SECURE SMART DOOR LOCK FEATURING FACIAL RECOGNITION

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Abstract: Identity fraud has become a big concern in today's society which increasing number of risks. A face recognition system must be built to prevent these thefts and identity fraud. For the purposes of security and monitoring, face recognition is critical. As a result, an efficient and cost-effective method is required. This project's goal is to create a face recognition-based security access control system. Open CV libraries and the Python programming language are utilized to improve accuracy and efficiency. The Raspberry Pi, an embedded device, is used for training and identification. The tracking of people who enter or leave the house is the most key component of any home security system. Instead, then to use passwords or pins to take account of it, unique faces can be used and they're a biometric characteristic. These are intrinsic and cannot be easily changed or taken. Face detection can be used to increase the level of security. The proposed facial recognition door lock security system was created to prevent robbery in high-security places such as the home with less power consumption and a more dependable independent security device for both intruder detection and door security. The Raspberry Pi circuit is used to power this system.

Keywords: Raspberry Pi, Face Recognition, Machine Learning, Smart Door, Security

1Introduction

Nowadays, there is a growing interest in smart home systems. When it comes to the most wanted smart home devices, 72 percent of respondents said self-adjusting thermostats and 71 percent said doors that can be closed from a distant place are the most significant characteristics, according to the report. A face recognition technology system capable of beating a facial feature from such a data perspective frame against such a face database. It tends to work by identifying and evaluating facial characteristics from a virtual image or a video, but is normally used to user authentication through email validation services.

Need for Smart Door System:

i. With reduced power consumption and a more dependable independent security device for both intruder detection and door security.

 ii. Prevent burglary in highly protected locations such as the home environment.Literature Survey[1]. K. Gopalakrishnan and V. Sathish Kumar proposed an embedded platform for image capturing in an embedded device based upon on Raspberry Pi. They concluded that the developed system is quick enough even to run this same data acquisition and acceptance testing, and the dataflow can run easily here between photo and the Pic Microcontroller panel after taking intoconsideration the requirements of image capturing and recognition algorithm, Raspberry Pi processing module and its peripherals, and implementing on this platform.[2]. "Raspberry Pi Face

Recognition in Treasure Box" is an excellent example of how to utilize OpenCV's computer vision algorithms with the Raspberry Pi and Pi camera. Tony Di Cola had proposed it. It may access the newest and most interesting computer vision techniques, such as facial recognition, by building the urrent version of Open CV. He also utilized a Solenoid double action lock, which locks and unlocks with a key once the electricity is turned off.[3]. KuldeepSoni created a system with a sophisticated surveillance camera capable of face identification and recognition utilizing the OPEN- CV library and Eigen face technique, all of which was done on a Raspberry Pi running Raspbian OS. He utilized the Pi Camera Board tocapture the photos. He demonstrated that an advanced surveillance camera system that uses face detection while also identifying the face identified is a highly secure system with the assistance of face recognition capabilities.

[4].Medak Teena Ravali, Prof. Ranga Sai Komaragiri proposed that a low-cost alternative for DSP kits for image processing using Raspberry pi board with Open-cv package. Inthis proposed work the platform for image processing is or algorithm for face recognition is implemented on principal component analysis. There system has been designed on the criteria of resources optimization, low power consumption and improved operation speed.

[5].R. Swathi, Sanjana Prasad, P. Mahalakshmi,

A.   John Clement Sunder In addition, their suggested solution incorporates a home security system that gathers data and transfers it to a smart phone over a 3G dongle via a web application. For remote sensing and monitoring, the Raspberry Pi runs and controls motion detectors and video cameras, broadcasts live footage, and records it for later viewing.

[6].MrudangShukla and Ajinkya Patil utilized their face recognition system for student attendance in their class to prevent wasting time by utilizing an automatic procedure based on image processing and face detection and identification system.

Face recognition distinguishes faces from non- faces, which is necessary for correct attendance. The alternative method is to use facialrecognition to track a student's attendance. The student database has been compiled. The databasecontains the pupils' names, pictures, and roll numbers.

