PROJECT INNOVATIONS IN DISTRIBUTED COMPUTING AND INTERNET TECHNOLOGY

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SMART EYE

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Abstract-The Smart Eye Spectacles project is wearable smart hardware which is aimed at helping the visually challenged members of our society. It uses modern state of the art palm sized computers with mounted cameras to perform active face recognition and analysis of images, and is able to intimate the wearer of the people they are surrounded with. Various applications and objectives of the above can be realized when one thinks of the difficulties faced by the blind people in our society, be it in a home or in a work environment. This project can hence be of great use and can be used as an additional security for people who cannot see.

Index Terms- Computer Vision, Fog Computing, Raspberry Pi zero, Real Time Image Processing, Smart spectacles

I. INTRODUCTION

Over 15 Billion humans living in India, there are a reported 15 million who are visually challenged, i.e. Partially blind/ night blind/completely blind. The difficulties faced by these people are simply quite ineffable. In the battle of performing even the fundamental human activities, they face this major issue of being unable to ascertain who they're talking to/ interacting with. The lives of blind people would be so much easier if they are told who they're interacting with in real time, be it a known friend, an acquaintance or even a stranger.

In consequence of the above problem statement, designing smart wearable spectacles would be a great solution to help the visually challenged members identify and recognize fellow human being thereby making their lives simpler trouble free.

The impact on the society is indeed a great one on implementing this project. If every blind person in this nation feels more secure and is more confident to live in his/her daily environment, this project would be a success. This device would make the wearer feel more secure, and will prevent any form of identity fakeness happening against blind people as a camera constantly tells them who they are looking at.

II. BASIC CONCEPTS/TECHNOLOGY USED

The technical components used in the project are, namely:

Raspberry Pi zero running latest raspbian build.

- NoIR PiCam 2.0 - The infrared Camera Module v2 (Pi NoIR) replaced the original PiNoIR Camera Module in April 2016. The v2 Pi NoIR has a Sony IMX219 8-megapixel sensor (compared to the 5-megapixel OmniVision OV5647 sensor of the original camera).

- The Pi NoIR gives you everything the regular Camera Module offers, with one difference: it does not employ an infrared filter. (NoIR = No Infrared.) This means that pictures you take by daylight will look decidedly curious, but it gives you the ability to see in the dark with infrared lighting.
- Open CV-Open CV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, Open CV makes it easy for businesses to utilize and modify the code.
- The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 14 million. The library is used extensively in companies, research groups and by governmental bodies.
- imutils module
- facedetection module for Image Recognition
- Haar machine.
- python3

III. STUDY OF SIMILAR PROJECTS OR TECHNOLOGY

Google Glass: It is a brand of smart glasses-an optical head-mounted display designed in the shape of a pair of eyeglasses. It was developed by X (previously Google X) with the mission of producing a ubiquitous computer. Google Glass displayed information in a smartphone-like, hands-free format. Wearers communicated with the Internet via natural language voice commands [2]. It is available only as an enterprise edition for industry usage [3].

IV. PROPOSED MODEL/TOOL

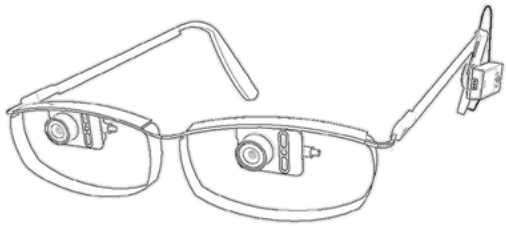
The Smart Eye is basically a wearable digital spectacles fitted with a camera, an MCU for processing, a microphone for audio input and an earphone to give audio feedback to the wearer.

A push of a button after wearing the spectacles will trigger the installed camera constantly scans for human faces and dumps faces to the cloud while constantly using machine

learning algorithms to classify and bucket known and unknown faces. The installed earphones are triggered to give audio feedback to the wearer on detection of a known face.

The spectacles will ask the wearer for a name if an unknown face is detected so that a new face can be automatically classified into a known face and stored in the cloud for further recognitions. Note that, the provision of details for known/unknown faces can be done on an online console made for The Smart Eye.

Furthermore, The Eye would give feedbacks of expression changes of the person they're facing now and then.



The proposed digital spectacles will be powered by a raspberry Pi connected to a power bank which can be suspended in the pockets of the wearer. The programming language used will be Python with OpenCV. It is notable that this technology is dominantly based on a "fog computing"/"cloud-to-the-edge" model, as most of the processing happens in the MCU itself, and only final data is pushed to the cloud.

V. IMPLEMENTATION AND RESULTS

A Raspberry pi zero running latest build of Raspbian OS is used for building the infrastructure of our software. The software packages installed are namely:

python, openCV, facerecognition module, imutils module.

Application source code is written using above four packages mainly, with additional usage of bluetooth module for audio feedback, and google text-to-speech module.

The application is initially built in with no default images of any persons. There's a desktop Application built for adding initial known faces to database of the Smart Eye. The smart eye is also given the ability to add faces dynamically to the database by manual microphone input by the user.

The smart eye is hence a device which learns when it sees new faces. It categorizes faces into groups such as : friends, relatives, acquaintances, etc. Using this information, the blind person can be told how the person is related to him. Each new face gets compared to the set of faces initially captured and stored in the database. These set of images also get replaced by better ones as user interacts more with the same person.

To increase algorithmic efficiency in matching a detected face to a known face, faces are compared based on an initial 'face structure classification', such as: 'round face,

long face, wide face', etc..This makes matching of face N times faster than liner iteration over all the faces.

Using the above highly abstract software implementation techniques, we engineer an efficient software application which gives real time output to the user about the faces they encounter.

VI. CONCLUSION

This project will be of major help for the visually challenged people of our society. Blind people would no longer have to be dependent on anybody during meetings. With this device, blind people get a clearer picture of the current scenario they're in, as the device constantly provides updates about the facial expression of the facer.

Further , this project can be extended easily to provide the wearer with more details about the details of the individual the wearer faces. The project has the potential to impact over 10 Million people in the subcontinent of India.

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