KUVEMPU UNIVERSITY

Sahyadri Science College

Shivamogga-577203

A PROJECT REPORT ON

COST EFFICIENT HOME SURVEILLANCE SYSTEM

Submitted in the partial fulfillment of the requirements for the award of the under graduate degree in

BACHELOR OF COMPUTER APPLICATION (BCA)

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2021-22

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PROJECT WORK CERTIFICATE

This is to certify that

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Has satisfactorily completed the project work entitled

"COST EFFICIENT HOME SURVEILLANCE SYSTEM"

submitted in partial fulfillment of the requirements for the award of the under

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DECLARATION

We are the students of 6th semester BCA, hereby declare that the PROJECT REPORT entitled **COST EFFICIENT HOME SURVEILLANCE SYSTEM** has been carried out under the supervision of **Mrs. Rashmi V** and **Dr. Vidyashankar M.H** HOD. Department of Computer science, Sahyadri Science College Shivamogga, in the partial fulfillment of the requirement for the award of degree in Bachelor of Computer Application (BCA) Prescribed by the **Kuvempu University,** Shivamogga. This project work has not been submitted to any other university wholly or in part for ward of any other degree.

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DEDICATED TO BELOVED PARENTS, FRIENDS AND LECTURES

<u>CONTENTS</u>

CHAPTER 1

INTRODUCTION

This project deals with a design and Implementation of smart surveillance monitoring system. Over the years, security has been a prime concern globally due to the high increase in the crime rate. The evolution of the security system begins after the creation of electricity. Right from telephone-controlled home appliances and simplecamera-based system, the home surveillance today has entered the IOT era. Surveillance requirement is rapidly increasing in domestic and commercial applications due to its low cost and ease of deployment. Personal securityinvolves practices like ensuring alarms are activated.

The Raspberry Pi based surveillance system requires the use of an intruder detection system that will help identify and report any intrusion. The intruder detection system is designed to reveal intrusion once an intruder enters a premise. The proposed home security system captures information and transmits it via email and alert the user.Face recognition is a technique used to identify a person from an image or a video feed.

It can emulate the ability of a human eye to recognize people. Face recognition has many applications in the real world. There are multiple methods available to implement this technology. The first step in any face recognition system is to detect the face (from the source). After a face has been detected, certain information is extracted from the detected face and compared to a known database to identify the person.

For the system, a Raspberry Pi 4 has been used along with a camera module attached to it. The face detection has been done using Haar cascade and the recognition using Local Binary Pattern Histogram (LBPH) algorithm. The aim is to achieve a low cost and reliable system which can be used for a variety of applications.

This paper describes the design and implementation of allow-cost system monitoring based on Raspberry Pi, a single board computer which follows Motion Detection algorithm written in Python as a default programming environment. In addition, the system uses the motion detection algorithm to significantly decrease storage usage and save investment costs.

1.1 Aim and Objectives:

- The main objective is to provide security by having surveillance all around the clock.

- Motion detectors will be used for accurate analysis of any kind intrusion.

- Face recognition is used to allow only the intended person into the home.

- If any unintended people try to enter the home, then alert will be sent to the owner of the house through email along with the message. Some alert noise in the form of alarm will be sent to neighbors.

1.2 Applications:

- Minimal cost, easier installation and effective technology.

- Surveillance camera to keep other properties safe, not to stalk.

- In this project, it increases the usage of technology to provide an essential security to our home and for other control applications.

- Facial recognition is one of the front-runner applications of AI.

CHAPTER 2

LITERATURE REVIEW

PAPER 1: <u>HOME AUTOMATION USING ARDUINO AND SMART PHONE</u>

Authors: Mr. T. M. Senthil Ganesan[1], M. Rama Jothi[2], R. S. Sangavi[3], L Umayal[4]

2.1.1 ABSTRACT:

The home automation systems are getting more popularity day to day due to their ease of use and wide operational capabilities and more applications. This Integratingvoice recognition technology for home automation systems for paralyzed people canmake the system more user friendly and easy to operate and control. Some require home automation system to satisfy their needs and comfort while for physically challenged people it can provide great assistance for the patients. Intelligent home navigation system for disabled person uses voice recognition module for the speechrecognition process. The Arduino receives the command from the voice recognition module and to control electrical devices. This proposed a home automation system uses the voice recognition module for the voice recognition function, amicrocontroller and relay module are used for the controlling functions like switching lights on and off etc. We can also control the home appliances by two methods by voice commands or by using android mobile as a remote controller. The voice recognition is done by the google assistant and thus given to the controller to control the devices.

2.1.2 PROCEDURE:

Arduino IDE is used to write code and uploading it to Arduino boards. Adafruit IO is a system that includes client libraries that wraps our REST and MQTT APIs (Message Queuing Telemetry Transport). Using a MQTT library or client we can publish and subscribe to a feed to send and receive feed data. IFTTT (If This Then That) services is for automatic activities. It is a free web-based facility to createchains of simple conditional statements, called APPLETS. IFTTT is the easy, free way to get your Apps and Devices functioning together. To connect mobile with Microcontroller, Mobile's hotspot name and password should be uploaded in the server using Arduino code. To connect mobile with Microcontroller, Mobile's hotspot name and password should be uploaded in the server using Arduino code. Fan, bulb and motor are connected with relays. Relays are connected with microcontroller. Connect the hardware components. In this system, voice commandsare given as input.

The commands format which are feeded while creating IFTTT

applets should be pronounced correctly to get the output. We will give the commands through google assistant and it sends the signal to controller. And this controller will control the devices to perform ON and OFF operation.

2.1.3 CONCLUSION:

The operating system of the smart mobile phone in android, we progress remote control program. The program connected with wi-fi to communicate with the robot. Wireless control is the most significant basic needs for all the people. Wireless network-controlled robots use wi-fi modules. Our Home automation will be helpful for disabled and Elderly people to perform ON and OFF operation automatically by giving voice commands. The main issues with these applications are Network – due to which causes problems like Installation issues etc., Won't load or not work properly, Voice should be properly loud and clear, Wi-Fi or Data connection is mandatory. Our future work will be focused to reduce the time takento recognize and response the voice commands. Trying to implement the same idea in other real-world application also.

