Chapter 1

Introduction

1.1 Fundamentals

As rapid change in technology always aims to serve the mankind, the expectation for living a simple yet advance and safe life keeps on increasing. Now a day's office environment security is a major requirement of every individual when away from home or at the home. Office environment should be leisurely so that the employees can give their best as office environment directly affects the working efficiency of employees/workers. A smart office is a place that makes life easy for employees, which empowers it and increases their ability to stay connected. A smart office aims to create a safe environment for employees so that they can focus more on their work and worry less about the safety. Sometimes employees need to maintain confidentiality about some sensitive documents, because of this one has to always make sure whether he/she locked the door properly or not, his/her laptop is safe or not and many other things. A smart office is a system that does all this work for you with some more additional features that ensures comfort of the employee while working. The systems also contribute in conserving the energy making it efficient to use.

Internet of things (IOT) forms the base of the smart office system. The internet of things is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices. The Internet of things (IOT) devices not only controls but also monitors the electronic, electrical and various mechanical systems which are used in various types of infrastructures. These devices which are connected to the cloud server are controlled by a single user (also known as admin) which are again transmitted or notified to all the authorized user connected to that network. Various electronics and electrical devices are connected and controlled remotely through different network infrastructures. Web browser present in laptop or mobile phone or any other smart technique through which we can operate switches, simply removes the hassle of manually operating a switch. Now a day's although smart switches are available, they prove to be very costly, also for their working we required additional devices such as hub or switch. As there is rapid change in wireless technology several connectivity devices are available in the market which solves the purpose of communicating medium with the device and the microcontroller. Starting from Bluetooth to WiFi, from ZigBee to Z-wave and NFC all solve the purpose of communicating medium. In this project we have used Arduino UNO to control various devices.

1.2 Objectives

This report addresses an IoT based approach on the Office Automation. Common use-cases include measuring office conditions, controlling office appliances and controlling office access through biometrics. However, the main focus of this system is to maximize the security of office through IoT. More specially, monitoring and controlling door locks, door sensors, surveillance cameras and smoke detectors, which helps ensuring and maximizing safety and security of office.

- The main objective of this project is to build a smart secure office automation device which can be used to control and investigate activities inside the office.
- The Smart Secure Office Automation System automates each and every activity and increases the throughput.

1.3 Scope

- We can use the voice command technology in offices. More devices can be added for better security purposes. Speech recognition technology is finding its way in day to day use. Hence merging this security system with voice command technology will increase its value in the market.
- Optimal energy conservation can be observed if wearable technology can be used with the automation system. It will also help in maintaining security and integrity within the various offices.

1.4 Organization of the Project Report

The report is organized as follows: The introduction is given in Chapter 1. It describes the fundamental terms used in this project. It motivates to study and understand the different techniques used in this work. This chapter also presents the outline of the objective of the report. The Chapter 2 describes the review of the relevant various techniques in the literature systems. It describes the pros and cons of each technique. The Chapter 3 presents the Theory and proposed work. It describes the major approaches used in this work. The results are discussed in Chapter 4. Conclusion and information about future scope are provided in Chapter 5.

Chapter 2

Literature Survey

A great amount of work goes into the field of emotion extraction. The study of previous published papers helps us immensely in creating a path towards better output while simultaneously preventing the mistakes from occurring in the process. This section contains the work done on the subject up until now and determining fine-grained distinctions in sentiment. Work exclusively on emotion detection is comparatively rare and lacks empirical evaluation.

2.1 Introduction

In this chapter the relevant modules in literature is reviewed. It describes various modules that will be used in our project. Identifying the current literature on related domain problems and identifying the techniques that have been developed and present the various advantages and limitation of these methods used extensively in literature.

2.2 Literature Review

2.2.1 Arduino based home automation using Internet of things (IOT)

Author: Lalit Mohan Satapathy, Samir Kumar Bastia and Nihar Mohanty Date: -2018

Lalit Mohan Satapathy, Samir Kumar Bastia and Nihar Mohanty proposed a paper in which system is server independent and uses IOT to control human desired appliances starting from industrial machine to consumer goods. The user can also use different devices for controlling by the help of web-browser, smart phone or IR remote module. This paper presents a low cost flexible and reliable home automation system with additional security using Arduino microcontroller, with IP connectivity through local Wi-Fi for accessing and controlling devices by authorized user remotely using Smart phone application. [1]

2.2.2 Design and Implementation of Smart Office Automation System

Author: - Renuka Bhuyarand Saniya Ansari Date: -2016

Renuka Bhuyar and Saniya Ansari proposed a paper in which system is based on subsystems

like lighting, heating. Security and alarming systems are also present. The sensors are used to extract the real time data from environment. Sensors are connected to the ARM11 Controller. It processes the data and gives the output. Fan, bulb, buzzer is output devices connected to the controller which will work when the system crosses the threshold value. The sensor's data is continuously recorded. Fingerprint Identification module is used for security purpose. Fire alarm and emergency call is given to the service room. This data is stored in PC. This data can be viewed on another PC's through Network switch. The data can be seen on the webpage and on GUI. [2]

2.2.3 Motion Detection, Tracking and Classification for Automated Video Surveillance

Author: -Neha Gabal, Neelam Barak and Shipra Aggarwal Date: -2016

Neha Gabal, Neelam Barak and Shipra Aggarwal proposed a paper in which an advanced approach to motion detection for automatic video analysis has been presented the proposed method is a pixel dependent and non-parameterized approach that is based on first frame to build the model. The detection of the foreground which represents the object and background which is the surrounding of the environment starts once the subsequent frame is captured. It utilizes unique tracking methodology that identifies and eliminates the ghost object from dissolving into the background of the frame. [3]

2.2.4 Integration of intrusion detection and web service alarm for home automation system using 'arm' microprocessor

Author: -Balakrishna Gokaraju,DonaldYessick Date:-2015

Balakrishna Gokaraju, Donald Yessick, Jonathan Steel, Daniel A. Doss and Anish C. Turlapaty proposed a paper in which intrusion detection system will be integrated wirelessly to the home WiFi system and could initiate an email to the respective authority. Moreover, these systems have high false alarm rates and unnecessary calls to 911 operator. The novelty of our present implementation design lies in cost and time effective communication of the intrusion event wirelessly to the home owners and law-enforcement with a confirmed image of the scene during the intrusion event. [4]

2.2.5 Wireless Communication-Based Smoke Detection System Design for Forest Fire Monitoring

Author: -Zhen He, Yongchun Fang*, Ning Sun, and XiaoLiang Date: -2016

Zhen He, Yongchun Fang*, Ning Sun, and Xiao Liang proposed a paper which describe

designs of the hardware scheme for the key functional modules, and implements the integration of the entire system, as well as the functional debugging at the platform. Based on the hardware design, the overall scheme of software system is set up, which successfully gets through the experimental debugging. For communication, the data received from the sensor nodes is collected by a router to a coordinator, and subsequently sent to the GPRS module through a serial port. Finally, the information is shown on the PC through the Internet. [5]

2.2.6 Design and Implementation of a Fingerprint Based Lock System for Shared Access

Author: -Jayasree Baidya, Trina Saha, Ryad Moyashir, Rajesh Palit (2016)

Proposed a system in which Biometric systems such as fingerprint provide tools to enforce reliable logs of system transactions and protect an individual's right to privacy. The RFID or password-based door lock mechanisms can easily be compromised when the RFID card or passwords are shared or stolen, thus for facilities with shared access require biometric based secure system. In the proposed system, fingerprints of the authorized users are enrolled and verified to provide access to a facility that is used by multiple users. A user can also be removed and a new user can be enrolled in the system. Implemented a centralized control system from which can control who can enter in which rooms and who cannot. [6]

2.2.7 Automatic Room Light Intensity Detection and Control Using a Microprocessor and Light Sensors

Author: -Ying-Wen Bai and Yi-Te Ku Date: -2008

Proposes a design using both a microprocessor and light sensors for automatic room light detection and control. Our design, the HLCM (Home Light Control Module) which will be installed in every light fixture of a family, is made up of four blocks: the pyro electric infrared (PIR) sensor circuit, the light sensor circuit, the microprocessor and the RF module. By using the PIR sensor circuit, the HLCM detects if a human body enters the detection area or not. If there is no human body present, all controlled lights are turned off. If there is, the HLCM detects he light intensity under the environment and maintains sufficient light by controlling the number of lights. They have also integrated an RF module to transmit and receive the data from each HLCM so it can control different lights in different regions. The result of using the HLCM shows that the total power consumption can be reduced. [7]

2.1 Summary of Literature Survey

Table 2.1 Summary of Literature Survey

Sr. no	Paper	Technique/Algorithm	Conclusion/Summary
1.	Lalit Mohan Satapathy, Samir Kumar Bastia, Nihar Mohanty,2018, "Arduino based home automation using Internet of things (IoT)	Arduino UNO,4-Channel Relay,ESP8266-01,WIFI, Gas Sensor,Temperature Sensor	The experimental setup which we designed has its focal point on controlling different home appliances providing 100% efficiency. Due to advancement in technology, Wi-Fi network is easily available in all places like home, Office Building and Industrial Building so proposed wireless network easily controlled using any Wifi network. The wiring cost is reduced. This also eliminates power consumption inside the building when the loads were in off conditions.
2.	Renuka Bhuyar Saniya Ansari, 2016," Design and Implementation of Smart Office-Automation System"	Microcontroller ADC LCD UART and IO Initialization PIR sensors	Many security safety techniques are used like smoke detectors fingerprint scanner, illuminating and lighting. Alarm will turn on when it crosses threshold value and will be notified on the mobile. Controller is used to perform any function.

3.	Neha Gabal, Neelam Barak and Shipra Aggarwal,2016" Motion Detection, Tracking and Classification-for Automated-Video Surveillance"	Initial Background Modelling,Segmentation Tracking of the Detected,Object, Update Background Model Classification of Moving Objects	The results of the technique presented in paper have been analyzed under qualitative and quantitative point of view. The results proved the efficiency of method on scales of accuracy and low processing requirements.
4.	Balakrishna Gokaraju, Donald Yessick, Jonathan Steel, Daniel A. Doss and Anish C. Turlapaty,2015" Integration of intrusion detection and web service alarm for home automation system using 'arm' microprocessor	ARM microprocessor, Range-Detection Sensor, Raspberry Pi System,Web-Camera,Wi-Fi Adapter,Webservice, Google Gmail Client, Smartphone	The performance of the total integrated system was analyzed and tested over multiple iterations and found to be very robust in reliability of the signal strength and latency of web service alarm.
5	ZhenHe,NingSun,Xiaoliang,Yongchun Fang,2016"Wireless communication-based smoke detection system"	Hardware-Sensor module design, microprocessor design, Antenna and power supply design Software-Router node coordinator node smoke sensors	The whole system is designed according to hardware and software. Any type of smoke is detected by the sensors used by function modules and its integration.

