



# **SAS: Smart Analysis System for Juvenile Safety Against Gun Violence using Facial Recognition Technology**

**By**

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**B.Sc. (Hons) in Intelligent Systems**

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## Chapter 1: Introduction To Study

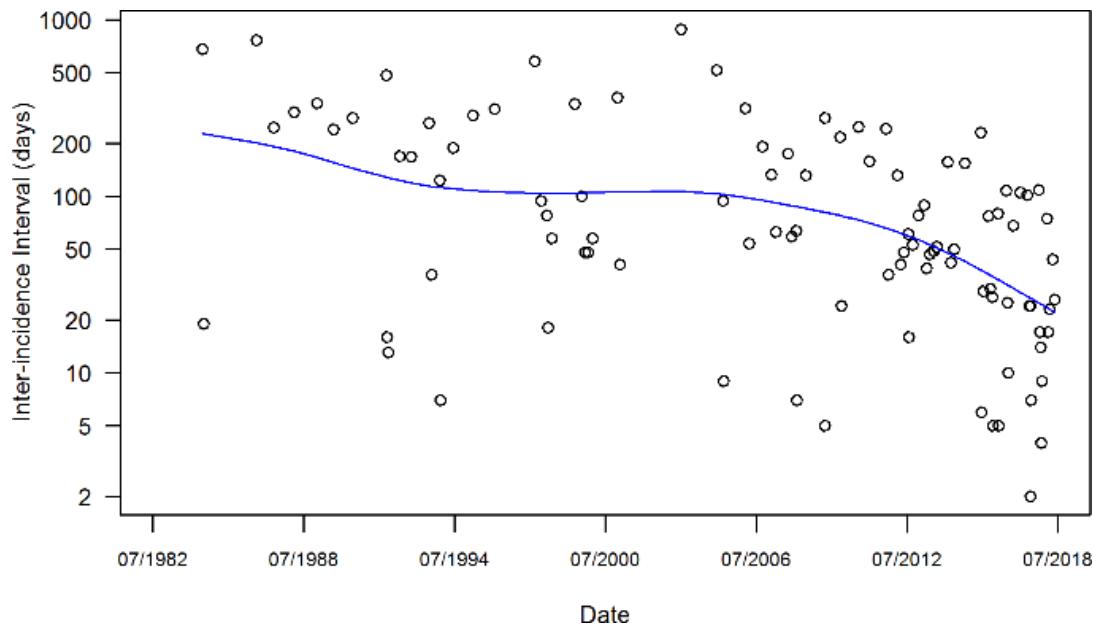
### 1.1 Background To Project

In the last few years, violence involving guns has risen significantly and is an ongoing problem. Facial Recognition Technology is the ultimate solution for solving this persistent. The paper proposes a related facial recognition device based on the computer's vision which is able to identify the face analysis on CC TV equipment for several subjects at a certain time. It can also prevent unwanted individuals from entering the school. Agile Scrum methodology is proposed for this research proposal. Smart Analysis System (SAS) can detect facial expression, body movement, age detection, emotion analysis, and to identify the potential high-risk individual. This paper also shows how Smart Analysis System (SAS) can reduce the rate of gun violence in school premises.

### 1.2 Problem Context

Firearm fierceness can interrupt the functioning of schools and make students' expeditions to and from school dangerous. Deficiency of state resources for education and the struggle of enlisting and retaining teaching staff in neighborhoods wracked by gun fierceness have a negative influence, declining the right to education. Pervasive firearm violence and associated uncertainty can have a particularly severe impact on children and youths, including unsettling school attendance and retention, harming the learning environment, and dropping the quality of teaching. This can, in turn, lead to minor life results regarding employment and income, and prolong cycles of deficiency, crime, and violence. In the USA, there were 316 occurrences of shooting on school grounds between July 2013 and June 2018 (**Figure 1**).

There are broad-based and sometimes misunderstood issues leading to the child picking up a firearm. Youth violence can, however, be related to terror, protection needs, police ignorance due to deep prejudice and biased police forces, a willingness to gain great respect and recognition, as well as involvement in criminal activities, in the situation of urban communities (International, 2019).



*Figure 1 shows the Gun Shooting Trend (International, 2019)*

### 1.3 Rationale

People who have clean histories and other pointers of fidelity and justice would receive lower insurance premiums. Those who have more erratic accounts would be required to pay higher premiums, with the most significant risk individuals potentially being valued out of the market. For this to work, gun protection would need to be compulsory in the same way that auto protection is required. However, if applied, it might link the gap between people on either side of the debate and help collective furnace progress toward reducing gun violence. Avoiding mass shootings is a complex but vital task, and many issues need to be addressed. Luckily, we live in the most technologically progressive age in history, and we have admittance to more data every day. Artificial intelligence can aid us in making sense of that info by recognizing trends we can use to create effective solutions. On gun ferocity and so many other urgent subjects, we can influence technology to find answers to the most challenging issues of our time.

From the research, gun violence can be prevented by implementing SAS in every school premises. It will help to detect unauthorized individuals from school grounds and alert the authority to take necessary action to avoid misfortune. AI could play a supportive role, as well. AI endorsing algorithms can retain guns safe and reasonable for lawful, skilled owners while keeping them out of the hands of high-risk persons. The theory is that AI algorithms could lure

on massive data sources to evaluate a person's risk before they are allowed to buy a gun. These data facts might include criminal background drafts, medical archives, employment positions, and even online interactive data to evaluate their risk profiles.

## 1.4 Potential Benefits

The potential benefits of the Smart Analysis System (SAS) are given below into two categories, i.e., Tangible and Intangible.

### 1.4.1 Tangible Benefits

- It will increase the revenue of the organization as more customers will be interested in investing in this organization because of this enhanced security system.
- It will highly reduce the cost of resources as the order is automated, which can save lots of manual processes of time.
- It can save tons of cost in hardware as the system can be implemented using existing CCTV Cameras.
- Typically, both the facial recognition and behavior analysis software are sold separately, while SAS has the features of both worlds, which can reduce the software costs vastly.
- Automated systems such as SAS can lead to productivity gain as it opens more job opportunities for people to work in other areas.

### 1.4.2 Intangible Benefits

- SAS provides enhanced user experience, which helps the organization to monitor for threats in real-time efficiently.
- It increases customer satisfaction. For instance, parents will feel more comfortable if they know that their children are studying in a more secure place.
- It prevents human error that can be a factor detecting high suspicious profiles during a massive event taking place in the school ground.

## 1.5 Target Users

APU students, employees and some international students will be main users of this program as well. The aim of this research is to understand the impact of an intelligent program to be introduced in the CCTV, such as the APU, to warn authorities when the Institute is at potential danger.

## 1.6 Scope & Objectives

### 1.6.1 Aims

The purpose of this investigation is to understand the impact of an intelligent program to alert authorities in the CCTV of the Education Institute if a potential danger arises in the institutional facilities. It may prevent the threat from acting prior to the threat. In the educational sector, this program will significantly reduce the number of crimes of weapons of violence against juvenile health.

### 1.6.2 Objectives

The study paper has the following objectives:

- To identify the potential risk individuals who act gun violence against juvenile safety in the educational institute.
- To develop an application known as Smart Analysis System (SAS) that can detect unauthorized individuals by detecting their faces and behavior as well.
- To design the User Interface for SAS that will help the school premises to be more secured against gun violence, which will also discourage the criminals in the gun firing.
- To validate the methods of Facial Recognition Technology, and authorities will test the system using unload guns in a small classroom with volunteered candidates.

### 1.6.3 Deliverables

SAS helps to detect unwanted individuals from school premises preventing the gun shooting. The following features are available:

1. It can recognize facial expressions.
2. It can detect body movement.
3. It can differentiate between various ethnicity.
4. It can identify high-risk potentials.
5. It can alert the authorities to prevent the gun shooting.

#### 1.6.4 Nature Of Challenges

There are three vital phases to develop SAS, which are face detection, extraction, and behavioral analysis. The developer has to identify and choose the right dataset for this system. It is difficult to find a free dataset that is correctly processed to use in this project. The developer will face challenges in implementing both behavioral analysis and facial recognition systems using python with the OpenCV library.

High-quality CCTV camera is required for this project to show desired results, as low quality can add more noise to the live video. Besides, reading suspicious behavior from an individual suspect is not easy as there are a lot of factors involved that might interfere with the results. To avoid all these issues, the developer has to do thorough research and write efficient code to eliminate anomaly data.

### 1.7 Overview Of This Investigation Report

#### **Chapter 1: Introduction To The Study**

The presentation is based on the project context, problem solving, reasoning, possible benefits, target customers, scope and objectives. In Chapter 1. The reader should have an understanding of the project as a whole.

#### **Chapter 2: Literature Review**

The proposed approach will be compared with related structures in Chapter 2 and the literature review will also be showcase domain analysis. The reader will get information about the project as a whole.

#### **Chapter 3: Technical Research**

Technical work to understand the resources needed to build this project will be performed in Chapter 3. This technical work will include tools like IDE, programming language, database and the web browser.

#### **Chapter 4: System Development Methodology**

Two approaches will be discussed in Chapter 4 and one best used for the creation of an intelligent research program. Based on these two methods, the comparative study is carried out.

#### **Chapter 5: Research Methods**

Chapter 5 offers a questionnaire for the compilation of draft data and offers thorough description of study methods. All questions will be tabled in the questionnaire.

#### **Chapter 6: Requirements Validation**

The knowledge obtained is examined in Chapter 6. It must be tested in order to comply with the project specifications.

### **1.8 Project Plan**

Please check the appendices for Gantt Chart.

## Chapter 2: Literature Review

### 2.1 Introduction

Violence involving Weapons has grown significantly and has become a recurrent concern in the United States in recent years (Bleuer, 2019). Every year, almost 2,900 kids and youths are shot, associated with a foreseeable three million kids are uncovered to shot annually. A devastating effect can fall upon the victims that face this traumatic scenario. In the wake of these misfortunes, people are desperate for responses and assurance. Everyone approves something that must be done, but they cannot decide what will be the ultimate solution. The discussion of inhibition of mass firings is yet highly debated and expressively charged.

Facial Recognition Technology, however, is unflustered. Computer algorithms can recognize guns before they are drawn out as they are not prone to uncertainty or emotion and are more reliable in analyzing data that can also prevent the gun violence persistent issue. While human decision making and intervention are vital to unraveling an issue as complex as gun violence, technologies like artificial intelligence and high-powered sensors can be designed to help stem the tide of mass gunfire in the United States.

### 2.2 Domain Research

#### 2.2.1 Comparing Ensemble Deep Learning Techniques

The writers have detailed experimental research on Facial Expression expert creation (FER) in this document (Renda, Barsacchi, Bechini and Marcelloni 2019) from the selection of standard Neural Network Materials (CNN). Nevertheless, the outcomes of the FER project will be important. This article seeks an in-depth analysis of different aspects of the group performance, which is based on the factors which have an effect on the FER classification accuracy. The author focuses on a number of methods for the development of the ensemble, the different aggregation schemes and the variety of simple classifiers in the ensemble. The ultimate aim is to provide input on effective CNN sets.

In particular, the author decided on the need to enhance overall accuracy through multiple sources of variance. For this to happen, pre- and pre-training procedures should ensure that simple classifications are heterogeneous enough. The use of different seeds does not seem simultaneously possible, and packaging benefits greatly. Nevertheless, the overall accuracy of this specific classification is limited. The strategy to increase the size of the ensemble is directly dependent on that. Nonetheless, in the best case, the additional basis classifiers achieve a certain amount of value in output that means that strong bonds can be avoided. The findings are therefore significant. Finally, the average conventional ballot is equal to or much higher than the other specific assembly system. In the report, the author takes into account four different approaches to ensemble design that are chosen to find the best ways to address diversity while making simple evaluations.

The first strategy produces the same networks by simply adjusting the pseudo-assignment seed. The structure depends on how the pseudorandom number generator influences the breakdown of data sets, the reduction, increased data and initial weight distribution. SE is, to the best of its ability, the most effective and commonly used technique. In the case of profound neural networks. This structure consists of nine basic classifiers, derived from the establishment of nine separate bodies as seeds for the learning cycle.

Kim et al. (2016a) characterizes PS; integrating 3 seed with three pre-processing techniques that take heterogeneity into account in data output. In particular, images must be preserved (standard) before processing, images with histogram equalization should be modified, and they should be prepared with standardization of the light (iNor). The lighting standardization approach is designed to take light changes of images into account by lightening them with scientific diffusion isotropic (Gross & Brajovic, 2003). Histogram equalisation is a relatively frequently method of changing contrasts (Gonzalez & Woods 2006). The results include nine basic categories that are achieved by selecting three different integral values as a seed for each of the three pre-processing techniques.

PT requires modifying PS through higher network variability: three seeds and three pre-processing methods are carried in tandem. Nevertheless, weights are initialized by pre-training networks in other facial expression datasets in three different ways according to the seed. In

particular, three fundamental basic conditions are random weight initial distribution, (ii) pre-trained parameters for a WSR Dataset Network-CK+ (Lucey et al. 2010), and (iii) set of parameters (Dhall & al. 2014; Dhall, Goecke, Luke, Dhall and Luke). (iii) The weight of training should be equal to that received during pretraining. The top layers are completely linked in contrast. A particular print shall be given for ex-large, conventional lighting and posing for each dataset as defined in Section 4.1. Since SFEW is present in positioned images and in lab-controlled images, both data sets meet this purpose. Weights initialized by three pretraining approaches (and the collection of three separate parts as seeds) for each of these three pretreatment strategies consist of nine basic classifiers.

The fourth technique employs packaging for each network in its entirety to create a different data set (Breiman, 1996). It is not typically used in deep education, but this method is popular for the generation of classifiers in the machine learning community. The result is that nine individual individuals, consisting of nine basic categories, are seeded for a random sample with a substitution.

Trials were conducted on three ordinal facial terms: Facial Expression in 2013 (Goodfellow et al, 2015), Extending Cohn (CK+) and Dynamically Facial Articulated in Wild datagrams (SFEW) (Dhall et al., 2014; Dhall et al., 2012, respectively). Their trials were performed on three popular facial expressions. (Goodfriend et al. 2015). CK+ and SFEW have only been used in preparatory training and FER-2013 for teaching and research purposes. It is a good choice for our research because it is the most unrelated pictures in the wild. The following explanations have not been used to test our methods for different data set (for example, MMI-Valstar & Pantic, 2010, BP4D / BP4D+ Zhang et al., 2014; Zhang et al., 2016, JA FE Lyons et al., 1988, CMU Multi-PIE Gross et al., 2010.): I collect video calls that result in extremely clustered cases and ii. send a small number in comparison.

Number of images per class in the three datasets used in the experiments.

Label	FER-2013	CK+	SFEW
Neutral	6197	327	228
Anger	4945	135	255
Disgust	547	177	75
Fear	5121	75	124
Happiness	8988	207	256
Sadness	6076	84	234
Surprise	4001	249	149
Contempt	-	54	-

Figure 2 shows the Datasets (Renda, Barsacchi, Bechini and Marcelloni, 2019)

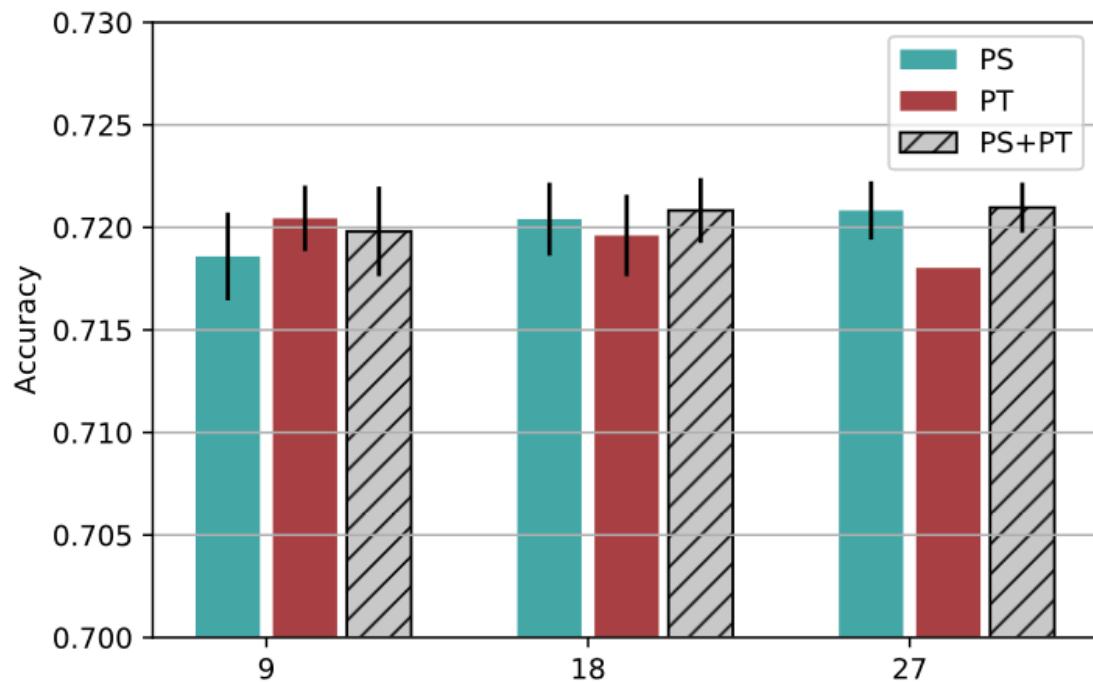


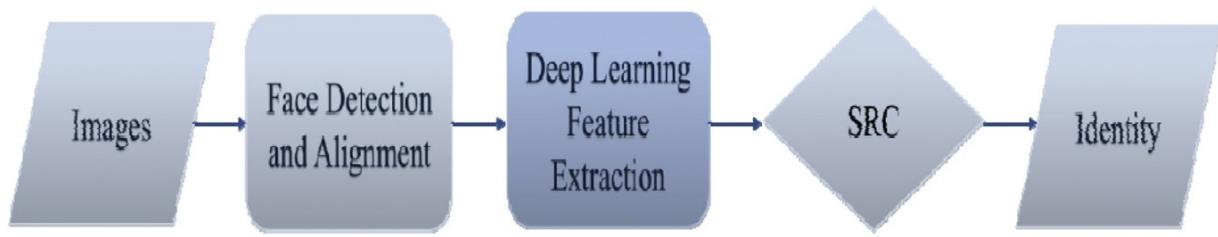
Figure 3 shows average accuracy against the base classification number  
(Renda, Barsacchi, Bechini and Marcelloni, 2019)

With a number of nin networks using the pre-training technique, the author has achieved 72.249% of maximum absolute test precision (Figure 3). It is the most effective way to establish the classification of the ensemble (to the detriment of information collection from other sources). The writer stops. It is much better than human precision and provides the same output as other projects done in the same dataset. The research by the author is not intended, contrary to earlier studies, to offer new ways in which facial expression is recognized in the field of deep learning. In addition, the contributions of authors are new for evaluating the efficacy of different clearly constructed ensemble approaches and for clarifying the variables that can be used to build numerous and exact neural networks.

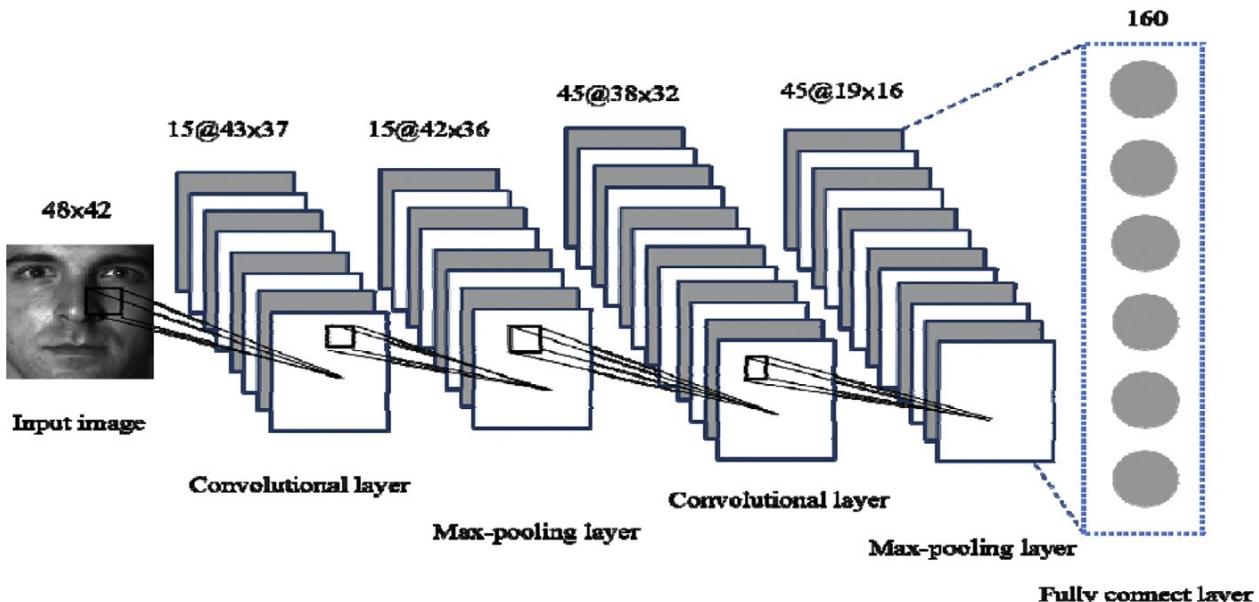
A systematic study of ensemble learning often focuses on variables that have not been discussed previously in literature: a scheme that blends the efficiency of simple classifiers with an increase of the size of the group. The authors propose that the practitioners will describe combination and aggregation technologies and contribute to more effective approaches to the use of deep-seated CNN sets. Recent research is limited to knowing the face. Nevertheless, the authors claim that the recorded findings are extremely typical for classifying computer vision tasks using neural networks, as the model and techniques proposed are not specifically involved.

### 2.2.2 Deep Sparse Detection System Representation Classification

With this paper, the authors (Cheng et al. 2019) propose to learn the high level features of sparse representation to identify the image through a two layer Convolutional Neural Network (CNN). Function extraction plays a key role in defining and classifying real-world pattern behaviors. The full clarification of the input face image greatly improves the performance of the facial recognition system. The "Sparse Representation Classifier" (SRC) is a normal facial classifier which depicts the facial image sparsely by means of a subset of training data, which is known for being insensitive to feature choice. A carefully chosen exactor function demonstrates SRC's improvements in efficiency. The results of the experiments show that the method proposed exceeds other data set approaches.



(a)



(b)

*Figure 4 Shows the complete proposed system architecture (Cheng et al., 2019)*

The complete design of the computer is shown in Figure 4. The proposed CNn model, which provides highly compact prediction characteristics to define analysis, comprises two max conversion layers and one fully connected layer. After conditioning, the output feature maps of the CNN model are used to complete SRC's ID mission. Caffe, a deep-seated open source software framework commonly used only in deep IT, implements the CNN architecture proposed. In the CNN information architecture there are two max core convolution layers, followed by a completely connected layer and a softmax output layer that define groups during training. The layer is replaced by the SRC during the test point and the data is transmitted from a completed layer to the SRC.

In a series of experiments on four commonly used face-to-face bases, including the Extended YALE B, AR, MIT and ORL-face databases, the proposed reconnaissance scheme was validated. We used two test methods in these experimental studies as seen in the state of the art. Half of the photographs of individuals are used in the first assessment procedure (P1) as training data and the remainder as evaluations. The second research protocol (P2) follows a ten-fold cross-validation strategy. SRC is correctly contrasted with the efficiency of the scheme with other canon technologies for Extende YALE B and AR data bases, as classification of both P1 and P2 assessment protocols. The architectural efficiency is assessed by MIT and the ORL face the P2 evaluation protocol. The following article also clarifies the specification for the sparse extraction of functions of the CNN architecture. **Figure 5** displays the four sets of tests for the validation of P2.

Dataset	Recall	Precision	F1-score
Extended YALE B	0.9954	0.9939	0.99465
AR	1	1	1
MIT	1	1	1
ORL	0.9925	0.9963	0.9943

*Figure 5 Displays findings for four P2 validating face datasets.*

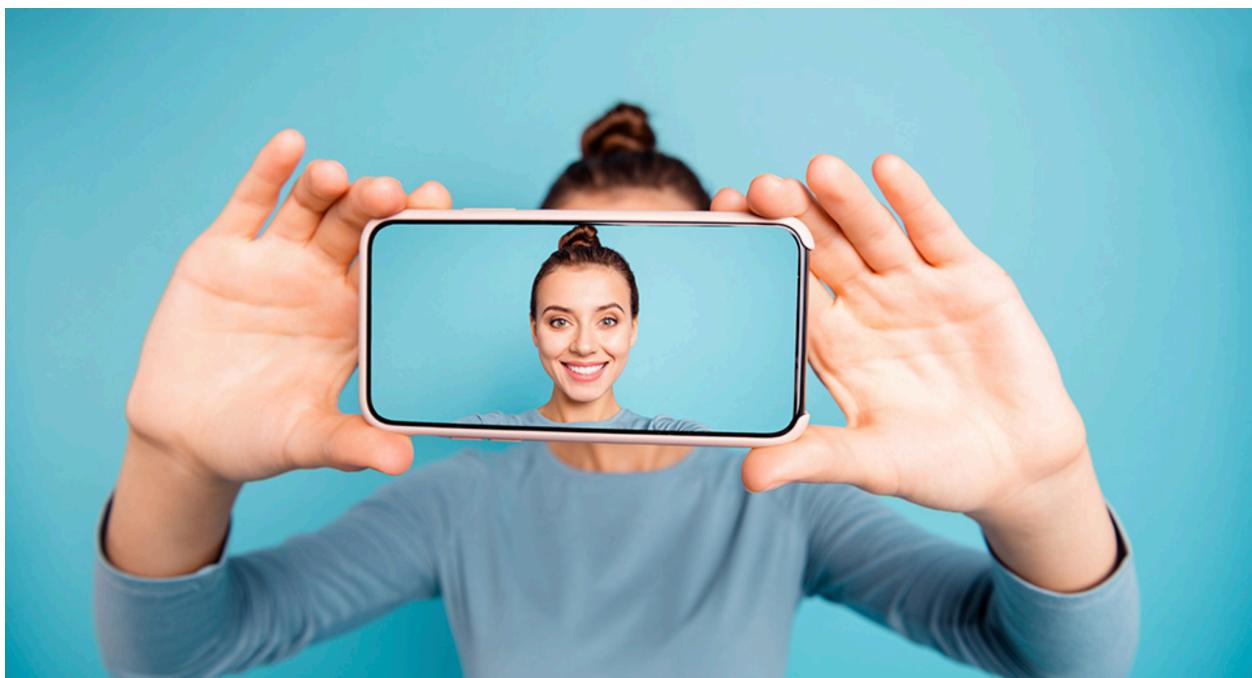
SRC delivers better results in classification even with the easy way of extracting the function. The proposed approach shows that the SRC efficiency can be enhanced by choosing different features. The proposed system is especially immune to light changes and face image communication. Although the efficiency in image classification has been superior to CNN, using the small dataset it is still difficult to use a large number of well-trained parameters. SRC also tries to build a exercise dictionary to display a test picture, which also affects the performance of the SRC via the data collection.

## 2.3 Similar Systems

In this section, three similar systems are discussed, which has certain features of the proposed method. The three similar systems are IDLive Face, Eocortex, and Innovatrics.

### 2.3.1 Idlive Face

Especially on mobile devices, the use of facial recognition for authentication is becoming more prevalent. Yet with easy access to social media images, and advancements in digital and print image quality, biometric systems have security vulnerabilities that fraudsters can exploit to hack a facial recognition system successfully (R&D, 2020). It is crucial to establish whether the displayed face is real or an attempt to cut the device by providing an artificial image of it for face biometrics to achieve widespread acceptance as a better mode of authentication fully. Thus, automatic detection of presentation attacks, and detection of liveliness, has become a required component of any authentication framework for verification based on face biometrics. IDLive Face uses Facial Liveness Detection that has a better mode of authentication to reduce security vulnerabilities (**Figure 6**).

