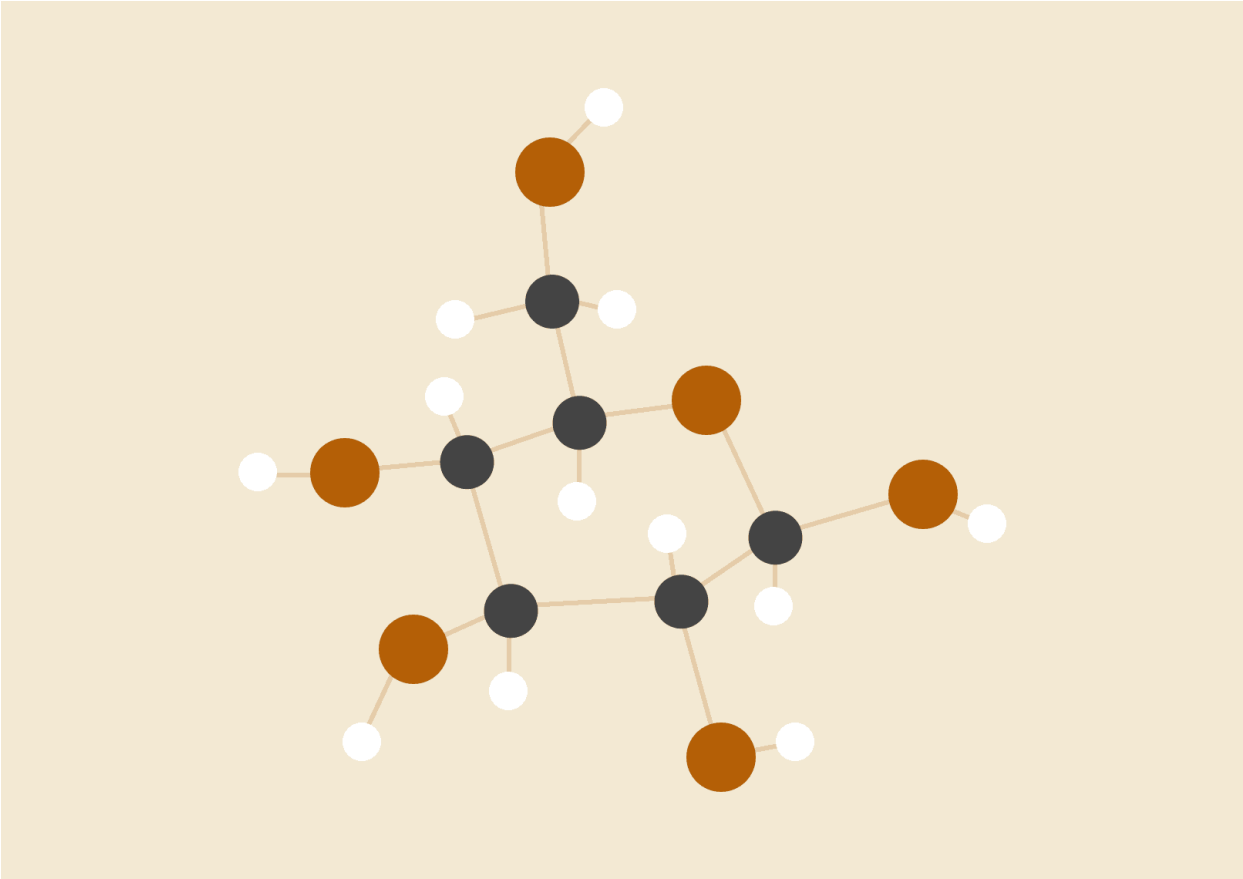
Project report



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INFO 4178 , 2023

INTRODUCTION

We are constantly faced with problems of criminal attacks and in some cases victims are afraid to report the crime and the means and way were not so easy ,through one of our course which is software engineering (INFO4178) we have been asked to carry out a project in group of five students in order to be able to respect the instructions and the deadlines constraints.
The project consists of setting up a platform which will allow victims to report various crimes to the police and the public in order to make them better known with the aim of implementing it while putting in practice the different notions and concepts seen in class such as scrum practices, Analytical Hierarchical process (AHP) and mathematical modeling.

TOPIC

Developing a web plateforme where victims report diverse crimes to the police and the public in order to better expose them.

Research Problem

Africa faces a seemingly ever-increasing range of security challenges, our main concern here is to look a way of voicing particular concern over terrorist attacks, population displacement and the resurgence of old armed groups in many African’s nation

General objectives

The general objective of this project is to create a platform that enables victims to

report crimes anonymously while providing law enforcement agencies with real-time data on crime trends.

Specific objectives

The specific objectives include:

- Designing an intuitive user interface that is easy to use for victims and law enforcement agencies

- Implementing robust security measures to protect the anonymity of victims

- Integrating the platform with existing police databases to provide real-time data on crime trends

- Testing the platform thoroughly to ensure that it meets the needs of all stakeholders

((Here our main concern is to come out with a platform where victims will report crimes and the police officers, law enforcement and the public will have access to information about reported crimes in return in order to increase awareness and potentially aid in prevention efforts.))

System requirements

Developing a platform where victims can report various crimes to the police and the public is a crucial step towards creating a safer society. This platform will not only help victims to report crimes but also aid in exposing them, leading to better law enforcement and justice. In order to develop such a platform, it is essential to consider both functional and non-functional requirements.

a. Functional requirement.

→ User Registration: The platform should allow users to register themselves with their basic details like name, contact information, and address.

→ Reporting System: The platform should have an easy-to-use reporting system that allows users to report crimes with all the necessary details like location, time of occurrence, type of crime, etc.

→ Notification System: The platform should have a notification system that alerts the concerned authorities about the reported crime.

→ Tracking System: The platform should have a tracking system that enables users to track the progress of their reported crime.

→ Data Management: The platform should have an efficient data management system that stores all the reported crimes' information securely.

→ Feedback System: The platform should have a feedback system that allows users to provide feedback on their experience with the reporting process.

- ➔ ***Geolocation***: A feature to identify the location of the crime automatically.
- ➔ ***Attachments/Photos***: Ability for users to upload photos or video evidence related to the crime.
- ➔ ***Notify Police***: A feature that notifies the local police department about the crime reported.
- ➔ ***Notify Public***: A feature that publishes reported crimes after verifying their validity.
- ➔ ***Crime Report Management***: A feature to allow police officers to view the reported crimes, investigate them, and update their status.
- ➔ ***Dashboard***: A feature to enable the authorized users (Police and Public) to view a summary of the reported crimes on the platform.

