# SMART CAMERA ENABLED DOOR LOCK AND UNLOCK SYSTEM USING IOT

Prajwal.TV
B.E , 8th semester
Computer Science Department,SJMIT
Chitradurga, Karnataka, INDIA
prajwal.tv2581999@gmail.com

Vishwas.G
B.E , 8th semester
Computer Science Department,SJMIT
Chitradurga, Karnataka, INDIA
vishwas.gnanmurthy@gmail.com

Prof Beena Sheril
Guide
Associate Professor
Computer Science Department,SJMIT
Chitradurga, Karnataka, INDIA

Ramesh B E
Co - Ordinator
Associate Professor,
Computer Science Department,
S.J.M.I.T, Chitradurga, Karnataka,
INDIA, be.ramesh@gmail.com

*Abstract*—**In the modern civilisation and modern lives the technology has blended exquisitely making our lives easier . But when it comes to modern technology there are chances of modern problems these require a serious attention . The problems may come in various ways like theft , anonymous situations , etc., and we may not know how to react for these . So , here is where our solution fits in using the using IOT access technology to detect and control through the actuators we can get sort these problem . Using the Internet of Things we can make things to communicate each other . We can define some instances like - Using the Haar - Cascade Algorithm for face detection and door unlock/lock mechanism . Using Load Cell to automatically book the LPG . Gestures to make devices turn on/off and voice commands to activate devices . Using flame detection and smoke detector for anonymous situation in homes and list goes on . We can install these all in very easy way and these can be operated from anywhere since everything is under IoT . The Raspberry Pi is an heartbeat of all these , since all of the ML algorithms , computations and making live connections between all is supervised by the Raspberry Pi itself.**

**Keywords— Haar - Cascade Algorithm , Gestures , Load Cell , Internet of Things , Raspberry Pi**

## I. INTRODUCTION

In the present scenario the crimes are increasing exponentially, arising a need of security . Security can also be described as a condition so that one can develop and progress freely and with a faith that no harm may be done. Hence we are introducing any automatic door lock security system and home automation for the security purpose. Camera is now enormously being used and with the development of its content that is used in various applications. One of such is automatic door lock security system using camera.

The Internet of Things (IoT) is the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure .Typically, IoTis expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects) , is expected to user in automation in nearly all fields , while also enabling advanced applications like a Smart Grid. Things, in the IoT, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, sensors, or field operation devices that assist fire-fighters in

search and rescue. Current market examples include thermostat systems and washer/dryers that utilize wifi for remote monitoring.

electric clams in coastal waters, automobiles with built-in Interfacing of camera to capture live face images. Create a database of authorized person if they exist . Capturing current image, save it and compare with the data base image. Interface GSM module to send alert to authorized person while unlocking the locked door in the form of SMS and CALL.This paper can also be used for surveillance.For instance, it can capture the images of unidentified individuals and store it which can later be used to determine the impostors who tried to gain illegitimate access. Interface relay as on output and additional home automation system is used to control the home appliance like fan and light using mobile application. With help of WiFi connected for the model usingTCP/IP.

The authorized person data has been stored in a cloud , the IR sensor is used to detect the person in front of the door , after the detection of the person the camera will be on , the camera will capture the image of the person and it will compare the image with the data which is stored in the cloud , if the data is matched then the door will be opened , if it doesn't match with the cloud data then the door will be not opened until the access will be given from authorized person.In these modern times. , home security is the need of the hour for the development of society as a

whole which in turn will help make our cities smart, so the concept of facial recognition to gain access of the house is an idea which is used to make our place of living more secure. A facial recognition system is a system which captures facial images and verifies the identity of a person using a digital camera.

The human face assumes an essential part in our social association, passing on individuals' character. Utilizing the human face as a key to security, biometric confront acknowledgment innovation has gotten tremendous consideration in the previous quite a while because of its potential for a wide assortment of utilizations. A facial acknowledgment framework is a framework which gets facial pictures and confirms the character of a man using a propelled camera. It is an application fit for distinguishing or checking a man from a computerized picture. One approach to do this is by looking at chose facial components from the picture and a face database.

