INTRUDER DETECTION SYSTEM

Mini Project-1B Report

Submitted in partial fulfillment of the requirements for the degree of

Bachelor of Engineering (Computer Engineering)

by:

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Under the Guidance of

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TERNA ENGINEERING COLLEGE

Nerul (W), Navi Mumbai 400706

(University of Mumbai)

(2021-2022)

Internal Approval Sheet

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Knowledge to Empower

TERNA ENGINEERING COLLEGE, NERUL

Department of Computer Engineering

Academic Year 2020-21

CERTIFICATE

This is to certify that the major project entitled **“INTRUDER DETECTION SYSTEM”** is a bonafide work of

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submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the Bachelor of Engineering (Computer Engineering).

Guide **Head of Department** **Principal**

Approval Sheet

Project Report Approval

This Major Project Report – an entitled "**INTRUDER DETECTION SYSTEM**" by following students is approved for the partial fulfillment of degree of ***B.E. in "Computer Engineering"***.

Submitted by:

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Examiners Name & Signature:

1.____________________________________-

2.____________________________________

Date: ______________________

Place: ______________________

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Date: ______________________

Place: _______________________

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Abstract

Among the various aspects of life, security is one of the lesser talked about topics while having a much more significant impact on day to day existence of people and their well being. As per the national crime statistics there has been a huge increase in the growth rate of crimes like robbery,thieving, murders etc. and this creates a very bad environment as people have to live in fear. Hence, the problem with home security in the modern world is a cause for concern. In such a scenario there is no possible way of practically ensuring security for everyone unless people take responsibility of securing themselves.

The conventional intruder detection system were using are highly expensive and sometimes there can be a possibility of false alarms. The major flaw with this kind of arrangement is that it demands the 24/7 availability of a house owner or member, or manual video surveillance, which is almost impossible. In addition, it is a tedious task to go through all the recorded video clips after a possible theft has become known. It might be that storage server contains a large amount of family footage, which is of no use in identifying trespassers.

In the current day and age this task has now been made much more easy and effective by using the growing range of integrated electronics, programming tools and frameworks. This approach will also be cost efficient.

This particular project explores one of the many approaches towards creating a security system. The proposed research methodology aims to design a generally implementable framework for providing a house owner with the immediate notification of an ongoing theft.

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1. Introduction

1.1 A Brief Introduction

In the modern era, security and surveillance are important issues. Recent acts of theft have highlighted the urgent need for efficient video surveillance and on-the-spot notification of ongoing thefts to house owners.

A number of surveillance solutions are currently available on the market for the populace, such as CCTV cameras and digital video recorders (DVRs) that
can record the unauthorized activities of a trespasser, however they demand excessive amounts of investment in terms of funds and time and cannot distinguish between human and non-human objects.

Also the commonly available systems are often targeted towards medium sized franchises and are out of reach of common people. The task of face detection and the recognition of an intruder become very difficult when the intruder hides their face partially or fully using some type of material such as fabric.

The fundamental idea was to design a cost-effective and efficient system for an individual to be able to detect any kind of theft in real-time and provide instant notification of the theft to the house owner.

Hence in this project we use some very common yet effective python libraries for processing video feeds and detecting the presence of a person and then interacting with the operating system for sending out alerts and images. The main objective of the software is to detect and report unsupervised human activity using large data handling techniques as close to real-time as possible.

1.2 Aim and Objective

In the elementary system proposed here the following objectives would be the the guidelines directing the progress of this project.

1. The system must be easy to implement,tangible and flexible in approach so that it can be easily deployed from the average hardware used by users.
2. The system must not require extensive development process involving professional software engineering teams.
3. The system must be able to send useful data to the user so that a proper decision can be taken swiftly.
4. The system must be able to seamlessly work with common email domains such as gmail.com,yahoo.com and also be able to send alerts to mobile phone as and when required.

1.3 Scope of project

The proposed system would be functional to the following extends-

- The system would be able to use inbuilt video cameras as a source of video feed.
- The system would then be able to synchronize itself with the email servers.
- The system would also be able to send alerts to a mobile app.
- The system can be programmed to give an audible alarm if needed.
- The system would be able to recognise the presence of a person by analysing the video feed.
- The system could be manually shutdown in a safe way while letting the owner know.
- The system would not need excessive storage space.

2. Literature Survey

The topic of electronic security systems has been a long standing topic and there is a wealth of information and research available regarding this, Hence in the following section we would take an overview of some available systems and break down their technicalities and analyse their features and shortcomings if any.

