

## RASPBERRY PI SMART SURVEILLANCE AND ATTENDANCE MANAGEMENT SYSTEM

**Sri Y. K. Viswanadham**  
Department of Information  
Technology  
Seshadri Rao Gudlavalleru  
Engineering College  
Andhra Pradesh, India.  
ykvpublications@gmail.com

**Gade Akash Reddy**  
Department of Information Technology  
Seshadri Rao Gudlavalleru Engineering  
College  
Andhra Pradesh, India.  
reddyakashg@gmail.com

**Amruthapalli Bhuvanewari**  
Department of Information  
Technology  
Seshadri Rao Gudlavalleru  
Engineering College  
Andhra Pradesh, India.  
amrutapalli112@gmail.com

**Machineni Kiran Priya**  
Department of Information  
Technology  
Seshadri Rao Gudlavalleru  
Engineering College  
Andhra Pradesh, India.  
kiranpriyamanchineni@gmail.com

**Enikapelli Abhishek**  
Department of Information Technology  
Seshadri Rao Gudlavalleru Engineering  
College  
Andhra Pradesh, India.  
[enikapelliabhishek@gmail.com](mailto:enikapelliabhishek@gmail.com)

### ABSTRACT

The society of network multimedia information access has recently been quite interested in face recognition. With the aid of facial recognition technology and a raspberry-pi, this project intends to develop a system that can automatically identify the faces of students who are present in a hallway or classroom. This technique, which makes use of a chip the size of a credit card, is economical. Hence, the image is taken using a webcam and sent to the Raspberry Pi for processing with the aid of openCV in order to detect faces and humans. An alert is then generated and sent to the authorities based on the comparison of the face observed with the database to determine whether the human discovered is known (a student) or not (a stranger). We benefited from a Raspberry Pi. We made use of a Raspberry Pi, Python packages like OpenCV and NumPy, and SQLite for database administration. With a Raspberry Pi, a smart surveillance system can both detect motion and individuals participating in an activity inside the campus. By presenting their information, such as STUDENT ID and names, this intelligent surveillance can identify pupils. A student's identity can be detected by this intelligent surveillance, which can then ascertain the student's time of entry and exit from the classroom. The mobile application will warn the authorities if the student's photograph is not in the database. Also, the programme has the option to upload student data to the database.

**Keywords:** CCTV camera systems, real-time surveillance, IP cameras, Raspberry Pi, OpenCV and NumPy, SQLite.

### 1. INTRODUCTION

Throughout the past few years, there have been numerous advancements in the field of security technology. We have progressed from wired video surveillance and passcodes to wireless cameras and facial recognition. In fact, it could be argued that the human face has evolved into the digital ID that authenticates the individual in the era of wearable technology and multi-factor authentication. Technology for facial recognition has been around for a while. It began in the 1960s. However as of late, it has become an enticing answer to a variety of modern identifying and identity-verification issues. It combines

the potential of other biometric systems, which aim to link identity to uniquely distinguishing physical characteristics, and the more recognisable qualities of visual surveillance systems. Law-enforcement authorities use this to the duty of validating the identity of legitimately arrested and previously known individuals and assess whether the individual matches the photographs in a gallery of "mug shots". Yet, this proposal calls for the deployment of facial recognition monitoring for security purposes at the university. Finding a specific person or researching their profile becomes important quite frequently. The institution stands to gain a lot from this method in that sense. There are several locations where access may be limited for a set amount of time to a particular group of people. If any unauthorized individuals enter the restricted area, this system can monitor them and notify the university.

This study will be extremely beneficial to the university's authority. A university should be concerned about security. Every intrusion into a classroom or college will have an impact on the circumstances. But, reviewing hours of video after a crime takes time. This takes a lot of time. This undertaking might offer a remedy. The system can be asked by university officials for a list of everyone present within a specific time period. The system will instantly browse the video server. The list of all the pupils who were present during that period will then be shown. Also, it will give those people's profiles. It will also state whether the person is not affiliated with the university. The camera will send a notification to the department or institution and take an image of any unidentified person it spots. Also, the system will keep track of when a pupil enters the classroom, which may be used to track their attendance.