PAPER 2: <u>IOT BASED AUTOMATIC DOOR LOCK SYSTEM BY FACE AND VOICE RECOGNITION</u>

Authors: Mayur Badgujar[1], Anushka Wagh[2], Sharad Chavan[3], Priyanka Chumbhale[4], Prof. R. C. Sonawane[5]

2.2.1 ABSTRACT:

Intelligent home, also known as the smart residential home, is moving towards the wireless remote control, multi-media control, and high-speed data transmission. The key technology of intelligent home is compatible to household controllers and it can also meet the transmission requirements through home networking. At present, lots of integrated transport network is based on comprehensive wiring technology limiting the system to special places, and higher cost. Currently, researches on the wireless intelligent home security surveillance system are becoming a hotspot due to its flexibility and convenience

2.2.2 PROCEDURE:

This paper is presenting a proposed work of an automated image Capture systemusing) using Python. This work is experimented on user face we have to used classification methods Haar Cascades, CNN convolution neural networks algorithms, etc. But improvements are expected to increase its efficiency of classification. This system automatically detects the user face and detect the by recognizing their face. This system is developed by capturing real time human faces. The detected faces are matched against the reference faces in the dataset and detect the user. voice based authentication using code word is done using google API and used in Detect frauds at crowded areas such as: Banking System,Parking with some disadvantages like it is cumbersome to maintain a huge set ofrecords, it is time Consuming, Error-prone and wastage of Resources.

2.2.3 CONCLUSION:

The purpose of the project is to build a smart home system. It saves time and energy, specifically when a significant amount of people is involved. It may be expanded to video surveillance to detect people in crowded settings such as bus stops, theatres, and train stations, where the identity of a perpetrators can be determined using facial recognition algorithms. Recognition system is a difficult topic in the subject of computer vision, which has gotten a lot of recent interest due to its numerous applications in diverse of fields.

PAPER 3: <u>IOT BASED WI-FI CONTROLLED HOME AUTOMATION</u>

Authors: Md. Shahin Alom[1], Md. Jahid Hasan[2], Adiba Mahjabin Nitu[3]

2.3.1 ABSTRACT:

Home automation evolution starts with some basic ideas. It minimizes the humanefforts and it can be deployed in a lot of fields like military, surveillance application is developed in the modern world. Now a day's home automation is developed by using Wireless technology. Wireless technology in home automation starts with Bluetooth, WI-FI, and Zigbee Communication. Based on the Requirement and Application they deployed the communication in Projects.

And we have numerous android Applications in Play store to control a home automation. Blynk is a Popular App used in this Project it has a lot of Features like buttons, gauges, Sliders and Plotting Features also. By using Wi-Fi technology, we can connect a greater number of home automation to control it very useful for surveillance application. Now a day's Indoor localization Technologies are developed on that case also we can deploy this type of Wi-Fi- controlled home automation.

2.3.2 PROCEDURE:

The concept of HOME AUTOMATION aims to bring the control of operating your everyday home electrical appliances to the tip of your finger, thus giving user affordable lighting solutions, better energy conservation with optimum use of energy. Apart from just lighting solutions, the concept also further extends to have a overall control over your home security as well as build a centralized home entertainment system and much more. The **Internet of Things** (or commonly referred to as IoT) based Home Automation system, as the name suggests aims to control all the devices of your smart home through internet protocols or cloud-based computing. The IoT based Home Automation system offer a lot of flexibility over the wired systems s it comes with various advantages like ease- of-use, ease-of-installation, avoid complexity of running through wires or loose electrical connections, easy fault detection and triggering and above and all it even offers easy mobility and the required software are Arduino IDE and Blynk android application.

2.3.3 CONCLUSION:

The operating system of the smart mobile phone in android we develop remote control program. The program connected with wi-fi to communicate with the robot. Wireless control is the most important basic needs for all the people. Wireless network-controlled robots use wi-fi modules. Blynk android application will transmit command using wi-fi to the car so that it can move in the required direction like moving forward, reverse, turning left, turning right and stop. with some disadvantages like **Internet reliability**, Security Issue and Extremely expensive.

PAPER 4: <u>REAL TIME FACE RECOGNITION USING RASPBERRY PI 4 PINOUT</u>

Authors: Suchith Das[1], Mohammed Sadrulhuda Quadri[2], Navaz Pasha[3], Nishant Nyan[4], Jyothi S Nayak[5]

2.4.1 ABSTRACT:

Face recognition is a technique used to identify a person from an image or a video feed. It can emulate the ability of a human eye to recognize people. Face recognitionhas many applications in the real world [7]. There are multiple methods available toimplement this technology. The first step in any face recognition system is to detect the face (from the source). After a face has been detected, certain information is extracted from the detected face and compared to a known database to identify the person [3]. For the system, a Raspberry Pi 4 Pinout has been used along with a camera module attached to it. The face detection has been done using Haar cascadeand the recognition using Local Binary Pattern Histogram (LBPH) algorithm. The aim is to achieve a low cost and reliable system which can be used for a variety of applications.

2.4.2 PROCEDURE:

The hardware includes a Raspberry Pi 4 Pinout device along with a camera module.It has a 1.2 GHz 64-bit CPU along with 1 GB RAM and the camera module has a resolution of 5 MP. Python language has been used along with the OpenCV libraryto create the face recognition program. OpenCV is an open-source library aimed at computer vision. It is highly optimized and offers excellent support for real time applications [1]. The input from the camera module is being processed into a grayscale image in order to reduce computation. Before anything, the face has to be detected i.e., captured by the system. The method used is the Haar Cascade Classifier. After detection, the LBPH algorithm identifies the face.

2.4.3 CONCLUSION:

A low cost and reliable face recognition system can have many benefits. It can be usedfor implementing biometric security systems which can be used in schools and offices.Other applications may include real time crowd monitoring systems, assistive devices for visually impaired people which can help in navigation, surveillance systems, etc. this system also have some drawbacks like It is time consuming Wont load, work properly Expensive are financially not feasible it requires advanced hardware. The fieldof face recognition is growing at a tremendous pace right now and the need for a low cost and reliable system is imperative.