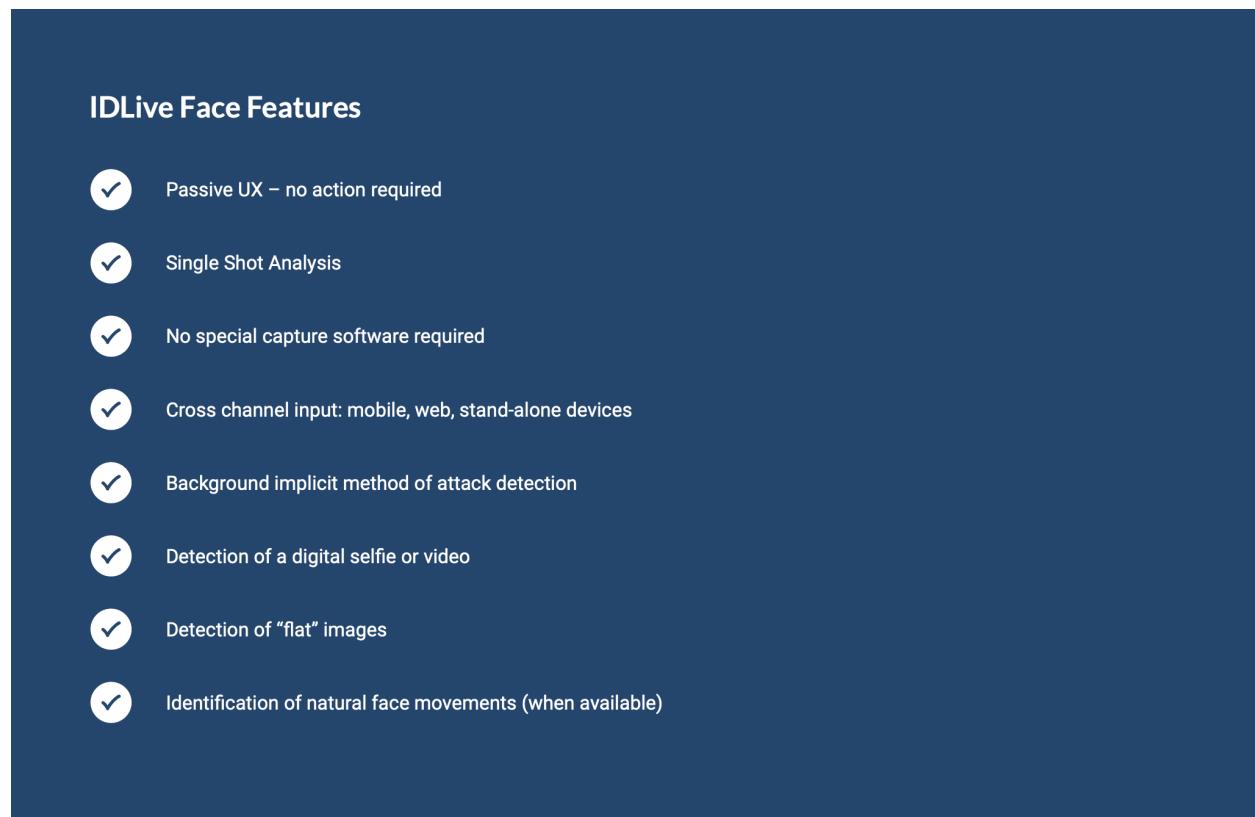


*Figure 6 shows IDLive Face Detection (R&D, 2020)*

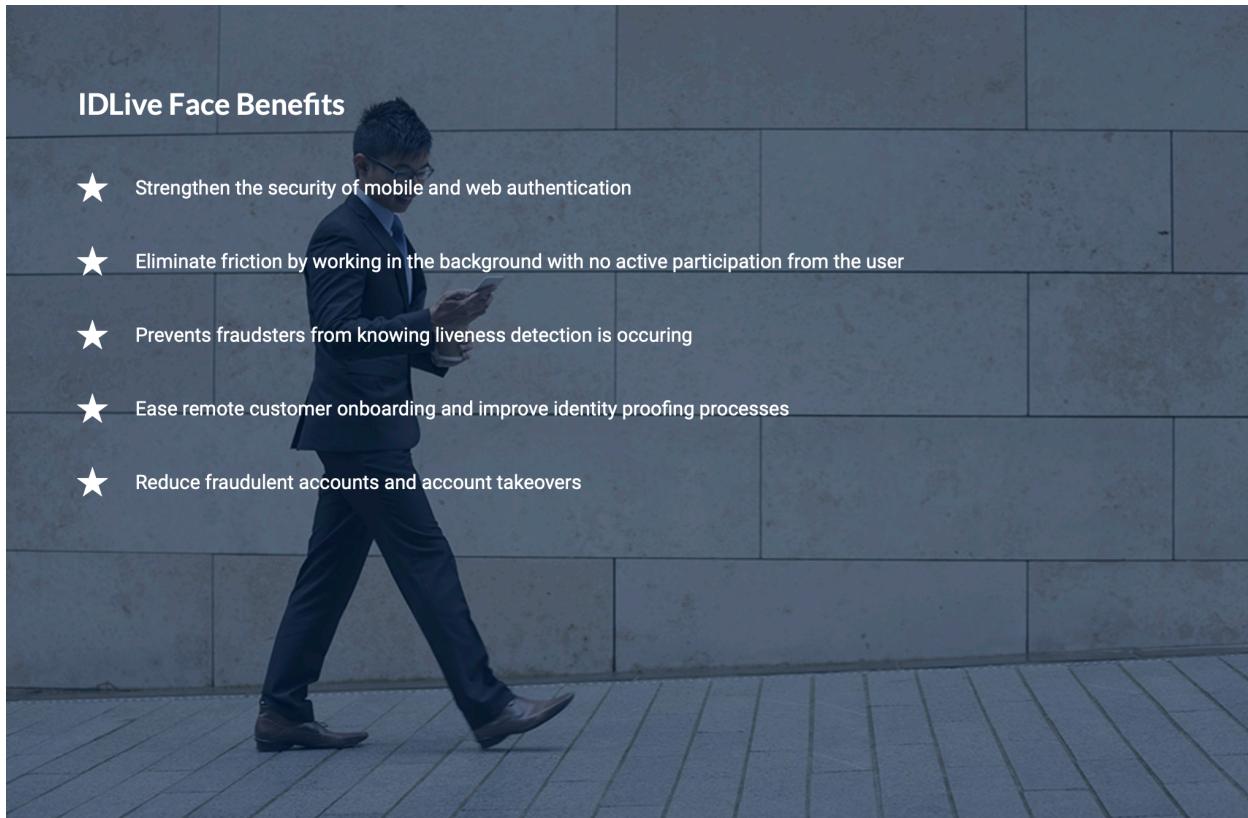
Detection of facial liveliness operates with a biometric device to assess and interpret physical characteristics and responses to determine if a biometric image is being taken from a living person present at the point of capture (R&D, 2020).

Most of today's facial animation technologies are "active," requiring users to blink, turn their heads, or switch back and forth with their hands. This leads to three issues: First, fraudsters can pose a picture with eye holes cut out, use a mask, or show a video to trick the system. Second, techniques used to respond to challenges warn attackers that they are being tested. And lastly, successful methods build the friction that delays the cycle of authentication, increases the rate of abandonment, and reduces the overall user experience (R&D, 2020).

IDLive Face is a passive facial vivacity detection SDK that works in the background with any biometric facial device to perform a frictionless test of liveliness. IDLive Face Features, Benefits, and Use Cases are shown in **(Figure 7)**, **(Figure 8)** and **(Figure 9)** respectfully.



*Figure 7 shows IDLive Face Features (R&D, 2020)*



*Figure 8 shows the IDLive Benefits (R&D, 2020)*

## Use Cases



Mobile and online face biometric authentication



Remote customer onboarding



Biometric-based device login



Physical biometric access systems

*Figure 9 shows the IDLive Use Cases (R&D, 2020)*

### 2.3.2 Eocortex Video Management Software

Eocortex Video Management Program is a complementary method for addressing a wide range and efficient monitoring tasks for modern educational institutions. The video analytics for Eocortex are shown in (**Figure 10**).

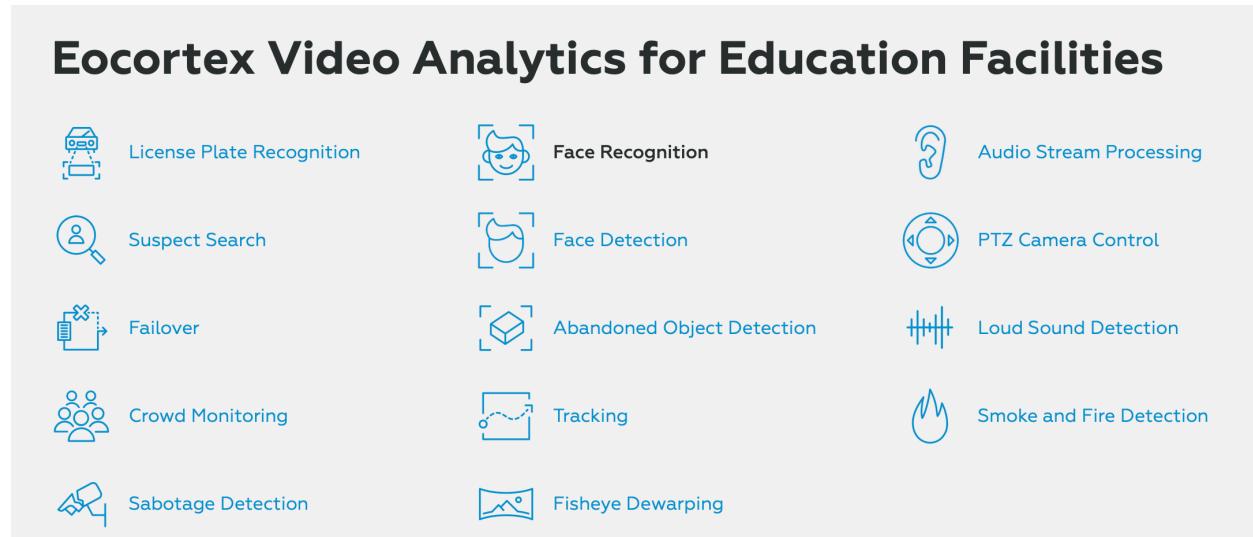


Figure 10 shows the Eocortex Video Analytics Features (Eocortex, 2020)

#### 1. Educational Facial Recognition

It helps reduce property damage, protects workers and students from an educational institution's life and health risks (**Figure 11**).

How it works: See all the faces in the field of view of the camera. When photos are detected, the computer, telephone or e-mail receives automatic alerts. Generate reports with a detection time indication for individuals with reported presence. JPG format save faces find.

Benefits: You don't have to watch 24-hour video displays. An individual who has reached the field of view of a camera installed in an off-limit zone and is prohibited from being in an area can be identified by the face detection module. It can also avoid incidents that endanger the protection of staff, students and institutional properties. In addition, the photos on the faces stored in the database can be used to investigate injuries and related events with details on their time and place of detection.

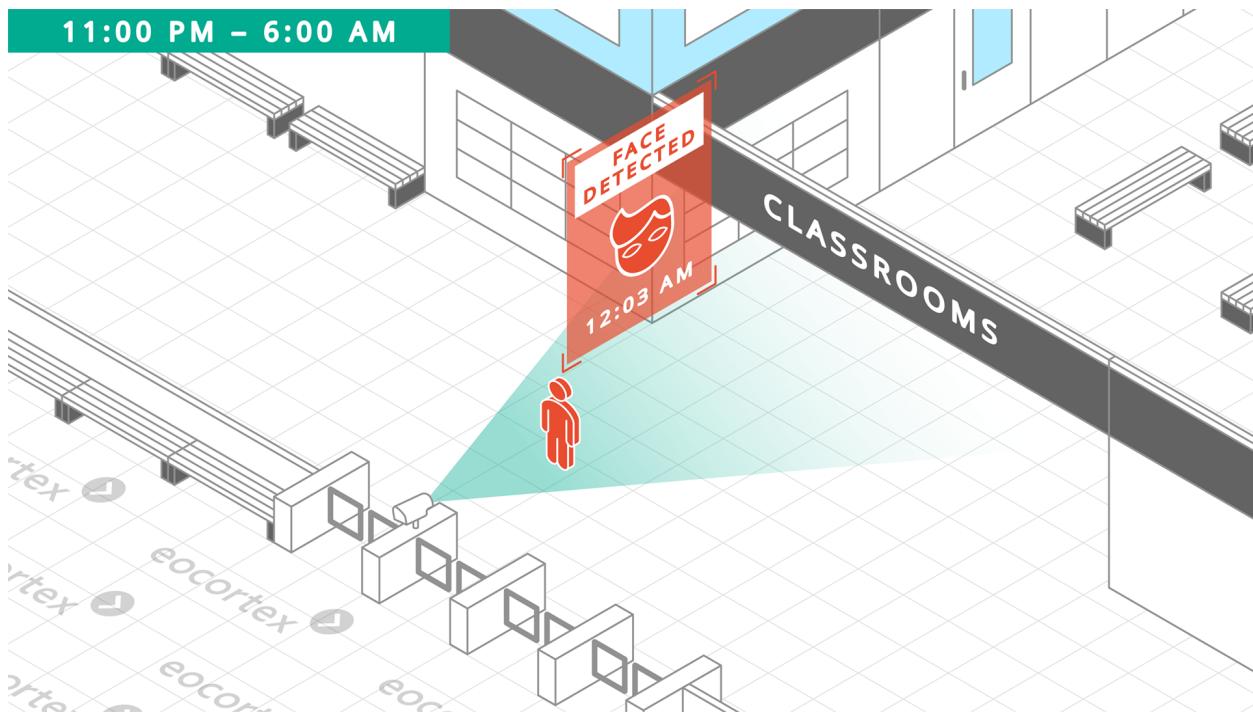


Figure 11 shows the Face Detection (Eocortex, 2020)

## 2. Educational Face Acknowledgement

It helps to automate and track the access of citizens to the territories and facilities of an educational institution (**Figure 12**).

How it works: Incorporate the module into a control system for hotel entry. Build a "trusted" or a "blacklisted" photo archive. Receive automatic alerts to your computer, mobile or e-mail about actions by individuals who do not have rights to respond to it. Check the established face fragmentation in the video archive, and search people in the visual archive for their images.

Benefits: Don't have to use workers to test admission to any premise. It also can provide automatic access to those people who have acceptable permission to the institution premises, and monitor the time they spend there. It impedes the entry of unauthorized individuals into institution premises. Therefore, using biometric control systems, it would be able to guarantee a high degree of protection for employees, students, and facilities.

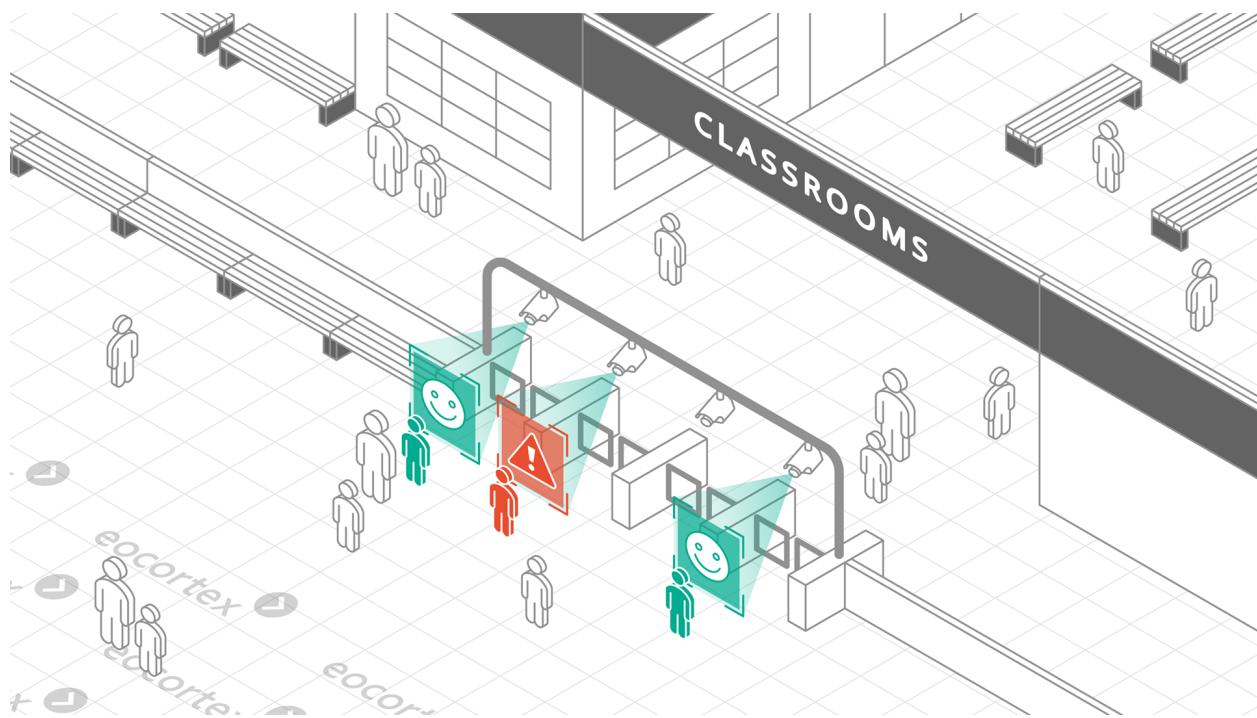


Figure 12 shows the Face Recognition (Ecortex, 2020)

### 3. Suspect Search for Educational Facilities

It is preventing and prosecuting crimes within an educational institution's jurisdiction (Figure 13).

How it works: This enables the production of a freeze frame and video clips in series of images of similar individuals from various cameras. In the preloaded layout of the premises it draws the direction of movement of the object. You can search for images in a video archive by type, color, scale, and position using the downloaded videos.

Benefit: The path of a person searching with a Suspect Search application can be reconstructed for up to one minute. This will allow a suspected offender to be rapidly located and arrested and security forces deployed. It can thus guarantee the security of the staff and students of an educational institution, preventing house harm.

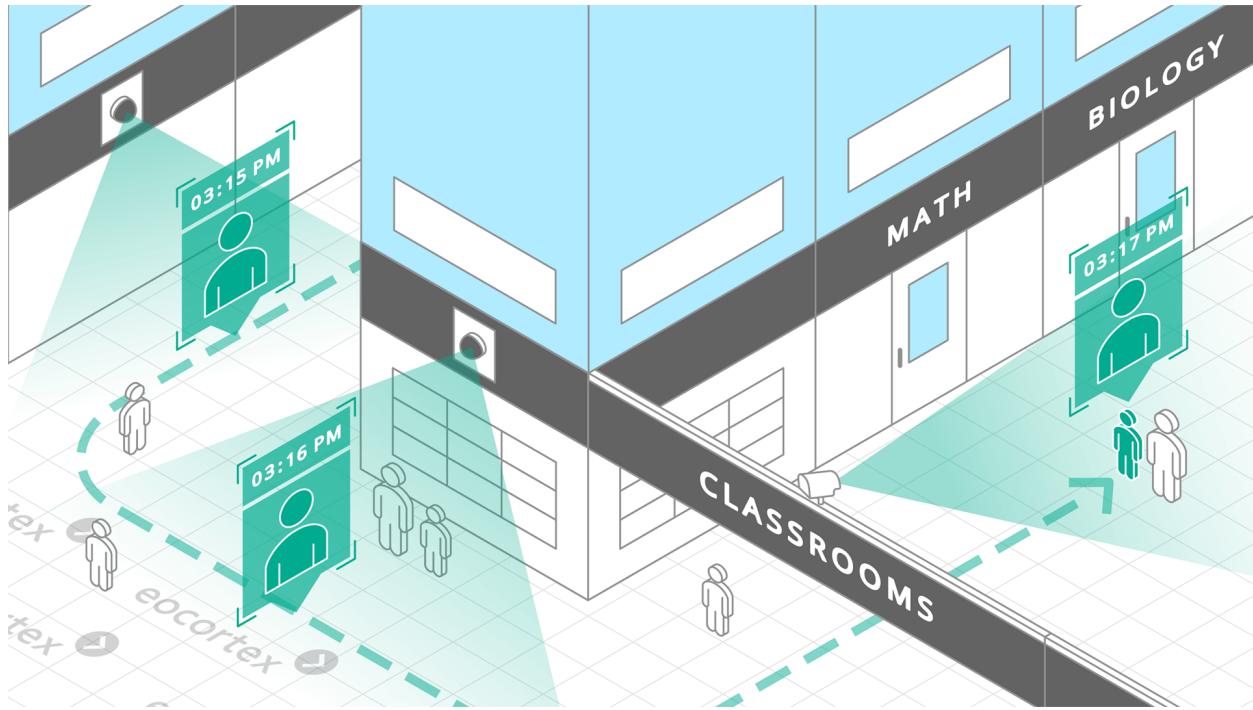


Figure 13 shows the Suspect Search (Eocortex, 2020)

### 2.3.3 Smartface

SmartFace is a high speed, scalable, face recognition server platform capable of processing multiple streams of real-time video in parallel. Leveraging the industry-leading algorithm of Innovatrics, SmartFace makes it simple for device integrators to integrate face recognition into their solutions (Innovatrics, 2020).

SmartFace is a fast deployment without requiring biometric skills. Save time and save money. Built listening to field requirements, SmartFace solves the usual problems associated with face recognition SDKs such as lack of specialist biometric skills, long integration times, and video file work problems, multiple IP camera streams. By design SmartFace is simple to implement, potentially saving hundreds of working hours and shortening ROI cycles dramatically. **Figure 14** shows the features of SmartFace.

## Key Features

-  **FACE DETECTION & TRACKING**  
 Detects and tracks faces fast and accurately in multiple video streams
-  **REAL-TIME FACE IDENTIFICATION**  
 Quickly identifies faces from watchlists; designed to send automated real-time alerts
-  **AGE & GENDER DETECTION**  
 Estimates age and gender, augmenting people counting data with advanced demographics
-  **WATCHLIST MANAGEMENT**  
 Easy-to-configure watchlist management through REST API and GUI
-  **MULTIPLE IP CAMERA PROCESSING**  
 Manages multiple camera streams per server without compromising speed or accuracy
-  **HARDWARE INDEPENDENT**  
 Operates with wide range of IP cameras and server platforms

Figure 14 shows the SmartFace Features (Innovatrics, 2020)

## Use Cases

### 1. Security and Surveillance

Track large numbers of people and use real-time face recognition and blacklist scanning to easily recognize possible security threats at airports, public meetings, or sports arenas (**Figure 15**).

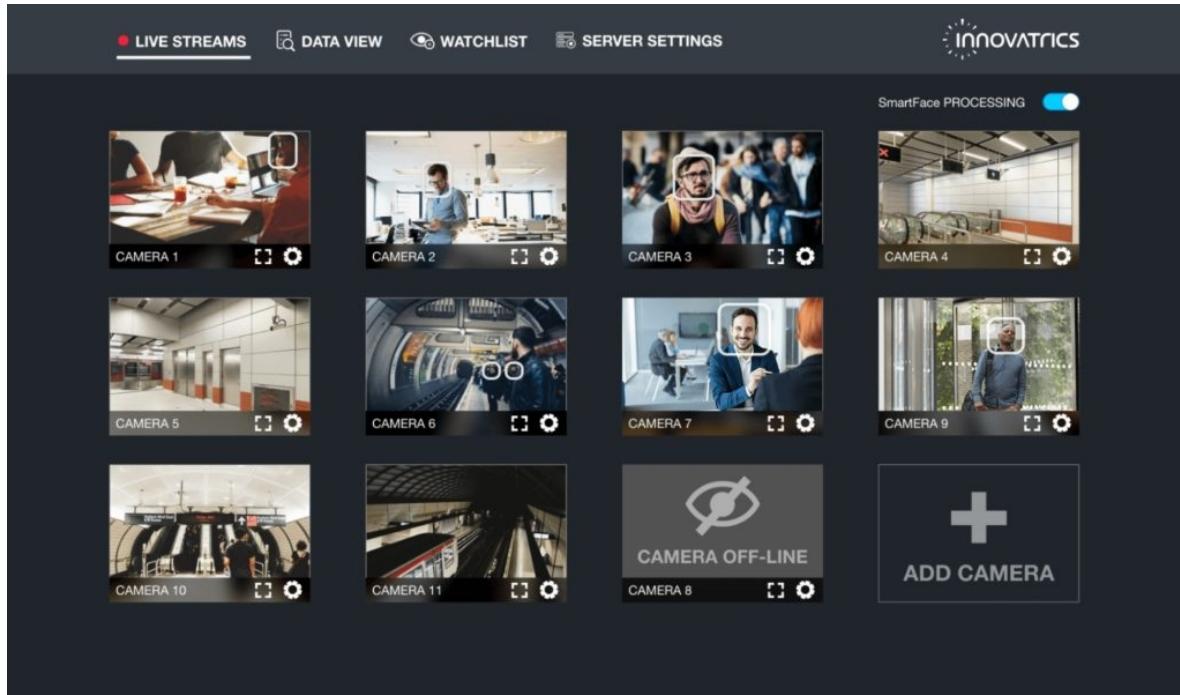
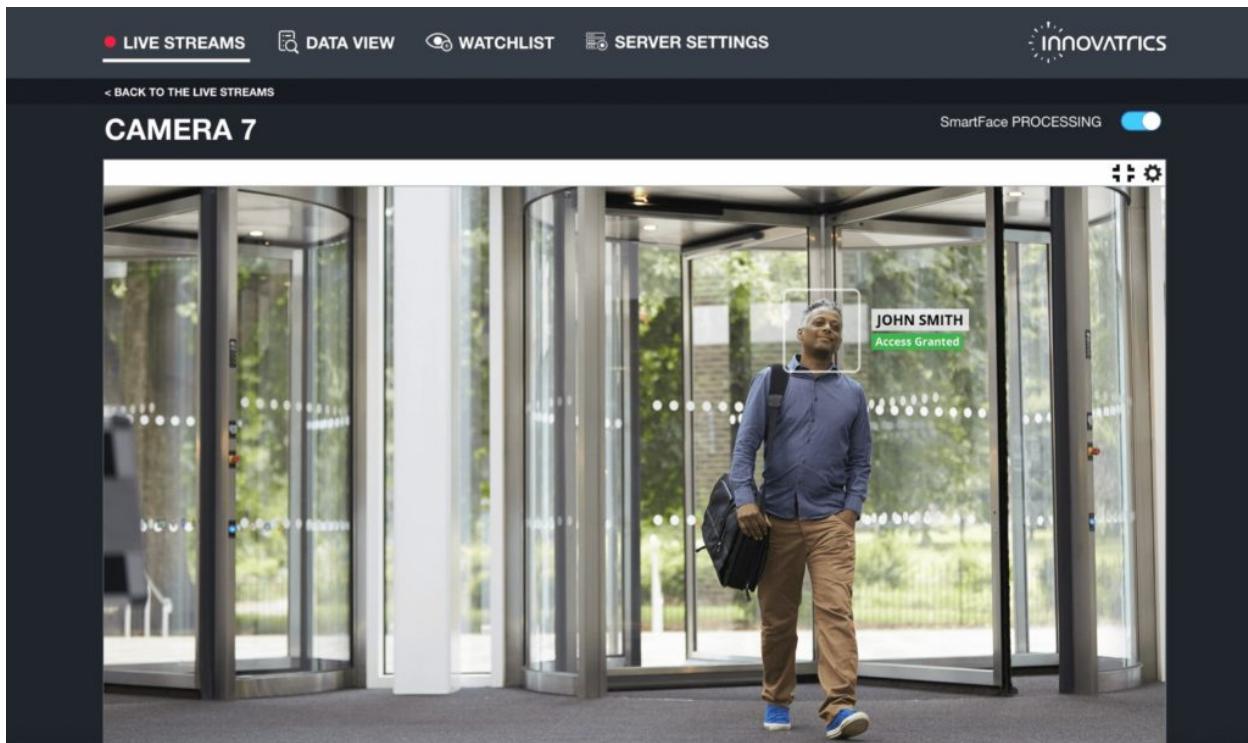


Figure 15 shows the Security and Surveillance (Innovatrics, 2020)

## 2. Access Control

Provide a secure environment for your staff and guests by using facial biometrics to monitor access and monitor individuals at your premises with precision (**Figure 16**).



*Figure 16 shows the Access Control (Innovatrics, 2020)*

## 3. Retail Analytics

Carry out detailed in-store consumer research using facial biometrics to provide demographic information. Quickly determine how many customers reach retail stores, time spent in-store, gender splitting, age demographics, and much more. Creating a consumer profile and measuring visit frequency, conversion rates, seasonal patterns, and outliers (**Figure 17**).

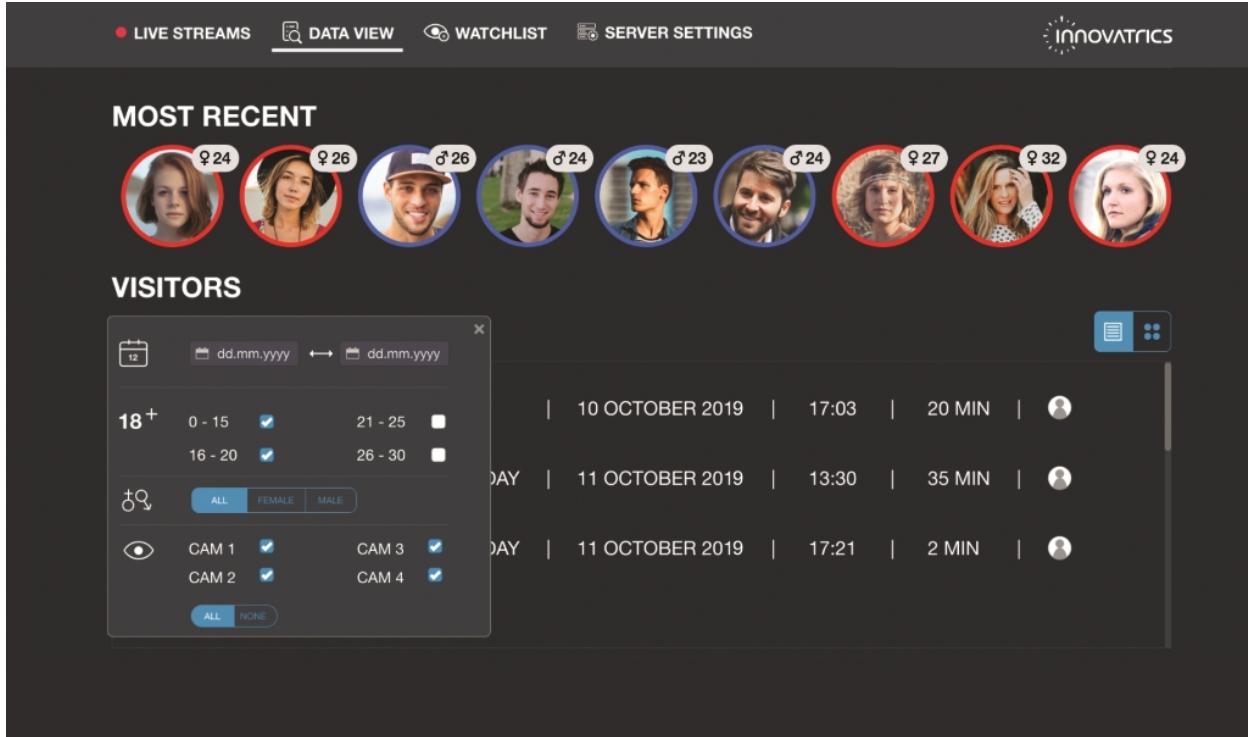


Figure 17 shows the Retail Analytics (Innovatrics, 2020)

#### 4. Loyalty Programs

SmartFace uses facial recognition to enhance the VIP customer experience. Immediately after entering the premises, identify the key clients and customers, and provide them with exceptional services. Build customer return lists automatically and reward the right ones accordingly (**Figure 18**).

