FACE RECOGNITION DOOR LOCK SYSTEM USING RASPBERRY PI

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ABSTRACT

With the world moving towards advanced technologies, security forms a crucial part in daily life. Among the many techniques used for this purpose, Face Recognition stands as effective means of authentication and security. This research paper deals with the user of principal component and security. Principal component analysis (PCA) is a statistical approach was used to simplify a data set. The minimum Euclidean distance found from the PCA technique is used to recognize the face. While a low cost Raspberry Pi ARM based computer on a small circuit board, controls the servo motor and other sensors. The servo-motor is in turn attached to the doors of home and opens up when the face is recognized.

I. INTRODUCTION

A ubiquitous property of human perception is our ability to tell apart between different faces even once they look similar and recognize many different Individuals with almost no effort. Automated face recognition is vicinity within Computer Vision inspired by this ability. Biometric identification systems specialize in extracting faces from static images and video sequences and deciding whether or not they belong to a database of known individuals.
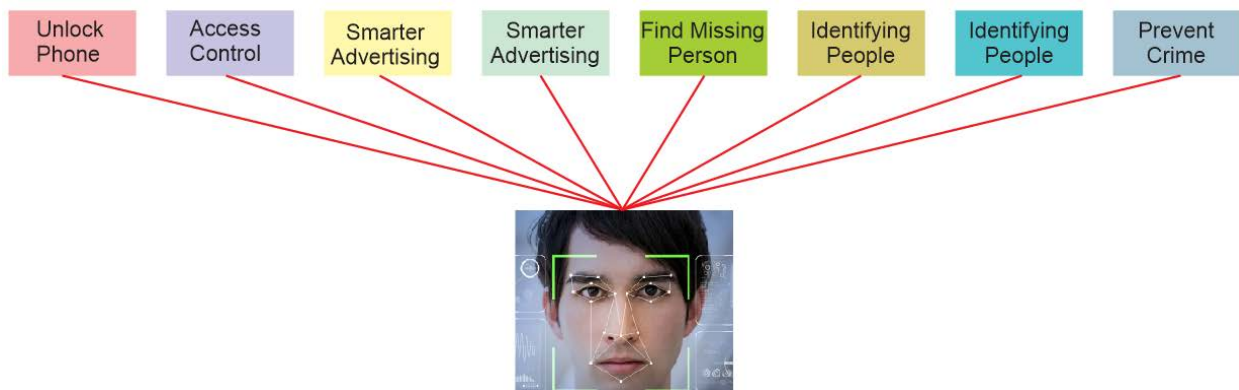

Fig - 1: Various applications of face recognition.

The face recognition system is that the hottest process of identification of a known person by his various image data. During this system, the pc will compare the person standing before the camera with its storage image files. If the face matched with the database files, then it'll recognize the person by its ID or name. If it doesn't then match, then the person is going to be unrecognized. For creat-

ing the face detection and recognition program most people prefer to use Python because of its libraries and applications in deep learning and machine learning fields. Automated face recognition is a motivating computer vision problem with many commercial and enforcement applications. Mugshot matching, user verification, and user access control, crowd surveillance, enhanced human-computer interaction all become possible if a good ace recognition system may be implemented. While research into this area dates back to the 1960s, it's only very recently that acceptable results are obtained. However, face recognition continues to be a district of active research since a totally successful approach or model has not been proposed to resolve the face recognition problem. In this paper, the face recognition system has been used to control the access of general people in restricted areas. The paper has divided into three parts, the author has described the methods of the system at the beginning, in the system setup it discusses circuit diagrams and at the result and discussion part, it analyzes its results.

Principal Component Analysis

Principal component analysis, a method to abridge huge high dimensional data, is a statistical approach for face recognition and image compression. The PCA uses mathematical tool such as eigenvector, eigen faces, euclidean distance, covariance matrix for its functioning. This 2-dimensional data feature extraction method, computes feature of each image in training set into their respective covariance matrix. This covariance matrix is used to determine the eigenvector and eigen value for each corresponding image. From the derived values, eigenvector corresponding to the highest eigen value is considered. This eigenvector is the principal component of that image and is projected in the face space. Similarly, eigen vector of the test image is calculated and the euclidean distance is evaluated. The euclidean distance is the average distance between the test vector and the training set.
The minimum distance represents the most similar image.