PAPER 5: <u>REAL-TIME FACE RECOGNITION AND DETECTION USING PYTHON</u>

Authors: Tayyaba Zamindae[1], Shradhatai Gangawane[2], Shital Kalane[3], Yogita Kalane[4]

2.5.1 ABSTRACT:

The basic concept here is that the face to be recognized is compared with some training set of known faces. In detection we need just to determine if there is someface in the image, but in recognition we want to determine whose face it is. We can recognize a number of faces learned throughout our lifespan and identify faces at a glance even after years of separation. This skill is quite robust despite of large variations in visual stimulus due to changing condition, aging and distractions such as beard, glasses or changes in hairstyle. Our aim, which we believe we have reached, was to develop a method of face recognition that is fast,robust, reasonably simple and accurate with a relatively simple and easy to understand algorithms and techniques It can identify multiple faces in a real – time video recording. Computers that detect and recognize faces could be applied to a wide variety of tasks including criminal identification, security system, image and film processing. Unfortunately, developing a computational model of face detection and recognition is quite difficult because faces are complex, multidimensional and meaningful visual stimuli.

2.5.2 PROCEDURE:

Over the past decade face detection and recognition have transcended from esoteric to popular areas of research in computer vision and one of the better and successful applications of image analysis and algorithm-based understanding. Because of the intrinsic nature of the problem, computer vision is not only a computer science area of research, but also the object of neuro-scientific and psychological studies also, mainly because of the general opinion that advances in computer image processing and understanding research will provide insights into how our brain work and vice versa. A general statement of the face recognition problem (in computer vision) can be formulated as follows: given stillor video images of a scene, identify or verify one or more persons in the scene using a stored database of faces.

Facial recognition generally involves two stages:

1) *Face Recognition***:** Face Recognition where that detected and processed face is compared to a database of known faces, to decide who that person is.

2) *Face Detection:* Face Detection where a photo is searched to finda face, then the image is processed to crop and extract the person's face foreasier recognition.

2.5.3 CONCLUSION:

Facial recognition system has been associated generally with very costly top secure application. Today the core technologies have evolved and the cost of equipment is going down. Certain applications of face recognition technology arenow cost effective, reliable and highly accurate. Fast and convenient in identifying a person. Great use in society, crime detection, security use and many other aspects. Face recognition is relatively easy to do in real-time if you are training on someone and then instantly trying to recognize them after, since it will be the same camera, and background will be the same, their expressions will be almost the same, the lighting will be the same, and the direction you are viewing them from will be the same. So, you will often get good recognition results at that moment. But once you try to recognize them from a different direction or from adifferent room or outside or on a different time of the day, it will often give bad results.

CHAPTER 3

ABOUT PROGRAMING LANGUAGE

3.1 <u>Python:</u>

Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation. It is a popular programming language. It was created by Guido van Rossum, and released in 1991. Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly procedural), object-oriented and functional programming. It is often described as a "batteries included" language due to its comprehensive standard library.

Guido van Rossum began working on Python in the late 1980s as a successor to the ABC programming language and first released it in 1991 as Python 0.9.0. Python 2.0 was released in 2000 and introduced new features such as list comprehensions, cycle-detecting garbage collection, reference counting, and Unicode support. Python 3.0, released in 2008, was a major revision that is not completely backward-compatible with earlier versions. Python 2 was discontinued with version 2.7.18 in 2020.

Python was conceived in the late 1980s by Guido van Rossum at Centrum Wickenden & Informatica (CWI) in the Netherlands as a successor to the ABC programming language, which was inspired by SETL, capable of exception handling and interfacing with the Amoeba operating system. Its implementation began in December 1989. Van Rossum shouldered sole responsibility for the project, as the lead developer, until 12 July 2018, when he announced his "permanent vacation" from his responsibilities as Python's "benevolent dictator for life", a title the Python community bestowed upon him to reflect his long-term commitment as the project's chief decision-maker. In January 2019, active Python core developers elected a five-member Steering Council to lead the project. Python 2.0 was released on 16 October 2000, with many major new features. Python 3.0, released on 3 December 2008, with many of its major features backported to Python 2.6.x 2.7. x. Releases of Python 3 include the 2 to 3 utilities, which automates the translation of Python 2 code to Python.

Python 2.7's end-of-life was initially set for 2015, then postponed to 2020 out of concern that a large body of existing code could not easily be forward-ported to Python No further security patches or other improvements will be released for it. With Python 2's end-of-life, only Python 3.6.x and later were supported. Later, support for 3.6 was also discontinued. In 2021, Python 3.9.2 and 3.8.8 were

expedited as all versions of Python (including 2.7) had security issues leading to possible remote code execution and web cache poisoning.

In 2022, Python 3.10.4 and 3.9.12 were expedited and so were older releases including 3.8.13, and 3.7.13 because of many security issues. Python 3.9.13 is the latest 3.9 version, and from now on 3.9 (and older; 3.8 and 3.7) will only get security updates.

3.2 Features:

There are many features in Python, some of which are discussed below as follows:

1. Free and Open Source

Python language is freely available at the official website and you can download it from the given download link below click on the Download Python keyword. Download Python Since it is open-source, this means that source code is also available to the public. So, you can download it, use it as well as share it.

2. Easy to code

Python is a high-level programming language. Python is very easy to learn the language as compared to other languages like C, C#, JavaScript, Java, etc. It is very easy to code in the Python language and anybody can learn Python basics in a few hours or days. It is also a developer-friendly language.

3. Easy to Read

As you will see, learning Python is quite simple. As was already established, Python's syntax is really straightforward. The code block is defined by the indentations rather than by semicolons or brackets.

4. Object-Oriented Language

One of the key features of Python is Object-Oriented programming. Python supports object-oriented language and concepts of classes, object encapsulation, etc.

5. GUI Programming Support

Graphical User interfaces can be made using a module such as PyQt5, PyQt4, wxPython, or Tk in python. PyQt5 is the most popular option for creating graphical apps with Python.

6. High-Level Language

Python is a high-level language. When we write programs in Python, we do not need to remember the system architecture, nor do we need to manage the memory.

7. Extensible feature

Python is an **Extensible** language. We can write some Python code into C or C++ language and also, we can compile that code in C/C++ language.

8. Easy to Debug

Excellent information for mistake tracing. You will be able to quickly identify and correct the majority of your program's issues once you understand how to interpret Python's error traces. Simply by glancing at the code, you can determine what it is designed to perform.

9. Python is a Portable language

Python language is also a portable language. For example, if we have Python code for windows and if we want to run this code on other platforms such as Linux, Unix, and Mac then we do not need to change it, we can run this code on any platform.

10. Python is an integrated language

Python is also an integrated language because we can easily integrate Python with other languages like C, C++, etc.