Authors **Kalathiripi et al.(2019) [2]** described a comprehensive security system which made use of 2 cameras for facial recognition and also a sonar based object detection module which allowed the system to accurately detect presence of people. This system also used a facial recognition for classifying the person detected as intruder or not by comparing the facial data with that stored on a server.

Authors **M.H.Assaf et al.(2012) [1]** in their paper describe a field programmable logic array based system which covers the entire apartment of the user and detects the exact room where intrusion has been detected. The system then goes onto alerting the user using email and web based interfaces. This system has multiple redundancies implemented which it uses in case of exceptional occurrences like power failure or even partial system failure. There is also a future scope of configuring this system to monitor the house in real time and also making it interface with other appliances.

Authors **Azlan Abu et al.(2018) [3]** have worked upon a particular aspect of a home security system I,e. they have worked upon motion detection by using a passive IR sensor coupled with an Arduino module.This arrangement in particular can be implemented to monitor door status in a house. They have also made use of the favouriot platform which is used for collecting sensor data from various sensors in an IOT project and then view and work with the data through internet.

3. Proposed System

In order to achieve the motion recognition and alert sending capabilities expected of this project, the following system is proposed.

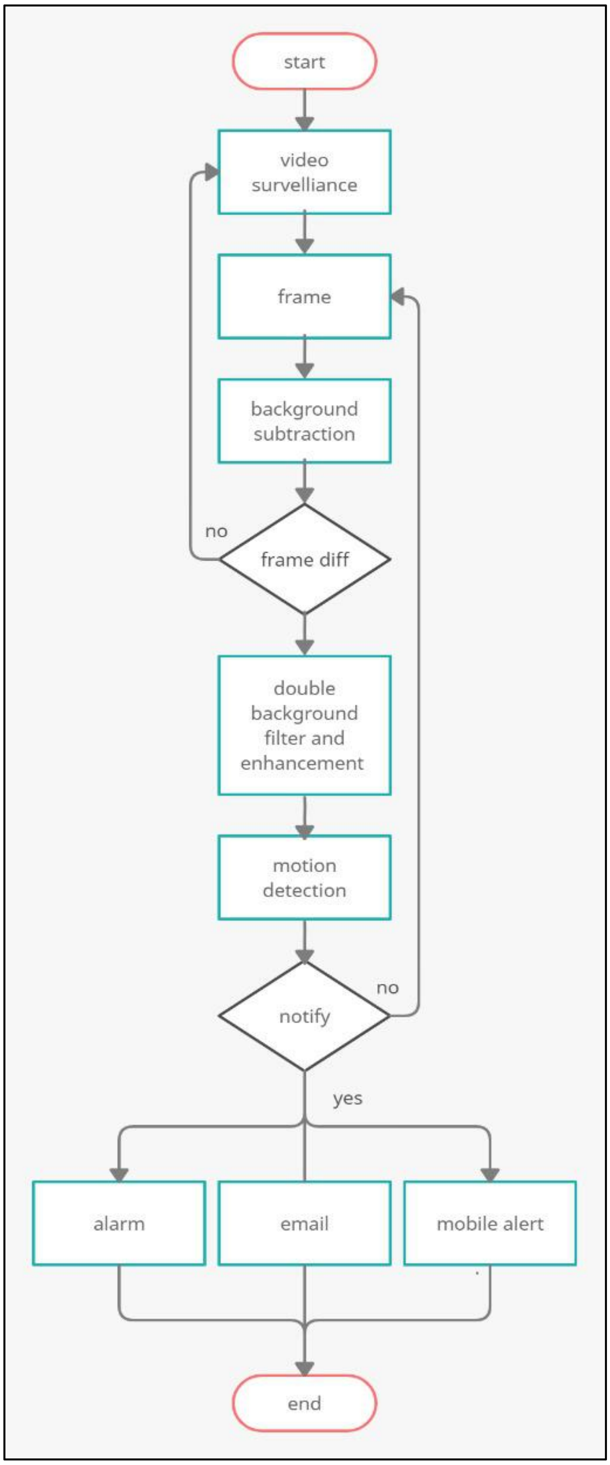


Figure 3.1- Proposed system

First the internal system camera is used for capturing two consecutive frames. The captured frames are then compared with each other in order to find difference within them. The difference detected within the images are converted to monochrome to increase accuracy of the system. Further Gaussian blur is applied on the difference between the two frames to reduce noise in the image. Once Gaussian blurring is applied, dilation to the image is applied for enlarging the white region of the image and getting smooth contours.