II. METHODOLOGY

Generally, people lock their doors to be safe from thieves or other people. There are various security access control systems such as keys, Barcode ID, or another system any unauthorized person can still brake in. But with face recognition system there is no such limitation, the face data are stored on Linux operating system based Raspberry pi and it'll compare real-time with the persons before the webcam. Raspberry Pi3 has been used because it's a creditcard sized computer that work faster than some other huge size computers.

The architecture of the Raspberry pi facial recognition system is smaller, easier than the PC-based facial recognition system, and has lower power consumption. It is freer to build applications on Linux due to open-source code. For the face recognition and identification method, the principal component analysis (Eigen faces) algorithm is used. The system is inexpensive, fast, highly durable and offers sufficient versatility to satisfy various system requirements.

Using this technology:

1) Image Processing: This method is used for image capture and recognition compared with database images.

2) Embedded System Design: This approach is used for the module, which combines hardware, software and many other featured components.
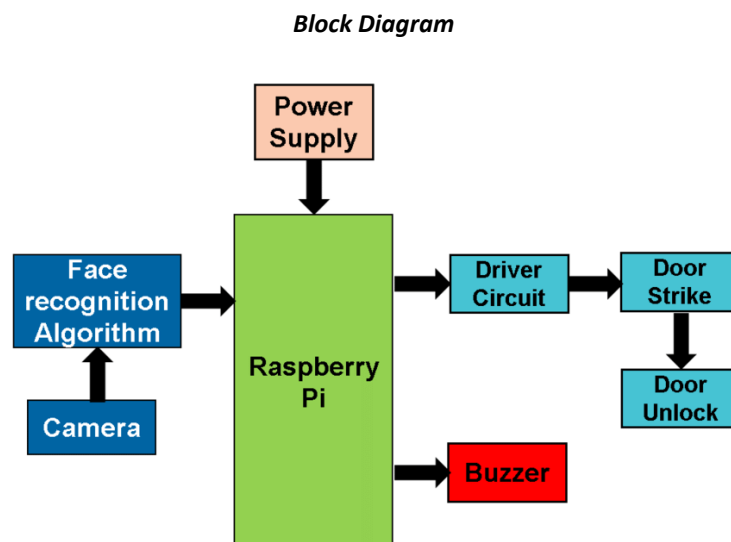
Block Diagram

Fig - 2: Block diagram of the proposed system.

A. Raspberry Pi

The version of the model (A or B) doesn't really matter. But we have used Raspberry Pi model B with Wi-Fi. With the intention of promoting the teaching of basic computer UK has developed Raspberry Pi as a credit card sized single board. It has a Broad com system on a chip (BCM2835). It also includes an ARM11 700 MHz, video core IV GPU, with originally 256 MB of RAM, now upgraded to 512 MB. It uses SD card for long term storage purpose. It uses a 5V power supply to run.

B. Pi Camera

It comes with a flex cable. This is inserted into the connector located in between the Ethernet and HDMI port. When there is someone next to the door, by using face recognition software it can capture the image and store it in the database using python and then it can be send to the owner through android application, this can help in providing security to home. The camera is capable of 2592 x 1944- pixel static images, and supports 1080p30, 720p60 and 640x480p60/90 video.

C. Relay

In our system we have used two channel relay for device control. A relay is an electrically operated switch to operate a suitable pull in and a holding current should be passed through its coil. It is designed to operate from 5V to 12V. Relay would be ON, When a LOGIC 1 is written on th e port PIN. It is turned OFF by writing LOGIC 0 on the port pin. The main advantage of this is it very low cost and expandable, and it is noise free system.

D. DC Motor

A DC motor is rotary electrical equipment which converts electrical energy into mechanical energy. A current running through a coil of wire generates an electromagnetic field aligned with the center of the coil. Changing of the direction and the magnitude of the magnetic field can be done by changing the current flow through it. It is connected to the relay where it drives the miniature door after successful recognition process.