11. Interpreted Language:

Python is an Interpreted Language because Python code is executed line by line at a time. like other languages C, C++, Java, etc. there is no need to compile Python code this makes it easier to debug our code. The source code of Python is converted into an immediate form called **bytecode**.

12. Large Standard Library

Python has a large standard library that provides a rich set of modules and functions so you do not have to write your own code for every single thing. There are many libraries present in Python such as regular expressions, unit-testing, web browsers, etc.

13. Dynamically Typed Language

Python is a dynamically-typed language. That means the type (for example-int, double, long, etc.) for a variable is decided at run time not in advance because of this feature we don't need to specify the type of variable.

14. Frontend and backend development

With a new project py script, you can run and write Python codes in HTML with the help of some simple tags <py-script>, <py-env>, etc. This will help you do frontend development work in Python like JavaScript. Backend is the strong forte of Python it's extensively used for this work because of its frameworks like Django and Flask.

15. Allocating Memory Dynamically

In Python, the variable data type does not need to be specified. The memory is automatically allocated to a variable at runtime when it is given a value. Developers do not need to write int y = 18 if the integer value 15 is set to y. You may just type y=18.

3.5 **About Python IDLE:**

IDLE (short for Integrated Development and Learning Environment) is an integrated development environment for Python. IDLE is intended to be a simple IDE and suitable for beginners, especially in an educational environment. To that end, it is cross-platform, and avoids feature clutter. The Python installer for Windows contains the IDLE module by default.

IDLE is not available by default in Python distributions for Linux. It needs to be installed using the respective package managers. Execute the following command to install IDLE on Ubuntu:

$ sudo apt-get install idle

IDLE can be used to execute a single statement just like Python Shell and also to create, modify, and execute Python scripts. IDLE provides a fully-featured text editor to create Python script that includes features like syntax highlighting, autocompletion, and smart indent. It also has a debugger with stepping and breakpoints features.

3.6 OpenCV:

OpenCV (Open-Source Computer Vision Library), an open-source computer vision and ML software library, is utilized to differentiate and recognize faces, and objects, group movement sin recordings, trace progressive modules, follow eye gesture, track camera actions, expel red eyes from pictures taken utilizing flash, find comparative pictures from an image data base, perceive landscape and set up markers to overlay it with increased reality and so forth. The proposed method makes use of these features of Open CV in resizing and colour conversion of data images.

3.7 Simple Mail Transfer Protocol (SMTP):

Email is emerging as one of the most valuable services on the internet today. Most internet systems use SMTP as a method to transfer mail from one user to another. SMTP is a push protocol and is used to send the mail whereas POP (post office protocol) or IMAP (internet message access protocol) are used to retrieve those mails at the receiver's side.

3.7.1 The SMTP-client and SMTP-server should have 2 components:
1. User agent (UA)
2. Local MTA

3.8 Raspberry pi 4 Model B:

The Raspberry Pi 4 board layout shows some major difference between the new RPI 4 and RPI 3B+ like more memory, two micro-HDMI ports that supports 4k resolution, USB C power port etc.

3.8.1 Specifications:

CPU: Raspberry Pi 4 uses Broadcom BCM2711 64-bit quad-core ARM Cortex A72(ARMv8 CPU)

GPU: Broadcom Video Core VI @ 500 MHz and OpenGL ES,3.0 graphics.

RAM: 2GB variants of LPDDR4 SDRAM.

USB ports: contains of two USB 3.0 and TWO USB 2.0 ports to connect it to an external device.

**USB power port:** it contains of a 5.1V,3A USB type-C power port.

HDMI port: two micro-HDMI ports capable of supporting up to 4k@60HZ resolution.

Ethernet port: it comes with true Gigabit Ethernet capable of sending Ethernet frames at a rate of one gigabit per second.

Composite Video Output: both the audio output socket and the video composite socket reside in a single 4-pole 3.5mm socket.
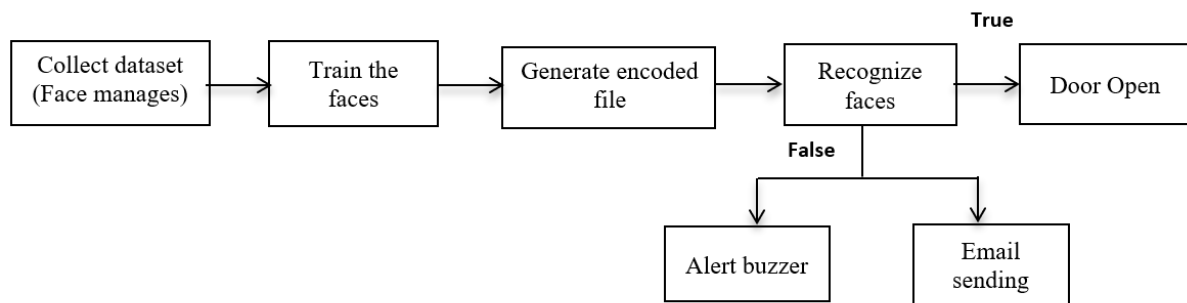
SD card slot: A micro-SD card slot is used for booting up the operating system and storage purpose.