The "Home Automation" concept has existed for many years. The terms "Smart Home", "Intelligent Home" followed and has been used to introduce the concept of networking appliances and devices in the house. Home automation Systems (HASs) represents a great research opportunity in creating new fields in engineering, and Computing. HASs

includes centralized control of lighting, appliances, security locks of gates and doors and other systems, to provide improved comfort, energy efficiency and security system. HASs becoming popular nowadays and enter quickly in this emerging market. However, end users, especially the disabled and elderly due to their complexity and cost, do not always accept these systems.

## II. OBJECTIVES

"Design and Development of Home Automation System with Security using Raspberry-PI". Smart Home Systems are the subset of everyday computing which includes smart technology for providing comfort, health, safety, security and energy reduction. When this application is controlled by machine intelligence to provide circumstance-aware settings, services and facilitate remote control it significantly improves user comfort. Further addition of automated appliance control and accessibility services can improve the quality of life as well. Internet of things that contain multiple sensors can detect temperature, light, sound, distance, air pressure, motion which act as different points of data sources. Since there is a huge amount of data involved Machine learning can be applied to the existing Home automation systems to make it perform exceptionally well based off the users emotions. In this paper we define an improved Home automation system using multiple machine learning algorithms that can detect human facial expressions and adjust the environment conditions accordingly

- In the present scenario the crimes are increasing exponentially , arising a need of security.
- Security can also be described as a condition so that one can develop and progress freely and with a faith that no harm may be done.
- Visually impaired people are more immune to such crimes.
- Camera is now enormously being used and with the development of its content that is used in various applications. One of such is visual surveillance that is in flagship demand in today's market *A. Disadvantages Of Existing System :*

- Complete surveillance can increase in the footage of the video .
- The near by people who may tend to risk can't be detected
- Sometime the electricity is wasted unnecessarily by turning on fan , light etc.,
- There may be fire hazards in an unknown conditions at that time we can't detect those.
- There might be people who are unknowingly entering your private area , those can't be stopped
- We can't control home appliances from the stage we are .
- Physically disabled people can't access doors and others things , so there is disadvantage of this
- While we are sleeping , the systems may be on un necessarily at that time , there is wastage of electricity
- We can't watch our home premises , when we go out of station or when we can't be in home.

The proposed system consists of Interfacing of camera to capture live face images. Create a data base of authorized person if they exist. Capturing current image, save it and compare with the database image. Interface GSM module to send alert to authorized person while unlocking the locked door in the form of SMS and CALL. The paper can also be used for surveillance. For instance, it can capture the images of unidentified individuals and store it which can later be used to determine the impostors who tried to gain illegitimate access. Interface relay as on output. *B. The Objectives Of Proposed System :*

- 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.
- Interfacing of camera to capture live face images.
- Create a database of authorized person if they exist.
- Controlling Home Appliance through Mobile Application using IOT Technology.
- Face Detection and Face Recognition using Haar cascade Algorithm.
- Automation of door locking using by comparing face with database.
- 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.
- Detection of Human Being using PIR / IR Sensor.
- Detection of Gas Leakage using MQ3 Sensor.
- Controlled by any device capable of Wi-Fi.
- Controlling of home devices by recognising the emotion of the person.
- Extensible Platform for Future Enhancement *C.*

*Advantages Of Proposed System :*

- Time management is one of the advantage that is taken into consideration in this system.
- Our system provides a better security system by the face recognition.
- Memory management is the key factor which is utilized in an efficient way.
- Even though the owner is away from his office or home, he`ll be capable of tracking and will be aware of security of his home or office.
- In case of emergency situations like gas leakages, fire accidents immediate actions can be taken.
- People may forget to switch off the lights in home or office in their absence which leads wastage of power, this can be easily avoided with the help of IOT.
- This is the best solution for elders and even for physically disabled person to operate equipment(electrical).
- The system also recognizes the emotion of the persons and it will automatically controls the home devices.
- If the person is slept without turning off lights or TV, the system will recognizes the emotion of the person and it will turn off all the home devices except the fan.

### III.                    LITERATURE SURVEY

**Y. Januzaj [1] proposed real time access control for face recognition using, Raspberry pi**

Instead of GSM service sand relay. The limitation of the work was it couldn't control the background light situation and ambient light conditions.

