PPM Project Report - Group Kii

Magnus Frater System

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NTU

Abstract

Magnus Frater (or Big Brother) has been created to help tackle the ongoing issue of security within large open campuses and premises, these sorts of locations inherently have an increased potential for intrusion through unmonitored sections of land. The group analysed the recent spree of attacks on schools and offices - for example the shooting that occurred at the YouTube headquarters in 2018 (Staff and Agencies 2018) - and found that in a large amount of these attacks there were open doors and spaces that allowed the attacker to enter with ease. As a consequence to this, the idea of creating a facial recognition system to analyse and report known and unknown people within a campus/large open setting was conceived.

As mentioned, the main purpose of the project was to create a system that would accurately detect and report people walking around an area to the associated security team, this data would differentiate between employees or authorised users and unknown people by linking into the companies employee/student database. Not only would this allow a security team to monitor who is within a set area at any one time, but it would also allow administrative users to track any persons movements and activities within a set time frame, through tracking of the targets face across multiple cameras. Another advantage to this project is that administrative users can view analytics in relation to the usage of campus properties, an example use case for this would be within a University. Admins could check what buildings within the campus are being utilised most by students.

After the main purpose behind the project was defined, the group decided on how to proceed in regards to the requirements for the project, most importantly how we should proceed with splitting up the individual hardware and software components so that the system could functions within any scenario or environment. It was decided that there will be 4 different modules, these being:

1. A Raspberry Pi that would be responsible for processing any facial data that is captured by the camera
2. A Camera module that would connect directly to the Raspberry Pi and provide images to the Raspberry Pi
3. A website created for administrators and security personnel to administer and manage hits/rejections.
4. An API (Application Programming Interface) used within the website and the Raspberry Pi for collation and provision of data.

These modules will work together to create the Cameras that report facial data and the web interface that is used to manage the data received by the camera, the connection between these modules was outlined in the design documentation (for example the Data Flow Diagram and Entity Relationship Diagram).

Once the components and requirements were completed, the group began to consider which program-

ming languages and setups would be best suited for the type of project this is (Facial Recognition with Web Related components). It was clear that Python should be used for the facial recognition section of the project due to its strong existing libraries. NodeJS would be used for the Web Frontend, PHP would be used to power the backend API that links all of the components together and the API would be using a MySQL database to hold all of the data. The system would work in the following way:

1. The Camera feeds data to the Raspberry Pi
2. The Python application on the Raspberry Pi calculates if a face is present
3. Any potential face found is sent to the API where corresponding facial data is requested from the database
4. If no corresponding data is found, then the face is unknown, otherwise the image will be linked to the person the face associates with.
5. The Website will update using data from the API to show new detections, known or unknown.

Once the product had been developed, testing took place to ensure that the facial recognition software worked from a variety of different distances and in unfavourable circumstances (heavy rain, fog, etc). While some of the tests passed, others failed to detect faces when they were present, however this only occurred in extreme circumstances. We made small enhancements to the facial detection algorithm to improve its effectiveness during these scenarios.

Due to the nature of this system, there are a lot of potential legal and ethical issues, people may not consent to the recording of their faces, people may not wish to have their faces processed and stored by this system. Therefore it was important for us to implement a blacklist system that would stop the system from performing facial data processing, however, this is a complex system because we first need to process a persons face to understand what to blacklist, which could cause further legal or ethical issues.

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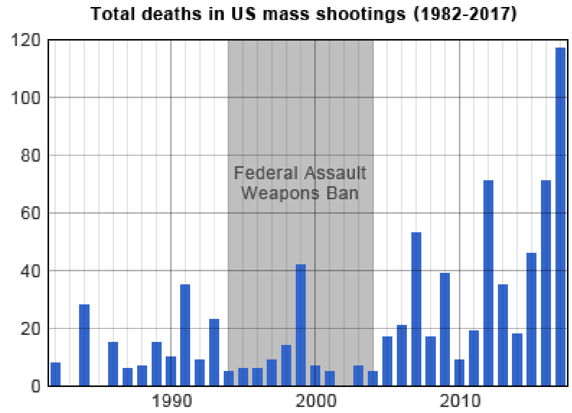
Introduction

Over recent years, especially in the United States, attacks on schools or open campus locations have been increasing at an alarming rate.



(GliderMaven 2016)

As you can see in the image above, there is a clear increase in mass shootings over the past few years, with a large percentage of these happening within schools or large open spaces. Current technology to prevent school shootings relies on hardening access to portions of the school or alerting people inside of an attack (through door barriers or locks and SMS messaging), however, this occurs after the shooting has begun and does not help to prevent the attack occurring in the first place.

Based on these findings, it can be deduced that there needs to be technology implemented that helps to prevent an attack happening, rather than lessening the impact of an attack. This is where our projects objectives come into play, our technology will help to identify unknown people within a school or campus, before they even enter the building. Automatically alerting security personnel so that they can investigate further.

We believe that this technology could greatly decrease the amount of potential attacks and could serve as a deterrent to people who want to commit a crime within an establishment that has the system installer.

Furthermore, the system could be improved to link with local police facial databases in order to identify known criminals who are attempting to enter a school or other location.

Project Aims

The main aim of the project is to provide organisations with open campus settings a way to effectively track and monitor who is on campus and where they are located at any time of day. This is to help reduce or prevent intrusions and attacks that occur on these types of locations.

Objectives

To ensure clear and appropriate objectives have been created for the project, the S.M.A.R.T. (specific, measurable, achievable/appropriate, realistic, time-constrained) goals (Doran 1981) were used. SMART allows us to create objectives that provide the project with lots of functionality, that will be meaningful to the objects, and still stay within the projects deadlines. For the project to be successful the following objectives should be met:

Staff Members should be able to:

- Add new faces or people to the system through a simple yet effective web interface
- Monitor the movements of people across buildings and campuses, whether they are registered as people or not
- Manage alerts of unknown people entering the campus
- Provide temporary passes to unknown people to authorize them for a set amount of time;

As a requirement to this, the camera and associated Raspberry Pi module should be able to provide the following:

- A stream of video that can be analysed by the algorithm on the Pi in order to find faces;
- A constant stream of face detections to the central server that manages all hits;

In general the following objective should be met:

- The camera and web interface should be able to talk to each other through an API (Application Programming Interface)

To meet the objectives set out for Staff Members, the group will be creating a web interface using NodeJS, this interface will have the functionality set out above and will interface with the API to get and set data. It was mentioned that the interface should be simple yet effective, we could easily bombard the user with a lot of metadata from the cameras, however, the web interface will only show the required information and actions to ensure that a staff member can quickly and easily identify if there is an intruder currently on campus. All of the outlines objectives are achievable and can be implemented in a timely manner.

To meet the requirements set out for the Raspberry Pi and API, we will have to ensure substantial testing of the facial detection algorithm takes place, the group wants to avoid experiencing a scenario in which multiple people are not identified. However, the algorithm cannot be 100% effective, there will always be scenarios in which the algorithm misses a person, or mis-identifies them, it would be unrealistic and a waste of development time to be chasing after a 100% success rate. We will also have to ensure that the API is tested thoroughly, not only for functionality, but for security purposes, if an attacker gained access to another users facial data then this would be a breach of GDPR, therefore we will be implementing multiple security procedures to ensure that the API is secure, including the use of security based unit testing and manual testing.

Existing Solutions

Product Demand

While there is no direct demand for this product, this could just be down to the fact that organisations and

Project Management

Meetings

Group meetings should occur at least once a week during term time.This may be altered and increased dependent on any deadlines that the group decide are enough of an impact to call extra meetings. The current meetings have an estimated length of 30 minutes to an hour, being held in a work-appropriate environment, such as a meeting room. IT can be useful to utilise software which allows the use of voice communication to enable remote working. It is possible that there will be instances in which not all the group will be able to meet. This may be caused through a great many scenario, each of which should be able to be resolved, given consideration and following a standard procedure. Some of the scenarios, and correct procedures to take in the event of said scenario, can be seen below:

General Absence

In the case of a general absence, being that a member of the group is absent without meaningful reason, the group may have to consider the situation the absent member may be in. The consideration being the current group position, the importance of the absent member's role, or contribution that may have been needed in the current session. In this event, the group may need to note down the general absence and keep track of the amount each member has committed, as many of these may show a lack of commitment to the project. A given example of this scenario is - "Marcus missed the meeting because he went to go see a movie."

Authorised Absence

In the event of an authorised absence, in which the member who is absent has given compelling reason and possibly proof if required, the member would be excused from the current session. For this scenario to be distinguishable from a general absence is down to a few possibilities: forewarning of absence with given reasoning and a group consensus to pass this absence, an event in which the member would not be able to attend due to reasoning outside of their control, or an unavoidable event where the member has no real ability to alter A given example of this scenario is - ”Jess couldn’t make it to the meeting as she had a medical appointment.”

Absence Procedure

In either of the circumstances mentioned above, the same procedure is taken. This is to ensure that the missing member will be able to catch up on the meeting that they missed, allowing for minimal drawbacks from the absence. For a team member to be considered ’fully informed, for the meeting of absence, the team must follow the stages below. A team member(s) who was present in said meeting must contact the absentee, giving a small briefing as well as the minutes of the meeting. This should be followed with any decisions or changes decided within the meeting, if not already noted down in the minuets. Furthermore, the absentee should be asked if they have any questions about the information given to them, to ensure that they are sound minded on the group’s current position, as well as each individual’s tasks.

Management

Project Manager

A member should be elected as Project Manager (PM), the role responsible to tracking information on the group members, as well as being the first to act on any events which may disrupt the project. PM will handle the attendance of the group during all forms of meetings, as well as the punctuality of tasks from each of the group. It will be the PM’s duty to talk to any members who show deviation from a consistent work ethic, ensuring that the member knows their tasks and is on track. If the PM finds the need to call a discussion with the group on a member’s behaviour and commitment toward the project they can initiate a vote to exclude the member from the group, with warning and consultation. The PM may find it useful to pass off a secondary role to another team member to ensure that the project is being fully watched. The deputy should report back to the PM with any extra information they have found to be added to their current information on the group.

Task Allocation

For the group to work as well as they can with minimal conflict, when a task is presented to the group they will be asked to whom would like to take on said task. If there is a conflict on the task allocation, it may be able to split the task into smaller subtasks; thus, allowing for multiple members to work on it. However, if the situation does not allow for this then a fair discussion will be made to decide which member will be assigned the task. Upon being assigned a task, the member will be given a deadline for the task to be complete, the deadline may be flexible, allowing for the member to negotiate and discuss with the team. When each member of the team is working on a task, the PM will ask for progress reports at intervals throughout each task. The PM will report to the team if any anomalies occur, allowing the team to propose ideas to ensure completion before its deadline.