GPIO Pins: Raspberry Pi 4 supports 40 GPIO Pins General Purpose Input Output. These digital input/output pins can be used to drive LED, Switches, and Sensors etc.
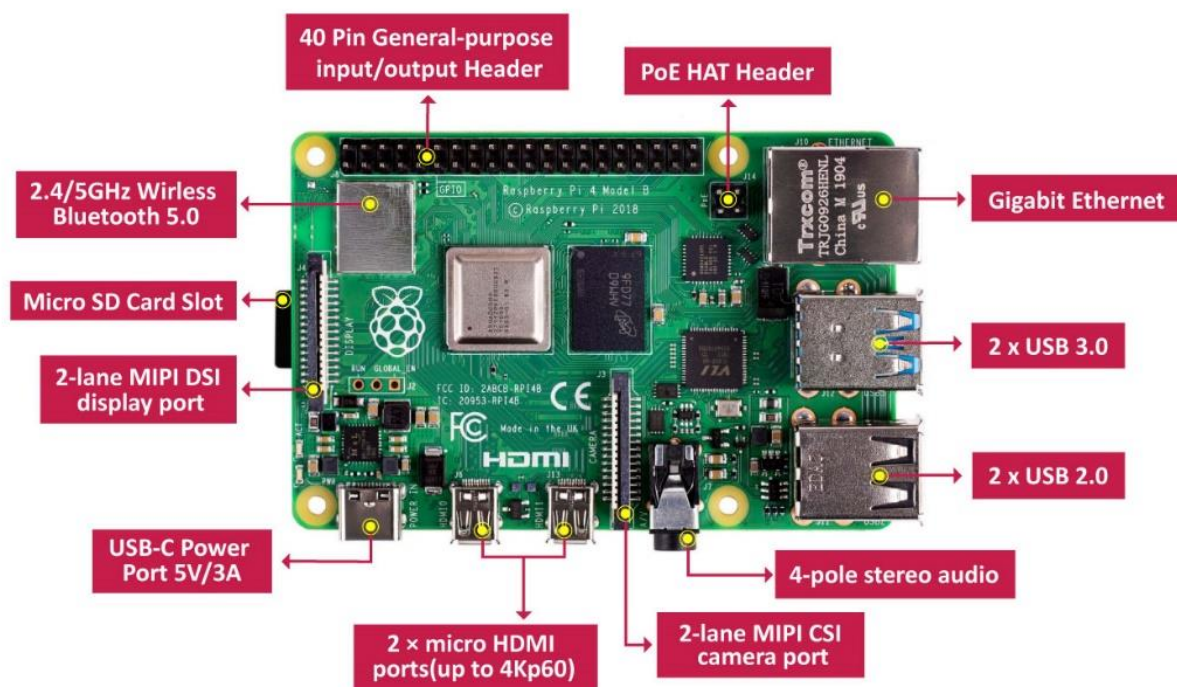
CHAPTER 4

SYSTEM DESIGN

One of the methods used for face recognition system development is the DFD (data flow diagram). It represents the system's major processes and alternatives that generate the internal flow of data. The DFD levels were used to discuss the face recognition system data flow. These levels have their part in expounding the system's data flow structure details.

The Architecture of the proposed system are the design diagram which depicts the scope of the project with the whole system design. In architecture diagram it highlights the modules with its various functionality as process. It aims to convey the internal design of the proposed system the above Fig shows the entire architecture of the proposed system.

Additionally, the data was properly categorized to illustrate the face recognition system structure. Take note that DFD is not part of the Face Recognition System UML Diagrams, but they complement each other in explaining the project activities, behaviours, interactions, and structure.

The importance of the data flow diagram (DFD) for face recognition system is to show the developers the actual happenings in the system. This is done by visualizing the system's data management at various levels. Data flow diagrams not only describe the flow of data but also denote the steps involved in transferring data from one process to another. As a result, the data was transformed from input to output.

There are two parts in this section. The first is the implementation of Door lock access by using Face Recognition and the second is the implementation of Intruder detection along with auto alert sending.

4.1 Implementation of Door Lock Access by using Face Recognition:

This project work proposes an idea of for face reorganization concept for accessing the door lock system and it implemented with the help of OpenCV which is a popular computer vision library. Face recognition is an important application of image processing owing to its use in many fields. An effective face recognition system based on OpenCV is developed in the project. Face recognition has been a best choice after problem of biometrics and it has a various type of applications in our present life. An efficient face recognition system can be of great help in forensic sciences, identification for law enforcement, authentication for banking and security system, and giving preferential access to authorized users i.e., access control for secured areas etc. A real time door lock access system by face recognition system based on PCA is presented in the project. The technique used here involves generating the 'Eigen faces' then projecting training data into face space and evaluation of a projected test element by projecting it into face space and comparing to training data. The face recognition systems presented here can extract the features of face and compare this with the existing facial images of database. The faces considered here for comparison are still faces.

4.2   Implementation of Intruder Detection along with Auto Alert Sending:

If some intruder or a person's face not stored in database detected is try to access the door, the system immediately captures the intruder's photo or video. Then it will alert the owner in two ways by sending email with detected intruder photo and through buzzer.

4.2.1 InputUnit:

In input unit the Facial images for Face Recognition and Video frames for intruder detection are captured from the camera input from Raspberry Pi Camera. Videos can be treated as stack of pictures called frames.

4.2.2 Communication Interface:

Communication interfaces which include wireless internet connectivity devices are associated with the Intruder detection module used to send alert messages in the form of e-mail and buzzer by using Internet connectivity.

4.2.3 Application Specific Unit:

The Application specific unit which consists of Door lock circuitry, it is associated with Door lock system module and it starts functioning according to results of the module to perform door lock open/close operation based on Face Recognition.

4.2.4 Tensor Flow:

TensorFlow, an interface for expressing machine learning algorithms, is utilized for implementing ML systems into fabrication over a bunch of areas of computer science, including sentiment analysis, voice recognition, geographic information extraction, computer vision, text summarization, information retrieval, computational drug discovery and flaw detection to pursue research. In the proposed model, the whole Sequential CNN architecture (consists of several layers) uses Tensor Flow at back end. It is also used to reshape the data(image) in the data processing.

4.2.5 Buzzer:

An audio signalling device like a beeper or buzzer may be electromechanical or piezoelectrical or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell and siren.

4.2.6 Communication between sender and the receiver:

The sender's user agent prepares the message and sends it to the MTA. The MTA's responsibility is to transfer the mail across the network to the receiver's MTA. To send mails, a system must have a client MTA, and to receive mails, a system must have a server MTA.

Sending Email: Mail is sent by a series of request and response messages between the client and the server. The message which is sent across consists of a header and a body. A null line is used to terminate the mail header and everything after the null line is considered as the body of the message, which is a sequence of ASCII characters. The message body contains the actual information read by the receipt.

`**Receiving Email:** The user agent at the server-side checks the mailboxes at a particular time of intervals. If any information is received, it informs the user about the mail. When the user tries to read the mail, it displays a list of mails with a short description of each mail in the mailbox. By selecting any of the mail user can view its contents on the terminal.