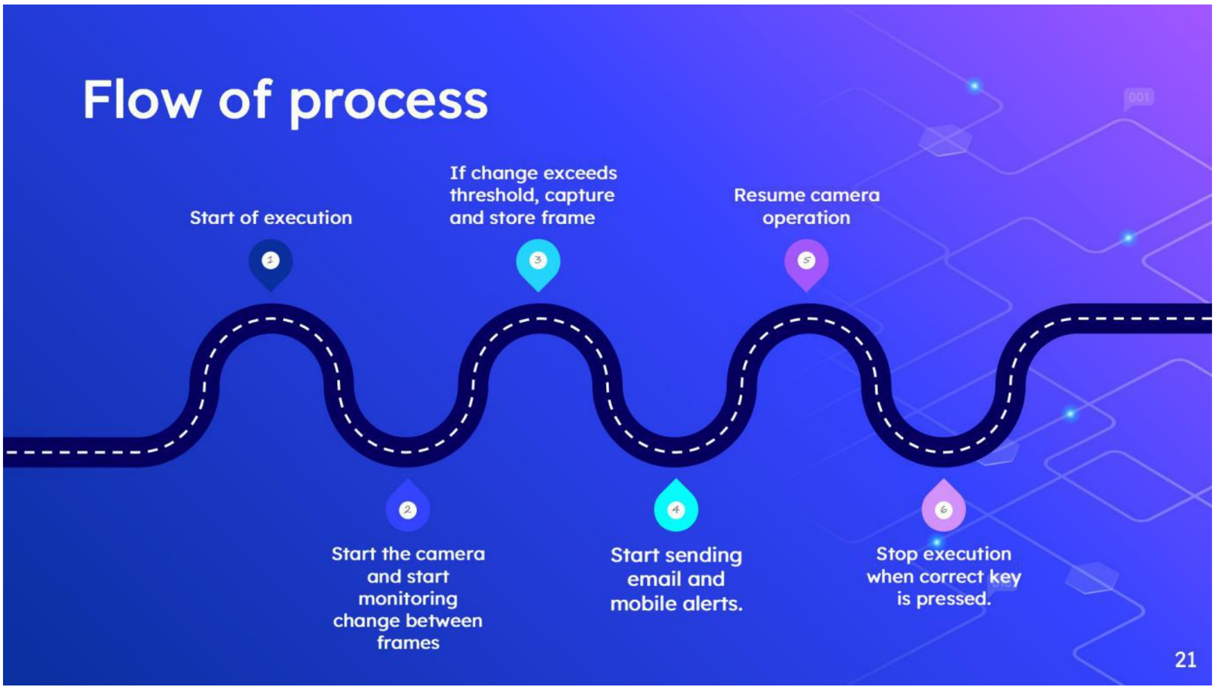
The contours are then detected and highlighted as a visual representation. There is a provision for setting the threshold at which the system will trigger for fine tuning the system. Once that threshold is crossed, functions for alerting the user through the means of email and messages are called.

This system sends the user email using the SMTPLIB library and the functionality for sending messages is achieved by using the pushbullet API. Furthermore these alerting services services are also used for informing the user about the current status of the system and also while starting-stopping as an added security feature in case somebody tries to tamper with the camera.

All the above processes are placed within a loop which continues till the user presses the correct key for disengaging the system. The secret key for disengaging the system is used as a way of verifying whether the system is being operated by the user or a trespasser.

4. System methodology

The following diagram indicates the flow of operations in the proposed system:-



Flow of process

1 Start of execution

2 Start the camera and start monitoring change between frames

3 If change exceeds threshold, capture and store frame

4 Start sending email and mobile alerts.

5 Resume camera operation

6 Stop execution when correct key is pressed.

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Figure 4.1-System methodology

4.1 Project processes

- When we start the program, the video recording begins.
- Then objects in the frame are identified by removing the background.
- The background is filtered again, enhancing the features of the object.
- Two consecutive frames from the video are checked for difference in them.
- If difference is less than that of set threshold then the loop is continued.
- If the difference is more than set threshold then the alerting system is activated.
- A snapshot of the moment when the intruder stepped in front of camera is captured.
- This snapshot accompanied with a warning message is sent through email and mobile notification.
- This process continues till the user presses the designated key to stop the system.