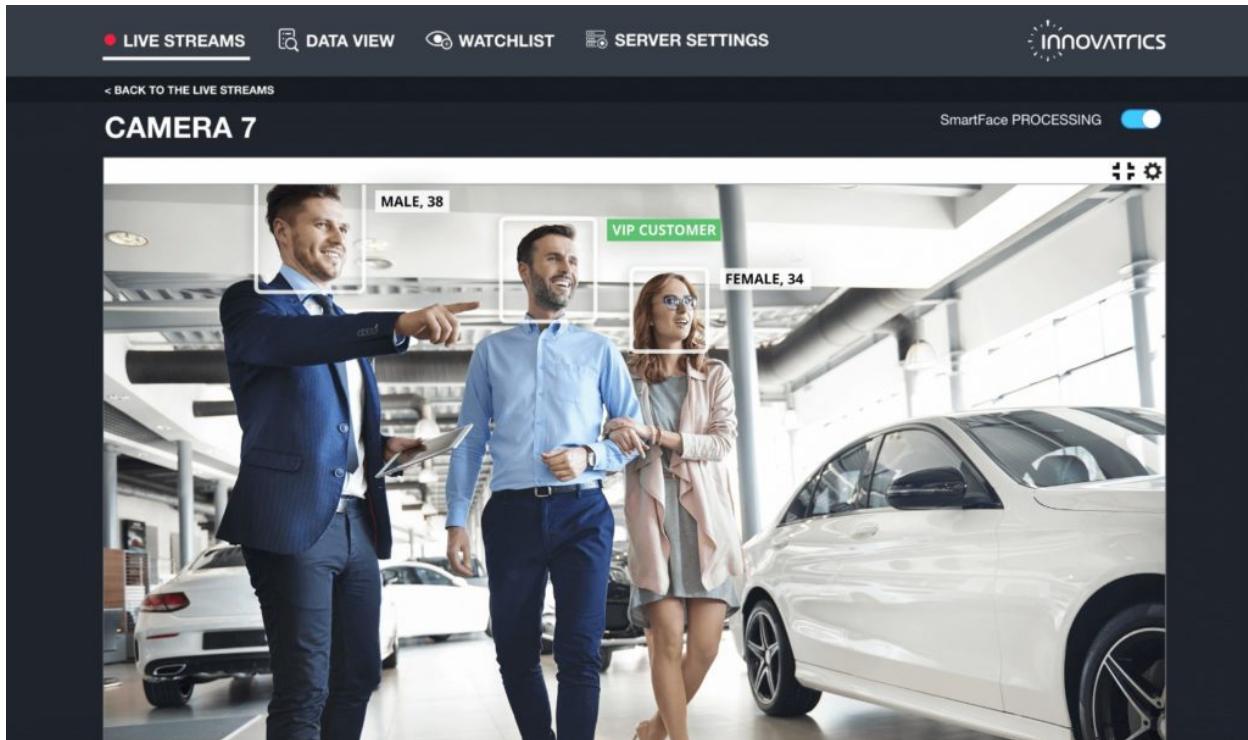


Figure 18 shows the Loyalty Programs (Innovatrics, 2020)

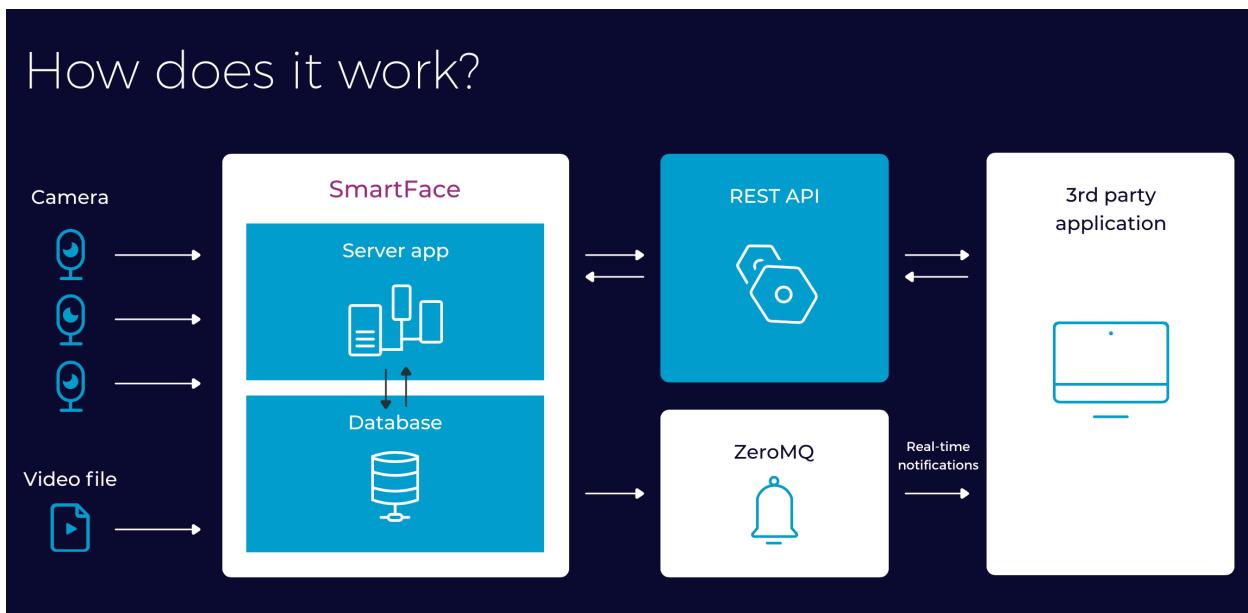


Figure 19 shows the Loyalty Programs (Innovatrics, 2020)

**Figure 19** shows the flowchart of the SmartFace System that is built by Innovatrics.

The technical specification of SmartFace is shown in **Figure 20**.

TECHNICAL SPECIFICATIONS	
<b>HW &amp; SW REQUIREMENTS</b>	
<b>Operating system:</b> Windows Server 2016 (x64), Windows 10	
<b>Database:</b> MS SQL Server 2016 +	
<b>Storage:</b> Minimum 2 GB for SmartFace + approx. 10 MB/camera/day	
<b>Supported cameras:</b> All IP cameras supporting Real Time Streaming Protocol	
<b>Supported video formats:</b> All standard video formats	
<b>Supported GPU:</b> CUDA compatible, min. 4 GB RAM	
	
	<b>SIZING RECOMMENDATIONS</b>
	<b>RAM per camera*:</b> 4 GB
	<b>CPU per camera*:</b> 1x 3 GHz CPU physical core
	<b>Bandwidth per camera*:</b> 4–8 Mbps
	<b>Multiple faces tracking:</b> Yes *1 Full HD camera (1920x1080), 25 fps
	<b>INTEGRATION</b>
	<b>Interface:</b> REST API
	<b>Message notifications:</b> ZeroMQ

*Figure 20 shows the Technical Specifications (Innovatrics, 2020)*

## 2.4 Summary

All three systems have few similarities with the proposed method. Some of them vary from each other. But all three system lacks to check for behavioral analysis to get more precise results. Smart Analysis System (SAS) has both facial recognition and behavioral analysis to get more consistent results. SAS will overcome most of the cons of these systems to provide a better solution. Some of the methods require high technical specifications such as CUDA compatibility with a minimum of 4 GB Ram, whereas SAS requires minimum Intel Graphics to produce results. The developer will try to implement more features that are mentioned in the above systems to make it interactive and user friendly.

From the research, gun violence can be prevented by implementing SAS in every school premises. It will help to detect unauthorized individuals from school grounds and alert the

authority to take necessary action to avoid misfortune. AI could play a supportive role, as well. AI endorsing algorithms can retain guns safe and reasonable for lawful, skilled owners while keeping them out of the hands of high-risk persons. The theory is that AI algorithms could lure on massive data sources to evaluate a person's risk before they are allowed to buy a gun. These data facts might include criminal background drafts, medical archives, employment positions, and even online interactive data to evaluate their risk profiles.

People who have clean histories and other pointers of fidelity and justice would receive lower insurance premiums. Those who have more erratic accounts would be required to pay higher premiums, with the most significant risk individuals potentially being valued out of the market. For this to work, gun protection would need to be compulsory in the same way that auto protection is required. However, if applied, it might link the gap between people on either side of the debate and help collective furnace progress toward reducing gun violence. Avoiding mass shootings is a complex but vital task, and many issues need to be addressed.

Luckily, we live in the most technologically progressive age in history, and we have admittance to more data every day. Artificial intelligence can aid us in making sense of that info by recognizing trends we can use to create effective solutions. On gun ferocity and so many other urgent subjects, we can influence technology to find answers to the most challenging issues of our time.

## Chapter 3: Technical Research

### 3.1 Chosen Language For Programming

The language for programming is used in the development of software programs, scripts or other machine instructions for software programmers. Computer Vision uses two primary programming languages: C++ and Python (Consulting, 2020). The advantages of each language of programming are shown below.

C++	Python
1. All OpenCVs are free of charge. Could use OpenCV freely and access the source and address bugs if necessary for commercial applications.	1. Python is mainly a simple language to learn compared with C++. Learning a first language is also high.
2. The OpenCV library is performance-optimized. Most algorithms are implemented using CUDA.	2. Python OpenCV offers a versatile learning platform and experiments with computer vision and machine learning.
3. Developers will use OpenCV in your mobile app, or as your web application's backend.	3. Developers have access to a large number of libraries written for Python while using OpenCV (Python).
4. OpenCV is a blend of individuals from rising fields and industries. OpenCV is funded by Intel, AMD and Google businesses.	4. Python is also a popular web-building language. Using OpenCV (Python), along with web frameworks, is very simple.

Python was chosen as the language of programming in this project. Python is a language for programmatic use that allows both beginner and seasoned programmers to quickly convert ideas into code. It is the most popular, mature and well-supported languages for machine learning, so many developers use Python for cv. Computer Vision allows computers to distinguish objects by means of digital images and videos on the other side. Implementing a CV via Python can help developers automate viewing tasks. While Computer Vision supports other programming languages, Python is the dominant market.

### 3.2 Integrated Development Environment Chosen

The developer has chosen Xcode to develop Smart Analysis System. Developers using macOS as their primary operating system can use the Xcode IDE. Developing applications for Apple products is a crucial development environment. The Xcode IDE is central to the experience of Apple's development. The Xcode version that the developer is using is 11.4.1. Xcode is fitted with a well-designed UI builder, which is simple to use. Excellent for filling out code. Using Xcode, a developer would be able to learn profiling and heap analysis. Xcode simulator helps you to quickly check the software while you're creating it in an iPhone-simulated environment. The app store has a vast audience able to pay for items (Sarkar, 2020).

### 3.3 Libraries Chosen

The project will include OpenCV (open vision library) as it focuses on computer vision. The project must create a house. OpenCV is a free-to-use open source repository for enterprise and academia. You can get it from <https://opencv.org/>. The explanation why the researcher choose this library is because the programming language chosen by the researcher is a deep learning module using python. In this library, image frames are read to train the human detector model and to process the frame for detection and tracking of human beings.

OpenCV has the benefit of being a multi-platform system. It supports Windows as well as Linux, and more recently, Mac OS X. OpenCV has so many features that at first, it can sound intimidating. The secret to obtaining good results when using OpenCV is a good understanding of how such approaches work.

An architecture focused on recurring and evolving neural networks is the engineering approach to solving this problem for behavioral analysis detection. The first neural network is a conversion designed to extract and decrease high image characteristics. We're going to use a pre-trained Google interface called Inception. ImageNet Wide Visual Recognition Challenge inception-v3 data collection trains (US, 2018).

### 3.4 Database Management System Of Choice

DBMS is software for the identification, alteration, retrieval and management of data in a database. Data sort, field names, storage arrangements and file configuration usually are controlled by DBMS. It also lays down guidelines for validation and data management. A data management processing software customer is relieved by DBMS. The DBMS software is used for four-generation query languages such as SQL to interact with a database.

	MySQL	Microsoft SQL Server
Background	<ul style="list-style-type: none"> <li>• Oracle company has built and owned MySQL</li> <li>• First released in 1995</li> <li>• IDE tools: MAMP</li> </ul>	<ul style="list-style-type: none"> <li>• Microsoft SQL Server is a Microsoft Company owned and built</li> <li>• First released in 1989</li> <li>• IDE tools: Management Studio</li> </ul>
Pros	<ul style="list-style-type: none"> <li>• Available for free</li> <li>• Able to work with other databases such as MongoDB and Oracle</li> <li>• User-friendly interface</li> </ul>	<ul style="list-style-type: none"> <li>• Fast and stable</li> <li>• Able to adjust and track performance levels</li> <li>• Works well with other Microsoft products</li> </ul>

	MySQL	Microsoft SQL Server
Cons	<ul style="list-style-type: none"> <li>• Need to pay for support</li> </ul>	<ul style="list-style-type: none"> <li>• Too expensive to afford</li> </ul>

MySQL has been chosen as the DBMS to be implemented in this project. This is due to a distinct storage-engine architecture that facilitates system administrators to configure a flawless performance of the MySQL database server. MySQL is built to satisfy even the most demanding applications while maintaining maximum capacity, full-text indexes, and specific memory caches for improved efficiency.

Through MySQL's round-the-clock assistance and client indemnification, all concerns and worries that occur with an open-source solution can be put to an end. MySQL's secure database and trusted software combine to provide successful transactions for large-volume ventures. This allows for quick and easy maintenance, testing, and updates while improving the end-user experience (US, 2018).

### 3.5 Operating System Chosen

The program of an OS that enables a user to run certain applications on a computer device is the most popular. The OS also provides services for the management and efficiency of any additional activated program and memory allocation.

Mac OS Catalina Version 10.15.4 has been chosen as the OS to be implemented in this project. One advantage of macOS over Windows is a user interface that is easier and more efficient. Remember that both operating systems have functional and convenient graphical user interfaces or GUIs. Another critical benefit of macOS relative to Windows is that one of the reasons why Mac computers are better than PCs based on Windows is less vulnerable to security problems and bugs. Like Windows, the types of malware created for macOS including viruses and worms are lower (Bonheur 2020).

### 3.6 Web Browser Chosen

The developer has chosen Safari to run the program as an Internet browser. Even Safari is not the only browser that can run the program. Mozilla Firefox, Chrome, Microsoft Edge, and several other web browsers would have no trouble running and using the application. Safari is the default browser of Mac OS. Safari has speed support, and it's easy to use. The page load times are amazing, and it offers all the security features. It cleans up unwanted garbage. It's perfect for Mac users and free to download, it's incredibly quick for Mac users to download. Developers can add extensions from Safari Extension. It has a clean and straightforward interface. It is easy to bookmark, and several tabs can be opened simultaneously (Soffar, 2019).

### 3.7 Summary

Finally, the author carried out the technical work to define the specification for this project's programming language, library code, database management and operating system. Different language programs and database management systems were comparable and Python and MySQL were concluded that this project was to be introduced. Furthermore, the most important aspect of the project is to use the OpenCV library, which plays a crucial role in the development of a network of computer vision experts.

## Chapter 4: System Development Methodology

In Agile, software development strategies are defined in order to emphasize through team execution and collaboration, ongoing preparation and learning instead of trying to do something at the end instantaneously. Agile strives to keep the process lean and produce minimum viable products (MVPs) that go through several iterations before everything is final. Feedback is continuously gathered and applied, and in all, it's a far more collaborative process where everyone works together for one objective. Agile software program improvement is an umbrella term for a fixed of frameworks and practices primarily based on the values and principles expressed within the Manifesto for Agile software improvement and the 12 standards in the back of it (**Figure 21**). For example, Scrum and XP under the Agile umbrella are commonly used structures that can help you become more agile (Paradigm, 2020).



Figure 21 shows the Agile Methodology (Logica, 2019)

## 4.1 Scrum

Scrum is a system through which people can solve complex adaptive issues while producing goods of the highest possible value constructively. Scrum itself is a fundamental mechanism for successful collaboration between teams on sophisticated products (**Figure 22**).

The entire cycle of development is therefore composed of a few short cycles of iteration called Sprint.

- Every sprint takes between 1 and 4 weeks to complete.
- Using the Product Backlog to handle the needs of the company and is a collection of value-sorting criteria.
- In each iteration, the Scrum team selects from the Product Backlog to work the highest priority criteria.
- At the Sprint system meetings, the chosen criteria are addressed, evaluated, and estimated to achieve the corresponding iteration targets and implementation schedules, which we call the Sprint Backlog.
- The version will have a Regular standing Scrum every day. By the conclusion of each phase, the Scrum team will invite businesses and stakeholders to discuss possible deliverables for the project.
- The team then checked the way it worked and proceeded to develop.
- Scrum is suitable not only for software development projects but also for any dynamic or creative project and experimentation as well as the design of organizational changes.
- In Scrum, self-organization is emphasized.

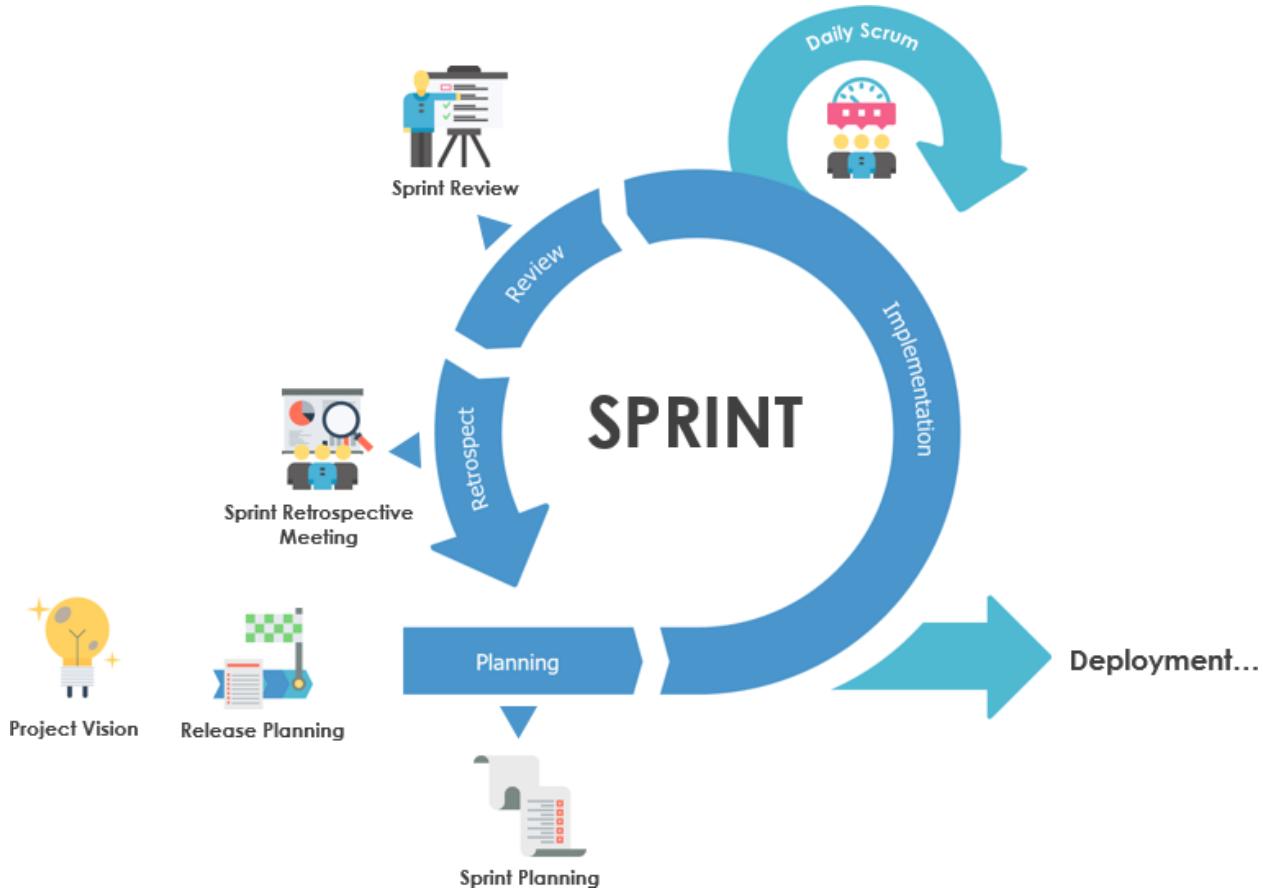


Figure 22 shows Scrum (Paradigm, 2020)

## 4.2 Extreme Programming (XP)

Extreme Programming (XP) for the production team is a high quality and enhanced quality of life engineering software approach. It provides a wide variety of applications. XP is the most common of the agile frameworks concerning effective software development engineering practices (**Figure 23**).

The phases in Extreme Programming (XP) are given below:

- It typically takes one or two weeks long.
- Its iterations are much more likely to alter.
- As long as the team has not started working on a specific function, in exchange for the un-started role, a new equivalent size feature can be switched into the iteration of the XP project.
- Act in strict order of priority.

- The customer (Scrum's Product Owner) gives priority to the features to be created, and the team is expected to work on them in that order.
- XP does prescribe any engineering practices.
- In XP it illustrates substantial constraints in engineering practice.

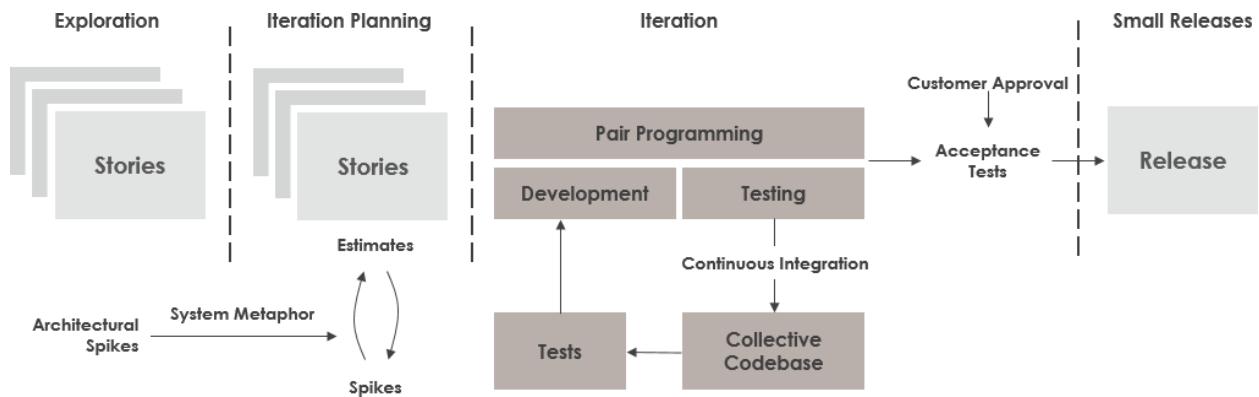


Figure 23 shows Extreme Programming (XP) (Paradigm, 2020)

The approach of extremes was chosen to enhance the systems when developing the Intelligent Analysis System (SAS). One of the software developing methods used to improve the software quality and to make customer change simple is extreme programming methodology. For example, the system may need to change system features for a few months, meaning that the best approach for use is extreme programming compared to other methodologies with the advantages of changing requirements rapidly. The theory of system design must be understood before the system is developed to allow developers to make quick changes to avoid the creation of time consuming systems. This approach is based on data obtained in first place. After testing has been completed, the developer can start designing the system using an ongoing test method to verify the order until the system can operate without errors or system errors. The process for research is also designed to ensure that consumers meet their needs and are followed up after the final order has been used. The better choice for development of this Smart Analysis System (SAS), therefore, is extreme programming.

## Chapter 5: Research Methods

### 5.1 Introduction

This section addresses the methods of analysis to be used for this project. Qualitative techniques are used to obtain answers to questions which the researcher needs to learn. The qualitative approach was selected for collecting the data in this project. The questionnaire was chosen by the researcher and will be carried out to determine the needs of this project. This approach is selected because the questionnaire takes less time. The questionnaire will be handed out through Google Forms. Participants play a significant role in collecting accurate details. Therefore it is crucial to determine which participants are the target. For the questionnaire, the researcher intends to provide 50 participants from various levels of education and occupation to ensure the findings are equal and good. The results will then be analyzed and illustrated via a chart in the chapter below.

### 5.2 Design

#### 5.2.1 Questionnaire

Demographic Profile	
Q1. Selection of your Gender. <input checked="" type="radio"/> Male <input type="radio"/> Female	Identifying interviewees' age.

Demographic Profile	
Q2. Selection of your Age group.  <input type="radio"/> Less than 20 <input type="radio"/> 20 - 30 <input type="radio"/> 31 - 40 <input type="radio"/> 41 - 50 <input type="radio"/> More than 50	To classify the age group of respondents.
Q3. Please select your nationality.  <input type="radio"/> Malaysian <input type="radio"/> Foreigner	To identify the nationality of respondents.
Q4. What is your current education level?  <input type="radio"/> Certificate <input type="radio"/> Foundation <input type="radio"/> Diploma <input type="radio"/> Degree <input type="radio"/> Master <input type="radio"/> PhD	To classify the education level of the respondents into six categories in general.

Demographic Profile	
Q5. What is your current employment status? <input type="radio"/> Student <input type="radio"/> Lecturer <input type="radio"/> Staff <input type="radio"/> Researcher <input type="radio"/> Other...	To organize the responses from a different career.
Safety Perception	
Q6. Please select the type of the institute. <input type="radio"/> University / College <input type="radio"/> School <input type="radio"/> Other	To identify the type of institute of respondents.
Q7. How comfortable would you feel when you are roaming around your educational institute? <input type="radio"/> 1 Very uncomfortable <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 Very comfortable	To find out the safety perception of respondents.

Safety Perception	
<p>Q8. Please select the security issues you have faced before.</p> <ul style="list-style-type: none"> <li><input type="radio"/> Do not face any issues</li> <li><input type="radio"/> Being injured by others</li> <li><input type="radio"/> Being followed by others</li> <li><input type="radio"/> Being robbed by others</li> <li><input type="radio"/> Other...</li> </ul>	To get the security issues that have been faced by respondents.
<p>Q9. Do you worry that you or your family members and friends might become a victim of a crime?</p> <ul style="list-style-type: none"> <li><input type="radio"/> Yes</li> <li><input type="radio"/> No</li> <li><input type="radio"/> Maybe</li> </ul>	To understand respondents' opinions about becoming a victim of crime.
<p>Q10. Please select the actions that you have done in unwanted crime scenarios that occurred at your institution.</p> <ul style="list-style-type: none"> <li><input type="radio"/> Ask help from security guards</li> <li><input type="radio"/> Shout for help from other people at your institution</li> <li><input type="radio"/> Call police</li> <li><input type="radio"/> Call family members</li> <li><input type="radio"/> Other...</li> </ul>	To understand the action which will be first taken by the respondents when facing unwanted scenario.

Opinions Towards Current CCTV Implementation	
<p>Q11. Does your institute has installed CCTV?</p> <ul style="list-style-type: none"> <li><input type="radio"/> Yes</li> <li><input type="radio"/> No</li> <li><input type="radio"/> Maybe</li> </ul>	To identify how many percentage of respondents have installed CCTV in their living place.
<p>Q12. How likely would you use CCTV for security purposes?</p> <ul style="list-style-type: none"> <li><input type="radio"/> 1 Very unlikely</li> <li><input type="radio"/> 2</li> <li><input type="radio"/> 3</li> <li><input type="radio"/> 4</li> <li><input type="radio"/> 5 Very likely</li> </ul>	To get respondents' opinions towards the CCTV in terms of security.
<p>Q13. Do you think CCTV is helpful for security purposes? If no, why?</p> <ul style="list-style-type: none"> <li><input type="radio"/> Yes</li> <li><input type="radio"/> Other...</li> </ul>	To identify how many percentages of respondents feel CCTV helpful.
<p>Q14. Do you feel troublesome when looking back on footage of CCTV to identify particular events?</p> <ul style="list-style-type: none"> <li><input type="radio"/> Yes</li> <li><input type="radio"/> No</li> <li><input type="radio"/> Maybe</li> </ul>	To get respondents' experiences or opinions on looking back CCTV footage.

<b>Opinions Towards Current CCTV Implementation</b>	
<p>Q15. Did you use any analytics system before to prevent threats? If yes, please state all the features that you are familiar with.</p> <ul style="list-style-type: none"> <li><input type="radio"/> No</li> <li><input type="radio"/> Other...</li> </ul>	To identify respondents who have used the analytics system before.
<b>Opinion Towards Smart Analysis System (SAS)</b>	
<p>Q16. Do you think Smart Analysis System (SAS) that is implemented in CCTV can reduce the crime rate against juvenile safety for gun violence? If no, why?</p> <ul style="list-style-type: none"> <li><input type="radio"/> Yes</li> <li><input type="radio"/> Other...</li> </ul>	To get respondents' opinions on implementing SAS on CCTV.
<p>Q17. How likely would you use Smart Analysis System (SAS) in your institution?</p> <ul style="list-style-type: none"> <li><input type="radio"/> 1 Very unlikely</li> <li><input type="radio"/> 2</li> <li><input type="radio"/> 3</li> <li><input type="radio"/> 4</li> <li><input type="radio"/> 5 Very likely</li> </ul>	How much will SAS be used in your organization for the percentage of respondents.

Opinion Towards Smart Analysis System (SAS)	
<p>Q18. Do you think Smart Analysis System (SAS) will violate your privacy? If yes, why?</p> <ul style="list-style-type: none"> <li>● No</li> <li>● Other...</li> </ul>	To understand the consideration of respondents towards the system in terms of privacy.
<p>Q19. Please provide the features that can be implemented in Smart Analysis System (SAS).</p> <ul style="list-style-type: none"> <li>● Long answer text...</li> </ul>	To gather enhancements or improvement of the proposed system from the respondents.
<p>Q20. Overall, what is your opinion towards Smart Analysis System (SAS)?</p> <ul style="list-style-type: none"> <li>● Long answer text...</li> </ul>	To evaluate the proposed system.

### 5.3 Summary

In conclusion, it is possible to obtain a broad sample size, from which an investigator can generalize and represent the population. The respondent provides data that can be converted easily into quantitative data to enable the statistical analysis of the answers. The questions are uniform. The same set of questions applies to all respondents. This means that a questionnaire to test the reliability is easy to reproduce. A second researcher may then verify the same results with the questionnaire. In order to ensure the findings are accurate and precise the researchers must have 50 participants from different levels of education and jobs. The results are then interpreted and shown via a diagram in the following chapter.

## Chapter 6: Requirements Validation

### 6.1 Analysis Of Data

In order to determine what portion of the given data, the data analysis is an empirical and logical assessment process. This analysis procedure is just one of the various steps to be taken during a research experiment. Data are collected, checked and evaluated from various sources in order to draw some inference or hypothesis. Informative methods include data mining, processing of documents, business intelligence and visualization of data.

#### 6.1.1 Analysis Of Data Collected Through Questionnaire

##### Demographic Profile

Q1. Please select your gender.



50 responses

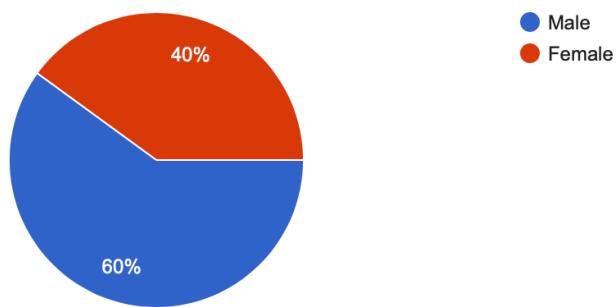
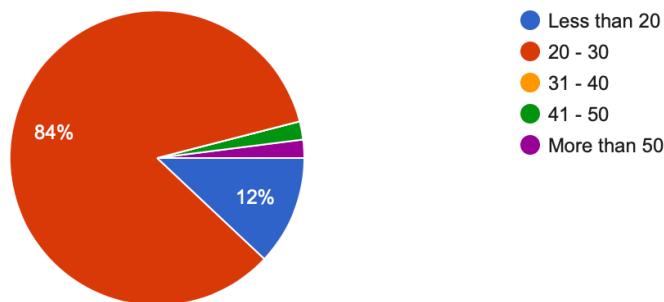


Figure 24 shows the Respondent Gender.

In question 1, the researcher has asked about the gender of the respondents. (**Figure 24**) shows that 60% of male and 40% female has taken the questionnaire. Thus, 30 males and 20 females have taken the questionnaire.

Q2. Please select your age group.