**H. Lwin [2] has proposed a door lock access system which consists of three subsystems: to be specific face recognition, face detection, and automated door access control.**

Face recognition is actualized by using the PCA (Principal Component Analysis). The door will open itself for the known person in command of the microcontroller and caution will ring for the unknown person .Demerit of this system is input images are taken through a web camera continuously until the 'stopcamera' button is pressed. Somebody is required at the location to check unauthorized person's images or status of the system and take further appropriate action. Personal computer (PC) is associated with the microcontroller, the entire system will not work if PC is crashed or Non-Function.

**G. Senthilkumar, Gopalkrishna K, Sathish Kumar [3] proposed a work on Embedded Image Capturing System**

Using Raspberry Pi. In this work, they captured the image and compared it with the database but the limitation was the system couldn't work properly in the ambient light condition.

**M. Carikci, [4] proposed a work on A Face Recognition System based on Eigen face method**

In which they used Eigen method for face recognition and Euclidean distance method to compare the image of the person concerned with the images in the database. It was very efficient and fast method and also gave high accuracy.

**S. Jogdand.et.al [5] proposed a work on Implementation of Automated Door Accessing System**

With Face Design and Recognition in which they used Viola Jones method for face detection and PCA (Principal Component Analysis) for the comparison of images. The limitation of this work was that it is not robust and the efficiency is less.

**U. Sowmiya.etall.[6] Developed to connect any door with internet .In this system user also implemented PIR sensor and camera.**

PIR sensor used for detecting person and camera used for capturing the video of the person who comes at the door. The video was sent through 3g dongle to authorized person. They had so discussed some advantages of this system. They had concluded use of this system in banks, hospitals etc. But their proposed model didn't provide the facility of sending messages to the authorized people.

Traditional ways for personal identification depend on external things such as keys, passwords, etc. But such things may be lost or forgotten. One possible way to solve these problems is through biometrics, for every person has his special biometric features definitely. Biometrics identification has gained increasing attention from the whole world. Biometrics features that can be used for identification include fingerprints, palm prints, handwriting, vein pattern, facial characteristics, face, and some other methods such as voice pattern, etc.

Compared with other biometric methods, the face recognition has the following advantages: The face image acquisition requires no physical contact, so face identification system is non-invasiveness since the face is created in a nearly random morphogenetic process during the gestation, it has little probability to find two people in the world whose face textures are identical. So face recognition is the most accurate method and has the lowest false recognition rate. The face recognition has more stability than other biometric identification methods because the face has much more features than other biometrics and it won't change in people's life. With the advantages of non invasiveness, uniqueness, stability and low false recognition rate, face recognition has been researched widely and has a broad usage, such as security, attendance, etc. Most of the recognition systems are based on PC. However, the portability of PC is limited by its weight, size and the high power consumption. Thus results in that the using of face recognition is , and it is inconvenient to use. The way to get rid of the limit of PC is using embedded system. The designed EICSRS platform acquires the images and stores the min to the real time data base, which in turn later used for comparing the faces of the users to provide access to them or to deny the access to a place or to operate a device. Recent technological advances are enabling a new generation of smart cameras that represent a quantum leap in sophistication. While today's digital cameras capture images, smart cameras capture high-level descriptions of the scene and analyze what they see.

These devices could support a wide variety of applications including human and animal detection, surveillance, motion analysis, and facial identification. Fortunately, Moore's law provides an increasing pool of available computing power to apply to real- time analysis. Smart cameras leverage very large-scale integration (VLSI) to provide such analysis in a low-cost, low-power system with substantial memory. Moving well beyond pixel processing and compression, these systems run a wide range of algorithms to extract meaning from streaming video. Because they push the design space in so many dimensions, image capturing are a leading edge application for embedded system research. Most of the capturing systems are based on PC.

However, the portability of PC is limited by its weight, size and the high power consumption. Thus results in that the using of image capturing is confined in few fields, and it is inconvenient to use. The way to get rid of the limit of PC is using embedded system. We analyzed the design method of the image capturing and recognition algorithm, Raspberry Pi board module and its peripherals, implementing based on this platform. The Raspberry Pi has a Broadcom BCM 2835 a System on Chip (SoC). Soc has ARM 1176JZF-S700MHz processor, Video Core IVGPU and was originally shipped with256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, but uses an SD card for booting and persistent storage.

## IV.     REQUIREMENTS

System requirements are the prerequisites that are often used as a guideline as opposed to an absolute rule. Requirements can be classified as functional requirements, non-functional requirements, software requirements and hardware requirements.

