

# Application Based Smart Security System with Face Recognition and Authentication

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## Abstract-

This paper presents a security system that performs face recognition, for examining threats in its vicinity. The system is capable of detecting humans in real time scenarios. The activity cycle of the system is categorized in a number of tasks: Object Detection, Face Detection, Face Recognition, generation of alert signals to the user, Capture image of unknown person. This security system detects the human face based on Cascade Algorithm using a camera module interfaced with Raspberry Pi. The system is exposed to numerous facial images of people from different angles and background conditions. This forms the database to train the system which aids in facial recognition. Subsequently, when the system detects a human face, it initiates the algorithm for recognition of face which uses Local Binary Pattern (LBP) approach. According to images in the dataset, the system determines whether the human detected is a threat or not. In case of a match with the dataset, the user receives a message through GSM module on his/her mobile phone along with the name of the person recognized. In case of a mismatch, threat or an alert message is received by the user and then capture image of unknown person the method use in capturing image is Dotnet application and save image of unknown person in our database.

**Keywords-** *Local Binary Pattern (LBP), Facial authentication Raspberry Pi, Automatic Face Recognition (AFR), Rapid Object Detection, Haar.*

## I. 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 behavioral 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. 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.

## II 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. This Paper 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 NOOBS. Local Binary Pattern Histogram (LBPH) algorithm that 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, and highly reliable 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.**

Wireless Communication through External Bluetooth to Dot. net application for capturing Image of unknown person.

## FACE DETECTION

It is a widely popular subject with a huge range of applications. Modern day Smart phones and Laptops come with built-in face detection software, which can authenticate the identity of the user. There are numerous apps that can capture, detect and process a face in real time, can identify the age and the gender of the user, and also can apply some really cool filters. The list is not limited to these mobile apps, as Face Detection also has a wide range of applications in Surveillance, Security and Biometrics as well. But the origin of its Success stories dates back to 2001, when Viola and Jones proposed the first ever Object Detection Framework for Real Time Face Detection.

### Haar Cascade

It is an Object Detection Algorithm used to identify faces in an image or a real time video. The algorithm uses edge or line detection features proposed by Viola and Jones in their research paper "Rapid Object Detection using a Boosted Cascade of Simple Features" published in 2001. The algorithm is given a lot of positive images consisting of faces, and a lot of negative images not consisting of any face to train on them on in video footage.

This feature continuously traverses from the top left of the image to the bottom right to search for the particular feature. This is just a representation of the whole concept of the haar feature traversal. In its actual work, the haar feature would traverse pixel by pixel in the image. Also all possible sizes of the haar features will be applied.

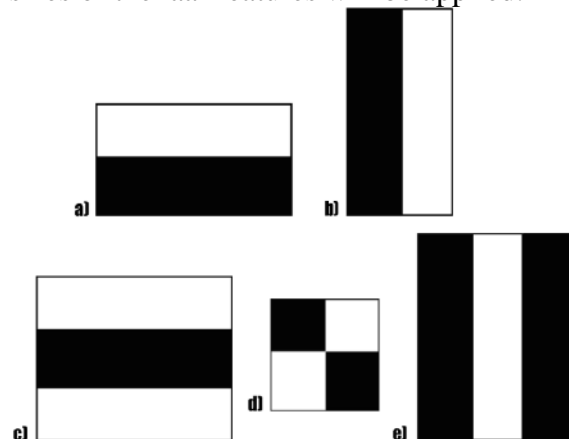


Fig.1 Edges in a horizontal or in a vertical direction

Depending on the feature each one is looking for, these are broadly classified into three categories. The first set of two rectangle features is responsible for finding out the edges in a horizontal or in a vertical direction (as shown above). The second set of three rectangle

features are responsible for finding out if there is a lighter region 8 surrounded by darker regions on either side or vice-versa. The third set of four rectangle features is responsible for finding out change of pixel intensities across diagonals.

## FACE RECOGNITION

In computer science, face recognition is basically the task of recognizing a person based on its facial image. It has become very popular in the last two decades, mainly because of the new methods developed and the high quality of the current videos/cameras.

