Final Year Project Report On Automated Infrangible Home Security

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Research titled "**Automated Infrangible Home Security",** submitted by **Amir Sohel** ID: 151-15-5454 and **Zakir Hossain** ID: 151-15-4969 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 7th November 2018.

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of Shah Md. Tanvir Siddiquee, Senior Lecturer, Department of CSE Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere forward of any degree or diploma.

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ABSTRACT

Homes of the 21st century will turn out to be increasingly self-controlled and automated because of comfort, includes security lock of doors and security particularly when utilized in a private home, voice command for controlling of lighting, temperature. The "Home Automation" idea has existed for a long time to give us comfort. The terms "Home Security" present the idea of giving security in the main entrance door by image processing. We can create data set for every known person and also can train this data for image processing. Whenever a known person will come, then the system opens the door and if any unknown person will come, then the door will not open and notify the owner by mail. Owner of the home can live stream and observe the system and can operate the door manually. A web interface is for live streaming. By this web interface, user can open and close door remotely from any place. A user can maintain entry record by taking snapshots. An IP address is for entering to the web interface. To develop the system essential components are single chip computer (Raspberry Pi3) with a camera module, monitor and others minor components. Nowadays Home automation and Home security system are becoming a popular system because of its attractive feature and effective performance.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Home automation is a general term that covers a grouping of imaginative capacities that can present in any one's home. Home automation system contains many individual subsystems such as door lock. The smart door lock is one kind of automated lock system which does not need one to control the door. It is such a great amount of irritating to open and close the door each time and furthermore it is in charge of our concentration break. The door will automatically open and also automatically close by the system command.

We can define that Smart Lock has the ability to do undertaking automatically and furthermore we can control it remotely. There are some security issues when we are absent from our home. In this time, we do not know what is happened to our home. We don't know that who went to our home. So we have to know the status of our home and furthermore, we have to realize that who was going to our home. If there is a surveillance system in our home, then we can get this opportunity.

Smart Lock system can provide every kind of security in any one's home. We would able to surveillance live to our home. Smart Lock system also contains the feature of automatic control of the door. At the point when any known person will come then the door will open and when an obscure person will come then the door still stay close. So no need to operate the door manually. We provide a web interface to make the whole system visible to users. Users can enter this web interface by a real IP. Using this IP address owner can control the whole system remotely from anywhere.

In this 21st century, all the system should be significantly more brilliant than previously. In every sector, automation will happen due to viability. It diminishes the hazard and makes everything simple to do. In our home, we require more solace and need everything with no physical exertion. Furthermore, that is the reason why automation going to popular day by day.

1.2 Motivation

In our Dhaka city, the majority of the general population originated from the various city for the various reason. They leave Dhaka city for various event, for example, 'Eid, puja and different vacation. As well as when they go to office, college, university. In this time their home's face security problem. For this reason, we think about an intelligent security system which can provide you the protection of any kind of security issues. The system will provide an interface for live stream which shows the current status of your home. You can operate the door and also see who come to your home. People getting apathetic day by day. They would prefer not to do general household work, for example, open and close the door every time. That is the reason why people need an automation system to make their work easy. If any unauthorized person comes to your home, then system detect this person and show you. If a known person will come, then system matching his or her face and the door will open. This system can keep your home safe.

1.3 Rationale of the study

Home security is a common problem in our everyday life. Some unexpected crime happens every day around us. During vacation, we suffer a common problem which is stealing. Even when we are not present at home such kind of situation will occur. We require an answer to maintaining a strategic distance from such sort of issue. Sometimes it is exasperating for us to open and close our door every time. Some of the time it breaks our fixation to our work. The goal of our project or research is to simplify and make a solution of such kind of problem. Since numerous people groups are enduring security issue of their home and they need to utilize automation in their home. We utilize automation for security reason. Our thought is to use automation in the door lock. Because entryway is the main important part of a home security. If entryway is safe then 60-70% security problem is solved. We use image processing on our entry door which scans everyone face and tries to match this face with data set. So any unauthorized person cannot enter our home. We also provide live streaming on our door so that owner can monitor. In the event that any unapproved individual will come however you need to offer authorization to enter your home, at that point you can open your door using web

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interface. You can take record who went to your home by taking snapshots. We also provide the feature of control everything remotely. You can use the whole system from anywhere by using an IP address. Using this IP address the whole system is visible to your web interface and the system will ready for use. The specialty of our project is that we use automation as a security purpose. This exploration will motivate our future age to utilize automation in various field of application. Our future aim is to utilize every automation feature in a different field with a different look. Because we believe that we can utilize the same thing in various way.

1.4 Research Question

> ➢ What is the definition of Home automation?
> ➢ What are the feature of automation?
> ➢ What are the security issues in a home?
> ➢ Which feature of automation used for which security problem?
> ➢ Which is the major security problem?
> ➢ What is the reason behind this security problem?
> ➢ What is the background knowledge necessary to fully understand this problem?
> ➢ What are the challenges to solving this problem?
> ➢ What are the approach to solve this problem?
> ➢ What are the solutions to this problem?
> ➢ Which technologies are used to solve this?
> ➢ Which equipment do we need?
> ➢ Is this solution being appropriate?
> ➢ Is this expensive or not?
> ➢ Is this system stable?
> ➢ What is the limitation of this system?
> ➢ What is the future implementation of this project?
> ➢ Prove that this system is better.

1.5 Expected Output

Our system is specially designed to providing security and as well as comfort to the user in their home. So our security system provides door security and also automation on the entry door. The output of our project is given below.

- ➢ Provides live streaming to your door.
- ➢ User can stream remotely from anywhere by a web interface using a IP address.
- ➢ The user can control the door open and close system from the web interface.
- ➢ If a known person will come, then the system matches his or her face, if the face is matched with data set then the door will open automatically.
- ➢ If an unknown person will come, then the user can see in live streaming and then the user can open the door from the web interface.
- ➢ When any unknown face found then, notify the owner by mail.
- ➢ The user can take record by taking snapshot that who is came to his home.
- ➢ No internet connection is needed for this system.

1.6 Report Layout

This report comprises of five parts, and this section gives the understanding of each of the five sections.