## 2. PROBLEM STATEMENT

Traditional surveillance systems were in use before the creation of smart surveillance systems. Often, these systems included cameras, recorders, and security staff to keep an eye on the cameras and deal with any questionable activity. These conventional systems, however, had some drawbacks. For instance, the cameras might not have had sufficient resolution to record crucial details, and security staff might not have been able to constantly keep an eye on all of the cameras. Furthermore, the recordings were frequently kept on physical media, which made it challenging to immediately access and evaluate material. The current system has few surveillance features, which prevents users and authorities from making timely decisions and analysing data.

The CCTV surveillance system often captures real-time activity in a location and provides the authorities with live streaming capability. The authorities could track the real-time data and view the old records as a result of this. Yet, it doesn't send any alerts to the police whenever a questionable individual or behaviour is discovered.

### 2.1 LIMITATION OF SYSTEM

CCTV systems do not identify or recognize the people who are participating in the detected acts; they just detect the behaviors. CCTV systems waste a lot of memory and use a lot of electricity. Data analysis is challenging. On any detected suspicious activity, it does not issue an alert. Lighting conditions have an impact on CCTV cameras and the quality of the video that is recorded. Certain features in the footage may be difficult to see in poor lighting situations like low light or glare. CCTV cameras are unable to do real-time analysis of the video they record. This can cause response times to be delayed because they are unable to immediately inform security personnel to potential threats. To store the video footage that CCTV systems record, a lot of storage capacity is needed. High storage costs may come from this, particularly for larger installations or those using high-resolution cameras.

## 3. PROPOSED SYSTEM

Smart surveillance systems were created to overcome these restrictions. These systems scan video data to find potential dangers or anomalies using cutting-edge technology like artificial intelligence, machine learning, and computer vision. As a result, monitoring is made more efficient and effective because the system can analyze data in real-time and take action without relying exclusively on human observation.

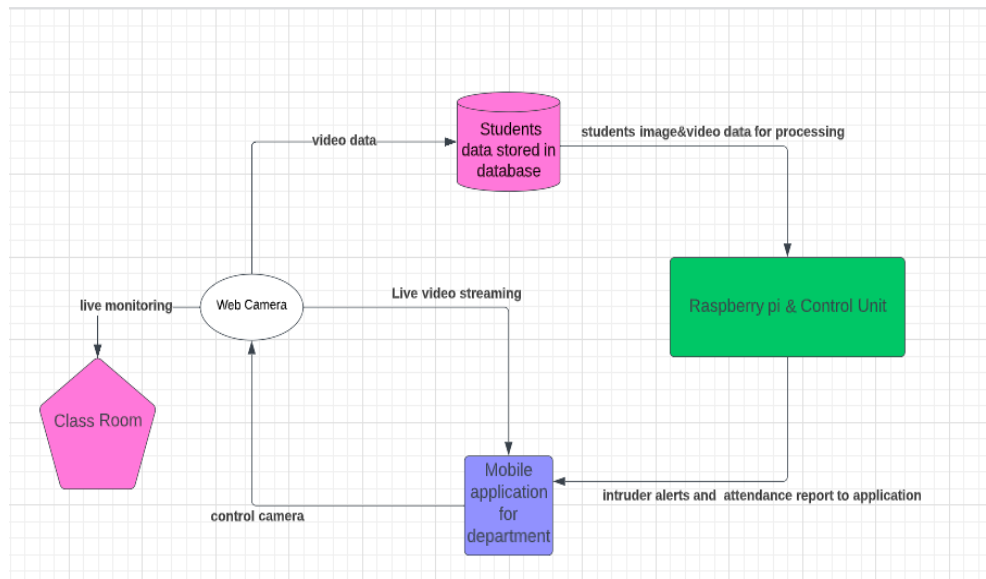
With better security and safety for a range of applications, from public safety to industrial security to retail loss prevention, smart surveillance systems are often a major improvement over traditional surveillance systems. The suggested system's goal is to eliminate all the flaws in the current system through efficiency portability. This surveillance system is affordable and simple to operate. With a Raspberry Pi, a smart surveillance system can both detect motion and individuals participating in an activity inside the classroom. By presenting their information, such as STUDENT ID and names, this intelligent surveillance can identify pupils. A student's arrival and exit from the college can also be tracked using this intelligent surveillance by identifying the student. The mobile application will warn the authorities if the student's photograph is not in the database. Also, this programme has the ability to upload student data to the database.