### A. Functional Requirements

In systems engineering and requirements engineering, functional requirements are the requirements which are specified by a stakeholder or customer that define specific behaviour or functions that the system should incorporate. Functional requirements for the proposed system are:

- Device should do minimal computations on its own.
- Device should be able to capture image and display it on the screen mean while the Image should be compared
- Device should be able to send and receive messages.

### B. Non-Functional Requirements

In systems engineering and requirements engineering, non-functional requirements are those requirements that specifies criteria that can be used to judge the operation of a system.

1. The camera is enabled during the image capture.
2. The image will be refreshed as the new image is captured.

### C. Hardware Requirements

Hardware requirements are those requirements that specify the hardware platform that is required to implement a system. Hardware requirements for the proposed system are given as follows:

- ARM11 Raspberry Pi 3board
- GSM
- WebCamera
- SDcard
- DC Motor
- MotorDriver
- PIRsensor
- MQ3sensor
- Relay

### D. Software Requirements

Software requirements are those requirements that specify the software platform that is required to implement a system. Software requirements for the proposed system are given as follows:

- RaspbianOS
- OpenCV
- EmbeddedC

The system will works in two different parts. The first part is for capturing and creating a database by storing the image. And the second one is to compare the image with the stored images in the database .For feature extraction we will use Eigen faces methodology and Euclidian distances will used for recognition of the face.

### E. Camera Module

Camera module is pi camera interfacing to the raspberry pi module. It is used to capture images and send the clicked images to the raspberry pi module. Camera contains LEDs and flashes to handle that light condition that is not explicitly supplied by the environment and these light conditions are known as ambient light conditions.

### F. Raspberry Pi Module

Raspberry pi 3 module is a small computer board. When an image is taken by raspberry pi it is compared with database image. For the first time when we capture an image to Create a database raspberry pi module captures many images to create a database in the system and this database is compared with the live captured images. After comparing the two images, based on whether the output is positive or negative it gives commands to GSM module.

### G. GSM Module

GSM module is used to send a message to the authorized people based on the output. If the output is positive "Information matched Access granted" message will be sent to the authorized people, otherwise in case of unauthorised access it will send an "Access denied. Some unknown person is trying to unlock the door". Message to the certified users of the system.

### H. PIR Sensor

More advanced security systems include passive infrared (PIR) motion detectors. The "motion sensing" feature on most lights and security systems is a passive system that detects infrared energy. These sensors are therefore known as PIR (passive infrared) detectors or pyro electric sensors. These sensors " see " the infrared energy emitted by an intruder's body heat. When an intruder walks into the field of view of the detector, the sensor detects a sharp increase in infrared energy.

### I. Python Langauge

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its highlevel built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together.Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance.

Python supports modules and packages, which encourages program modularity and code reuse . The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed. Python is dynamically typed and garbage-collected. It supports multiple programming paradigms, including procedural, object-oriented, and functional programming. Python is a general Purpose and high-level programming language .We can use Python for developing desktop GUI applications, websites and web applications. Also, Python, as a high-level programming

language, allows you to focus on core functionality of the application by taking care of common programming tasks.

## V.　　SYSTEM DESIGN

### A. Overview

System design is the process of defining the architecture, components, modules, interfaces and data for a system to satisfy specified requirements. System design could see it as the application of systems theory to product development. Theory is some overlap with the disciplines of system analysis, systems architecture and systems engineering.

System design is one of the most important phases of software development process. The purpose of the design is to plan the solution of a problem specified by the requirement documentation .In otherwards , the first step in solution is the design of the  paper.

The design of the system is perhaps the most critical factor affecting the quality of the software. The objective of the design phase is to produce overall design of the software. It aims to figure out the modules that should be in the system to fulfil all the system requirements in efficient manner.

The design will contain the specification of all the modules, their interaction with other modules and the desired output from each module. The output of the design process is a description of the software architecture.