- ➢ In our report chapter one includes introduction, motivation, rationale of the study, research question and expected output.
- ➢ Chapter two contains research Background related work such as related works, research summary, scope of the problem and challenges.
- ➢ Research methodology includes in chapter three. In this chapter contains Research subject and Instrumentation, Data collection procedure, statistical analysis and implementation requirements.
- ➢ Chapter four is for experimental results and discussion with descriptive analysis.
- ➢ At last in chapter five is for summary, conclusion, recommendation and implication for future research.

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CHAPTER 2
BACKGROUND

2.1 Introduction

Technology is a piece of our life step by step like as human nourishment. Because of appeal and modernizing progress, any sort of designers and specialists are interfacing more things to the web. In that circumstance Internet is the intensity of things to make more supportive gadget for the human.

In our day by day life correspondence is vital. In any case, in this period correspondence bound with human to human as well as machine to machine which is presented IoT and man-made consciousness. In this situation, the security issue is excessively imperative. Any exceptional case between related with high need for security. This idea is the beginning phase of business organization still now with low spending plan, however numerous industry and specialist effectively finished with high spending plan.

Presently multi day, we are associating home machines, vehicles to the web utilizing IoT idea so why not rule room. This investigation plans to build up a savvy room reconnaissance framework with low spending plan by interfacing IoT gadget through web.

2.2 Related Works

This is neither a unique nor another thought. There are many existing implementations like this system after presentation of Smart Home Security. However, this is a new plan for designing a smart principle Door surveillance system with proper secure strengthen in low budget and real time visualization on smart phone or smart device.

The paper [1], proposed a novel arrangement that makes the reconnaissance of home from anyplace utilizing the Team Viewer Software, Arduino Uno smaller scale controller, RF transmitters, PC, IP camera through web. Here in this utilizing Team Viewer Software for checking the graphical perspective of home utilizing the IP camera through web. Working methodology controlled by miniaturized scale controller gadget

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which is known as Arduino Uno. RF Transmitter get detecting information through camera and transmit the flag from smaller scale controller. The capacity to get the live film of room and need to keep an eye for observing. A windows-based home application has been made through which client can control the robot and tilt for the camera.

B. Udaya Kumar and et al. presents the execution of an ease remote home security framework utilizing ZigBee convention and remote access through web [2]. A ZigBee based star coordinate with two hubs had been set up utilizing Xbee radio, ARM7, PIC, and MBED microcontroller. The identification of the interloper movement, gas spillage identification and visual observation of the house were furnished with the assistance of Passive Infrared Sensor (PIR), Gas sensor (GH-312) and Camera (LS_Y201). Issue is here numerous small scale controllers are utilized, use of ZigBee based system to speak with the base station is restricted to 100-150 meters in length remove as it were. Base station is reliant on Ethernet for web availability.

J. Shankar Kartik and et al. Have proposed two frameworks are proposed, one depends on GSM innovation and other utilizes web camera to distinguish the interloper. The principal security framework utilizes a web camera, introduced in house premises, or, in other words programming introduced on the PC and it employments Web for correspondence. The camera distinguishes movement of any interloper before the camera measurements or camera extend. The product conveys to the expected client by means of Web organize and in the meantime it gives sound alarm. The second security framework is SMS based and utilizes GSM innovation to send the SMS to the proprietor [3].

Hteik Htar Lwin and et al. Have proposed an entryway bolt get to framework which included for the most part of three subsystems: specifically confront discovery, confront acknowledgment and programmed entryway get to control. Face acknowledgment is actualized by utilizing the Chief Component Analysis (PCA). The entryway will open naturally for the known individual because of the order of the microcontroller. Then again, caution will ring for the obscure individual. Downside of this framework is input pictures are taken through a web camera persistently until the 'stop camera' catch is squeezed [4]. Somebody is required at the area to check unapproved individual's pictures

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or status of the framework and make additionally move. (PC) is associated with the microcontroller, the entire framework will not work if PC is smashed or Non-Function.

This paper [5] proposed a system, Door Access by using face recognition. Using Raspberry pi, IP camera and some inductor. The System take a picture of the person who press the button to open the door and system matching the capture image with trained dataset. If the capture image match with the data set door will open automatically.

The System has shown driven advancement process for home security. It comments the employments of client's end application, for example, Telegram to safely transmit data through layers of IoT design. The framework likewise aids nearness discovery, ID and validation of outsider. It requires web at the two closures with the end goal to work [6].

The paper [7], proposed a model for a home remote observing framework utilizing Arduino microcontroller with an OPNET mimicked remote system framework. Utilizing different sensors and camera, the Arduino miniaturized scale controller screens the security of the earth and reports the outcomes to a remote framework over the web. The remote system framework includes the nearby and remote area to the Arduino. The WLAN is in charge of interfacing different modules on the Arduino to the web and the remote system tends to the entrance from this area to the Arduino.

2.3 Comparative Studies

In our paper study, we are found an ideal solution of Door security and surveillance system. In all paper inspired diverse sort of security of home with various way. Be that as it may, we see the all strategy and learn miniaturized scale controller gadget and between related all availability procedure which is utilized every single esteemed paper.

Data is intense social occasion for learning. In entire examination, we choose to make Door Security and outdoor surveillances system and we care about most minimal expense successfully.

Maximum all project depending on internet, our system also dependent on internet but we create another hope to sending the information to authorized via email and detect object

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to another way of web interface by internet. Owner can have operated the system by web interface at any place in the world.

2.4 Scope of the Problem

This study focuses on finding a way to develop a smart door lock and outdoor surveillance system to reduce overall expenditure related to room surveillance as well as better performance.

2.4.1 Camera Detection on web Interface

In this smart door lock and surveillance system, user can see the current situation of outdoor activity by pi camera through internet and need to database or server for kept information. As a result, user can be matching with existing data to control the system. For this our system need real IP to communicated with raspberry Pi through internet. User don't need to bring another device for showing the current state. User can use their smart device e. g smart phone, tab, laptop, PC.

2.4.2 Matching image

In our project, we are using pi camera module to live streaming and capture image. Pi camera module's capture image depends on light and resolution of camera to better perform of make dataset and matching with the existing dataset. For this reason, we are facing some problem to trained dataset and math with existing data.