6	Jayasree Baidya, Trina Saha, Ryad Moyashir, Rajesh,Palit,2015" Design-and Implementation of a Fingerprint Based Lock System for Shared Access"	Arduino Uno, fingerprint sensor, Electronic lock, push button, Buzzer,4X4 Matrix keypad, Channel relay module, Adafruit Fingerprint sensor library	The RFID or password-based door lock mechanisms can easily be compromised when the RFID card or passwords are shared or stolen, thus for facilities with shared access require biometric- based on secure system. Our fingerprint-based lock system has high accuracy rate and is also quick to recognize fingerprints.
7	Ying-Wen Bai and Yi-TeKu,2008" Automatic Room Light Intensity Detection and Control Using a Microprocessor and Light Sensors"	Automatic Room Light Intensity Detection and Control Using a Microprocessor Light Sensors HLCM (Home Light Control Module)	The HLCM detects if a human body is present or not by using the PIR sensor circuit. If there is, the HLCM then detects the light intensity under the environment by using the light sensor circuit and the system maintains sufficient room light by switching lights on/off.

Chapter 3

Smart Secure Office Automation System

3.1 Overview of Existing System

All the sensors are connected to the ARM Controller. As per the input given to ARM controller by the sensors all the other devices are controlled.

3.1.1 Existing System Architecture

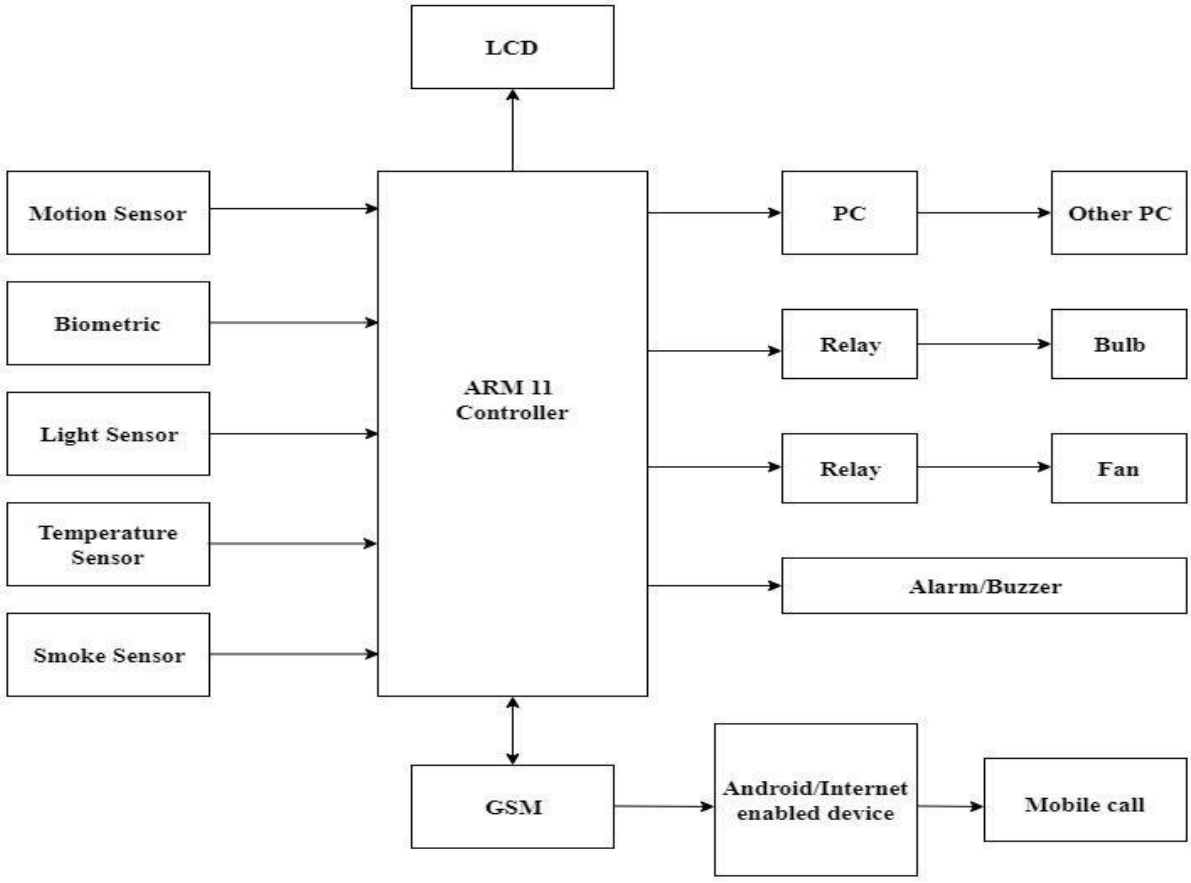


Figure 3.1.1 Existing System Architecture

As shown in the block diagram all the sensors are connected to an ARM11 controller. ARM11 is a group of older 32-bit RISC ARM processor cores licensed by ARM Holdings. This microprocessor accepts the input from all the sensors mentioned in the block diagram and acts accordingly on the other devices like fan, pc, etc.

In this system the sensors that are used (as shown in the above figure) perform the following function:

1. Temperature sensor is used to get the details regarding the humidity and temperature of the room at that particular time period.
2. Light sensors are used to switch ON or OFF the lights, fans, AC's etc. based on the person who enters the room FIRST or LAST respectively.
3. Smoke sensors are used for safety measures to detection smoke or fire from any equipment present in the room.
4. Biometric is used to give access to office to authorized employees only to ensure that no intruder can enter in to the office premises.
5. Motion sensors are used to detect the intruder who has accessed office premises without biometric authentication during closed office hours.

In the end when an intrusion/smoke is detected, office alarm starts ringing and messages are sent to the employees working as an alert system.

Advantages:

1. Biometric helps in security purpose.
2. All the other sensors contribute to make the office smart.
3. Works in two modes: automatic and manual.

Disadvantages:

1. If the central device i.e. ARM controller fails, the whole system collapses.
2. System must have some backup power in case of power failures.

3.1.2 Proposed System Architecture

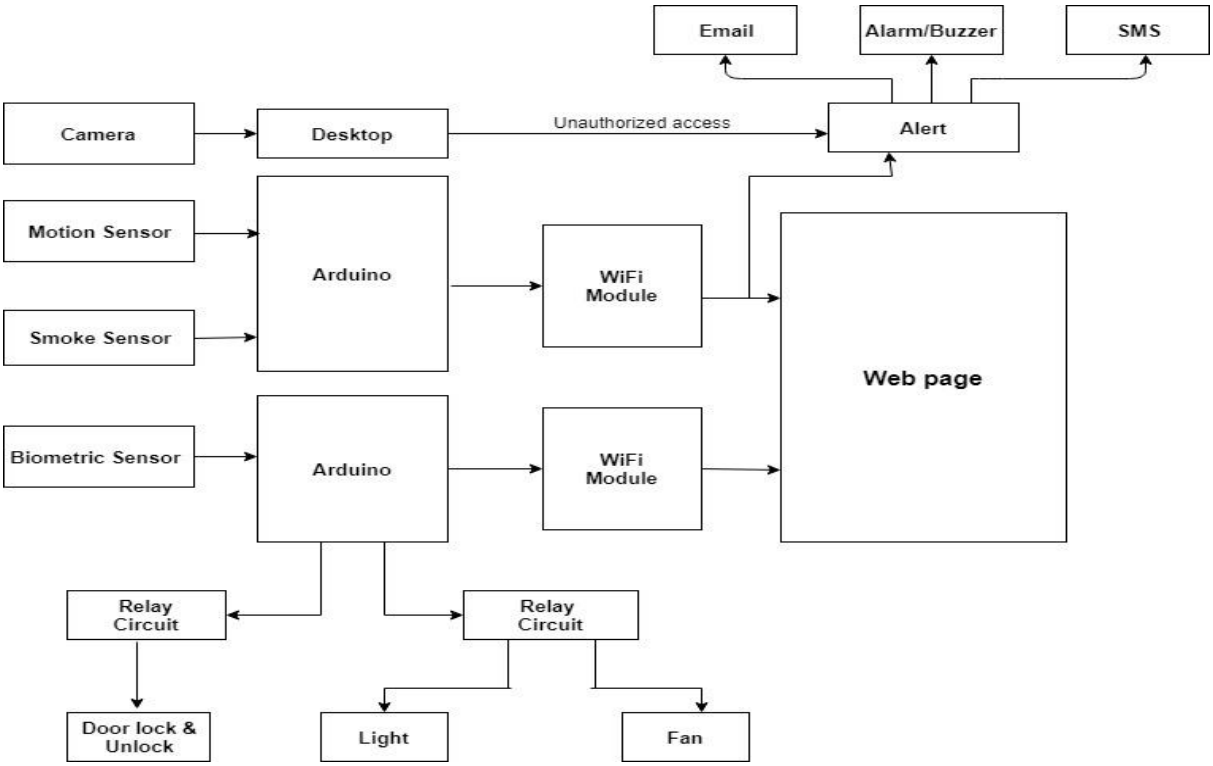


Figure 3.1.2 Architecture of proposed system

IOT plays an important role in home automation system. The use of IOT in offices to ensure security is the key aspect of smart office automation system. The system includes various sensors that sense the environment and detect any malicious activities. The sensor data is then processed and according to the input, that is the sensed data the system produces output.

1. **Camera:** Camera will be continuously capturing video footage. This video footage will be further processed using image processing techniques. It is used to capture activities of intruders if any. [4]
2. **Biometric Lock:** Biometric lock will be implemented on the door, so that only authorized people can enter in the office. [6]

3. **Motion Sensor:** A motion sensor (or motion detector) is the linchpin of your security system, because it's the main device that detects when someone is in your home when they shouldn't be. A motion sensor uses one or multiple technologies to detect movement in an

area. If a sensor is your security system's control panel, which connects to your monitoring center, alerting you and the monitoring center to a potential threat in your home. [7]

4. **Smoke Detector:** Smoke detectors are used to alert people as soon as possible in case of fire. When smoke is detected in the room the alarm is set. [5]
5. **Arduino UNO:** All the sensors are connected to separate Arduino Uno. The data from the sensors is taken as input and accordingly output is produced. If CCTV detects any intruder activities the same data is sent to Arduino which in turn sets the alarm, sends desired people email/call. The same is done if biometric lock comes across any unauthorized access and also when smoke detector detects smoke in the room. [1]
6. **Email, SMS:** Email and/or SMS will be sent to people who are registered in emergency contacts. [4]
7. **Alarm:** In case of fire, any unauthorized access sensed by fingerprint lock, or any intruder activities are discovered the alarm situated in the office is set on. [5].
8. **Relay Circuit:** Fingerprint sensor is connected to the two-relay circuit. One relay controls the door Lock/Unlock mechanism and other one controls light and fan ON/OFF mechanism. [6]

3.2 Implementation Details

3.2.1 Technique Used

Face Recognition: LBPH Algorithm:

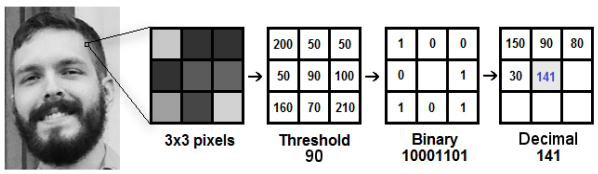
Face Recognition: Understanding LBPH Algorithm In computer science, face recognition is basically the task of recognizing a person based on its facial image. It has become very popular in the last two decades, mainly because of the new methods developed and the high quality of the current videos/cameras

Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number. When LBP is combined with histograms of oriented gradients (HOG) descriptor, it improves the detection performance considerably on some datasets. Using the LBP combined with histograms we can represent the face images with a simple data vector.