Non-functional requirements

- ***Security***: The platform must be secure enough to protect user data from unauthorized access or cyber-attacks.
- ***Scalability***: The platform must be scalable enough to handle an increasing number of users and reports over time.
- ***Reliability***: The platform must be reliable enough to ensure that all reported crimes are addressed promptly and efficiently.
- ***Usability***: The platform must be user-friendly and easy-to-use for all types of users, including victims, law enforcement agencies, and the general public.
- ***Accessibility***: The platform must be accessible from any device or location with an internet connection.
- Performance: The platform must perform efficiently without any lag or delay in processing reports or notifications.

Application of Scrum

a. Presentation of scrum team

Scrum role	Name	Matricule
Product owner	ZEKENG ARTHUR XAVIER	18T2911
Scrum master	NGUEGANG FEUMOE OUVANE AUXILIA	18T2482
member	TEYOU GHOMFO MARTIAL	19M2364
member	NJIKE HELENE IVANA	19M2280
member	CARRÉ VILMORIN YVAN MARCEL	19Y078

b. Description of how you applied scrum to your specific project

Explanation of how Sprints were carried out

- Here, we divided our work into 4 majors sprints which were directed by the scrum master and followed and helped by the scrum members
- Technically, every sprint was made of four steps: planning, execution, review, and retrospective.
- During the planning phase we discussed what was to be done and how it will be done.
- The execution phase was to put in practice what was decided in the planning.
- The review and the retrospectives was to make sure everything was done the right way , it was usually insisted during the retrospective

Team organization and role

SCRUM MEMBER	ROLE
Product Owner	He is responsible for the product and must ensure that the team works on the features that bring the most added value.
Scrum Master	He is responsible for the SCRUM process ruling and must ensure that the team follows good practices.
Développer	Head of Feature Development

	.
Tester	Responsible for testing to ensure the product works properly .
Designer	Responsible for software design and user's experience

Daily scrum Agenda

The organization of the daily agenda was directed by the answering of three majors questions at the daily scrum which were;

1. What have you done since yesterday? with this question, it was to make sure everyone was to step forward during

2. What are you planning to do today? After the previous task was validated we had to improve with the next task to be done.

3. Are there any impediments or stumbling blocks? With this question , we helped each member who faced an obstacle during the progress of his or task . By doing that we were at the same level of advancement .

Scrum conflict Resolution

During the elaboration of the requirements specification document and even choosing the research topic we faced a number of difficulties but thanks to scrum we overcame them through the following .

- For the research topic all the group members listed and defended their topic , we ended up voting among the best proposed topics.
- We proceeded by voting for the attribution of the scrum master and the product owner proposed himself and we all agreed.
- For the choice of Technologies and tools to use, everyone was allowed to

work with what was more productive for him or herself .

- For the elaboration of the requirements specifications document nobody wanted to take the initiative so the scrum master attributed tasks to each scrum member .

Scrum workflow management

- At the beginning of the project, the roles were assigned and the team assembled. A meeting was held between the Product Owner, the user, the Scrum Master and the Development team to extract the project Product backlog.
- We decided to group the users' stories into a group of small functionalities where each member was assigned a task to do and each of the weekly meetings was grouped as sprints so as to ease the work evolution and the group performance.
- A list of weekly scrum meetings was held each friday to present each member's evolution and discuss on what next to do or to ameliorate.

Product Backlog

ID	Requirements (User Stories)	Acceptance criteria	priority	Initial Estimate (in days)	Adjustment factor	Adjustment estimate
1	As a user especially for a police officer i should be able to register myself it is	when a user logs into the platform ,he as a police officer is asked to register so as to have informations	1	3	1.5	2

	optional for a victim	concerning him, he enters his informations and clicks the validation button				
2	As a victim of domestic violence, I want to report my abuser anonymously so that I can get help without fear of retaliation.	When a victim is connected, they can fill in a form anonymously, so they can get help without fear of reprisals.	2	3	1	3
3	As a police officer investigating a crime scene, I want to access real-time data on crime reports in my area so that I can make informed decisions.	When a police officer logs into the system, the platform should provide real-time data on crime reports in the officer's designated area. The data should be accurate and up-to-date, reflecting the latest crime reports filed by victims.	3	7	1	7
4	As a victim, I want to report a crime to the police or public using the platform so that I can take immediate action.	When the victim logs into the system, the platform should provide a form that the victim can fill with all the necessary details about the crime, such as the date, time, location, incident details, and any other relevant information. It should allow the victim to upload photos or videos related to the crime, as evidence that can help the police investigate the case.	5	2	1.5	3
5	As a police officer, I want to have access to reported crimes information on the platform so that I can investigate them.	When a police officer accesses the platform using his credentials, he should be able to view the list of reported crimes and filter them by date, location, and severity. He should also be able to see the details of each report, including the victim's name, contact information, the nature of the crime, and any attachments (if provided). The platform should also notify him of any updates or changes made to the report.	4	4	1	4
6	As a member of the public,	When a member of the public	8	3	1	3

	I want to see the reported crimes information on the platform to stay informed about criminal activities happening around me.	accesses the platform without any credentials, I should be able to view a list of reported crimes within my vicinity or the location of my choice. The information should be easily understandable and searchable, and I should be able to report any inaccuracies to the concerned authorities. The platform should also alert me to any emergency situations or critical updates.				
7	The system is capable of localizing the location from where the victims is reporting the crime	when the victim reports a crime, the system uses geolocalization Api to sort out he victims position and attaches it to his report form	6	4	1	4
8	The system should be able from the list of the recent reported crimes estimates which crime has the highest priority by judging the different criteria	when a certain number of crimes a reported within the day the system compares the crimes priority by using criteria like position and degree of gravity so that the police has a idea on which crime to investigate first	7	4	1	4

Sprint Backlog

Release	Sprint	Id of USer Stories	Period(Days)
Release 1 : user registration form, reporting form,	1	1,2	20th May-25th May
Release 2: AhP applied with basic system's functionalities	2	3	25th may -02nd june
Release 3 : user and police dashboard	3	4,5	3rd june- 10th june
Release4: whole	4	6,7,8	11th june -21 th

