glass that captures the surrounding environment, processes it, and sends the related information of the obstacles and persons near the poor vision people and transfers the details through earphones to him. They can walk in an unknown environment with different set-up mazes independently. They can independently for shopping, can read the books they want without any difficulties, can sense the person in and around the room and identify the known faces.

Keywords: Raspberry pi, Picam, Smart Glass, Visually impaired.

I. INTRODUCTION

The numbers of human beings who do not have proper vision or have different complaints in the eye sight are increasing day by day. As per report of World Health Organization (WHO), the vision impairment people living are 253 million. The blind people number is 36 million. The poor vision people count is 217 million. Globally, the chronic eye diseases are the primary reason for poor vision. According to survey, the percentage of visually impaired people with 50 years and above is 81%. According to the survey taken in Europe, the percentage of poor vision people with 50 years is 65%, among which about 90% have the age greater than 60. When the older age people population increases, more people will be at risk of vision impairment due to chronic eye diseases in 2012. Also, children having age around 15 lose their vision due to refractive errors is estimated as 12 million.

II. OBJECTIVE

The intention of the project is to resolve the problem of vision with the low-vision people, who are officially classified as blind persons. Although they are considered blind, they have different issues that

can be handled with variety of solutions; one of them is to improve the remained vision by enhancing various environment scenes. This can be achieved by implementing a smart glass that depends on capturing the scenes, they are processed and after all they are conveyed to the blind people using the headphones connected with the glass. The significant value of the project is the improvements in the wearer's social and academic life. In order to identify the objects, a special camera placed at the topmost place of the glasses body which takes the image and they are processed using deep learning. The image is compared with the test cases and the final result is converted to speech via headphones mounted on the side of the glasses.

III. BLOCK

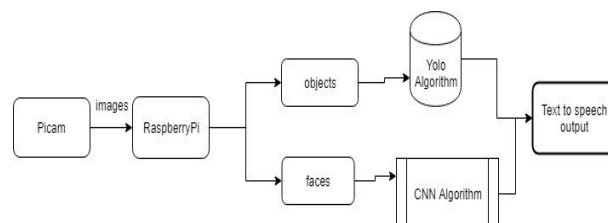


Fig. 1. Functional diagram

Fig.1 is the functional diagram of smart vision glasses for poor eye sight. It consists of Picam,

Raspberry Pi, objects, faces, Yolo Algorithm, CNN Algorithm and Text to speech output. PiCAM has a video system with web server. It has vision sensor having resolution up to 5MP (megapixel). PiCAM provides recordings provision which depends on the memory capacity of the SD card. Raspberry Pi is less price small size CPU. This can be connected to a computer.

A. Neural Networks Terminologies

This section says about three neural networks algorithm and they are explained briefly. They are Recurrent Neural Network, Convolutional Neural Network and You Only Look Once. Fig.2 shows the representation of Yolo object detection algorithm. These algorithms are studied and finally concluded with YOLO algorithm. Let us discuss about them in detail.

B. Convolution Neural Network (CNN)

Nat present artificial intelligence is having tremendous growth in bridging the gap between human beings and machines. Computer vision is a main research area related to artificial intelligence. This uses the knowledge of image recognition, Image Analysis, & Video recognition, Natural Language Processing, Media Recreation etc.

Convolution neural networks are combination of math and biology, but these networks have are used in the field of computer vision. In the year 2012, neural nets were used to win ImageNet competition, the classification error record reduces from 26% to 15%, an remarkable improvement. After that many companies had deep learning about this concept. Nowadays this concept is used for different applications. Consider the mathematical relations given below

$$(h * l)(t) = \int h(x) \cdot l(t - x)dx \quad (1)$$

$$(h * l)(t) = \sum h(x) \cdot l(t - x) \quad (2)$$

C. Recurrent Neural Network(RNN)

Recurrent Neural Networks is one of the powerful

network. It uses many algorithms with internal memory. In this the output previous step is considered and is given as input to the present value. In the neural network, the inputs and the outputs do not depend on each other. RNNs are used for learning algorithms from the past. RNN was used for practical applications in the year 1980. This is used because of its applications for computations, due to the high amount of data which is available nowadays and the development of LSTM during 1990's.

D. Convolution Neural Network (CNN)

Recurrent neural network belong to the category of neural network widely used in speech recognition and language processing. RNN recognizes sequential characteristics. This is used when output based on input is needed. The inputs do not depend on each other in case of neural network. Fast recurrent neural network has the benefits of deep transition RNNs and multi scale RNNs. It uses different time scales for sequential data. It also uses complex transition functions. The method of approach is similar in RCNN and FSRNN. The input is given to CNN to create the feature map. Using the feature map, the region of proposals is identified and makes them into squares. Then it is shaped into fixed size. R-CNN does not need convolutional neural network every time. So it is faster than R-CNN. In addition to this a feature map is generated by doing the convolution operation once for a image.