CHAPTER 6

REQUIREMENTS

6.1 Raspberry pi 4 Model B:

6.1.1 Specifications

- 1GB/2GB/4GB Variants
- Quad-Core 64-bit Broadcom 2711, Cortex A72 Processor
- WLAN 802.11 b/g/n/ac (2,4 + 5,0 GHz)
- LAN RJ45 10/100/1000 Mbit (Gigabit LAN over USB 3.0)
- Operating Power 5V@3A via USB Type-C port
- Dual-Display Micro HDMI Ports which supports H 265 Decode for 4K Video @60p

6.2 Pi Camera Module:

6.2.1 PiCam Features:

- 5MP colour camera module without microphone for Raspberry Pi
- Supports both Raspberry Pi Model A and Model B
- MIPI Camera serial interface
- Omni vision 5647 Camera Module
- Resolution: 2592 * 1944
- Supports: 1080p, 720p and 480p
- Lightweight and portable (3g only)

6.3 <u>Active Noise Buzzer:</u>

6.3.1 Specifications

- Operating voltage 3.3V-5V
- PCB Dimensions: 29 (L) x 14 (W) x 12 mm (H)
- Wire length: 20cm
- Weight: 7 gm.
- Frequency: 2500Hz

6.4 <u>Mouse and Keyboard:</u>

CHAPTER 7

CODING

7.1 <u>Face recognition Code:</u>

```python
import face_recognition
import argparse
import imutils
import pickle
import time
import cv2

ap = argparse.ArgumentParser()
ap.add_argument("-e", "--encodings", required=True,
help="path to serialized db of facial encodings")
ap.add_argument("-o", "--output", type=str,
help="path to output video")
ap.add_argument("-y", "--display", type=int, default=1,
help="whether or not to display output frame to screen")
ap.add_argument("-d", "--detection-method", type=str, default="hog",
help="face detection model to use: either `hog` or `cnn`")
args = vars(ap.parse_args())

print("[INFO] loading encodings...")
data = pickle.loads(open(args["encodings"], "rb").read())

print("[INFO] starting video stream...")
vs = VideoStream(src=0).start()
writer = None
time.sleep(2.0)

while True:
frame = vs.read()

rgb = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
rgb = imutils.resize(frame, width=750)
r = frame.shape[1] / float(rgb.shape[1])

boxes = face_recognition.face_locations(rgb,
model=args["detection_method"])
encodings = face_recognition.face_encodings(rgb, boxes)
names = []

for encoding in encodings:
matches = face_recognition.compare_faces(data["encodings"],
encoding)
name = "Unknown"

if True in matches:
```

```
matchedIdxs = [i for (i, b) in enumerate(matches) if b]
counts = {}

for i in matchedIdxs:
name = data["names"][i]
counts[name] = counts.get(name, 0) + 1

name = max(counts, key=counts.get
names.append(name)
for ((top, right, bottom, left), name) in zip(boxes, names):
top = int(top * r)
right = int(right * r)
bottom = int(bottom * r)
left = int(left * r)
cv2.rectangle(frame, (left, top), (right, bottom),
(0, 255, 0), 2)
y = top - 15 if top - 15 > 15 else top + 15
cv2.putText(frame, name, (left, y), cv2.FONT_HERSHEY_SIMPLEX,
0.75, (0, 255, 0), 2)
if writer is None and args["output"] is not None:
fourcc = cv2.VideoWriter_fourcc(*"MJPG")
writer = cv2.VideoWriter(args["output"], fourcc, 20,
(frame.shape[1], frame.shape[0]), True)
if writer is not None:
writer.write(frame)
if args["display"] > 0:
cv2.imshow("Frame", frame)
key = cv2.waitKey(1) & 0xFF
if key == ord("q"):
break
cv2.destroyAllWindows()
vs.stop()
if writer is not None:
writer.release()
```