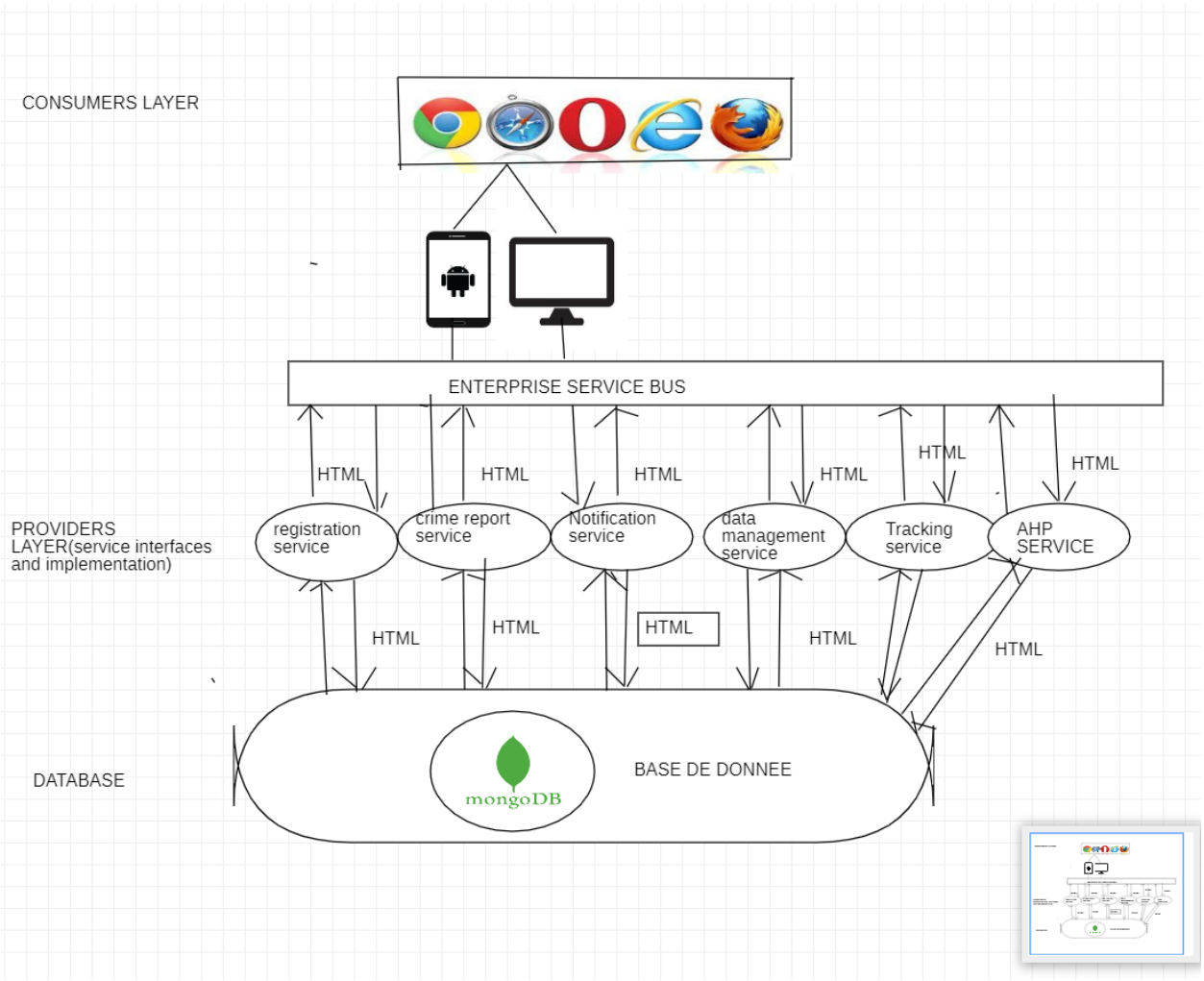
web application			june

Methodology

a. Architecture of your system

There exist a good number of different architectures to use during the elaboration of a project but we decided to choose A **Service Oriented Architecture** (SOA) to represent our project.

i. Architectural Diagram



ii.Description of Architecture

Service Oriented Architecture (SOA) is an architectural approach in which application components make use of a collection of services available in a network, which communicates with each other.
In service oriented architecture, services communicate with each other, either to pass the data or to coordinate an activity. The above diagram is explained in the following way.

- **Consumer interface layer**: These are graphical user's interfaces for users

to access the services, for our application we have : the victim dashboard , police dashboard, registration interface and victime report interface. The Consumer Layer is the point where consumers interact with the SOA and they are able to do this with the help of a smartphone or a computer through a web browser. It enables an SOA to support a client-independent, channel-agnostic set of functionality, which is separately consumed and rendered through one or more channels (client platforms and devices like laptop and smartphone).

- **The Database :** In SOA architecture database storage is shared between all services , in our case study we used the mongo DB database .
- **The providers layer :** the provider layer is the point where all services are defined within the SOA. Services such as registration , crime report service ,tracking service , data management service and notification service are implemented at this level
- **The Enterprise Service Bus (ESB) : t**he enterprise service bus (ESB) implements a communication system between mutually interacting software applications in a service-oriented architecture. ESB promotes agility and flexibility with regard to high-level protocol communication betw**een applications.**provide communication by a common communication protocol , or communication bus ,which has connections between the consumers and providers.

iii. Architectural Drivers

Architectural drivers are considerations that need to be made for the software system that are architecturally significan**t**. They describe what you are doing and why you are doing it.There are four groups of architectural drivers: **technical constraints** , **business constraints , functional requirements and quality attributes.**

Here we are going to mainly list our qualities attributes since the functional requirements were listed above. Since it was an academic project we did not experience the technical and business constraints .

