HOME LOCKING SYSTEM THROUGH FACE RECOGNITION USING RASPBERRY PI AND GSM MODULE

PROJECT REFERENCE NO.: 40S_BE_0592

COLLEGE : BANGALORE INSTITUTE OF TECHNOLOGY, BENGALURU
BRANCH : DEPARTMENT OF TELECOMMUNICATION ENGINEERING
GUIDE : PROF. CHETAN ANAND N.
STUDENTS : MS. POOJITHA S.
          MS. YASHODHA S.A.
          MS. PRIYADARSHINI S.

Introduction:

Biometrics refers to metrics related to human characteristics. Biometrics authentication (or realistic authentication) is used in computer science as a form of identification and access control. It is also used to identify individuals in groups that are under surveillance. Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals. Biometric identifiers are often categorized as physiological versus behavioural characteristics. Physiological characteristics are related to the shape of the body. Examples include, but are not limited to fingerprint, palm veins, face recognition, DNA, palm print, hand geometry, iris recognition, retina and odour/scent. Behavioural characteristics are related to the pattern of behaviour of a person, including but not limited to typing rhythm, gait, and voice. More traditional means of access control include token-based identification systems, such as a driver's license or passport, and knowledge-based identification systems, such as a password or personal identification number. Since biometric identifiers are unique to individuals, they are more reliable in verifying identity than token and knowledge-based methods.

Among these systems, facial recognition appears to be one of the most universal, collectable, and accessible systems. Biometric face recognition, otherwise known as Automatic Face Recognition (AFR), is a particularly attractive biometric approach, since it focuses on the same identifier that humans use primarily to distinguish one person from another. One of its main goals is the understanding of the complex human visual system and the knowledge of how humans represent faces in order to discriminate different identities with high accuracy. Hence, we have considered face recognition for the implementation of highly secure home locking system.

Objectives of the project:

To design and implement face authenticated real time security system.

- To design and implement face authentication of captured image using camera by OpenCV/ 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.

Methodology:
Face recognition system is widely used for human identification due to its capability to measure and subsequently identifies human identification especially for security purposes. The project deals with the design and implementation of secure locking automation using Raspberry Pi for door unlocking to provide essential security to our homes and send security alert through the GSM module. Raspberry Pi operates and controls the video camera for capturing the images. Open CV/ Python library is formulated as given images of a scene identify or verify one or more persons in the scene using a stored database of faces. Thus, the images are extracted and allowed to match with the database images. If the images are matched, the door opens automatically. If not, GSM module sends the alerting message to the predefined mobile number. The design of the face recognition system using Raspberry pi can make the smaller, lighter and with lower power consumption, so it is more convenient than the PC-based face recognition system. Because of the open source code, it is freer to do software development on Linux. Principle component analysis (Eigen faces) algorithm is used for the face recognition and detection process. Also send a security alert message to the authorized person utilities. The developed scheme is cheap, fast, highly reliable and provides enough flexibility to suit the requirements of different systems.

Technology used:

- Image processing: This technique is used in capturing the image and recognizing it by comparing with the database images.
- Embedded system design: This method is used in the module where hardware, software and many other functional devices are combined to execute the operation.
- Wireless communication through GSM module.

Block diagram:

The above figure shows the basic block diagram of the Raspberry pi based face recognition system for door unlocking. The project system can be operated in two different sections, i.e. one for capturing and creating a data base and the other section is to capture the image and which is used for identifying or comparing the images in the database. Here in the second section we use Eigen faces methodology of face recognition for finding the matches.

Camera module: Camera module is Pi camera interfacing to the raspberry pi module. It is used for capturing an image and send captured image to the Raspberry pi module.

Raspberry pi module: Raspberry pi module is small computer board. When image taken by the raspberry pi it is compared with Eigen face image. At the first time when we capture the image to create a data base, raspberry pi module captures six types of the images to create a data base in the system and this data base is compared with the live captured image. After comparing two images output is positive/negative then it gives commands to GSM module.
GSM module: GSM module is used to send a message to the authorities after comparison output is positive or negative. If output is positive then "face recognized… door will be opened" message is sent to the authority person otherwise sent as intruder alert.

Results and conclusion:

The experimental results shows two different cases like if it is an authenticated person then the door will be opened automatically and in the case of unauthenticated person the door will remain closed and with the help of the GSM an SMS will be delivered to the user. The snap shot of the authenticated person is taken. The captured image is compared with the image in the database, by extracting the eigen face and eigen values. With these features the image is decided to be an authenticated one. Once the image is declared to be an authenticated one, then the door of the system will be opening automatically.

Sometimes unknown person may also enter, this cannot be avoided but at all times everyone will not be aware of the intruder. For this type of situation this model proposes a solution. If the captured image is an unauthenticated person, then an SMS will be automatically generated to the user that an Unauthenticated Person Has Entered Home and the door will remain closed itself. Face recognition system has been developed in order to study the potential application for automated door access control. Among the other biometric techniques, face recognition approach possess one great advantage which is user friendliness. The technique of Eigen faces has been applied into the system which makes the system more secure. A cost effective and SMS operated home security system has been designed and tested with the GSM network. As future efforts, improving the reliability and robustness in both the recognition and detection process can be concentrated more. The Face recognition algorithm is applied on a wide variety of images taken under different lighting conditions and with different backgrounds. The images also have pose variation, emotions etc. The training set contained different set of people belonging to different races. The various stages in the algorithm are explained using the training set of RGB images. Now convert RGB image into gray image for preprocessing steps. First of all train the gray size image. Now normalized the training set using many pre-processing steps. The mean image of normalized training sets is determined. Eigen faces of normalized training set is calculated. The reconstructed image from input image is used for recognizing, it is in database or not.

Scope and future work:

- The proposed system will further extended to provide the notices from long distance by providing the internet connectivity which will allow the system to update notices, anywhere in the world.
- Using raspberry pi the current project can be modified by an Infrared camera interfacing it can be used in Smart Surveillance Monitoring security system which any type of public security is using Living body detection or spying. Also it can be used in Attendance system of the class, Also some profound applications can be implemented using interfacing of Raspberry pi and Arduino UNO board like sensor application of smartcard swapping, finger detection, alcohol detection, agriculture humidity sensing, Temperature sensing using web server, and many more.
- Internet of households where we can attach other devices of house with internet.
- Industrial automation and control through internet.
- Automated fire exit systems can be build.
- Improvement in the security issues in highly restricted areas.