### **3.1 ADVANTAGES OF PROPOSED SYSTEM**

The suggested system has the ability to identify students and show their information, including student ID, name, and department, making it simple to identify students. It decreases the manual labour. This technology can tell what time a student entered and left the college. By analysing who was present there when a specific action took place inside the campus, this can aid in both preventing unruly behaviour and investigating an incident. This technology can identify a person and look up that person's information in a database; if the individual isn't there, it will send notifications to authorities' mobile applications.

## **4. SYSTEM ARCHITECTURE**

The Raspberry Pi board, a camera module, a network, storage, display, software, and power are all included in the system design for classroom surveillance utilizing the Raspberry Pi. The Raspberry Pi board is a single-board computer that is inexpensive, energy-efficient, and simple to customize and can be used to operate cameras and store video data. High-definition video is recorded by the camera module, which can be either a fixed or a PTZ camera module. To enable data transfer, the Raspberry Pi board needs to be connected to a network, either through a wired or wireless network. The camera module's video recordings can be kept on a USB drive or a microSD card that is connected to the Raspberry Pi board. The surveillance crew can examine both live and recorded video from the cameras on a display device. The system's software should offer all of the capabilities required to organize and review the video footage, including functions like motion detection, facial recognition, and automatic warnings. Open-source applications like MotionEyeOS, which offers a user-friendly interface for controlling cameras, can be installed on the Raspberry Pi. Lastly, a reliable power supply, either a wall adapter or a battery pack, should be used to power the Raspberry Pi board.

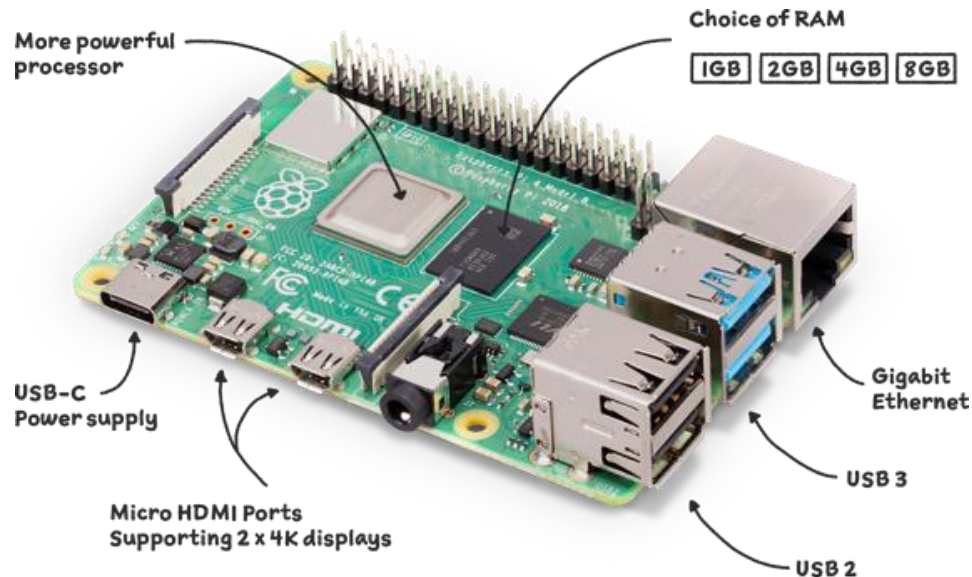


*Architecture Diagram for the proposed system*

## 5. IMPLEMENTATION

### 5.1 RASPBERRY PI

The Raspberry Pi line of compact, reasonably priced single-board computers was initially created to support computer science instruction in schools. Since the initial Raspberry Pi model was introduced in 2012, other variations with different features and specifications have been made available. These little computers are made to be simple to use and programmable, which makes them perfect for a range of tasks like home automation, media centers, gaming consoles, and even robotics. Operating under a version of Linux, ARM-based processors power Raspberry Pi boards. Also, they provide a number of ports and connectors for attaching various peripherals, including keyboards, mouse, displays, and cameras. The Raspberry Pi has grown in popularity among hobbyists, students, and educators. It has even been employed in business settings, including digital signage and industrial automation. Ultimately, Raspberry Pi has transformed the single-board computer industry and assisted in making technology more widely available and affordable..