Team Members, Responsibility & Skills

Project Manager: Callum Axon

Name	Responsible For	Relevant Skills
Callum Axon	Backend Database & API	- PHP - MySQL - UML Tooling - Testing - Server Management
Callum Carney	Monitoring Application	- HTML & CSS - JavaScript, Testing
Finlay McKinnon	Monitoring Application	- HTML & CSS - Screen & Graphic Design
Jordan Brightmore	Facial Recognition Software	Python - Machine Learning - Raspiban - Computer Vision
Vital Harachka	Backend Database	SQL - PHP
Wing Lam Chiang	Documentation & Database	SQL - PHP - Project Management Software

Risk Assessment

ID	Description	Impact	Probability	Response
RE1	Team member is ill, injured or cannot work on project due to personal reasons	High	Medium	Reorganise workload to cover team member.
RE2	Team member does not attend meetings due to a busy university schedule	Medium	Low	Organise more meetings at a common available time. Alternatively, use a digital solution
RE3	Team member consistently not doing work, time schedule falls at least a week behind	High	Medium	Assign multiple members to the same task - enabling redundancy
RE4	Data Loss	High	Low	Ensure a regular backup of work is taken. Use version control systems (VCS) for code & store in cloud.
RE5	Deadline Changes	Medium	Low	If deadline is earlier than before, change work schedule to account for it.
RE6	Missed Internal Deadlines	Very High	Low	Workload reorganised to complete project ahead of schedule, meetings to identify problems causing missed deadlines.
RE7	Team member leaves module/course	Very High	Low	Assign multiple members the same task, enabling redundancy, also ensure that all team members have open communication methods so that an early warning can be provided

ID	Description	Impact	Probability	Response
RE8	Domineering personalities	Low	Low	If there is a dominant personality in the group which causes other members to feel unable to contribute, then limits could be made on individual contributions, also it is important that when members are speaking they have no interruption. Remind all the members of the group that it is important to hear and respect all opinions in relation to the topic.
RE9	Working with team members during non-term time	Medium	Low	If it is required for us to work with team members during non-term time then it will be important for us to have good communication so that all the team members still know what their roles are and what work need to be completed.
RE10	ICT resources may not be adequate or appropriately available for the demands of the project	Medium	Low	If ICT resources are inadequate then consider using external sources to reach the goals needed to complete the project to a good standard.
RE11	Team members finding topics or concepts difficult to grasp	Medium	Medium	Try help the team member to understand the topic they’re working on, however if they still don’t understand suggest a switch of topic or role on the project.

Requirements

Functional Requirements

FR#	Function	Goal	Actor	Justification	Importance Rating (out of 5)
1	Face Scanning	A stationary camera is able to detect a face and scan certain data points for analysis	Stationary Camera	In order to provide a product that tracks people on a large campus, we must have an effective face scanning algorithm to track people across cameras	5 - This functionality is required for the system to work
2	Position Reports can be filed	Once a person has been identified all of the associated metadata is compiled and submitted as a report to the API	Camera - Raspberry Pi	In order to provide person tracking functionality the API must recieve compiled position reports to query at a later date, without these the application would loose a large portion of functionality.	5 - This functionality is required for the system to work properly

FR#	Function	Goal	Actor	Justification	Importance Rating (out of 5)
3	New facial data can be added to the system	An administrative user must be able to upload new facial data to be detected at a later point in time	Administrat User	In order to match new faces to current people, an original image of a persons face must be uploaded to the system so that the two images can be compared at a later date	5 - FR4 requires this function to exist
4	New facial data is processed when uploaded to the web interface	Once an image of a person has been uploaded the associated facial data points are created and stored	API	In order to compare two faces, the system needs to generate data points from the two images and then compare the data points to calculate who has been detected	5 - Without this functionality the system would not be able to discover people
5	A person can be discovered when they have a valid position report	If a member of the security team is looking for a person, they can search and find the related position reports	Security Personnel	A person must have position reports associated with them to allow the security team to search for them and discover their past or present location	3 - The application will still function without this, however a large piece of functionality would be missing

FR#	Function	Goal	Actor	Justification	Importance Rating (out of 5)
6	A person can be located within a Campus/Location	A person must be able to be located within a campus setting.	Security Personnel	In order to allow security personnel to find people within a certain location, there must be functionality to discover a person.	3 - The application will still function without this, however a large piece of functionality would be missing
7	A temporary pass can be assigned to a person	In order to be able to allow unknown users to walk around a campus without causing alerts a temporary pass can be assigned	Security Personnel	In order to lower the amount of False Negatives within a system, administrators can assign temporary passes that will allow unknown people to walk around the campus without causing alerts	4 - The application will still function without this, however a very important feature would be missing
8	List Campuses	Display a list of Campuses	Web Interface	In order to display required information to users of the system, there must be functionality to display added campuses	4 - The application will still function without this, however a very important feature would be missing

FR#	Function	Goal	Actor	Justification	Importance Rating (out of 5)
9	Add Campuses	Add a Campus	Web Interface	In order to manage buildings, campuses must be added so that buildings can then be associated with them	5 - This functionality is required for the system to work properly
10	Remove Campuses	Remove a campus	Web Interface	A campus may no longer be required or may be phased out, therefore the ability to remove campuses must be included	4 - The application will still function without this, however a very important feature would be missing
11	List Buildings	Display a list of buildings	Web Interface	In order to display required information to users of the system, there must be functionality to display added buildings	4 - The application will still function without this, however a very important feature would be missing
12	Add Buildings	Add a building	Web Interface	In order to manage cameras, buildings must be added so that cameras can then be associated with them	5 - This functionality is required for the system to work properly

FR#	Function	Goal	Actor	Justification	Importance Rating (out of 5)
13	Remove Buildings	Remove a building	Web Interface	A building may no longer be required or may be phased out, therefore the ability to remove buildings must be included	4 - The application will still function without this, however a very important feature would be missing
14	Add Cameras	Add a camera	Raspberry Pi	In order to link person discovered with cameras a camera must first be enrolled onto the system, this occurs within the Python applications code	5 - This functionality is required for the system to work properly
15	List Cameras	Display a list of Cameras	Web Interface	In order to display required information to users of the system, there must be functionality to display added cameras	4 - The application will still function without this, however a very important feature would be missing

FR#	Function	Goal	Actor	Justification	Importance Rating (out of 5)
16	Update Cameras	Update a camera	Web Interface	A camera may have its location or information changed therefore, there must be functionality to update added cameras	4 - The application will still function without this, however a very important feature would be missing
17	Remove Cameras	Remove a camera	Web Interface	A camera may no longer be required or may have been phased out therefore, there must be functionality to delete added cameras	4 - The application will still function without this, however a very important feature would be missing
18	List Users	List Users	Web Interface	Administrators need to be able to list users to see who is administrating their system and what people have been registered	4 - The application will still function without this, however a very important feature would be missing

FR#	Function	Goal	Actor	Justification	Importance Rating (out of 5)
19	View Users	View Users	Web Interface	Administrators should be able to view user profiles which should include statistics in regards to current and previous locations	3 - If possible, the system should have this implemented as it would be an excellent feature to have, however it is not critical to the functioning of the system
20	Add Users	Add Users	Web Interface	Administrators need to be able to add users to the system, this could be for administrative purposes or just adding a low level user	4 - The application will still function without this, however a very important feature would be missing
21	Remove Users	Remove Users	Web Interface	Administrators need to be able to list users to see who is administrating their system and what people have been registered	4 - The application will still function without this, however a very important feature would be missing

FR#	Function	Goal	Actor	Justification	Importance Rating (out of 5)
22	List Statistics	List Statistics	Web Interface	Administrators should be able to look at statistics of their systems for example, what location is most popular, etc	2 - The application does not need or require this functionality, it is purely a quality of life improvement, however it would be a great advantage for administrators of the system
23	React to Alerts	React to Alerts	Web Interface	Administrators and security personnel must be able to react (false negative, resolved) to alerts of unknown users on Campus in order to remove an unknown user listing	5 - The core objective of this system is that organisations can react to unknown people activity, therefore this functionality needs to be included

Non-Functional Requirements

NFR#	Function	Goal	Actor	Importance Rating (out of 5)
1	Be usable	The system should be usable by any users with varying levels of computer proficiencies	Administrators	5
2	Performance	The system should be fast and responsive when administrators are using the Web Interface	Administrators	4
3	Be easy to setup	Cameras should be easy to setup and link into the web interface	System Installer	3
4	Automated Backup	The system should have an automated backup for the facial data to prevent loss of authorised users	Administrators	3
5	Language	The system should have a variety of languages available in order to cater for non english speakers	Administrators	2
6	Security	The system should be inherently secure and all data should be held in a secure facility/location	Administrators	5

Normalisation

UNF	1NF	2NF & 3NF
*Person ID	**Person**	**Person**
Person First Name	*Person ID	*Person ID
Person Last Name	First Name	First Name
Date of Birth	Last Name	Last Name
Gender	Date of Birth	Date of Birth
Camera ID	Gender	Gender
Camera Name		
Camera Address	**Camera**	**Camera**
Camera Active Flag	*Camera ID	*Camera ID
Campus Name	Camera Name	*#Building ID*
Campus Address	Camera Address	Name
Campus City	Camera Active Flag	Address
Campus County	Campus Name	Active Flag
Campus Postcode	Campus Address	
Building Name	Campus City	**Campus**
Position Report ID	Campus County	*Campus ID
Position Report Camera	Campus Postcode	Name
Position Report Building	Building Name	Address
Position Report Campus	Position Report ID	City
Security Alert ID	Security Alert ID	County
Security Alert Camera	Security Alert Timestamp	Postcode
Security Alert Timestamp	Security Alert Actioned Flag	
Security Alert Actioned Flag		**Building**
		*Building ID
		#Campus ID
		Name

UNF	1NF	2NF & 3NF
		Security Alert
		*Security Alert ID
		#*Camera ID*
		Timestamp
		Actioned Flag