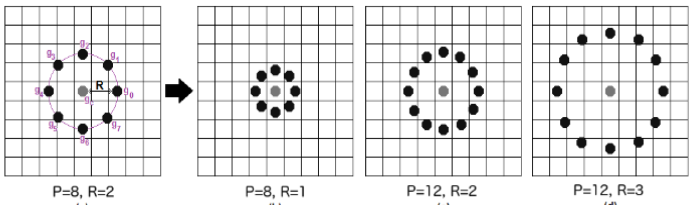
Steps:

1. **Parameters:** the LBPH uses 4 parameters:
    - **Radius**: the radius is used to build the circular local binary pattern and represents the radius around the central pixel. It is usually set to 1.
    - **Neighbors**: the number of sample points to build the circular local binary pattern. Keep in mind: the more sample points you include, the higher the computational cost. It is usually set to 8.
    - **Grid X**: the number of cells in the horizontal direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.
    - **Grid Y**: the number of cells in the vertical direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.
2. **Training the Algorithm**: First, we need to train the algorithm. To do so, we need to use dataset with the facial images of the people we want to recognize. We need to also set an ID (it may be a number or the name of the person) for each image, so the algorithm will use this information to recognize an input image and give you an output. Images of the same person must have the same ID.

The image below shows this procedure:

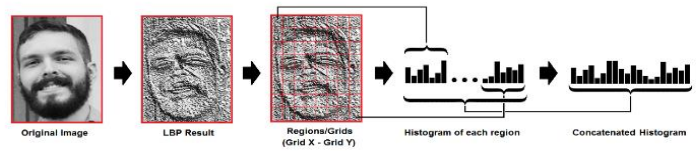


3. **Applying the LBP operation**: The first computational step of the LBPH is to create an



intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameter's radius and neighbors.

4. **Extracting the Histograms**: Now, using the image generated in the last step, we can use the Grid X and Grid Y parameters to divide the image into multiple grids



5. **Performing the face recognition**: In this step, the algorithm is already trained. Each histogram created is used to represent each image from the training dataset. So, given an input image, we perform the steps again for this new image and creates a histogram which represents the image.

- So, to find the image that matches the input image we just need to compare two histograms and return the image with the closest histogram.
- We can use various approaches to compare the histograms (calculate the distance between two histograms), for example: euclidean distance, chi-square, absolute value, etc. In this example, we can use the Euclidean distance (which is quite known) based on the following formula:

$$D = \sqrt{\sum_{i=1}^{n}(hist1_i - hist2_i)^2}$$

- So, the algorithm output is the ID from the image with the closest histogram. The algorithm should also return the calculated distance, which can be used as a 'confidence' measurement. Note: don't be fooled about the 'confidence' name, as lower confidences are better because it means the distance between the two histograms is closer.
- We can then use a threshold and the 'confidence' to automatically estimate if the algorithm has correctly recognized the image. We can assume that the algorithm has successfully recognized if the confidence is lower than the threshold defined.

3.2.2 Use Case Diagram

The purpose of a use case diagram in UML is to demonstrate the different ways that a user might interact with a system.

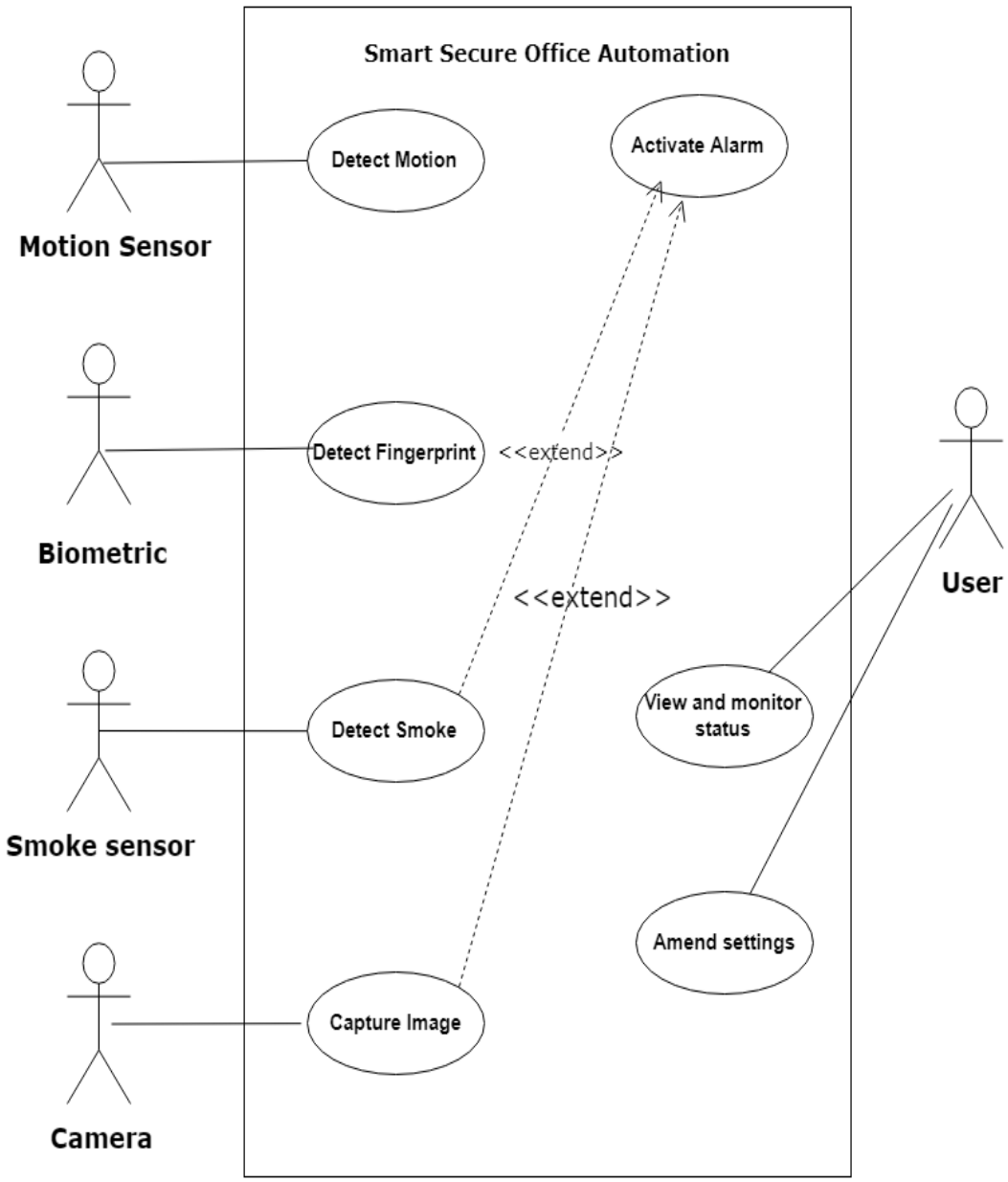


Figure 3.2.2 Use Case Diagram

3.2.3 Class Diagram

Class diagram is a static diagram. It represents the static view of an application.

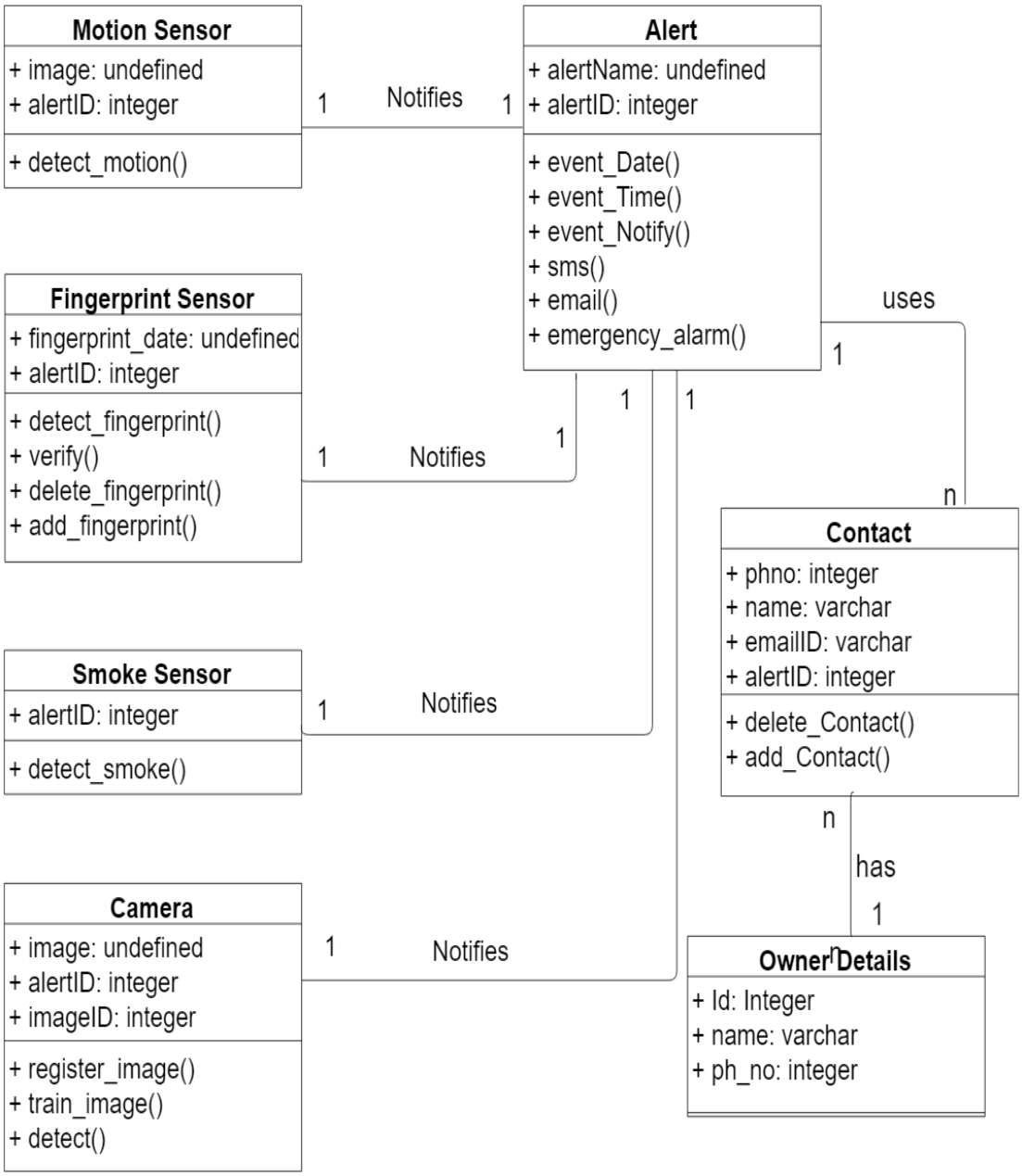


Figure 3.2.3 Class Diagram

3.2.4 Sequence Diagram

Sequence diagrams are a popular dynamic modeling solution in UML because they specifically focus on lifelines, or the processes and objects that live simultaneously, and the messages exchanged between them to perform a function before the lifeline ends.

