**Project Report**

# SMART VIDEO SURVEILLANCE SYSTEM USING IOT

***Submitted in partial fulfillment of the***

***requirement for the award of the degree of***

Bachelor of Technology in Computer Science and Engineering


**Under The Supervision of**
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**SCHOOL OF COMPUTING SCIENCE AND ENGINEERING**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**GALGOTIAS UNIVERSITY, GREATER NOIDA, INDIA**

**DECEMBER - 2021**

# SCHOOL OF COMPUTING SCIENCE AND ENGINEERING
# GALGOTIAS UNIVERSITY, GREATER NOIDA

## CANDIDATE'S DECLARATION

**I/We hereby certify that the work which is being presented in the project, entitled " Smart Video Surveillance System Using Iot " in partial fulfillment of the requirements for the award of the BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING**

submitted in the **School of Computing Science and Engineering** of Galgotias University, Greater Noida, is an original work carried out during the period of **JULY-2021 to DECEMBER-2021**, under the supervision of **Mr. Praveen Mishra, Assistant Professor**, **Department of Computer Science and Engineering** of School of Computing Science and Engineering , Galgotias University, Greater Noida

The matter presented in the project has not been submitted by me/us for the award of any other degree of this or any other places.

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19SCSE1010662 - PAWAN KUMAR PRADHAN

This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Supervisor

(Mr. Praveen Mishra, Assistant Professor)

## CERTIFICATE

The Final Thesis/Project/ Dissertation Viva-Voce examination of **19SCSE1010368 - SHARAD CHAND BIND, 19SCSE1010662 - PAWAN KUMAR PRADHAN** has been held on _and his/her work is recommended for the award of **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING**.


**Signature of Examiner(s)** **Signature of Supervisor(s)**

**Signature of Project Coordinator** **Signature of Dean**

Date:

Place:

## ABSTRACT

Smart video surveillance is a IOT-based application as it uses Internet for various purposes. The proposed system intimates about the presence of any person in the premises, also providing more security by recording the activity of that person. While leaving the premises, user activates the system by entering password. System working starts with detection of motion refining to human detection followed by counting human in the room and human presence also gets notified to neighbor by turning on alarm. In addition, notification about the same is send to user through SMS and e-mail.

The proposed system's hardware implementation is supported by Raspberry Pi and Arduino board; on the other hand, software is given by OpenCV (for video surveillance) and GSM module (for SMS alert and e-mail notification). Apart from security aspect, system is intelligent enough to optimize power consumption wastage if user forgets to switch off any electronic appliances by customizing coding with specific appliances.

Internet of Things offers user interoperability and connectivity between devices, systems, services, networks and in particularly control systems. This paper details the design and development of IoT based security surveillance system using Raspberry Pi Single Board Computer (SBC) with Wi-Fi network connectivity.
Traffic signal light can be optimized using vehicle flow statistics obtained by Smart Video Surveillance Software (SVSS). This research focuses on efficient traffic control system by detecting and counting the vehicle numbers at various times and locations. At present, one of the biggest problems in the main city in any country is the traffic jam during office hour and office break hour. Sometimes it can be seen that the traffic signal green light is still ON even though there is no vehicle coming.

Similarly, it is also observed that long queues of vehicles are waiting even though the road is empty due to traffic signal light selection without proper investigation on vehicle flow. This can be handled by adjusting the vehicle passing time implementing by our developed SVSS. A number of experiment results of vehicle flows are discussed in this research graphically in order to test the feasibility of the developed system. Finally, adoptive background model is proposed in SVSS in order to successfully detect target objects such as motor bike, car, bus, etc.



Keywords: Vehicle detection, Motion detection, Traffic density estimation, Traffic signal control.

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# CHAPTER-1

# Introduction

In the present world, situation security assumes a vital part. Numerous individuals utilize distinctive sorts of security system to keep their property from unapproved person's entry. Security system helps individuals to feel somewhat safe while they have to travel or avoid their home & vehicle detection for work. A large number of the security system works just inside a specific territory limit for instance, CCTV, as a person need to see camera footage from control room.

Nowadays, people want one sole thing that is to make them feel safe and secure. The most commonly used security system is the CCTV (closed circuit Television). The cost of implementation of CCTV varies depending upon the size and use of the system. It is usually installed in hospitals, malls, parking lots etc. However, with the help of CCTV one can monitor the area 24/7, or the footage if stored in a location can beretrieved when required. Although, it can be used to deter crime and allows the authorities to identify and solve a crime, it doesn't detect neither recognize the person who is involved.

We have implemented a system which provides both face detection and face recognition with the help of Raspberry pi 3 which is a credit card sized minicomputer and a Pi camera which is made especially for the raspberry pi 3. Thus, when dealing with the real-time image processing, Open source computer vision(openCV) software,a powerful library of image processing tools, is a good choice. With the help of a smart surveillance system, we have achieved a system that can record the event, detect and recognize the person. A GSM module is used to send a message stating whether the person is an intruder or a visitor. If it is a visitor, then a command is sent by the user to perform some operation like- open the door (any type of automation is implemented) however if it is a stranger an alarm is generated to indicate that there is an intruder.