1. Objective

The Face Recognition technology has improved drastically in the past decade and now it is primarily used for surveillance and security purpose.

- Save Images to Database.
- Detect Faces.
- Match detected Faces to Database.
- Recognize Faces.
- Provide Accurate Information.

To design and implement face authenticated real time security system. To design and implement face authentication of captured image using camera by Open CV/ Python platform on Raspberry Pi.

The captured image is compared and verified with the database, if found matching then the access to locking device is allowed.

In case of failure of face authentication an alerting SMS can be sent to the predefined mobile number through GSM module.

2. Methodology

This LBPH (Local Binary Pattern Histogram) Algorithm is being used in the project. In compared to other types of algorithms in the base paper, such as Fisher Face & Eigen Faces Algorithms, this method would provide us more accurate results.

When there is no face recognition, the LBPH Algorithm will take a number of photos from various angles and compare them. We take 20 photographs of a person from various perspectives and save them in our database. For this technique, a VNC viewer running on Raspbian OS is used to detect photographs in the database.
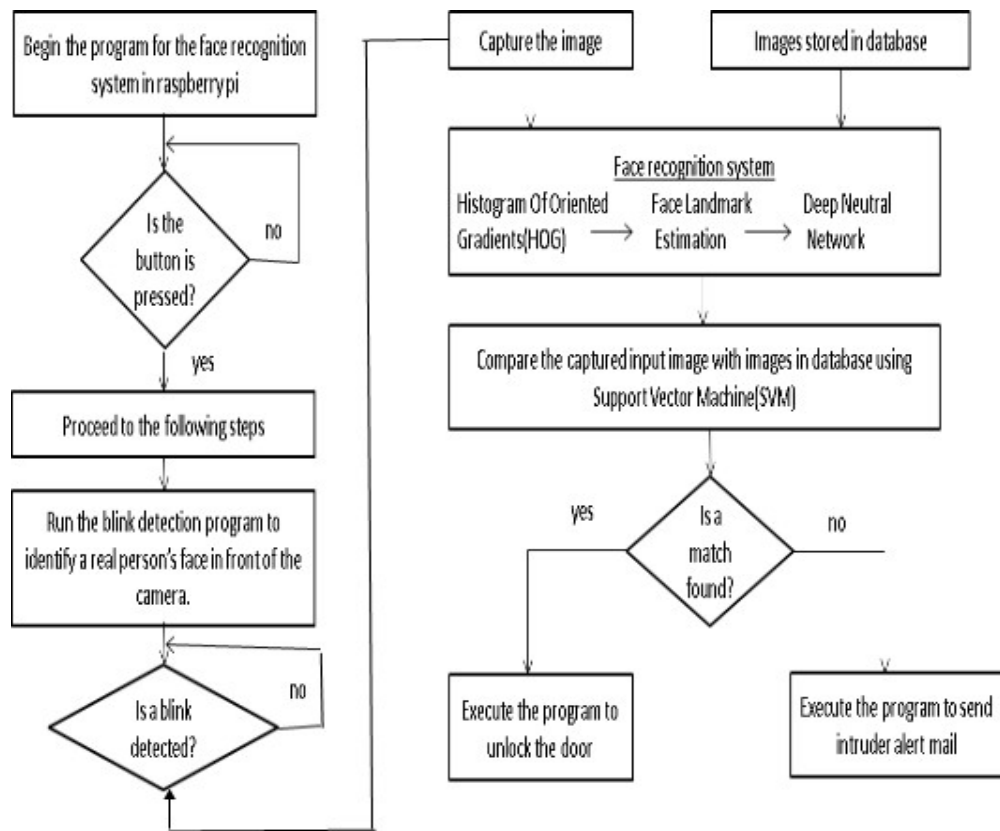

Fig1 : Flow chart

The Images are initially saved using data sets, and then the faces are converted to algorithms and stored in the database. It turns color images to greyscale images before converting them to pixels for detection. It divides the image into numerous portions before storing the values of each pixel. Pixels that are less than 0 will be represented as 0, and pixels that are more than 0 will be represented as 1.