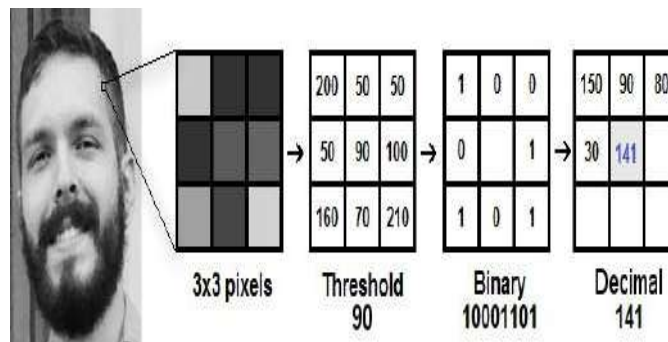
Face Detection: it has the objective of finding the faces (location and size) in an image and probably extract them to be used by the face recognition algorithm.

- Face Recognition: with the facial images already extracted, cropped, resized and usually converted to grayscale, the face recognition algorithm is responsible for finding characteristics which best describe the image.

**Local Binary Pattern (LBP)** is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.

Using the LBP combined with histograms we can represent the face images with a simple data vector.

Fig.2 Face images with a simple data vector.



## III. BLOCK DIAGRAM

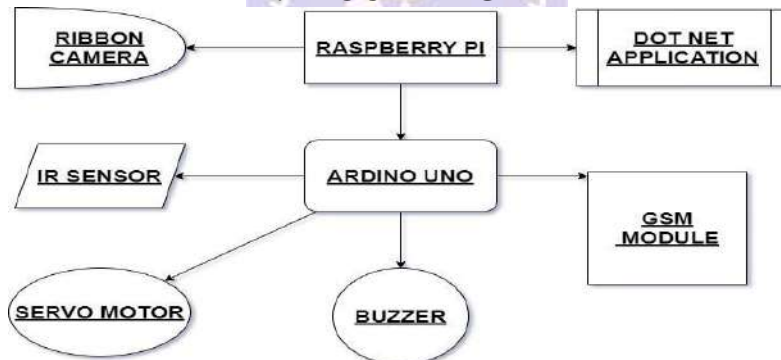


Fig. 3 Block diagram of working Module

## IV WORKING

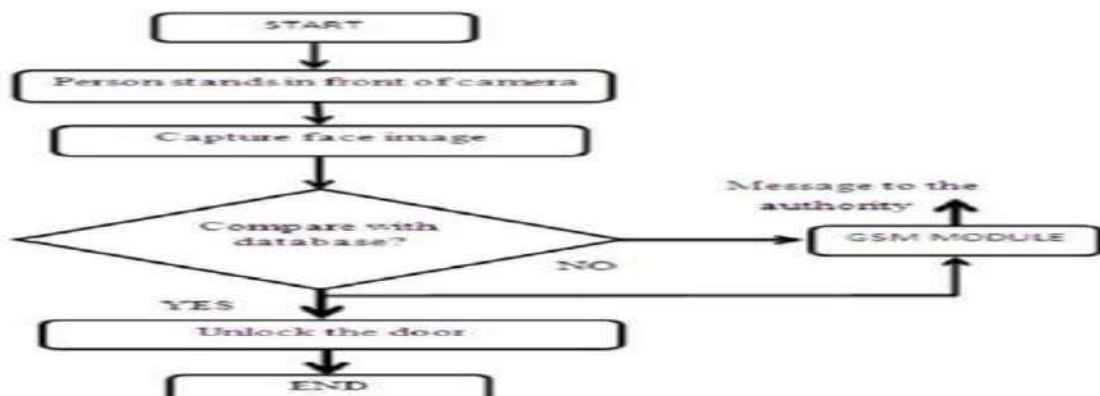


Fig.4 Flow Chart

## V.OUTPUT

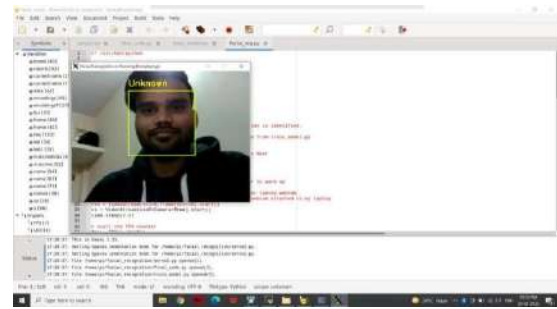
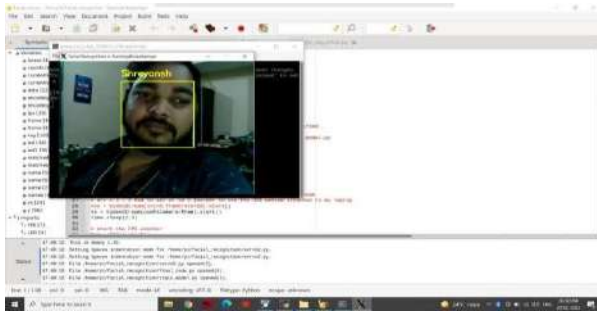