2.5 Challenges

We face some challenges during our project work. We describe those challenges below.

2.5.1 Communication with Web Interface through internet

In our system internet is most important part to communicated with surveillance camera and control the activity of the door. Without internet it is impossible to authorized an unknown person to give permission to enter the room or entre restricted to the person. That's why internet connection is principal needed in our system to be communicated.

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2.5.2 Lack of light to detection

Proper light is essential to matching an object from live streaming. We use pi camera with 5.0 megapixel with resolution and quality is not perfect for low light. So that we need to think alternative way to supply more light to the camera for better performance to surveillance and matching.

2.5.3 Catching Web Command to Raspberry PI

In this system, the authorized person can be pass command to the pi module to do the action. In our Web interface we use two button to open the door and close the door. When a user command to the close or open, the web send a request to the raspberry pi to complete the action according to the command. The PI catch the signal and send it to the GPIO pin to do the action. To the input command we need to study on web signal transmission.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

In image recognition usually accepted the strategy used to change over shading pictures to grayscale has little effect on recognition execution. We contrast three diverse grayscale calculations and four sorts of picture descriptors and exhibit that this presumption isn't right: not all shading to-grayscale calculations work similarly well, notwithstanding when utilizing descriptors that are vigorous to changes in light. These techniques are tried utilizing a cutting edge descriptor-based picture recognition structure, on face, protest, and surface datasets, with moderately few preparing occasions. We distinguish a basic strategy that for the most part works best for face recognition, and work well for recognizing.

3.2 Research Subject and instrumentation

For this implementation we are using two algorithm Color-to-Grayscale Algorithm and Cascades Algorithm. We are some important instrument to implement this project. Algorithm and instrumental description are given bellow:

3.2.1 Method

Color-to-Grayscale Algorithm

In this section [8] we briefly describe thirteen methods with linear time complexity for converting from color-to-grayscale. we denote all grayscale algorithms by capitalizing the first letter and italicizing in the text. We denote gamma corrected channels as R', G', and B'. The output of the grayscale algorithms on several images is shown in Fig. 1.
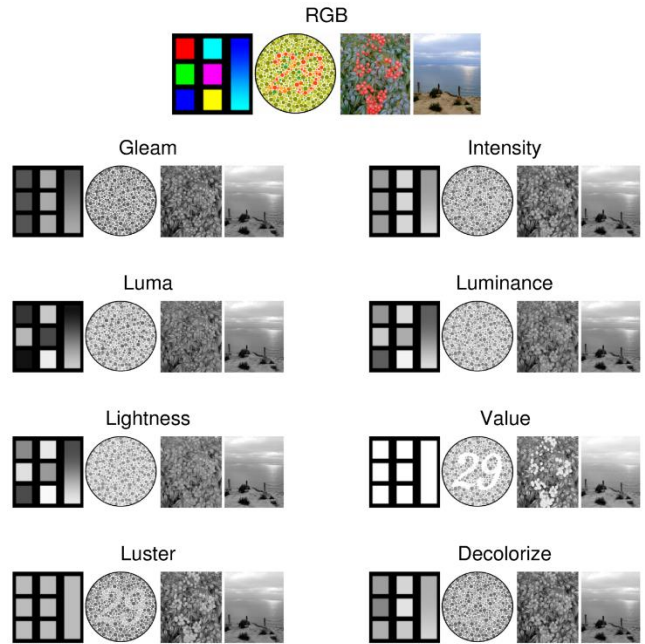
Fig: 3.2.1.1 Qualitative comparison of color to grayscale algorithm. [8]

Perhaps the simplest color-to-grayscale algorithm is *Intensity*. It is the mean of the RGB channels:

$$G_{Intensity} \leftarrow \tfrac{1}{3}(R+G+B) \qquad [8]$$

Although *Intensity* is calculated using linear channels, in practice gamma correction is often left intact when using datasets containing gamma corrected images. We call this method Gleam:

$$G_{Gleam} = \tfrac{1}{3}(R`+G`+B`) \qquad [8]$$

Luminance is designed to match human brightness perception by using a weighted combination of the RGB channels:

$$G_{Luminance} \leftarrow 0.3R + 0.59G + 0.11B \qquad [8]$$

Luma is a similar gamma corrected form used in high-definition televisions (HDTVs)

$$G_{Luma} \leftarrow 0.2126R` + 0.7152G` + 0.0722B` \qquad [8]$$

Lightness is a perceptually uniform grayscale representation used in the CIELAB and CIELUV color spaces:

$$G_{Lightness} \leftarrow \frac{1}{100}(116f(Y) - 16) \qquad [8]$$

Value is the achromatic channel in the Hue, Saturation, and Value (HSV) color space and it provides absolute brightness information. It is computed by taking the maximum of the RGB channels:

$$G_{Value} = Max(R,G,B) \qquad [8]$$

Luster is the L channel in the HLS (Hue, Lightness, and Saturation) color space [1]. We changed its name from lightness to *Luster* so it is not confused with CIELAB's *Lightness* channel. *Luster* is the mean of the minimum and maximum RGB values, i.e.,

$$G_{Luster} \leftarrow \frac{1}{2}\big(Max(R,G,B) + Min(R,G,B)\big) \qquad [8]$$

Flowchart
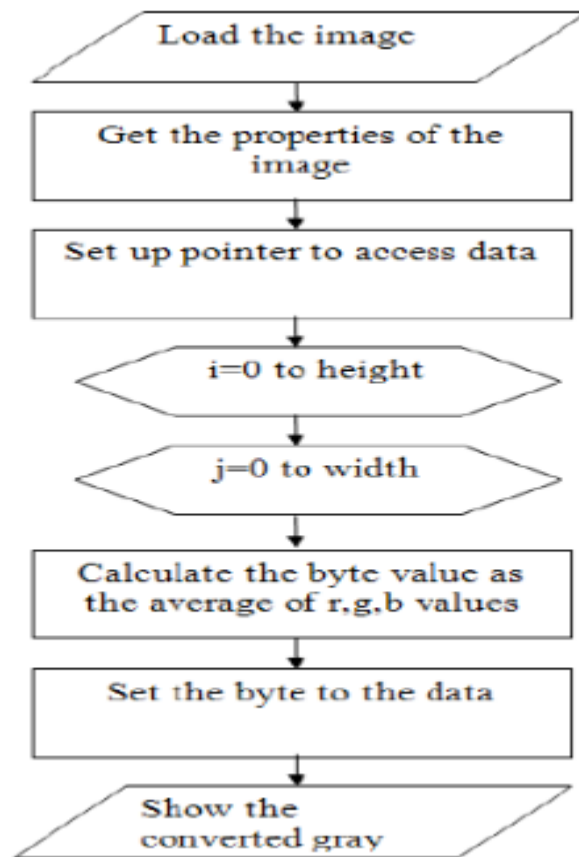
Fig: 3.2.1.2: Flow chart for Converting image to grayscale. [9]

