IOT BASED HOME SECURITY SYSTEM USING RASPBERRY PI

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ABSTRACT

This paper deals with the idea of secure locking automation utilizing IOT for door unlocking system to provide essential security to our homes, bank lockers and related control operations and security caution through the GSM module .It uses an image capturing technique in an embedded system based on raspberry pi server system. RPi (Raspberry pi) controls the video camera for catching it for turning on a relay for door unlocking. The module contains a secured face recognizer for automatic door unlocking. The camera catches the facial picture and compares it with the image which is stored in the database .If the picture is found in the database then the door lock opens otherwise it will produce a SMS that an unknown person is trying to gain access.

Keywords:
Face Recognition; Internet of Things(IOT); Image comparison; Sensors; piCamera; Raspberry Pi3;Person Identification

1. INTRODUCTION

In these modern days, home security is a need of the hour for the development of society which in turn will make our cities smart, so the concepts of facial recognition and comparison came into existence to gain the access of the house to make our home more secure. The need to secure our home, industries and related properties is a very important task to be played. A home security system is a system which captures images of our face and verifies the identity of a person using a pi camera. The human face is assumed to be an essential part in our social association, passing on individual's character. Utilizing face as a key to biometric, security has gotten incredible consideration while it's potential for a wide assortment of utilizations.

A facial acknowledgement framework is a framework which gets pictures and confirms the character using a camera. It is used for checking a man from a picture. One way to do this is by looking at facial features from the image and also the database. Face images can be caught from a separation without touching the individual being recognized, and the name and number does not require participating with the person. It is basically utilized as a part of security framework and can be compared with various biometrics and it also has turned out to be main stream as a commercial recognizable proof and advertising mechanism.

Internet of things:

The IOT i.e., Internet of things additionally called the Internet of articles, refers to a main objective between the items. The term IOT has come to discover the various advances and researches teach that empower the web to connect into the present reality of physical articles. There are various technologies that come to know about the IOT like RFID, Near-field communication, optical tags and quick response codes, Bluetooth. In this work we have used Raspberry pi3 which is a mini computer and is used to carry on multiple functions which was created in UK by the raspberry pi establishment. Raspberry pi has multiple number of generations.
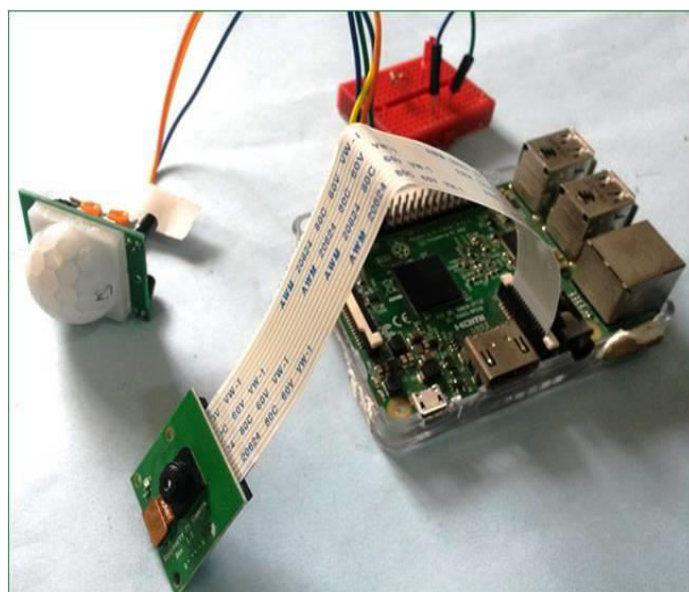
Here we are pi3 which is the replacement of pi2 and it is believed to be approximately faster in parallelized task. It has ARM architecture of ARM v8 which is either 64 or 32 bit, Broadcom BCM 2837 System on Chip used along with the CPU of 12GHz 64/32 bit quad core ARM cortex A53. The memory of raspberry pi3 is 1GB and the storage is in the micro SDHC slot. It has also the facility of Wi-Fi and Bluetooth as compared with other raspberry pi versions.

Cloud Computing:

In a home security system along with the raspberry pi is combined with the cloud computing to provide the communication between the person and the intruder to provide maximum security. Cloud is a service provider or a type of internet based computing that provides shared computers processing resource and other devices on demand. It is a gathering of advances that IT assets provide to utilize on an on-request premise and showed by means of the web. It can be viewed as another processing view that permits the figuring frame work with atleast one level of deliberation, as on-request benefit accessible over the wed or other PC organize. It is versatile and also sold on request incrementally or the hour. Its versatile because a client can have to such an extent as they need at any time and it is completely over seen by the supplier. It has the most prominent adaptability at lower cost. Cloud computing is a subject that has been getting a fair arrangement of consideration. It can be ordered into four sorts on the premise of area where cloud is facilitated. They are: 1.Public Cloud: It is the cloud in which the work and other assets that it has are made accessible to the over -all population all around the world using the web services. It is accomplished with a cloud supplier offering cloud administrations and also outside to an association.