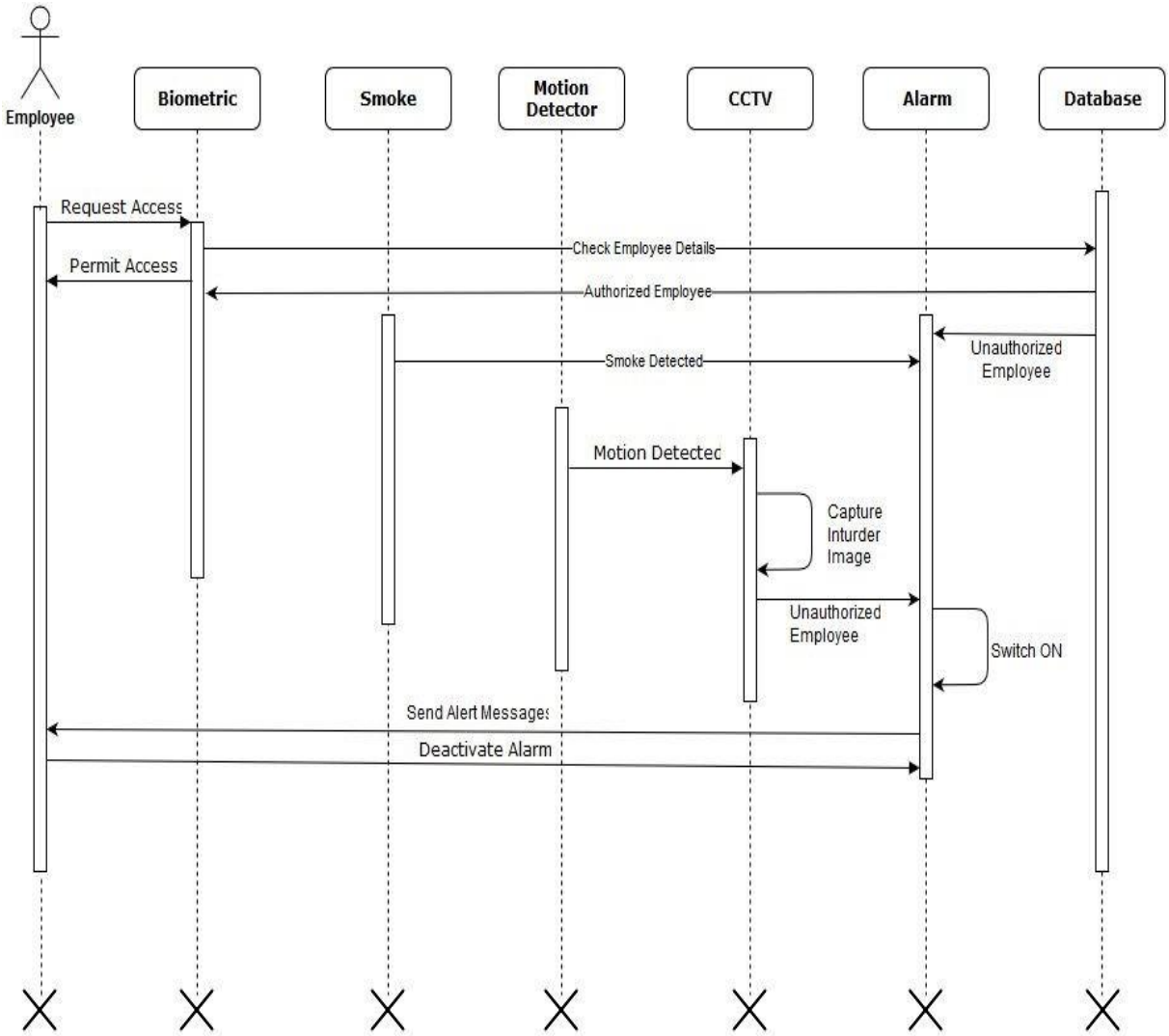


Figure 3.2.4 Sequence Diagram

3.2.5 Activity Diagram

Activity diagram is basically a flowchart to represent the flow from one activity to another activity.

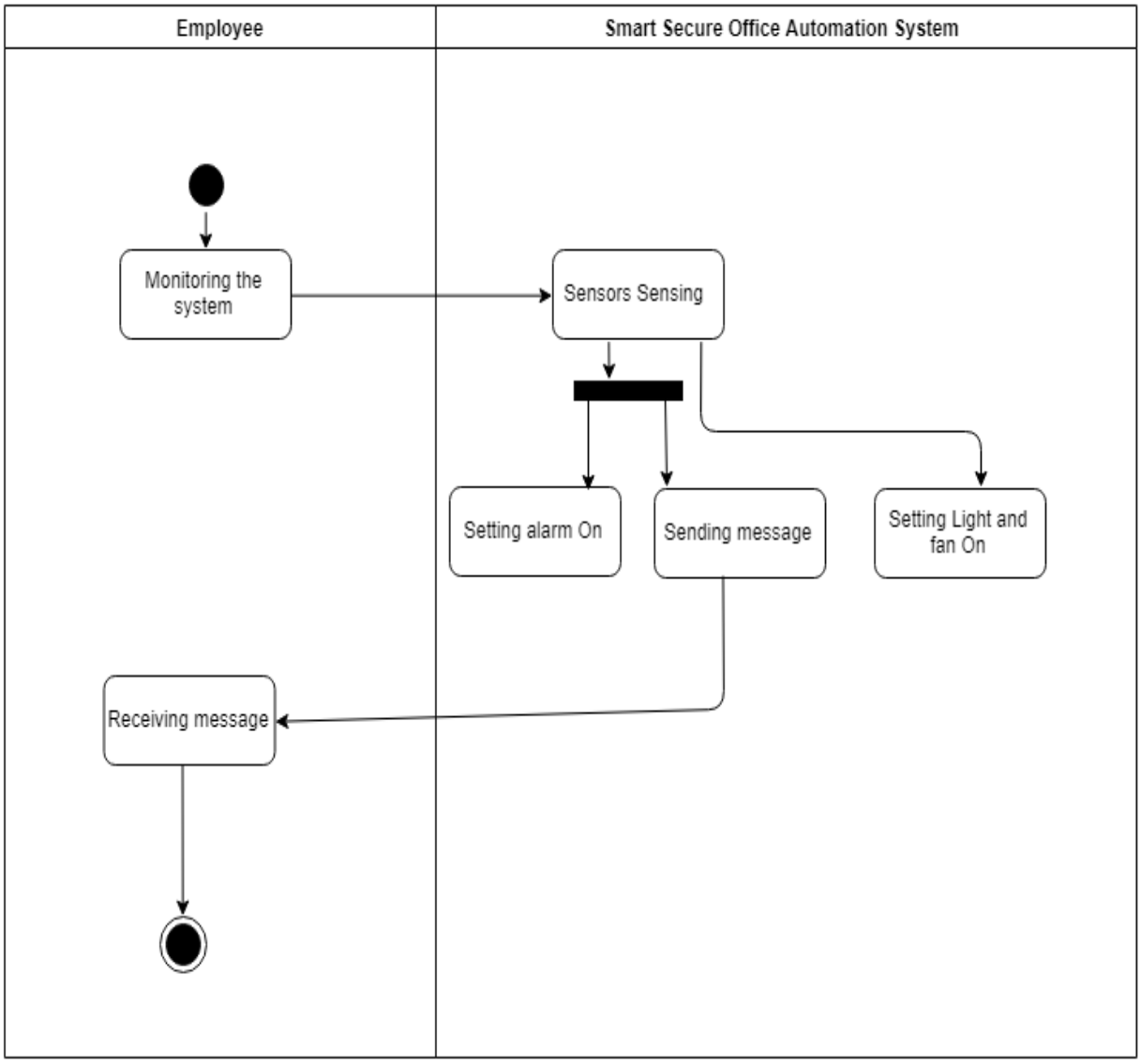


Figure 3.2.5 Activity Diagram

3.2.6 Hardware and Software Specifications

The experiment setup is carried out on a computer system which has the different hardware and software specifications as given in Table 3.2 and Table 3.3 respectively.

Table 3.2 Hardware details

2 X Arduino UNO	5V
Fingerprint Sensor	5V
Smoke Detector	5V
Camera	2MP
PIR Sensor	5V
2 X WIFI Module	3.3V
2 X Relay Circuit	5V
Processor	1.8 GHz Intel
HDD	1 TB
RAM	8 GB

Table 3.3 Software Details

Arduino IDE	1.8.7
Arduino Studio	3.2.1
Operating System	Windows

3.3 Applications

There are various applications of this domain system. The application is listed here. This new wave of connectivity is going beyond laptops and smartphones, it's going towards smart homes, smart cities and military bases. Basically, a connected life. These devices will bridge the gap between physical and digital world to improve the quality and productivity of life, society and industries. With IoT catching up Smart homes is the most awaited feature, with brands already getting into the competition with smart appliances.

1. Smart Home

Smart Home clearly stands out, ranking as highest Internet of Things application on all measured channels. More than 60,000 people currently search for the term "Smart Home" each month. This is not a surprise. The IoT Analytics company database for Smart Home includes 256 companies and start-ups. More companies are active in smart home than any other application in the field of IoT. The total amount of funding for Smart Home start-ups currently exceeds $2.5bn. This list includes prominent start-up names such as Nest or Alert Me as well as a number of multinational corporations like Philips, Haier, or Belkin.

2. Smart City

Smart city spans a wide variety of use cases, from traffic management to water distribution, to waste management, urban security and environmental monitoring. Its popularity is fuelled by the fact that many Smart City solutions promise to alleviate real pains of people living in cities these days. IoT solutions in the area of Smart City solve traffic congestion problems, reduce noise and pollution and help make cities safer.

3. Military-Smart Bases

Incorporating IoT devices and sensors into military bases can have several positive effects automated security screening, for example, increases safety while decreasing manpower, and a network of security cameras connected to their environment via sensors and to a central network via the Internet will also minimize security risks. Smart management of resources – electricity and water for example – will increase the capacity and output of military bases while ensuring that the wellbeing of all individuals.

Chapter 4

Result and Discussion

4.1 Screenshots of the Website

1] Admin login page

The below snap represents the login page for the administrator, who will look up the factors like number of employees present in the office, in this system the administrator is the Security Manager. The admin has the right to track all the activities of the entire employee. The admin will be notified if any unauthorized person tries to enter in the office. The admin requires entering the username and password to get logged-in onto the system.