3. COMPONENT DESCRIPTION:

i.   <u>**Raspberry Pi:**</u>
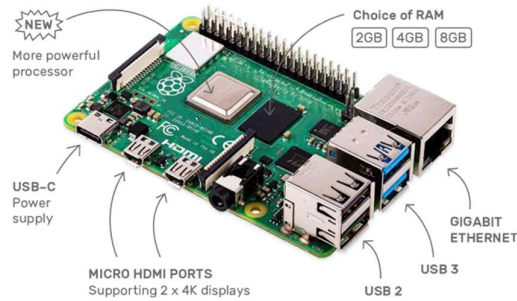
The Raspberry Pi is a low-cost computer with a set of GPIO ports for controlling electronic components and experimenting with the Internet of Things. It runs Linux and has a set of GPIO ports for controlling electronic components and experimenting with the Internet of Things (IoT). It's a competent little device that teaches people of all ages about computers and programming languages like Scratch and Python.

ii.   <u>**Raspberry Pi Camera:**</u>
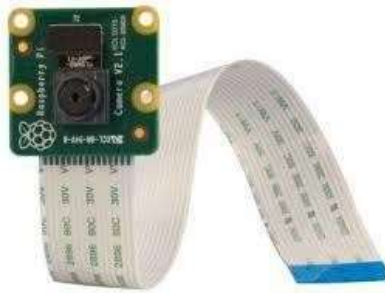
The Raspberry Pi Camera Board connects to port of the Raspberry Pi. It can shoot 1080p HD video and snap photos with a 5MP quality. The Raspberry Pi Camera Board is a fixed- focus module with a 5MP Omni vision 5647 sensor that was specifically designed and manufactured in the United Kingdom by the Raspberry Pi Foundation. Raspbian, the Raspberry Pi's chosen operating system, supports the camera in its most recent version.

iii. GSM Module:

In most embedded systems, these modules are the most often utilized communication modules. A GSM Module is a piece of hardware that connects a microcontroller to a GSM network A GSM module is a physical device that uses GSM mobile phone technology to connect to a remote network. A GSM MODEM is made up of a GSM Module as well as other components like a communication interface, a power supply, and indicators.

iv. Solenoid Lock:

A solenoid lock is an electrical locking and unlocking latch. It comes in two versions: unlocking in power-on mode and locking and keeping in power-on mode, both of which can be utilized selectively for different situations.

While the solenoid is turned on, the power-on locking type can lock a door. The door is unlocked if the power is turned off. While the solenoid is turned on, the power-on locking type can lock a door. The door is unlocked if the power is turned off.

v. Relay Module:

An electromagnet controls a relay module, whichis an electrical switch. A separate low-power pulse from a microcontroller activates the electromagnet. The electromagnet is powered which pulls to open or close an electrical. The relay is a device that opens or closes contacts to cause other electric controls to operate. It detects an unfavorable situation in a specific area and instructs the circuit breaker toswitch on or off the affected area. The relay can be operated in both electrical andmechanical modes. It includes of electromagnetic and contact sets that conduct switching functions.

vi. ush Button:

When pressed the push button switch is a compact, sealed mechanism which completes an electric circuit. A little metal spring within makes contact with two wires when it's turned on, letting electricity to flow. When it's turned off, the spring retracts, interrupting contact andpreventing current flow.

vii. DC Power Supply:

A DC power supply has two wires, one ofwhichis negatively charged and the other positively charged. To convert AC to DC, a device known as a rectifier is utilized. When the circuit's electricity becomes negative, a diode allows it to flow down the negative wire. DC, or "direct current," unlike AC, only flowsin one direction.