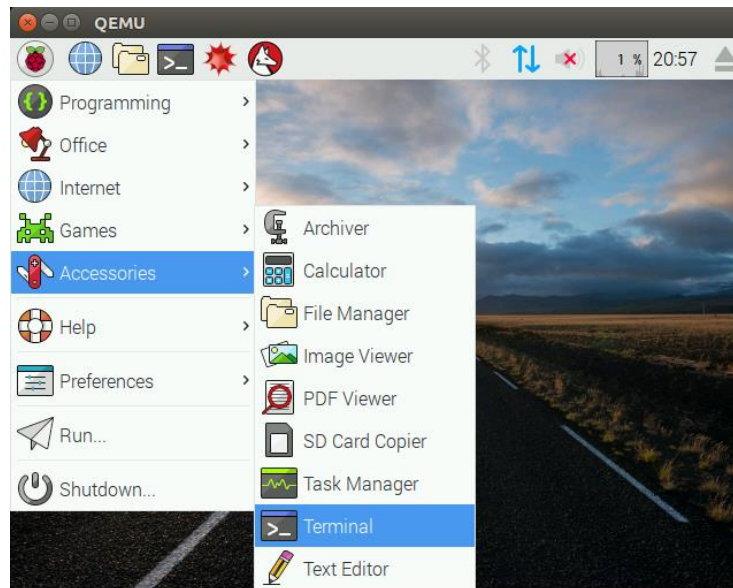
*Fig. Raspberry PI 3*

## 5.2 RASPBIAN SOFTWARE

A Debian-based open-source operating system created especially for the Raspberry Pi single-board computer is called Raspbian. It is the Raspberry Pi's official operating system.

On the Raspberry Pi, Raspbian offers a full desktop environment that includes a web browser, office suite, programming tools, and other software programmers. It is quick and effective because the ARM architecture of the Raspberry Pi's CPU has been optimized for it.

Raspbian comes in two variations: Raspbian Stretch and Raspbian Buster. The most recent version, Buster, was published in 2019. It has new features, is better performing, and supports newer hardware than the previous version. The "raspi-config" software, which is also part of Raspbian, offers simple tools for adjusting a variety of system settings, including expanding the storage, changing the hostname, configuring WiFi, and more. Also, Raspbian has a sizable and vibrant user and development community that produces and maintains a variety of software packages for the operating system. This makes finding and installing extra software for your Raspberry Pi simple.



### 5.3 WORKING PRINCIPLE

A flowchart can be used to explain how the camera operates generally. The image is taken by a web camera with a resolution of 5MP and a frame rate of 30 frames per second. This image is then transmitted to a face identification module, which scans the frame for any faces that can be identified using Haar-like features and removes them if they are discovered. Once the face has been compared to the thoroughly trained database, it is determined whether the face can be recognized. If the photograph matches the database, the person is a visitor, and the user receives notification via a picture and alert that an unauthorized person has entered the classroom. However, A message is given to the user via a picture and alert informing them that someone unknown has entered the classroom if the image matches the database and the individual is a visitor. In contrast, if the face doesn't match the database, the person is recognized as a stranger, and a notification is given to the authorities along with the image of the detected face.

#### 1. Setting up the Raspberry Pi:

The first step is to set up the Raspberry Pi with the necessary software and hardware components. This includes installing the Raspbian operating system on the Raspberry Pi, connecting a camera module, and configuring the network settings.

#### 2. Recording video:

Once the Raspberry Pi is set up, it can be used to record video of the classroom using the camera module. The video can be recorded continuously or triggered by motion detection using software like Motion.

#### 3. Saving the video:

The video can be saved to a local storage device or uploaded to a cloud storage service for remote access.

#### 4. Accessing the video:

The video can be accessed by authorized users, such as teachers or administrators, using a web interface or mobile app. The video can be viewed live or accessed later for review.

#### 5. Monitoring and analysis:

The video can be monitored and analyzed for various purposes, such as detecting and preventing incidents of bullying, improving classroom management, and assessing teacher performance.