Face Detection using Cascades Algorithm

Here we will work with face detection. At first, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. For each feature computation, we have to discover the whole of pixels under white and black rectangles. To solve this, they presented the integral images. It simplifies calculation of sum of pixels, how large may be the number of pixels, to an operation involving just four pixels. It makes things super-fast. Yet among all these features we calculated, most of them are irrelevant. For example, consider the image below. Top row indicates two good features. The first feature selected seems to focus on the property that

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the region of the eyes is often darker than the region of the nose and cheeks. The second feature selected relies on the property that the eyes are darker than the bridge of the nose. In any case, similar windows applying on cheeks or some other place is irrelevant.
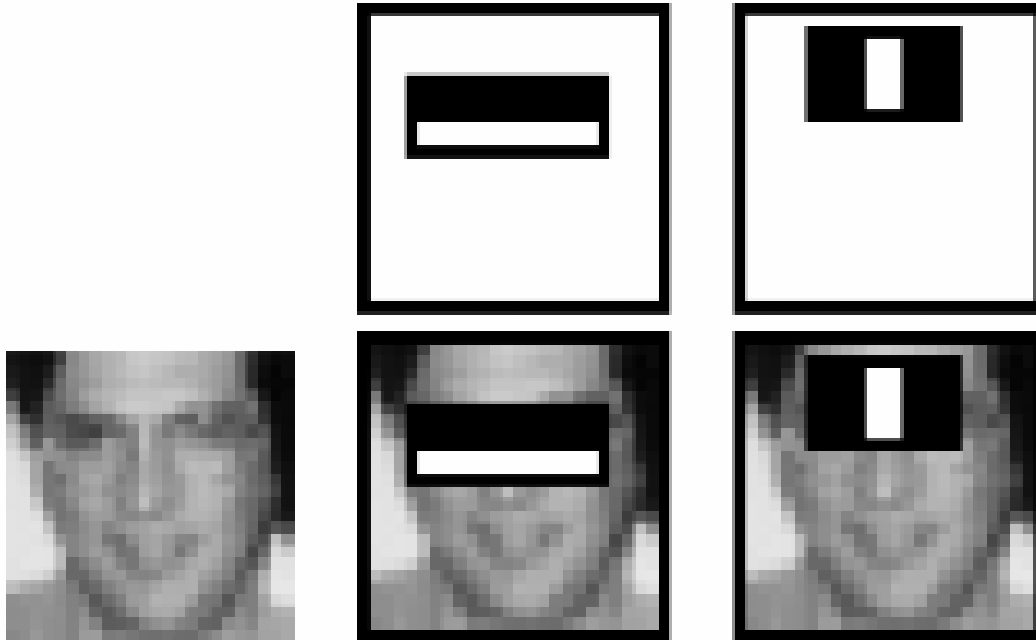
For this, we apply every last element on all the training images. For each element, it finds the best limit which will group the faces to positive and negative [11]. However, clearly, there will be errors or misclassifications. We select the features with minimum error rate, which implies they are the features that best classifies the face and non-face images. The process is not as simple as this. Each picture is given an equivalent weight first and foremost. After each classification, weights of misclassified images are expanded. Then again same process is done. New error rates are calculated. Also new weights. The process is continued until required accuracy or error rate is achieved or required number of features are found. Final classifier is a weighted sum of these weak classifiers. It is called weak because it alone can't classify the image, however together with others frames a solid classifier. The paper says even 200 features provide detection with 95% accuracy.

General Purpose Input/output signal receiving by lock

The way a servo motor reads the information it's being sent by using an electrical signal called Pulse Width Modulation (PWM). That just means sending ON electrical signs for a specific measure of time, trailed by an OFF period, rehashed many times each second. We will be sending PWM signals from one GPIO pin on the Raspberry Pi, and powering it from the GPIO board, so three wires will keep running from the servo to the Raspberry Pi.
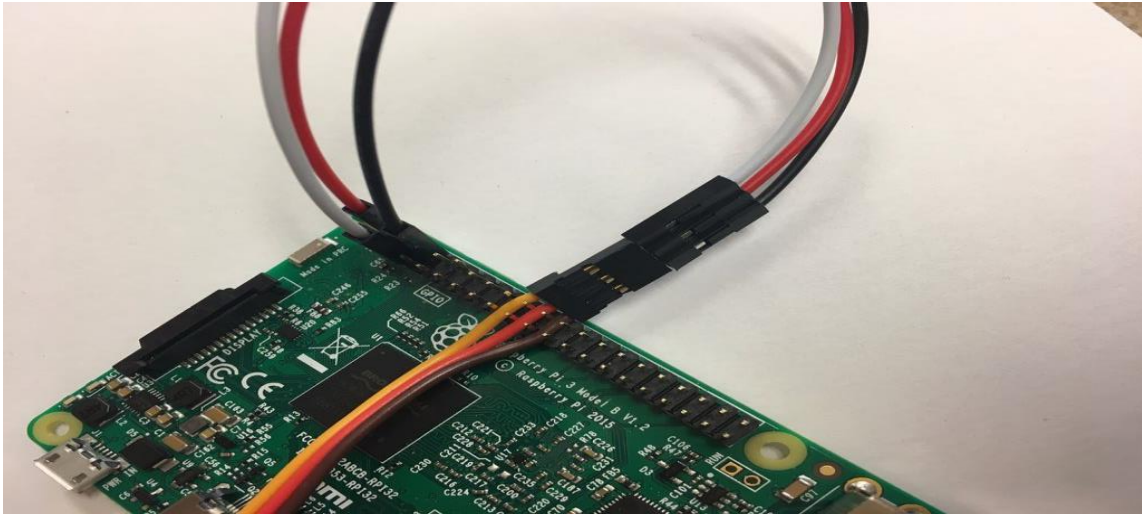