7.2 <u>Code to send the captured image to owner's Email:</u>

```
import cv2
import imghdr
from email.message import EmailMessage
import smtplib
from imutils.video import VideoStream
def cap_send():
 vs = VideoStream(src=0).start()
 frame = vs.read()
 print("Captured")
 cv2.imwrite("captured.jpg",frame)
```

```python
    Sender_Email = "lgroup788@gmail.com"
    Reciever_Email = "kiran080923@gmail.com"
    Password = "xxwmysjkhpceaykn"
    newMessage = EmailMessage()
    newMessage['Subject'] = "Unknown person"
    newMessage['From'] = Sender_Email
    newMessage['To'] = Reciever_Email
    newMessage.set_content('unknown person deteced')
    with open('captured.jpg','rb') as f:
     image_data = f.read( )
     image_type = imghdr.what(f.name)
     image_name = f.name
   newMessage.add_attachment(image_data,maintype='image',subtype=image_type,file
   name=image_name)
    with smtplib.SMTP_SSL('smtp.gmail.com',465) as smtp:
     smtp.login(Sender_Email,Password)
     smtp.send_message(newMessage)
    print("mail Sent")
    vs.stop()
   cap_send()
```
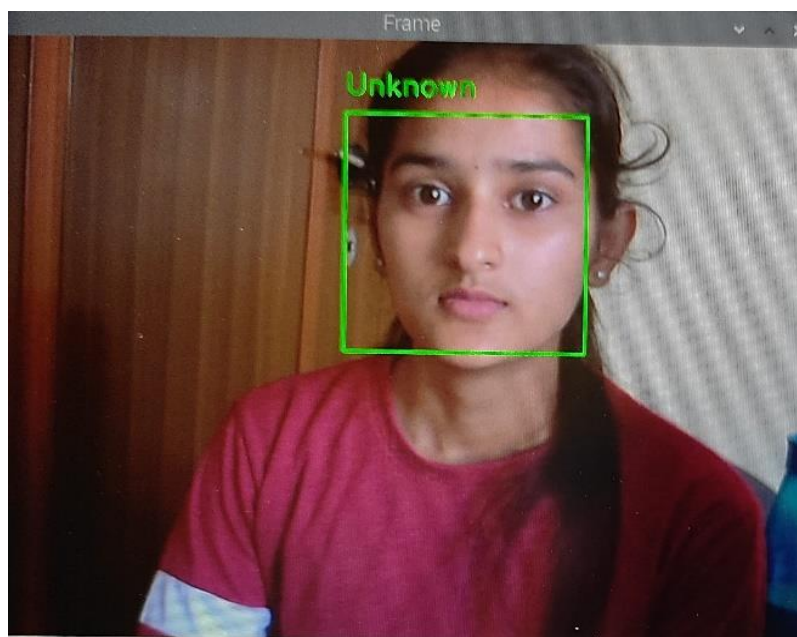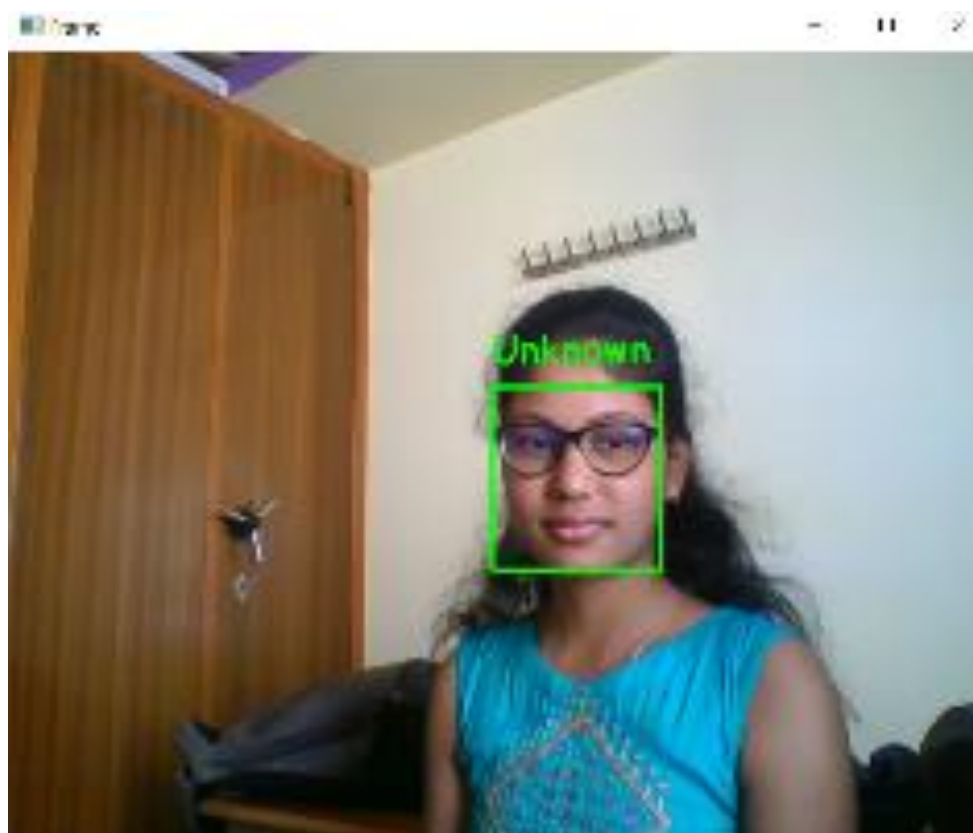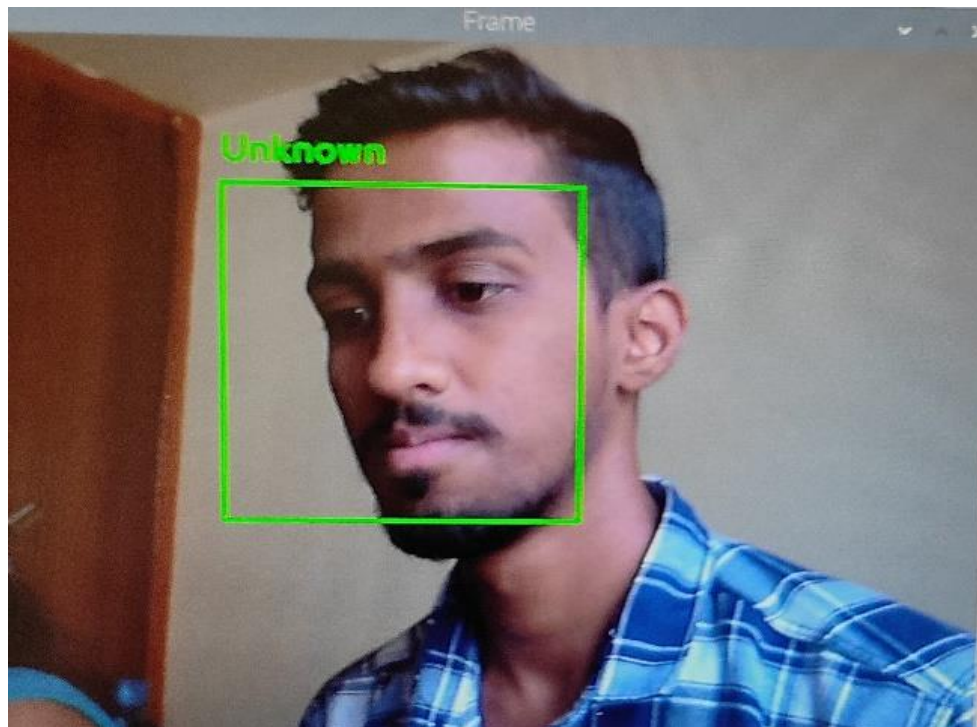
CHAPTER 8