5. System requirements

5.1 Software requirements

Software name	Version/specification
1.Visual Studio Code	Version 1.51
2.Visual Studio code python extension	LTE version
3.Python Interpreter	Version 3.9.0 (5th October 2020 release)
4.Operating System	OS X Yosemite and above Windows 7 (with .NET Framework 4.5.2), 8.0, 8.1 and 10 (32-bit and 64-bit) Linux (Debian): Ubuntu Desktop 14.04, Debian 7
5.Microsoft .NET framework	Version 4.5.2

Table 5.1-Software requirements

5.2 Hardware requirements

Hardware name	Version/Specification
1.Processor	1.6 Ghz or faster
2.RAM	Minimum 1GB
3.Microphone	Built-in or external
4.Camera(internal/external)	>=3 Megapixels resolution

Table 5.2-Hardware requirements

6. Design and Implementation

6.1 System Architecture

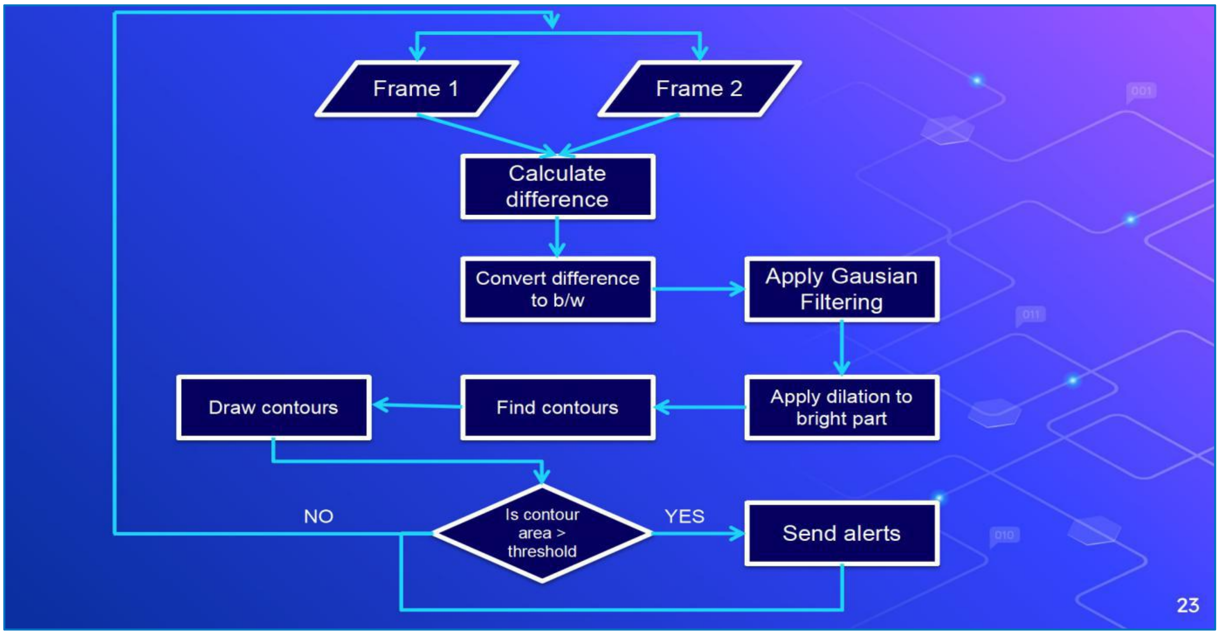


Figure 6.1-System Architecture

6.2 Architecture modules

Architecture module	Description
1.Email interface unit	This unit sends alert messages through the email account registered with it.
2.Video capturing unit	This unit captures video and processes it frame by frame for detecting motion.
3.Mobile alert unit	This unit uses the pushbullet app to push data directly to the user's mobile.

Table 6.1-Architecture modules

6.3 Language Used

- For implementing this project the language of choice was python.
- Due to it's very expressive syntax which allowed for reducing the lines of code and making production and testing process much more efficient.
- Also the presence of large number of application based libraries makes this a lucrative choice for such projects.

6.4 Libraries used

The following open source libraries were used for implementing this project:-

Name of Library	Purpose of Library
1.Open CV 2	for processing video feed
2.smtplib	for interfacing with the email servers.
3.pushbullet	For accessing pushbullet message services.
4.imghdr	For recognising and processing image files stored on the computer.
5.winsound	For recognising and processing audio files stored on the computer.

Table 6.2-Libraries used

6.5 Detailed description of modules

- **Video capturing unit**
  - This module is responsible for creating a loop which capture video.
  - This module also analyses the video feed frame by frame for detecting motion.
  - Then the change detected is compared with the threshold configuration of the programmed and then it's known whether a trespass has taken place or not.