Fig 3.2.1.3: Servo motor connection with raspberry pi. [10]
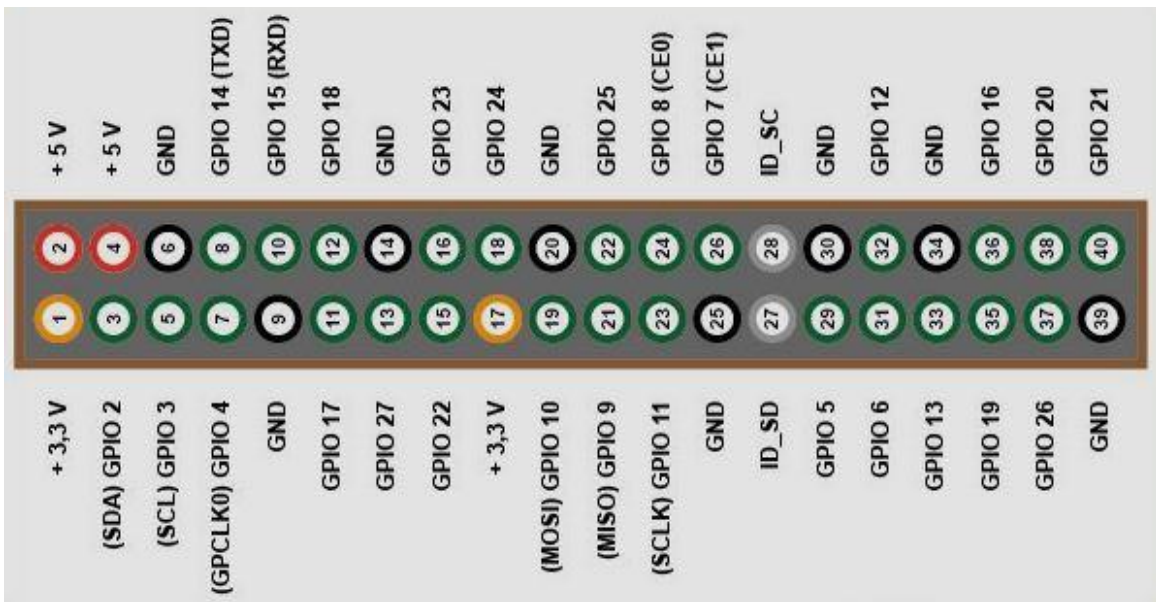
Fig 3.2.1.4: Raspberry pi GPIO pins. [10]

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Fitting a M/F jumper into each of the holes on the end of the servo cord, at that point plug the one coming off the red wire into pin #2, the one coming off of the brown into pin #6, and the one coming out of the yellow wire into pin #3.

3.2.2 Instrument

Raspberry Pi3

The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics and dalmatics. Peripherals (such as keyboards, mice and cases) are not included with the raspberry pi

Fig: 3.2.2.1: Raspberry Pi3. [10]

Raspberry Pi camera module

The Raspberry Pi camera module can be used to take high-definition video, as well as stills photographs. It's easy to use for beginners, but has plenty to offer advanced users if you're looking to expand your knowledge. Pi Camera Are Fixed focus lens on-board,8-

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megapixel native resolution sensor-capable of 3280 x 2464-pixel static images, supports 1080p30, 720p60 and 640x480p90 video, Size 25mm x 23mm x 9mm, Weight just over 3g, connects to the Raspberry Pi board via a short ribbon cable (supplied), Camera v2 is supported in the latest version of Raspbian, Raspberry Pi's preferred operating system.

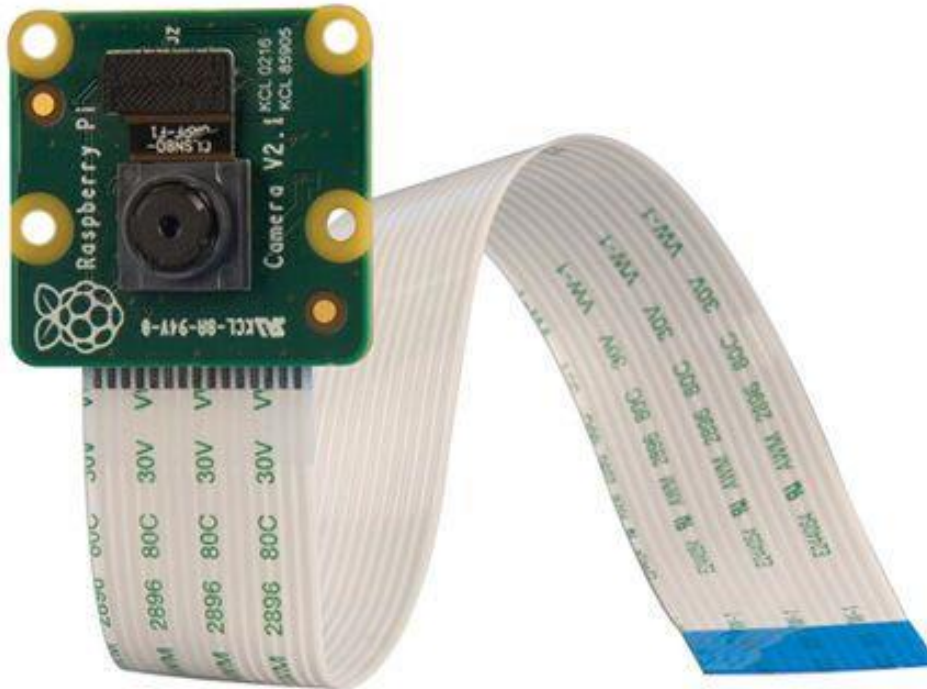
Fig: 3.2.2.2: Raspberry Pi Camera Module V2. [10]

Servo Motor

The servo motor is specialized for high-response, high-precision positioning. As a motor capable of accurate rotation angle and speed control, it can be used for a variety of equipment. It's use for Tuning Free, Compact and High Power, Wide Variable Speed Range, Standard or Planetary Geared Type and Electromagnetic Brake Types.