4. WORKING
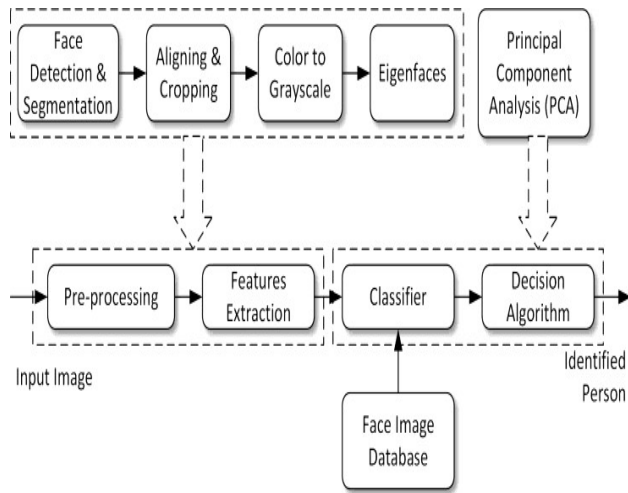
i. Face Detection and Segmentation:

Face detection is a computer technique that recognizes human faces in digital images and is used in a range of applications. The psychologicalprocess through which humans locate and attend to faces in a visual context is known as facedetection.

Image segmentation divides images into various sets of pixels, which is usually necessary to recognize the region of interest (ROI) from an image using homogeneity criteria like color, intensity, or texture, which aids in the finding andidentification of objects or boundaries in an image.

ii. Aligning and Cropping:

Face alignment is often a type of computer visionin which the geometrical structure of human faces in digital photographs is identified. Based on position & shape of a face, it instantly determinesthe shape of facial components such as the eyes and nose. Cropping a photo normally entails removing unnecessary areas and preserving only the desired parts, although it can be done in a variety of ways, and cropped photos can be used as backgrounds for other photos or social media images.

iii. Color to Grayscale:

The only colors in a grayscale (or gray level)image are shades of grey. The difference between these images and other types of color images is that each pixel requires less information.

iv. Eigen faces:

Whenever applied in the computer vision problem with human face identification, an eigenface is the title given to a set of eigenvectors. The basis of eigenfaces is Principal Components Analysis (PCA), an uncontrolled dimensional reduction technique that we utilize to reduce the dimensions of images into something smaller.

v.   Pre-Processing:

To test the photographs, the proposed algorithm is employed, as well as pre-processing, which is the first stage in any face recognition system. A new pre-processing technique has been presented for face recognition applications under unpredictable and harsh lighting settings.

vi.   Feature Extraction:

The process of extracting face component parts such as eyes, nose, and mouth from a human face image is known as facial feature extraction. The eye detector is utilized in the first module to detectthe eye pattern using the Gabor filter.

vii.   Classifier:

Using several PCA-based classifier approaches, the rate of face recognition was increased. To compute the recognition distance, three classifier approaches are utilized. The Euclidian distance method, the Squared Euclidian Distance method, and the city-Block Distance method are the three different types of classifiers.

viii.   Face Image Detection:

Imagery data is utilized to evaluate face processing algorithms in Face Databases. Facedatabases are collected and used to evaluate the performance of face recognition biometricsystems in the contents of biometrics.

ix.   Principal Component Analysis (PCA):

PCA is a dimensionality-reduction technique for lowering the dimension of large amounts of data by transforming a huge collection of factors into a smaller set that maintains the majority of the information in the larger set.

x.   Decision Algorithm:

The supervised learning algorithm family includes the decision algorithm. An objective of employing a Weight Map is to build a training model that can be used to determine the target or quantity of a target variable by learning simple decision rules inferred from past data (training data).

5.   Conclusion

The arrangement of a facial recognition system is used through the raspberry pi can make the system littler, lighter and work successfully utilizing lower control use, so it is more convenient than the pc- based face recognition system. It is open source software on Linux. which will send a security alert message to the authorized person utilities. We would be providing power backup for the smooth and uninterrupted functioning of the system in case of power failure. The power bank will 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 with providing enough flexibility to suit the requirements varying for different people.

This system can be converted into a double system in the future. Retinal scanners and fingerprint scanners are examples of verification mechanisms. Scanner, OTP, PIN Code, and other devices This system will be implemented first. Identify the face, and if the face is located in the database, proceed. It will likely want a second verification mechanism. either of the aforementioned, and if the person passes both, only after passing the verification test will the door open, and if the face is not visible, the door will not open. The image will be submitted to the website if it is located in the database. This system will provide you a lot of security. The appearance of the face recognition method can be used in conjunction with another.

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