2. Private Cloud: It is a cloud which has a restrictive system or a server farm that facilitates administrations to a specific number of individuals. It might be known to any association or an outsider, and might present inside the associations server farm or outside of it.

3. Community Cloud: It is a group cloud which is like the private cloud but the foundation and the assets are shared by a few associations that have regular protection mainly the security from various intruders and the administrative contemplations, rather than utilizing strictly the solitary association.

4. Hybrid Cloud: It is a breed cloud and also a piece of at least two mists either private, group or open. The mists are extraordinary elements that might be bounded together by institutionalized or restrictive innovation that produces interoperability.

Cloud computing also uses three conveyance models by which diverse sorts of administrations are conveyed to the end client at the maximum rate. The three conveyance models are SAAS, PAAS and IAAS which give framework assets, application method and programming part as administrations to the buyer.

Software-as-a-Service: It is characterized as a product display in which the needs are facilitated by a specialist. It is also called as 'On-Request' programming.

Platform-as-a-Service: It gives foundation on which engineers can create new applications without buying advancement or generation server framework.

Infrastructure-as-a-Service: It is a programming method of organization where the basic figuring foundation of servers, programming is given on-request benefit.

2. LITERATURE REVIEW:

For today's fast paced and ever changing world, security is one of the basic wish of the people. For this the technology in the field of security plays a crucial role in maintaining a secured life as well as reducing the manpower efforts.
Y. Januzaj.et al. proposed real time access control for face recognition using, Raspberry pi instead of GSM services and relay. The limitation of the work was it couldn't control the background light situation and ambient light conditions.

H.Lwin.et.al has proposed a door lock access system which consists of three subsystems: to be specific face recognition ,face detection, and automated door access control. Face recognition is actualized by using the PCA (Principal Component Analysis). The door will open itself for the known person in command of the microcontroller and caution will ring for the unknown person. Demerit of this system is input images are taken through a web camera continuously until the 'stop camera' button is pressed. Somebody is required at the location to check unauthorized person's images or status of the system and take further appropriate action. Personal computer (PC) is associated with the microcontroller, the entire system will not work if PC is crashed or Non-Function.

M. Chowdhury.et al. had implemented security system where if any person came at the door it was notified to the home owner via e-mail and twitter then the user could see the person standing at the door using camera from remote location. The image of the person got captured and sent to twitter and e-mail. They stated that user couldn't control the door remotely. They had concluded that this system was useful for preventing

unauthorized access. The limitation of this work was that the alert generated was sent to the mail and twitter account but if the user didn't have internet connection on his/her phone, he/she couldn't check the mail and couldn't recognize that any unauthorized person was trying to access the door.

G.senthilkumar.et al. proposed a work on Embedded Image Capturing System Using Raspberry Pi. In this work, they captured the image and compared it with the database but the limitation was the system couldn't work properly in the ambient light condition.

M. Carikci.et al. proposed a work on A Face Recognition System based on Eigen face method in which they used Eigen method for face recognition and Euclidean distance method to compare the image of the person concerned with the images in the database. It was very efficient and fast method and also gave high accuracy.

S. Jogdand.et.al proposed a work on Implementation of Automated Door Accessing System with Face Design and Recognition in which they used Viola Jones method for face detection and PCA (Principal Component Analysis) for the comparison of images. The limitation of this work was that it is not robust and the efficiency is less.

U. Sowmiya.et al. developed to connect any door with internet. In this system user also implemented PIR sensor and camera. PIR sensor used for detecting person and pi camera is used for capturing the video of the person who comes at the door. The video was sent through 3g dongle to authorized person. They had also discussed some advantages of this system. They had concluded use of this system in banks, hospitals etc. But their proposed model didn't provide the facility of sending messages to the authorized people.

Hardware:

- Raspberry Pi: It is a mini computer used to perform every task that is done by a computer within less cost and very less space and it also has a in-built Wi-Fi module which is used to access internet easily.

- Pi Camera: It is a camera module used to capture images and is attached directly to the raspberry pi board in the given slot for the camera.

- PIR Sensor: This sensor is used to know whether the person is present in the specified place for the camera to capture the images.

- LED: Here LED is used to know whether the person is authorized one or not. If not, the LED goes to OFF condition automatically.

- Connecting wires: We use jumper wires to connect the board, sensors and other external devices we want to connect.

