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Low Cost Device for Helping Alzheimer Patient

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ABSTRACT: Patients suffering from Alzheimer's disease are not able to recognize their near and dear ones. In order to help them to recognize their family members, a low cost device is proposed which can help them to solve this problem in the real time. The proposed device recognizes the person standing in front of the patient and recognizes him/her within a fraction of seconds with a high reliability and tells the relationship of him/her with the patient to the patient.

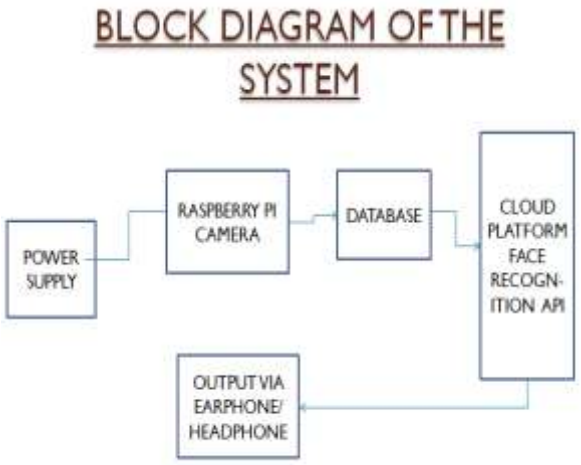
KEYWORDS: Alzheimer's disease, Google Cloud Platform, Raspberry Pi, MongoDB.

I. INTRODUCTION

As per World Health Organization, dementia is defined as a syndrome, which is usually of a chronic or progressive nature, in which there is deterioration in the cognitive function beyond what might be expected from the traditional ageing of a human being. It affects memory, thinking power, orientation, learning capacity, comprehension, calculation, language, and judgment. The impairment in cognitive function is commonly accompanied, and occasionally preceded, by deterioration in social behavior, emotional control, or motivation.

Many different types of dementia are there out of which the Alzheimer's disease is the most common form. Alzheimer's disease is having the largest share amongst all types of dementia patients. As per the World Health Organization report, Alzheimer's disease has a share of around 70 percent of all the dementia patients all around the world. Also, according to the same report, it is projected that the total number of people with dementia would reach 82 million by 2030 and 152 million by 2050. Much of this increase is attributed to the rising numbers of people with dementia living in low- as well as middle-income countries.

Thus, the demand for the memory aid devices will be growing exponentially, owing to the increase in the number of Alzheimer's disease patients. It is a high time that there is a need for proposing a low cost memory aid device which will be beneficial for the patients fighting from Alzheimer's disease. We have proposed a similar low cost memory aid device which will be helpful for the patient by increasing their ability to recognize people using a face recognition model which matches the facial features of a person with stored pictures of known people over the cloud.



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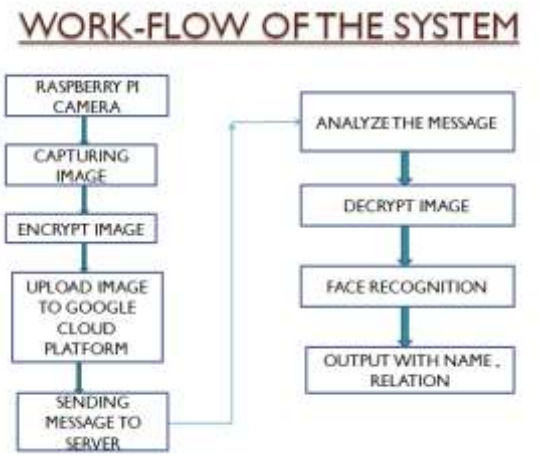

Fig 1. Block Diagram of the System
Fig. 2: Work Flow of the System

II. SYSTEM PERFORMANCE

The hardware device that is used for the project implementation is a Raspberry PI 4 which is powered by a 1.5GHz Broadcom 2711, 64-bit quad-core Cortex-A72 processor, along with a 5 megapixel native resolution sensor-capable of 2592 x 1944 pixel static images which is fixed externally to the module. The software part used is Python along-with the OpenCV which is an open source library. For training the model, we have used Haar Cascades Algorithm. Also, we have proposed to use the Cloud Service for storing the database of the facial characteristics of the people, so that device would be capable of remotely adding and deleting the people characteristics and hence, increasing the flexibility to the system as well as ensuring an increased security to the system.