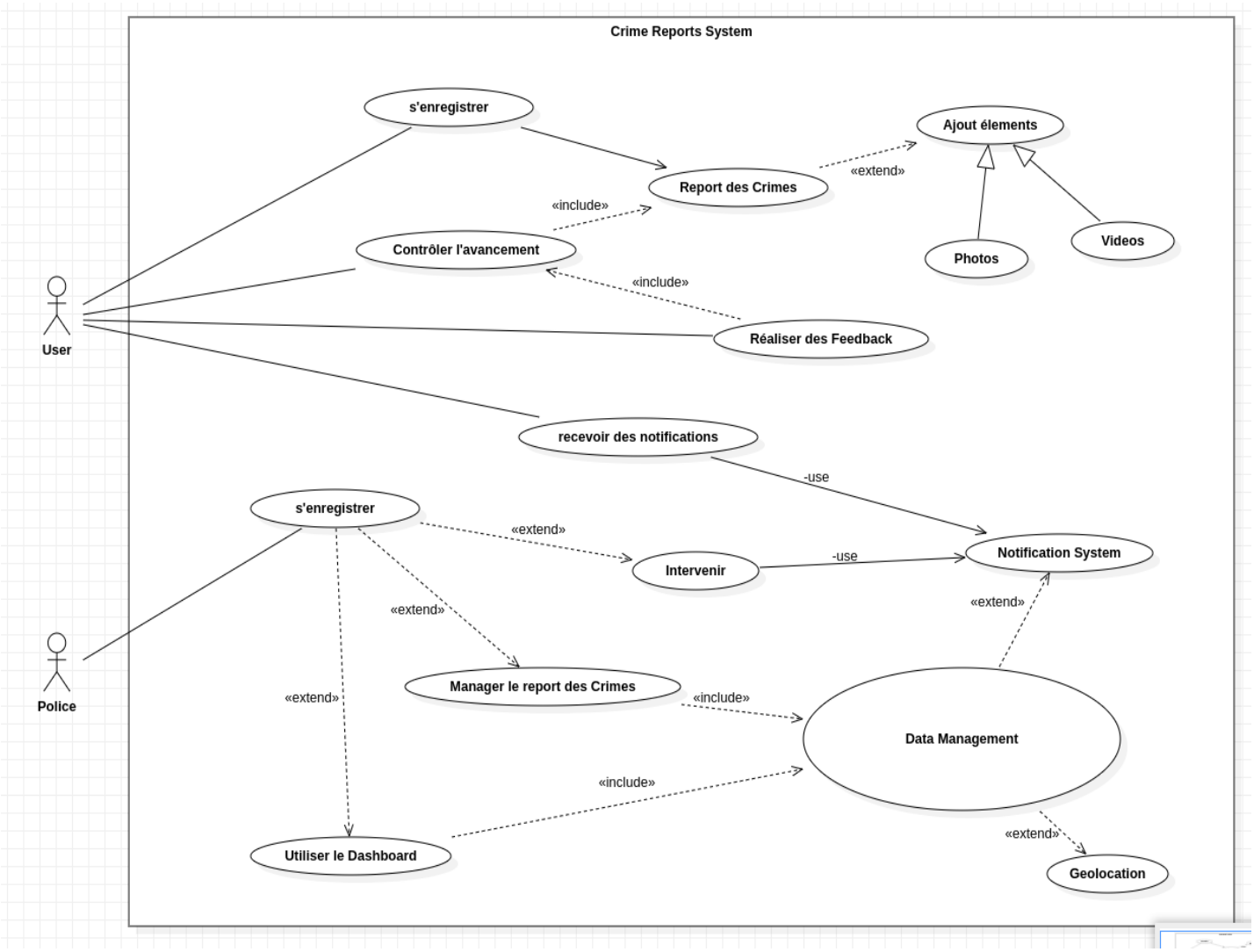
Quality attributes of our system;

- ***Security***: The platform is secure enough to protect user data from unauthorized access or cyber-attacks.
- ***Scalability***: The platform t is able to handle an increasing number of users and reports over time.
- ***Reliability***: The platform is reliable enough to ensure that all reported crimes are addressed promptly and efficiently.
- ***Usability***: The platform is user-friendly and easy-to-use for all types of users, including victims, law enforcement agencies, and the general public.
- ***Accessibility***: The platform is accessible from any device or location with an internet connection.