Context Diagram

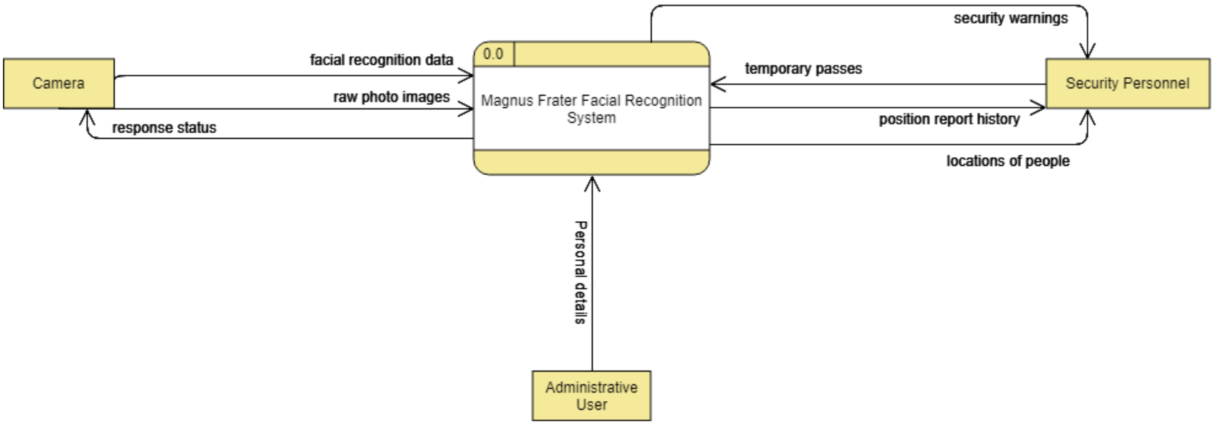


Figure 1: Context Diagram

Level 0 DFD

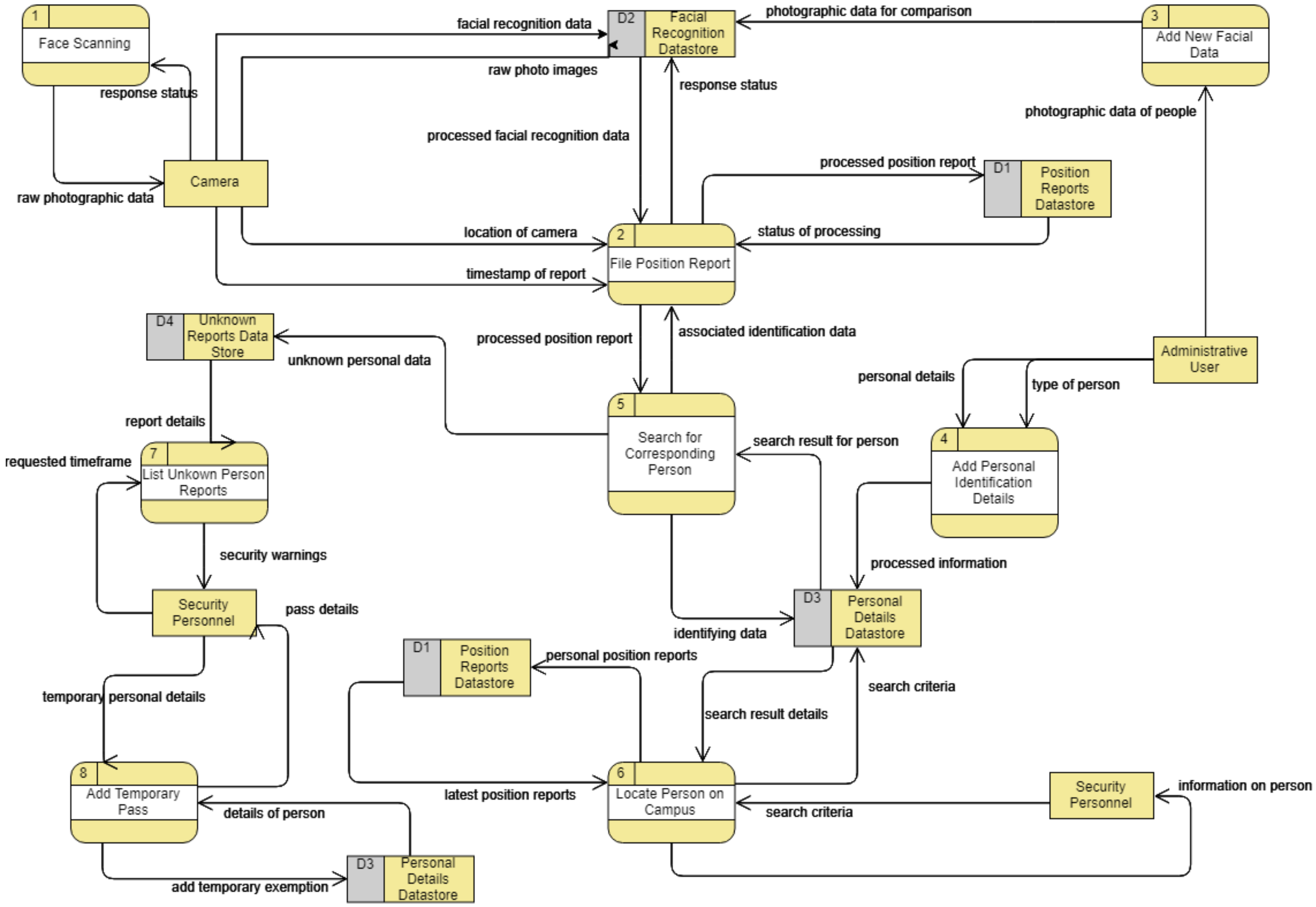


Figure 2: Level 0 DFD

Concept Map

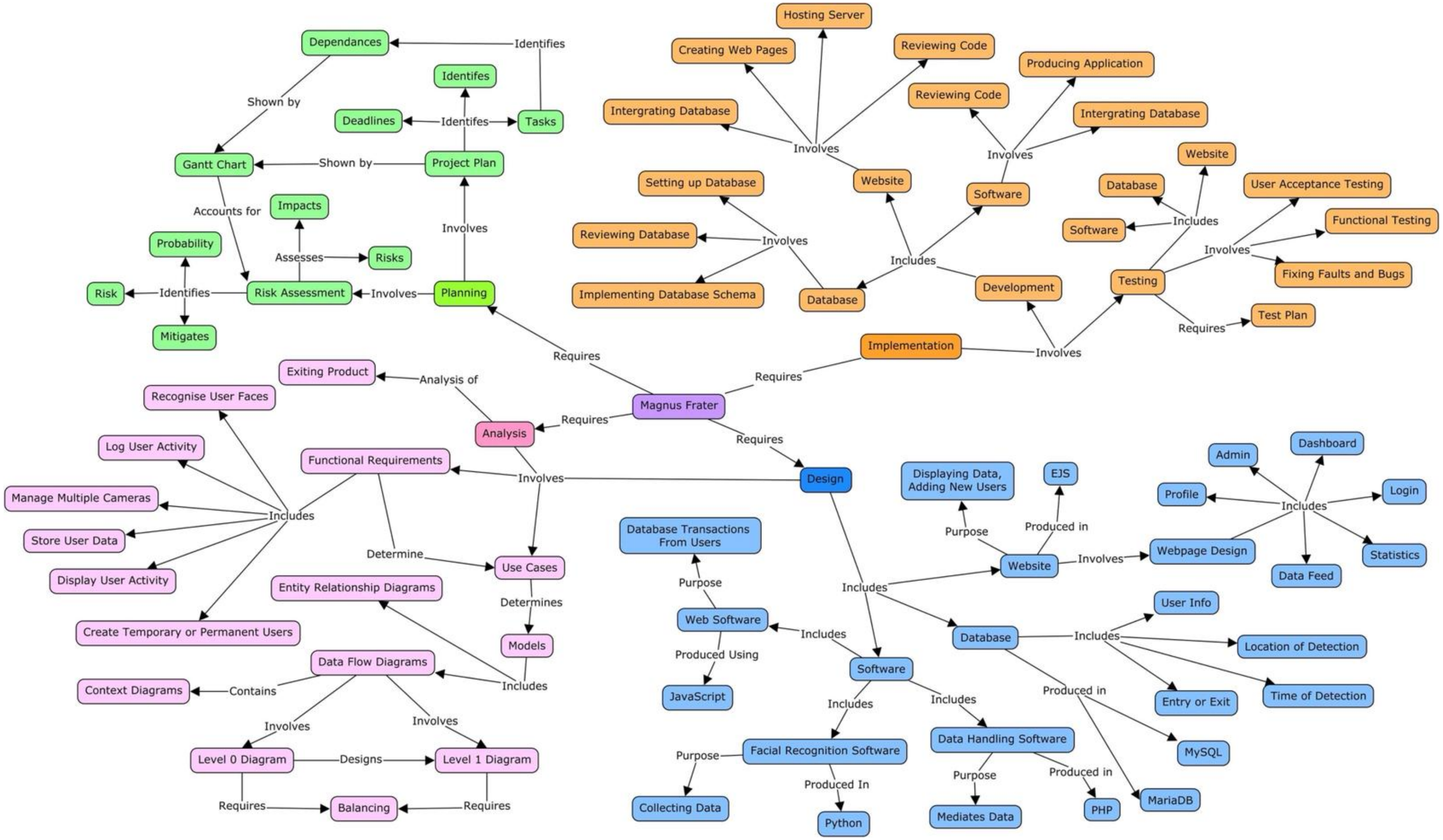


Figure 3: Concept Map

Deployment Diagram

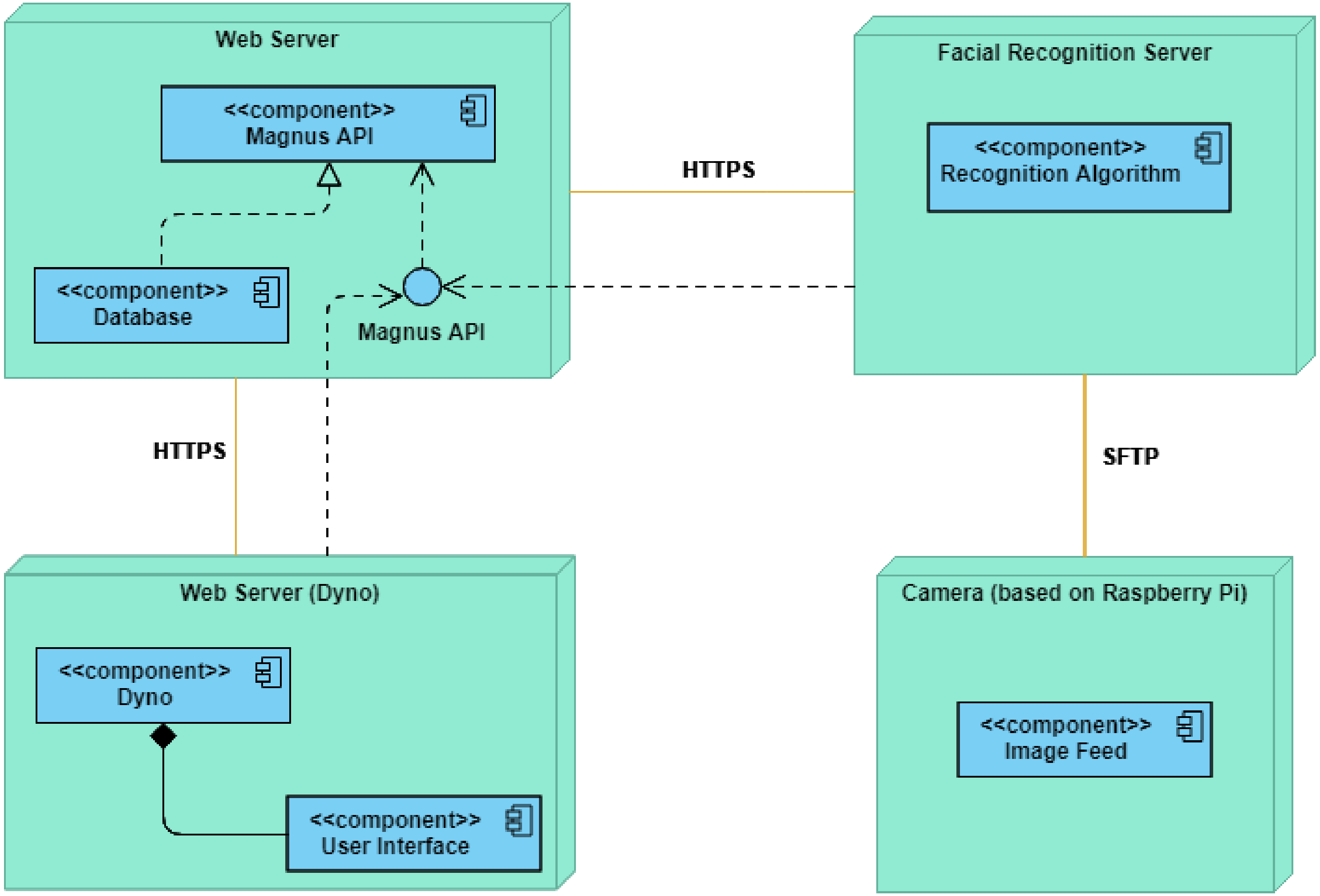


Figure 4: Deployment Diagram

Logical ERD

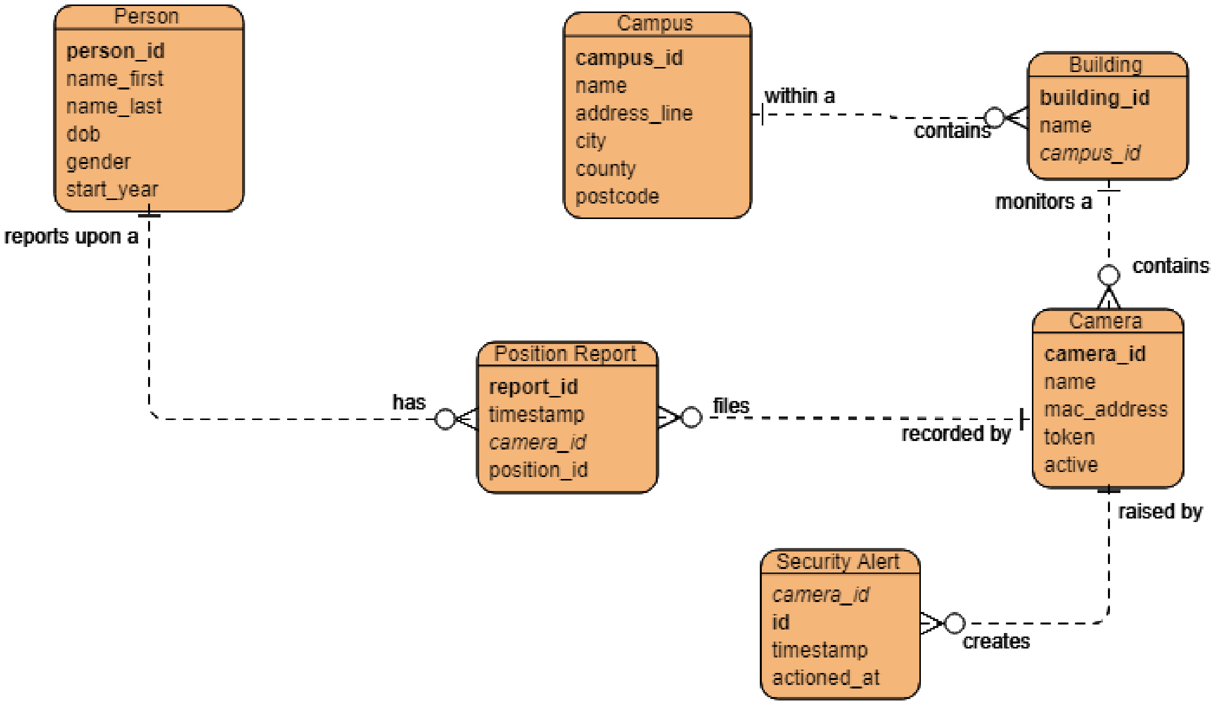
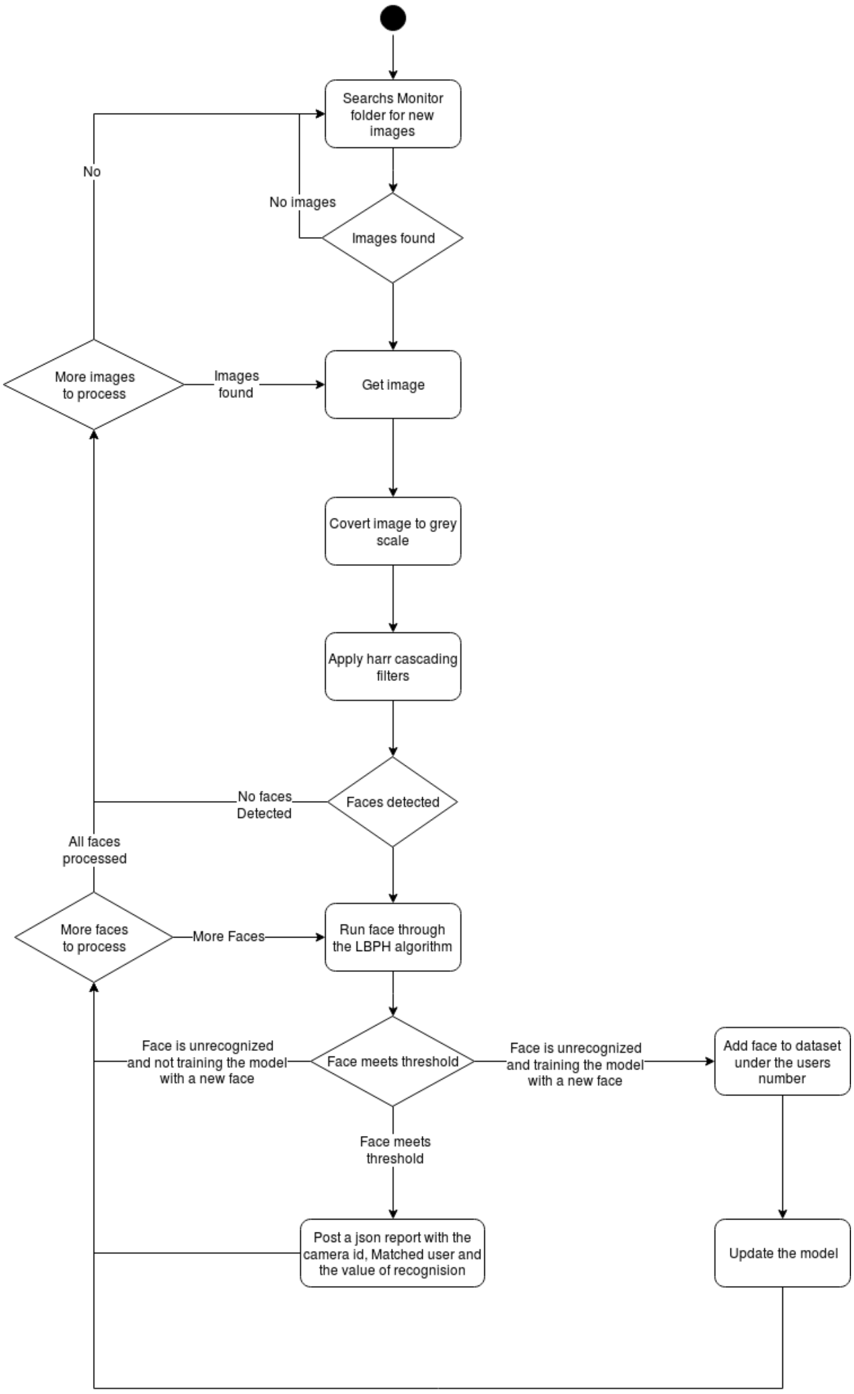


Figure 5: Logical ERD

Process flow for Camera


Searchs Monitor folder for new images
No
No images
Images found
More images to process
Images found
Get image
Covert image to grey scale
Apply harr cascading filters
No faces Detected
Faces detected
All faces processed
More faces to process
More Faces
Run face through the LBPH algorithm
Face is unrecognized and not training the model with a new face
Face meets threshold
Face is unrecognized and training the model with a new face
Add face to dataset under the users number
Face meets threshold
Post a json report with the camera id, Matched user and the value of recognision
Update the model

BCS Code of Conduct

In order to make our project as efficient as possible, the group decided that it will essential to use the British Computer Society's (BCS) code of conduct, so it can guide us with professional standards and be aware of our responsibilities to each other and the public.

All of our decisions were made with the BCS code of conduct in mind. In order to keep our work professional, with competence and integrity, we made sure to thoroughly research and be up to date with the latest technology and techniques for our respective parts in this project. As it states in the BCS code of conduct "develop your professional knowledge, skills and competence on a continuing basis, maintaining awareness of technological developments, procedures, and standards that are relevant to your field." ("BCS Code of Conduct" 2015).

