

AN INTEGRATED IOT BASED HOME SECURITY AUTOMATION THROUGH DIGITAL IMAGE PROCESSING AND AMAZON WEB SERVICES

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Abstract: Doors are controlled by persons with the use of keys, security cards and passwords. The aim of this paper is to help users for improvement of the door security of sensitive locations by using face detection and recognition. The face is a complex multidimensional structure and needs good computing techniques for detection and automatic door access control. Face detection is the process of detecting the region of the face in an image. If a face is recognized i.e., present in the database, it is known, else it is unknown. The door automatically opens for the known person by matching with the known database image using image processing. On another side, for an unknown person, the image will be sent to cloud through android application and simultaneously a message will be sent to the owner's phone. The door will be opened or closed based on the owner's command.

IndexTerms - Image processing, GSM, Android application, OpenCV, AWS.

I. INTRODUCTION

Identification of a person in automation using access control have been in mode by using android image processing data instead of using patterns, cards or passwords. A main detail of the image specifics has to be gathered and used as known images. Once person stands in front of the door face is detected by utilizing face detection technique in OpenCV and the whole face recognition process is realized without using any hardware. Face detection is the initial step of face recognition method. The execution of the entire face recognition part is dependent on face detection. Using the face detection method, it can detect only the facial part of the image irrespective of the background of the image. If the taken image is matching with the database images the door will open automatically, else if it doesn't match with the image in the database then it will be sent to the cloud through android application and simultaneously a message will be sent to the owner's phone.

II. METHODOLOGY

This methodology consists of three modules namely face detection, face recognition and automated door access control. In face detection ultrasonic sensor will detect the obstacle near the door, the camera will then capture image of the person and send it to the MATLAB for image processing. If the image compared matches with the existing database image, then the door opens using L293 driver which operates the DC motor for opening of the door. If the image captured does not match with the image in the database message is sent to the owner's phone through GSM. The door will be opened or closed based on the owner's decision.

LCD (Liquid Crystal Display) is used to display the work flow of the process. When an obstacle is detected, message will be displayed on LCD that obstacle is detected, if image is being compared then corresponding message will be displayed on the LCD. Microcontroller fundamentally controls the action, where it receives the input from the device they are controlling as well as they retain the control by means of sending the device signal to different division of the device.

In image processing, face detection is the initial step where it is the process of detecting the region of the face in an image. In face recognition process it extracts the dominant features of set of human faces stored in the database and performing mathematical operations on the values corresponding to them. Hence when a new image is fed into the system for recognition, the main features are extracted and computed to find the difference between the input image and the stored images. When the new image of a person differs from the images of that person stored in the database, the system will be able to recognize the new face and inform the owner.

Automatic door access control deals with controlling of the door. When the image of the known person is detected and matches with the image in the database, the door is opened automatically. If not the door remains closed and the message is sent to the owner's phone and based on the owner's command the door can be opened or closed.

Each of the modules mentioned such as face detection, face recognition and automatic door access control follows the same methodologies, namely.

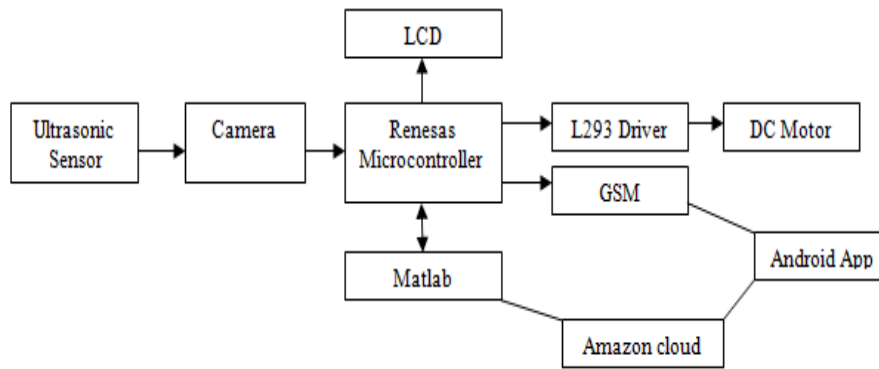


Figure.1 block diagram

I. Obstacle detection

Obstacle detection is done by using ultrasonic sensor which senses anything that is either object or person who comes near the door. An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transmitter to send and receive ultrasonic pulses that relay back information about an object's proximity. The transmitter transmits the waves, when Obstacle comes these waves hits and reflects back which is captured by the receiver, thus obstacle is detected.

II. Android application

When the obstacle is detected by the ultrasonic sensor, the camera gets activated and the image is captured. The image captured will be sent to the Amazon cloud through android application.

III. Image processing

Image processing is the process of analysis and manipulation of a digitized image, especially in order to improve its quality. There are two steps in image processing.