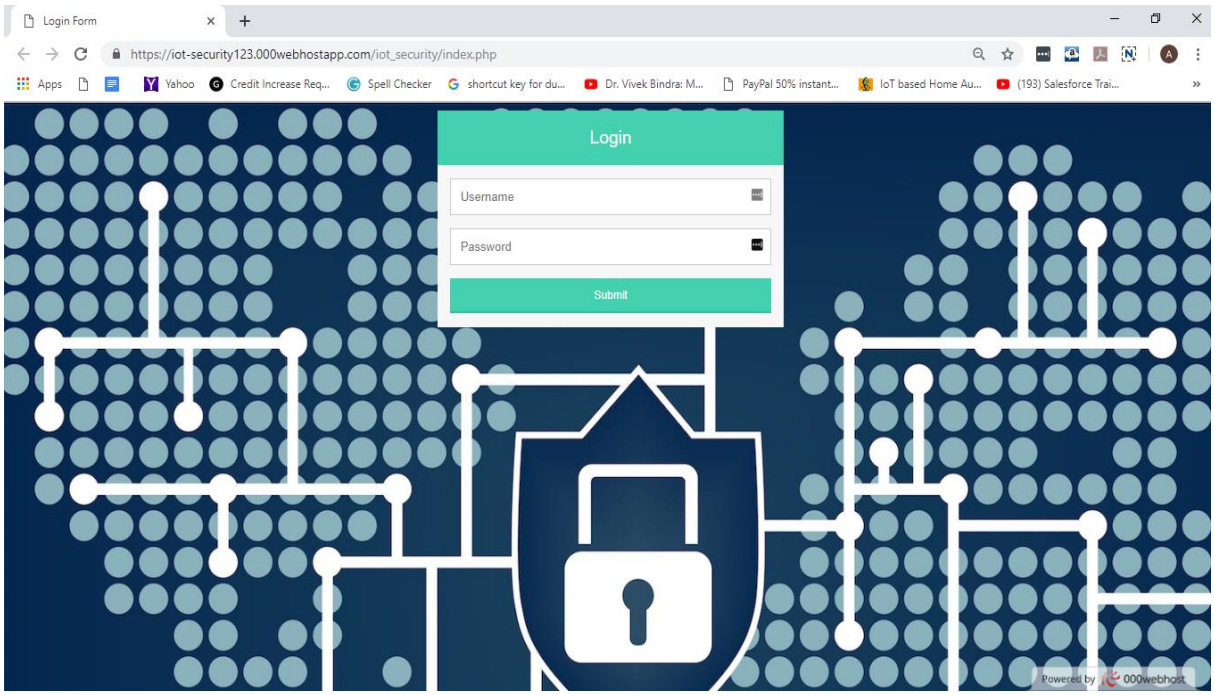


Figure: 4.1.1 Admin Login Page

2] Home Page

After admin is successfully logged in it is redirected to home page. Home Page contains IN and OUT status of the employee along with their names. Home Page comprises of various navigation buttons such as Motion Detection Status, Smoke Detection Status and Add user

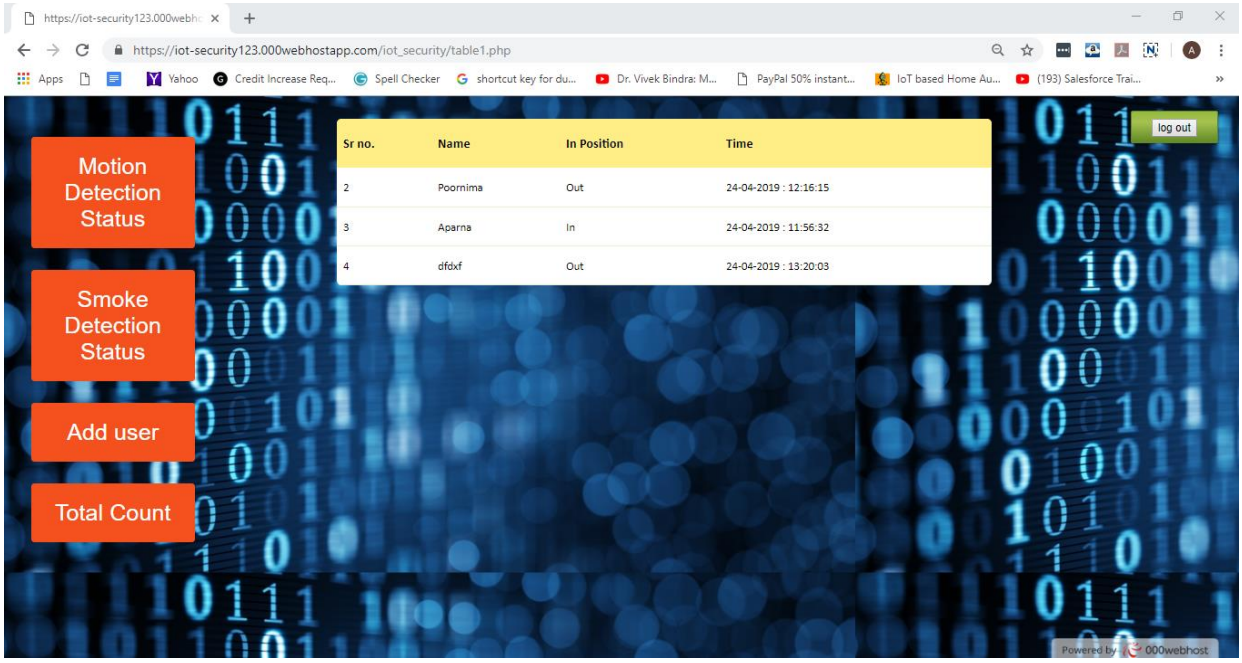


Figure: 4.1.2 Home Page

3] Motion Detection

The below snap is of PIR sensor which is connected to Arduino. If PIR sensor detects any motion LED glows.

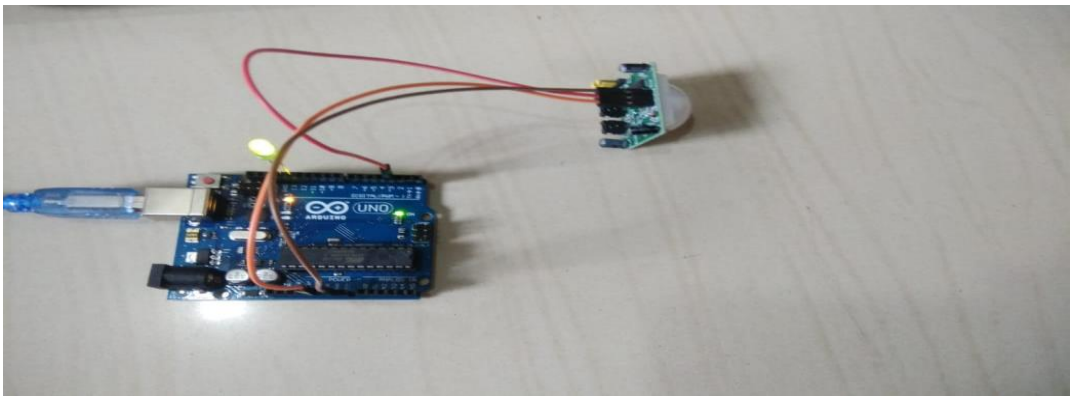


Figure 4.1.3 PIR Sensor

Below page displays the motion related activities in a specific office room. When intruder enters the office room and if its motion is detected by PIR sensor.

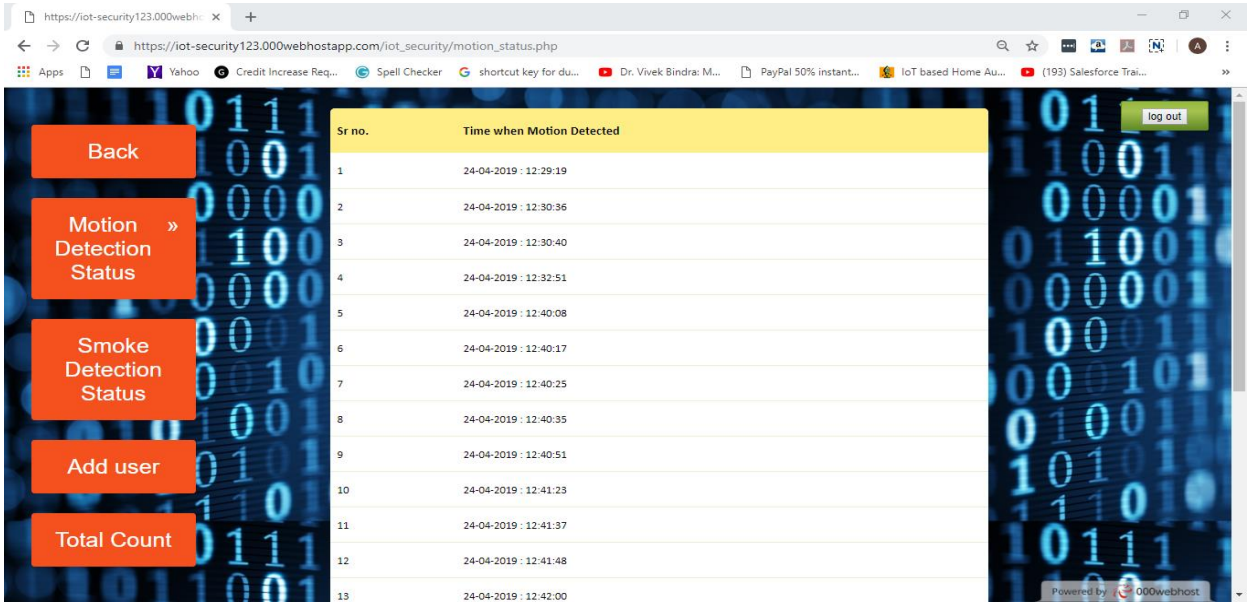


Figure: 4.1.4 Motion Detection Status

Below snap is of SMS alert. After detecting motion, a SMS alert is sent to the admin's phone.

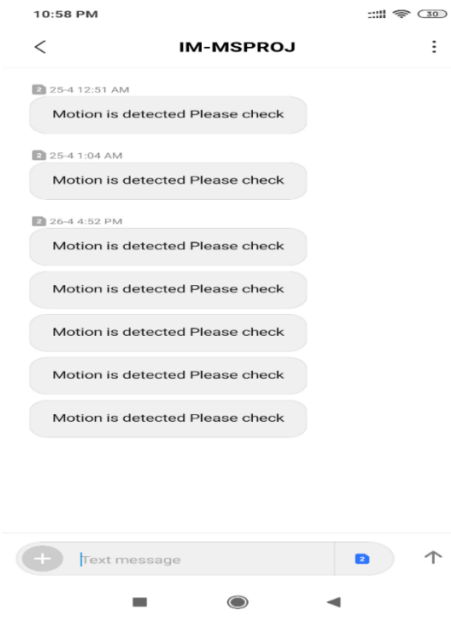


Figure: 4.1.5 SMS Alert of Motion Detection

4] Smoke Detection

The below snap is of smoke sensor which is connected to Arduino. If smoke sensor detects any the smoke LED light glows and its responds with alarm and SMS alert is sent.

Figure: 4.1.6 Smoke Sensor

When smoke Detector detects the smoke all the details regarding it like time and date all stored in admin database. Admin can view the details through the above webpage.