SNAPSHOTS

8.1 Administrator/ Owner Face:
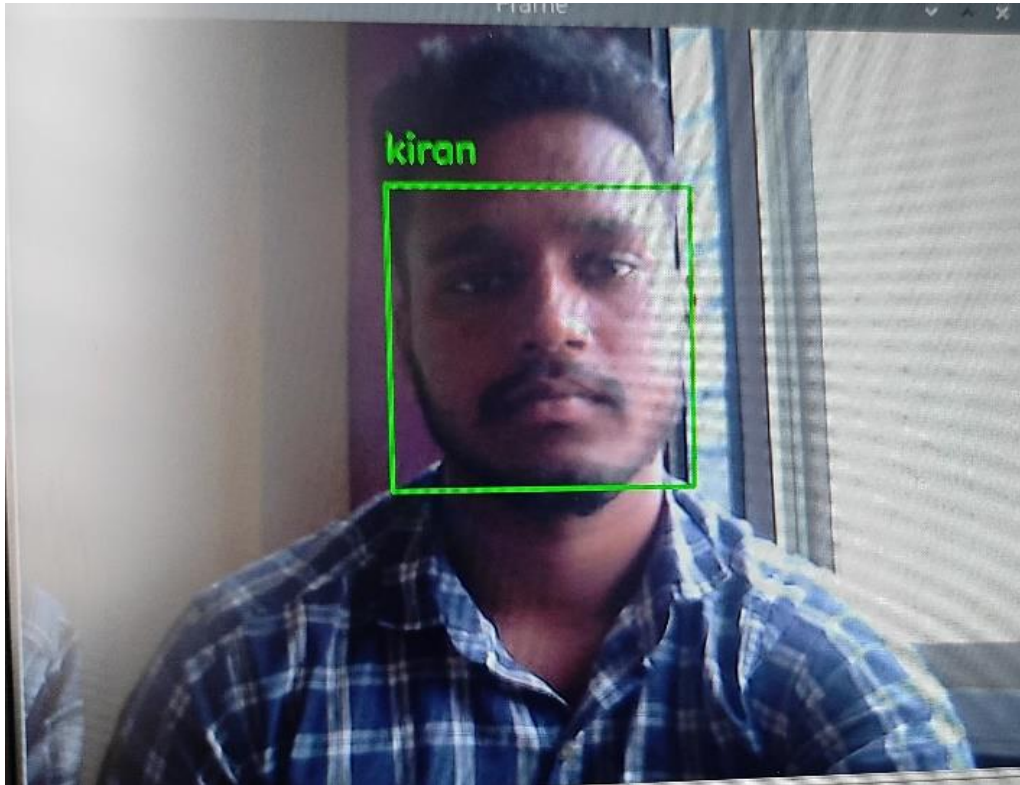
8.2 Intruder /Unauthorized face:

8.3 Captured Intruder image is Sent to the Owner:

If the system detects intruder, it makes the Alarm sound through Buzzer and captures the image of the Intruder and sends it to the administrators Email from the Gmail *lgroup788@gmail.com* which is predefined to the system during the development phase.
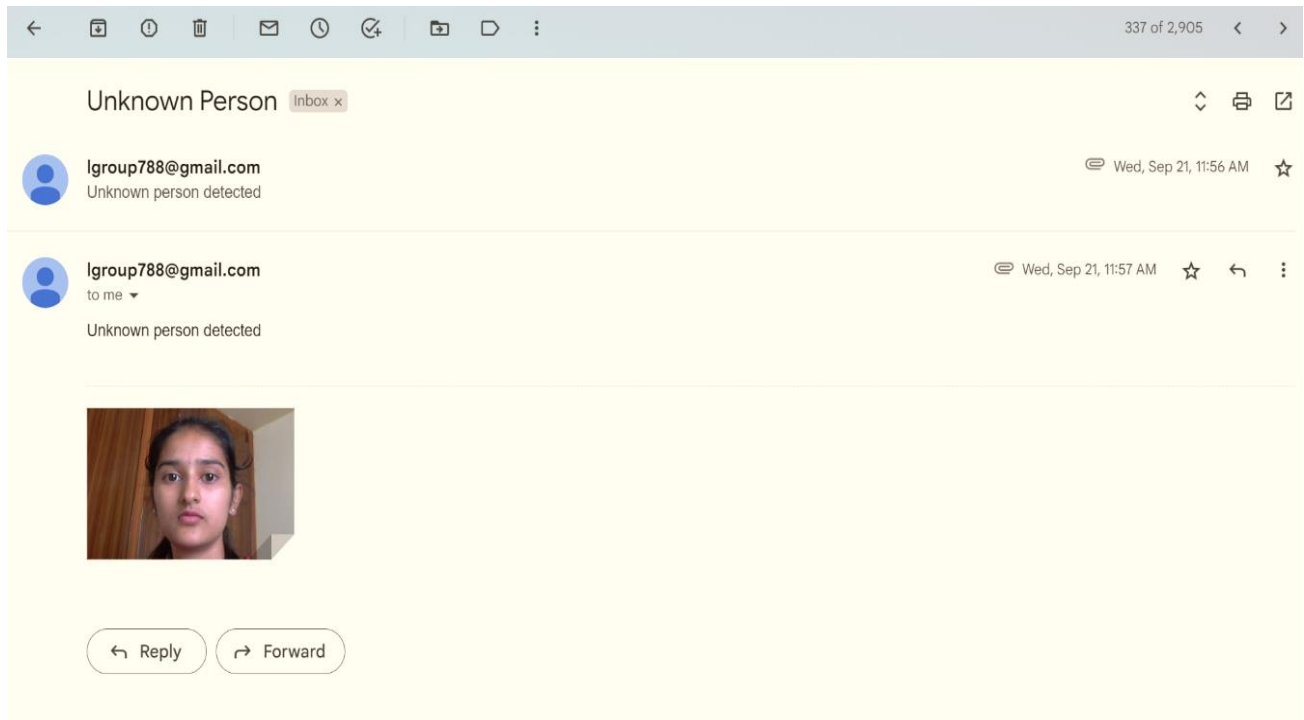

Fig. Showing the sent Email of the intruder to the Owner

CHAPTER 9

CONCLUSION AND FUTURE ENHANCEMETS

The system can be used in several places like banks, hospitals, schools, labs and other sophisticated automated systems, which dramatically reduce the hazard of unauthorized entry. Evidence can be given to the security department if any robbery issue occurs. The design of the face recognition system using Raspberry pi can make the smaller, lighter and with lower power consumption, so it is more convenient than the PC-based face recognition system. Because of the open-source code, it is freer to do software development on Linux.

The system was programmed using Python programming language. Initially camera will capture the image and face detection algorithm will detect the face in image. Then recognition algorithm is applied on this detected part. The efficiency of the system was analysed in terms office detection rate. The analysis revealed that the present system shows excellent performance efficiency and can be used for face detection even from poor quality images. The field of face recognition is growing at a tremendous pace right now and the need for a low cost and reliable system is imperative.

9.1 Future Enhancement:

The future scope of the project is to interface the hardware in order to control the door lock. Arduino can be an interface to control the door lock on successful recognition of the face.

- The Raspberry Pi Zero is a small form-factor board that comes in at half the size of a Model A+ without sacrificing the power you'd expect from an RPi. Both the Raspberry Pi Zero and Zero W feature the same BCM2835 SoC found on the original Raspberry Pi, but the W version has wireless functionality.

- The Raspberry Pi Pico microcontroller board features a dual-core ARM Cortex-M0+ processor and an RP2040 microcontroller chip, along with 264KB internal RAM

and 2MB QSPI flash memory. It has 26 GPIO pins, two SPI controllers, two I2C controllers, and 16 PWM channels, offering plenty of connectivity options.

9.2 Limitations:

- Camera position must be good all the time.
- Internet connection is needed for sending email.
- Slight appearance of Latency while working with system.
- Heating issue in Raspberry Pi board.
- No Backup power supply, Electricity is must needed.

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