Fig: 3.2.2.3: Servo Motor. [10]

Web Interface

Web interface page is created using the following languages: HTML, JavaScript, PHP. JavaScript enables user friendly interaction with equipment's to HTML. Interaction with database of home security system is handled by page scripts which are embedded in or included with HTML pages. User can access the web interface by widespread browsers, operating system.

Smart Door Lock System Based On Face Detection | Open | Close | SnapShot
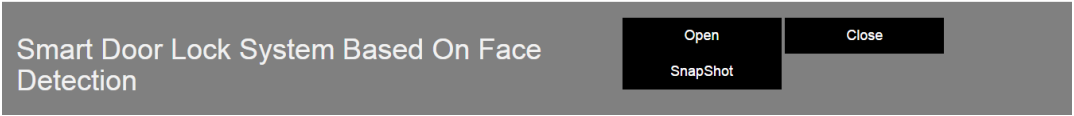
Fig: 3.2.2.4: Web Interface of system.

GPIO

The Raspberry Pi 3 includes a similar 40-stick broadly useful information yield (GPIO) header as every one of the Pis returning to the Model B+ and Model A+. Any current GPIO equipment will work without adjustment; the main change is a change to which UART is uncovered on the GPIO's pins, however that is taken care of inside by the working framework
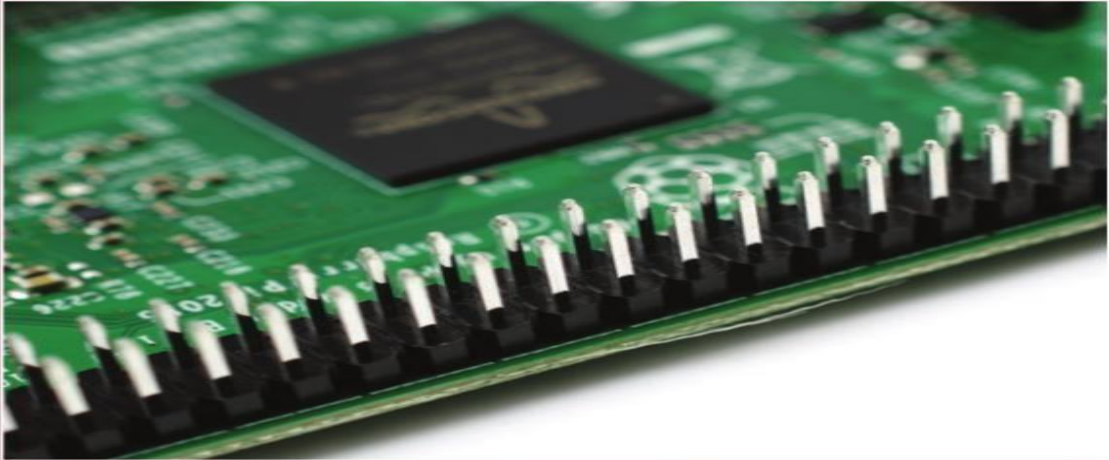

Fig: 3.2.2.5: Raspberry Pi3 System GPIO Pin. [10]

3.3 Data Collection Procedure

For the research purpose different sort of images are collected from many people with different light and different condition of faces. To Collecting data, we flow some step:
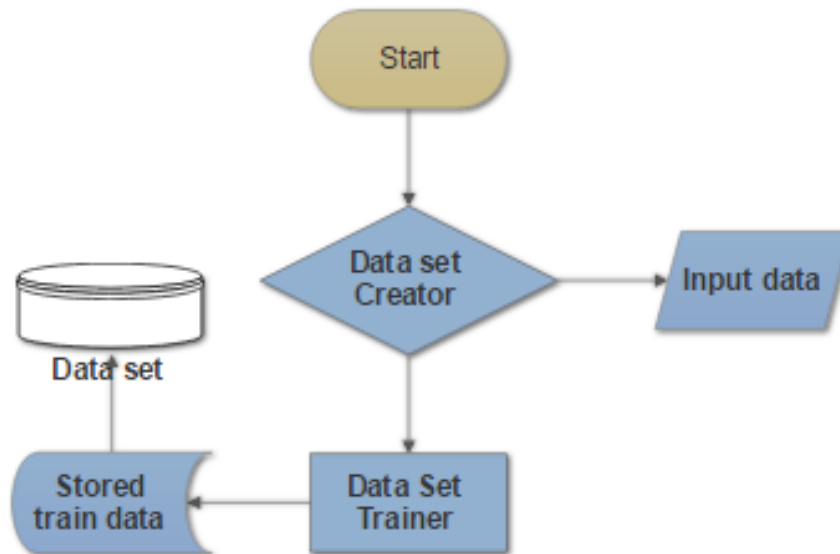
Fig: 3.3.1: Data Collection Procedure. [9]