The video data is analyzed by the raspberry pi built logic and thus if the picture of person doesn't match with the pictures in the database the authorities will get an alert along with the picture of the person



6. IMPLEMENTATION SCREENSHOTS

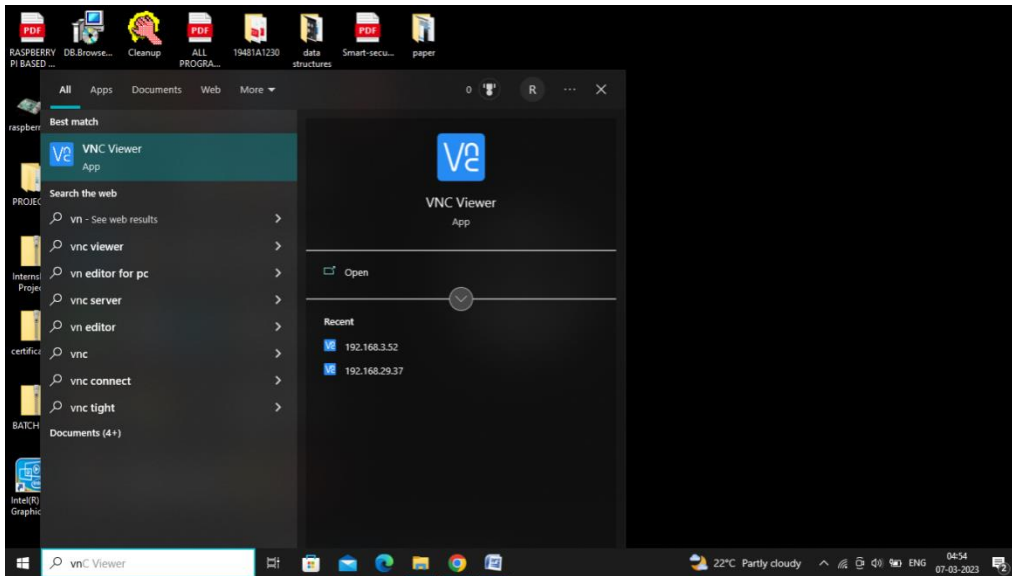


Fig. Opening the VNC viewer

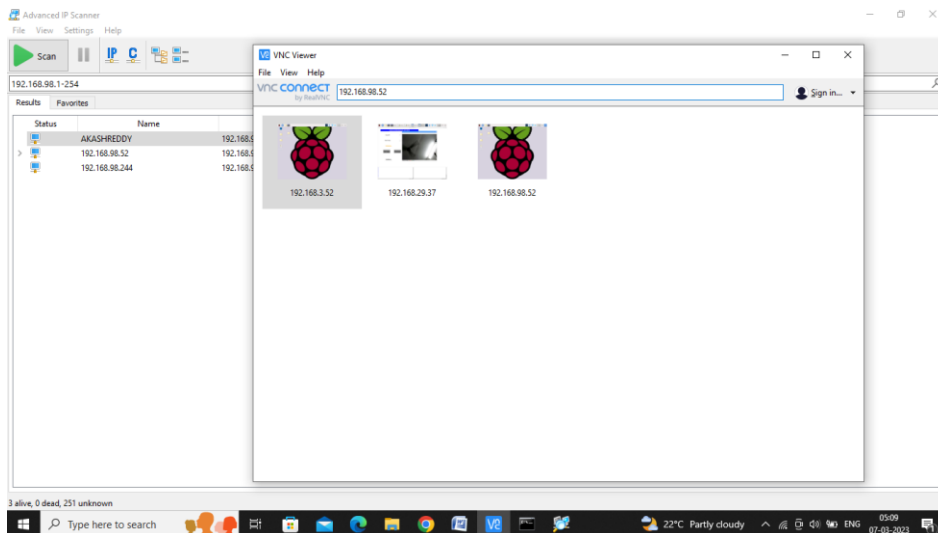
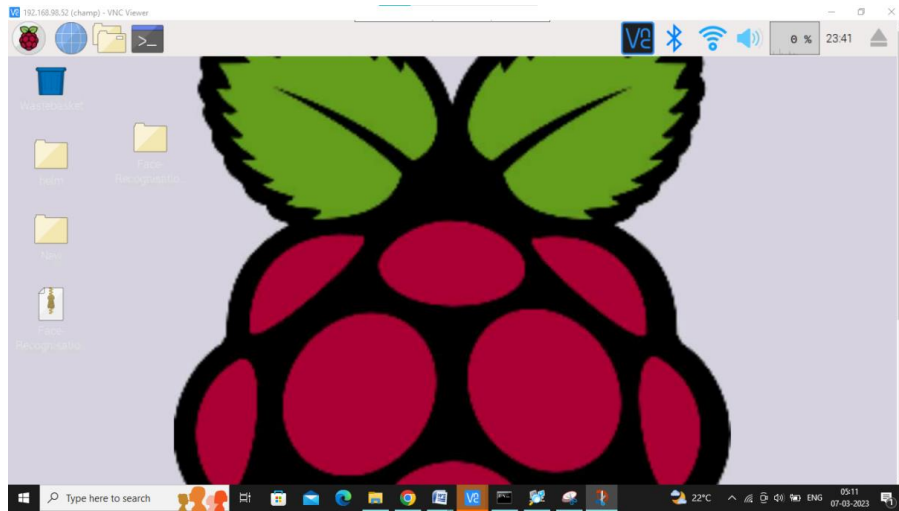
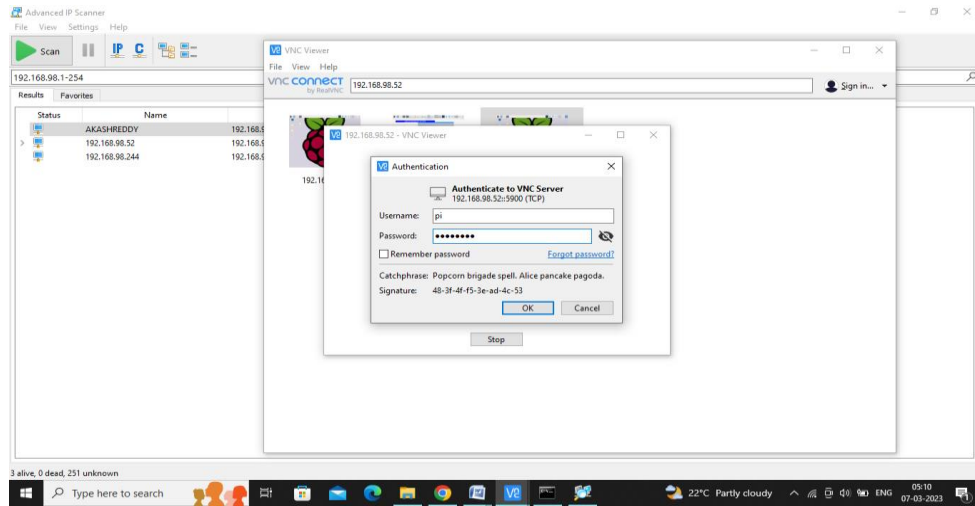