## 1.2 Problem Statement

It is necessary to make use of automatic video analysis technologies for developing smart surveillance system which can aid the human operator in both detecting and reacting to potential threats. The internet and wireless broadband infrastructure is becoming robust enough to permit excellent remote video surveillance. With advances in hardware and software technology, and the emergence of ubiquitous internet infrastructure and wireless networks with broadband capability, it is now possible to design and build a networked video surveillance system that can do an excellent job of remote video supervision from anywhere and at any time. The requirements of a video surveillance system differs in important ways from CCTV, NVR's and DVR's. Smart Video Surveillance System(SVSS) provides video based object analysis capabilities.

The developed SVSS provides a wide range of features in order to solve the following problems in surveillance areas:

- Detecting objects.
- Face detection.

• Sending prompt messages in case of intruder.
• Internet Of Things(IOT)
• AI Assistant

## 1.3 System architecture of SVSS

Figure 1 shows the detail software design and system architecture of Smart Video Surveillance Software (SVSS). It highlights the relationship unit among different hardware and software components.

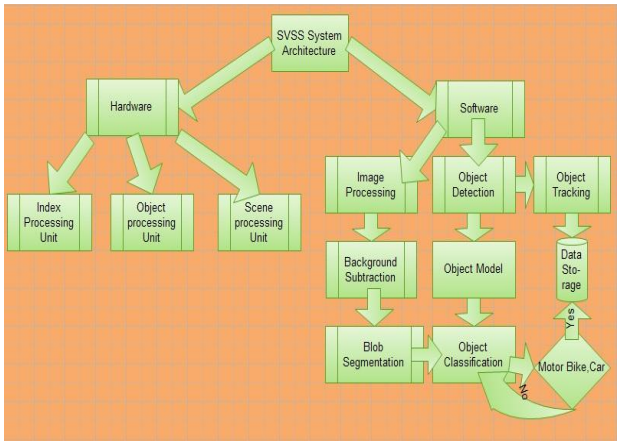



**Fig. 1. SVSS Software Architecture.**

### Hardware selection

The hardware components required for the SVSS is shown in Table 1.

**Table 1. Hardware Components of the SVSS.**

| S.No | Components | Description | Quantity |
|---|---|---|---|
| 1 | Outdoor Box Camera | 1/3" Sony Super HAD, 380TVL / 0lx / 3.6 mm / 22IR LEDs / 12VDC | 3 |
| 2 | Dome Camera | 1/3" Sony Super HAD | 1 |
| 3 | DVR Card | 4 Channel 3rd Party DVR Card | 1 |
| 4 | Cable | Lay coaxial cable | 50 ft |
| 5 | DVR | DVR card | 1 |
| 6 | Main Server | High Speed CPU | 1 |

- Micro-processor: Raspberry Pi 3
- SoC: Broadcom BCM2837
- CPU: 4 ARM Cortex-A53, 1.2GHz
- GPU: Broadcom VideoCore IV
- RAM: 1GB LPDDR2 (900 MHz)
- Networking: 10/100 Ethernet, 2.4GHz 802.11n wireless

- Bluetooth: Bluetooth 4.1 Classic, Bluetooth Low Energy
- Storage: microSD
- GPIO: 40-pin header, populated
- Ports: HDMI, 3.5mm analogue audio-video jack, 4 USB 2.0, Ethernet, CameraSerial Interface (CSI), Display Serial Interface (DSI)
- Camera: Raspberry Pi Camera Module
- Operating System: Raspbian

**Software selection**

The minimum software requirements for this project are:

- Windows XP
- Html
- Python Programming Language
- Css
- My Sql

**Software Requirements**

- Operating System: Linux
- Coding Language: Python
- Library: OpenCV

# Chapter 2
# Literature Survey/Project Design

## 2.1 Introduction

Literature survey is mainly carried out in order to analyze the background of the current project which helps to find out flaws in the existing system and guides on which unsolved problems we can work out. So, the following topics not only illustrate the background of the project but also uncover the problems and flaws which motivated to propose solutions and work on this project.

## 2.2 Literature Survey

Literature survey is the documentation of a comprehensive review of the published and unpublished work from secondary sources data in the areas of specific interest to the researcher. The library is a rich storage base for secondary data and researchers used to spend several weeks and sometimes months going through books, journals, newspapers, magazines, conference proceedings, doctoral dissertations, masters theses, government publications and financial reports to find information on their research topic. Reviewing the literature on the topic area at this time helps the research er to focus further interviews more meaningfully on certain aspects found to be important is the published studies even if these had not surfaced during the earlier questioning .So the literature survey is important for gathering the secondary data for the research which might be proved very helpful in the research. The literature survey can be conducted for several reasons.