50 responses

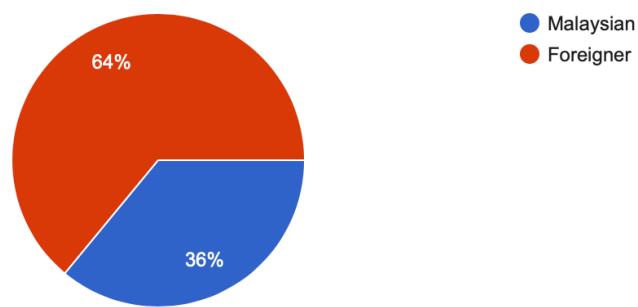


*Figure 25 shows the Respondents Age.*

In question 2, the researcher has asked about the age of the respondents. (**Figure 25**) shows that 84% of respondents fall under the classification of age (20 - 30). 12% in (Less than 20), 2% in (41 - 50), and 2% in (More than 50).

Q3. Please select your nationality.

50 responses

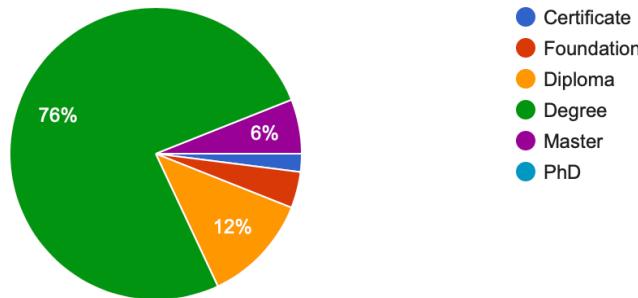


*Figure 26 shows Respondents Nationality*

In question 3, the researcher has asked about the nationality of the respondents. (**Figure 26**) shows that 64% of respondents are Foreigners, and 36% are Malaysian. Thus, 32 respondents are Foreigners, and 18 are Malaysian.

Q4. What is your current education level?

50 responses

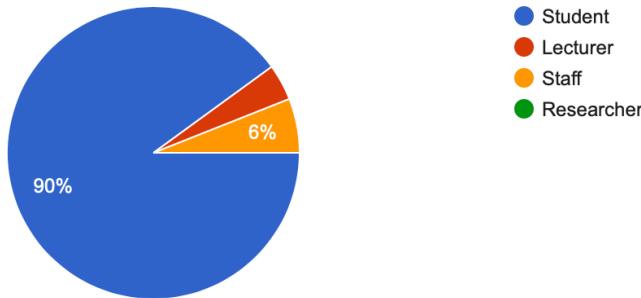


*Figure 27 shows Respondents Education Level*

In question 4, the researcher has asked about the education level of the respondents. (**Figure 27**) shows that 76% of respondents are doing a Degree, 12% are doing a Diploma, 6% are doing a Master, 4% are doing Foundation, and 2% are doing Certificate.

Q5. What is your current employment status?

50 responses

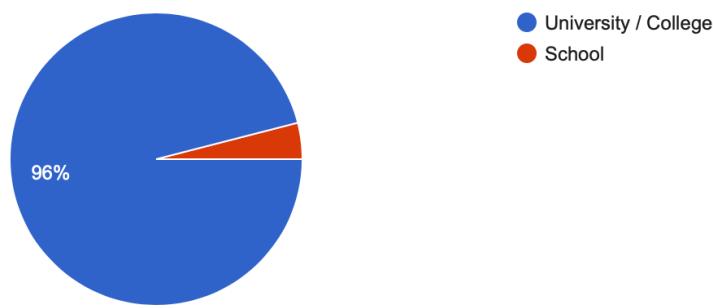


*Figure 28 shows Respondents Employment Status*

In Question 5, the investigator questioned the respondents about their job status. (**Figure 28**) suggests that the students are 45, the staff is 3, and the lecturers are 2.

Q6. Please select the type of the institute.

50 responses

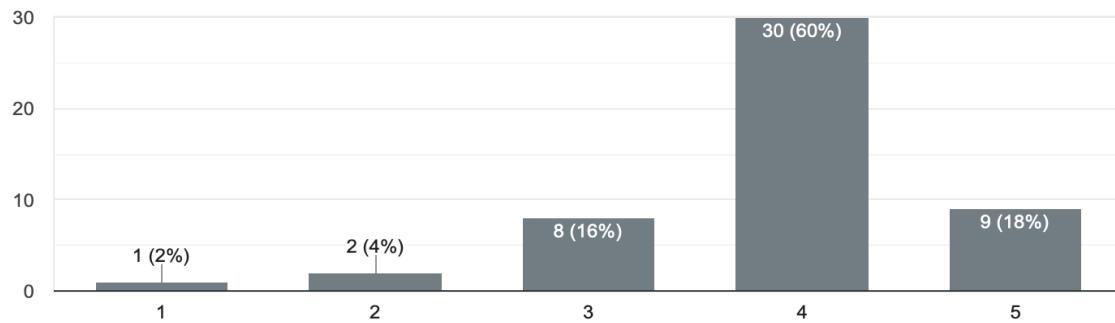


*Figure 29 shows Respondents Type of Institute*

In question 6, the researcher has asked about the type of institute of the respondents. (**Figure 29**) shows that 96% of respondents are currently in University, while 4% are in School.

Q7. How comfortable would you feel when you are roaming around your educational institute?

50 responses

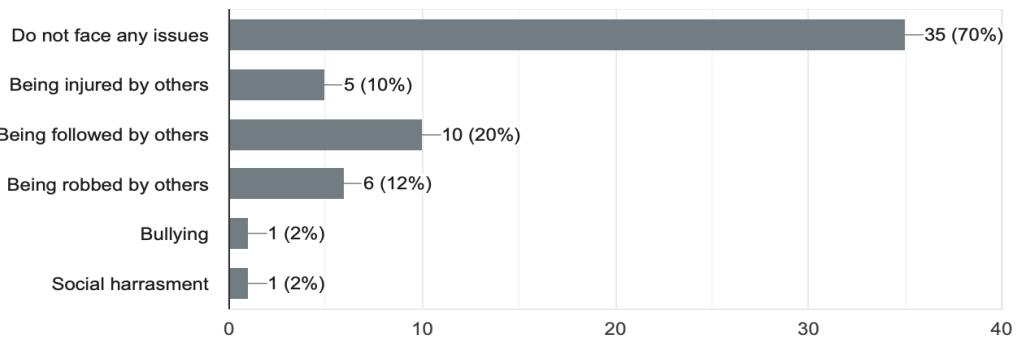


*Figure 30 shows Respondents Roaming Comfortable Level*

In question 7, the researcher has asked about the roaming comfortable level of the respondents. (**Figure 30**) shows that only 18% respondents feel very comfortable roaming around their institute.

**Q8. Please select the security issues you have faced before.**

50 responses

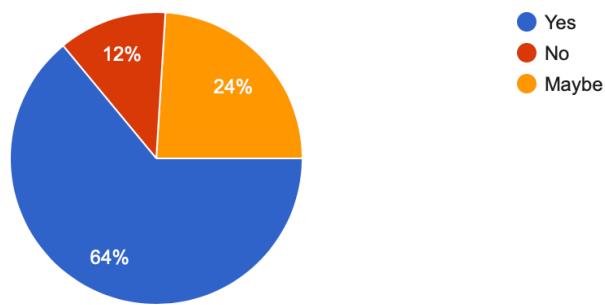


*Figure 31 shows Respondents Security Issues*

In question 8, the researcher has asked about the security issues of the respondents. (**Figure 31**) shows that 70% of respondents didn't face any issues while the other 30% face a different kind of security issues.

**Q9. Do you worry that you or your family members and friends might become a victim of a crime?**

50 responses

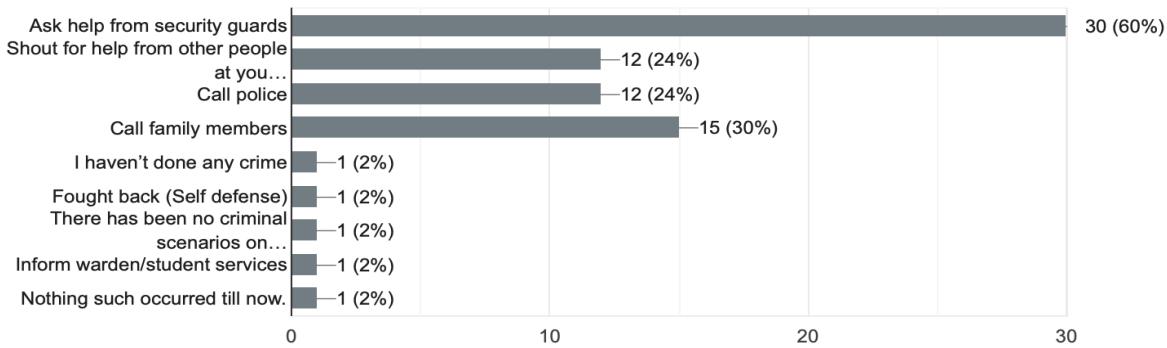


*Figure 32 shows Respondents Members Being Victim*

In question 9, the researcher has asked about respondents' members being a victim. (**Figure 32**) shows that 64% of respondents are worried, while 12% are not worried.

Q10. Please select the actions that you have done in unwanted crime scenarios that occurred at your institution.

50 responses

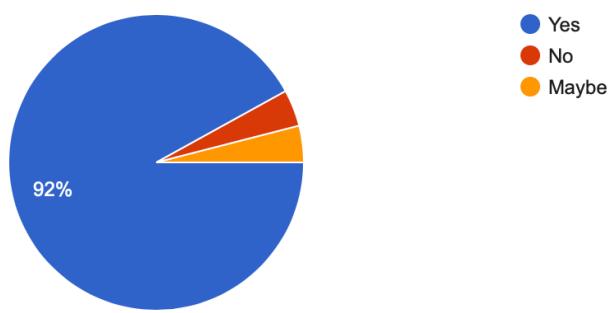


*Figure 33 shows Respondents Actions*

In question 10, the researcher has asked about respondents' actions against crime scenarios. (**Figure 33**) shows that 60% of respondents require to assist from security guards while others approach different kinds of assist.

Q11. Does your institute has installed CCTV?

50 responses

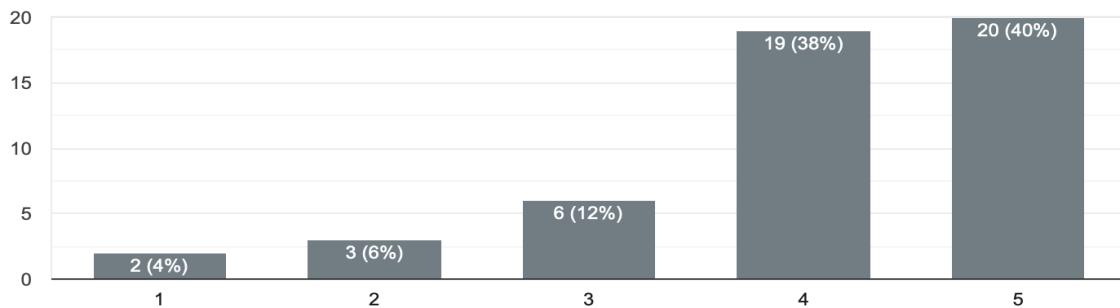


*Figure 34 shows CCTV Installations*

In question 11, the researcher has asked about the CCTV installations at their institute. (**Figure 34**) shows that 92% of respondents have CCTV in their institute.

Q12. How likely would you use CCTV for security purposes?

50 responses

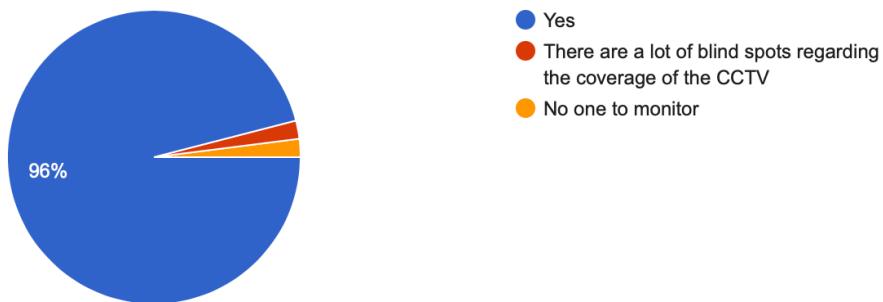


*Figure 35 shows CCTV for Security Purposes*

In question 12, the researcher has asked about the applications of CCTV for security. (**Figure 35**) shows that 40% of respondents are very likely to use CCTV, while 4% is doubtful.

Q13. Do you think CCTV is helpful for security purposes? If no, why?

50 responses

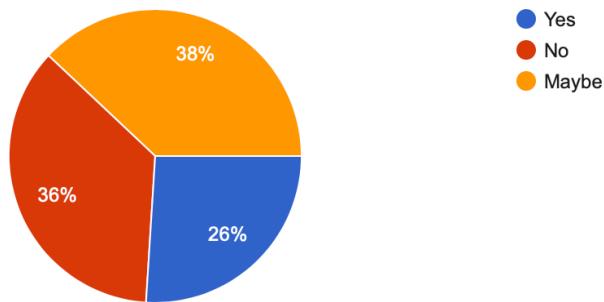


*Figure 36 shows CCTV Being Helpful*

In question 13, the researcher has asked about CCTV being helpful. (**Figure 36**) shows that 96% of respondents find it useful to use CCTV, while 4% is doubtful.

Q14. Do you feel troublesome when looking back on footage of CCTV to identify particular events?

50 responses

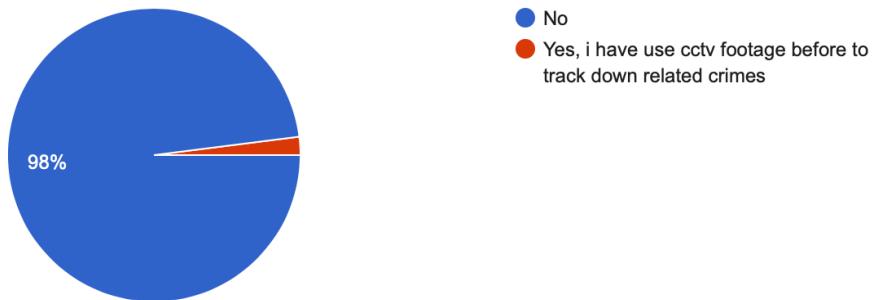


*Figure 37 shows Troublesome to Look at CCTV*

In question 14, the researcher has asked about the difficulty of looking at CCTV. (**Figure 37**) shows that 26% of respondents agree, while 74% is doubtful.

Q15. Did you use any analytics system before to prevent threats? If yes, please state all the features that you are familiar with.

50 responses

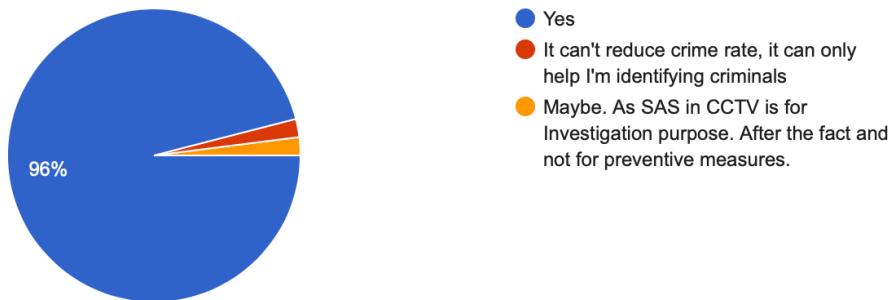


*Figure 38 shows Analytics System Familiarity*

In question 15, the researcher has asked about the familiarity of using the analytics system. (**Figure 38**) shows that 98% of respondents disagree, while 2% is agreed.

Q16. Do you think Smart Analysis System (SAS) that is implemented in CCTV can reduce the crime rate against juvenile safety for gun violence? If no, why?

50 responses

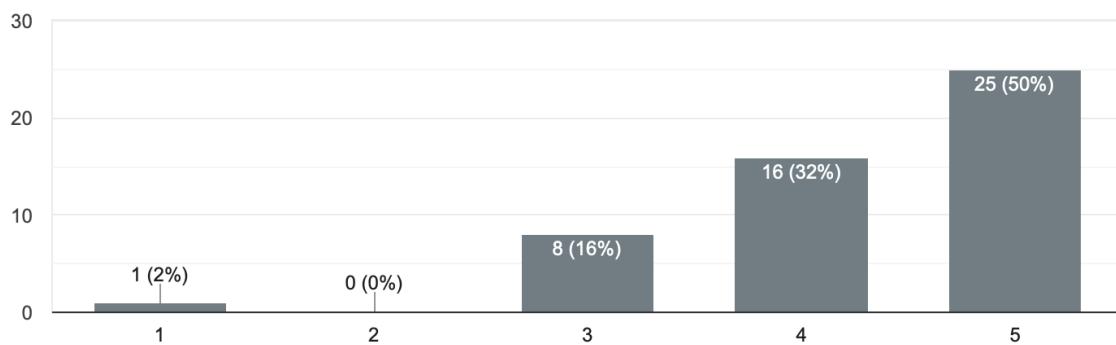


*Figure 39 shows SAS Reducing Crime Rate*

In question 16, the researcher has asked about reducing the crime rate using SAS. (**Figure 39**) shows that 96% of respondents agree, while 4% is doubtful.

Q17. How likely would you use Smart Analysis System (SAS) in your institution?

50 responses



*Figure 40 shows SAS Application*

In question 17, the researcher has asked about the application of SAS in the institute. (**Figure 40**) shows that 50% of respondents are very likely to use, while 2% is doubtful.

Q18. Do you think Smart Analysis System (SAS) will violate your privacy? If yes, why?

50 responses



*Figure 41 shows SAS Privacy Issues*

In question 18, the researcher has asked about the privacy issues of SAS. (**Figure 41**) shows that 80% of respondents disagree, while 20% is agreed.

Q19. Please provide the features that can be implemented in Smart Analysis System (SAS).

50 responses

Object Detection

High quality camare must be installed.

*Figure 42 shows SAS Features Suggestion*

In question 19, the researcher has asked about features suggestions for SAS. (**Figure 42**) shows that many respondents feel like Object Detection and High-Quality Camera is needed for using SAS.

Q20. Overall, what is your opinion towards Smart Analysis System (SAS)?

50 responses

In my opinion the Smart Analysis System is a one of a kind system that no individual has ever attempted to create and implement on campus grounds. Furthermore, I'am 100% certain that once the (SAS) has been implemented there will be a considerable drop in the number of crime scenarios on campus.

The benefits outweighs the issues of privacy that are a great concern, but it will be worse if a disaster like mass shooting can be averted if we didn't consider adoring this types of technology.

*Figure 43 shows SAS Overall Opinion*

In question 20, the researcher has asked about the overall opinion of SAS. (**Figure 43**) shows that many respondents feel like SAS has a higher potential to reduce gun violence against juvenile safety in educational institutions.

## 6.2 Summary

On a questionnaire basis, the Designer will assess the reduction and avoidance of possible crime in the educational institution by integrating SAS in CCTV. Every technology has its advantages and its disadvantages. This would help the environment, if SAS has been controlled appropriately. People feel relaxed on the go and can focus on their everyday lives. In order to improve the performance and usability of SAS, the developer should seek to implement the necessary functions.

## Chapter 7: System Architecture

### 7.1 Introduction

SAS helps spot unauthorized people from school premises to avoid the firing of weapons. With high precision, it can classify high-risk possibilities. In real-time, users can monitor criminal locations, add people, police, and the most wanted offenders to the database. It can be used in CCTV and used in many fields, such as research institutions, banks, hospitals, and many more. To prevent the gun from firing until the crime takes place, it will warn the authorities.

Features of the system are as follows:

#### Version 1

- Login
- Logout
- Register User

#### Version 2

- View User
- Identify Thief
- Track Thief

#### Version 3

- View Report
- Citizen Registration
- View Citizen

## 7.2 Abstract Architecture

### 7.2.1 System Design

#### 7.2.1.1 Use Case Diagram

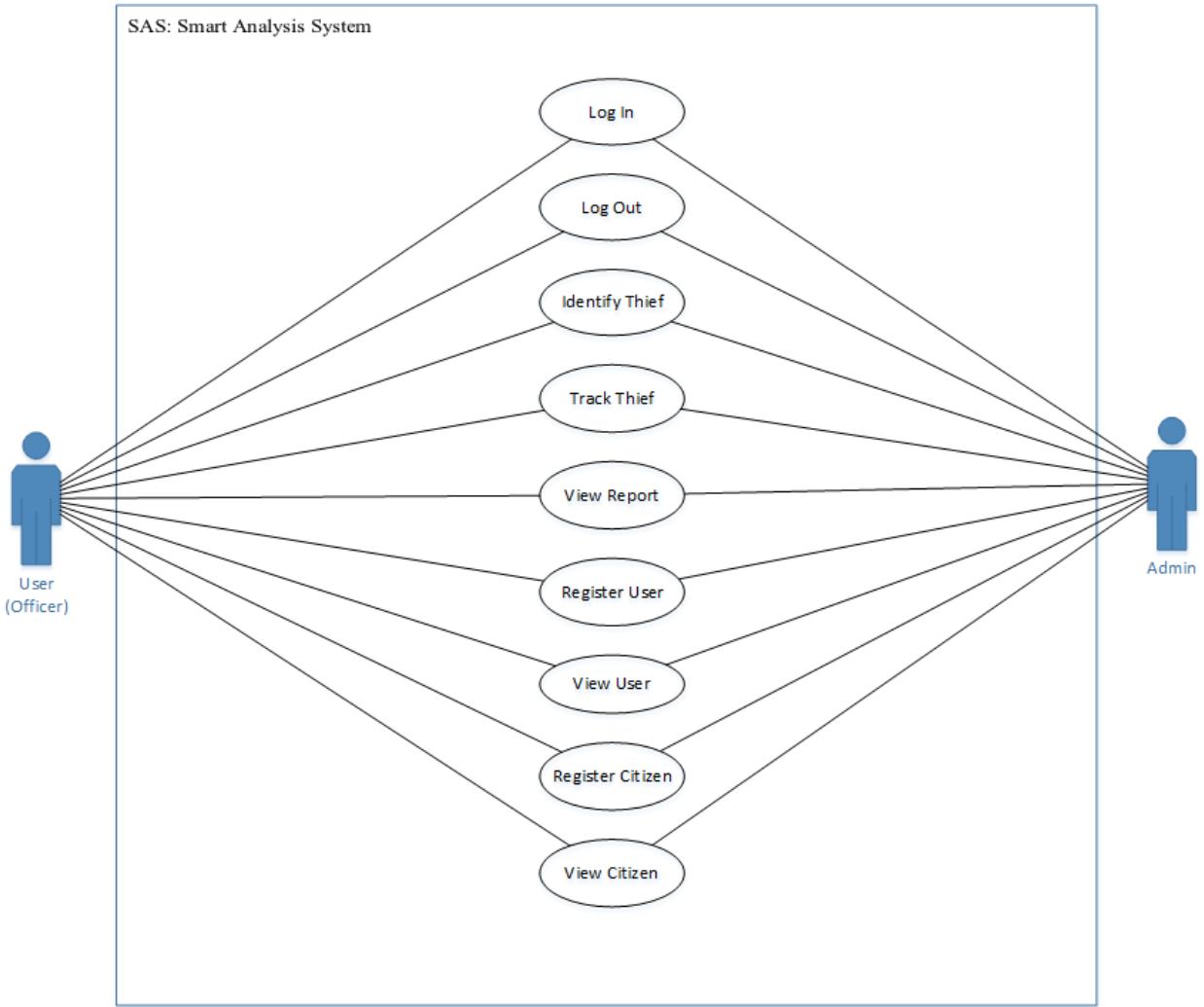


Figure 44 shows Use Case Diagram

## 7.2.1.2 Use Case Specification

<b>Name:</b>	Login
<b>Brief Description:</b>	Allows users to log into the app
<b>Actors:</b>	Admin & User
<b>Inputs:</b>	Username & Password
<b>Pre-Conditions:</b>	User must be registered
<b>Post Conditions:</b>	A person with a valid account joins the main menu.
<b>Main Flow:</b>	<ol style="list-style-type: none"> <li>1. User clicks login</li> <li>2. User input credentials</li> <li>3. System Validates the credentials</li> <li>4. Redirect to main menu</li> </ol>
<b>Alternate Path:</b>	<ol style="list-style-type: none"> <li>1. If user inputs invalid credentials</li> <li>2. System display error message</li> <li>3. System redirect to login Page</li> </ol>

Name:	Logout
Brief Description:	Allows user to logout of the application
Actors:	Admin & User
Requirements:	None
Pre-Conditions:	Must be Logged In
Post Conditions:	Display Login Page
Main Flow:	<ol style="list-style-type: none"><li>1. User clicks on logout button</li><li>2. Systems removes user from application</li></ol>
Alternate Path:	None

<b>Name:</b>	Register User
<b>Brief Description:</b>	Allows the admin and user to register new users into the system
<b>Actors:</b>	Admin & User
<b>Inputs:</b>	Name, Address, Police ID & Password
<b>Pre-Conditions:</b>	Navigate to Register User
<b>Post Conditions:</b>	Redirect to Register User Page
<b>Main Flow:</b>	<ol style="list-style-type: none"> <li>1. User inputs all required fields</li> <li>2. Clicks register</li> <li>3. System Validates</li> <li>4. Redirect to Register User Page</li> </ol>
<b>Alternate Path:</b>	<ol style="list-style-type: none"> <li>1. Leave fields empty</li> <li>2. Click register</li> <li>3. Display error message</li> <li>4. Redirect to register user page</li> </ol>

<b>Name:</b>	Register Citizen
<b>Brief Description:</b>	Allows the admin and user to register new citizens into the system
<b>Actors:</b>	Admin & User
<b>Inputs:</b>	Name, Address, National ID & Picture
<b>Pre-Conditions:</b>	Navigate to Register Citizen
<b>Post Conditions:</b>	Redirect to Register Citizen Page
<b>Main Flow:</b>	<ol style="list-style-type: none"> <li>1. User inputs all required fields</li> <li>2. Clicks register</li> <li>3. System Validates</li> <li>4. Redirect to Register Citizen Page</li> </ol>
<b>Alternate Path:</b>	<ol style="list-style-type: none"> <li>1. Leave fields empty</li> <li>2. Click register</li> <li>3. Display error message</li> <li>4. Redirect to register citizen page</li> </ol>

<b>Name:</b>	View User
<b>Brief Description:</b>	Allows the admin and user to view users available into the system
<b>Actors:</b>	Admin & User
<b>Inputs:</b>	None
<b>Pre-Conditions:</b>	Navigate to View User
<b>Post Conditions:</b>	Redirect to View User Page
<b>Main Flow:</b>	<ol style="list-style-type: none"> <li>1. User navigate to View User Page</li> <li>2. Display the list of users and admin</li> </ol>
<b>Alternate Path:</b>	None

<b>Name:</b>	<b>View Citizens</b>
<b>Brief Description:</b>	Allows the admin and user to view citizens available into the system and update status
<b>Actors:</b>	Admin & User
<b>Requirements:</b>	None
<b>Pre-Conditions:</b>	Navigate to View Citizen Page
<b>Post Conditions:</b>	Redirect to View Citizen Page
<b>Main Flow:</b>	<ol style="list-style-type: none"> <li>1. User navigate to View Citizen Page</li> <li>2. Display list of citizens and thieves</li> <li>3. Update the status of the citizens</li> </ol>
<b>Alternate Path:</b>	None

<b>Name:</b>	<b>View Report</b>
<b>Brief Description:</b>	Allows the admin and user to view accuracy report of the system
<b>Actors:</b>	Admin & User
<b>Inputs:</b>	None
<b>Pre-Conditions:</b>	Navigate to View Report Page
<b>Post Conditions:</b>	Redirect to View Report Page
<b>Main Flow:</b>	<ol style="list-style-type: none"> <li>1. User navigate to View Report Page</li> <li>2. Display the accuracy of the system</li> </ol>
<b>Alternate Path:</b>	None

<b>Name:</b>	Identify Thief
<b>Brief Description:</b>	Allows the admin and user to identify criminals using both picture and webcam
<b>Actors:</b>	Admin & User
<b>Inputs:</b>	Upload Picture
<b>Pre-Conditions:</b>	Navigate to Identify Thief Page
<b>Post Conditions:</b>	Redirect to Identify Thief Page
<b>Main Flow:</b>	<ol style="list-style-type: none"> <li>1. User navigate to Identify Thief Page</li> <li>2. User can select either upload picture or open webcam</li> <li>3. User gets the output result showing the identification of the individual</li> <li>4. User redirects to Identify Thief page</li> </ol>
<b>Alternate Path:</b>	None

<b>Name:</b>	Track Thief
<b>Brief Description:</b>	Allows the admin and user to track criminals in real time and update the status in the database
<b>Actors:</b>	Admin & User
<b>Inputs:</b>	None
<b>Pre-Conditions:</b>	Navigate to Track Thief Page
<b>Post Conditions:</b>	Redirect to Track Thief Page
<b>Main Flow:</b>	<ol style="list-style-type: none"> <li>1. User navigate to Track Thief Page</li> <li>2. User can track thief location</li> <li>3. User can update the status of the individual</li> <li>4. User redirects to Track Thief page</li> </ol>
<b>Alternate Path:</b>	None