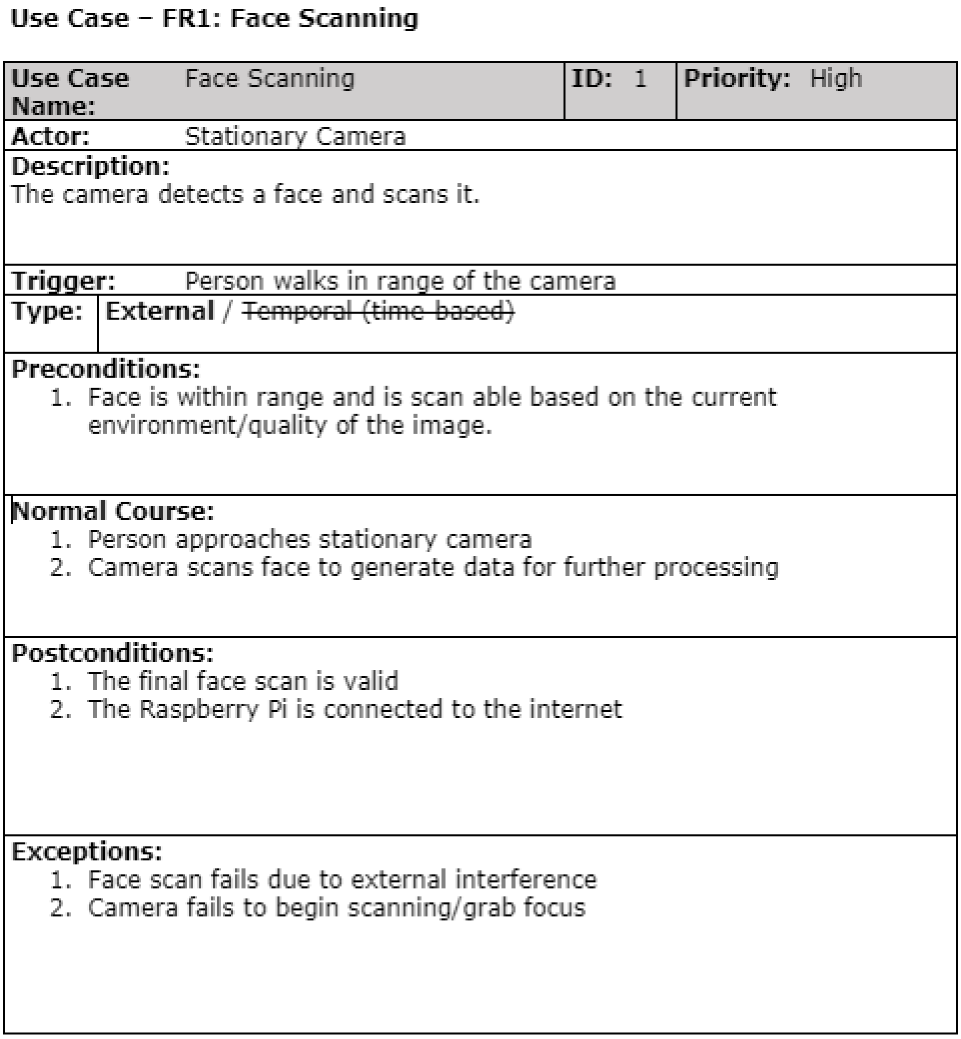
Because of the nature of this project, working in a group, we ensured that everyone in the group had the same rights and authority toward the project. Everyone's thoughts and opinions were taken into account , no matter the content, everyone had a voice and no one could contradict that, not only it is immoral it is enforced by the (BCS) code of conduct "respect and value alternative viewpoints and, seek, accept and offer honest criticisms of work." ("BCS Code of Conduct" 2015).

With that said this brings us to another matter, any form of discrimination was prohibited, not only it's immoral, it is also illegal. The Equality Act 2010 and the BCS code of conduct state that any kind of discrimination is not allowed "conduct your professional activities without discrimination on the grounds of sex, sexual orientation, marital status, nationality, colour, race, ethnic origin, religion, age or disability, or of any other condition or requirement" ("BCS Code of Conduct" 2015).

It is important to say that we worked on this project for the public interest. We wanted to provide security and efficiency. With this product we want to saver time for the public and make there lives easier. Of course, the privacy of the public is our priority, we implemented restricted access to our product, so only personal that have a username and password can access the private data. With the BCS code of conduct stating, "You shall have due regard for public health, privacy, security and wellbeing of others and the environment." ("BCS Code of Conduct" 2015).