### B. System Architecture

A system architecture is a conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system.
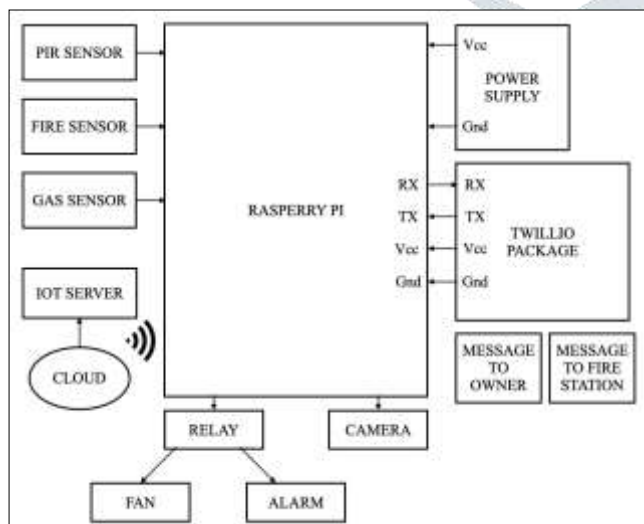
### 1) Raspberry Pi3 board

Pi is a credit-card sized computer that connects to a computer monitor or TV and uses input devices like keyboard and mouse. It is capable of performing various functionalities such as surveillance system, military applications,  surfing  internet, playing high definition videos, live games and to make databases.

### 2) Processor / SoC (System on Chip) :

The Raspberry Pi has a Broadcom BCM2835 System on Chip module. It has a ARM1176JZF-Sprocessor.The Broadcom SoC used in the Raspberry Pi is equivalent to a chip used in an old smartphone (Android or iPhone). While operating at 700MHz by default, the Raspberry Pi provides a real world performance roughly equivalent to the 0.041GFLOPS.

### 3) Power Source :

The Pi is a device which consumes 700mA or 3W or power. It is powered by a Micro USB charger or the GPIO header. Any good smartphone charger will do the work of powering the Pi.

### 4) GPIO (General Purpose Input Output)

General-purpose input/output (GPIO) is a generic pin on an integrated circuit whose behavior, including whether it is an input or output pin, can be controlled by the user at run time. GPIO pins have no special purpose defined, and go unused by default.

### 5) Status LEDs :

There are 5 status LEDs on the RPi that show the status of various activities as follows:

- ▸ "OK" – SD Card Access (via GPIO16) - labeled as "OK" on Model B Rev1.0 boards and "ACT" on Model B Rev2.0 and Model A boards
- ▸ "POWER" - 3.3 V Power - labelled as "PWR" on all boards



Fig 5.1 : System Architecture of Proposed System.

- ▸ "FDX" - Full Duplex (LAN) **(Model B)** - labelled as "FDX" on all boards
- ▸ "LNK" - Link/Activity (LAN) **(Model B)** - labelled as "LNK" on all boards

▸ "10M/100" - 10/100 Mbit (LAN) **(Model B)** - labelled (incorrectly) as "10M" on Model B Rev1.0 boards and "100" on Model B Rev2.0 and Model A boards.

*6) LPG GAS SENSOR*

LPG gas sensor module consist a MQ3 sensor which detects LPG gas. This MQ3 sensor has a heater inside which needs some heater supply to heat up and it may takes up to 15 minute to get ready for detecting LPG gas.

7) DC MOTORS

Electric motors are everywhere! In your house, almost every mechanical movement that you see around you is caused by an AC (alternating current) or DC (direct current) electric motor. Let's start by looking at the overall plan of a simple two-pole DC **electric motor**. A simple motor has six parts, as shown in the diagram below:

- Armature or rotor
- Commutator
- Brushes
- Axle
- Field magnet

## VI. ANALYSIS OF TESTING

Implementation is one of the most important phases of the Software Development Life Cycle (SDLC). It encompasses all the processes involved in getting new software or hardware operating properly in its environment, including installation, configuration, running, testing, and making necessary changes. Specifically , it involves coding the system using a particular programming language and transferring the design into an actual working system. *A. Steps To Create A Haar - Like Classifier:*

STEP 1: Collecting Image Database
STEP 2: Arranging Negative Images
STEP 3: Crop & Mark Positive Images
STEP 4: Creating a vector of positive images
STEP 5: Haar-Training
STEP 6: Creating the XML File

The vital element of any paper development phase is testing. Testing is the mechanism to find faults. A paper is inadequate without testing and implementation. Testing is the final chance to expose the flaws in the system. It is considered as one of the vital aspect that represents the latest report of system specification, architecture and coding.

The main objective of testing phase is to explore flaws by testing respective components. At the time of system testing, all these components are incorporated to build the complete system. Testing should target on whether the system satisfies the requirements and does not operate in an abrupt ways.