- **Mobile alert module**
  - This is module which pushes the text and image alert through the pushbullet app.
  - The user's personal app code is used for making this a safe process.

- **Email interface**
  - This unit sends alerts through the email system.
  - Also this unit uses encryption facilities in order to safely transmit and receive emails.
  - Use of this module simplifies the program implementation by abstracting how the computer communicates with the email servers.

6.6 Limitations

While implementing this system the following limitations were encountered:-

1. Dependence on system camera quality

- The better the resolution of input camera feed, the better are the chances for accurately detecting motion.
- Thus the camera quality directly affects the effectiveness of this solution.

2. Lack of facial recognition features

- The proposed system detects intruders on the basis of motion detection causing relative difference between frames.
- The detected intruder however is not internally recognised by the system, however this presents a very attractive opportunity for future work and improvement on this solution.

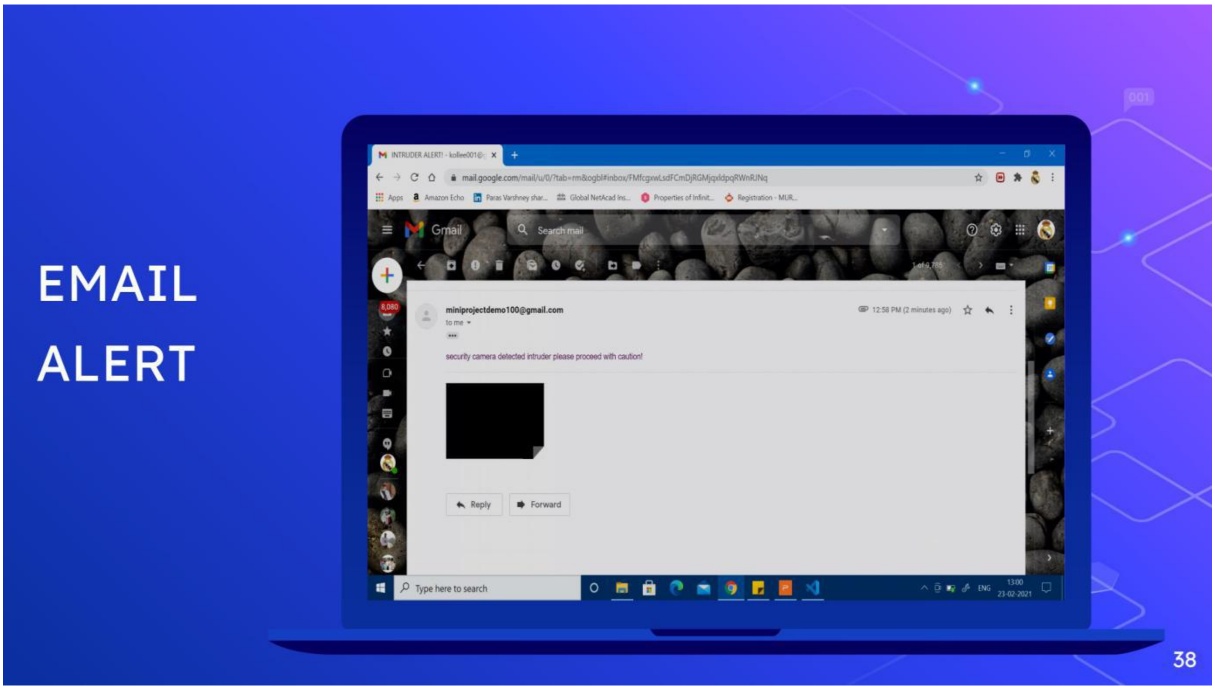
3. Lack of remote access features

- The current proposed solution can remotely inform the user about suspicious movements.
- However the current system still is not capable of being remotely operated by the user.

4. Insufficient resources & time

- Voice recognition and it's implementation in various utilities is something that requires rigorous research and testing.
- Such operations often demand significant amount of financial resources as well as other research tools.
- This lack of resources often impedes research work and leads to production of very specialized systems which are not economical neither are they widely and easily available.