Appendix

Use Cases



Use Case – FR1: Face Scanning

Use Case Name: Face Scanning		**ID:** 1	**Priority:** High
Actor: Stationary Camera			

Description:
The camera detects a face and scans it.

Trigger: Person walks in range of the camera

Type: **External** / ~~Temporal (time based)~~

Preconditions:

1. Face is within range and is scan able based on the current environment/quality of the image.

Normal Course:

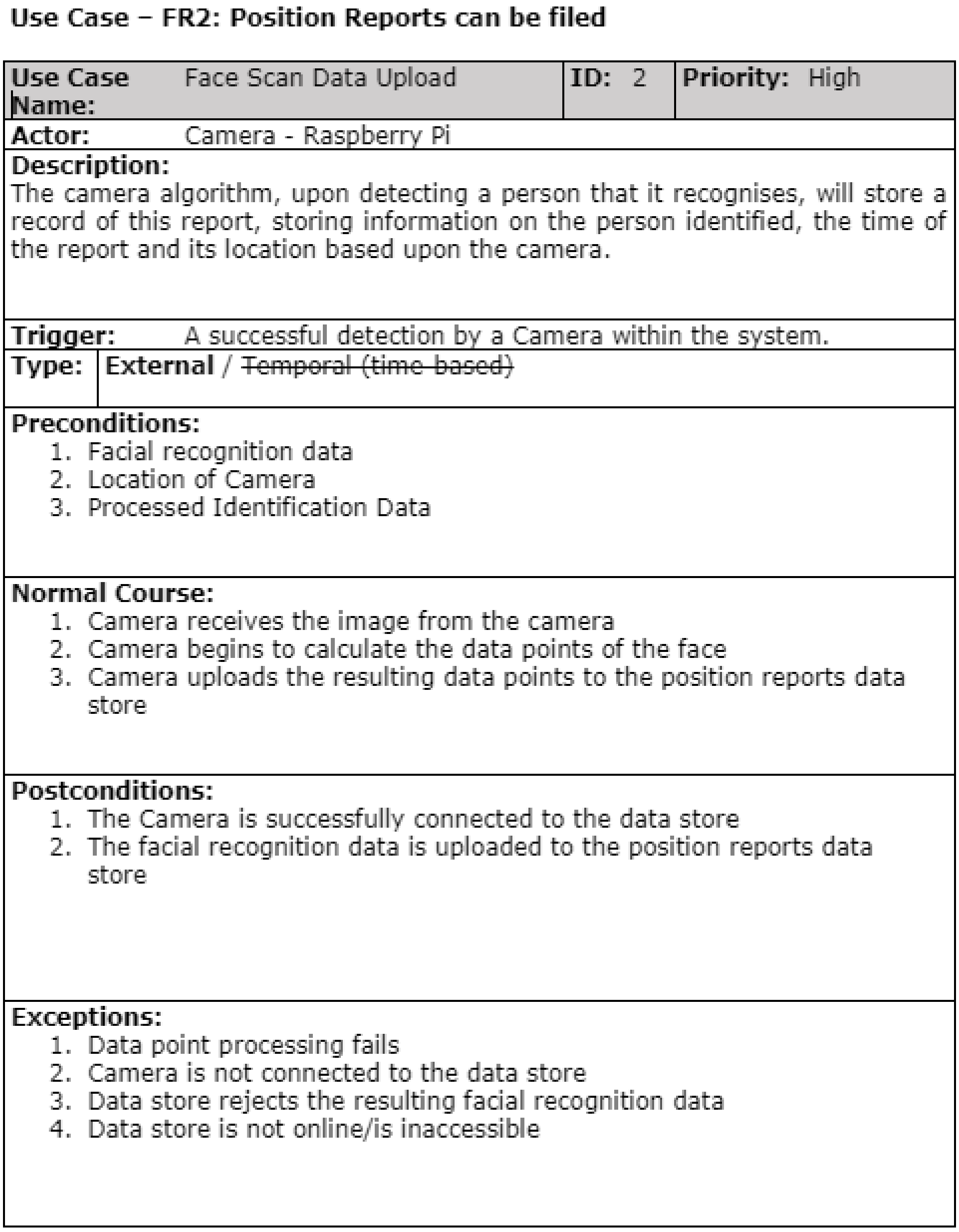
1. Person approaches stationary camera
2. Camera scans face to generate data for further processing

Postconditions:

1. The final face scan is valid
2. The Raspberry Pi is connected to the internet

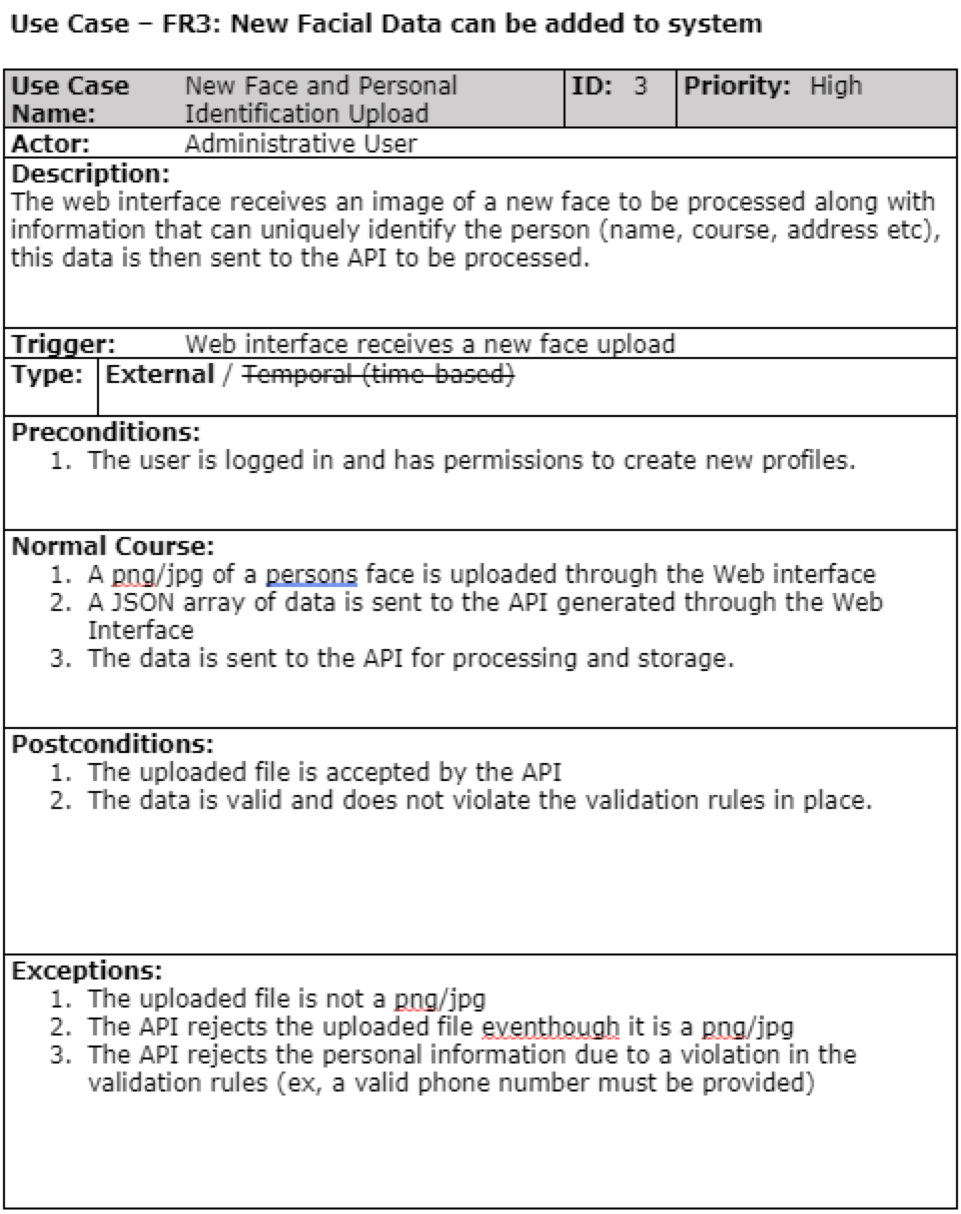
Exceptions:

1. Face scan fails due to external interference
2. Camera fails to begin scanning/grab focus



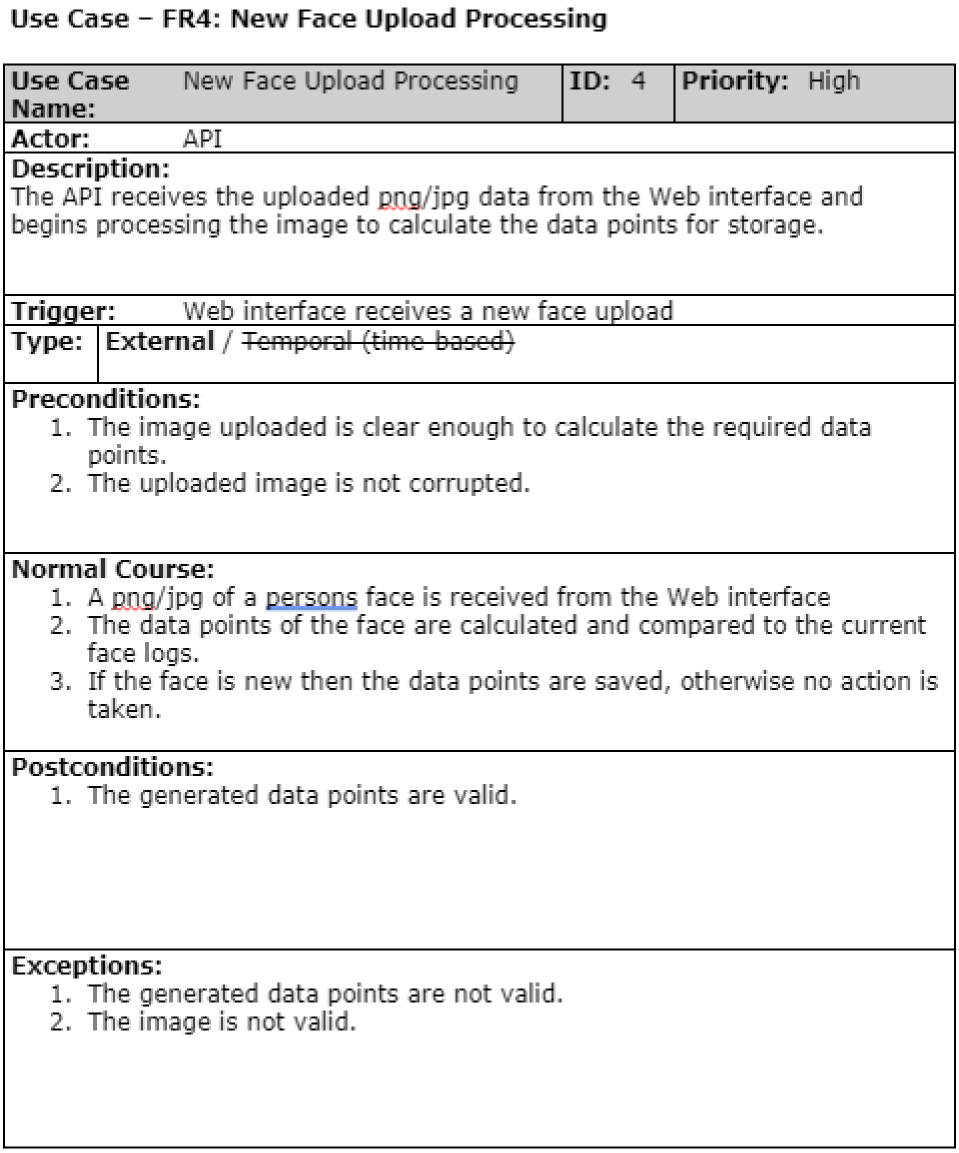
Use Case – FR2: Position Reports can be filed