Deep learning eliminates all the disadvantages of other techniques, deep learning does involve the task of developing a feature extractor.The convolutional neural network is the most effective and efficient way to classify images, CNNs can be trained on a large-scale database and then its learnings can be enhanced and used in other task with less amount of training data. The working of CNNs is inspired by the human brain, CNNs try to mimic the working of human brain using small units called perceptron which are analogous to neurons in human brain. The perceptron can accept input and produce an output, input is to the perceptron is associated with a weight and these weights can be changed.

### 2.2.1 Paper 1

SMART SURVEILLANCE CAMERA USING RASPBERRY PI 2 AND OPENCV

Context: Abstract Nowadays the need for a safe and secure system is desired by each and every individual in the society. The most commonly used system, Closed Circuit TeleVision (CCTV) is being implemented everywhere such as in hospitals, warehouses, parking lots, buildings etc.However this very system though effective has its downside when it comes to cost.

Thus the need for a cost effective system is required. The existing system for surveillance is a security camera with the night vision capabilities using raspberry pi and openCV. This is a cost effective method that uses a credit card sized chip RPI. The image is captured and each frame is processed. The image is stored and an email is sent if human is detected. The existing system has accuracy of about 83 %. In this project we propose to use an enhanced recent model- raspberry pi 2

which has operating speed 900MHz. Also we use a pi camera.

So the image is captured via the pi camera and it is send to the raspberry pi 2 for processing for face and human detection with the help of openCV. Then, the face detected is compared with the database, if the human detected is known (visitor) or not (stranger) and based on the output, an audio output is produced and a message is sent to the user. Thus, one can provide a low cost security system.

### 2.2.2 Paper 2

Low Cost Smart Security Camera with Night Vision Capability Using Raspberry Pi and PIR Sensor

Context: Abstract: In order to further maintain peace and provide security to people now a day, Closed-circuit television (CCTV) surveillance system is being utilized. This study focused on the design and implementation of a low cost smart security camera with night vision capability using Raspberry Pi (RPI) with PIR.

The system was designed to be used inside a warehouse facility. It has human detection and smoke detection capability that can provide precaution to potential crimes and potential fire. The credit card size Raspberry Pi (RPI) with A passive infrared sensor (PIR sensor) handles the moving body, control algorithms for the alarms and sends captured pictures to users email via Bluetooth.

As part of its alarm system, it will play the Espeech sounds: intruder when there is detection. The system uses ordinary webcam but its IR filter was removed in order to have night vision capability. With help of LDR it will sense whether it is night or day if it is night the led will on when it detect intruder.

### 2.2.3 Paper 3

Motion sensor and face recognition based surveillance system Using Raspberry Pi

Context: An intelligent surveillance system is a smart monitoring system which is developed from the security point of view. The objective of this project is to develop a system that monitors the area in which it is being implemented. An Intelligent surveillance system is applicable in the area where no one is permissible to enter, also where we need to detect if any motion has been done.

For this a digital camera is used. By combining the PIR sensor and camera we can use this system to detect the motion. The Camera is used to catch the live images of the area in which it is being implemented, if any object is moving. The captured images are stored in a particular folder. The stored images will be then useful to work on.

As the PIR sensor recognize the motion it uses local binary pattern histogram (LBPH) and matches his/her face with the data provided in the database. If the face is not matched with the database then he is unauthorised and the buzzer starts buzz ring including the message/mail services to the owners.

### 2.2.4 Paper 4

Object Detection on Raspberry Pi

Context: Object discovery and following are essential and testing undertakings in numerous PC v is ion applications , for example, reconnaissance, vehicle route and s elf-sufficient robot route. Question recognition includes finding objects in the casing of a video success ion. Each following strategy requires a question recognition component either in each edge or when the protest firs t shows up in the video.

For instance figuring the measure of a planet(astronomy), distinguishing disease in a mammographys can(medicine), abs taining from controlling into an obstacle(robotics ), and identifying a man's eye shading or hair color(security). The goal is to construct a model that can recognize the protest of indicated shading that make utilization of open source equipment and that chips away at the premise of visual information caught from an ordinary webcam which has a reasonable lucidity.

Having a picture preparing calculation which distinguishes a protest firs t and after that tracks it the length of it is in the observable pathway of the camera. As the protest moves , the PC/portable PC/implanted Board offers flag to engine to turn the camera which is mounted on a stepper engine. We executed the proposed calculation on Raspberry Pi board utilizing OpenCV on Linux foundation. It is a proficient protest following technique which take ca re of the following issues .

### 2.2.5 Paper 5

Smart Surveillance System using Raspberry Pi and Face Recognition

Context: Abstract: This paper proposes the Smart Surveillance System using Raspberry Pi and Image Processing. This system will serve as smart security module for monitoring. Traditional surveillance systems only records the activities based on motion, but this system serves the purpose of facial recognition so as to reduce the error caused due to motion detection .

Raspberry Pi camera module is used to capture images once the motion is detected by the PIR Sensor. This system will monitor when motion detected and checks for the faces in the image captured and with the help of face recognition alerts if the face detected is not stored in the database.