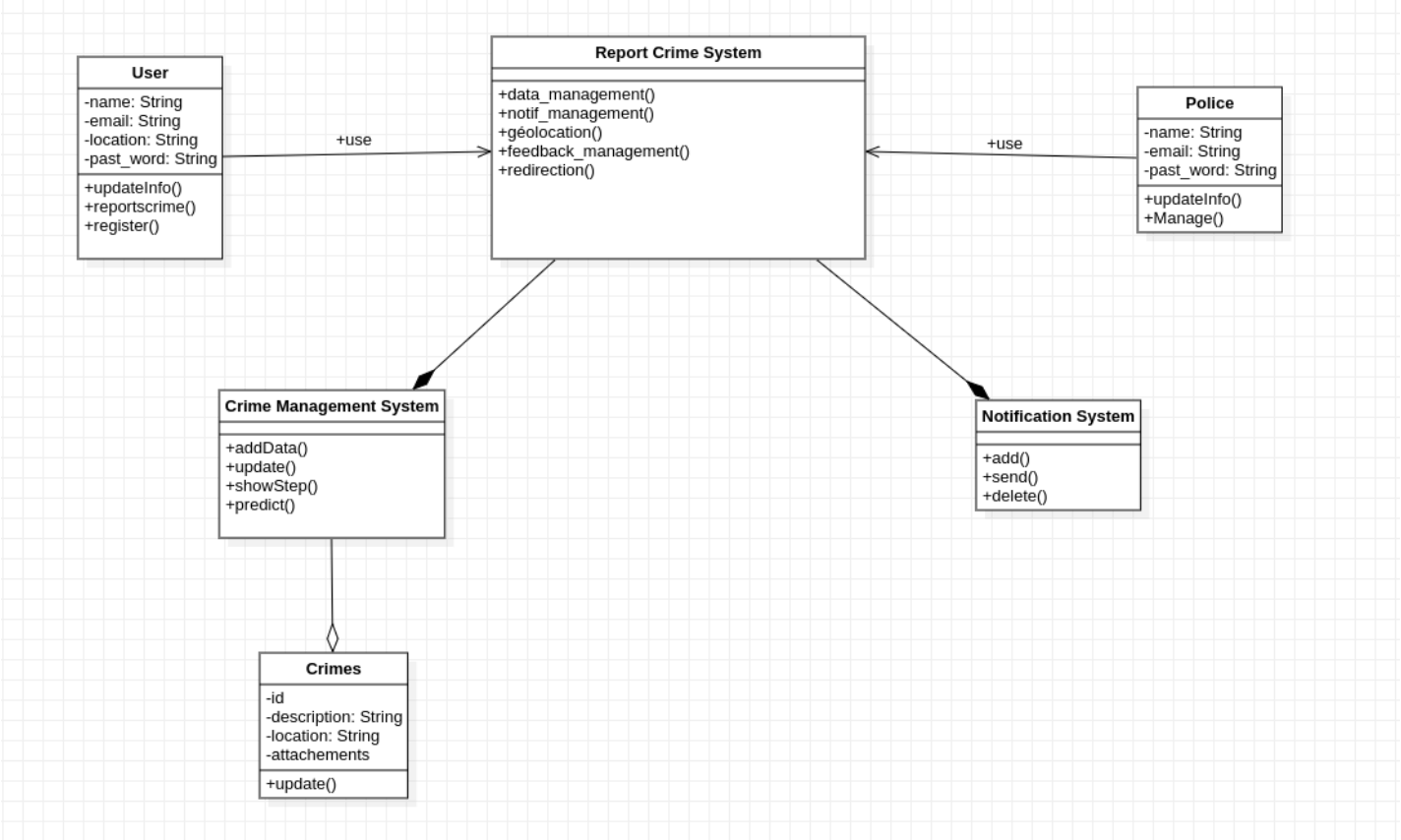
b.Model of your system

i.Model UML

1. Use case diagram

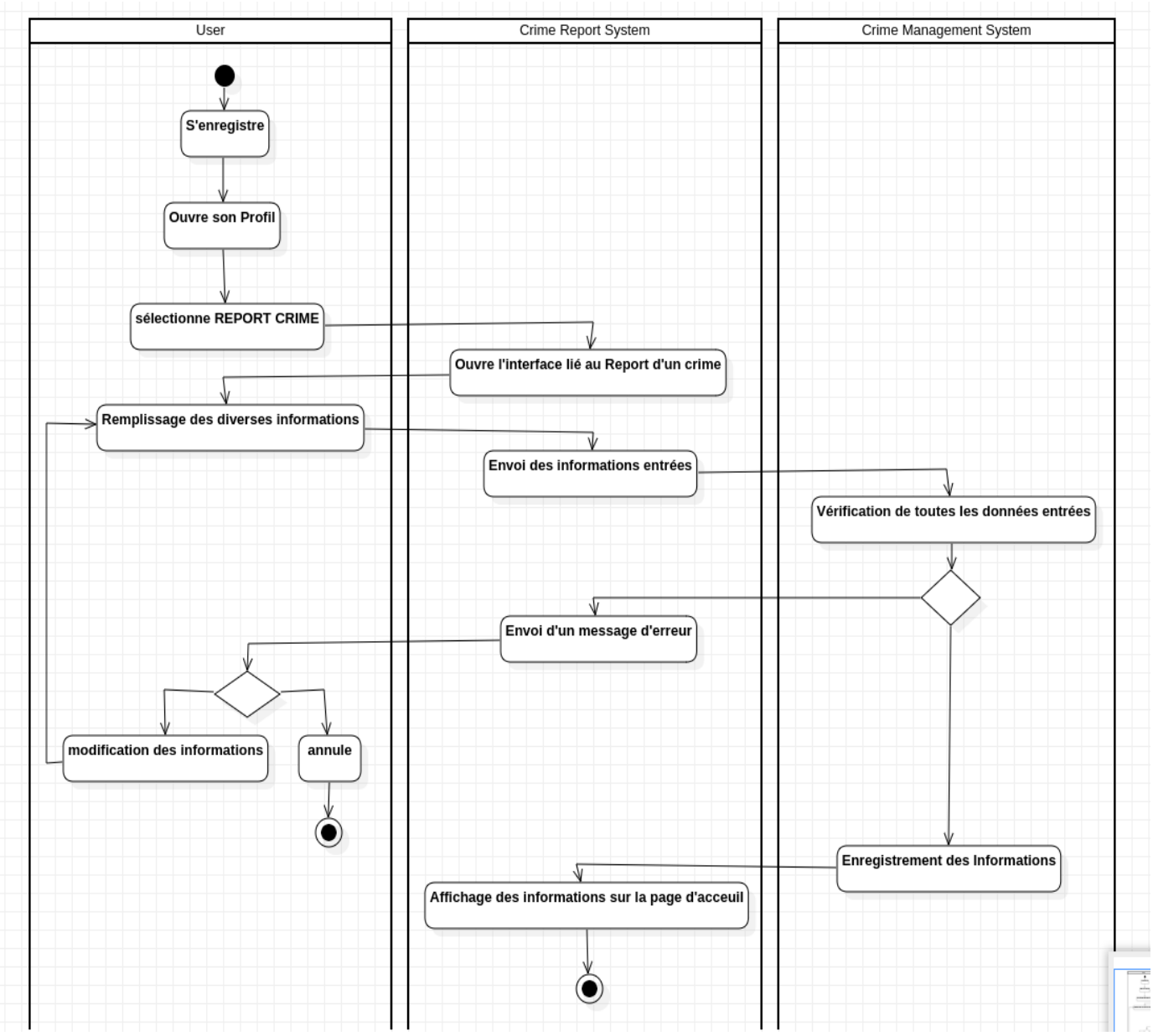

Crime Reports System
s'enregistrer
Ajout élements
Report des Crimes
«extend»
«include»
Contrôler l'avancement
Photos
Videos
«include»
User
Réaliser des Feedback
recevoir des notifications
-use
s'enregistrer
«extend»
Intervenir
-use
Notification System
«extend»
«extend»
Police
Manager le report des Crimes
«extend»
«include»
Data Management
«include»
«extend»
Utiliser le Dashboard
Geolocation