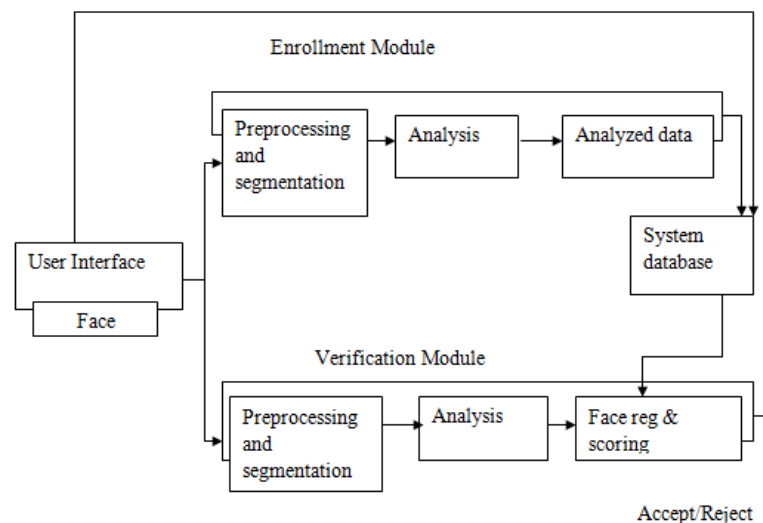


Figure.2 image processing

In Image processing there is enrollment module and verification module. In enrollment module a new face will be captured and registered, image will be preprocessed, analyzed and this data will be stored in the database. In verification module newly captured image will be compared with the existing database images. The newly captured image will be again preprocessed and segmented and analyzed and now comparison is done with existing images and scoring is done, if image matches then it is a match and door will be opened, else message will be sent to the owner's android application to decide the opening or closing of door.

Face detection- Ultrasonic sensor will detect the obstacle near the door, the camera will then capture the image of the person and send it to the MATLAB for image processing. In image processing face detection is the early step, where it is the process of detecting the region of the face in an image.

Face recognition- The face recognition method used is principal component analysis (PCA) which is a technique that can be used to simplify a dataset. It is a linear transformation that chooses a new coordinate system for the dataset such that the greatest variant by any projection of the dataset comes to lie on the first axis (called the first principal component), the second greatest variance on the second axis, and so on. PCA can be used for reducing dimensionality in dataset while retaining those characteristics of the dataset that contribute most to its variance, by keeping lower-order principle components and ignoring higher order ones. The idea is that such low-order component often contains the "most important" aspects of the data. Eigen values and Eigen vectors. Large matrices can be costly, in terms of computational time to use. Large matrices may have to be iterated hundreds or thousands of times for a calculation. Additionally, the behavior of the matrices would be hard to explore without important mathematical tools. One of the mathematical tools, which have applications not only for linear algebra but also for differential equations, calculus and many other areas, is the concept of

Eigen values and Eigen vectors. An Eigen value of a square matrix is a scalar that is usually represented by the Greek letter lambda (λ) and Eigen vector is a non-zero vector denoted by small letter x . for a given square matrix A all Eigen values and Eigen vectors satisfy the equation $Ax = \lambda x$. Since each Eigen vector is associated with an Eigen value, we frequently refer to an x and λ that corresponds to one another as an Eigen pair. An Eigen space is a space consisting of all Eigen vectors which have the same Eigen values. These Eigen vectors are derived from the covariance matrix of the probability distribution of the high-dimensional vector space of possible faces of human beings and hence Eigen faces are a set of Eigen vectors.

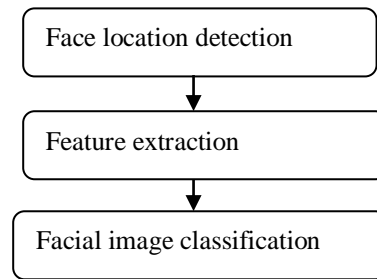


Figure.3 steps of principal Component Analysis.

IV. Amazon Cloud

In this paper, Amazon simple storage service is used for storage for the internet. Amazon S3 has a simple web service interface that one can use to store and retrieve any amount of data, at any time, from anywhere on the web. Amazon cloud will get the data (images) from the android application. This data will be extracted by the MATLAB for the image processing. Once the comparison is completed the results will be sent back to the Amazon cloud. The result consists of the image of the person entered along with their name and time of entrance.

V. Door access control

This deals with controlling of the door. When the image of the known person is detected and matches with the image in the database, then the door is opened automatically. If not, door remains closed and message is sent to the owner's phone and based on the owner's command the door can be opened or closed.

III. RESULT AND DISCUSSION

Home security is achieved through image processing, where the result is opening and closing of the door, which is controlled by the L293driver which operates the DC motor, no manual operation is required for the process. Operation of the door is completely automated. Where microcontroller control all the activity and signals to L293 driver which drives the DC motor in opening and closing the door based on the owner decision. If the image captured by the camera matches with the image stored in the database, then door will get open automatically. In other case if image comparison fails then message is sent to the owner, owner will see the unknown person image by accessing the cloud, based on the owner's command the door will be opened or closed.

IV. CONCLUSION

To achieve security for home through digital image processing was to match the captured image with the image stored in the database. For image comparison OpenCV method is used. Eigen value and Eigen vector will compute the eye to nose ratio, where the eye to nose ratio will vary from person to person. The principal component analysis involves finding the Eigen vectors of the covariance matrix and projecting the data on to the Eigen vectors with largest Eigen values. The homes security can also be done more effectively and speedily through which helps us to compare the capture image more appropriately and fetch the result more quickly from the database.

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