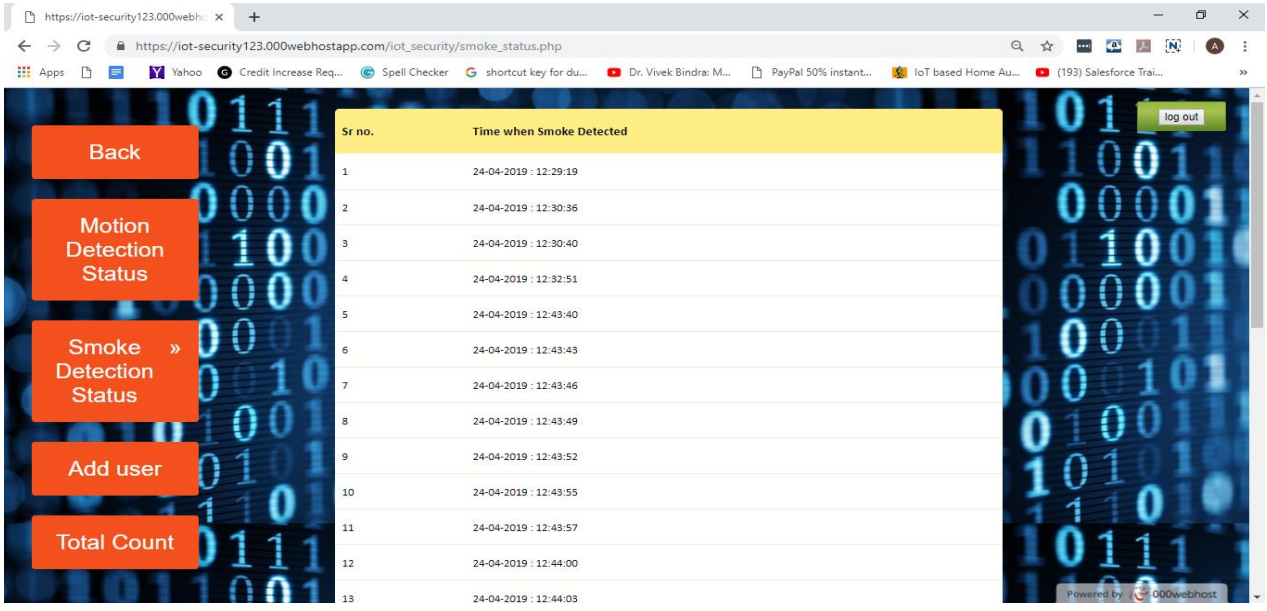


Figure: 4.1.7 Smoke Detection Status

Below snap is of SMS alert. After detecting motion, a SMS alert is sent to the admin's phone.

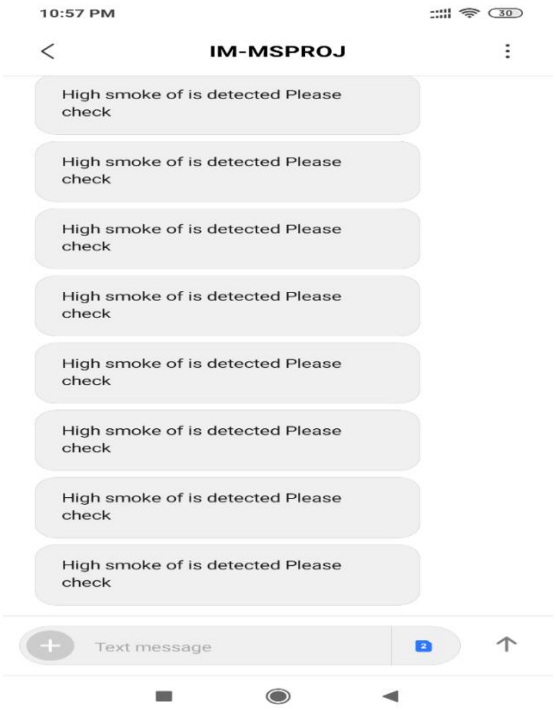


Figure: 4.1.8 SMS Alert of Smoke Detection

5] Biometric Detection

The below snap is of fingerprint sensor which is connected to Arduino and relay circuit. If employee scans his fingerprint and fingerprint sensor detects a valid fingerprint then the door is unlocked (relay circuit is set ON).

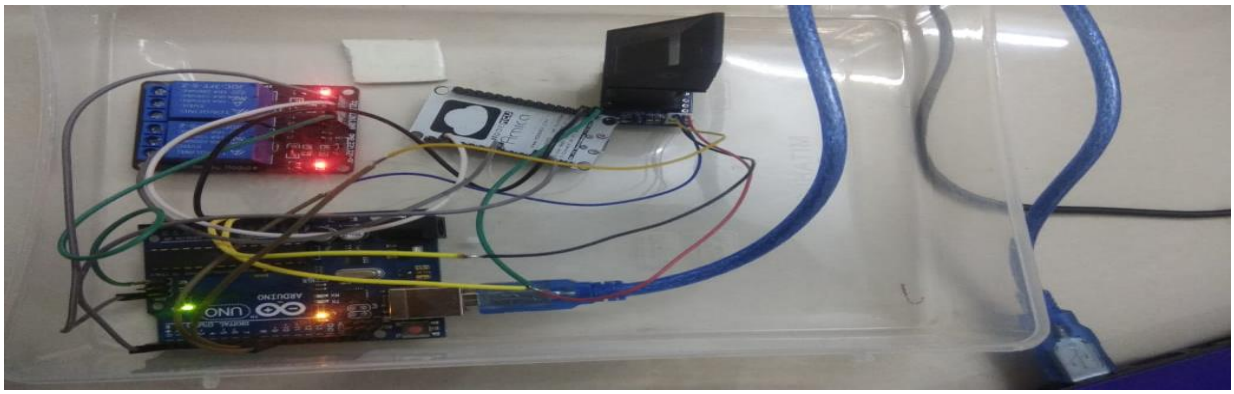


Figure: 4.1.9 IN Fingerprint Sensor

Below snap shows no. of employee present in the office. If the employee is present in the office the light and the fans are automatically turned on.

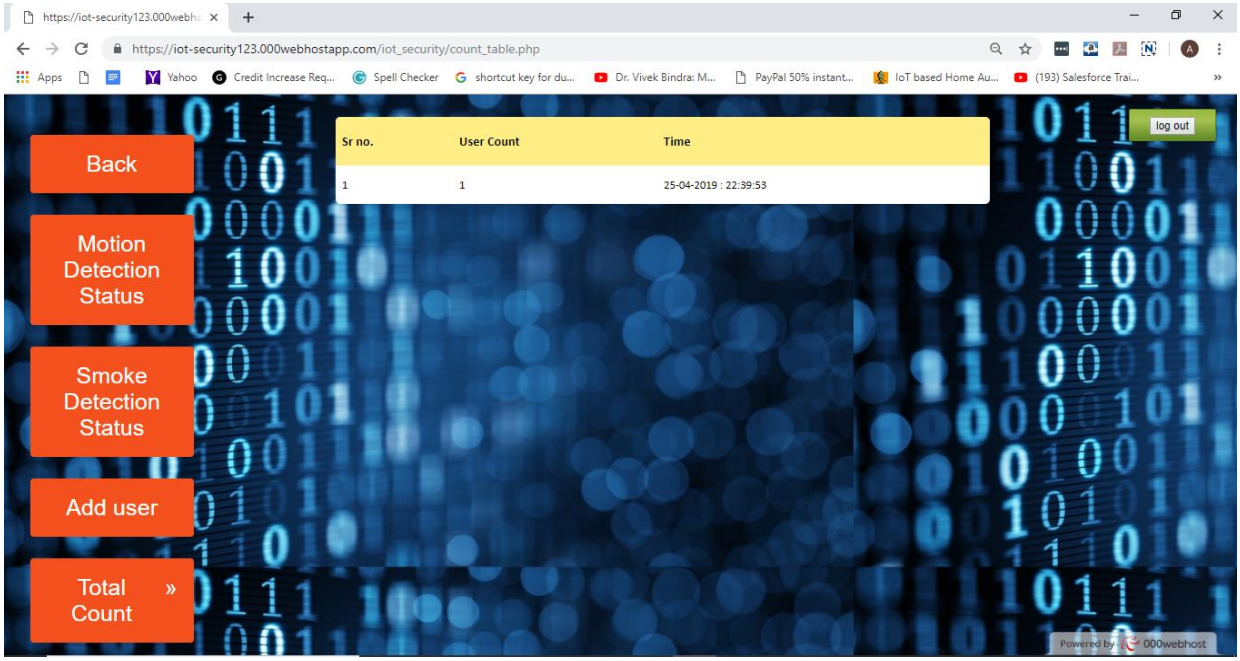


Figure: 4.1.10 Employee Count Status

If the employee wants to leave the office, he/she has to validate his/her fingerprint to unlock the door. If the user count is 0 then relay is set OFF.

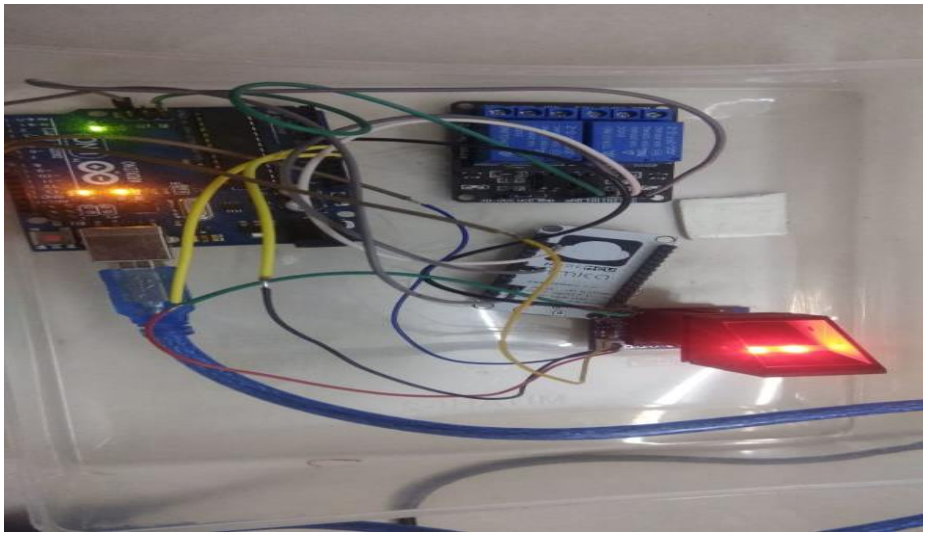


Figure: 4.1.11 OUT Fingerprint Sensor

Below snap show no of employee present in the office. If no employee is present in the office room then all the lights and fan are automatically turned off.