2 .Class diagram

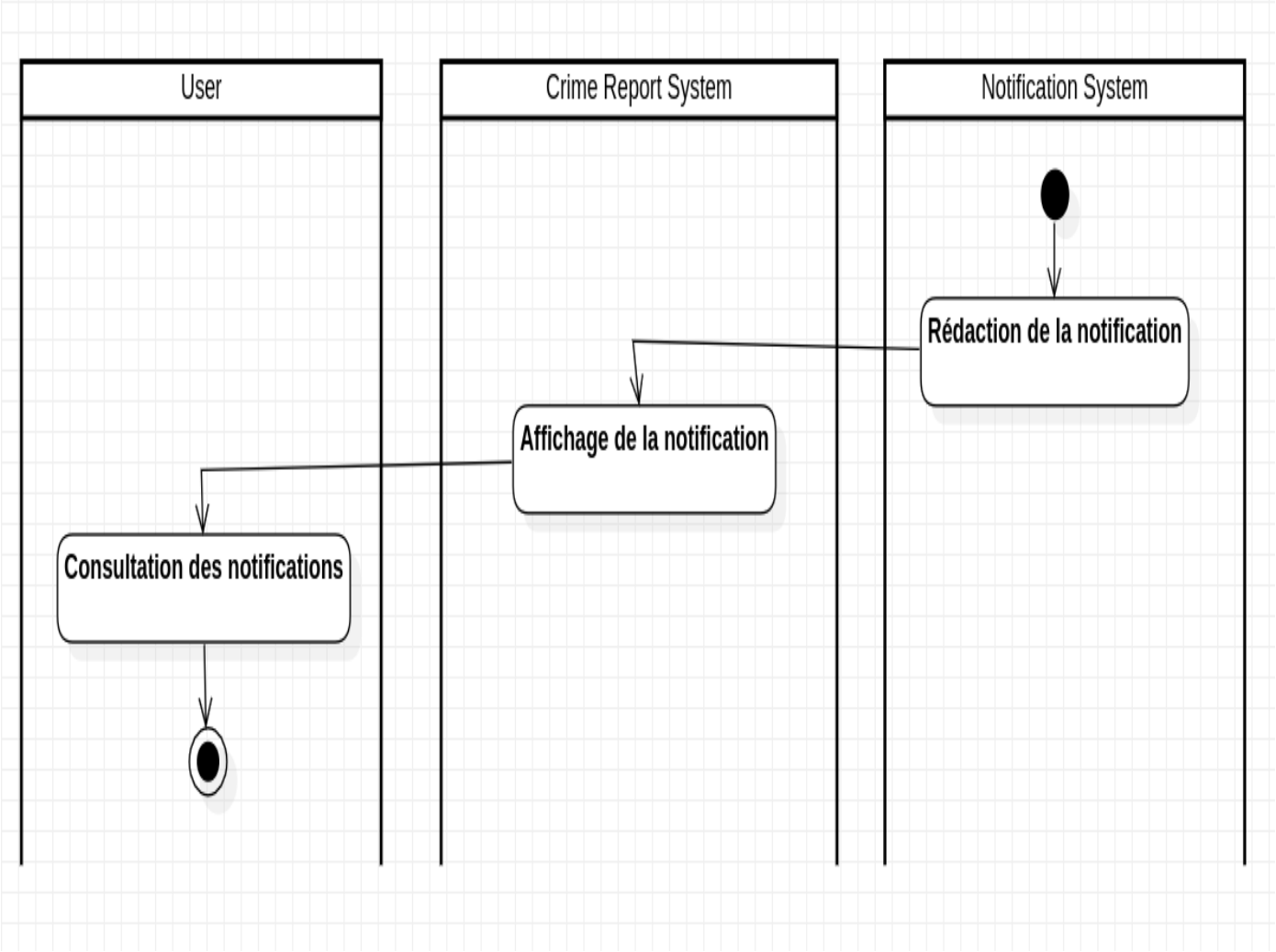


3.Activity diagram

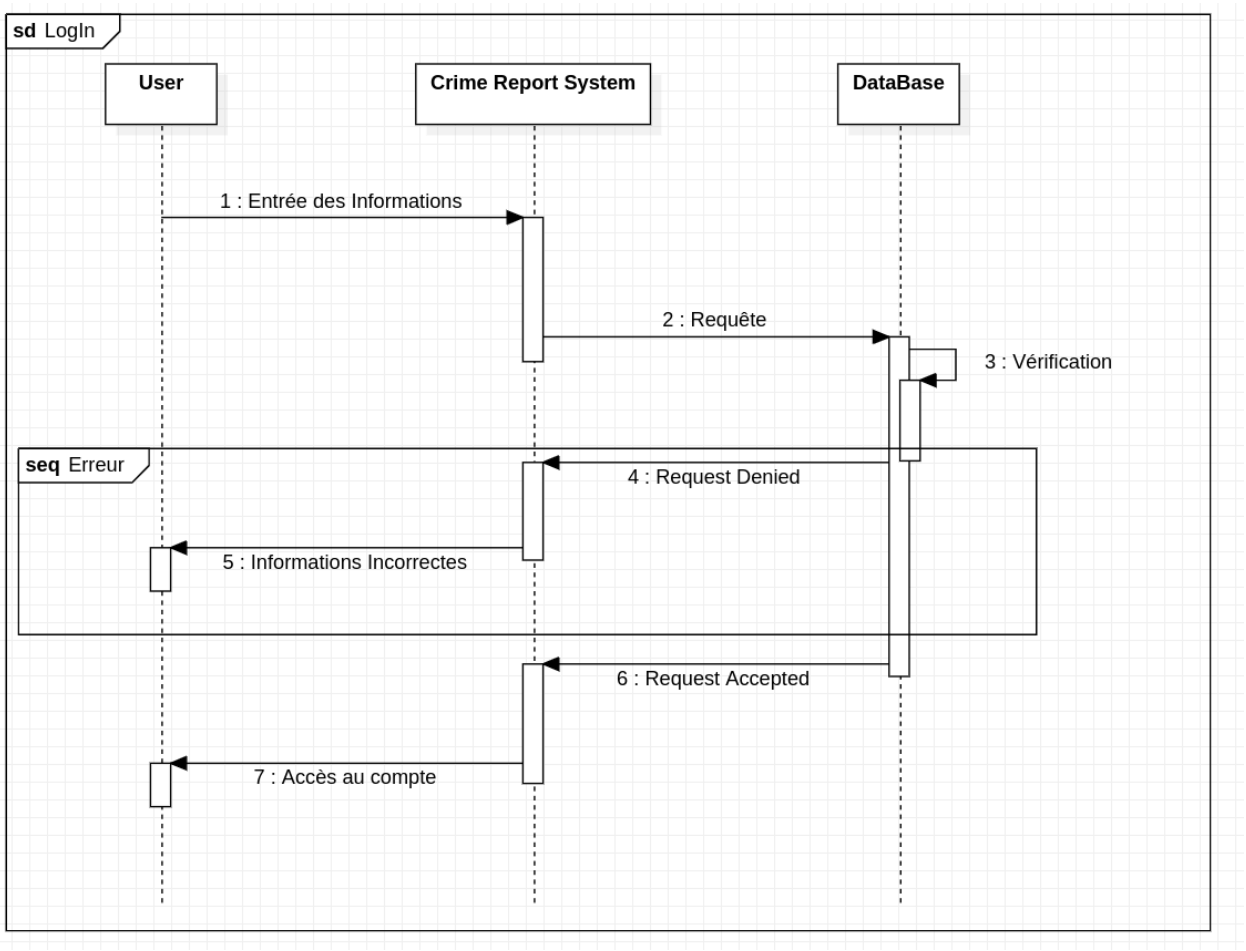
- Activity Diagram for the **Crime Report**



- Activity for the **Notifications**



4. Sequence diagram



ii.Mathematical Model

For the mathematical modeling, we used multidimensional exploratory statistics to be able to represent our data and extract crucial information from it thanks to the various techniques and measures used in statistics.