### 7.2.1.3 Class Diagram

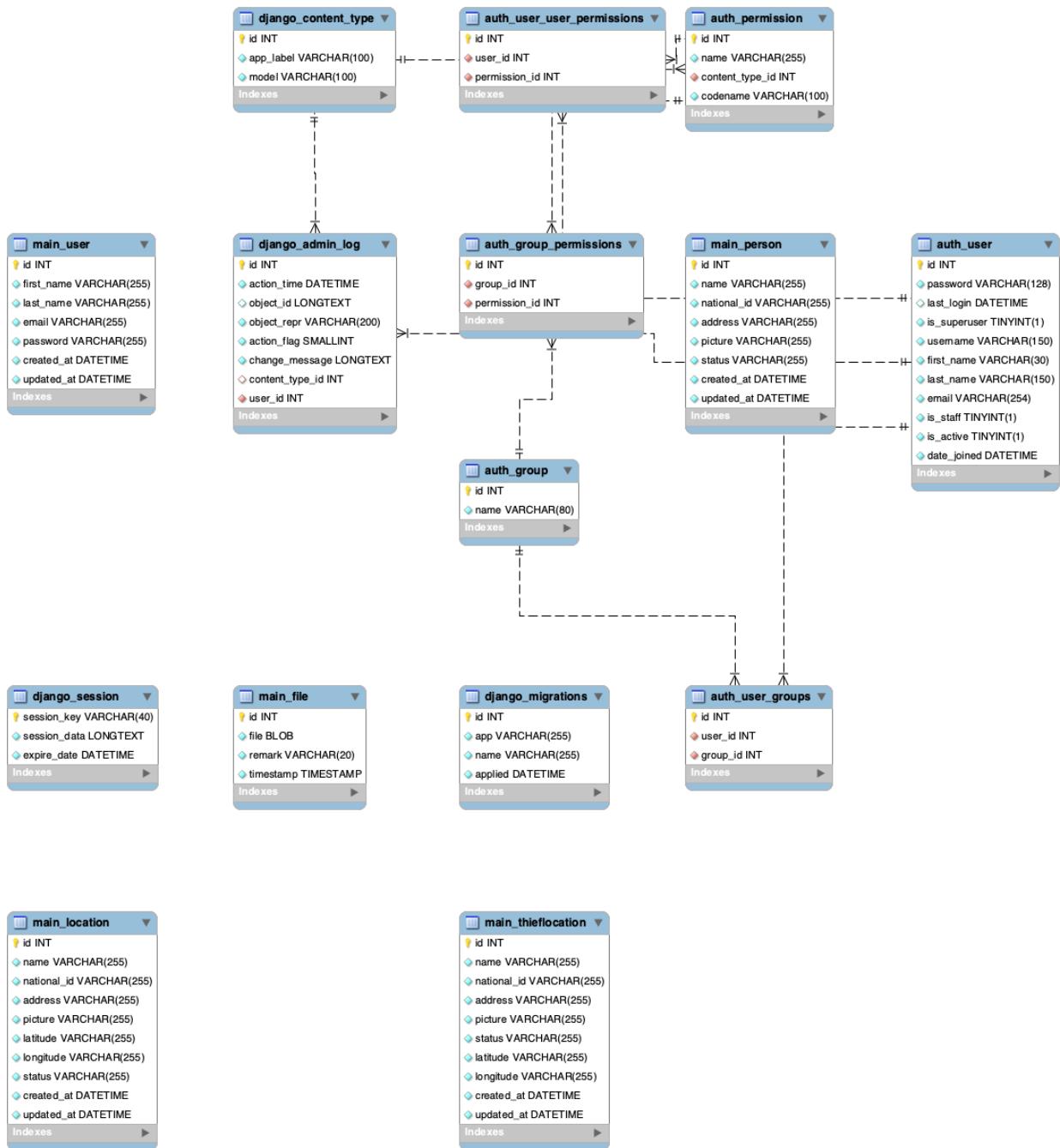


Figure 45 shows Class Diagram

### 7.2.1.4 Activity Diagram

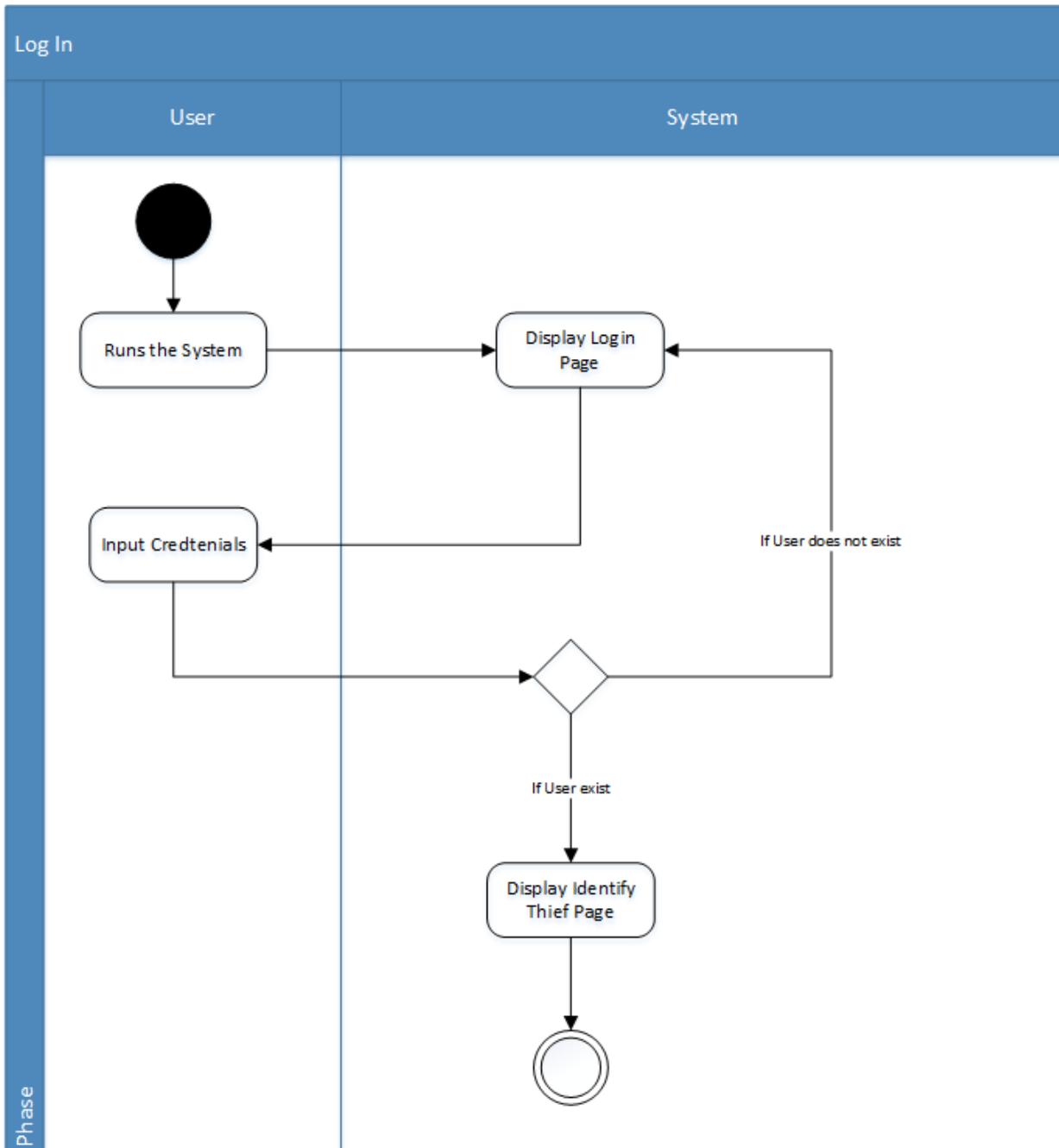


Figure 46 shows Login Diagram

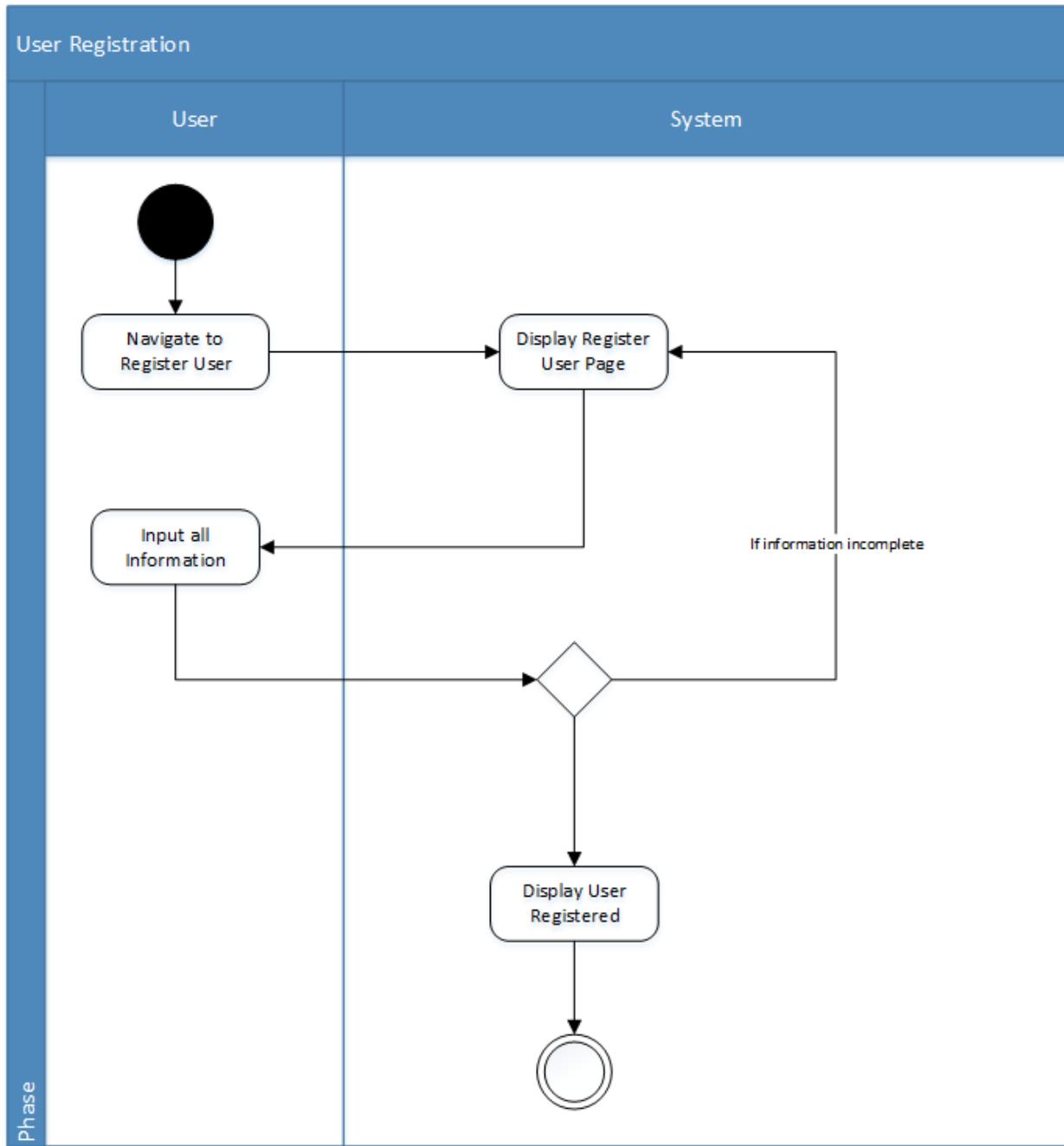


Figure 47 shows User Registration Diagram

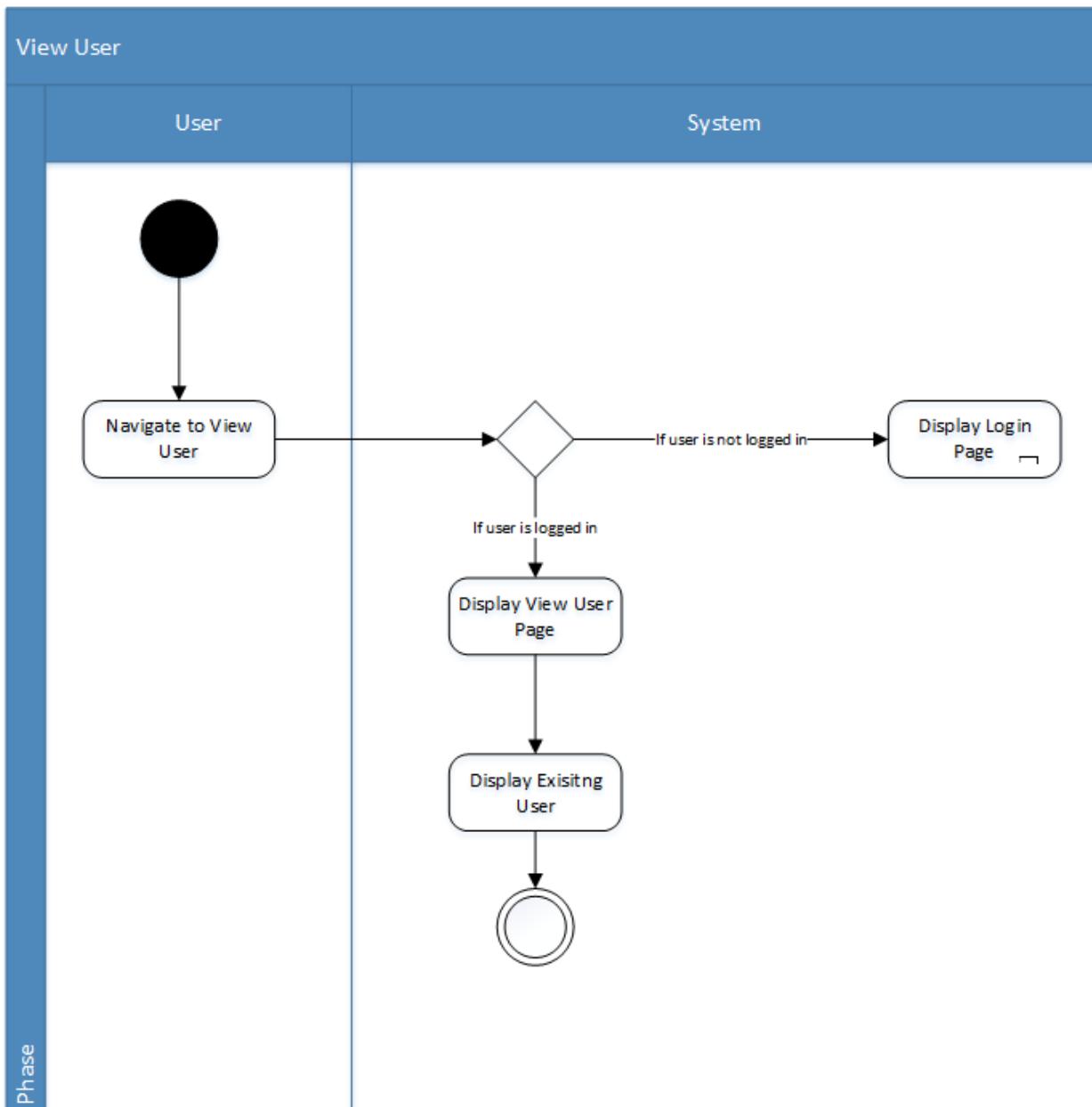


Figure 48 shows View User Diagram

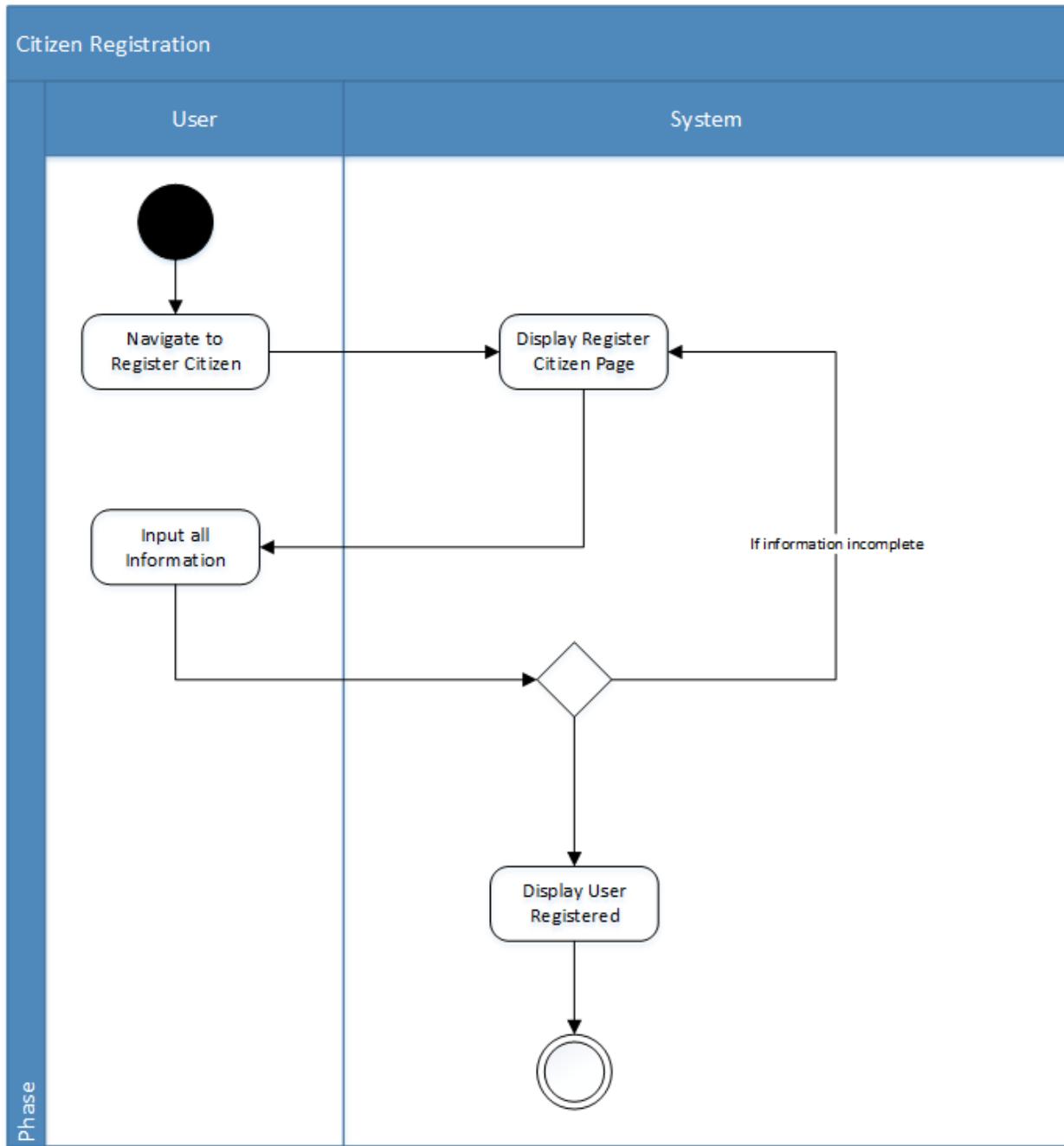


Figure 49 shows Register Citizen Diagram

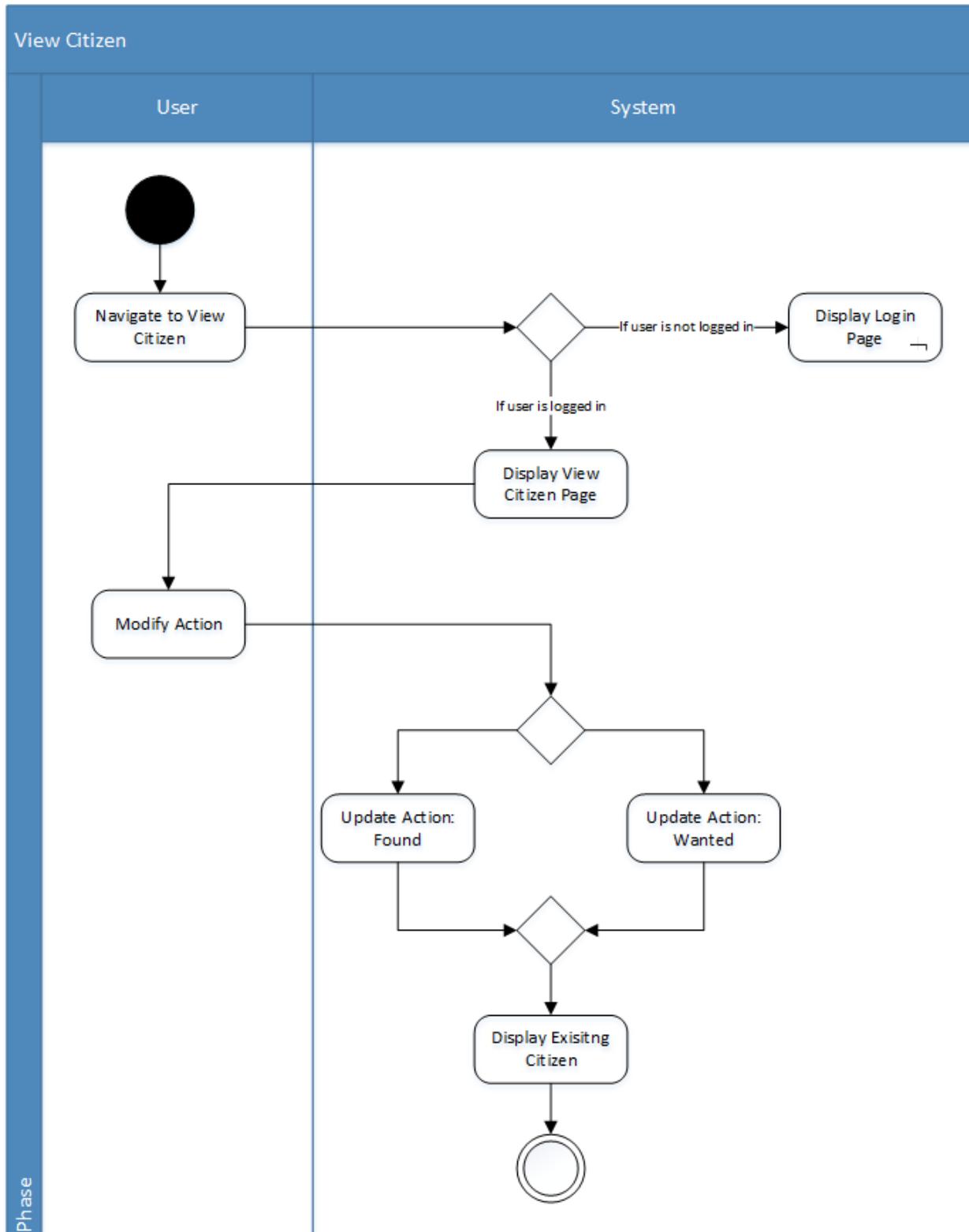


Figure 50 shows View Citizen Diagram

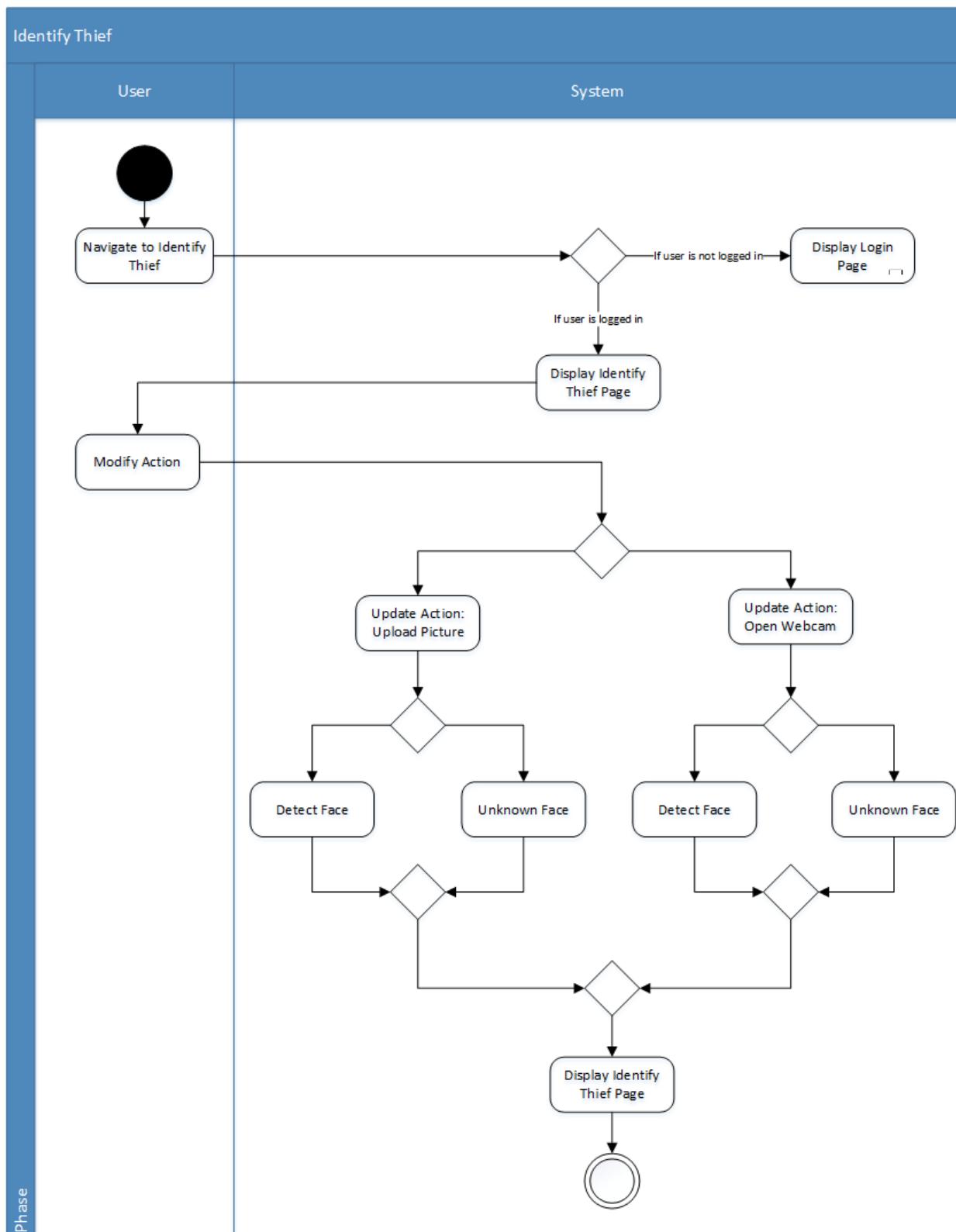


Figure 51 shows Identify Thief Diagram

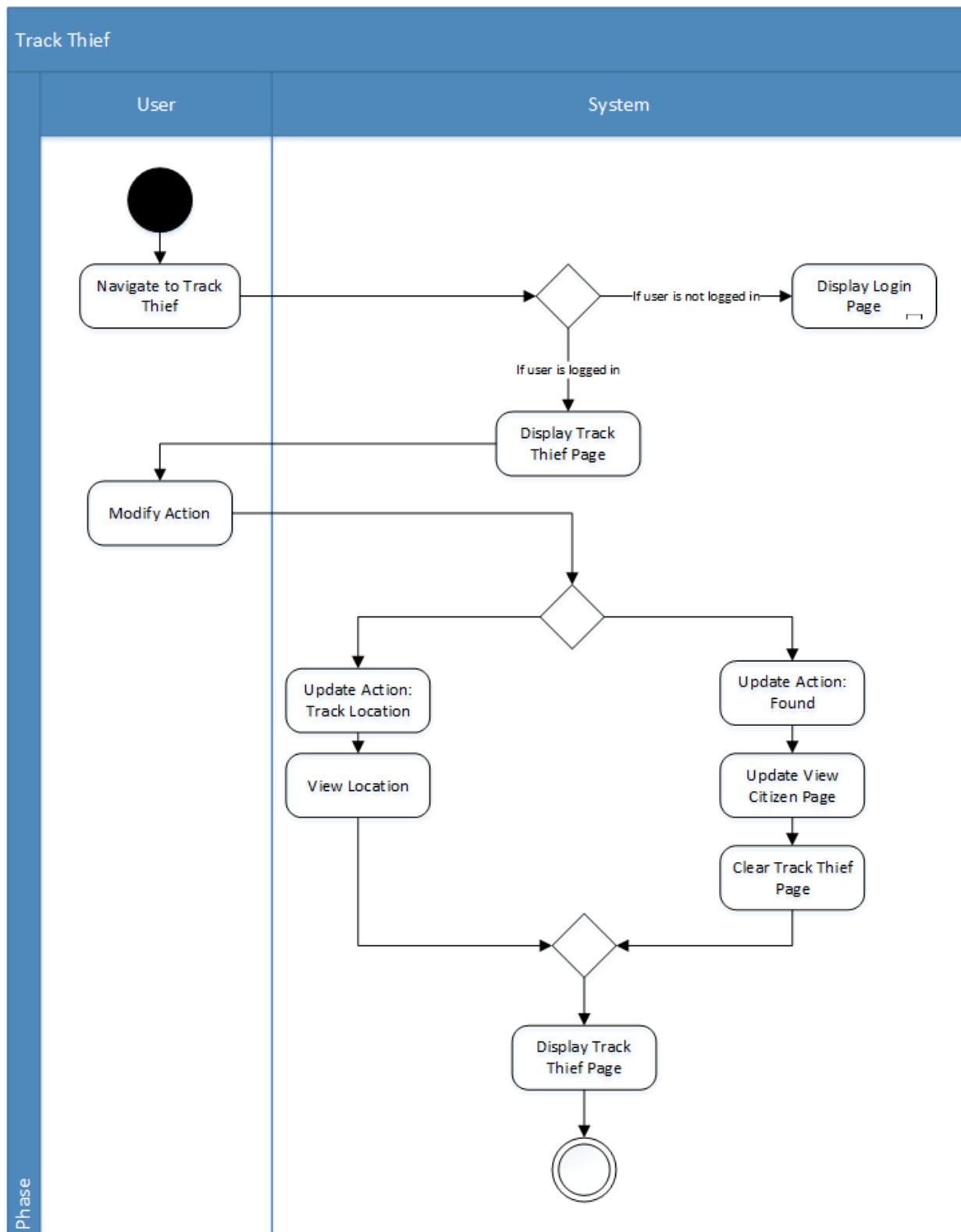


Figure 52 shows Track Thief Diagram

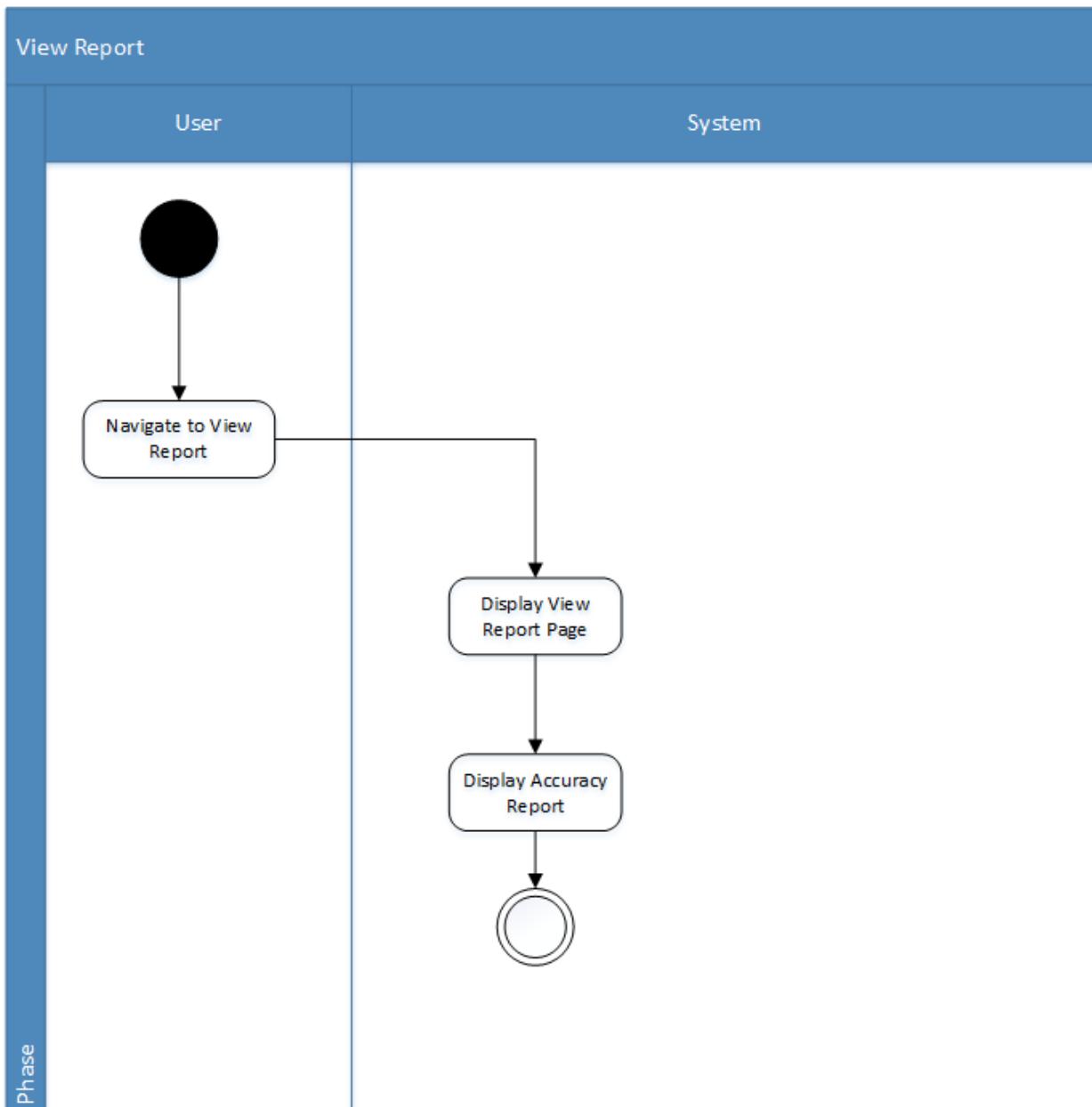


Figure 53 shows View Report Diagram

## 7.2.2 Database Design

### 7.2.2.1 Entity Relationship Diagram

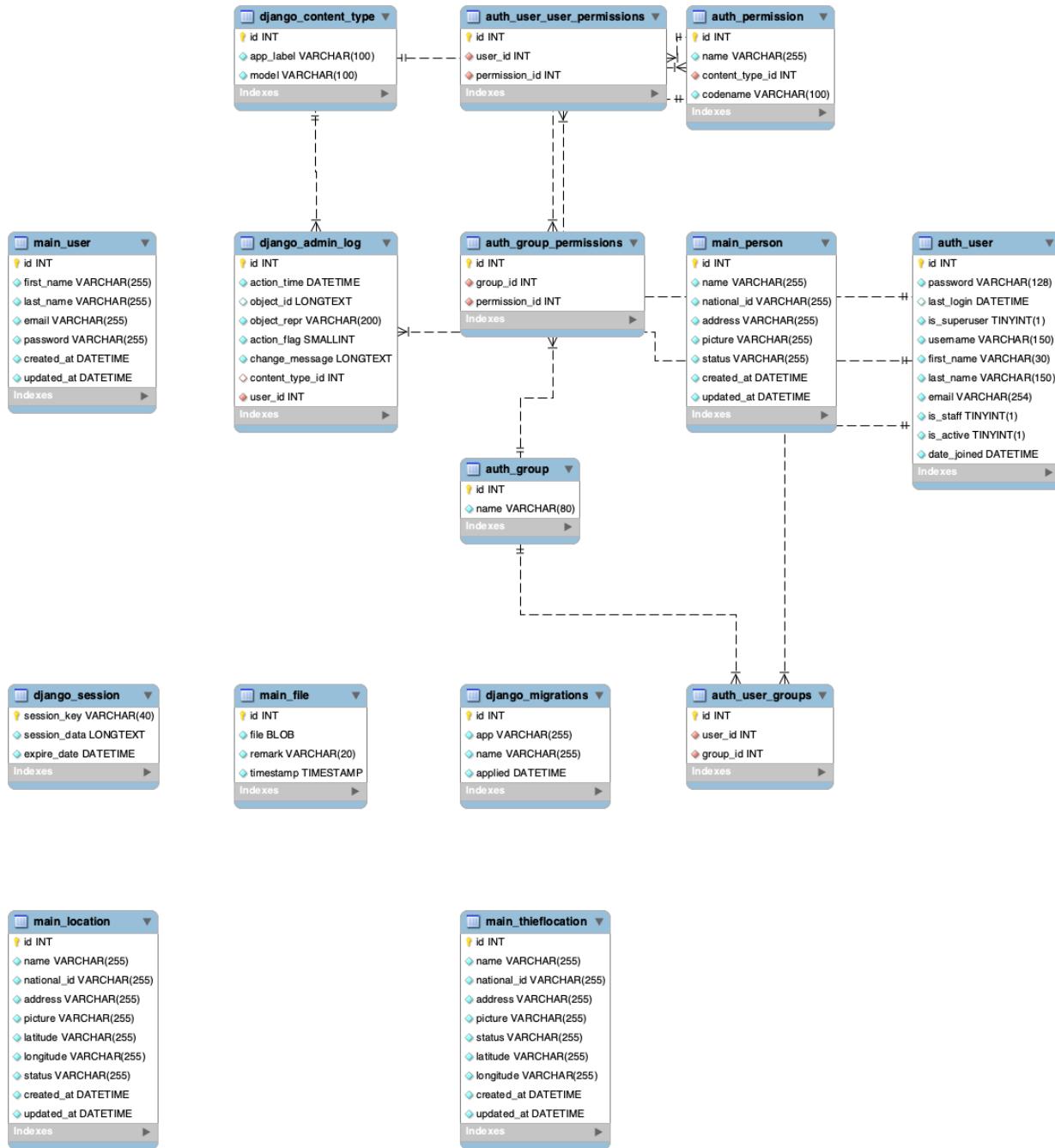


Figure 54 shows ERD Diagram

### 7.2.2.2 Database Table Structure

auth\_group

Field Name	Data Type	PK	NULL	Description
<b>id</b>	int	Y	NO	User identifier
<b>name</b>	varchar(80)		NO	Group name

auth\_permission

Field Name	Data Type	PK	NULL	Description
<b>id</b>	int	Y	NO	User identifier
<b>name</b>	varchar(255)		NO	Name
<b>content_type_id</b>	int		NO	Content type ID
<b>codename</b>	varchar(100)		NO	Codename

auth\_user

Field Name	Data Type	PK	NULL	Description
<b>id</b>	int	Y	NO	User identifier
<b>password</b>	varchar(128)		NO	User password
<b>last_login</b>	datetime		NO	User last login
<b>is_superuser</b>	tinyint(1)		NO	Shows if user is superuser
<b>username</b>	varchar(150)		NO	Username
<b>first_name</b>	varchar(30)		NO	User first name
<b>last_name</b>	varchar(150)		NO	User last name

Field Name	Data Type	PK	NULL	Description
email	varchar(254)		NO	User email
is_staff	tinyint(1)		NO	Shows user is staff
is_active	tinyint(1)		NO	Shows user is active
date_joined	datetime		NO	Shows when user joined

## auth\_user\_groups

Field Name	Data Type	PK	NULL	Description
id	int	Y	NO	User identifier
user_id	int		NO	User ID
group_id	int		NO	Group ID

## auth\_user\_user\_permission

Field Name	Data Type	PK	NULL	Description
id	int	Y	NO	User identifier
user_id	int		NO	User ID
permission_id	int		NO	Permission ID

## django\_admin\_log

Field Name	Data Type	PK	NULL	Description
id	int	Y	NO	User identifier
action_time	datetime		NO	Action time
object_id	longtext		YES	Object ID

Field Name	Data Type	PK	NULL	Description
object_rpr	varchar(200)		NO	Object
action_flag	smallint unsigned		NO	Action Flag
change_message	longtext		NO	Change message
content_type_id	int		YES	Content type ID
user_id	int		NO	User ID

## django\_content\_type

Field Name	Data Type	PK	NULL	Description
id	int	Y	NO	User identifier
app_level	varchar(100)		NO	App Level
model	varchar(100)		NO	Model

## django\_migrations

Field Name	Data Type	PK	NULL	Description
id	int	Y	NO	User identifier
app	varchar(255)		NO	App
name	varchar(255)		NO	Name
applied	datetime		NO	Applied

## django\_session

Field Name	Data Type	PK	NULL	Description
session_key	varchar(40)	Y	NO	Session key

Field Name	Data Type	PK	NULL	Description
session_data	longtext		NO	Session data
expire_data	datetime		NO	Expiration date

main\_file

Field Name	Data Type	PK	NULL	Description
id	int	Y	NO	User identifier
file	blob		NO	File
remark	varchar(20)		NO	Remark
timestamp	longtext		NO	Time stamp

main\_location

Field Name	Data Type	PK	NULL	Description
id	int	Y	NO	User identifier
name	varchar(255)		NO	Citizen name
national_id	varchar(255)		NO	Citizen national ID
address	varchar(255)		NO	Citizen address
picture	varchar(255)		NO	Citizen picture
latitude	varchar(255)		NO	Latitude of the thief location
longitude	varchar(255)		NO	Longitude of the thief location
status	varchar(255)		NO	Categorized as free, found or wanted
created_at	datetime		NO	User when joined the system

Field Name	Data Type	PK	NULL	Description
<b>updated_at</b>	datetime		NO	Last updated time

## main\_person

Field Name	Data Type	PK	NULL	Description
<b>id</b>	int	Y	NO	User identifier
<b>name</b>	varchar(255)		NO	Citizen name
<b>national_id</b>	varchar(255)		NO	Citizen national ID
<b>address</b>	varchar(255)		NO	Citizen address
<b>picture</b>	varchar(255)		NO	Citizen picture
<b>status</b>	varchar(255)		NO	Categorized as free, found or wanted
<b>created_at</b>	datetime		NO	User when joined the system
<b>updated_at</b>	datetime		NO	Last updated time

## main\_thief\_location

Field Name	Data Type	PK	NULL	Description
<b>id</b>	int	Y	NO	User identifier
<b>name</b>	varchar(255)		NO	Citizen name
<b>national_id</b>	varchar(255)		NO	Citizen national ID
<b>address</b>	varchar(255)		NO	Citizen address
<b>picture</b>	varchar(255)		NO	Citizen picture
<b>latitude</b>	varchar(255)		NO	Latitude of the thief location

Field Name	Data Type	PK	NULL	Description
longitude	varchar(255)		NO	Longitude of the thief location
status	varchar(255)		NO	Categorized as free, found or wanted
created_at	datetime		NO	User when joined the system
updated_at	datetime		NO	Last updated time

## main\_user

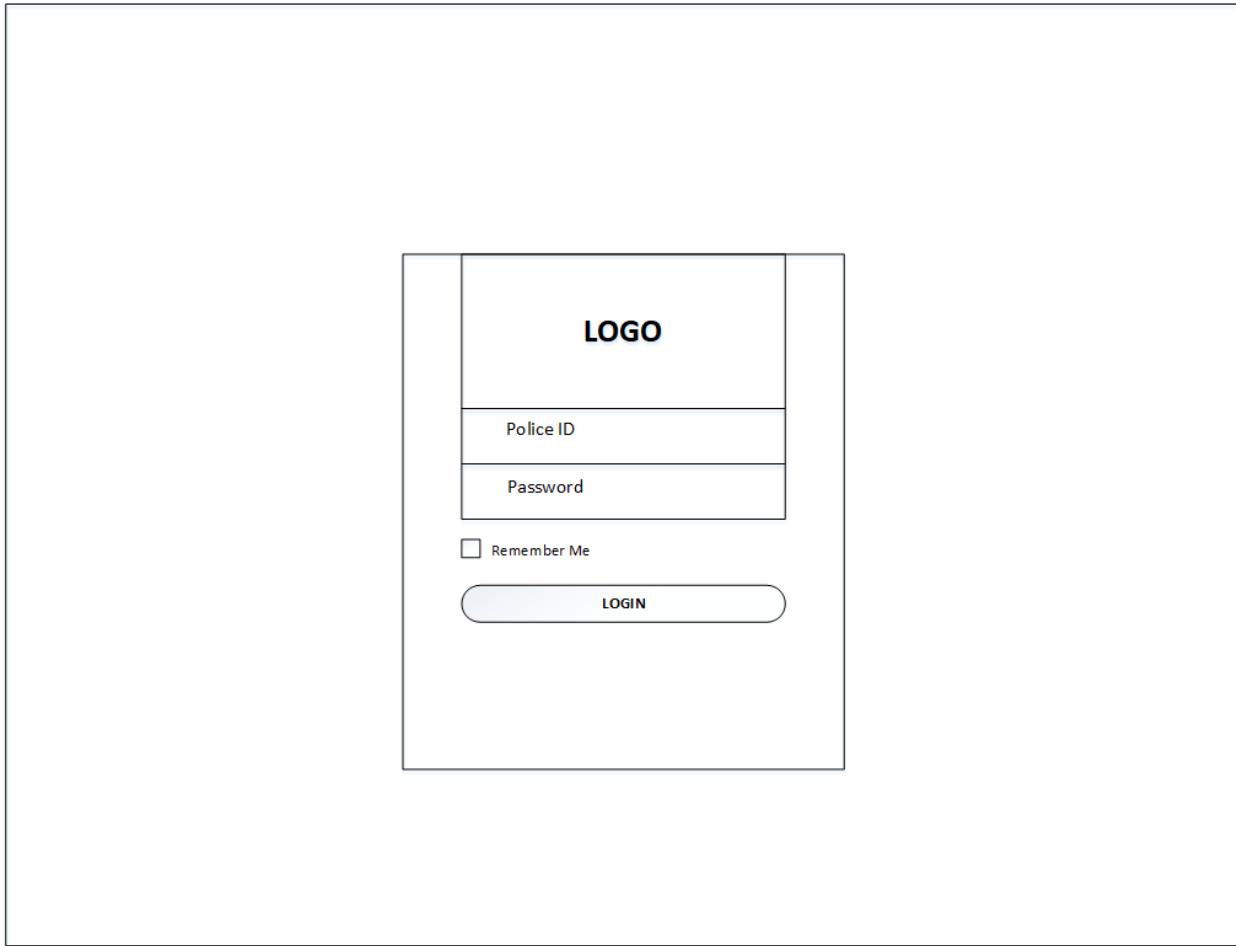
Field Name	Data Type	PK	NULL	Description
id	int	Y	NO	User identifier
first_name	varchar(255)		NO	User first name
last_name	varchar(255)		NO	User last name
email	varchar(255)		NO	User email
password	varchar(255)		NO	User password
created_at	datetime		NO	User when joined the system
updated_at	datetime		NO	Last updated time

## auth\_group\_permission

Field Name	Data Type	PK	NULL	Description
id	int	Y	NO	User identifier
group_id	int		NO	Group ID
permission_id	int		NO	Permission ID

### **7.2.3 Interface Design**

#### **7.2.3.1 Login Page**



*Figure 55 shows Login Diagram*

### 7.2.3.2 Identify Thief Page

<b>LOGO</b>	<input type="text" value="Username"/>	
Users	Dashboard	
Identify Thief	Welcome to Smart Analysis System, Username	
Track Thief	<b>IMAGE</b>	<b>IMAGE</b>
Reports	<input type="button" value="Upload Picture"/>	<input type="button" value="Open Webcam"/>
Citizens		
	<b>COPYRIGHT ©</b>	

Figure 56 shows Identify Thief Diagram

### 7.2.3.3 Add User Page

<b>LOGO</b>	<input type="text" value="Username"/>
Users	Dashboard
Identify Thief	Add System User
Track Thief	Name <input type="text"/>
Reports	Surname <input type="text"/>
Citizens	Police ID <input type="text"/>
	Password <input type="text"/>
	<input type="button" value="Submit"/>
<b>COPYRIGHT ©</b>	

Figure 57 shows Add System User Diagram

## 7.2.3.4 View User Page

<b>LOGO</b>	<input type="text" value="Username"/>				
Users	Dashboard				
Identify Thief	View Users				
Track Thief	Show <input type="text"/> entries <input type="text" value="Search"/>				
Reports	<table><thead><tr><th>Name</th><th>Surname</th><th>Police ID</th><th>Date Joined</th></tr></thead></table>	Name	Surname	Police ID	Date Joined
Name	Surname	Police ID	Date Joined		
Citizens					
	<b>COPYRIGHT ©</b>				

*Figure 58 shows View User Diagram*

## 7.2.3.5 Track Thief Page

<b>LOGO</b>	<input type="text" value="Username"/>					
Users	Dashboard					
Identify Thief	Spot Wanted People					
Track Thief	Show <input type="text"/> entries <input type="text" value="Search"/>					
Reports	<table><thead><tr><th>Name</th><th>National ID</th><th>Address</th><th>Status</th><th>Action</th></tr></thead></table>	Name	National ID	Address	Status	Action
Name	National ID	Address	Status	Action		
Citizens						
	<b>COPYRIGHT ©</b>					

Figure 59 shows Track Thief Diagram

## 7.2.3.6 View Report Page

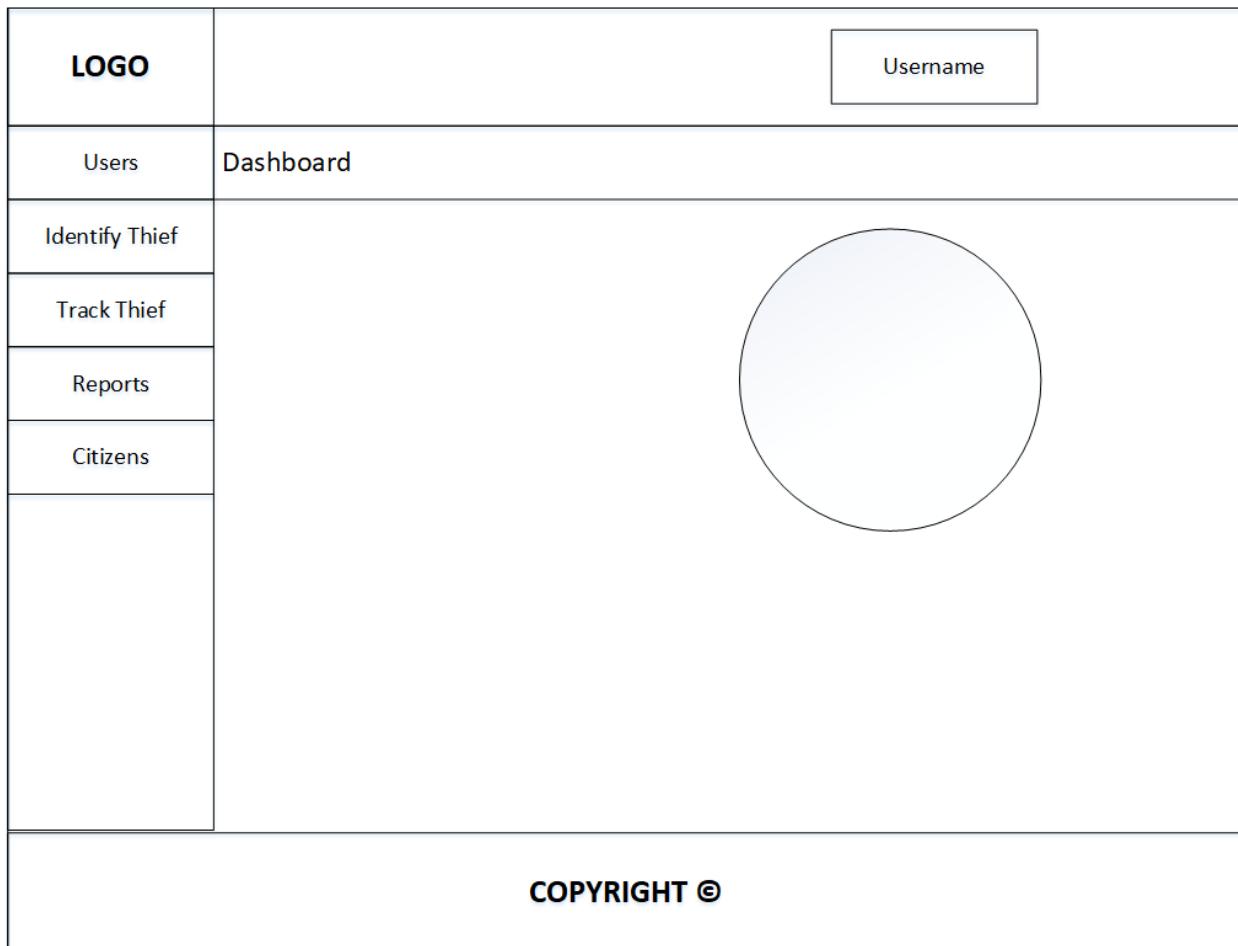


Figure 60 shows View Report Diagram

## 7.2.3.7 Add Citizen Page

<b>LOGO</b>	<input type="text" value="Username"/>
Users	Dashboard
Identify Thief	Add Citizen User
Track Thief	Name <input type="text"/>
Reports	National ID <input type="text"/>
Citizens	Address <input type="text"/> Picture <input type="file" value="Choose File"/>
	<input type="button" value="Submit"/>
<b>COPYRIGHT ©</b>	

Figure 61 shows Add Citizen Diagram

## 7.2.3.8 View Citizen Page

<b>LOGO</b>	<input type="text" value="Username"/>					
Users	Dashboard					
Identify Thief	View Citizens					
Track Thief	Show <input type="text"/> entries <input type="text" value="Search"/>					