### 2.2.6 Paper 6

Survey Paper on Smart Surveillance System

Context: This paper deals with the survey of Smart surveillance monitoring system using Raspberry pi. Video Surveillance is important as far as security is concerned these days. Commercial spaces, schools and hospitals, warehouses and other challenging indoor and outdoor environments require high end cameras. The current technologies require RFIDs which are costly and hence the security domain in all becomes expensive and hence there was a need to work on this. This paper describes the use of low cost single on board computer Raspberry Pi.

This new technology is less expensive and in this project it is used as a standalone platform for image processing. It increases the usage of mobile technology to provide essential security to our homes and for other control applications. The proposed home security system captures information

and transmits it via a 3G Dongle to a Smart Phone using web application Raspberry pi.

### 2.2.7 Paper 7

Enhanced Home Security Using IOT and Raspberry PI

Context: A smart home application features great help to our everyday life. This system rejuvenates facilities of a house to evolve into a smart home by adding more security features. The improvement in security aspect offers innovative and productive scope to the means of living. All these characteristics is adapted by using Internet of Things (IoT) and Raspberry Pi. The recognition problem is always questionable in smart home applications. So, a recovery is done to identify the intruder as known or unknown by the use of image processing techniques for face recognition. This tend to solve many issues in terms of authentication.

This protection mechanism notifies the user accordingly, giving a clear picture of the scenario happening at the users house. The sensor based system highlights many features enabling it to be widely used. Fire sensor detects any temperature increase in the living room and posts its status in the URL given to the user. The gas sensor helps in detecting the presence of any gas leakage based on the intensity of the gas in air. With the help of DC motor, auto door locking mechanism is actuated.

This is very useful. All the statuses are processed between the sensors and the user via IoT. Raspberry Pi connects all the components and brings forth the proper functioning of the whole package. The procedures that are used here are very simple. Hence, even novice users could understand the systems advanced features and use it with ease. The use of surveillance camera also helps in identifying the presence of flame and thus a buzzer is activated in the case of fire detection.

### 2.2.8 Paper 8

Real Time Face Detection and Tracking Using OpenCV

Context: In this paper, we intend to Implement a real-time Face detection and tracking the head poses position from high definition video using Haar Classifier through Raspberry Pi BCM2835 CPU processor which is a combination of SoC with GPU based Architecture.

SimpleCV and OpenCV libraries are used for face detection and tracking the head poses position. The experimental result computed by using computer vision SimpleCV and OpenCV framework libraries along with above mentioned hardware results were obtained through of 30 fps under 1080p resolutions for higher accuracy and speediness for face dete ction and tracking the head poses position.

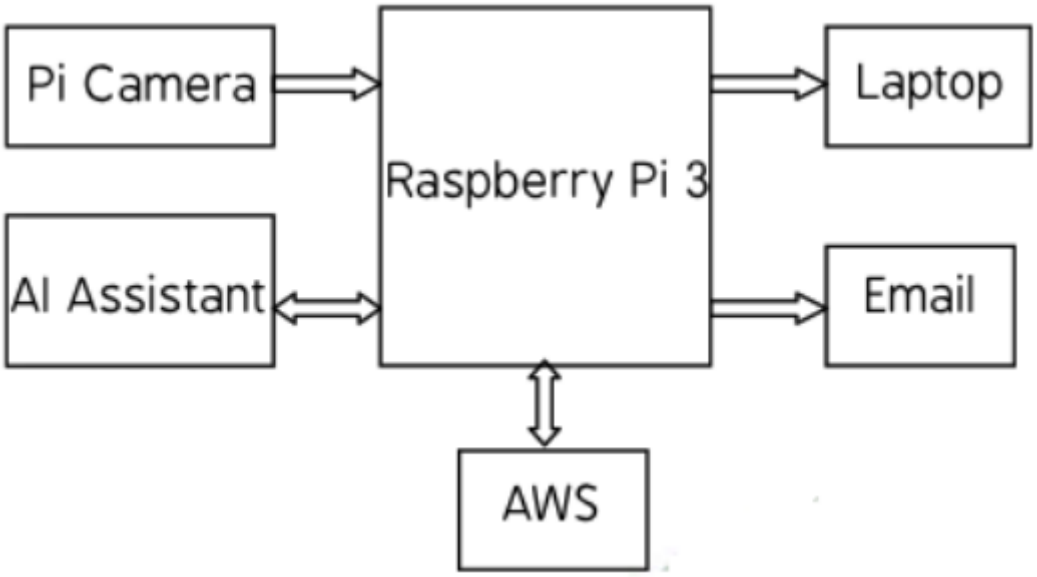
# Chapter 3
# Functionality/Working of Project

The implementation phase of the project is where the detailed design is actually transformed into working code. Aim of the phase is to translate the design into a best possible solution in a suitable programming language. This chapter covers the implementation aspects of the project, giving details of the programming language and development environment used. It also gives an overview of the core modules of the project with their step by step flow. The implementation stage requires the following tasks:

- Careful planning.
- Investigation of system and constraints.
- Design of methods to achieve the changeover.
- Evaluation of the changeover method.
- Correct decisions regarding selection of the platform.
- Appropriate selection of the language for application development.