Fig.5 Output of face recognition

Fig.6  
person  
Image

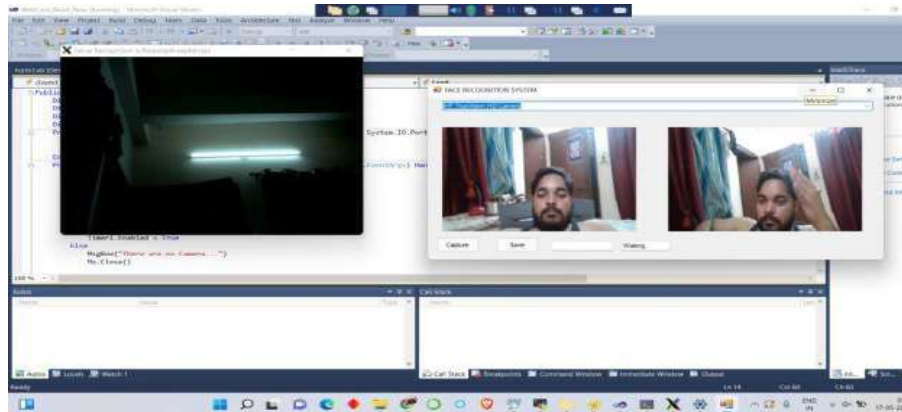


Fig.7

Output of  
unknown  
capturing

Output of SMS at mobile no.



VI

## APPLICATIONS

**Offices:** Physical access to workspace facilities.

**Home Security:** Only allow to family members.

**Government Sector:** Transfer important document safely, when their face is saved in database.

**Examination Hall:** Only allow students of class.

**Banking and Telecom:** Help to know the current process to the customer, allow authentication of credit/debit cards.

**Real Estate Commercial:** Offers access to campus facilities like residence halls, common area, cafeteria, etc.

**Aviation:** Paperless travel at airports.

**Entertainment:** Access to multiplex cinema.

**Car Parking:** Automatic car parking without token.

**Lifts:** In Apartments only authorised person access to respective floor.



### VII Further scope of work

According to recent statistics, facial recognition reduces violent crimes in retail stores. Software companies leverage facial recognition systems to help users access their technology. This technology can be further developed in other lanes such as banking, A.T.M.s, and payments, accessing confidential files or other sensitive data. It has the potential to make other security measures such as passwords and keys obsolete. It is used in healthcare not only for security purposes but also to help diagnose diseases, used widely for access control along with individual biometrics including fingerprint or iris recognition systems. However, facial recognition provides the added benefit of a contactless and non-invasive process.

### VIII CONCLUSIONS

As the step into the fourth industrial revolution, it can rest assured that everything revolves around technology and automation. We are witnessing changes in the industries that require technological advancements. 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 free to do software development, we successfully finished A Secured Lock System Based on Face Recognition using Raspberry Pi and GSM module, DotNet application is presented. We will design the system which provides security locks for door, comfort, connivance security and energy efficiency for user. In this system, to implement with a combination of webcam, Raspberry Pi, Servo Motor and GSM module. And we used Local Binary Pattern (LBP) for recognize the face. The arrangement of a facial recognition system using 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. Also, send a security alert message to the authorized person utilities. 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 and DotNet application start work automatically and capture image of unauthorized person then save it to database. The face recognition is able to recognize the face and able to send notification to a user when an unknown being has been detected and capture image of unknown person. Face recognition technology is continuously evolving day by day due to the extensive help from machine learning algorithms enabling the systems to read facial expressions and detect emotions, thus uniquely identifying a person by analyzing the various patterns based on the shape, facial textures, colour, and the distance between the person's facial features. It has complete applications across various platforms. It is used in mundane as well as high security activities.

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