Use Case Name: Face Scan Data Upload		**ID:** 2	**Priority:** High
Actor: Camera - Raspberry Pi			
Description: The camera algorithm, upon detecting a person that it recognises, will store a record of this report, storing information on the person identified, the time of the report and its location based upon the camera.			
Trigger: A successful detection by a Camera within the system.			
Type:	**External** / ~~Temporal (time-based)~~		
Preconditions: 1. Facial recognition data 2. Location of Camera 3. Processed Identification Data			
Normal Course: 1. Camera receives the image from the camera 2. Camera begins to calculate the data points of the face 3. Camera uploads the resulting data points to the position reports data store			
Postconditions: 1. The Camera is successfully connected to the data store 2. The facial recognition data is uploaded to the position reports data store			
Exceptions: 1. Data point processing fails 2. Camera is not connected to the data store 3. Data store rejects the resulting facial recognition data 4. Data store is not online/is inaccessible			



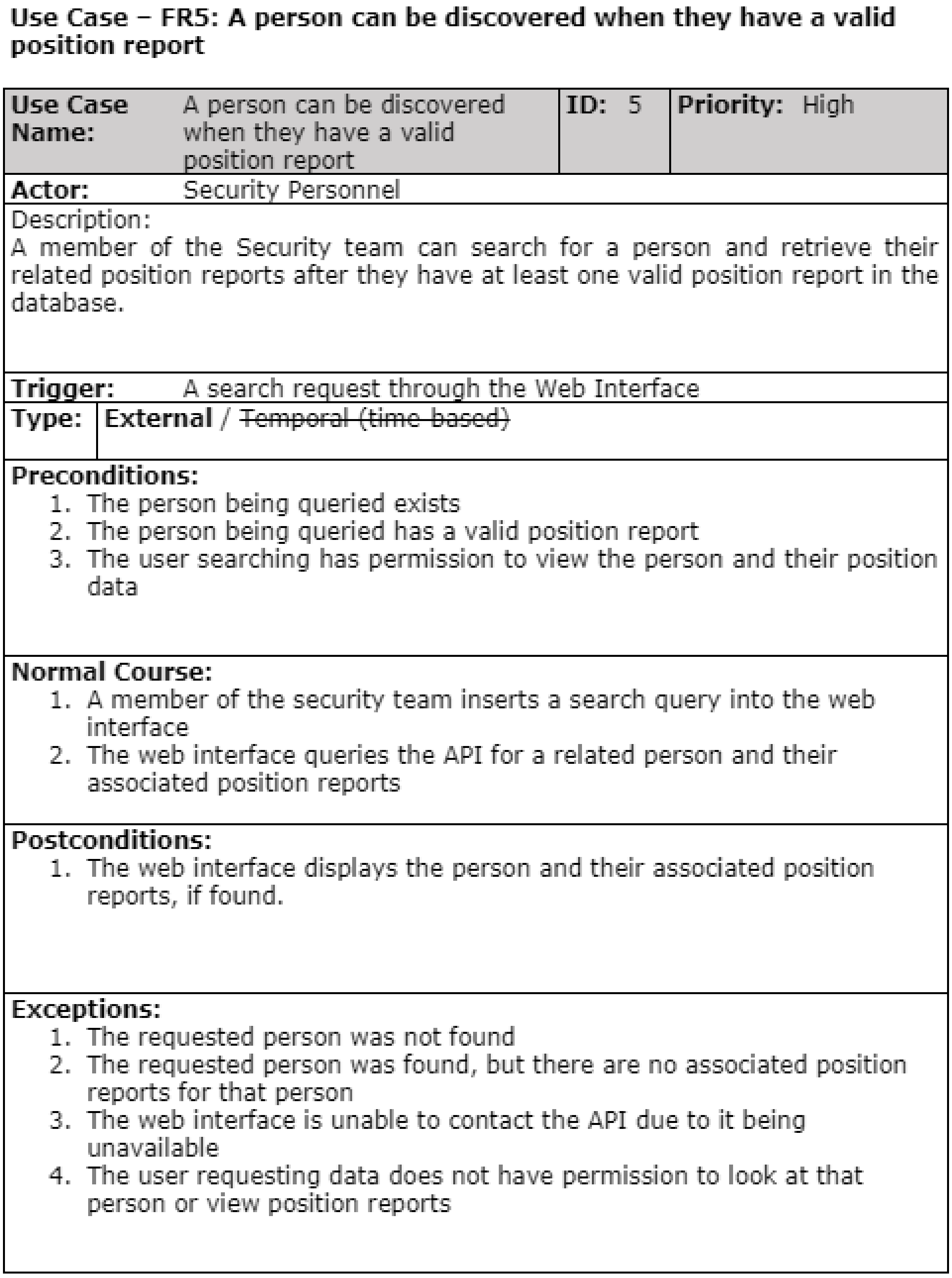
Use Case – FR3: New Facial Data can be added to system

Use Case Name:	New Face and Personal Identification Upload	**ID:** 3	**Priority:** High
Actor:	Administrative User		
Description: The web interface receives an image of a new face to be processed along with information that can uniquely identify the person (name, course, address etc), this data is then sent to the API to be processed.			
Trigger:	Web interface receives a new face upload		
Type:	**External** / ~~Temporal (time-based)~~		
Preconditions: 1. The user is logged in and has permissions to create new profiles.			
Normal Course: 1. A png/jpg of a persons face is uploaded through the Web interface 2. A JSON array of data is sent to the API generated through the Web Interface 3. The data is sent to the API for processing and storage.			
Postconditions: 1. The uploaded file is accepted by the API 2. The data is valid and does not violate the validation rules in place.			
Exceptions: 1. The uploaded file is not a png/jpg 2. The API rejects the uploaded file eventhough it is a png/jpg 3. The API rejects the personal information due to a violation in the validation rules (ex, a valid phone number must be provided)			



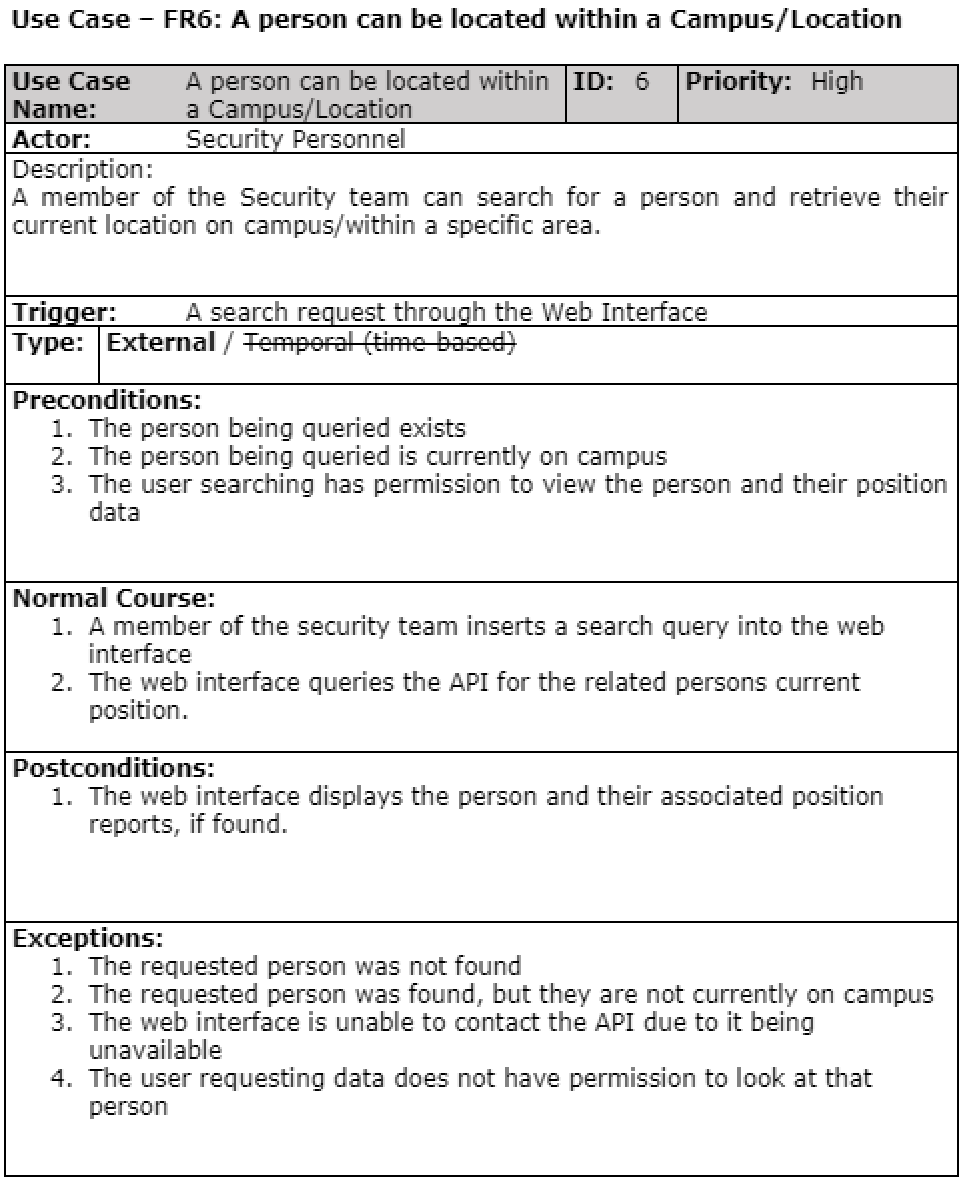
Use Case – FR4: New Face Upload Processing

Use Case Name: New Face Upload Processing		**ID:** 4	**Priority:** High
Actor: API			
Description: The API receives the uploaded png/jpg data from the Web interface and begins processing the image to calculate the data points for storage.			
Trigger: Web interface receives a new face upload			
Type:	**External** / ~~Temporal (time based)~~		
Preconditions: 1. The image uploaded is clear enough to calculate the required data points. 2. The uploaded image is not corrupted.			
Normal Course: 1. A png/jpg of a persons face is received from the Web interface 2. The data points of the face are calculated and compared to the current face logs. 3. If the face is new then the data points are saved, otherwise no action is taken.			
Postconditions: 1. The generated data points are valid.			
Exceptions: 1. The generated data points are not valid. 2. The image is not valid.			



Use Case – FR5: A person can be discovered when they have a valid position report

<table>
<tr><td><b>Use Case Name:</b></td><td>A person can be discovered when they have a valid position report</td><td><b>ID:</b> 5</td><td><b>Priority:</b> High</td></tr>
<tr><td><b>Actor:</b></td><td colspan="3">Security Personnel</td></tr>
<tr><td colspan="4">Description:
A member of the Security team can search for a person and retrieve their related position reports after they have at least one valid position report in the database.</td></tr>
<tr><td><b>Trigger:</b></td><td colspan="3">A search request through the Web Interface</td></tr>
<tr><td><b>Type:</b></td><td colspan="3"><b>External</b> / ~~Temporal (time-based)~~</td></tr>
<tr><td colspan="4"><b>Preconditions:</b>
1. The person being queried exists
2. The person being queried has a valid position report
3. The user searching has permission to view the person and their position data</td></tr>
<tr><td colspan="4"><b>Normal Course:</b>
1. A member of the security team inserts a search query into the web interface
2. The web interface queries the API for a related person and their associated position reports</td></tr>
<tr><td colspan="4"><b>Postconditions:</b>
1. The web interface displays the person and their associated position reports, if found.</td></tr>
<tr><td colspan="4"><b>Exceptions:</b>
1. The requested person was not found
2. The requested person was found, but there are no associated position reports for that person
3. The web interface is unable to contact the API due to it being unavailable
4. The user requesting data does not have permission to look at that person or view position reports</td></tr>
</table>



Use Case – FR6: A person can be located within a Campus/Location

Use Case Name:	A person can be located within a Campus/Location	**ID:** 6	**Priority:** High
Actor:	Security Personnel		

Description:
A member of the Security team can search for a person and retrieve their current location on campus/within a specific area.