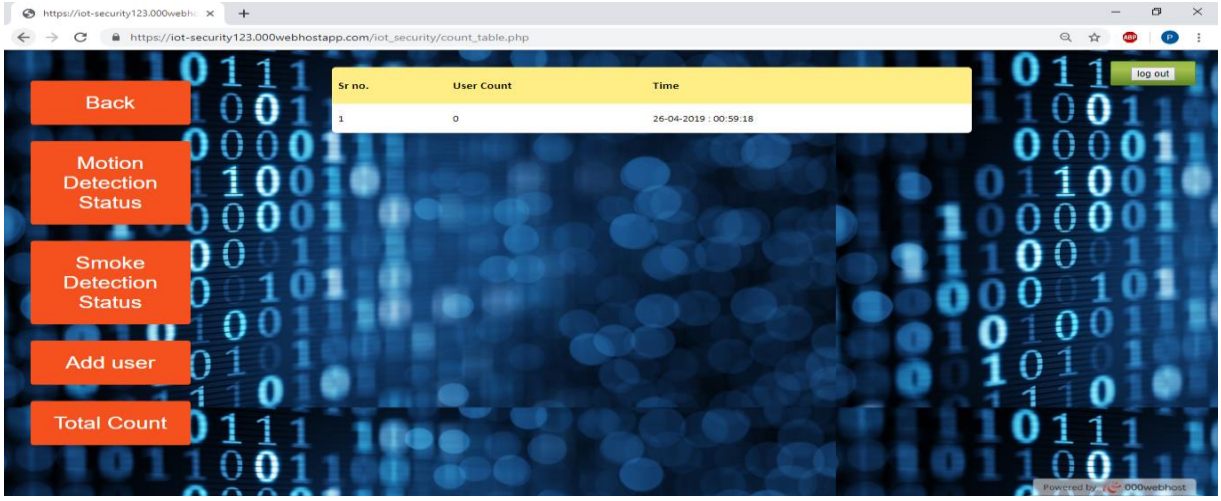


Figure: 4.1.12 Employee Count Status

6] Add Employee

If the admin wants to add new employee its database then admin has to click on add user button in the home page and then he will redirect to the add employee form where admin has to enter the details of the employee and after submitting all the details will be added to the database.

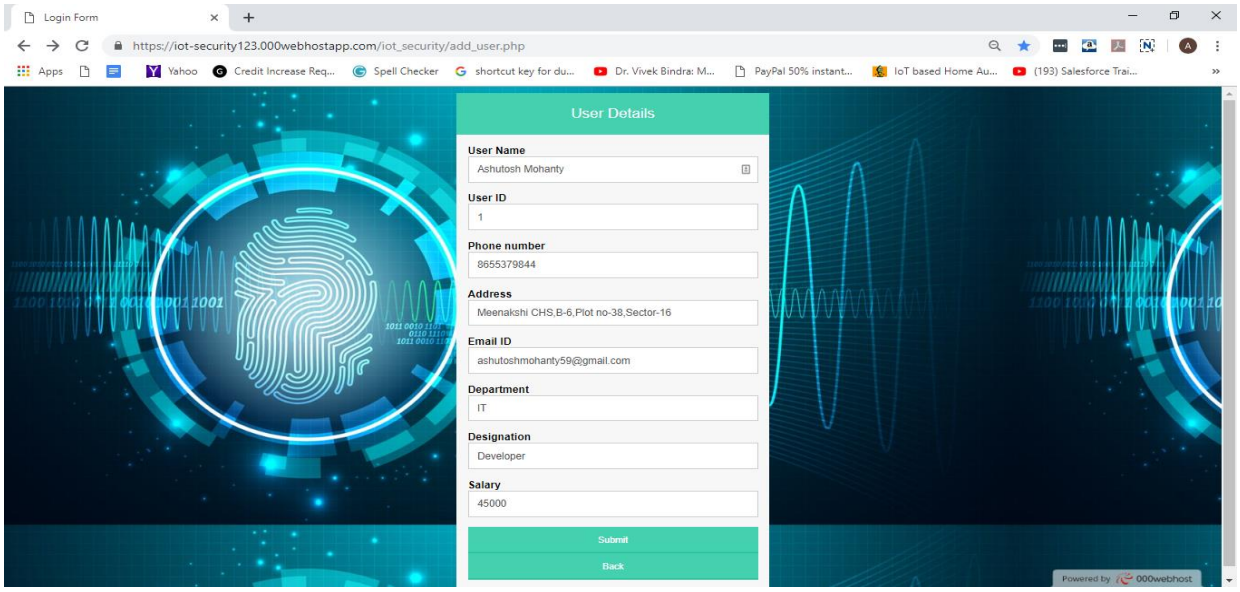


Figure: 4.1.13 Inserting New Employee

7] Face Detection

For face detection the first step is to record the face. Admin has to enter the name of the employee and the face recorder records the face of the employee and creates a dataset of the employee.

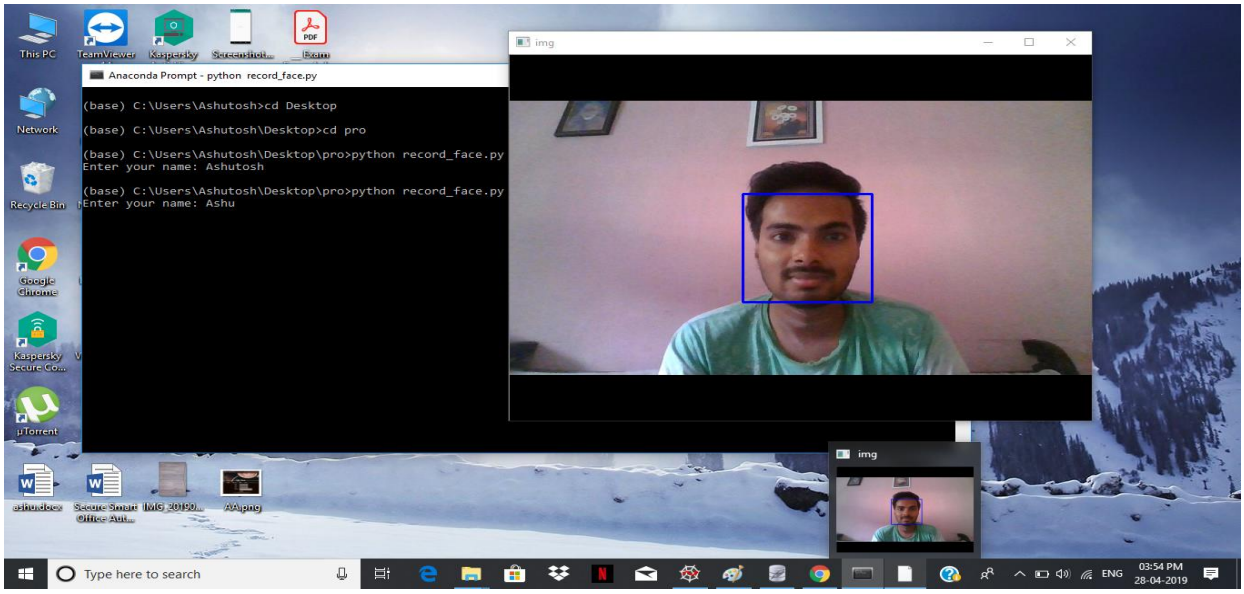


Figure: 4.1.14 Inserting New Faces

After the dataset is created, Image of the employee is trained so that camera can recognize the face of the employee.

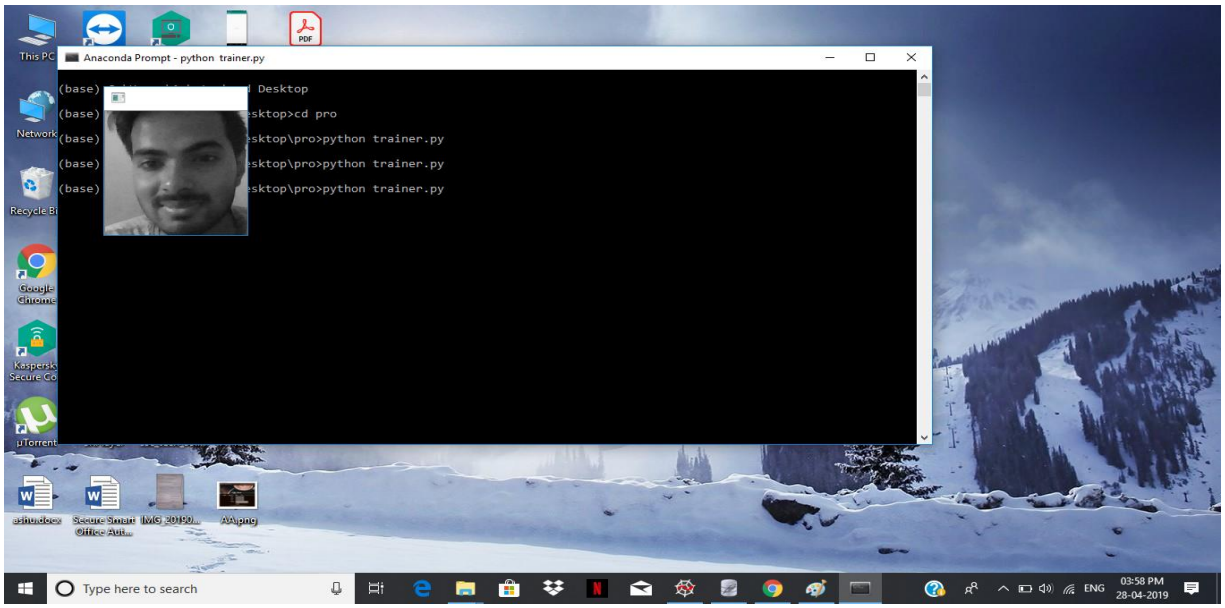


Figure: 4.1.15 Training Faces

After the image is been successfully trained. Camera can easily detect the face of the employee. Admin will be able to see the employee through camera along with his name.

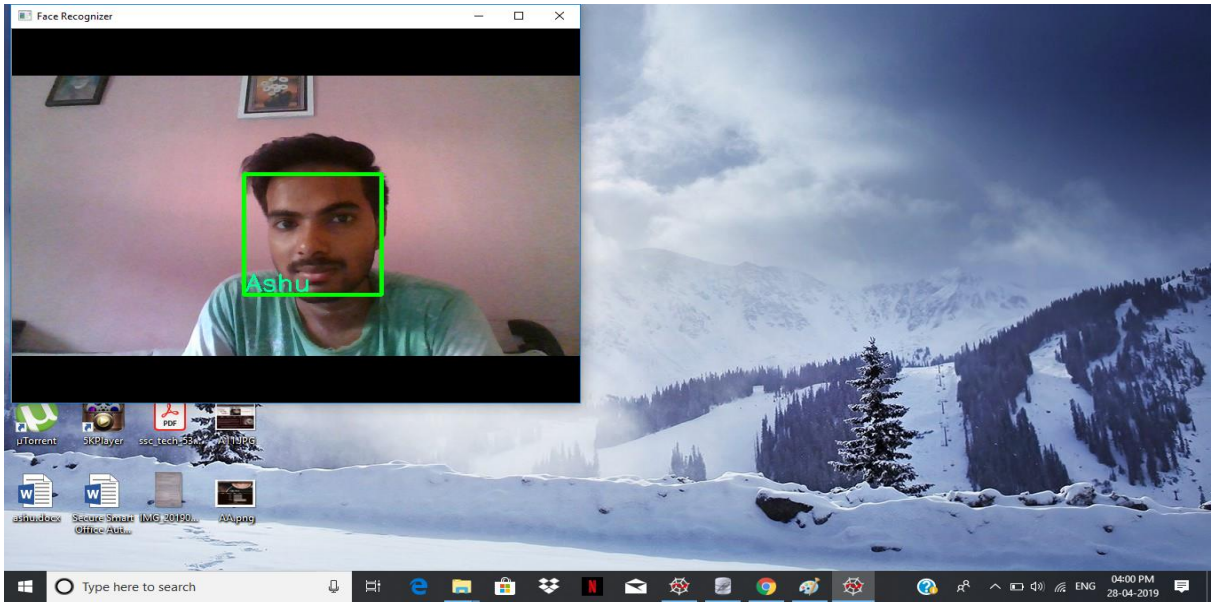


Figure: 4.1.16 Detecting Known Faces

If other than an employee or a person whose image is not trained enters the room camera can easily understand that some unknown person is trying to enter the room.