**Block Diagram**

The block diagram of the paper is quite simple which has a few basic components but it is quite efficient in producing the result as required.




The input is the pi camera, which is used to capture the image and the captured image is sent to the processor which checks for the faces. If any faces are detected then it is further processed to check if the face is familiar or not. Finally the output is produced.

## Working Principle

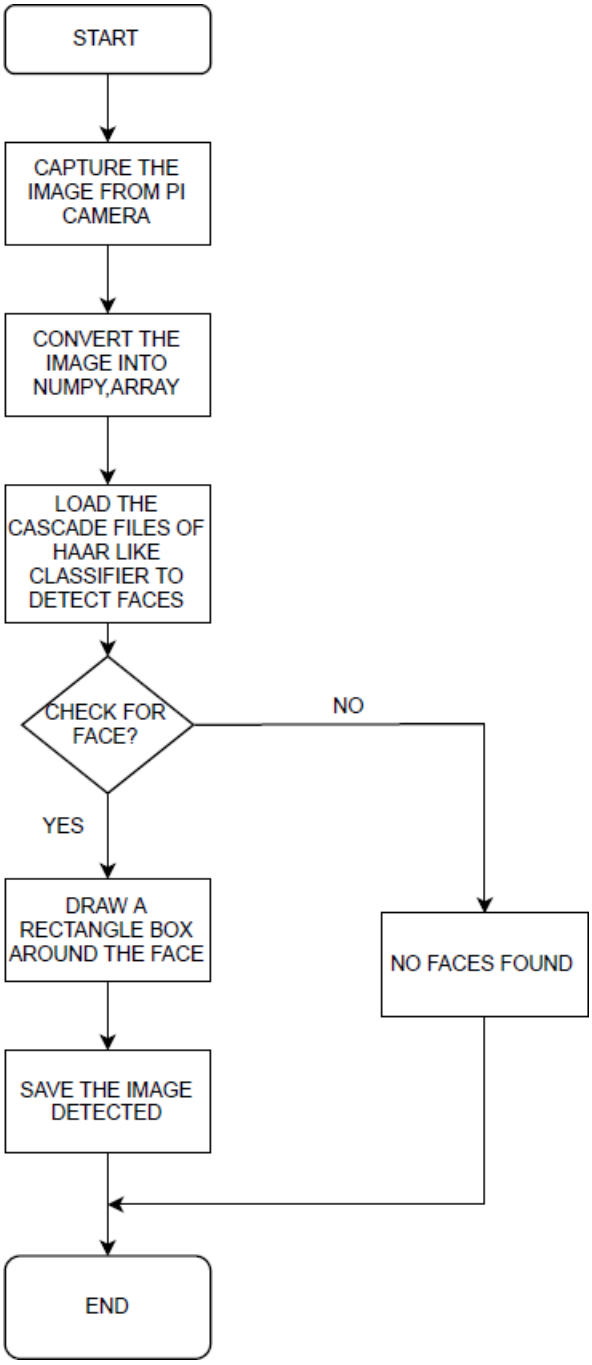
The overall working of the camera can be explained with the help of a flowchart. The image is captured by the picamera which has 5MP pixel resolution with 30 FPS, this image is then sent to the face detection module, which checks the frame obtained for any faces that can be found with the help of the Haar like features, if the face is detected then it is cropped out.

Once the face is compared with the well trained database, it is checked if the face is recognized. If the image matches with the database, then the person is a visitor and a message is sent to the user via a GSM module indicating that someone who is known has come home. However, if the face doesn't match with the database, then the person is identified as a stranger, and SMS is sent alerting the user, and an audio output is produced to warn and alarm the intruder.

## Face Detection

We are providing a secure system, whose in ut I,0captured from the pi camera is sent to processor for face detection. The algorithm used for face detection is Haar like feature cascade classifier. Haar-like features are digital image features used in object recognition. They owe their name to their intuitive similarity with Haar wavelets and were used in the first real-time face detector.[2] Viola and Jones adapted the idea of using Haar wavelets and developed the so-called Haar-like features. A Haar-like feature considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region and calculates the difference between these sums. This difference is then used to categorize sub-sections of an image.

Therefore a common haar feature for face detection is a set of two adjacent rectangles that lie above the eye and the cheek region. The position of these rectangles is defined relative to a detection window that acts like a bounding box to the target face. The captured image is first converted into the numpy which is a multidimensional array supported by the openCV. Now this image is converted to gray scale, with the help of the loaded haar cascade file from the openCV documentation, the feature is




compared with the image, if any face is found based upon the haar like feature, [3]a rectangle box is drawn to indicatethat a face is detected.