As an example of representation we can have:

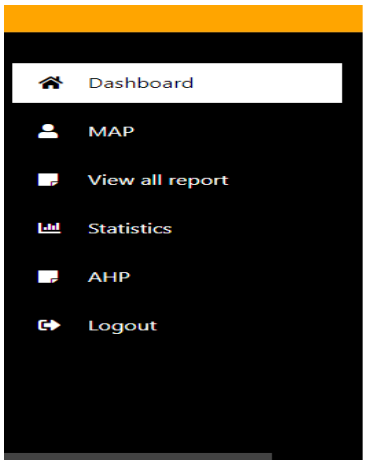
Modalités/ Axes d'analyse	Ville A									Ville B								
	Quartier A			Quartier B			Quartier C			Quartier A			Quartier B			Quartier C		
	Crime A	Crime B	Crime C	Crime A	Crime B	Crime C	Crime A	Crime B	Crime C	Crime A	Crime B	Crime C	Crime A	Crime B	Crime C	Crime A	Crime B	Crime C
Effectif	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
ECC																		
ECD																		
...																		
Total	...			...			...			...			...			...		

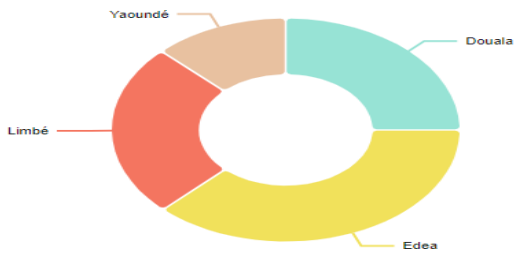
By using statistical techniques, this representation allows us to highlight measures and trends such as:

- The point cloud

- Calculation of metrics (mode, mean, standard deviation, variance, quartiles, etc.)

- Charts (Histogram, bar chart, …)





- Linear adjustment

- Multidimensional representation

- Predictive, descriptive, exploratory, causal and inferential analysis.

- …

These techniques will help to understand the different crimes, their correlation to better understand them and make decisions.

This multidimensional representation allows for even deeper analysis using Business Intelligence tools (Power BI, Talend) to bring out representative reports and dashboards

III. Algorithme

```
    return M


def calculte_criteria_weight(A):
    return A.mean(axis=1)


def calculate_criteria_sum(M, B):
    Mn = normalize_pair(M)
    print(Mn)
    print("----------------")
    print(B)
    S = calculte_criteria_weight(Mn)

    for i in range(Mn.shape[0]):
        for j in range(Mn.shape[1]):
            B[j][i] = B[j][i]*S[i]
    return np.array([B.sum(axis=1), S])

# print(calculate_criteria_sum(M,N))


def calculate_lambda_max(Matrix):
    R = np.zeros((1, Matrix.shape[1]))
    for j in range(Matrix.shape[1]):
        R[0][j] = Matrix[0][j]/Matrix[1][j]
    return R.mean()


def calculate_CI(Matrix):
    l = calculate_lambda_max(Matrix)
    return (l-Matrix.shape[1])/(Matrix.shape[1]-1)


def calculate_CR(Matrix):
    RI = [0, 0, 0.58, 0.9, 1.12, 1.24, 1.32, 1.41, 1.45, 1.49]
    return calculate_CI(Matrix)/RI[Matrix.shape[1]-1]
```

c. Analytical Hierarchical process (AHP) algorithm applied to your project

First, let's define the project goal as "Enabling police officers to choose where to intervene in case of multiple crimes."

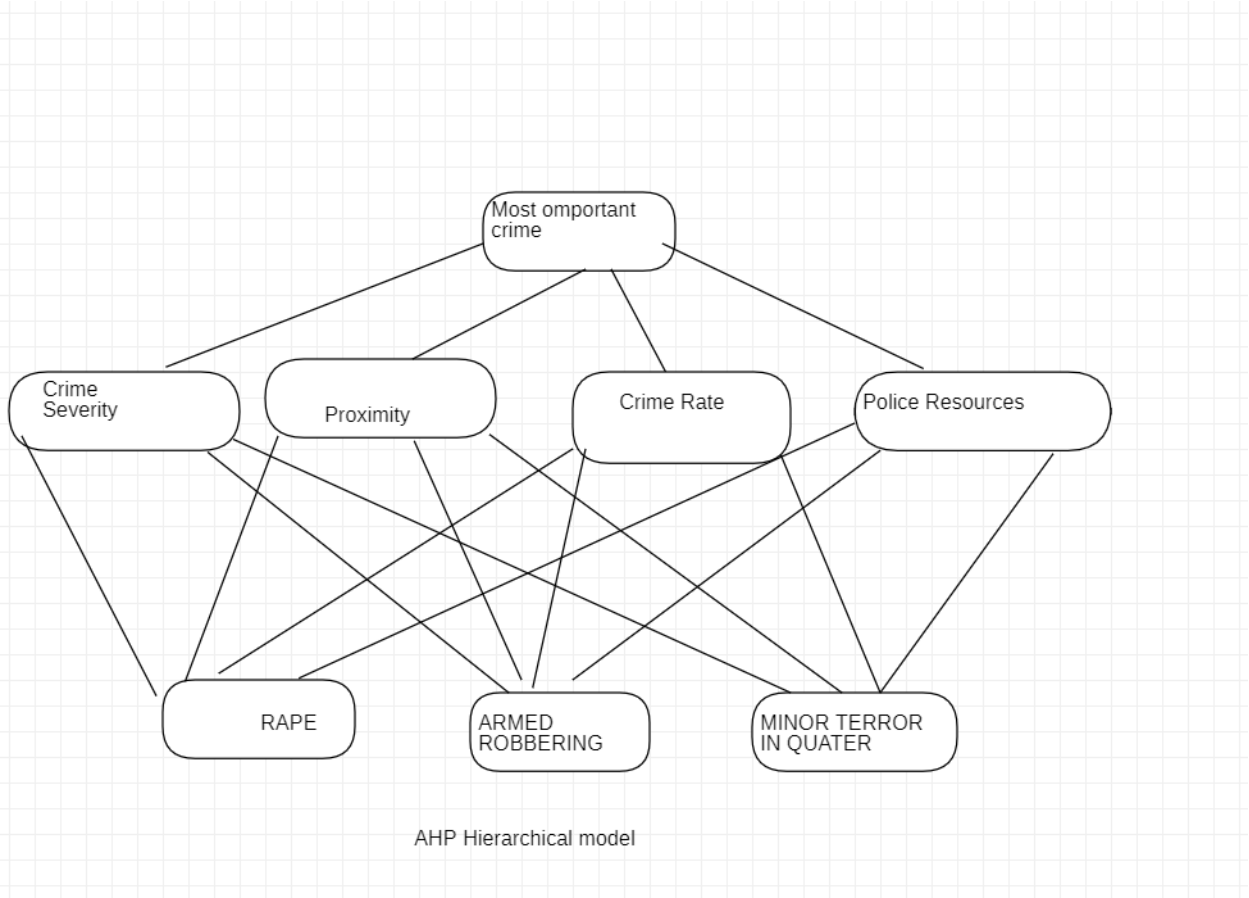
Next, we need to identify the criteria that are important for achieving this goal. Based on the project goal, we can identify the following four criteria:

- ***Crime Severity:*** The severity of the crime should be considered as a criterion since police officers should prioritize intervention in cases of more severe crimes.
- ***Proximity:*** The proximity of the crime scene to the police station should be considered since police officers should be able to intervene quickly and efficiently in areas that are closer.
- ***Crime Rate:*** The crime rate in the area should be considered since police officers should be able to intervene in areas with higher crime rates.
- ***Police Ressources:*** The availability of police resources such as personnel, equipment, and vehicles should be considered since police officers should have the necessary resources to intervene in multiple crimes.

