HOME SECURITY FOR ALZHEIMER'S PATIENTS

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Abstract - *Alzheimer's is an irreversible disease named after Dr. Alois Alzheimer's. In 1906, Alois noticed a change in a female brain, who died because of mental illness. It was recorded that her symptoms were memory loss, lack of decision making and language problem. After her death, Alois examined her brain and found many clumps and tangled fibers which were the main reason for Alzheimer's. In case of Alzheimer patient, the neurons are not able to communicate because of the blockage. The overall vandalization in the hippocampus leads to memory loss and hampers learning and is the main reason for all the problems. In this project, we have tried to solve the problem through the most demanding technology IoT. We have provided an image detection mechanism that will detect the face and provide a proper response to the patient if the detected face is familiar. There are camera modules surrounding the house. It is a security system which will send notification to nominees of the patient when the unknown person is detected with a help of alert message. Our ultimate goal is not to make them dependent on the gadget but to help them overcome the daily life problem.*

Key Words: Home Automation for Alzheimer patient, IoT, Camera Module, Face Recognition, GPS

1. INTRODUCTION

In general, movement, thoughts, feelings, etc. of a person is because of brain signals which are circulated all over the body of a human being with the help of neuron cells. Neurons are constantly in contact with other neuron cells with the virtue of electric charges that travel across axioms. These charges cause the release of some kind of chemicals between the neuron cells. There are many other brain cells that are responsible for the health of the neuron cells such as atrocities and microglia. Any person diagnosed with Alzheimer's suffers from some noxious alterations in the brain, destroying the health of the brain which eventually disturbs the healthy balance of the brain. It can be very difficult to detect any symptoms of dementia; it may take up to a decade for the symptoms of dementia to be recognizable. All this time the brain cells beta-amyloid and tau become harmful to the brain. Tau leads to the formation of tangles inside neurons and beta-amyloid build up between neurons stopping the signal to the process. Furthermore, the increase in amyloid leads to an increase in tau throughout the brain. It is also noticed that one more reason is that there is a shortage of blood and nutrients to the brain which is the duty of the vascular system. As a result, it fails to communicate with other neurons. The brain starts to contract due to the death of the neuron cells. This contraction originates from the hippocampus which helps in learning and memory. This results in memory loss, lack of decision making and language problems. In order to help the Alzheimer patients, the camera around the house will always be detecting faces and tell the patient who has come to the door. In case an unfamiliar face is detected the patient will be not to open the door. Also, an alert message will be sent to the nominees and relatives. All these functionalities require IoT devices.

1.1 MICROCONTROLLER

One example of a microcontroller board is Arduino Uno. These are small and low-cost microcomputers. Embedded systems are discrete devices that are connected with each other via some kind of communication channel like the internet. These microcontrollers are used in embedded systems for processing. Most of the devices that we use today house a microcontroller in them, be it a TV remote, memory sticks like RAM, Graphic Card, etc.

1.2 FACE DETECTION

The identity of a person can be identified by many things but the face of a person makes it the easiest task. There are basically two phases of the human face recognition procedure. First of all, the face of a person is captured which acts as an input to the system. In the next step, we train the model on that face and introduce that face to the system. These steps are then repeated for a certain number of times. This forms a dataset for the model to identify faces from. So, whenever the model detects a face it matches it with the existing dataset and gives the result.

1.3 SENSORS

This is an electronic component that is designed in order to measure the change in the environment and send a signal back to the microcontroller for processing.

1.4 NODE-MCU ESP-8266

This is the microcontroller which is designed to get connected to the internet and transfer the data to the site like thinger.io in order to send the mail and for other online processing.

2. EXISTING TECHNOLOGY USED

2.1 Local Binary pattern histogram face detection algorithm.

This is the most common and classic face detection algorithm that helps in face detection. This has been implemented in three steps, first creation of data, second training with the data, and last prediction.

In dataset creation, the image is taken and converted into grayscale and we can get the part of this image as a window of 3*3 pixel. The window holds the potency of every pixel from 0 to 255. Once we have the window, we calculate the threshold value which is nothing but the central value from the window of pixels. The central value is now compared with the other 8 neighbors. After comparison, if we find any of these 8 values to be greater than the central value set its value to one else zero. Once all this is done, we note all these binary values in the matrix in a serial order. Now, this binary value needs to be converted to a decimal value. The reason behind this binary to decimal conversion is that it gives better characteristics about the image and also increases its accuracy.

2.2 Thinger.io

This is the platform which helps us to create endpoint once the particular action is done. We will be using this in order to trigger the email service and notification on the mobile phone. They provide us with the cloud infrastructure for associating a large number of devices. REST-API can be used to access these devices from the admin console.

2.3 Google Reminder

This feature has been used to set a reminder for a specific topic. It is mandatory to select a date and a time when one needs to be notified. Tap on the create button, write the topic for the reminder, select time and date and finally select save. The reminder is synched with the google calendar.

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper.