Reports	<table border="1"><thead><tr><th>Name</th><th>National ID</th><th>Address</th><th>Status</th><th>Action</th></tr></thead></table>	Name	National ID	Address	Status	Action
Name	National ID	Address	Status	Action		
Citizens						
	<b>COPYRIGHT ©</b>					

Figure 62 shows View Citizen Diagram

## Chapter 8: Project Plan

According to (Project Plan - Professional Services Automation, 2020), a project plan outlines project priorities, and priorities describe activities and how objectives will be completed, describes what resources will be required, and the budgets and deadlines associated with them for completion. A project plan specifies and describes who will do all of the work within a project. A standard project plan consists of a task statement, a resource list, a framework for job breakdowns, a project schedule, and a risk plan.

### 8.1 Features

The core attributes of SAS is to identify and track criminals on the institution premises. The following features are implemented in SAS described below.

**Login:** This feature allows the admin and the police officer to login to the system using correct credentials.

**Logout:** This feature allows the user to logout from the system properly so that next user can login using correct credentials.

**User Registration:** This feature allows the admin and the police officer to register and login to the system with correct credentials.

**View Users:** This feature allows the user to view the registered admin's details and the police officer in the system.

**Identify Thief using Picture:** This feature allows the system to identify registered criminals from the database using a given picture and represent the criminal's demographic.

**Identify Thief using Webcam:** This feature allows the system to identify registered criminals from the database using realtime video from the webcam and represent the criminal's demographic.

**View Report:** This feature allows the user to show the criminal identification rate's accuracy per month.

**Citizen Registration:** This feature allows the user to create citizens by inputting their information and pictures in the database.

**View Citizen:** This feature allows the user to view the demographic of the citizen and their current status as Free, Found, or Wanted.

## 8.2 Details of the Release Plan

SAS will be released in three versions to finalize the product. This is to make sure that there are any bugs available in the system, and it can run efficiently without any problem in the future. The following attributes are divided into three versions.

### Version 1

- Login
- Logout
- Register User

### Version 2

- View User
- Identify Thief
- Track Thief

### Version 3

- View Report
- Citizen Registration
- View Citizen

#### 8.2.1 Version 1

The developer focuses on logging in, registering, and logging out for the application's first version. The first edition focuses on ensuring that the registration page data is effectively entered into the database and called up when the user logs in. The priority level of this version is set between medium and high, as the user will be able to access the application by logging in and registering. If the user finds any errors on these pages, the user will not navigate and use the application. July 21<sup>st</sup>, 2020, is the release date of this edition.

### 8.2.2 Version 2

In version 2, the developer focuses on viewing users, identifying thieves using the picture, and using the webcam to develop the system. This version is the most crucial part of the system as it involves working with the face recognition models to identify thief using both picture and live webcam. Users will be able to identify the high potential individual against the criminal database. The model will be used as the highest accuracy for identifying effectively. The user will also be able to track the realtime location of the thief which can be categorized as Found. Updating the action button will also change the citizen database as well. The developers will also implement a view user page to see the list of registered users available in the system. August 4th, 2020, is the release date of this edition.

### 8.2.3 Version 3

The final version involves implementing a view report, viewing citizen, and citizen registration, which is the remaining SAS features. Users will be able to view the face recognition model's accuracy, which represents in the pie chart. It will show the rate of criminal identification in the system. Citizen registration will help the user to register citizen with their picture in the database for identification. In view citizen, the citizen can be categorized as free, found, or wanted to distinguish between each other. August 17th, 2020, is the release date of this edition.

## 8.3 Test Plan

### 8.3.1 Unit Testing

Unit Testing is part of the test plan that will ensure that all of the critical functionalities of the institutional Smart Analysis System perform as desired. For each version and prominent feature of the application, the test will be carried out by the developer until it is released, ensuring that little to no errors are found when the final users use the application.

## 1. Version 1

### Login Page Plan

Case Number	Test Description	Expected Output	Actual Output
1	Inputs are valid.	Login successful.	N/A
2	Username & password is missing.	Pop-up error message indicating missing credentials.	N/A
3	Inputs are invalid.	Pop-up error message indicating invalid credentials.	N/A
4	Press logout button.	Logout successfully.	N/A

### User Registration Page Plan

Case Number	Test Description	Expected Output	Actual Output
1	Inputs are valid.	Register successful.	N/A
2	Username, password, police ID & address is missing.	Pop-up error message indicating missing credentials.	N/A

**2. Version 2****Identify Thief Page Plan**

Case Number	Test Description	Expected Output	Actual Output
1	Upload picture is valid.	Identify the thief successfully or categorize as unknown.	N/A
2	Open webcam is valid.	Identify the thief successfully.	N/A

**Track Thief Page Plan**

Case Number	Test Description	Expected Output	Actual Output
1	Press found button.	Clear the list of spot wanted people and update the view citizen page.	N/A
2	Search wanted people.	Identify the given search successfully.	N/A

**View User Page Plan**

Case Number	Test Description	Expected Output	Actual Output
1	Search user.	Identify the given search successfully.	N/A

### 3. Version 3

#### Citizen Registration Page Plan

Case Number	Test Description	Expected Output	Actual Output
1	Inputs are valid.	Register successful.	N/A
2	Name, national ID, address & picture is missing.	Pop-up error message indicating missing credentials.	N/A

#### View Citizen Page Plan

Case Number	Test Description	Expected Output	Actual Output
1	Search citizen.	Identify the given search successfully.	N/A
2	Change the status of the citizen as Free, Found or Wanted.	Successfully can categorized the status.	N/A

### 8.3.2 User Acceptance Testing

Name:

Position:

Date:

Type: User

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

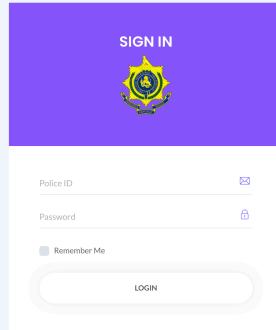
Type: Admin

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

## Chapter 9: Implementation

### 9.1 Screenshots

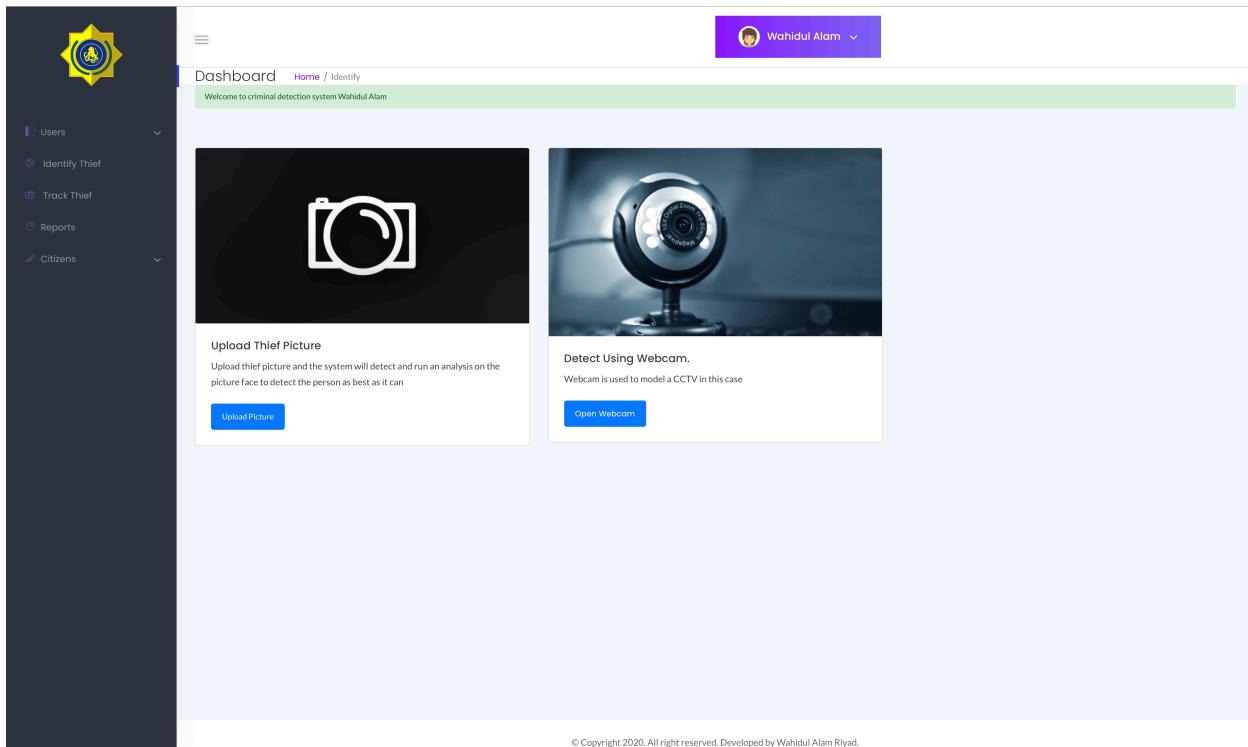
#### 9.1.1 Login Page



*Figure 63 shows Login Page Diagram*

Anyone can access the login page, even if they are not registered. A single login page is used by all forms of users, including the same login page for admin access. The login page asks the user to enter a username and password, and the user will receive an alert to enter the missing fields if the field is missing (Figure 63).

### 9.1.2 Identify Thief Page



*Figure 64 shows Identify Thief Page Diagram*

This page is the most crucial part of the system as it involves working with the face recognition models to identify thief using both picture and live webcam. Users will be able to identify the high potential individual against the criminal database. The model will be used as the highest accuracy for identifying effectively (Figure 64).