**Code:**

```
import smtplib
from email.mime.Multipart import MIMEMultipart
from email.mime.Text import MIMEText
from email.mime.Image import MIMEImage

# Email you want to send the update
fromEmail = '@gmail.com'

fromEmailPassword = ''

# Email you want to send the update to
toEmail = '@gmail.com'

def sendEmail(image):
    msgRoot = MIMEMultipart('related')
    msgRoot['Subject'] = 'Security Update'
    msgRoot['From'] = fromEmail
    msgRoot['To'] = toEmail
    msgRoot.preamble = 'Raspberry pi security camera update'

    msgAlternative = MIMEMultipart('alternative')
    msgRoot.attach(msgAlternative)
    msgText = MIMEText('Smart security cam found object')
    msgAlternative.attach(msgText)

    msgText = MIMEText('<img src="cid:image1">', 'html')
    msgAlternative.attach(msgText)

    msgImage = MIMEImage(image)
    msgImage.add_header('Content-ID', '<image1>')
    msgRoot.attach(msgImage)

    smtp = smtplib.SMTP('smtp.gmail.com', 587)
    smtp.starttls()
    smtp.login(fromEmail, fromEmailPassword)
    smtp.sendmail(fromEmail, toEmail, msgRoot.as_string())
    smtp.quit()
```

```python
import cv2
import sys
from mail import sendEmail
from flask import Flask, render_template, Response
from camera import VideoCamera
import time
import threading

email_update_interval = 600
video_camera = VideoCamera(flip=True)
object_classifier = cv2.CascadeClassifier("models/fullbody_recognition_model.xml")

app = Flask(__name__)
last_epoch = 0

def check_for_objects():
    global last_epoch
    while True:
        try:
            frame, found_obj = video_camera.get_object(object_classifier)
            if found_obj and (time.time() - last_epoch) > email_update_interval:
                last_epoch = time.time()
                print ("Sending email...")
                sendEmail(frame)
                print ("done!")
        except:
            print ("Error sending email: ", sys.exc_info()[0])
@app.route('/')
def index():
    return render_template('index.html')

def gen(camera):
    while True:
        frame = camera.get_frame()
        yield (b'--frame\r\n'
               b'Content-Type: image/jpeg\r\n\r\n' + frame + b'\r\n\r\n')
@app.route('/video_feed')
def video_feed():
    return Response(gen(video_camera),
                    mimetype='multipart/x-mixed-replace; boundary=frame')
if __name__ == '__main__':
    t = threading.Thread(target=check_for_objects, args=())
    t.daemon = True
    t.start()
    app.run(host='0.0.0.0', debug=False)
```

```python
import cv2
from imutils.video.pivideostream import PiVideoStream
import imutils
import time
import numpy as np

class VideoCamera(object):
    def __init__(self, flip = False):
        self.vs = PiVideoStream().start()
        self.flip = flip
        time.sleep(2.0)

    def __del__(self):
        self.vs.stop()

    def flip_if_needed(self, frame):
        if self.flip:
            return np.flip(frame, 0)
        return frame

    def get_frame(self):
        frame = self.flip_if_needed(self.vs.read())
        ret, jpeg = cv2.imencode('.jpg', frame)
        return jpeg.tobytes()

    def get_object(self, classifier):
        found_objects = False
        frame = self.flip_if_needed(self.vs.read()).copy()
        gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
        objects = classifier.detectMultiScale(
            gray,
            scaleFactor=1.1,
            minNeighbors=5,
            minSize=(30, 30),
            flags=cv2.CASCADE_SCALE_IMAGE
        )

        if len(objects) > 0:
            found_objects = True
        # Draw a rectangle around the objects
        for (x, y, w, h) in objects:
            cv2.rectangle(frame, (x, y), (x + w, y + h), (0, 255, 0), 2)

        ret, jpeg = cv2.imencode('.jpg', frame)
        return (jpeg.tobytes(), found_objects)
```

```python
import boto3
import os
import time

access_key = "AKIAIFZWHWUW6WNJ7U4A"
access_secret = "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"
region ="us-east-1"
queue_url = "https://sqs.us-east-1.amazonaws.com/227679985855/CameraQueue"

def pop_message(client, url):
    response = client.receive_message(QueueUrl = url, MaxNumberOfMessages = 10)

    #last message posted becomes messages
    message = response['Messages'][0]['Body']
    receipt = response['Messages'][0]['ReceiptHandle']
    client.delete_message(QueueUrl = url, ReceiptHandle = receipt)
    return message

client = boto3.client('sqs', aws_access_key_id = access_key,
    aws_secret_access_key = access_secret, region_name = region)

waittime = 20
client.set_queue_attributes(QueueUrl = queue_url, Attributes =
    {'ReceiveMessageWaitTimeSeconds': str(waittime)})

time_start = time.time()
while (time.time() - time_start < 60):
        print("Checking...")
        try:
                message = pop_message(client, queue_url)
                print(message)
                if message == "on":
                        #os.system("~/cameraon.sh")
                        print("Camera On")
                elif message == "off":
                        #os.system("~/cameraoff.sh")
                        print("Camera Off")
        except:
                pass
```