7. Results on implementation



EMAIL ALERT

INTRUDER ALERT! - kollee001@

mail.google.com/mail/u/0/?tab=rm&ogbl#inbox/FMfcgxwLsdFCmDjRGMjqxldpqRWnRJNq

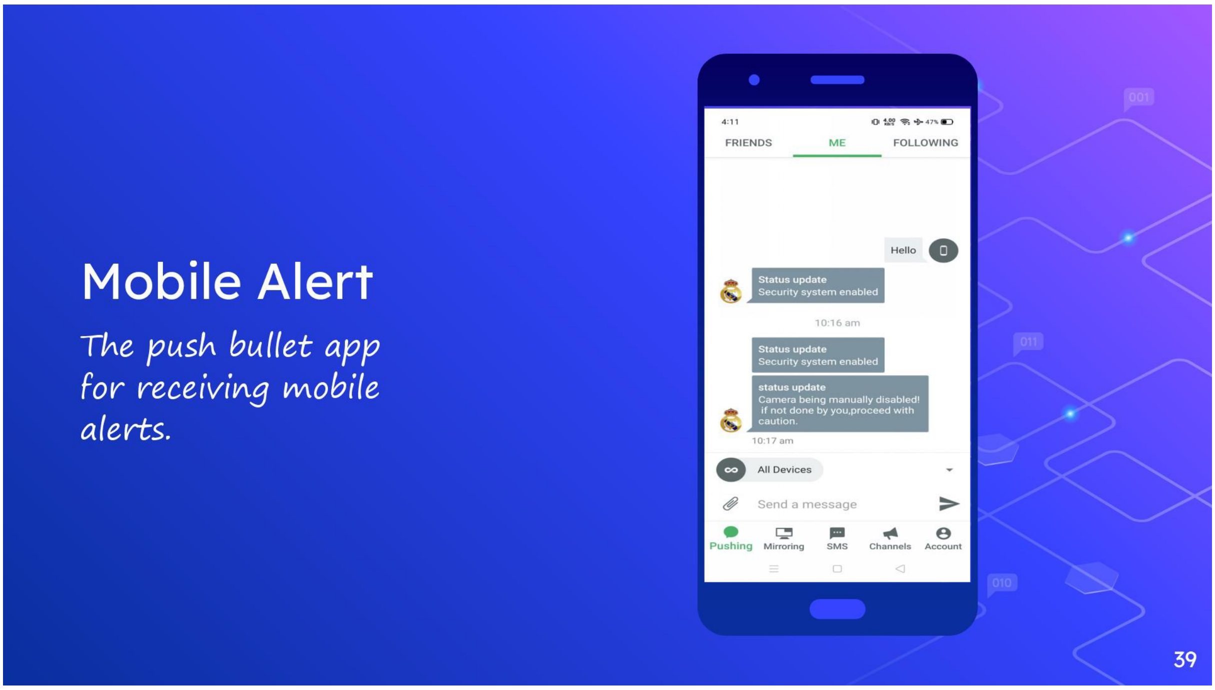
miniprojectdemo100@gmail.com

to me

12:58 PM (2 minutes ago)

security camera detected intruder please proceed with caution!

Figure 9.1-email alert sent on mail, this picture shows the email alert which is received when the system is triggered and a picture is included of the detected intruder.



Mobile Alert

The push bullet app for receiving mobile alerts.