System layout is ideal only when conversation between user and designer is thorough and clear and it also helps in an effective testing and implementation. Testing is fundamental for accomplishment of a system. This chapter focus on testing operated on paper.

Testing is a mechanism of exploiting software in order to identify the faults. The significant logic for testing a network based system which works on distinct computers on distinct platforms in heterogeneous situations. Network based system testing revise the basic fundamentals for software testing. The basic fundamentals are:

- Testing should have the ability to discover the faults that are not yet discovered.
- Extensive testing is not possible.
- An excellent testing should have high portability of identifying faults.

*A. Unit Testing*

In unit testing the client, centralized server and service provider modules are tested. Since the system is a client server based system, the server should be ready to serve clients for the service. When the client select the service and send request to centralized server for the registration it should be ready to receive the request form client. Service provider select the service, enter/select the message that has to be broadcasted and then the centralized server should be ready to receive the message. The centralized server should be ready to serve both service provider and clients.

*B. Integration Testing*

After the system is unit tested for each module, then the modules are incorporated and tested for their interactions. Since in this paper client send request for the registration of the service to centralized server both of the modules have to be integrated and tested for interaction. Service provider provide services to the clients, here the service message is passed through the centralized server and then from centralized server to all clients. So the client, centralized server and service provider module must be integrated for interactions.

*C. System Testing*

System testing justify that all components are appropriate and the entire function performance is accomplished. It also performs test to explore inconsistencies between the system and its initial objective, existing specifications. The overall operations are tested for gathered application.

During system testing, the client will send request for the service to the centralized server by giving the username, password, server name and port number. After the registration is successful, client receives ID generated by centralized server. Service providers select the service and enter/select the message that has to be broadcasted. Centralized server receive message from all service providers, verify the details and then broadcast the messages to all users registered for particular services. Clients receive the service messages . Centralized server retransmits the messages that are not delivered to clients.

*D. Test Cases*

**Table 6.1: Test Cases**

| TEST NAME | INPUT GIVEN | EXPECTED OUTPUT | ACTUAL OUTPUT OCCURED | TEST PASS |
|---|---|---|---|---|
| FACE UNLOCK FOR KNOWN USER | Face will be detected via camera module | Door should open | Door opened | YES |
| UNKNOWN FACE | Face will be detected via camera module | Door should not open and notification should be sent to owner mobile | Door did not open and notification was sent to owner mobile | YES |

The program that has to be tested is executed with test cases and output of the program for test cases is

| TEST NAME | INPUT GIVEN | EXPECTED OUTPUT | ACTUAL OUTPUT OCCURED | TEST PASS |
|---|---|---|---|---|
| KNOWN FACE | Face will be detected via camera module | Door should not open and notification should be sent to owner mobile and a OTP will be required to open the door | Door did not open and notification was sent to mobile , after entering the OTP the door was opened | YES |

assessed to determine whether the program is operating normally. Flaws were detected and revised by using testing steps and alteration was reported for forthcoming references.


VII.                    CONCLUSION

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.It is open source software on Linux. Also , send a security alert message to the authorized person utilities . We are also providing power backup for the smooth and continuous functioning of the system in case of power failure. The power bank is 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 and provides enough flexibility to suit the requirement of different people.


REFERENCES

1. Chowdhury, M , Nooman S. 2013. Access Control of Door and Home Security by Raspberry Pi through Internet.
2. Senthikumar, G., Gopalkrishnan, K., Sathish Kumar, V. 2014 Embedded Image Capturing System Using Raspberry Pi System.
3. Çarıkçı, M., , Özen, F. 2012 A Face Recognition System Based on Eigen faces Method.
4. Jogdand, S., Karanjkar, M. 2015 Implementation of Automated Door Accessing System with Face Design and Recognition.
5. Sowmiya, U., shafiq mansoor, J. 2015 Raspberry pi based home door security through 3g dongle.
6. Kartik J. Srimadhavan V. 2013 SMS Alert and Embedded Network Video Monitoring Terminal.
7. Ramesh.B.E, Prajwal.TV, Vishwas.G Recent Advances In Lightning Delivery System Volume 6 | Issue 2 | 2019-02-23 2 Pages : 403-407 Paper Id : JETIRAB06069 http://www.jetir.org/view?paper=JETIRAB06069