Trigger: A search request through the Web Interface

Type: **External** / ~~Temporal (time-based)~~

Preconditions:

1. The person being queried exists
2. The person being queried is currently on campus
3. The user searching has permission to view the person and their position data

Normal Course:

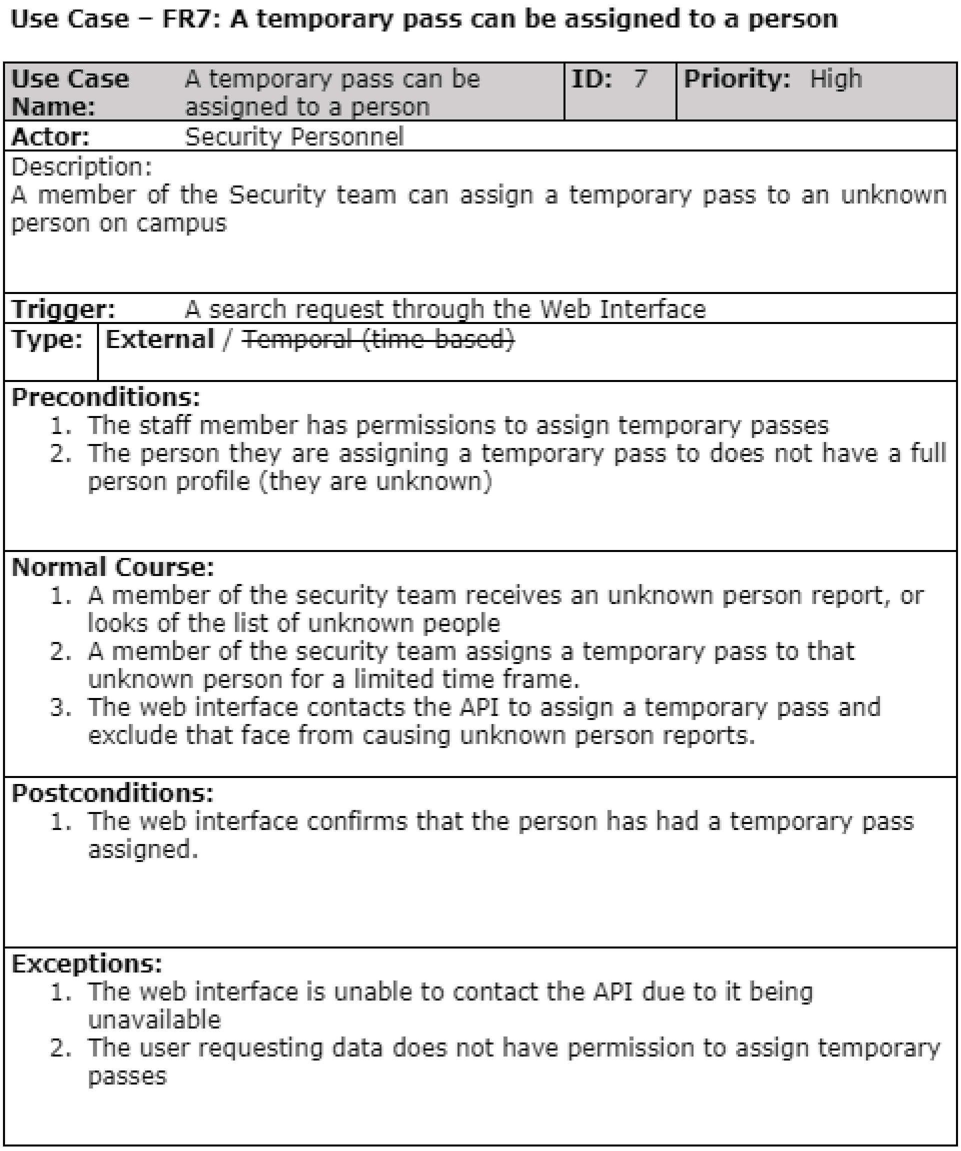
1. A member of the security team inserts a search query into the web interface
2. The web interface queries the API for the related persons current position.

Postconditions:

1. The web interface displays the person and their associated position reports, if found.

Exceptions:

1. The requested person was not found
2. The requested person was found, but they are not currently on campus
3. The web interface is unable to contact the API due to it being unavailable
4. The user requesting data does not have permission to look at that person



Use Case – FR7: A temporary pass can be assigned to a person

Use Case Name:	A temporary pass can be assigned to a person	**ID:** 7	**Priority:** High
Actor:	Security Personnel		
Description: A member of the Security team can assign a temporary pass to an unknown person on campus			
Trigger:	A search request through the Web Interface		
Type:	**External** / ~~Temporal (time-based)~~		
Preconditions: 1. The staff member has permissions to assign temporary passes 2. The person they are assigning a temporary pass to does not have a full person profile (they are unknown)			
Normal Course: 1. A member of the security team receives an unknown person report, or looks of the list of unknown people 2. A member of the security team assigns a temporary pass to that unknown person for a limited time frame. 3. The web interface contacts the API to assign a temporary pass and exclude that face from causing unknown person reports.			
Postconditions: 1. The web interface confirms that the person has had a temporary pass assigned.			
Exceptions: 1. The web interface is unable to contact the API due to it being unavailable 2. The user requesting data does not have permission to assign temporary passes			

Screen Designs

Login

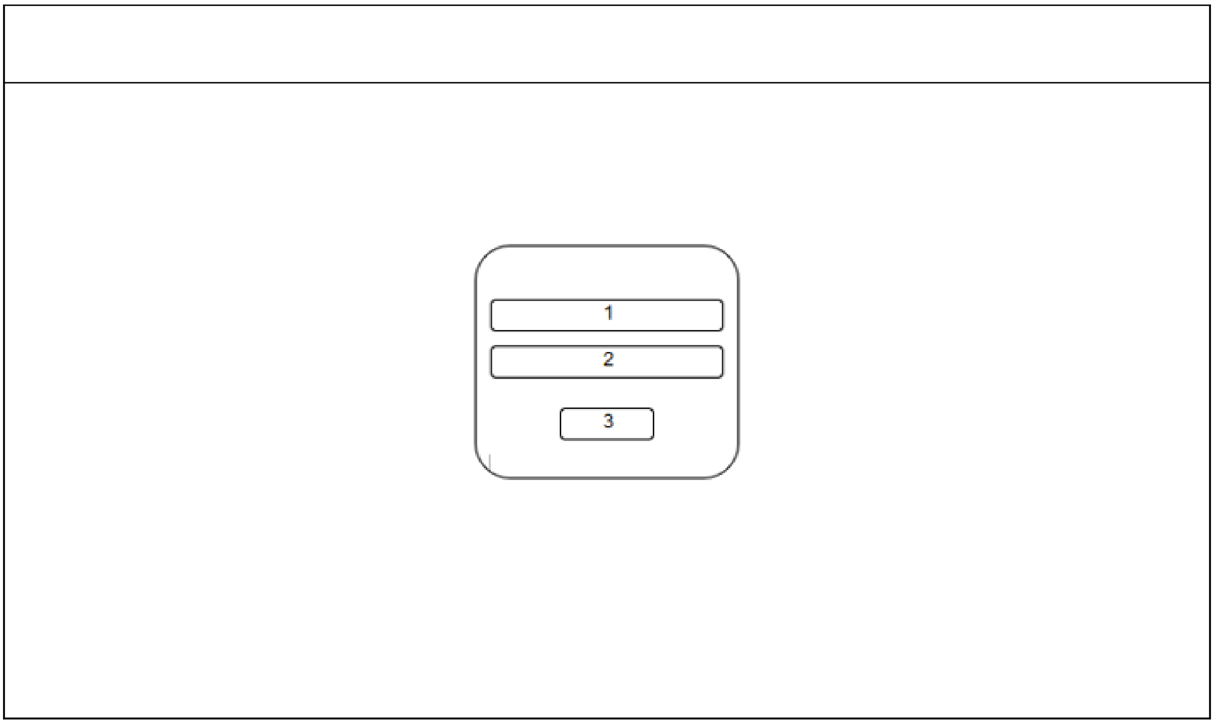


Figure 6: Login Page

The login page will be the first page that the user will interact with. This will require a username / email and password to be entered in order to access the website. This will also contain a “Forgotten Password” button to give extra assistance to the user.

Dashboard

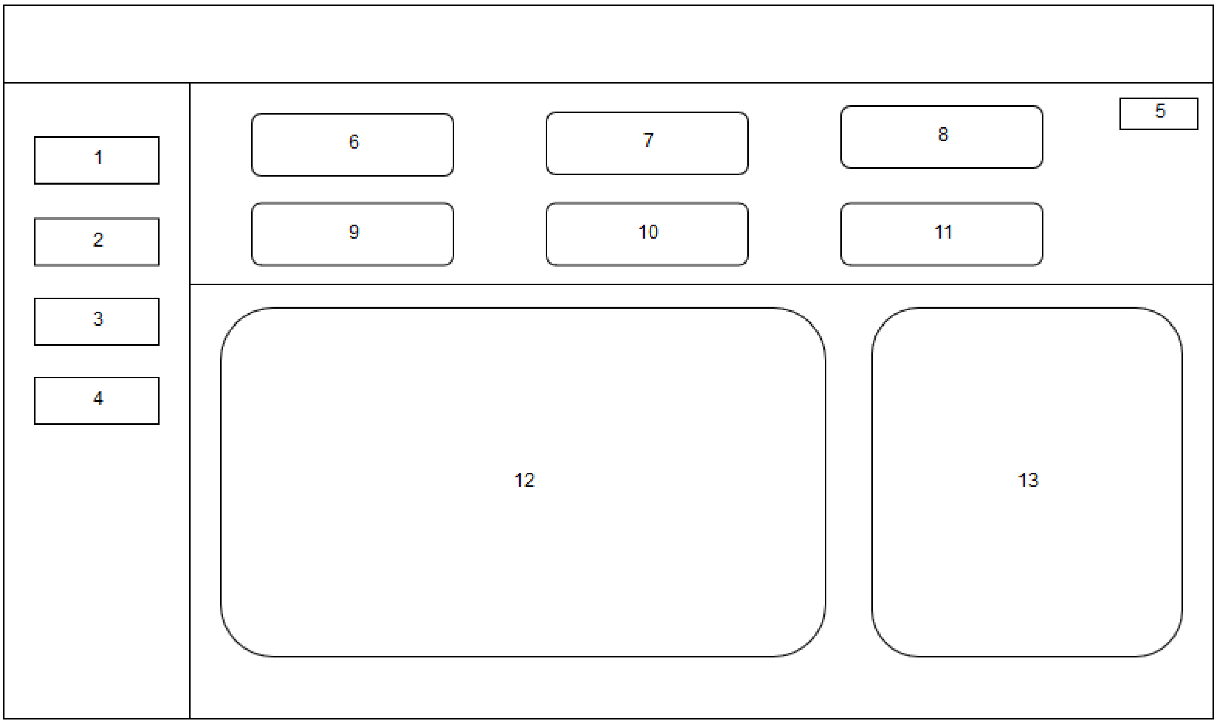


Figure 7: Dashboard

The dashboard will be the first screen that the user views after logging in. This page will display general details about the system and how it is preforming, giving specific updates on new users, detections, unknown detections, etc. This will also show specific data on camera activity, showing which cameras have detected what user type, or if it has detected and invalid user.