Fig. Choosing the RaspberryPI



*Fig.Raspbian OS interface*



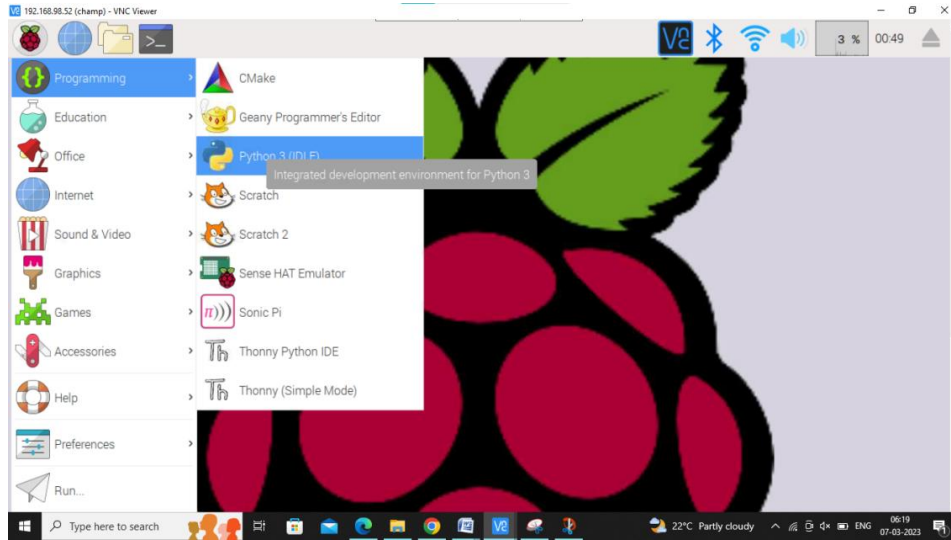
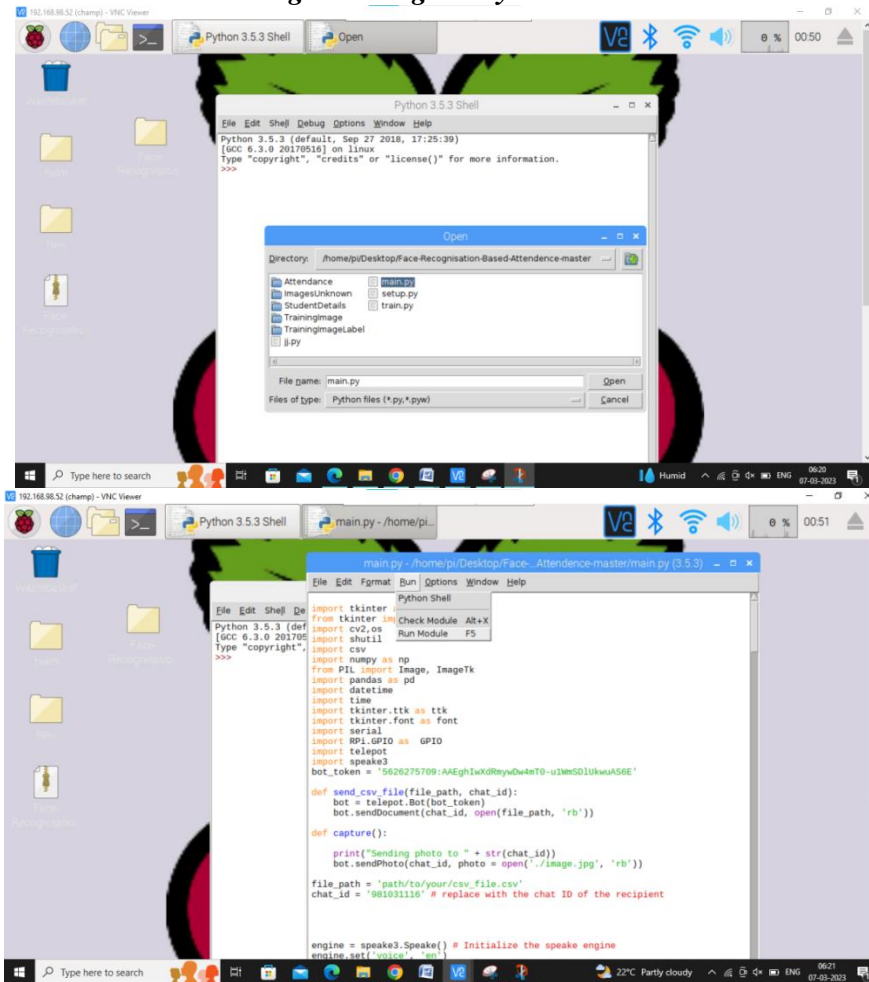
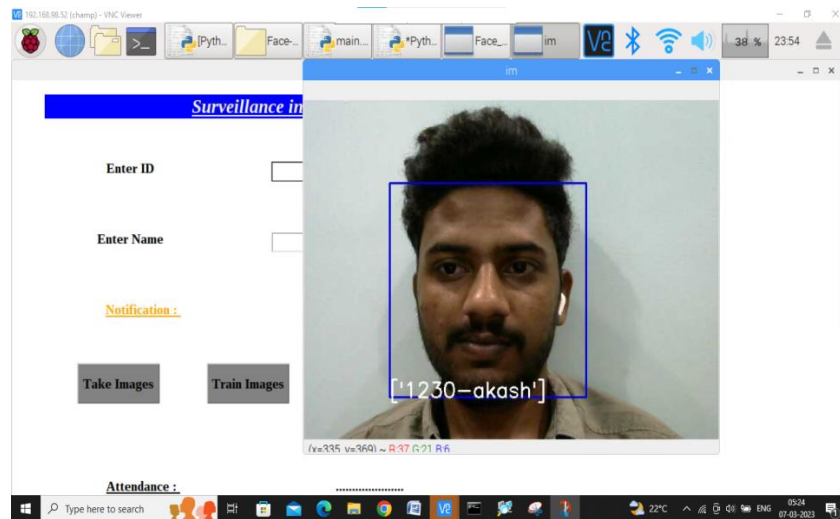