# Chapter 4
# Results and Discussion

## Test Case 1

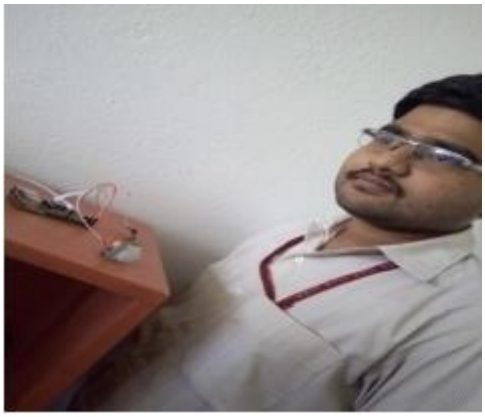
Function: def sendmail(image)
Purpose: Send mail to the user
Preconditions: The object should be detected first
Inputs: Face detected
Expected Output: Send mail to the user
Postconditions: Mail sent successfully

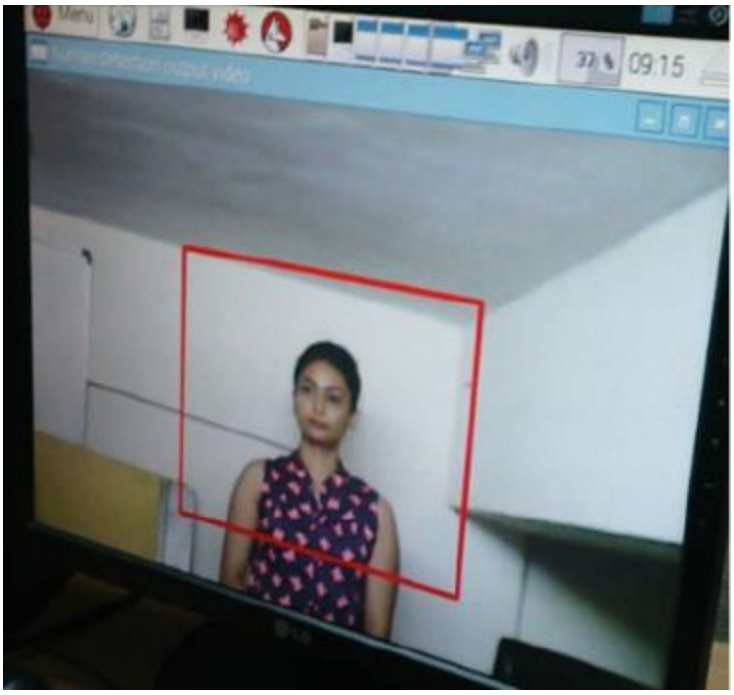
## Test Case 2

Function: def checkforobject()
Purpose: Face detection
Preconditions: Camera should be turned on
Inputs: Image Feed
Expected Output: Detect Image
Postconditions: Image Detected successful

## Results

The smart surveillance camera is very effective in a way that it provides security by reducing the alarming raise of crime at home. The Face of the human being is detected easily with the help of the implemented algorithm a Haar classifier. like cascade.




09:15

# Chapter 5
# Conclusion and Future Scope

## Conclusion

Thus, we have developed a smart surveillance camera that can be started using alexa and is capable of providing face detection a. Also the camera system is compact and can be implemented with low cost. The implemented face detection algorithm (Haar like cascade classifier) is very effective, with an accuracy of 88.9 percent which can be increased further by effectively improving the illumination of the area. However, this system is connected with the help of a Ethernet cable to the laptop to communicate with the raspberry pi. This can be overcome by making the system wireless.

## Future Scope

This system has a wide range of uses in various fields, such as banking, forensic department, etc The reason this system is quiet useful is due to the fact that it is highly compact and it provides face detection and an instant notification about the same through email. In addition to this face recognition can also be tried in future. Recognition is the main part of any security system. Usually for a best recognition system, we require a well-trained database, which can provide the base for our recognition. So to obtain the database, first collect the images of the subject individual for the recognition. Once we obtain and train our system, we can provide face recognition.

We use the local binary pattern histogram (LBPH) for providing face recognition. This method helps us to provide a recognition model. The image is converted into a gray scale image. Then, the image pixels are compared with the neighboring pixels in a clock-wise or anti-clock-wise manner. Histogram is performed and normalization is done and a feature vector is generated for every image. These feature vectors can now be processed with some algorithms

to classify images which is used to identify the texture. Once the face is recognized, it is checked to see if the detected face is familiar or not. Thus we integrate the face detection and recognition to provide a smart surveillance system for the domestic purposes in our everyday life.