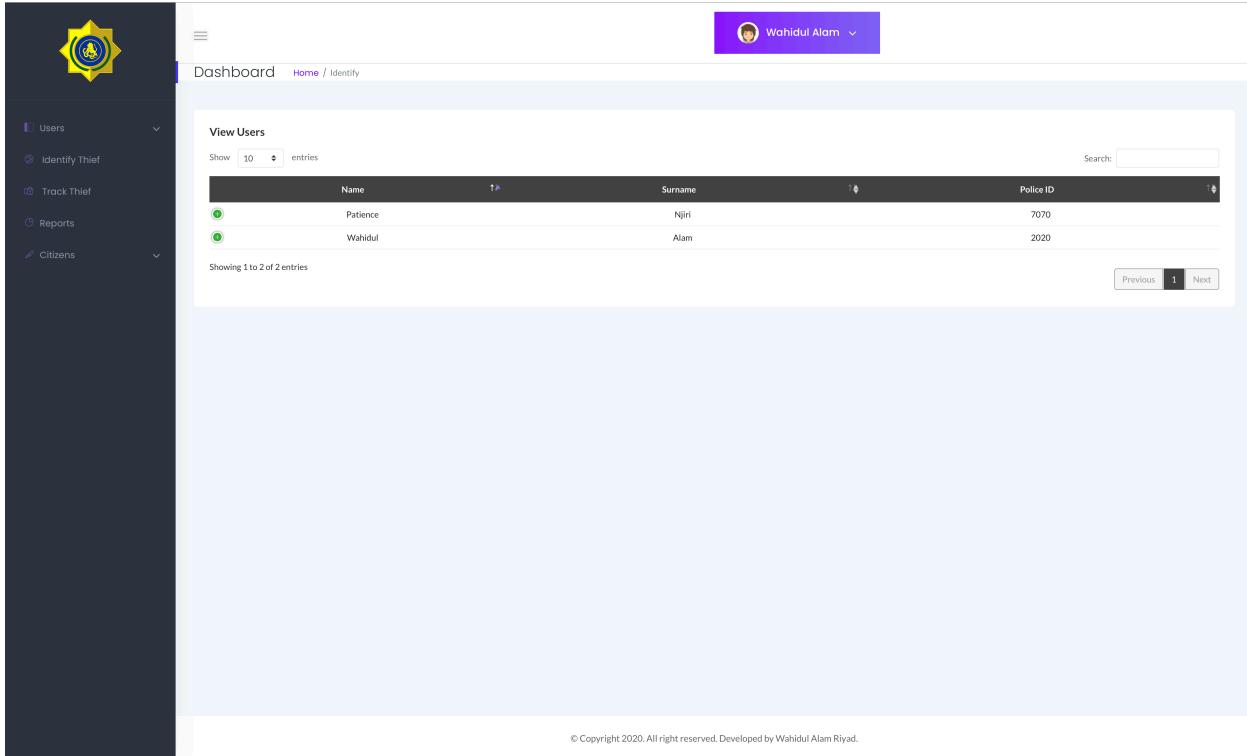
### 9.1.3 Add User Page

The screenshot shows a web-based application interface. On the left, there is a dark sidebar with a yellow circular logo at the top. Below the logo, there are five menu items: 'Users', 'Identify Thief', 'Track Thief', 'Reports', and 'Citizens'. The 'Users' item is currently selected, indicated by a blue border. The main content area has a light gray background. At the top, it says 'Dashboard' and 'Home / Identify'. Below this, a title 'Add System User' is centered. There are four input fields: 'Name', 'Surname', 'Police ID', and 'Password', each with a corresponding text input box. At the bottom of the form is a blue 'Submit' button. In the top right corner, there is a purple header bar with a user icon and the name 'Wahidul Alam'.

Figure 65 shows Add User Page Diagram

If the user is registered, then only the registration page is available. The registration page asks the user to enter a name, address, a police ID, and a password, and the user will receive an alert to enter the missing fields if any fields are missing or the passwords do not match (Figure 65).

### 9.1.4 View User Page



The screenshot shows a user interface for viewing user details. At the top right, there is a purple header bar with a profile icon and the text "Wahidul Alam". Below the header, the page title "Dashboard" is visible, along with "Home / Identify". On the left, a sidebar menu includes "Users", "Identify Thief", "Track Thief", "Reports", and "Citizens". The main content area is titled "View Users" and displays a table with two entries:

	Name	Surname	Police ID
1	Patience	Njiri	7070
2	Wahidul	Alam	2020

Below the table, it says "Showing 1 to 2 of 2 entries". At the bottom right of the content area, there are buttons for "Previous", "1", and "Next". A small copyright notice at the bottom center states "© Copyright 2020. All right reserved. Developed by Wahidul Alam Riyad."

Figure 66 shows View User Page Diagram

This feature allows the user to view the registered admin's details and the police officer in the system (Figure 66). Users can also search other user from the history as well.

### 9.1.5 Track Thief Page

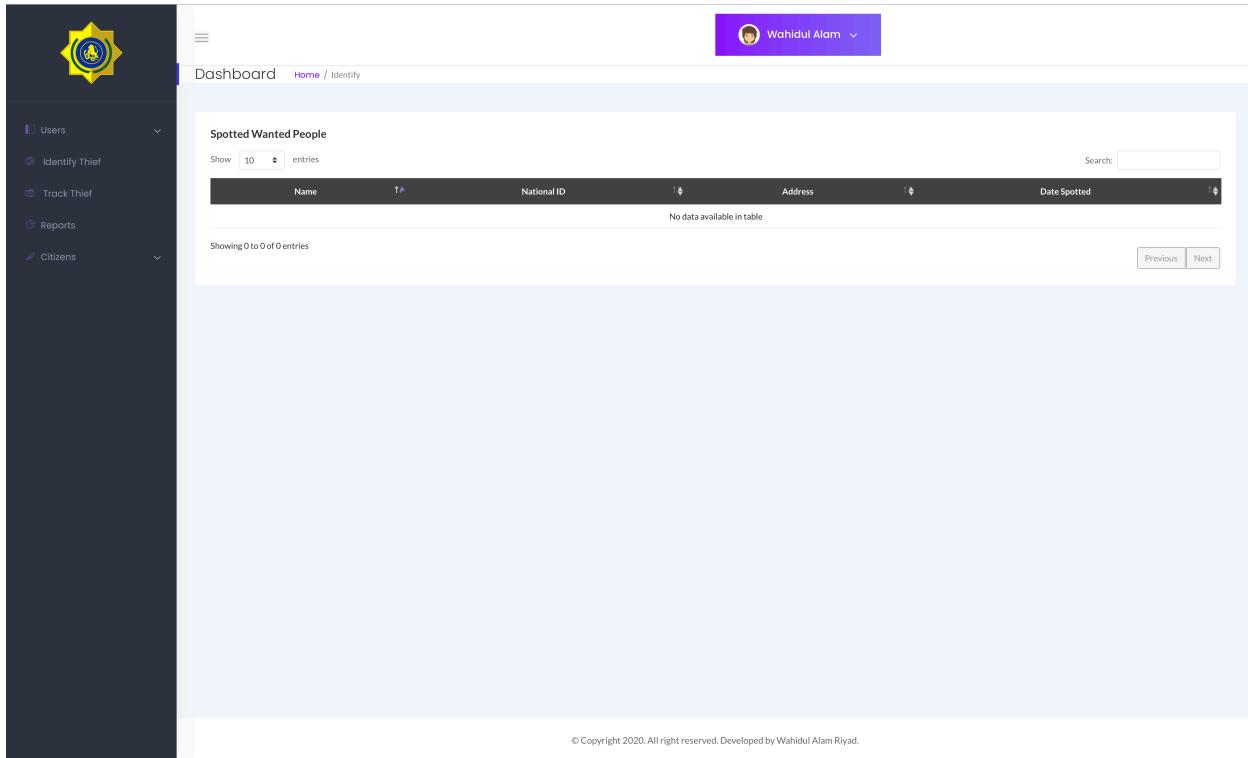


Figure 66 shows Track Thief Page Diagram

The user will also be able to track the realtime location of the thief which can be categorized as Found. Users can also search criminal from the history as well. Updating the action button will also change the citizen database as well (Figure 66).

### 9.1.6 View Report Page

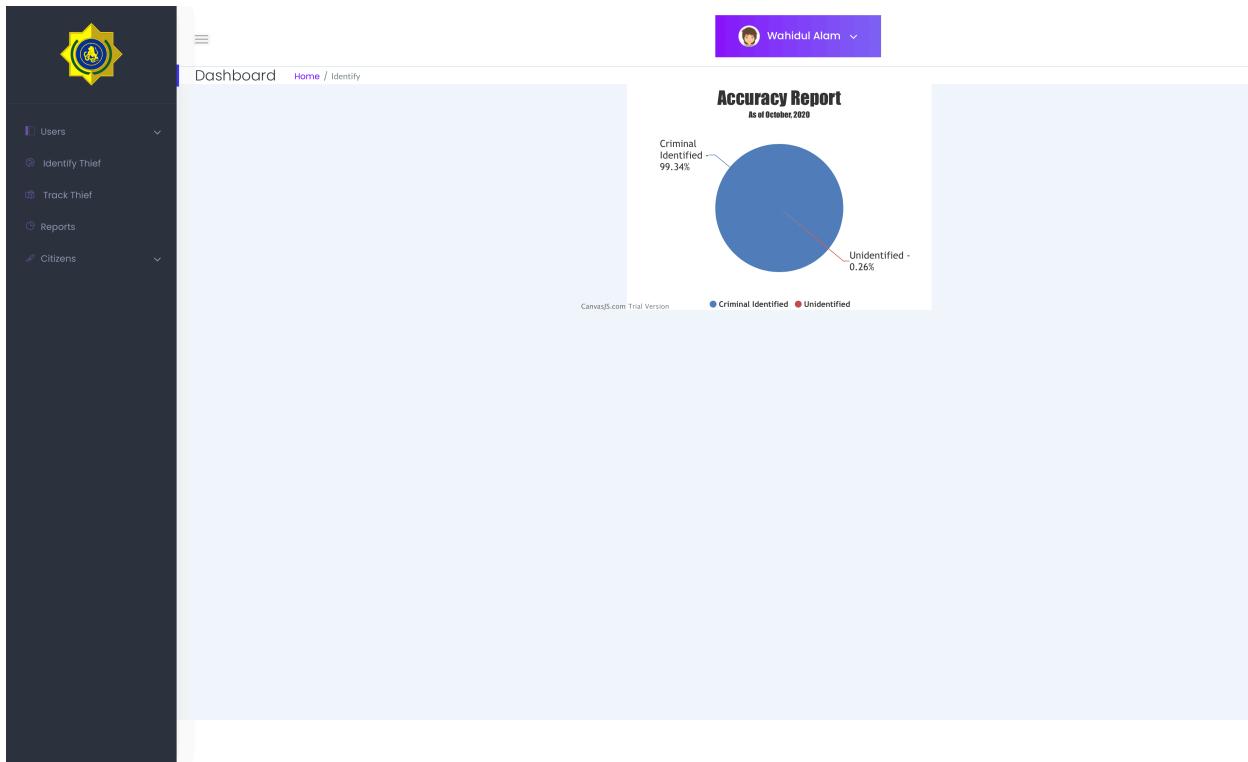


Figure 67 shows View Report Page Diagram

Users will be able to view the face recognition model's accuracy, which represents in the pie chart. It will show the rate of criminal identification in the system (Figure 67).

### 9.1.7 Add Citizen Page

The screenshot shows a user interface for adding a citizen. On the left is a dark sidebar with a yellow circular logo at the top. Below the logo are five menu items: 'Users', 'Identify Thief', 'Track Thief', 'Reports', and 'Citizens'. Under 'Citizens', there are three sub-options: 'Add Citizen', 'Identify Thief', and 'Track Thief'. The main content area has a header bar with a profile picture and the name 'Wahidul Alam'. Below the header is a breadcrumb navigation showing 'Dashboard / Home / Identify'. The central part of the screen is a form titled 'Add Citizen'. It contains four input fields: 'Name' (with a placeholder 'Name'), 'National ID' (with a placeholder 'National ID'), 'Address' (with a placeholder 'Address'), and 'Picture' (with a placeholder 'Choose File no file selected'). At the bottom of the form is a blue 'Submit' button.

Figure 68 shows Add Citizen Page Diagram

Citizen registration will help the user to register citizen with their picture in the database for identification (Figure 68).

### 9.1.8 View Citizen Page

The screenshot displays the 'View Citizens' section of a web application. At the top, there's a purple header bar with the user profile 'Wahidul Alam'. Below it, the main title 'View Citizens' is centered above a table. The table has columns for Name, National ID, Address, and Status. There are three entries:

Name	National ID	Address	Status
patience	30123479	3456 nehanda gwenu	Found
Wayne Butete	30303030	1234 Mbare Zimbabwe	Wanted
Webster Moswa	29295480M07	1450 Woodlands Park	Wanted

Below the table, a message says 'Showing 1 to 3 of 3 entries'. On the far right, there are 'Previous' and 'Next' buttons. The sidebar on the left contains links for 'Users', 'Identify Thief', 'Track Thief', 'Reports', and 'Citizens'.

Figure 68 shows Add Citizen Page Diagram

In view citizen, the citizen can be categorized as free, found, or wanted to distinguish between each other (Figure 68). Users can also search citizens from the history as well.

## 9.2 Sample Codes

### 9.2.1 Face Detection & Recognition

```

12     def print_result(filename, location):
13         top, right, bottom, left = location
14         print("{}\n{},{}\n{},{}\n{},{}".format(filename, top, right, bottom, left))
15
16
17     def test_image(image_to_check, model):
18         unknown_image = face_recognition.load_image_file(image_to_check)
19         face_locations = face_recognition.face_locations(unknown_image, number_of_times_to_upsample=0, model=model)
20
21         for face_location in face_locations:
22             print_result(image_to_check, face_location)
23
24
25     def image_files_in_folder(folder):
26         return [os.path.join(folder, f) for f in os.listdir(folder) if re.match(r'.*\.(jpg|jpeg|png)', f, flags=re.I)]
27
28
29     def process_images_in_process_pool(images_to_check, number_of_cpus, model):
30         if number_of_cpus == -1:
31             processes = None
32         else:
33             processes = number_of_cpus
34
35         # macOS will crash due to a bug in libdispatch if you don't use 'forkserver'
36         context = multiprocessing
37         if "forkserver" in multiprocessing.get_all_start_methods():
38             context = multiprocessing.get_context("forkserver")
39
40         pool = context.Pool(processes=processes)
41
42         function_parameters = zip(
43             images_to_check,
44             itertools.repeat(model),
45         )
46
47         pool.starmap(test_image, function_parameters)
48
49
50     @click.command()
51     @click.argument('image_to_check')
52     @click.option('--cpus', default=1, help='number of CPU cores to use in parallel. -1 means "use all in system"')
53     @click.option('--model', default="hog", help='Which face detection model to use. Options are "hog" or "cnn".')
54     def main(image_to_check, cpus, model):
55         # Multi-core processing only supported on Python 3.4 or greater
56         if (sys.version_info < (3, 4)) and cpus != 1:
57             click.echo("WARNING: Multi-processing support requires Python 3.4 or greater. Falling back to single-threaded processing!")
58             cpus = 1
59
60         if os.path.isdir(image_to_check):
61             if cpus == 1:
62                 [test_image(image_file, model) for image_file in image_files_in_folder(image_to_check)]
63             else:
64                 process_images_in_process_pool(image_files_in_folder(image_to_check), cpus, model)
65         else:
66             test_image(image_to_check, model)

```

Figure 69 shows Face Detection Code Diagram

```

14     def scan_known_people(known_people_folder):
15         known_names = []
16         known_face_encodings = []
17
18         for file in image_files_in_folder(known_people_folder):
19             basename = os.path.splitext(os.path.basename(file))[0]
20             img = face_recognition.load_image_file(file)
21             encodings = face_recognition.face_encodings(img)
22
23             if len(encodings) > 1:
24                 click.echo("WARNING: More than one face found in {}. Only considering the first face.".format(file))
25
26             if len(encodings) == 0:
27                 click.echo("WARNING: No faces found in {}. Ignoring file.".format(file))
28             else:
29                 known_names.append(basename)
30                 known_face_encodings.append(encodings[0])
31
32     return known_names, known_face_encodings
33
34
35     def print_result(filename, name, distance, show_distance=False):
36         if show_distance:
37             print("{}: {}, {}".format(filename, name, distance))
38         else:
39             print("{}: {}".format(filename, name))
40
41
42     def test_image(image_to_check, known_names, known_face_encodings, tolerance=0.6, show_distance=False):
43         unknown_image = face_recognition.load_image_file(image_to_check)
44
45         # Scale down image if it's giant so things run a little faster
46         if max(unknown_image.shape) > 1600:
47             pil_img = PIL.Image.fromarray(unknown_image)
48             pil_img.thumbnail((1600, 1600), PIL.Image.LANCZOS)
49             unknown_image = np.array(pil_img)
50
51         unknown_encodings = face_recognition.face_encodings(unknown_image)
52
53         for unknown_encoding in unknown_encodings:
54             distances = face_recognition.face_distance(known_face_encodings, unknown_encoding)
55             result = list(distances <= tolerance)
56
57             if True in result:
58                 [print_result(image_to_check, name, distance) for is_match, name, distance in zip(result, known_names, distances) if is_match]
59             else:
60                 print_result(image_to_check, "unknown_person", None, show_distance)
61
62         if not unknown_encodings:
63             # print out fact that no faces were found in image
64             print_result(image_to_check, "no_persons_found", None, show_distance)
65
66
67     def image_files_in_folder(folder):
68         return [os.path.join(folder, f) for f in os.listdir(folder) if re.match(r'^(.*\.(jpg|jpeg|png))$', f, flags=re.I)]

```

*Figure 70 shows Face Recognition Code Diagram*

This version is the most crucial part of the system as it involves working with the face recognition models to identify thief using both picture and live webcam. Users will be able to identify the high potential individual against the criminal database. The model will be used as the highest accuracy for identifying effectively (Figure 69 & 70).

### 9.2.3 Track Thief Page

```

23 <div id="map"></div>
24 <script>
25
26 // This example displays a marker at the center of Australia.
27 // When the user clicks the marker, an info window opens.
28
29 function initMap() {
30   var uluru = {lat: -25.363, lng: 131.044};
31   var map = new google.maps.Map(document.getElementById('map'), {
32     zoom: 4,
33     center: uluru
34   });
35
36   var contentString = '<div id="content">' +
37     '<div id="siteNotice">' +
38     '</div>' +
39     '<h1 id="firstHeading" class="firstHeading">Uluru</h1>' +
40     '<div id="bodyContent">' +
41     '<p><b>Uluru</b>, also referred to as <b>Ayers Rock</b>, is a large ' +
42     'sandstone rock formation in the southern part of the '+
43     'Northern Territory, central Australia. It lies 335&#160;km (208&#160;mi) '+
44     'south west of the nearest large town, Alice Springs; 450&#160;km '+
45     '(280&#160;mi) by road. Kata Tjuta and Uluru are the two major '+
46     'features of the Uluru - Kata Tjuta National Park. Uluru is '+
47     'sacred to the Pitjantjatjara and Yankunytjatjara, the '+
48     'Aboriginal people of the area. It has many springs, waterholes, '+
49     'rock caves and ancient paintings. Uluru is listed as a World '+
50     'Heritage Site.</p>' +
51     '<p>Attribution: Uluru, <a href="https://en.wikipedia.org/w/index.php?title=Uluru&oldid=297882194">'+
52     'https://en.wikipedia.org/w/index.php?title=Uluru</a> '+
53     '(last visited June 22, 2009).</p>' +
54     '</div>' +
55   '</div>';
56
57   var infowindow = new google.maps.InfoWindow({
58     content: contentString
59   );
56
60   var marker = new google.maps.Marker({
61     position: uluru,
62     map: map,
63     title: 'Uluru (Ayers Rock)'
64   );
65   marker.addListener('click', function() {
66     infowindow.open(map, marker);
67   });
68 }
69 </script>
70 <script async defer
71 src="https://maps.googleapis.com/maps/api/js?key=AIzaSyC3mtaCY30xQocRYlmdNbqQogtyUSckEzo&callback=initMap">
72 </script>

```

Figure 71 shows Track Thief Page Code Diagram

Here the developer is using google api for measuring the location of the spotted wanted people. This uses the latitude and longitude from the moment the webcam is turned on Figure 71).

## 9.2.4 Home Page

*Figure 72 shows Home Page Code Diagram*

Here the developer is using both the function to identify criminals using picture and real time webcam as well (Figure 72).

## Chapter 10: System Validation

### 10.1 Unit Testing

#### 10.1.1 Version 1

##### Login Page

Case Number	Test Description	Expected Output	Actual Output
1	Inputs are valid.	Login successful.	Login successful.
2	Username & password is missing.	Pop-up error message indicating missing credentials.	Pop-up error message indicating missing credentials.
3	Inputs are invalid.	Pop-up error message indicating invalid credentials.	Pop-up error message indicating invalid credentials.
4	Press logout button.	Logout successfully.	Logout successfully.

##### User Registration Page

Case Number	Test Description	Expected Output	Actual Output
1	Inputs are valid.	Register successful.	Register successful.
2	Username, password, police ID & address is missing.	Pop-up error message indicating missing credentials.	Pop-up error message indicating missing credentials.

## 10.1.2 Version 2

## Identify Thief Page

Case Number	Test Description	Expected Output	Actual Output
1	Upload picture is valid.	Identify the thief successfully or categorize as unknown.	Identify the thief successfully or categorize as unknown.
2	Open webcam is valid.	Identify the thief successfully.	Identify the thief successfully.

## Track Thief Page

Case Number	Test Description	Expected Output	Actual Output
1	Press found button.	Clear the list of spot wanted people and update the view citizen page.	Clear the list of spot wanted people and update the view citizen page.
2	Search wanted people.	Identify the given search successfully.	Identify the given search successfully.

## View User Page

Case Number	Test Description	Expected Output	Actual Output
1	Search user.	Identify the given search successfully.	Identify the given search successfully.

## 10.1.3 Version 3

## Citizen Registration Page

Case Number	Test Description	Expected Output	Actual Output
1	Inputs are valid.	Register successful.	Register successful.
2	Name, national ID, address & picture is missing.	Pop-up error message indicating missing credentials.	Pop-up error message indicating missing credentials.

## View Citizen Page

Case Number	Test Description	Expected Output	Actual Output
1	Search citizen.	Identify the given search successfully.	Identify the given search successfully.
2	Change the status of the citizen as Free, Found or Wanted.	Successfully can categorized the status.	Successfully can categorized the status.

## 10.2 User Acceptance Testing

Name: Sylvia Chan Poh Yee

Position: Student

Date: 18<sup>th</sup> August, 2020

Type: User-1

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

Type: Admin-1

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

Name: Saleh Al- Saroori

Position: Student

Date: 25<sup>th</sup> August, 2020

Type: User-2

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

Type: Admin-2

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

Name: Manahil Rahamatullah

Position: Student

Date: 1<sup>st</sup> September , 2020

Type: User-3

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

Type: Admin-3

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

Name: Saim Zafar

Position: Student

Date: 15<sup>th</sup> September, 2020

Type: User-4

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

Type: Admin-4

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

Name: Anas Mustafa

Position: Student

Date: 22<sup>nd</sup> September, 2020

Type: User-5

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

Type: Admin-5

Testing Description	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Consistency					
Ease-to-use					
Interactivity					
User Interface					
Navigation					

## 10.3 Summary

The developer carried out two forms of testing, which were the unit testing and the user acceptance test. For the developer to determine if all the functions that were introduced in the application are working as desired, the unit testing was carried out. Based on the test, there were no problems found, and all the results were as planned. Furthermore, if any mistakes were made, the developer would have addressed it quickly to ensure that the application met the deadline. The user approval test was the next test carried out. The developer designed this test to get an idea of how users would react to the application and how well it was produced. A collection of rating scales was given to the testers to rate the application's critical requirements and whether it works well or not. They would have told the developer if the users had noticed any mistakes, but there were no errors during the testing phases successfully.

## Chapter 11: Conclusion & Reflections

### 11.1 Critical Evaluations

The report was prepared for the proposed web application, Smart Analysis System for Institution, in coloration. The first step taken in this report was to try to determine what the concerns are and why the proposed web application was made. The developer began the second phase after extensively reviewing the challenges faced and how the new web application would be useful.

The developer's second stage was the company's context for which the proposed web application was being created. The developer proceeded to the next step, the literature review, after having a better understanding of the problem. Two components of the literature review were divided into domain analysis and related structures. The creator studied numerous previous works and journals of researchers in the related area of facial recognition. The rationale for this is to obtain a clear understanding of what previous researchers have accomplished and achieved and work on that basis.

The developer undertook technical research to provide a clear understanding of the various types of programming languages, IDE, DBMS, web browser, operating systems, and web server, followed next. Once the developer evaluated various forms of different fields, the developer determined what the web application will be created and how.

Next was the methodology of system development; the developer studied the three most common and often used methodologies to find the developer's most appropriate methodology when designing this project. The consumer systematically described it and followed it through during the project's development until the developer settled on the approach that would be integrated with the project.

According to the methodology of system creation, the developer has cross-analyzed three data collection methods in this part of the research: interview, questionnaire, and observation. After evaluating and comparing them, the developer decided that a questionnaire was the most powerful and most productive way to provide a quantity of data. The developer prepared a

questionnaire and sent it to many university students to collect relevant data and use it for the next step, reviewing requirements. The developer analyzed all the information that was obtained from the previous stage in the requirement analysis process. To see whether this project's goal would be willing to approve the application or not, the collected data was analyzed.

The next step was the layout of the system, at which point the developer began designing and planning the application storyboard that was to be prepared. The developer wanted to use UML diagrams to illustrate how the application will be, what features will be, and how it will be followed. The developer continued with the implementation phase after the design phase was completed. It was strictly coding and production in this phase. The developer ensured that all the planned features were available and functioned well.

Until the application was ready, the next step was the testing process. In this step, the developer prepared unit tests in which the developer evaluated every aspect of the prepared application. This stage was carried out to ensure that all the device functionality functions as intended and that no problems or defects have been identified to ensure that the end-user would not have any difficulties with the program. The developer's hand-selected some beta users after all the unit testing was done, in which their duties were to use the application and record whether there were any problems or errors that were to be identified. This test was performed to see how the program would run if it already hit the end-users, so why it had to be used first by the beta testers to see if any bugs needed to be corrected.

Ultimately, the proposed project's implementation performs well and is free of any mistakes based on the beta testers who checked and assessed the program. A few improvements were made, and the developer reviewed it again to see whether it still performed well or whether the other areas of the application were affected.

## 11.2 Conclusion

In conclusion, Smart Analysis System is the ultimate solution as it can prevent persistent gun violence issues. The facts referring to the many will increase in gun violence at durations. The college setting is marvelous and fearsome. Mostly, schools are created to be secure havens for university college students and college, anyplace all people will sense protected and upload whether it's contributing to learning. As soon as violent acts, collectively with gun shootings, take place, accept as real with and security are compromised, make the most university and college students feeling defeated and traumatized. Therefore, to make sure the nicely-being of all students and college, it might be beneficial for a bridge to be designed among colleges and government corporations. The limitations of this research are the ethical issues that it can represent in terms of privacy. Some people might not feel comfortable with the idea that they are being monitored on school premises. Thus, a juvenile might avoid CCTV cameras to avoid being recorded. It can be improved vastly if the government permits the system to use everywhere, which can help to collect data and improve the performance of the detection. All the tools, techniques, and methodologies required for implementing SAS were investigated and included by the developer in the study. The creator managed to achieve the project's main objective. Nevertheless, once the project is introduced, some work must be undertaken. Functionalities that end-users would like to need to be more comprehensive as the projects grow. Overall, the investigation was completed on schedule with all the required criteria.

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# Appendices

## FYP Poster

**SAS**  
**(SMART ANALYSIS SYSTEM)**  
WAHIDUL ALAM RIYAD  
BSc (Hons) in Intelligent Systems – UC3F2002IS

**Introduction**  
In the last few years, violence involving guns has risen significantly and is an ongoing problem. Facial Recognition Technology is the ultimate solution for solving this persistent. The paper proposes a related facial recognition device based on the computer's vision which is able to identify the face analysis on CC TV equipment for several subjects at a certain time. It can also prevent unwanted individuals from entering the school. Agile Scrum methodology is proposed for this research proposal. Smart Analysis System (SAS) can detect facial expression, body movement, age detection, emotion analysis, and to identify the potential high-risk individual. This paper also shows how Smart Analysis System (SAS) can reduce the rate of gun violence in school premises.

**Technology Used to implement SAS**  
SAS is developed by using the Python Programming Language and facial recognition technology. It means that the SAS can be implemented as a Web-Application

**System Feature**

1. It can recognize facial expressions.
2. It can track real-time location.
3. It can differentiate between various ethnicity.
4. It can identify high-risk potentials.
5. It can alert the authorities to prevent the gun shooting.

**Objective**

- To identify the potential risk individuals who act gun violence against juvenile safety in the educational institute.
- To develop an application known as Smart Analysis System (SAS) that can detect unauthorized individuals by detecting their faces.
- To design the User Interface for SAS that will help the school premises to be more secured against gun violence, which will also discourage the criminals in the gun firing.

**Conclusion**  
In conclusion, Smart Analysis System is the ultimate solution as it can prevent persistent gun violence issues. The facts referring to the many will increase in gun violence at durations. The college setting is marvelous and fearsome. Mostly, schools are created to be secure havens for university college students and college, anywhere all people will sense protected and upload whether it's contributing to learning. As soon as violent acts, collectively with gun shootings, take place, accept as real with and security are compromised, make the most university and college students feeling defeated and traumatized. Therefore, to make sure the nicely-being of all students and college, it might be beneficial for a bridge to be designed among colleges and government corporations. The limitations of this research are the ethical issues that it can represent in terms of privacy. Some people might not feel comfortable with the idea that they are being monitored on school premises. Thus, a juvenile might avoid CCTV cameras to avoid being recorded. It can be improved vastly if the government permits the system to use everywhere, which can help to collect data and improve the performance of the detection. All the tools, techniques, and methodologies required for implementing SAS were investigated and included by the developer in the study. The creator managed to achieve the project's main objective. Nevertheless, once the project is introduced, some work must be undertaken. Functionalities that end-users would like to need to be more comprehensive as the projects grow. Overall, the investigation was completed on schedule with all the required criteria.

**Screenshot of SAS Home Page**

**Screenshot of Login Page**

**Hardware and Software Requirement Specification**  
SA is only support for the browser and software version as shown below.

- Safari
- Chrome
- Edge
- Core i7 CPU
- Minimum 8 GB Ram

**SAS (Smart Analysis System)**  
Developed by: WAHIDUL ALAM RIYAD  
TP043338  
BSc (Hons) in Intelligent Systems  
Intake Code: UC3F2002IS  
Supervised by: Dr Hamam Mokayed

## Project Log Sheets



(APU: Serial Number)

PLS V1.0

Project Log Sheet – Supervisory	Session
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**Notes on use of the project log sheet:**

1. This log sheet is designed for meetings of more than 15 minutes duration, of which there must be at minimum **SIX (6)** during the course of the project (**SIX** mandatory supervisory sessions).
2. The student should prepare for the supervisory sessions by deciding which question(s) he or she needs to ask the supervisor and what progress has been made (if any) since the last session, and noting these in the relevant sections of the form, effectively forming an agenda for the session.
3. A log sheet is to be brought by the STUDENT to each supervisory session.
4. The actions by the student (and, perhaps the supervisor), which should be carried out before the next session should be noted briefly in the relevant section of the form.
5. The student should leave a copy (after the session) of the Project Log Sheet with the supervisor and to the administrator at the academic counter. A copy is retained by the student to be filed in the project file.
6. It is recommended that students bring along log sheets of previous meetings together with the project file during each supervisory session.
7. The log sheet is an important deliverable for the project and an important record of a student's organisation and learning experience. The student **must** hand in the log sheets as an appendix of the final year documentation, with sheets dated and numbered consecutively.