III. IMPLEMENTATION

The paper is face recognition with the help of Raspberry Pi for the door unlocking, which ensures that our homes are safely protected. Raspberry Pi operates the video camera to capture images and monitors them. Open CV/ Python Library is developed by using a stored facet database as a given picture of a scene to recognize or check one or more people in the scene. The pictures are then derived and will match photographs from the collection. The door opens automatically if the pictures are paired. Otherwise, the door lock remains closed.

In this research, 3 very distinct phases for Face Recognition was considered:

A. Data Collection

We worked with face detection using this Haarcascade classifier. We need to extract features from positive and negative images and train the model which then detects the faces. The OpenCV consists of a trainer as well as a detector. OpenCV already contains many pre-trained classifiers for face, eyes, smile, etc. Those XML files can be download from Haarcascades directory. This python code consists of 2 phases face detection and then gathering the detected data into a dataset. For collecting the data into the dataset, create a folder to hold the data inside the project directory.

B. Train the Model

On this second step, we took all user data from the dataset and train the OpenCV Recognizer. This is done straight by a specific OpenCV function. The result will be a .yml file that will be saved on a "trainer/" directory. A new python file training.py is created to write the trainer program.

C. Recognize the Faces

In the final step of the project, we will capture a fresh face on our camera through a live video stream and if this human's face is snapshotted and features extracted before, the recognizer model makes a prediction returning the person's name and an index, shown how confident the recognizer is with this match. And then the solenoid lock is opened to which the electrical is send by raspberry Pi through the relay module.
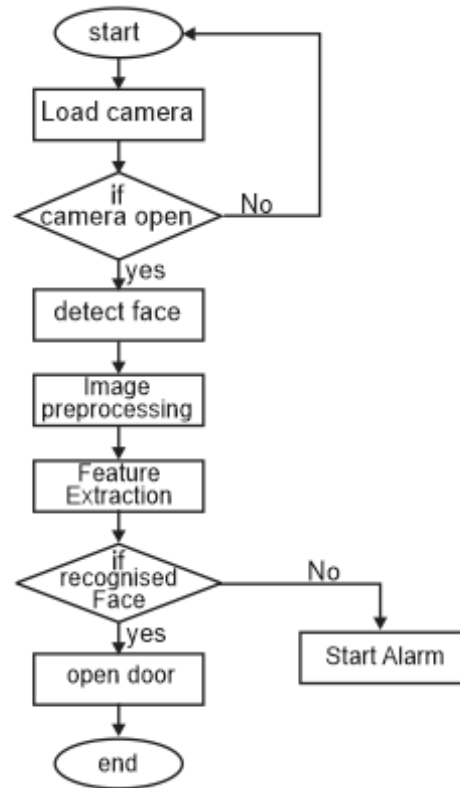
Fig - 3: Flow chart of the face recognition system

IV. RESULTS & DISCUSSION

In this experiment, there were individual ID numbers for everyone's faces at face data accusation. The first step was to get face database and then extract the faces with the LBP algorithm and finally get the recognized faced information and observe how it open the door or buzz for unknown faces. For testing, authors collected various face data to see how the system respond to different factors and it used raspberry pi camera module v1 (1080 Px) for data accusation. The face database of ten random people with 31 images for each person was created and stored in the Dataset folder with individual face ID, and the faces were captured and converted into greyscale images of 25x25. Here, only the frontal face is marked in the Haar Cascade Face detection process, so our system saved only the rectangle part from the faces and saved the image with id by converting that image into RGB to Grayscale image.

Through the datasets and training algorithm will be able to identify the known face and give permission to enter the room. There is an image below which shows the system has identified the person and given permission to enter the room.

Conclusion

The arrangement of a facial recognition system using raspberry pi had used the Linux operating system that can make the system littler, lighter and work successfully utilizing lower control use, so it is more convenient than the PC-Windows based face recognition system. Also, it triggers the security alarm for unauthorized persons whose faces data doesn't match with the stored data inside its database. The main concern was to create a face recognition based door access controlling system that would be able to identify knowing persons with their ID, then it will give access to known persons and alarm for the unknown ones.

Acknowledgment

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