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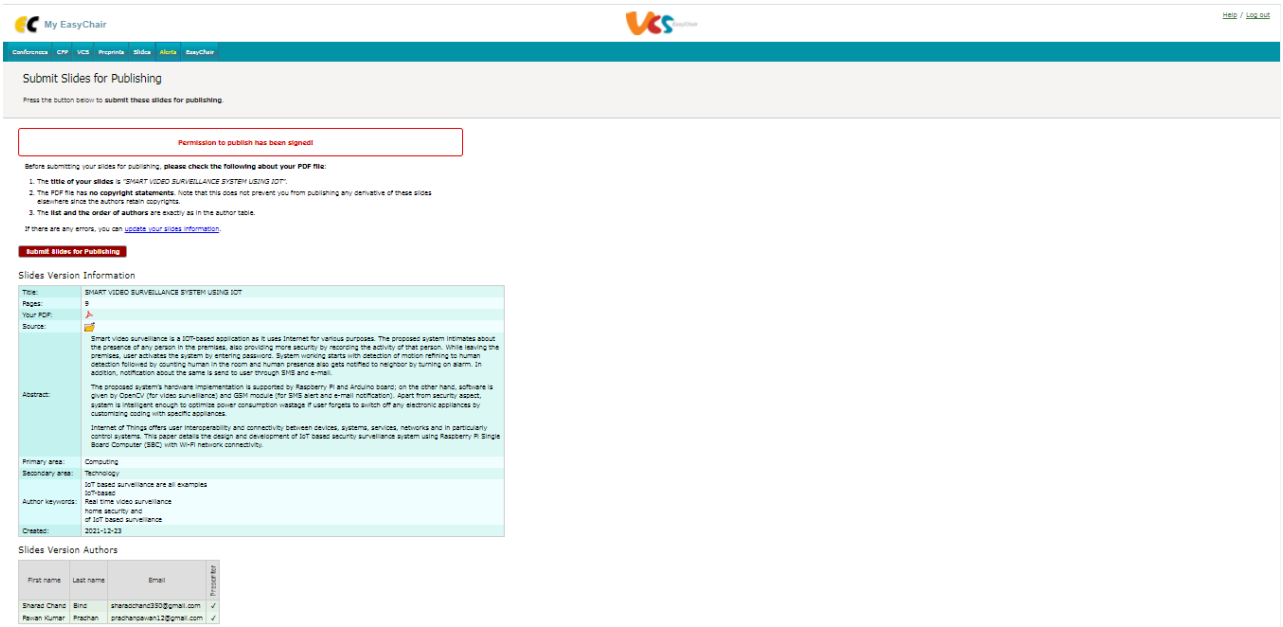

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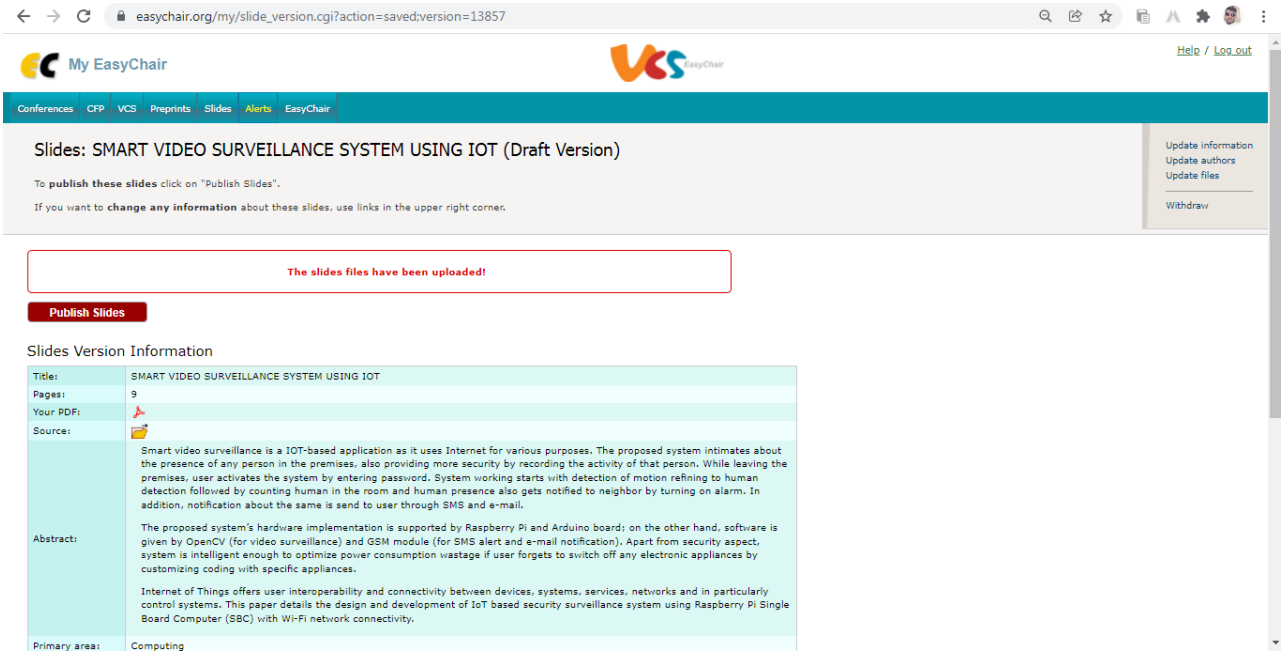


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