E. You Only Look Once (YOLO) Algorithm

This algorithm is used to detect real time objects. This algorithm does not spend time to generate region proposals. YOLO uses the images to optimize the performance. This method has more advantages than normal methods. This algorithm is working very fast. Base network speed is 45 fps. The highest speed of operation is greater than 150 fps. In real-time, the speed of process streaming video is less than 25 milliseconds. Fig.2 shows the Yolo Object Detection Algorithm.

F. Comparison of Neural Networks

The neural networks that we have taken for comparison are given as follows:

- Selective Search Algorithm
- Convolutional Neural Network
- ImageNet Classification with Deep CNN
- Recurrent Neural Network

- Fast Recurrent Neural Network
- You Only Look Once Algorithm

The most useful method for object detection and face detection is chosen by comparing the above methods and came to the conclusion that the YOLO Algorithm is the best for the object detection.

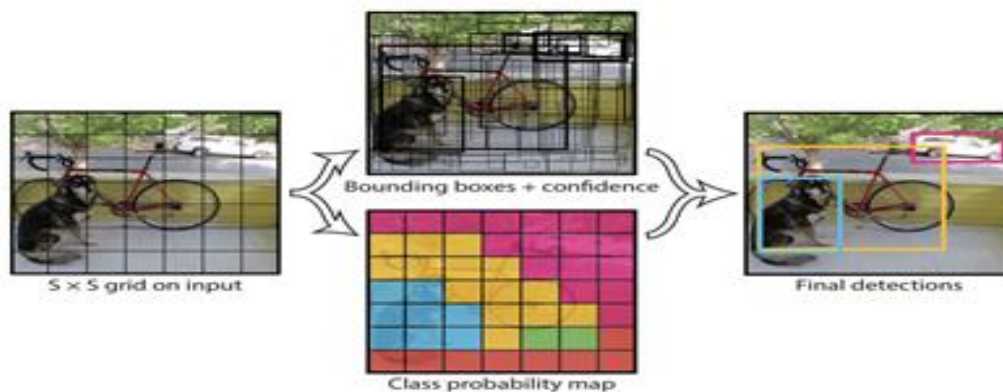


Fig. 2. Yolo Object Detection Algorithm

IV. HARDWARE CONFIGURATION

A. Augmented Reality for Visually Impaired

Augmented reality (AR) can provide accessible annotations and auditory, haptic, tactile and visual improvement for the objects in the surrounding environment (Coughlan & Miele, 2017; Ichikari, Yanagimachi, & Kurata, 2016; Peli & Woods, 2009). James et al (Coughlan & Miele, 2017) coined the terminology “Augmented Reality for Visual Impairment” (AR4VI) for these kinds of AR tools that allows people with visual impairment and vision loss to explore their surroundings by natural gestures with implementation of a gestural interface.

B. Camera Based Computer Vision

Human beings use their eyes to see the object and their brain to sense the happenings of the world. The Society for Pattern Recognition uses computer vision: In Computer vision, computer is used to

sense and understand the things and to provide the output. It is difficult to recognize the images of different objects using computer.

C. ORCAM

ORCAM is a standalone device, compared to Seeing AI that utilizes mobile phone cameras. It supports reading texts, recognizing faces, and identifying products in real time (“OrCam User Stories,” n.d.). Based on the aforementioned characteristics and serving purposes of camera-based solutions, it is possible to use them for detecting objects and assisting with orientation and navigation based on processed images.

V. PROPOSED DESIGN

Among all the mentioned solutions, we adopted the idea of smart glasses, where the user will move independently without any additional assistants such as canes or guide dogs. The goal of the project is to help the low-vision user to avoid the obstacles

surrounding them in an unknown environment, and to interact with different environments by improving the user's mobility. The main idea is to extend the vision sense through an interface. Fig. 3 shows the virtual environment of the suggested system. Fig.4 shows the training data of set of faces. Fig.5 shows the detection of faces in Live CAM. Fig.6 shows the detection of multiple faces simultaneously in Live CAM. The detection of objects in the living room is shown in Fig.7. Fig.8 shows the detection of the images of person and football in the Playground.