Hello

Status update
Security system enabled

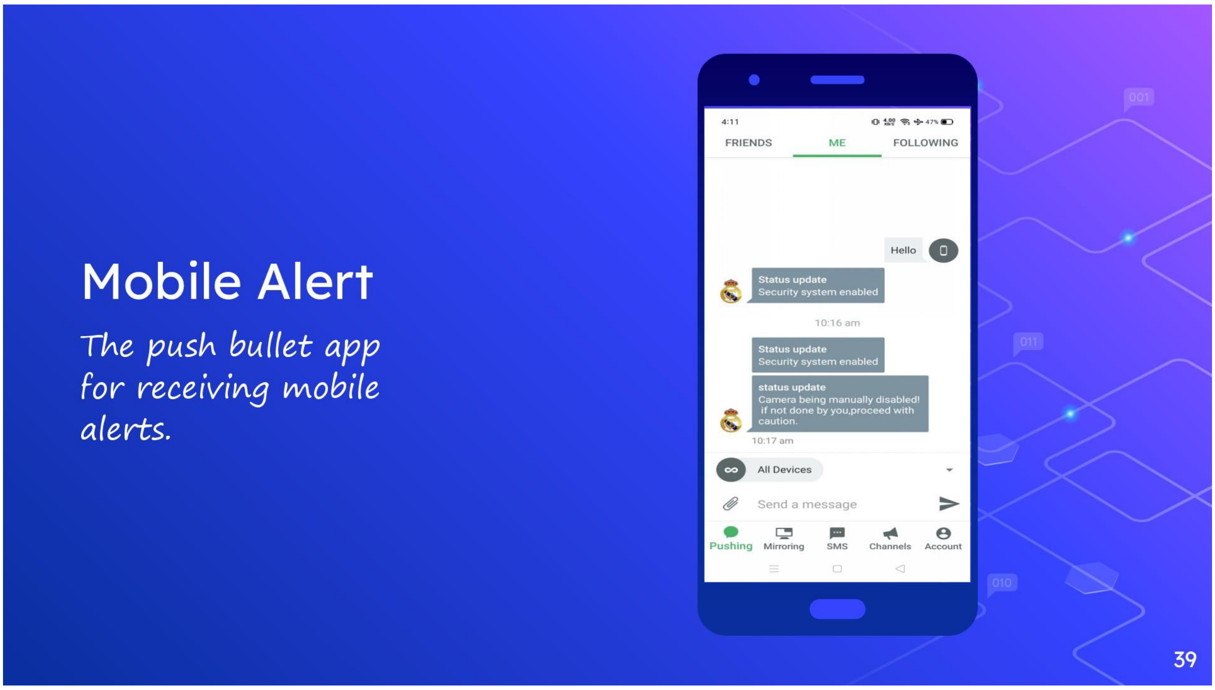
10:16 am

Status update
Security system enabled

status update
Camera being manually disabled!
if not done by you,proceed with caution.

10:17 am

Figure 9.2 - alert received on phone, these are the notifications pushed onto the user’s phone when the program is activated.



Mobile Alert

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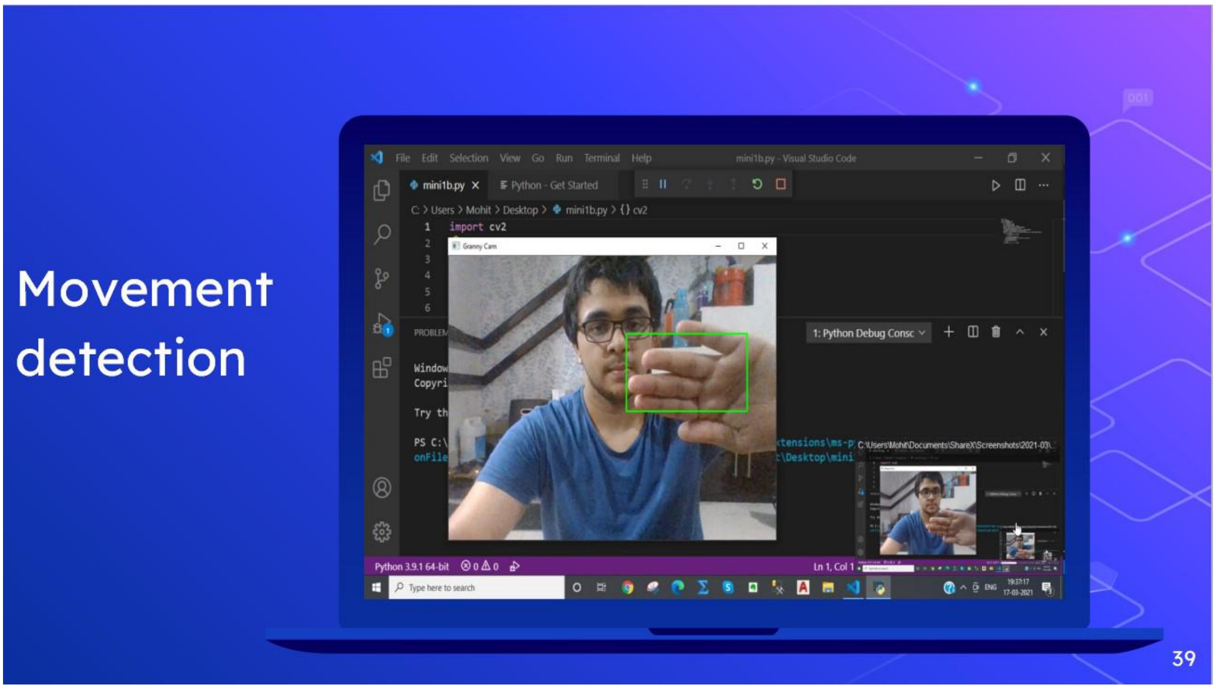
10:16 am

Status update
Security system enabled

status update
Camera being manually disabled!
if not done by you,proceed with caution.

10:17 am

Figure 9.3-System engaging and disengaging mobile alert, mobile alerts can also be used to inform the user about the health of system and whether somebody is trying to manually disengage it.



