

Door Lock Access Control System Using Facial Recognition

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Abstract— This paper represents implementation of “Door Lock Access Control System using Facial Recognition” which is used for Accessing the door, the developed system is very handy and can be deployed at several places like office, Apartments, cabins and etc. The developed product will give you the access of Door without even touching the door handles. It will automatically open for people who are registered to the system. No big systems are required to deploy the product, the developed unit requires very little space. The main aim of our project is to develop a system which is very secure as in today’s world security is major concern to everyone. The human face has complex and multidimensional structure and hence it needs good computing technique for face detection and face recognition. The project is developed in python language using OpenCV module because it uses Eigen face and reduce the scale of the images with no loss of vital features. The faces of many people can be stored in the database. The door can be accessed remotely from any part of the world using mobile application. If any user arrives who are not registered then their photo is sent to the admin through email for security purpose and later admin can decide whether to give access or not.

Keywords: Python, OpenCV, Raspberry pi, Email

I. INTRODUCTION

The Human being are identified with their differential facial characteristics. In the Facial recognition approach the face is compared with all the faces stored in the database and to pick one face who have highest percentage of similarity with the given face. In the field of bio-science the facial recognition is one of the fastest emerging fields. The use of face recognition in security system is due to the commercial interest and hence there is a development in feasible technology to support the development of facial recognition. The commercial interest is majorly in Surveillance, Human and computer interaction, Multimedia management, Passport verification and others. The face detection is very challenging process because identifying the face when they have sun-glasses and beard become ineffective. Sometimes because of the extra light, over saturation the image becomes brighter and hence become ineffective. So, to overcome to this issue in our facial recognition system we have used OpenCV which uses Haar Cascade Classifier for the faces. The camera is deployed on Raspberry pi which is the main processing unit. The camera captures the face and compare the faces stored in the database, when the face is recognized the access to the door is given and the log is stored in the database with the user ID and the accessing time. The main processing unit have a solenoid lock, a camera, PIR sensor, relay module and led lights. A trainer is used to train the model which is built and it will store the data in YML file.

II. PROBLEM DEFINITION

The project is developed to avoid the security issue which arrive when key, password is stolen or lost. In traditional approach the door is unlocked by using key or Id password mechanism. Earlier to give a one time access the user have to present over there or to share password or key. The issue is solved by our face recognition door lock access system which provides contactless access of door to the user as well as the door can be unlocked remotely from any part of the world, it is very useful when someone wants to give access only for one time.

III. METHODOLOGY

The proposed project is built on Raspberry pi which have fast processing power. The Raspberry Pi has Debian based Linux operating system called Raspbian. Different modules like Pi camera, Solenoid lock, Relay module PIR sensors are deployed on Raspberry pi. Initially when user comes in front of the camera the face of the person is captured and it compares it with all the faces stored in the database, if the matching percentage of the user is more than the matching percentage which we have set than the user is recognized and access to the door is given. Every user has a unique ID which is stored in the database, whenever the access is given to any user their ID along with the access time is stored in the database which is a proof that user accessed the door. Only the admin has the authority to add user for security purpose, to do this the admin have to login to the system by using face recognition and then the admin can add new user. By logging in the admin have a complete control on the system, the admin can add new user, delete existing user, view the door access log. Whenever a new user is added, it is compulsory to train the model to save the image to user in trainer YML file. The trainer model takes very few seconds to train the model. The major advantage of the project is, it is based on the real time data i.e. the camera is continuously ON to provide ease is accessing the door also to achieve the contactless accessing of door. If the user who is not registered arrives in front of the camera then the snapshot of the user is taken and send to the admin of the system by email, after that if the admin wants, they can give the access with the help of telegram app. In this project SQLite database is used to store the user data and to store the user log. SQLite is a light weight database We have used a light weight database which is Sqlite3. Sqite3 can be integrated with Python using sqlite3 module, which was written by Gerhard Haring. The face recognition algorithm is based on OpenCV which is developed in C++ and has binding with JAVA, Python and MATLAB. Image processing and video processing are the two main important features of OpenCV.

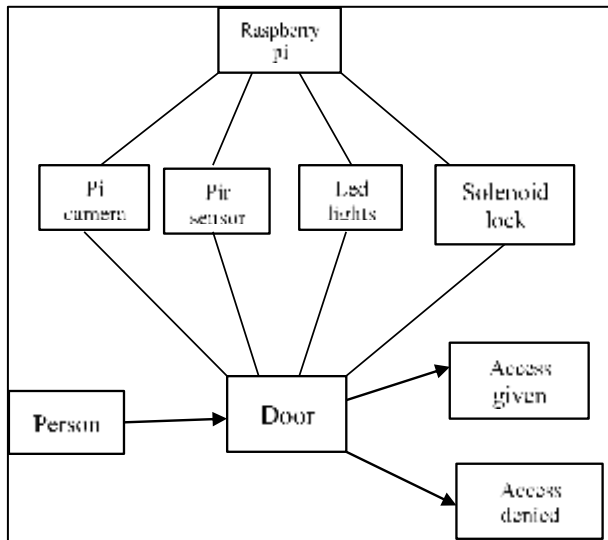


Fig. 1 System Architecture

The system Architecture diagram shows the connection between the different modules like camera, solenoid lock, sensors and lights. The facial recognition software is installed on raspberry pi. The projects work based on several modules they are Input module, Processing unit, Enrollment module, Authentication module and Application module.