2.4 Global Positioning System

The Global Positioning System (GPS), as the name suggests helps in finding the location of a particular object with the help of a sensor attached to the object. All thanks to 24 satellites separated by 11000 miles and are revolving all around the earth. GPS has been bluntly efficacious for non-military applications. Even though the GPS satellites are so far away from the land, they are providing us with very reliable results and that too for 24 hours of continuous surveillance.

3. RELATED WORKS

[1] This paper describes on the algorithm which is sufficient enough to detect the frontal and side face, with an accuracy of 50-70%. According to them, the face recognition is divided into 4 parts. First, Information Acquisition Module, the particulars accumulated by this module are further used for test samples for the survey. Second, Feature Extraction Module gives the dissimilarity statistics of a pixel to its neighboring pixel. Third, Classification module is further used to identify the faces. Fourth, Training Classifier database module deals with the storage of result in a database for future use and detection.

[2] This paper explains the use of the mi-wi device in order to track the patient. The device will be connected to the patient constantly. So, in any case whenever the patient diagnosed with Alzheimer's is inaccessible, the caretaker is supposed to receive the location of the patient in the form of coordinates i.e. latitude coordinates and longitude coordinates. It will help the caretaker to locate the patient on Google Maps. In cases where equipment or the device fails or is off-track the rearmost value of the location coordinates will be delivered to the caretaker. The caretaker can also share patient details with social media and people can track using that information.

[3] From this paper we have considered the working of GSM/GPS system for tracking the person at the time of emergency in order to provide help as soon as possible.

[4] This paper focuses on Face recognition which is the most in-demand application which is used in home security, mobile phones, ATM, etc. In this paper, they have used open CV to detect faces that are pre-trained on many positive and negative images and finally used the LPH algorithm to detect the faces.

[5] This paper has examined that tracking various activities like a heartbeat, sleep tracking, mood tracking, etc. play a very vital role in predicting the health of the patient. In an Alzheimer's patient, these factors need to be examined very carefully. In order to help the patient, they have built the smart mind gadgets which track their sleeping time, heartbeat and mood and at the end of the day predict their mental status and health.

4. SYSTEM DESCRIPTION

According to Fig – 1, the first step of the system is face recognition. In this, we will be supplying a dataset to our model as much as possible, in our face detection model the user will be asked to supply 20 images by pressing the identification no and password set by admin. Once the dataset is created the model will train itself on those images in order to predict the output. The output will be the relation of that target person with the patient along with his/her name. In order to capture the face for predicting we need

two cameras one will be fitted inside the house near the gate and the other will be fitted with the spectacles. Now consider the situation when the person is outside and unknown person tries to connect with him by telling the fake relation of that person with the patient in order to take advantage , so to overcome from it our spectacles will come into play which will detect the face and showing the output on the spectacles or as a small notification on the phone whereas the camera inside the house will work on the same principle i.e. to authorize them inside the house. We are also having a security system designed especially for this purpose. Once an unknown person enters the house it will come into play as it will send a message to the selected contact list set by the user asking them to revert back as soon as possible, live location link and live video streaming link. In addition to that, we have a live video streaming system that will start recording and continue saving the video on the cloud server so that anyone who has the proper authorization can access the video.
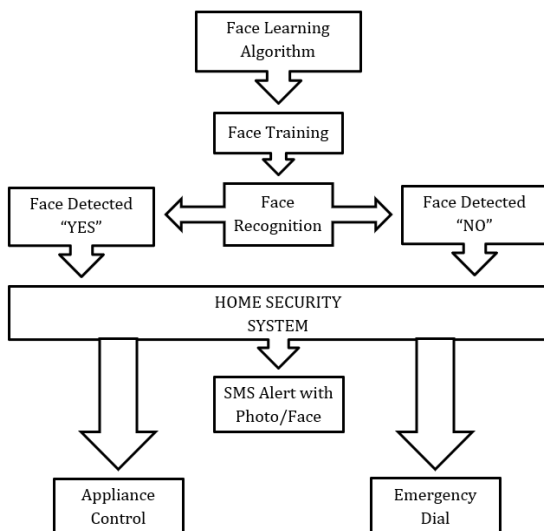

Fig -1: Block Diagram

5. IMPLEMENTATION

5.1 Notification

This is used for getting the response after the face detection i.e. the person is in relation to the patient or not inpatient mobile whereas in the case of the caretaker phone the emergency message which says revert back as soon as possible with location and live video streaming link.

5.2 Email

For sending alert e-mail to the selected contact list i.e. nominees and to the nearest police station available to help the patient.

5.3 Algorithm

We have used face recognition using the LBPH facial recognition algorithm.

6. RESULTS AND DISCUSSION

The following Fig – 2 displays the result of the face recognition algorithm results which is based on the training set.

Fig -2: Face Detected

7. CONCLUSION

The project is not to make the patient dependent on the gadgets but help the patient to overcome the daily life problems and learn from them. In the future, lots of gadgets will be available which will be cost-effective and easy to install or maybe medical science may find a way to solve the problem but till we have to use the latest technology and our hard work to find an efficient and easy to use way to protect and help our dear and near one.

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