Statistics

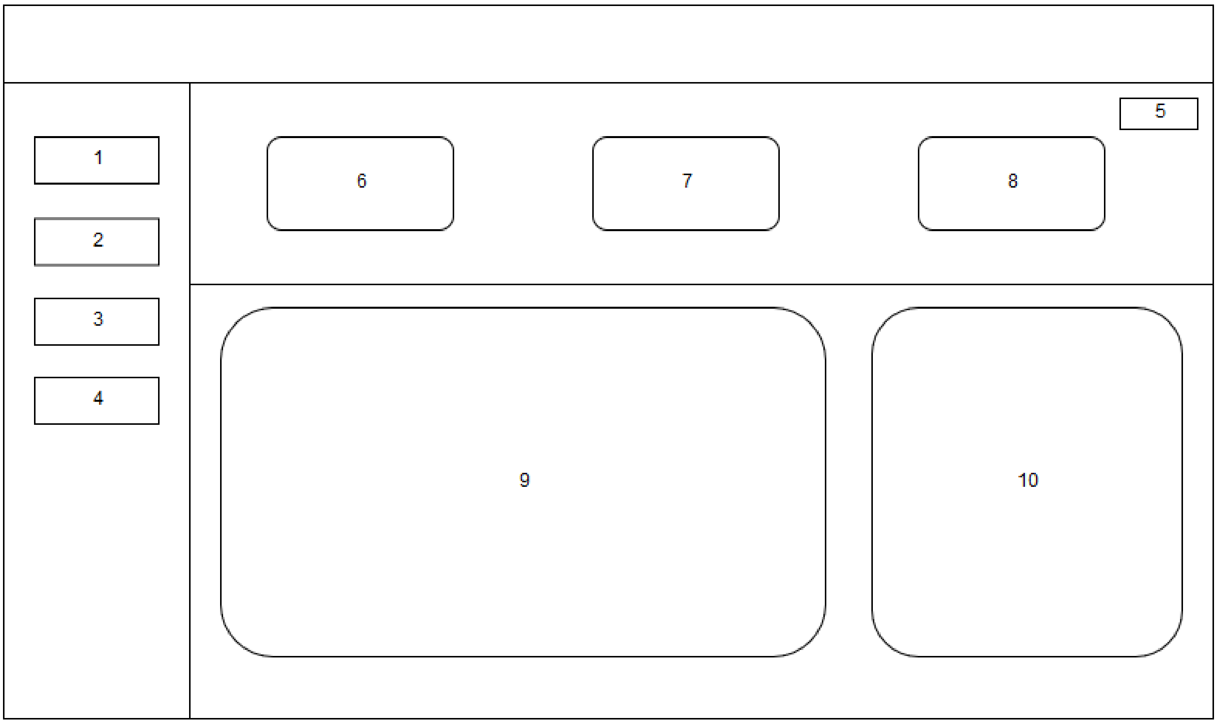


Figure 8: Statistics

The statistics page will show the user all of the relative data regarding user activity. This page includes a graph which will show specified user activity between campus locations. The specified user will be changeable by a set of buttons at the top of the screen. The statistics page will also display campus activity in specific buildings.

Admin

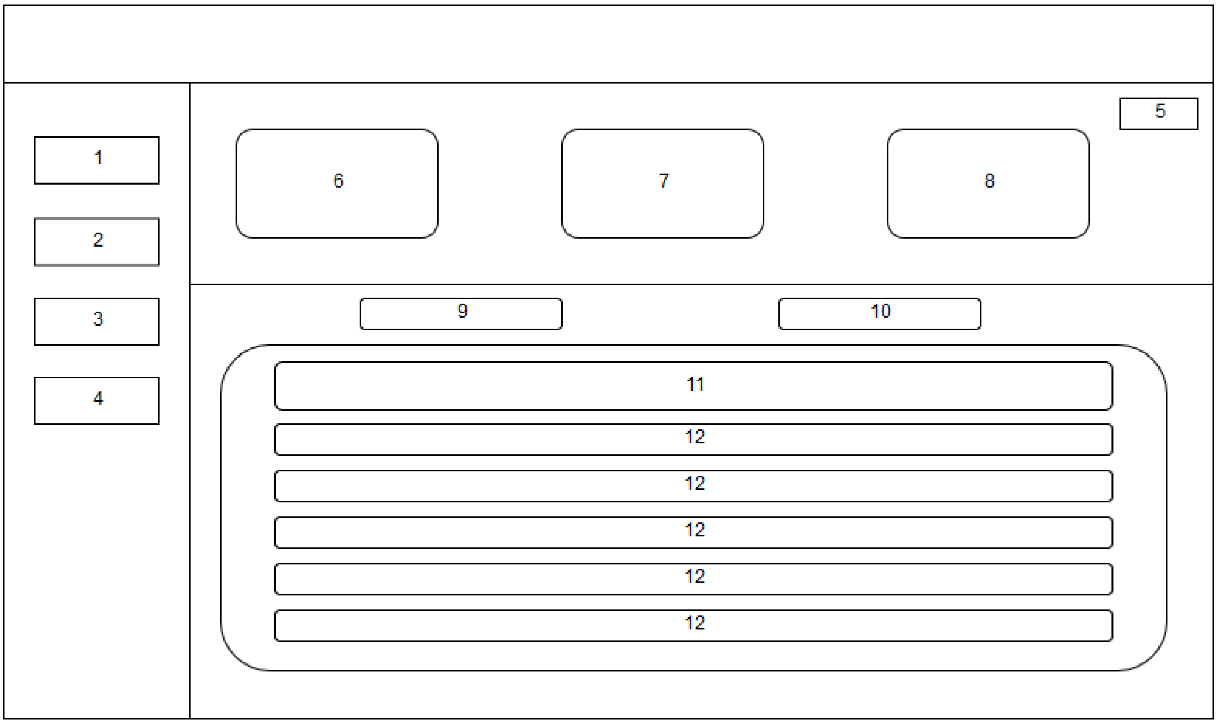


Figure 9: Admin

The admin page will allow the user the create and edit data. This data may be regarding a permanent user, temporary user, or a camera. This page will be used in order to view users' profiles, add users, edit current user's data, find specific locational data and also find specific camera data.

User Profile

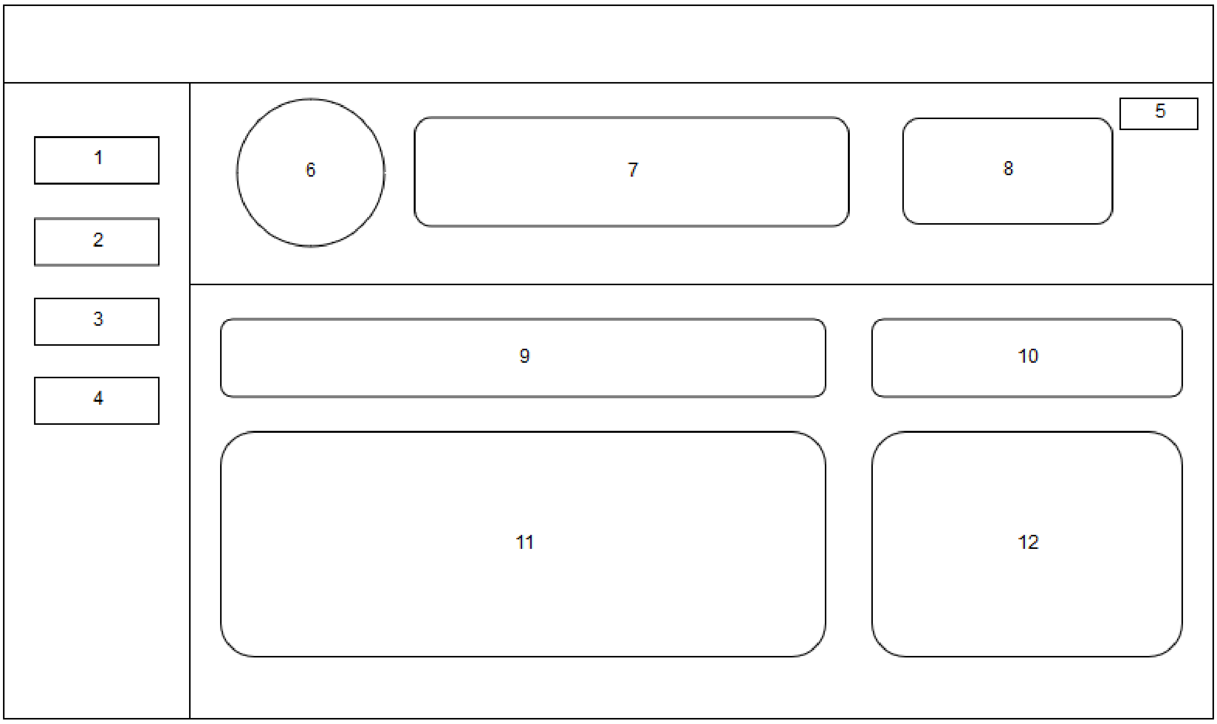


Figure 10: User Profile

The profile page will show the user the chosen user's profile information. This will contain basic information about the user, including name, course, year, attendance, location, and activity. The default user for this page will be the profile that is associated with the current log-in. Other user's will be able to be accessed by the admin page through selecting a user and then the profile button.

Elements Appendix

Login:

1. Username Input
2. Password Input

3. Sign in Button

Dashboard:

1. Dashboard
2. Profile
3. Statistics

4. Admin

5. Logout

6. Total Users Detected
7. New Users
8. Valid Detections
9. Invalid Detections
10. Most Used Cameras
11. Current Campus Population
12. Camera Details (Detections)
13. Location Details (Population)

Statistics:

1. Dashboard
2. Profile
3. Statistics
4. Admin
5. Logout

6. “Students” Button
7. “Teachers” Button
8. “Guests” Button
9. Specified User Activity Graph

10. Locational Data (Population %)

Admin:

1. Dashboard
2. Profile
3. Statistics
4. Admin
5. Logout
6. Total Users
7. Current Population
8. Invalid Detections
9. Users Tab
10. Cameras and Locations Tab
11. Data Table Categories
12. Records of Data Table

Profile:

1. Dashboard
2. Profile

3. Statistics
4. Admin
5. Logout
6. Profile Image
7. Basic Data (Name, Course)
8. Attendance
9. Current Location
10. Favoured Location
11. Detections Table
12. Total Activity Breakdown

References

"BCS Code of Conduct." 2015. *BCS*. https://www.bcs.org/membership/become-a-member/bcs-code-of-conduct/.

Doran, George T. 1981. "There'sa Smart Way to Write Management's Goals and Objectives." *Management Review* 70 (11): 35–36.

GliderMaven. 2016. "Total Deaths in Us Mass Shootings." *GliderMaven*. Wikipedia. https://commons.wikimedia.org/w/index.php?curid=50124456.

Staff, The Guardian, and Agencies. 2018. "YouTube Hq Shooting: Police Identify Woman Who Opened Fire." *The Guardian*. Guardian News; Media. https://www.theguardian.com/technology/2018/apr/04/youtube-shooting-police-identify-woman-opened-fire-hq.