- Power supply: We use a very less power such as 12V or 5V for the devices to work.

Software:

- Python 3.0: To run a program using raspberry pi we mainly use the python programming and it is also the safe method to execute the required task.

- Open CV 3: Open CV3 is used to operate several functions for image processing and can be used to execute any program using a single library.

- Raspbian Stretch: It is one of the operating systems just like windows and linux in our PC.

The various modules that we use in our project are as follows:

1. Camera module:
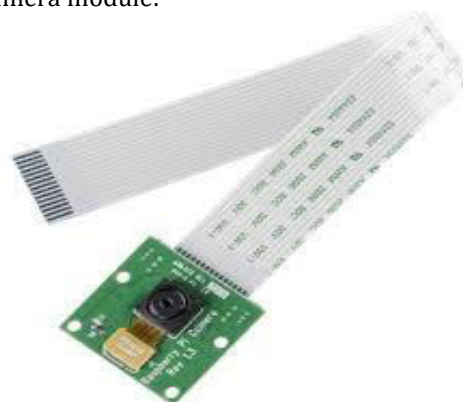
Camera module is the pi camera interfacing to the raspberry pi module. It is used to capture images and send them to the pi module. The LED flashes to handle the light condition that is supplied by the environment and these are called as ambient light conditions.

2. Raspberry pi model:

Rpi3 module works as a mini computer board. The image taken by the camera is compared with the database image. First of all, we should capture a group of images and store them in folder. At the time of door unlock we compare the image captured with the data base images. After comparing the images, based on whether the output is true or false it gives commands to the mail using the Wi-Fi module.

3.   Wi-Fi module:
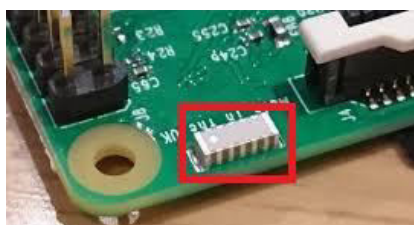
This module is the specific feature which was uniquely observed on the raspberry pi board which is used to access the persons at distance just like our hotspot in cellular systems or any electronic system. This module made the pi board unique as it can be used in multiple devices all around the world.

Block diagram
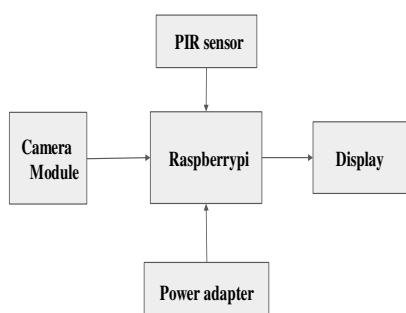
3. Methodology :

The proposed one works as follows:

1.   Installing Open CV and Raspbian stretch to interface with the Raspberry pi board.
2.   Interfacing a camera with the board to capture images of the faces.
3.   Creating a database of authorized persons if they exist.
4.   Save the captured image with a specific path and then compare with the images present in database.
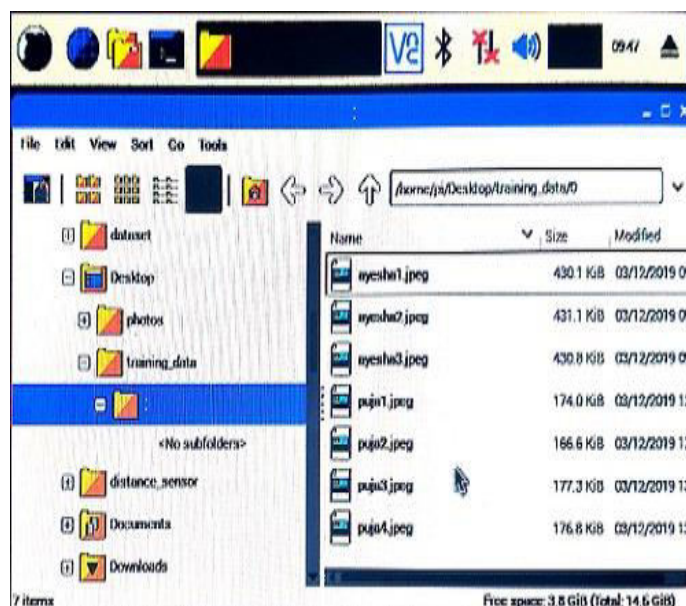
5.   If the image matches with the database image then the door unlocks automatically.
6.   We also create a tester image for the comparison and also to know the authorized persons easily.
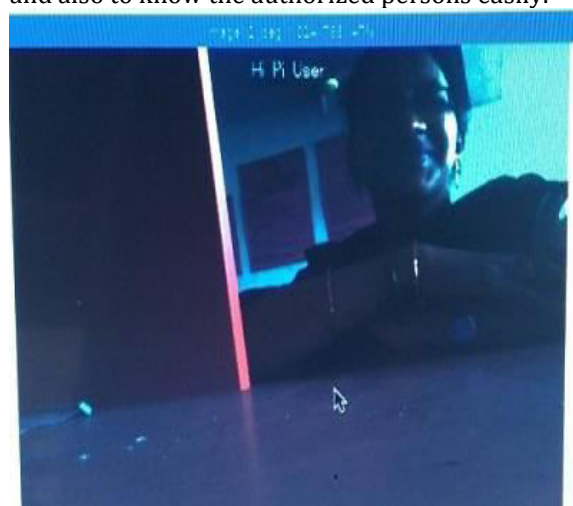