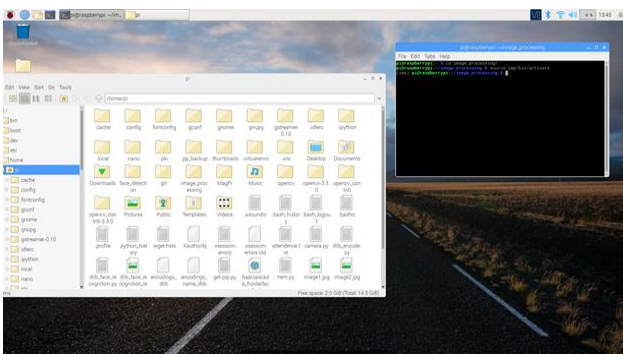


Fig. 3.Virtual Environment

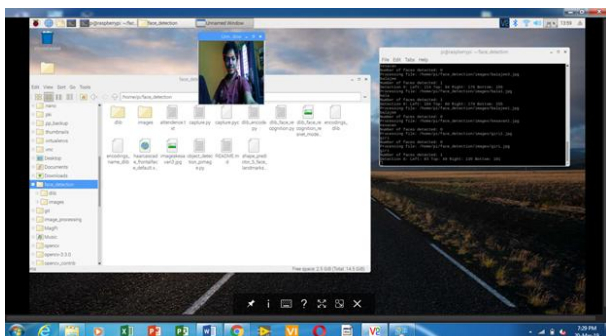


Fig. 4.Training Data set of Faces

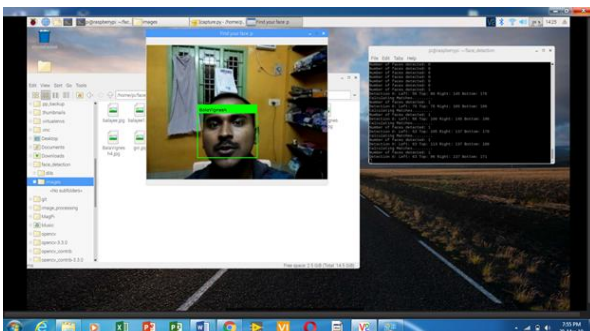


Fig. 5.Detecting the faces in Livecam

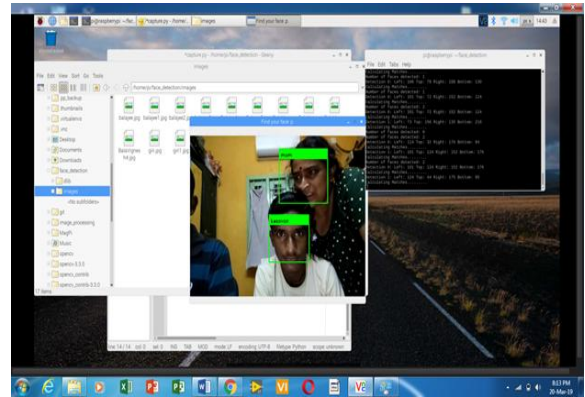


Fig. 6.Detecting Multiple Faces simultaneously



Fig. 7.Detecting the objects in the living room

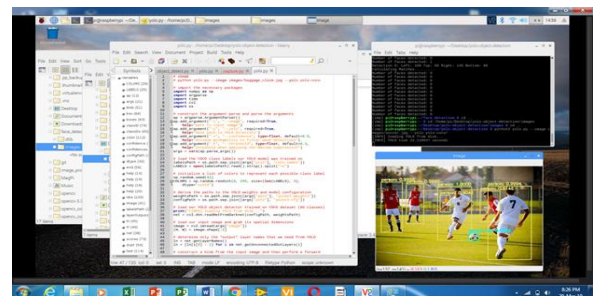


Fig. 8.Detecting the images of person and football in the Playground

A. To create virtual environment

The manager for python reference is pip package. This is involved for installation of packages and to update them. Pip uses the latest version for installation.

B. Python3 pip install --upgrade pip

The manager for python reference is pip package. This is used to connect and upgrade packages. The latest version of pip is necessary for installation.

C. Python3 pip install python3 pip install

Virtual env is used to install separate packages for different projects. In this, python installation is virtually isolated. This is used to install packages using virtual installation.

VI. CONCLUSION

Generally speaking, the substantial purpose of this project is to promote the life's Different aspects, and to improve the ability to avoid obstacles. It is important to realize that the glass's function is to consolidate the scene, not to recover the vision. Hence, the visually impaired persons can also independently walk or make some response to the surrounding environment and they feel less stressed. Further improvements are to be made in the vision of human being so that poor vision human beings could serve like a life of human with normal vision.

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AUTHORS PROFILE

M.Ganesan received his BE Degree in Electrical and Electronics Engineering from Government college of engineering/ Manonmanium Sundaranar University in 1997. He obtained M.E in Power Electronics and Drives from Government college of engineering Anna university in 2006. Presently he is working as Associate professor, Department of Electrical and Electronics, RMK Engineering college Chennai, Tamil Nadu India.

Geetha Ramadas received her B.Tech. Degree in Electrical Engineering from N S S College of Engineering, Palakkad / Calicut University in 1986. She obtained M.E in High Voltage Engineering from College of Engineering, Guindy, Anna University in 2002. She obtained PhD in Electrical Engineering from College of Engineering, Guindy, Anna University in 2010. Presently she is working as an Professor & Head, Department of Electrical and Electronics Engineering. R.M.K Engineering College. Chennai. Tamilnadu, India.



Sukhi Y received her B.E. Degree in Electrical and Electronics Engineering from Government College of Engineering / Madurai Kamaraj University in 1993. She obtained M.E in Mechatronics from Madras Institute of Technology, Anna University, Cromptet in 2000. She obtained PhD in Electrical Engineering from Sathyabama University, Chennai in 2010. Presently she is working as an Professor, Department of Electrical and Electronics Engineering. R.M.K Engineering College. Thiruvallur District,. Tamilnadu, India.