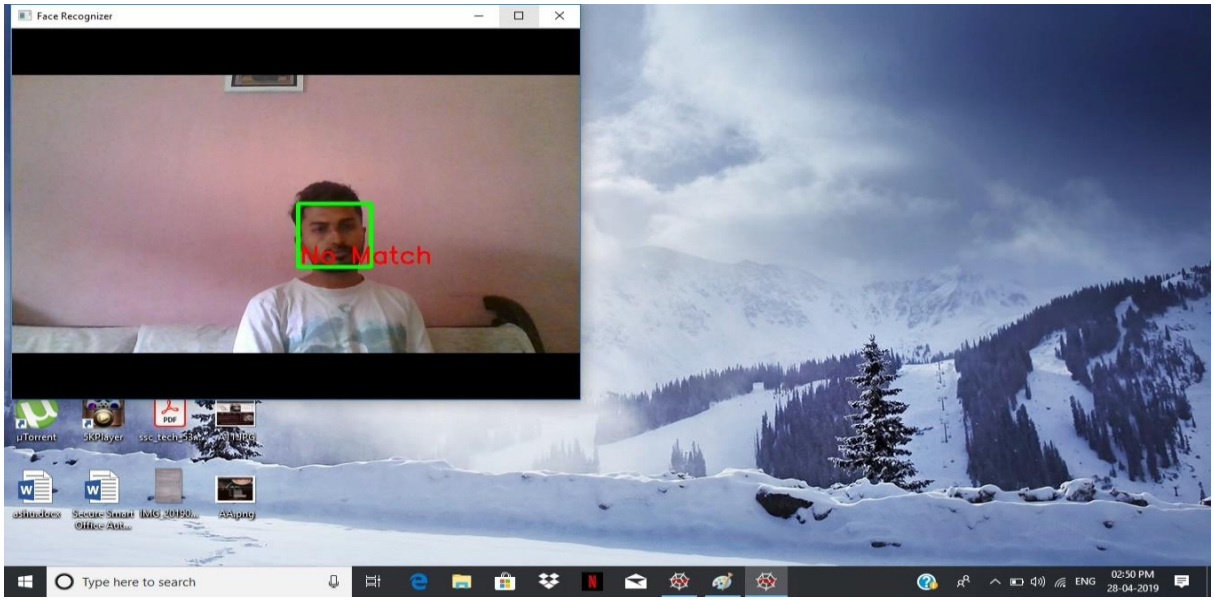


Figure: 4.1.17 Detecting Unknown Faces

If unknown person tries to enter the office room then camera captures the photo and sends email alert to the admin along with the captured photo. Due to this mechanism every movement of the intruder can be tracked by the admin.

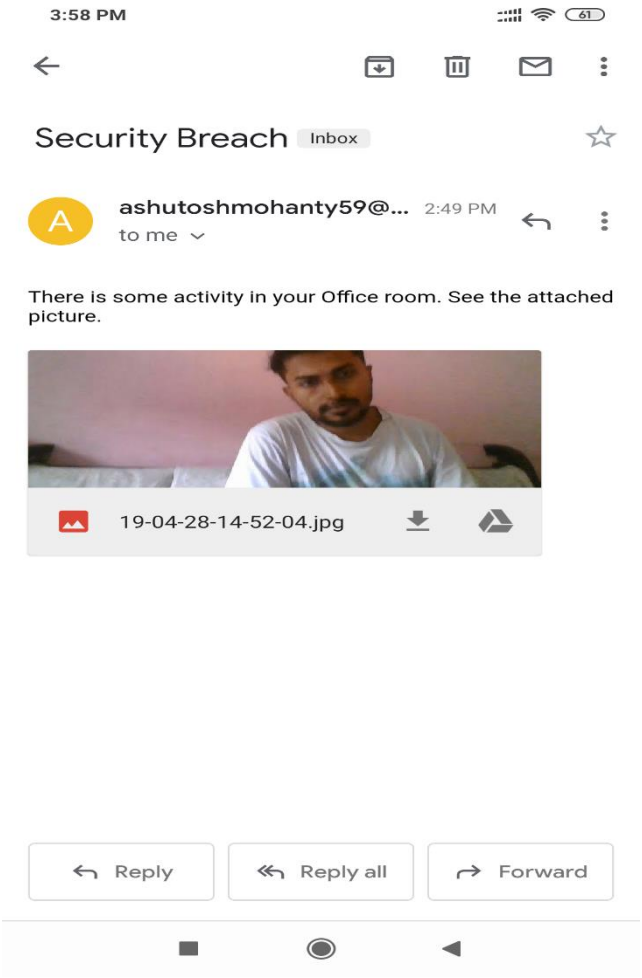


Figure: 4.1.18 Email Alert

4.2 Evaluation Parameters

4.2.1 Performance Metrics

Cost estimates are based upon prices at the time of estimating. Thus, whenever inflation rates become known, the estimates should be adjusted so as to provide a valid baseline from which to identify cost variances and take corrective action. Cost escalation also results from work inefficiency, poor management and planning, poor communication, lack of supervision, and weak control. Careful work planning, tracking and monitoring of activities and tight control improve efficiency and contain cost escalation. Hence it is essential to understand the cost variance for task assuming inflation due to different parameter in different stages of project. Following is the performance analysis conducted for our project.

Project Control Process

Project controls are all-encompassing for project definition, planning, execution, and completion; assisting in the entire lifecycle of your project. The Project Managers Institute (PMI) lists the project control process as part of the monitor and control process group. This group of work consists of the processes required to track and monitor the progress and performance of a project and identify any areas that require changes.

Table 3.4 Setting performance standards

Sr. No.	**Task**	**Resources**	**Start Date**	**Finish Date**	**Budget**
1	Information Gathering	IEEE Papers	1/8/2018	20/8/18	50
2	Performance Analysis	IEEE Papers	30/08/18	4/9/2018	100
3	Planning	IEEE Papers	9/9/2018	29/9/18	400
4	Design of Project	Software, Existing Model	1/10/2018	20/9/18	1900

5	Module 1	Sw/Hw	21/9/18	26/9/18	2300
6	Module 2	Sw/Hw	27/9/18	2/10/2018	2000
7	Module 3	Sw/Hw	3/10/2018	10/10/2018	2100
8	Testing	Software	19/10/18	29/10/18	4000
9	Implementation	Software, Hardware	30/10/18	30/1/19	2000
					Total
					14,850

Table 3.5: Comparing these standards with current performance

Sr. No.	**Task**	**Resources**	**Planned Start Date**	**Scheduled Finish Date**	**Planned Value (PV) Budget**
1	Information Gathering	IEEE Papers	1/8/2018	20/8/18	80
2	Performanc e Analysis	IEEE Papers	30/08/18	4/9/2018	100
3	Planning	IEEE Papers	9/9/2018	29/9/18	400
4	Design of Project	Hardware, Existing Model	1/10/2018	20/9/18	1900

5	Module 1	Sw/Hw	21/9/18	26/9/18	2300
6	Module 2	Sw/Hw	27/9/18	2/10/2018	2000
7					Total
					4980

4.3 Performance Analysis

The basic premise of earned value management (EVM) is that the value of a piece of work is equal to the amount of funds budgeted to complete it. As part of EVM, we use the Planned value (PV), Earned Value (EV), Actual cost (AC), Schedule Variance (SV) and Cost Variance (CV) information to assess our schedule and cost performance throughout our project

Table 3.6 Cost and Schedule analysis with earned value

Sr. No.	**Task**	**Resources**	**Planned Start Date**	**Scheduled Finish Date**	**Planned Budget (PV)**	**Actual Start Date**	**Scheduled Finish Date**	**Actual Value (AC) Budget**	**Earned Value (EV)**
1	Information Gathering	IEEE Papers	8/1/2018	20/8/18	80	1/8/2018	21/8/18	100	80
2	Performance Analysis	IEEE Papers	30/08/18	4/9/2018	100	30/08/18	6/9/2018	150	100
3	Planning	IEEE Papers	9/9/2018	29/9/18	400	9/9/2018	30/9/18	420	400

4	Design of Project	Software Existing Model	1/10/2018	20/9/18	1900	1/10/2018	21/9/18	2000	1900
5	Module 1	Sw/Hw	21/9/18	26/9/18	2300	21/9/18	26/9/18	2500	2300
6	Module 2	Sw/Hw	27/9/18	2/10/2018	2000	27/9/18	2/10/2018	2500	2000
7	Module 3	Sw/Hw	3/10/2018	10/10/2018	2100				0
8	Testing	Softwares	19/10/18	29/10/18	4000				0
9	Implementation	Softwares,Hardware	30/10/18	30/1/19	2000				0
					Total			**Total**	**Total**
					14,880			7,670	4,980

Calculated PV, AC, EV, CV, SV.

From Figure;

PV =Rs.14880

EV =Rs.4980

AC = Rs.7670

CV = EV-AC.

Rs.4980-Rs.7670 = -- Rs.2690

The project cost is over budget.

SV = EV-PV

Rs.4980-Rs.14880 = -- Rs.9900

The project is behind schedule

Chapter 5

Conclusion and Future Scope

5.1 Conclusion

Smart Office System has been one of the popular areas of automation and embedded electronics, over past several decades we have used various different techniques for generating alarm, security and automating the office devices. Smart Office System also has several other components like safety and security, many safety devices like fire alarm device is been proposed in the past. Most of the existing alarm systems are based on GSM and GPRS based techniques which are slow in latency as well as quite expensive as the messages and voicemail are not free, in this work we have proposed a novel architecture to offer safety, and automation of the office over IoT architecture.

The proposed system can alert the user in case office catches fire or in case there is an intruder at office, when he is absent. The system also allows the user to operate his office devices purely through his mobile. The entire control and notification system are based on IOT and SMTP communication protocol like Gmail are free sites and it can operate over the Wi-Fi data; this significantly reduces cost as GSM and GPRS are not been used over here.

5.2 Future Scope

In the system described in the above report the better result can be obtained by using IR night Vision Surveillance camera for obtaining better result when the room lights are off.

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