7.   Otherwise, an alerting mail will be sent to the authorized person to unlock the door.
8.   This project can also be used in industries, hospitals and other places for the surveillance.
9.   We can also use the servo motor to rotate the door instead of led that we are using just to indicate the existence of an authorized person.

The project of ours can work in two different parts. The first part is to capture and compare the image of the person with the database images. And the second one is to glow the led or using a servomotor for door access or else to send a mail.

For future extraction we can also use the Eigen faces methodology and Euclidian distances will be used recognition of the face.

Flow chart
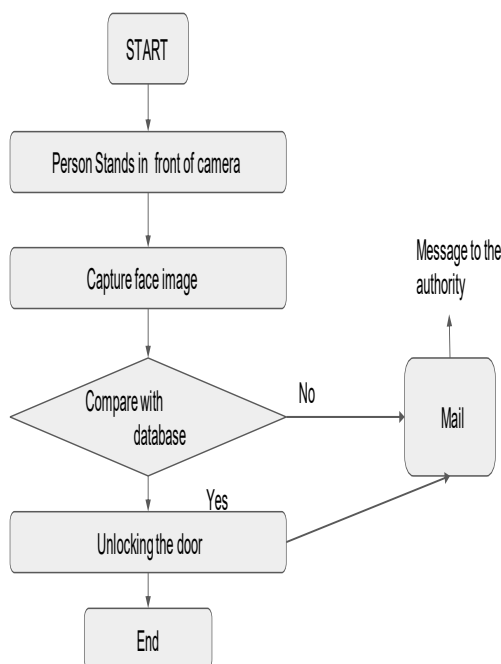
4. RESULT

We have initially installed the software without any errors and then done with the programming part for the project to be verified. Using the image capture program we created a database with few images for atleast 10 individuals and then compared the captured image during the execution with the images present in the data base. First of all, we will capture video, from that video we will read an image for the comparison. The database images must have size of 100*130 pixels of height and width and we can also change the pixels size.
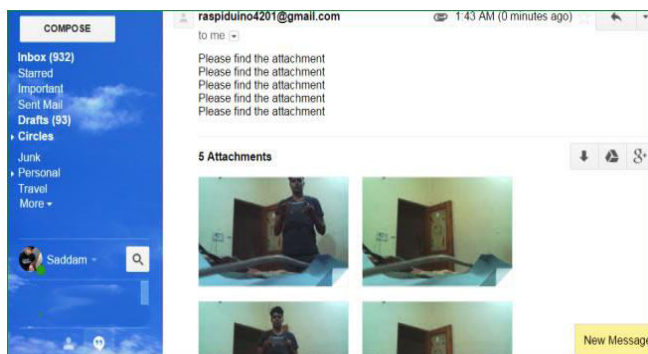
5. CONCLUSIONS AND FUTURE WORKS

The arrangement of a facial recognition system using raspberry pi can make the system littler, lighter and work successfully utilizing less power, so it is more convenient than the pc- based face recognition system. It is open source software on Linux and also Windows. Also, we will send a security alert mail to the authorized person utilities. We are also providing power backup for the smooth and continuous functioning of the system in the case of power failure. The power bank can also be used to charge the Raspberry Pi so there is less chance to slow down the system. This development scheme is cheap, fast, and highly reliable and Raspberry pi takes less power and provides enough flexibility to suit the requirement of different people. This development scheme is cheap, fast, and highly reliable.

1. System becomes lighter and littler.
2. Sends alert message to the authorized person.
3. Raspberry pi takes less power and provides enough flexibility to suit the requirement of different people.

Future work:

1. If a blacklisted person tries to open the door, the system will send a mail to the admin using Wi-Fi module regarding the same.
2. A real time speaking assistant can be deployed to make the system more user-friendly and efficient.
3. Highly secure protocols such as TLS can be deployed to ensure there is no security breach.
4. We can also develop a home automation system deploying several sensors for this project and can bring everything to our control.

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