On the software part, Raspbian OS is used as the operating systems for Raspberry Pi. Next the Python and OpenCV library was installed for the algorithm implementation. To train the faces into the library, we use the "2_trainer.py" algorithm in the OpenCV library. The training data should be loaded into the script. These images will be captured using the code "1_dataset.py". This code will continuously capture images into the training data folder. The training data also requires a negative training images that are built into the Raspberry pi library. Sets of 30 images for each person is trained at a time and "2_trainer.py" script is executed. Sample of the training images is shown:
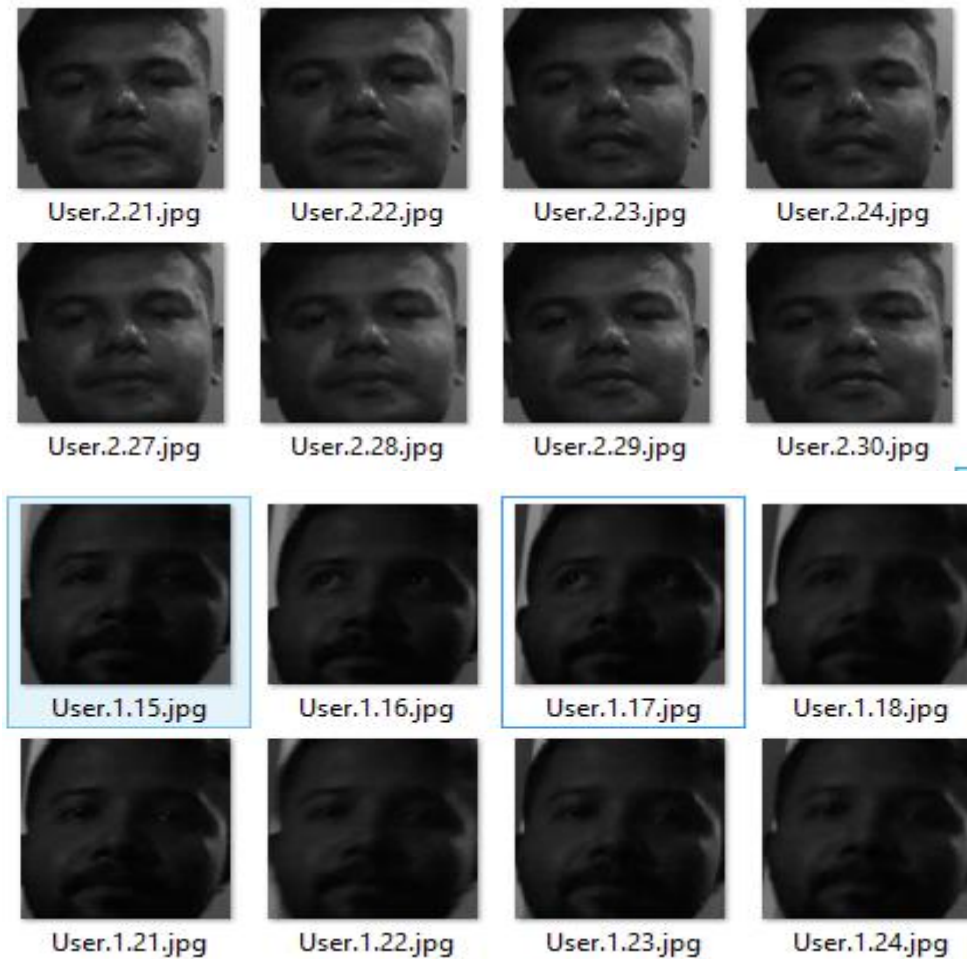
Fig: 3.3.2: Collected Data Sample

The training data given will produce an output named "faceDetector.xml" file which contains the positive data processed into it. This process can also be done using a full-fledged computer to shorten the training time. An average of 10 minutes was required using a smaller picture to process using the Raspberry Pi. Finally, ports are initialized using the terminal in root mode to access the GPIO pins. The initial set up was done using a servo but this set up can be replaced to magnetic lock or solenoid lock by simply changing the Pulse Width Modulation (PWM) pin to any other GPIO pins and initialize the pin in the script. To run the code, the terminal window on the Raspberry Pi is opened and the python code "app.py" is executed. When the code run on the system is ready to execute face recognition.

3.4 Statistical Analysis

As per the analysis of data, calculation of the accuracy of the system is achieved 93%. To calculate that, some more attributes are extracted with the help of confusion matrix. For example, using supervised learning the confusion matrix of Matching face and unlock the door is given below.

Table 3.4.1: Confusion Matrix for Matching face

		Predicted Class	
		Positive	Negative
Actual Class	**True**	30	20
	False	40	25

Confusion Matrix – Confusion matrix is to summarize the performance of a classification technique. Classification accuracy can be misleading for an unequal number of observations in each class or more than two classes in dataset. Calculating confusion matrix gives better idea of what classification model is getting right and what types of errors it is making.

True Positives (TP) - These are the correctly predicted positive values which means that the value of actual class is yes and the value of predicted class is also yes. E.g. if actual class value indicates that this input and dataset data tells the same thing.

True Negatives (TN) - These are the correctly predicted negative values which means that the value of actual class is no and value of predicted class is also no. E.g. if actual class says this input and dataset data tells you the same thing.

False positives and false negatives, these values occur when your actual class contradicts with the predicted class.

False Positives (FP) – When actual class is no and predicted class is yes. E.g. if actual class says input and dataset data tells that this the person is known.

False Negatives (FN) – When actual class is yes but predicted class in no. E.g. if actual class value indicates that input and dataset data tells that this the person is unknown.

Table 3.4.2: Confusion Matrix for Opening Door.

	Match	**Unknown**
True	Open	Close
False	Close	Close

3.5 Implementation requirements

- ➢ For implementation this system there should be installed:
- ➢ Platform: Raspberry Pi, Web, Raspberry Pi Camera
- ➢ Language: Python, HTML, Java script
- ➢ Tools: Python IDLE, Notepad, Open-cv, NumPy .

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CHAPTER 4

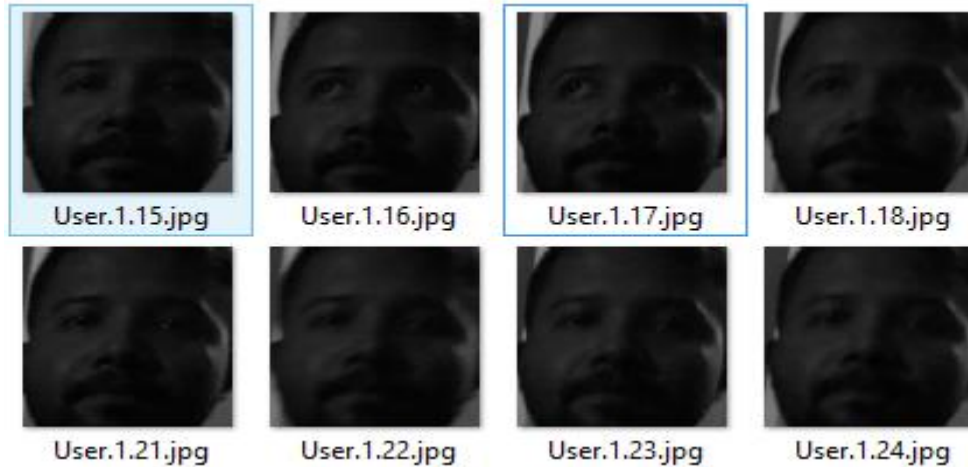## EXPERIMENTAL RESULT AND DISCUSSION

4.1 Introduction

To get the ultimate output, first we have to collect the raw image by Raspberry pi camera module. We take 30 images of the object for make our system more efficient. On the off chance that we take most maximum picture of the object, at that point this object will more clear and intelligible to our program. In spite of the fact that we working with live video then we require clear thought regarding object. Since in live video we have moving object. After taking the images of objects we need to train all image. After train all the data our system will recognize the objects which are in data set. After matching the object with data set then the door will open. And after few second the door will close.