Movement detection

```
import cv2
```

File Edit Selection View Go Run Terminal Help
mini1b.py - Visual Studio Code
mini1b.py
Python - Get Started
C: > Users > Mohit > Desktop > mini1b.py > {} cv2
Granny Cam
1: Python Debug Consc
Python 3.9.1 64-bit
Ln 1, Col 1
Type here to search
39

Figure 9.4 - Code snapshot, this is exhibits the system highlighting the area around which it has detected motion.

8. Conclusion

The rise of mega metro settlements, an ever widening pay gap and a devastating global pandemic has lead to countless people loosing their livelihoods and other familiar sources of income, under such unfortunate circumstances, desperate people have lead to shy high crime rates where most of the crimes involve robberies. Under such circumstances a wide bracket of people for the first time have considered opting for security and surveillance systems.

However till date the the security industry was not quite targeted towards individual homes and the solutions they offered came at a considerable and are almost not affordable.

Hence in this project we have tried to create an effective software which could detect intruders and also send digital alerts to the user. Versatility has always been a key aspect while creating this project. Hence as a result the final software can be implemented through a variety of different hardware setups, no matter how crude they may seem.

This has been an attempt to fulfill the required specifications for such a system and the results look promising. Further work and improvement on this topic will further improve and provide lucrative solutions for this segment which would be able to identify people's faces and then selectively perform the task of face recognition based on whether the person is denoted as a intruder or not in system database.

9. System Code Implementation

```
#Mini Project 1B
#AI based security camera
#Batch 2019-23

import cv2
import winsound
import smtplib
import imghdr
import time
from pushbullet import Pushbullet
from email.message import EmailMessage



from pushbullet import Pushbullet

pb = Pushbullet('**********')
push = pb.push_note("Status update", "Security system enabled")
print("security system online")



def sendmail():
    try:
        Sender_Email = "*****"
        Reciever_Email = "*****"
        Password = ('******')

        newMessage = EmailMessage()
        newMessage['Subject'] = "INTRUDER ALERT!"
        newMessage['From'] = Sender_Email
        newMessage['To'] = Reciever_Email
        newMessage.set_content('security camera detected intruder
please proceed with caution!')

        with
open('C:/Users/soham/Desktop/security_cam-main/opencvsecurity.png',
'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, filename=image_name)

        with smtplib.SMTP_SSL('smtp.gmail.com', 465) as smtp:

            smtp.login(Sender_Email, Password)
            smtp.send_message(newMessage)
            smtp.quit()
    except:
        push = pb.push_note("Warning", "Something went wrong with
security system")
        print("sent error message")



    else:
        push = pb.push_note("Warning", "INTRUDER DETECTED CHECK IMAGE TO
CONFIRM:-q")
        with open("opencvsecurity.png", "rb") as pic:
            file_data = pb.upload_file(pic, "opencvsecurity.png")
        push = pb.push_file(**file_data)
        print("sent mail with image")
```

```
cam = cv2.VideoCapture(0)
while cam.isOpened():

    ret, frame1 = cam.read()
    ret, frame2 = cam.read()
    diff = cv2.absdiff(frame1, frame2)
    gray = cv2.cvtColor(diff, cv2.COLOR_RGB2GRAY)
    blur = cv2.GaussianBlur(gray, (5, 5), 0)
    _, thresh = cv2.threshold(blur, 20, 255, cv2.THRESH_BINARY)
    dilated = cv2.dilate(thresh, None, iterations=3)
    contours, _ = cv2.findContours(dilated, cv2.RETR_TREE,
cv2.CHAIN_APPROX_TC89_L1)
    cv2.drawContours(frame1, contours, -1, (200, 255, 0), 2)
    for c in contours:
        if cv2.contourArea(c) < 50000:
            continue
        x, y, w, h = cv2.boundingRect(c)
        cv2.rectangle(frame1, (x, y), (x+w, y+h), (0, 255, 0), 2)

winsound.PlaySound("C:/Users/soham/Desktop/security_cam-main/alert.w
av",winsound.SND_FILENAME)
        return_value, image = cam.read()
        cv2.imwrite('opencv'+'security'+'.png', image)
        sendmail()
    if cv2.waitKey(10) == ord('q'):
        push = pb.push_note("status update", "Camera is being manually
disabled!\n if not done by you,proceed with caution.")
        print("disengaging security system")
        time.sleep(4)
        break



    cv2.imshow('security Cam', frame1)
```

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