**Student's name:** ...Wahidul Alam Riyad..... **Date:** ...13/02/2020...**Meeting No:** ...1.....

**Project title:** .....SAS..... **Intake:** UC3F2002IS

**Supervisor's name:** Dr. Hamam Mokayed..... **Supervisor's e-signature:** Hamam Mokayed

**Items for discussion (noted by student before mandatory supervisory meeting):**

1. Come out with a title for Final Year Project.
2. Get some ideas and big picture of the Final Year Project

**Record of discussion (noted by student during mandatory supervisory meeting):**

1. Get some ideas of title for Final Year Project.
2. Create interface of system with PHP and create database for the system.

**Action List (to be attempted or completed by student by the next mandatory supervisory meeting):**

1. Fix the title for the Final Year Project.
2. Finish PSF.

*Note: A student should make an appointment to meet his or her supervisor (via the consultation system) at least ONE (1) week prior to a mandatory supervisor session – please see document on project timelines. In the event a supervisor could not be booked for consultation, the project manager should be informed ONE (1) week prior to the session so that a meeting can be subsequently arranged.*

**Project Log Sheet – Supervisory****Session****Notes on use of the project log sheet:**

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6. It is recommended that students bring along log sheets of previous meetings together with the project file during each supervisory session.
7. The log sheet is an important deliverable for the project and an important record of a student's organisation and learning experience. The student **must** hand in the log sheets as an appendix of the final year documentation, with sheets dated and numbered consecutively.

**Student's name:** ...Wahidul Alam Riyad..... **Date:** ...30/03/2020...**Meeting No:** ...2.....

**Project title:** .....SAS..... **Intake:** UC3F2002IS

**Supervisor's name:** Dr. Hamam Mokayed..... **Supervisor's e-signature:** Hamam Mokayed

**Items for discussion (noted by student before mandatory supervisory meeting):**

1. Changing system programming language.
2. Get permission from supervisor.

**Record of discussion (noted by student during mandatory supervisory meeting):**

1. Changing the contents of Programming Language for IR.
2. Submitted the PSF to the FYP bank system and get approval from supervisor.

**Action List (to be attempted or completed by student by the next mandatory supervisory meeting):**

1. Review on my investigation report.
2. Change the report if necessary.

*Note: A student should make an appointment to meet his or her supervisor (via the consultation system) at least ONE (1) week prior to a mandatory supervisor session – please see document on project timelines. In the event a supervisor could not be booked for consultation, the project manager should be informed ONE (1) week prior to the session so that a meeting can be subsequently arranged.*

**Project Log Sheet – Supervisory****Session****Notes on use of the project log sheet:**

1. This log sheet is designed for meetings of more than 15 minutes duration, of which there must be at minimum **SIX (6)** during the course of the project (SIX mandatory supervisory sessions).
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7. The log sheet is an important deliverable for the project and an important record of a student's **organisation** and learning experience. The student **must** hand in the log sheets as an appendix of the final year documentation, with sheets dated and numbered consecutively.

**Student's name:** ...Wahidul Alam Riyad..... **Date:** ...15/04/2020...**Meeting No:** ...3.....

**Project title:** .....SAS..... **Intake:** UC3F2002IS

**Supervisor's name:** Dr. Hamam Mokayed..... **Supervisor's e-signature:** Hamam Mokayed

**Items for discussion (noted by student before mandatory supervisory meeting):**

1. Changing system programming language.
2. Get permission from supervisor.

**Record of discussion (noted by student during mandatory supervisory meeting):**

1. Changing the contents of Programming Language for IR.
2. Submitted the PSF to the FYP bank system and get approval from supervisor.

**Action List (to be attempted or completed by student by the next mandatory supervisory meeting):**

1. Review on my investigation report.
2. Change the report if necessary.

*Note: A student should make an appointment to meet his or her supervisor (via the consultation system) at least ONE (1) week prior to a mandatory supervisor session – please see document on project timelines. In the event a supervisor could not be booked for consultation, the project manager should be informed ONE (1) week prior to the session so that a meeting can be subsequently arranged.*

**Project Log Sheet – Supervisory****Session****Notes on use of the project log sheet:**

1. This log sheet is designed for meetings of more than 15 minutes duration, of which there must be at minimum SIX (6) during the course of the project (SIX mandatory supervisory sessions).
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7. The log sheet is an important deliverable for the project and an important record of a student's ~~organisation~~ and learning experience. The student **must** hand in the log sheets as an appendix of the final year documentation, with sheets dated and numbered consecutively.

**Student's name:** ...Wahidul Alam Riyad..... **Date:** ...10/05/2020...**Meeting No:** ...4.....

**Project title:** .....SAS..... **Intake:** UC3F2002IS

**Supervisor's name:** Dr. Hamam Mokayed..... **Supervisor's e-signature:** Hamam Mokayed

**Items for discussion (noted by student before mandatory supervisory meeting):**

1. Changing system programming language.
2. Get permission from supervisor.

**Record of discussion (noted by student during mandatory supervisory meeting):**

1. Changing the contents of Programming Language for IR.
2. Submitted the PSF to the FYP bank system and get approval from supervisor.

**Action List (to be attempted or completed by student by the next mandatory supervisory meeting):**

1. Review on my investigation report.
2. Change the report if necessary.

*Note: A student should make an appointment to meet his or her supervisor (via the consultation system) at least ONE (1) week prior to a mandatory supervisor session – please see document on project timelines. In the event a supervisor could not be booked for consultation, the project manager should be informed ONE (1) week prior to the session so that a meeting can be subsequently arranged.*

**Project Log Sheet – Supervisory****Session****Notes on use of the project log sheet:**

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7. The log sheet is an important deliverable for the project and an important record of a student's organisation and learning experience. The student **must** hand in the log sheets as an appendix of the final year documentation, with sheets dated and numbered consecutively.

**Student's name:** ...Wahidul Alam Riyad..... **Date:** ...10/06/2020...**Meeting No:** ...5.....

**Project title:** .....SAS..... **Intake:** UC3F2002IS

**Supervisor's name:** Dr. Hamam Mokayed..... **Supervisor's e-signature:** Hamam Mokayed

**Items for discussion (noted by student before mandatory supervisory meeting):**

1. Changing system programming language.
2. Get permission from supervisor.

**Record of discussion (noted by student during mandatory supervisory meeting):**

1. Changing the contents of Programming Language for IR.
2. Submitted the PSF to the FYP bank system and get approval from supervisor.

**Action List (to be attempted or completed by student by the next mandatory supervisory meeting):**

1. Review on my investigation report.
2. Change the report if necessary.

*Note: A student should make an appointment to meet his or her supervisor (via the consultation system) at least ONE (1) week prior to a mandatory supervisor session – please see document on project timelines. In the event a supervisor could not be booked for consultation, the project manager should be informed ONE (1) week prior to the session so that a meeting can be subsequently arranged.*

**Project Log Sheet – Supervisory****Session****Notes on use of the project log sheet:**

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**Student's name:** ...Wahidul Alam Riyad..... **Date:** ...10/08/2020...**Meeting No:** ...6.....

**Project title:** .....SAS..... **Intake:** UC3F2002IS

**Supervisor's name:** Dr. Hamam Mokayed..... **Supervisor's e-signature:** Hamam Mokayed

**Items for discussion (noted by student before mandatory supervisory meeting):**

1. Changing system programming language.
2. Get permission from supervisor.

**Record of discussion (noted by student during mandatory supervisory meeting):**

1. Changing the contents of Programming Language for IR.
2. Submitted the PSF to the FYP bank system and get approval from supervisor.

**Action List (to be attempted or completed by student by the next mandatory supervisory meeting):**

1. Review on my investigation report.
2. Change the report if necessary.

*Note: A student should make an appointment to meet his or her supervisor (via the consultation system) at least ONE (1) week prior to a mandatory supervisor session – please see document on project timelines. In the event a supervisor could not be booked for consultation, the project manager should be informed ONE (1) week prior to the session so that a meeting can be subsequently arranged.*

## Project Proposal Form

### Introduction

In the United States, Gun-involved violence has increased dramatically in the past few years and has become a persistent issue (Bleuer, 2019). Every year, almost 2,900 kids and youths are shot, associated with a calculable three million kids are uncovered to shot annually. A devastating effect can fall upon the victims that face this traumatic scenario. In the wake of these misfortunes, people are desperate for responses and assurance. Everyone approves something that must be done, but they cannot decide what will be the ultimate solution. The discussion of inhibition of mass firings is yet highly debated and expressively charged.

Facial Recognition Technology, however, is unflustered. Computer algorithms can recognize guns before they are drawn out as they are not prone to uncertainty or emotion and are more reliable in analyzing data that can also prevent the gun violence persistent issue. While human decision making and intervention are vital to unraveling an issue as complex as gun violence, technologies like artificial intelligence and high-powered sensors can be designed to help stem the tide of mass gunfire in the United States.

### Problem Statement

Firearm fierceness can interrupt the functioning of schools and make students expeditions to and from school dangerous. Deficiency of state resources for education and the struggle of enlisting and retaining teaching staff in neighborhoods wracked by gun fierceness have a negative influence, declining the right to education. Pervasive firearm violence and associated uncertainty can have a particularly serious influence on children and youths, including unsettling school attendance and retention, harming the learning environment, and ping the quality of teaching. This can, in turn, lead to minor life results regarding employment and income, and prolong cycles of deficiency, crime, and violence. There were 316 shooting at schools in the USA between 2013 and June 2018 (Figure 1). There are broad and often little understanding of the problems which lead to a child picking a firearm. Year-old violence may, however, be associated with fear, need for protection, police unbelief as regards engrained prejudice and

limited police action, and an appetite for respect and encouragement and involvement in criminal events as far as urban communities are concerned (International, 2019).

### Project Aim

It focuses on the development of an implementation of the intelligent analysis program that identifies unlicensed faces from school premises to avoid gunfires.

### Project Objectives

The study paper has the following objectives:

- Factors associated with population occurrence rates of mass shootings and to find alternatives to gun violence for young people are established.
- To develop an application known as Smart Analysis System (SAS) that can detect unauthorized individual by detecting their faces and behavior as well.
- To design the User Interface for SAS that will help the school premises to be more secured against gun violence, which will also discourage the criminals in the gun firing.
- To validate the methods of Facial Recognition Technology, authorities will test the system using unload guns in a small classroom with ed volunteered.

### Literature Review

The following papers are related to gun violence & facial recognition system. The factors of gun violence are also presented in these papers.

#### 2.1 Facial Recognition Technology using Deep Learning in Real-Time.

This article (Miao, 2019) offers the author an image-based period of a popularity gadget for face expression, which is designed to distinguish the facial expressions of more than one theme in the same time with ~~a~~ optical optical digicam. Their planned strategy combines a controlled transfer of strategic information with a not uncommon method of supervising with the center failure, which is huge to face tasks. In every offline and in a very time-frame, MobileNet with all the precision and speed makes a newly scheduled Convolutional neural net (CNN) for

fast and accurate real time results. Significant studies are carried out similar to important JAFFE and CK+ datasets. 95.24% are reached for the JAFFE dataset, while 96.92% for the CK + 6, which includes all the final imagery frames, are collected.

## 2.2 Intellectual Effects of Gun Ferocity

In this sense, the author (Spiro, 2016) noted that a growing community of behavioral science researchers have linked that aggression can lead to rapid and sustained psychological effects on people in all kinds of attacks. The studies are categorised into phrases of psychological and mental damage as incognizable wounds. Relatedly (Bagroy, 2017) estimated that a city of violence was not entirely associated with intellectual land problems such as depression, frustration and anxiety following gun violence mishaps within the US schools. The overall educational success of scholars was collectively adversely affected.

The authors also identified the differences in evaluating the mental consequences of violence by using information given by student groups from their schools, collected in previous times and after violent incidents. Social media reduce anxiety by means of analytical analyzes of psychological circumstances, which are commonly documented in the gift and stored, usually reassured. More specifically, due to the opportunity to access historical social media data, the mental consequences of a violent event can be quantitatively studied, based on analyses of the trends found over a period without abuse.

## 2.3 Merging Facial Parts for RGB-D

Among computer vision researchers, the triumph of evolving RGB-D cameras like the Kinect sensing element, merging the form and texture knowledge to progress the standard of acknowledgement has become an inclination. During this paper, the author (AZZAKHNINI, 2018) address the problem of face classification within the context of RGB pictures and depth knowledge. Galvanized by the psychological consequences for external body part insight, this text concentrates on checking out that facial components are best at creating the distinction for a few social aspects of face perception, crucial the optimum decision by combining the choice rendered by the individual components, and extracting the promising options from RGB-D faces

to use all the potential that this knowledge gives. Experimental results on ~~EurecomKinect~~ Face and ~~CurtinFaces~~ databases show that the projected approach improves the popularity quality in several use cases.

In a recent study, the authors discover the price of depth pictures exploitation four native feature extraction strategies enforced to identity, gender, and quality recognition tasks. What is more, the authors in Reference projected the fusion of 3DLBP the tactic with the bar chart of Averaged familiarized Gradients (HAOG), a variant of HOG (Histogram of familiarized Gradients) for face detection once Kinect is enforced because of the 3D face scanner. A brand-new multi-modal ~~manoeuvre~~ was planned for face recognition issue. Authors in Reference prompt a technique supported the entropy of RGB-D faces in conjunction with the prominence feature obtained from a 2nd face. The popularity of superiority was achieved by a tree bagger classifier. In accumulation, a brand-new raw depth poses estimate associate degreed an automatic crop of facial the region was planned in Reference. A brand-new native descriptor (ELMDP) has been planned by Reference applied autonomously on the depth and RGB pictures and united with a score fusion methodology. From a unique perspective, some researchers planned approaches supported the pure mathematics of the face. Associate degree rule supported AAM procedures to trace the entire countenance from depth pictures are introduced. Lastly, another work reports the problem of feeling recognition in RGB-D pictures employing a geometric-based approach was given in Reference.

## Deliverables

SAS helps to detect unwanted individuals from school premises preventing the gun shooting.

The following features are available:

1. It can detect facial expressions.
2. It can detect body movement.
3. It can differentiate between various ethnicity.
4. It can detect high-risk potentials.
5. It can alert the authorities to prevent the gun shooting.

## Project Specification Form

### 1.1 Background To The Project

In the United States, Gun-involved violence has increased dramatically in the past few years and has become a persistent issue (Bleuer, 2019). Every year, almost 2,900 kids and youths are shot, associated with a calculable three million kids are uncovered to shot annually. A devastating effect can fall upon the victims that face this traumatic scenario. In the wake of these misfortunes, people are desperate for responses and assurance. Everyone approves something that must be done, but they cannot decide what will be the ultimate solution. The discussion of inhibition of mass firings is yet highly debated and expressively charged.

Facial Recognition Technology, however, is unflustered. Computer algorithms can recognize guns before they are drawn out as they are not prone to uncertainty or emotion and are more reliable in analyzing data that can also prevent the gun violence persistent issue. While human decision making and intervention are vital to unraveling an issue as complex as gun violence, technologies like artificial intelligence and high-powered sensors can be designed to help stem the tide of mass gunfire in the United States.

Gun-involved violence has increased dramatically in the past few years and has become a persistent issue. Facial Recognition Technology is the ultimate solution for solving this persistent. The paper proposes a related facial recognition device based on the computer's vision which is able to identify the face analysis on CC TV equipment for several subjects at a certain time. It may also forestall unwanted people from getting into faculty premises. Agile Scrum methodology is proposed for this research proposal. Smart Analysis System (SAS) can detect facial expression, body movement, age detection, emotion analysis, and to identify the potential high-risk individual. This paper also shows how Smart Analysis System (SAS) can reduce the rate of gun violence in school premises.

### 1.2 Problem Context

Firearm fierceness can interrupt the functioning of schools and make students expeditions to and from school dangerous. Deficiency of state resources for education and the struggle of enlisting and retaining teaching staff in neighborhoods wracked by gun fierceness have a

negative influence, declining the right to education. Pervasive firearm violence and associated uncertainty can have a particularly severe impact on children and youths, including unsettling school attendance and retention, harming the learning environment, and ping the quality of teaching. This can, in turn, lead to minor life results regarding employment and income, and prolong cycles of deficiency, crime, and violence. In the USA, there were 316 occurrences of shooting on school grounds between July 2013 and June 2018 (Figure 1).

There are broad-based and sometimes misunderstood issues leading to the child picking up a firearm. Youth violence can, however, be related to terror, protection needs, police ignorance due to deep prejudice and biased police forces, a willingness to gain great respect and recognition, as well as involvement in criminal activities, in the situation of urban communities (International, 2019).

### 1.3 Rationale

People who have clean histories and other pointers of fidelity and justice would receive lower insurance premiums. Those who have more erratic histories would be required to pay higher premiums, with the most significant risk individuals potentially being valued out of the market. For this to work, gun protection would need to be compulsory in the same way that auto protection is required. However, if applied, it might link the gap between people on either side of the debate and help collective furnace progress toward reducing gun violence. Avoiding mass shootings is a complex but vital task, and many issues need to be addressed. Luckily, we live in the most technologically progressive age in history, and we have admittance to more data every day. Artificial intelligence can aid us in making sense of that info by recognizing trends we can use to effective solutions. On gun ferocity and so many other urgent subjects, we can influence technology to find answers to the most challenging subjects of our time.

From the research, gun violence can be prevented by implementing SAS in every school premises. It will help to detect unauthorized individuals from school grounds and alert the authority to take necessary action to prevent misfortune. AI could play a supportive role, as well. AI endorsing algorithms can retain guns safe and reasonable for lawful, skilled owners while keeping them out of the hands of high-risk persons. The theory is that AI algorithms could lure

on massive data sources to evaluate a person risk before they are allowed to buy a gun. These data facts might include criminal background drafts, medical archives, employment positions, and even online interactive data to evaluate their risk profiles.

### Nature of Challenge

To develop a facial recognition system, there are three important phases which are face detection, extraction and face recognition. During all these phases, research and understanding in the theory of algorithms and how the algorithm will be part of the challenge on my project. Besides that, the security of protecting user data has to take into consideration. For example, prevention of SQL Injection, encryption of the member information and filtering the upload file extension from the user is to enhance the data through the cloud server and local database. It is necessary to understand how SQL Injection attack the database and concept of an encryption algorithm for making a suitable one.

Aim: It focuses on the development of an implementation of the intelligent analysis program that identifies unlicensed faces from school premises to avoid gunfires.

Objective: The study paper has the following objectives:

- Factors associated with population occurrence rates of mass shootings and to find alternatives to gun violence for young people are established.
- To develop an application known as Smart Analysis System (SAS) that can detect unauthorized individual by detecting their faces and behavior as well.
- To design the User Interface for SAS that will help the school premises to be more secured against gun violence, which will also discourage the criminals in the gun firing.
- To validate the methods of Facial Recognition Technology, authorities will test the system using unloaded guns in a small classroom with students volunteered.

Deliverables: SAS helps to detect unwanted individuals from school premises preventing the gun shooting. The following features are available:

1. It can detect facial expressions.
2. It can detect body movement.
3. It can differentiate between various ethnicity.
4. It can detect high-risk potentials.
5. It can alert the authorities to prevent the gun shooting.

**Hardware:**

1. MacBook Pro 16 inch (2019)
2. Intel Core i7, the 9th generation 2.6 GHz 6 core
3. Intel UHD Graphics 630 1536 MB
4. AMD Radeon Pro 5500M 8 GB VRAM
5. 32 GB 2667 MHz DDR4
6. 512 GB Apple SSD
7. 4K Resolution Monitor
8. MacBook Pro Built-In Keyboard
9. MacBook Pro Built-In Trackpad
10. Camera / Webcam

**Software:**

1. macOS Catalina Version 10.15.4
2. Xcode 11.4
3. MySQL / Apache / phpMyAdmin
4. OpenCV 4
5. TensorFlow
6. Python 3.8
7. HTML 5
8. CSS3
9. PHP
10. Bootstrap

### Access to Information or Expertise

To build this system, consultation from the university supervisor, 2nd maker, and lecturer's guidance is necessary. All the consulting range including information on database parts, system coding, overall development guidance and documentation. In addition, questionnaires and interviews could be carried out on the APU campus to study student's preferences and expectations from the system.

### User Involvement

The user involved or target user will be utilizing this system would be the technical assistant staff and on-campus staff. Interviews need to be conducted with a technician to acquire knowledge on troubleshooting.

Book:

Title: (Mastering OpenCV 4 with Python)

Author: Alberto Villan

Publisher: ~~Packt~~ Publishing (March 26, 2019)

The methodology chosen for Smart Analysis System is the Agile Methodology.

Agile Methodology could be a kind of project supervision procedure. The agile technique forestalls alteration and permits for way more suppleness than ancient strategies. Agile software program improvement is an umbrella term for a fixed of frameworks and practices primarily based on the values and principles expressed within the Manifesto for Agile software improvement and the 12 standards in the back of it. While you technique software improvement in a ed way, it's commonly properly to stay utilizing those values and principles and use them to assist figure out the proper activities given your unique context. One issue that separates Agile from other techniques to software improvement is the point of interest at the human beings doing the work and the way they work together. Answers evolve via collaboration among self-organizing move-practical teams utilizing the correct practices for their context. There's a

significant awareness within the Agile software program development network on collaboration and the self- organizing crew.

In terms of sampling, a small group of the juvenile will be volunteered to act as the victim and one person as the shooter. Unloaded guns will be given to the person to see whether the system can detect before he draws the gun out. If the system can detect and alert the authorities before he draws the gun, it means SAS is working efficiently.

#### Success Criteria

The goal is to build a Smart Analysis System application that can detect unauthorized faces from the school premises preventing gunfire.

#### Unit Testing

In order to ensure the tests perform as anticipated, the specific part of a test device is taken out of the system for testing. Unit is individually tested for new faces, faces are trained in algorithms and the faces are recognized.

#### Integrating Testing

The combination of two tested units into a component will be taken in this section. Here is an example from the system, new added member ID allows us to capture their face with the capturing function after their information registered or recorded into the database.

#### Usability Testing

End-user satisfaction must be obtained during usability testing. Concrete information on the usage of actual users should be used by participants in this research process. The system was also evaluated by various factors, including the Interface, system response time, protection of privacy and system opinion. The program was not influenced by a number of factors. For example, depending on the classification it is user-friendly to use the system Interface, which involves beginners, informal and professional users.

## Ethics Form

Office Record	Receipt – Fast-Track Ethical Approval
Date Received:	Student name:
Received by whom:	Student number: Received by: Date:

<b>APU FAST-TRACK ETHICAL APPROVAL FORM (STUDENTS)</b>	
Tick one box:	<input type="checkbox"/> TAUGHT POSTGRADUATE project <input checked="" type="checkbox"/> UNDERGRADUATE project <input type="checkbox"/> TAUGHT POSTGRADUATE MODULE assignment <input type="checkbox"/> TAUGHT UNDERGRADUATE MODULE assignment
Title of Specialism on which enrolled ... B.Sc (Hons) in Intelligent Systems .....	
Tick one box: Full-Time Study <input checked="" type="checkbox"/> or Part-Time Study <input type="checkbox"/>	
Title of project SAS: Smart Analysis System for Juvenile Safety Against Gun Violence using Facial Recognition Technology	
Name of student researcher ... Wahidul Alam Riyad .....	
Name of supervisor/ Dr. Hamam Mokayed .....	

**Student Researchers- please note that certain professional organisations have ethical guidelines that you may need to consult when completing this form.**

**Supervisors/Module Tutors - please seek guidance from the Chair of the APU Research Ethics Committee if you are uncertain about any ethical issue arising from this application.**

		YES	NO	N/A
1	Will you describe the main procedures to participants in advance, so that they are informed about what to expect?	✓		
2	Will you tell participants that their participation is voluntary?	✓		
3	Will you obtain written consent for participation?			✓
4	If the research is observational, will you ask participants for their consent to being observed?			✓
5	Will you tell participants that they may withdraw from the research at any time and for any reason?			✓
6	With questionnaires and interviews will you give participants the option of omitting questions they do not want to answer?	✓		
7	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	✓		
8	Will you give participants the opportunity to be debriefed i.e. to find out more about the study and its results?	✓		

If you have ticked **No** to any of Q1-8 you should complete the full Ethics Approval Form.

		YES	NO	N/A
9	Will your project deliberately mislead participants in any way?		✓	
10	Is there any realistic risk of any participants experiencing either physical or psychological distress or discomfort?		✓	
11	Is the nature of the research such that contentious or sensitive issues might be involved?		✓	

If you have ticked **Yes** to 9, 10 or 11 you should complete the full Ethics Approval Form. In relation to question 10 this should include details of what you will tell participants to do if they should experience any problems (e.g. who they can contact for help). You may also need to consider risk assessment issues.

		YES	NO	N/A
12	Does your project involve work with animals?		✓	
13	Do participants fall into any of the following special groups?  <b>Note that you may also need to obtain satisfactory Criminal Records Bureau clearance (or equivalent)</b>	Children (under 18 years of age) People with communication or learning difficulties Patients People in custody People who could be regarded as vulnerable People engaged in illegal activities ( eg drug taking )	✓	
14	Does the project involve external funding or external collaboration where the funding body or external collaborative partner requires the University to provide evidence that the project had been subject to ethical scrutiny?		✓	

If you have ticked **Yes** to 12, 13 or 14 you should complete the full Ethics Approval Form. There is an obligation on student and supervisor to bring to the attention of the APU Research Ethics Committee any issues with ethical implications not clearly covered by the above checklist.

#### STUDENT RESEARCHER

Provide in the boxes below (plus any other appended details) information required in support of your application.  
THEN SIGN THE FORM.

#### Please Tick Boxes

I consider that this project has no significant ethical implications requiring a full ethics submission to the APU Research Ethics Committee.	✓
<b>Give a brief description of participants and procedure (methods, tests used etc) in up to 150 words.</b>	
Qualitative techniques are used to obtain answers to questions which the researcher needs to learn. The qualitative approach was selected for collecting the data in this project. The questionnaire was chosen by the researcher and will be carried out to determine the needs of this project. This approach is selected because the questionnaire takes less time. The questionnaire will be handed out through Google Forms. Participants play a significant role in collecting accurate details. Therefore it is crucial to determine which participants are the target. For the questionnaire, the researcher intends to provide 50 participants from various levels of education and occupation to ensure the findings are equal and good.	
I also confirm that: ii) All key documents e.g. consent form, information sheet, questionnaire/interview are appended to this application.	✓
Or ii) Any key documents e.g. consent form, information sheet, questionnaire/interview schedules which need to be finalised following initial investigations will be submitted for approval by the project supervisor/module leader before they are used in primary data collection.	✓

Signed.....  Print Name..... Wahidul Alam Riyad..... Date..... 29 / 04 / 2020  
(Student Researcher)

**Please note that any variation to that contained within this document that in any way affects ethical issues of the stated research requires the appending of new ethical details. New ethical consent may need to be sought.**

The completed form (and any attachments) should be submitted for consideration by your Supervisor/Module Tutor

**SUPERVISOR/MODULE TUTOR  
PLEASE CONFIRM THE FOLLOWING:**

<b>Please Tick Box</b>	
I consider that this project has no significant ethical implications requiring a full ethics submission to the APU Research Ethics Committee	<input checked="" type="checkbox"/>
i) I have checked and approved the key documents required for this proposal (e.g. consent form, information sheet, questionnaire, interview schedule)	<input checked="" type="checkbox"/>
Or	
ii) I have checked and approved draft documents required for this proposal which provide a basis for the preliminary investigations which will inform the main research study. I have informed the student researcher that finalised and additional documents (e.g. consent form, information sheet, questionnaire, interview schedule) must be submitted for approval by me before they are used for primary data collection.	<input checked="" type="checkbox"/>

**SUPERVISOR AND SECOND ACADEMIC SIGNATORY**

**STATEMENT OF ETHICAL APPROVAL (please delete as appropriate)**

- 1) THIS PROJECT HAS BEEN CONSIDERED USING AGREED APIIT/SU PROCEDURES AND IS NOW APPROVED**
- 2) THIS PROJECT HAS BEEN APPROVED IN PRINCIPLE AS INVOLVING NO SIGNIFICANT ETHICAL IMPLICATIONS, BUT FINAL APPROVAL FOR DATA COLLECTION IS SUBJECT TO THE SUBMISSION OF KEY DOCUMENTS FOR APPROVAL BY SUPERVISOR (see Appendix A)**

Signed... Hamam Mokayed... Print Name... Hamam Mokayed... Date 29/04/2020  
(Supervisor/2<sup>nd</sup> Marker)

Signed... Print Name... Date...  
(Second Academic Signatory)

Office Record	Receipt – Appendix A (Fast-Track Ethics Form)
Date Received:	Student name:
Received by whom:	Student number: Received by: Date:

**APPENDIX A  
AUTHORISATION FOR USE OF KEY DOCUMENTS**

**Completion of Appendix A is required when for good reasons key documents are not available when a fast track application is approved by the supervisor/module leader and second academic signatory.**

I have now checked and approved all the key documents associated with this proposal e.g. consent form, information sheet, questionnaire, interview schedule

Title of project .....  
.....

Name of student researcher .....

Student ID: ..... Intake: .....

Signed.... Print Name.... Date....  
(Supervisor/2<sup>nd</sup> Marker)

<b>Office Record</b> Date Received: Received by whom:	<b>Receipt</b> Student name: Student number: Received by: Date:
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## ACADEMIC RESEARCH ETHICS DISCLAIMER

**Declaration about ethical issues and implications of research proposals to be included on project application forms**

SAS: Smart Analysis System for Juvenile Safety Against Gun Violence using Facial Recognition Technology

**Project Title:** .....

The following declaration should be made in cases where research project applicants for a particular project and the supervisor(s) for that project conclude that it is not necessary to apply for ethical approval for a research project.

We confirm that the University's guidelines for ethical approval have been consulted and that all ethical issues and implications in relation to the above project have been considered. We confirm that ethical approval need not be sought.

Wahidul Alam Riyad <hr/> Name of Research Project Applicant	 <hr/> Signature	29 / 04 / 2020 <hr/> Date
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Hamam Mokayed <hr/> Name of Research Project Supervisor / 2 <sup>nd</sup> Marker	Hamam Mokayed <hr/> Signature	29 / 04 / 2020 <hr/> Date
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## Gantt Chart