4.2 Experimental Results

In this research, first task is image processing. In image processing we need to find matching between object and data set. We use Color to Grayscale algorithm to convert color image. This process is show in Fig. 1. After that our image look like this format.

User.2.21.jpg User.2.22.jpg User.2.23.jpg User.2.24.jpg

User.2.27.jpg User.2.28.jpg User.2.29.jpg User.2.30.jpg

| User.1.15.jpg | User.1.16.jpg | User.1.17.jpg | User.1.18.jpg |
| User.1.21.jpg | User.1.22.jpg | User.1.23.jpg | User.1.24.jpg |

After matching the object with data set then next task is to send a General Purpose Input/Output (GPIO) signal to raspberry pi. Raspberry Pi send GPIO Pulse Width Modulation (PWM) outputs to a servo motor to set its angle. We use servo motor as door lock. If image matched with data set, then servo motor rotates into 90 degrees. That means the door will open. If image will not match, then servo motor's status will same as before.

4.3 Descriptive Analysis

The system experimental output is almost satisfying to our expected output. We analyze our image matching Accuracy, Sensitivity, Specificity, Precision.

1. Accuracy: Accuracy is the most intuitive performance measure and it is simply a ratio of correctly predicted observation to the total observations. One may think that, if we have high accuracy then our model is best. Yes, accuracy is a great measure but only when you have symmetric datasets where values of false positive and false negatives are almost same. Therefore, one has to look at other parameters to evaluate the performance of the model.

$$Accuracy \ = \ \frac{TP+TN}{TP+FP+TN+FN} \quad \dots\dots(\text{i})$$

2. Sensitivity: The sensitivity of this system is its ability to determine the actual classes correctly. To estimate the sensitivity mathematically, this can be stated as:

$$\text{Sensitivity} \quad = \quad \frac{TP}{TP+FN} \ldots \ldots \ldots \ldots \text{(ii)}$$

3. Specificity: The specificity of this system is its ability to determine the negative cases correctly. To estimate the specificity mathematically, this can be stated as:

$$\text{Specificity} \quad = \quad \frac{TN}{FP+TN} \quad \ldots \ldots \text{(iii)}$$

4. Precision: Precision is the number of relevant classes among all the positive cases. To estimate the precision mathematically, this can be stated as:

$$\text{Precision} = \quad \frac{TP}{TP+FP} \quad \ldots \ldots \ldots \text{(iv)}$$

Sample	Test	Accuracy	Sensitivity	Specificity	Precision	Average Accuracy	Average Sensitivity	Average Specificity	Average Precision	Total (%) Accuracy	Total (%) Sensitivity	Total (%) Specificity	Total (%) Precision
1	1	0.47	0.54	0.40	0.42								
	2	0.35	0.45	0.20	0.25								
	3	0.40	0.35	0.35	0.35	0.354	0.428	0.31	0.356				
	4	0.25	0.25	0.35	0.20								
	5	0.30	0.55	0.25	0.56								
2	1	0.40	0.44	0.24	0.34								
	2	0.35	0.40	0.25	0.20								
	3	0.45	0.30	0.50	0.35	0.36	0.368	0.298	0.298	35.13	39.46	29.73	32.2
	4	0.25	0.25	0.30	0.24								
	5	0.35	0.45	0.20	0.36								
3	1	0.42	0.50	0.41	0.40								
	2	0.30	0.44	0.20	0.25								
	3	0.40	0.30	0.30	0.25	0.34	0.388	0.284	0.312				
	4	0.25	0.25	0.31	0.20								
	5	0.33	0.45	0.20	0.46								

4.4 Summary

Every people want to secure their home from any kind of unexpected security risk. So considering their necessities this Smart Lock system is best solution to their security concern. Because our experimental result Accuracy almost 35% satisfying our expected result. Our image matching technique is more viable than others. Our system does not need any internet connection to use. Web interface is so much simple and user friendly. So any one can easily operate the system.

CHAPTER 5

SUMMARY, CONCLUSION, RECOMMENDATION AND IMPLICATION FOR FUTURE RESEARCH

5.1 Summary of the Study

The Smart lock security system is used for secure main entrance of a home. First step security is live streaming on main door. User can surveillance home from a web interface using a IP address. second step security is image processing application on main door. If face of the stranger is match with the data set only than the door will open otherwise it remain close. Owner can open and close door manually from the web interface. This system provides you security as well as comfort.

5.2 Conclusions

In this report we describe in details about our project Smart Lock system. Smart Lock is an application of Home automation. Here automation used in security purpose. In Smart Lock system main door will control by image processing. It has live streaming feature which show in a web interface. All the system can access remotely from anywhere.

5.3 Implication for Further Study

To make our life more comfortable and secure we need to research more on automation. Try to use automation in every sector with different idea. our future features are.

- ➢ Use biometric lock in door.
- ➢ Install vibrate sensor on door. If anyone try to destroy the door lock, then system give alert.
- ➢ All the lights and room temperature will control automatically.

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APPENDICES

Appendix A: Research Reflection

The reason for this Appendix is to give a prologue to Research refection. The gathering research venture was a testing and pleasant experience commonplace of the course all in all. We have had little introduction to gather work at the university. Along these lines, it was a decent change to be a piece of a successful and dynamic group.

The experience instructed us that arranging and creating reactions take quite a while in groups than without anyone else. The broad exertion required was eventually something worth being thankful for. In our gathering, we are always creating and refining each other's thoughts.

Appendix B: Related Issues

We face few challenges during our project implement work. Due to low processing power of raspberry pi we face few problems. Because some process is performing simultaneously. Camera needs much light for better performance. But we enjoy a lot during work on under pressure. The work is very attractive and interesting. We learn many new things during work which will help us in our future life.