Fig.Choosing the Python IDE





## 7. CONCLUSION

For the classroom in this project, we put in place a smart security and attendance control system. Face detection and security alert are the two key components of the system. We have created a database of all the students who are a part of a class or department for the facial recognition component. An image of any intruder found in the area is taken right away, and the department authorities' mobile application receives it. As a result, it is not necessary to check the security camera's entire footage. Instead, we can look for the divided photos that the intelligent system has saved..This will make it easier to monitor that location overall. The system comes with some useful features. First of all, the system is unaffected by background alteration. Any background can be used for the faces in the stored image. Background changes are tolerated by the system. Little environmental changes won't then have an impact on system performance. So, the system will not be affected by natural light, strong artificial light, or dim lighting. Also, the system performs quickly. As a result, the intrusion is discovered as quickly as possible. Also, the alarm module sends a message to authorities indicating an intrusion has occurred together with the image of the intruder when immediate action must be taken..

## 8. FUTURE ENHANCEMENT

The system's objectives are to prevent unauthorized access to restricted areas and to notify users of any unexpected behavior. It is possible to further expand the system presented in this study. Here are a handful of them.

A system for recognizing behaviors can be created. The system will examine an intruder's actions to determine whether they involve breaking into a room or other questionable activity. It is possible to spot unusual activity and stop threats. To improve the system's functionality, a weather update system will be put on it..

## 9. BIBLIOGRAPHY

1. [https://en.wikipedia.org/wiki/Facial\\_recognition\\_system#History](https://en.wikipedia.org/wiki/Facial_recognition_system#History)
2. "Facial Recognition Technology A Survey of Policy and Implementation Issues Lucas D.Introna Lancaster University, UK; Centre for the Study of Technology and Organization andHelen Nissenbaum New York University; Department of Media, Culture, and Communication,ComputerScience, and the InformationLaw Institute".
3. "Multi-Order Statistical Descriptors for Real-Time Face Recognition and ObjectClassification Arif Mahmood; Muhammad Uzair; SomayaAl-Maadeed;IEEEAccess,Year: 2018,Volume:6,Pages:12993-13004"
4. "FACE DETECTION AND TRACKING USING KLT AND VIOLA JONES RiteshBoda and

- M.Jasmine PemeenaPriyadarsini School of Electronics and Communication Engineering,VITUniversity,IndiaEMail:riteshboda9@gmail.com;VOL.11,NO.23,DECEMBER2016;ISSN1819-6608ARPJournalof EngineeringandAppliedSciences”
5. “A novel approach flow-lightimageusedforfacerecognitionDafengRen;HuiMa;LaijunSun;Tingchun Yan; 2015 4th International Conference on Computer Science and NetworkTechnology(ICCSNT),Year:2015, Volume: 01,Pages:790 -793”
  6. <https://www.amazon.in/Raspberry-Pi-3B-plus-Motherboard/dp/B07BDR5PDW>
  7. <https://ryanscomputers.com/audio-video/webcam/a4-tech-pk-920h-web-cam.html#tab-product-view1>
  8. <https://www.botshop.co.za/product/gsm-module-sim900-arduino-shield/>
  9. [https://www.dhakatribune.com/bangladesh/dhaka/2019/03/28/16-000-fire-incidents-in-10-years.](https://www.dhakatribune.com/bangladesh/dhaka/2019/03/28/16-000-fire-incidents-in-10-years)