We are using a 5 megapixel native resolution sensor camera fitted to our Raspberry Pi 4b, connected over the internet with the google cloud platform via Wi-Fi, which will be responsible for capturing the image of the person standing in front of the patient and will send the same to the cloud server via the Raspberry Pi 4 module. On the Google Cloud Platform we have defined four API's in total which are responsible for four different operations namely- create operation, read operation, delete operation and the update operation to the data saved over the Mongo database. The whole working process of the system can be best explained with four API's. These are:

1. Create Operation
2. Read Operation
3. Deleting Operation
4. Updating Operation

III. WORKING

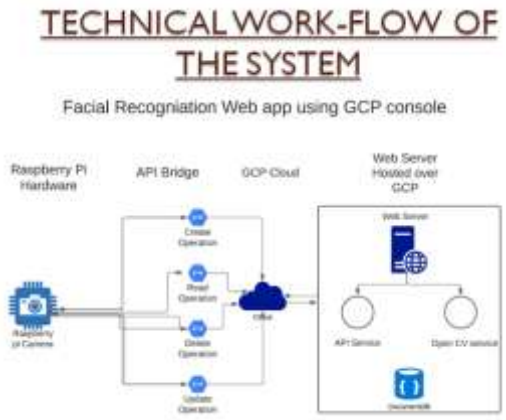

Fig. 3: Technical Work Flow of the System

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Create Operation: This API segment of the python code is mainly responsible for recording a person's identification data. For this, the code instructs the camera to take 20 sample pictures. And users need to provide information about his/her name and relationship with the patient. This information is then stored in MongoDB database along with the 60 sample pictures. When the data of a person matches with any previous record, his/her sample pictures are updated. This feature makes our system adaptive to small changes in the person's facial characteristics.

Read Operation: This API is responsible for matching the photo captured by the camera mounted over the Raspberry Pi with the data available in the database.

Deleting Operation: This API is responsible for deleting the all the data from the database along with all the relevant photos and the name content.

Updating Operation: This API is responsible for updating the data on the server including the name, his/her relation as well as the captured images in the case if the information given to the server is wrong.

If the captured image is sent directly from the Raspberry Pi Camera to the Cloud then the read operation will be triggered and the captured image will then be matched with the data available in the database over the cloud and if it is a match then the output will be given with the person's name along with his/her relation with the patient into the ear of the patient through headphones or earphones connected to the Raspberry Pi 4 using Google text to speech converter and if it does not match then it will output the result as no match found.

Moreover, all the other operations namely Create Operation, Delete Operation and the Updation Operation will be triggered manually by logging into the Google Cloud Platform.

IV. FUTURE SCOPE OF WORK

An external GPS Module can also be attached to the Raspberry Pi so that the live location of the Alzheimer's Patient can also be tracked by his/her family members in case the patient gets missing. Also, the family members can set a defined parameter of the area and if the patient goes beyond that point then an automatic notification can be sent to the pre-registered numbers which can be of the patient's family members and the concerned person in charge. Moreover, an automatic alarm can also be set for reminding the patient about taking medicines at the right time which can be done through the earphones/headphones plugged into the ears of the patient which will then speak into his/her ears via google text to speech converter.

V. RESULT

The device for helping the Alzheimer's disease patient was successfully made functional and below are the few captured image which were saved into the database for helping to recognize the person along with their name and their relation with the patient.

Fig 4.1: Facial Characteristics as saved in the database on the cloud.

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Fig 4.2: Facial Characteristics as saved in the database on the cloud.

Fig 4.3: Facial Characteristics as saved in the database on the cloud.

VI. CONCLUSION

The whole system is built on the Raspberry Pi 4 system using the Raspberry Pi camera responsible for capturing the images of the person. The Raspberry Pi 4 is the brain of the system. The dataset for the system which contains the face information along with the name relation with the patient is stored on the Google Cloud Platform and the database used for storing the data is MongoDB. The database contains information regarding the person to be detected. The given system is very powerful and efficient as it has no impact of the background effect during recognizing the person. It can effectively recognize the person even if the environment and background changes. And it works satisfactorily in different lighting conditions. Small changes in a person's face like make-up, the spectacles have little to no effect on the recognition process.

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