- 1) **Input module:** The input module consists of the camera and PIR sensor. The camera is used to capture the image of user and PIR sensor is used to detect the presence of user.
- 2) **Processing unit:** The processing module is Raspberry pi board along with the scripts, code, database, and other modules.
- 3) **Enrollment module:** The data which is collected from the camera is stored in the database. Before storing the data, we extract features of the face using Haar Cascade classifier.
- 4) **Authentication module:** In this module, we recognize and detect the input images. This module is connected to the outer side of the door, where the captured image converted into Haar Feature based Cascade Classifiers. And matching this feature extraction image with the database

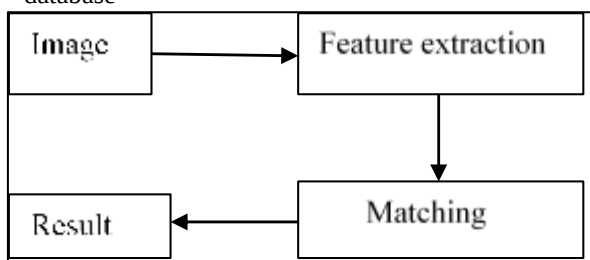


Fig.2 Authentication module

- 5) **Application module:** This module consists of door lock circuitry, it is associated with the door and start functioning once the authentication module provides a green signal,
- 6) **Collaboration diagram:** The collaboration diagram, which is also known as a communication diagram, is used to portray the object's architecture in the system. In this diagram we will see how the user or admin interact with the software.

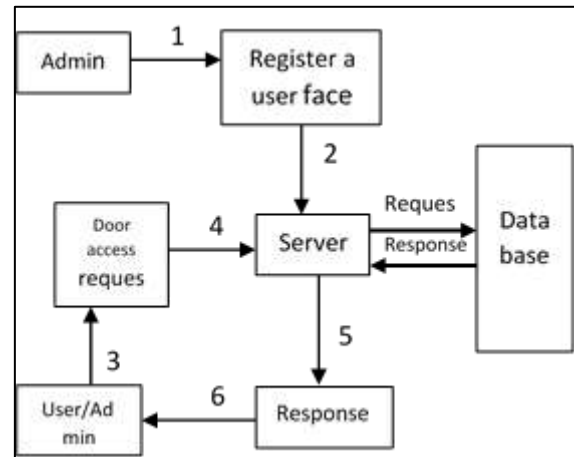


Fig.3 Collaboration diagram

Activity diagram: Activity diagram is basically a flowchart to represent the flow from one activity to another activity. The diagram shows the activity of user throughout the software.

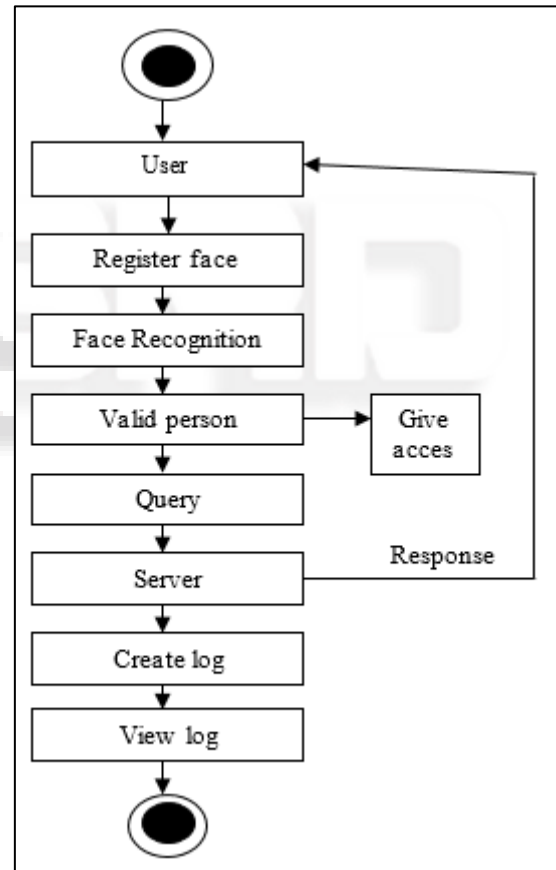


Fig 4. Activity diagram

IV. APPLICATIONS

- Home security: Alert the user if unknown person comes near house.
- Security/ Counter terrorism.
- Document verification.
- Attendance system and to know the entry time for employees.
- Government services like law enforcement investigation and passport verification.

- Offices, cabins and many more.

V. RESULT

As you can see in figure 5. The software has successfully recognized the registered face. Now it will give the access to the door and updates the log for this person with its ID and time when the door has been accessed.

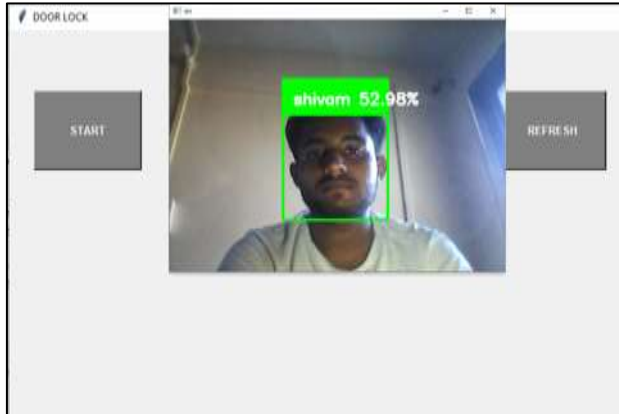


Fig 5. Face recognition

The user is also able to access the door remotely anywhere from the world. For this the user can simply send UNLOCK message through telegram as you can see in figure 6.



VI. CONCLUSION

The project which is built is a good example of Raspberry pi and Pi camera and OpenCV. The face recognition system is developed using Python programming language and SQLite database. The system is able to access the real time data which is captured using Pi camera. The efficiency of the system is analyzed in terms of face recognition rate. The analysis states that the system which is built shows excellent performance efficiency.

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