Next, we need to assign weights to each criterion based on their relative importance in achieving the project goal. We can do this by pairwise comparison using a scale from 1 to 9, where 1 means equal importance and 9 means extreme importance.

Example: Application of AHP Problem to determine the crime on which to intervene first

Solution: Come up with hierarchical model of decision problem



AHP Hierarchical model

Come up with a criteria relative scale of preference

1 – Equal importance

3 – Moderate importance

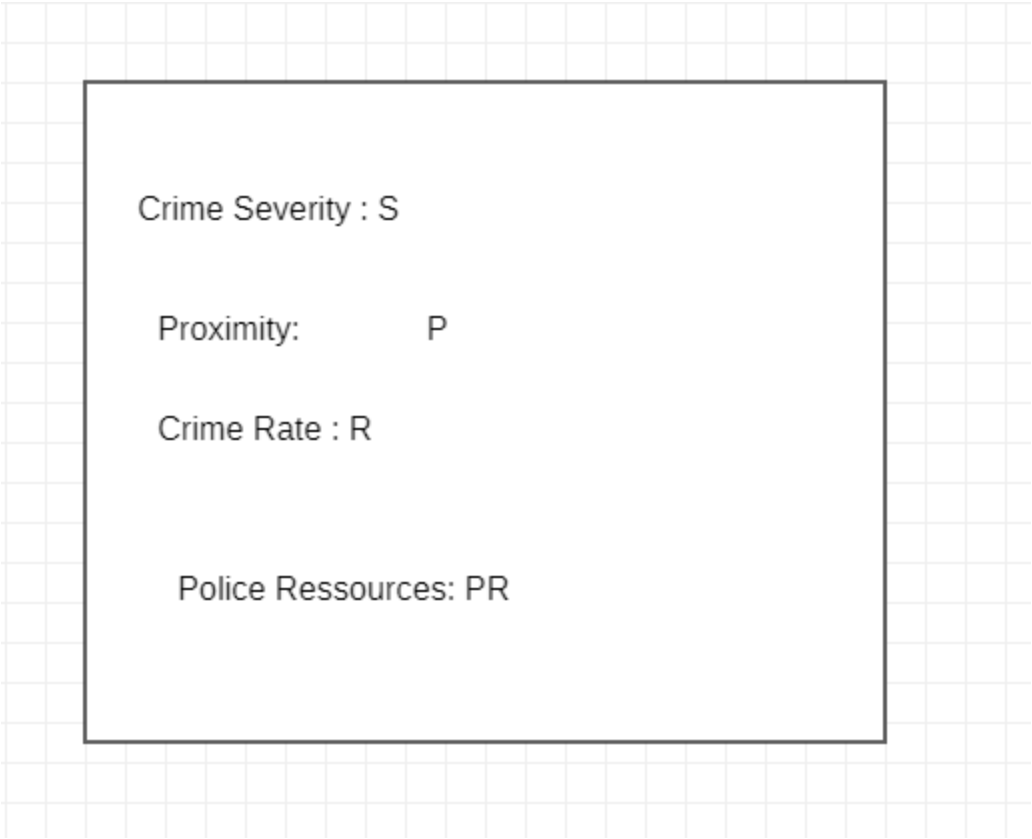
5 – Strong importance

7 – Very strong importance

9 – Extreme importance

2,4,6,8 intermediate values

1/3,1/5,1/7,1/9 Inverse values



crime severity / Degree

proximity /m

crime rate/ Area(m2)

police resource /quantity

Derive a pairwise comparison matrix

We keep on asking questions about scale of preference till we fill up the entire matrix

	S	P	R	PR
S	1	5	4	5
P	1/5	1	2	3

R	1/4	1/2	1	3
PR	1/7	1/3	1/3	1
SUM	1.59286	6.83333	7.33333	14

Normalized the pairwise matrix

Normalization is done by dividing each cell by the corresponding column sum ie cell PxP we get: **1/1.59286**

	S	**P**	**R**	**PR**
S	0.6278	0.73171	0.54545	0.5
P	0.12556	0.14634	0.27273	0.21429
R	0.15695	0.07317	0.13636	0.21429
PR	0.08969	0.04878	0.04545	0.07143
SUM	**1**	**1**	**1**	**1**

Calculate criteria weights

	S	**P**	**R**	**PR**	**Weighted Criteria**
S	**0.6278**	**0.73171**	**0.54545**	**0.5**	**0.601241138**

P	**0.12556**	**0.14634**	**0.27273**	**0.21429**	**0.189728747**
R	**0.15695**	**0.07317**	**0.13636**	**0.21429**	**0.145192689**
PR	**0.08969**	**0.04878**	**0.04545**	**0.07143**	**0.063837426**
SUM	**1**	**1**	**1**	**1**	

Checking for consistency

Multiply each cell value of the un-normalized pairwise matrix with the criteria

	S	**p**	**R**	**PR**	**Weighted Criteria**
S	1*0.601241138	5*0.189728747	4*0.145192689	7*0.063837426	**0.601241138**
P	(1/5)*0.601241138	1*0.189728747	2*0.145192689	3*0.063837426	**0.189728747**
R	(1/4)*0.601241138	(1/2)*0.189728747	1*0.145192689	3*0.063837426	**0.145192689**
PR	(1/7)*0.601	(1/3)*0.189	(1/3)*0.145	1*0.063837	**0.06383742**

	241138	728747	192689	426	**6**
SUM	**1**	**1**	**1**	**1**	

Calculate criteria weighted sum

This is done by summing up all values in a row

	S	**P**	**R**	**PR**	**Weighted Criteria Sum**
S	1*0.601241138	5*0.189728747	4*0.145192689	7*0.063837426	**2.57751761**
P	(1/5)*0.601241138	1*0.189728747	2*0.145192689	3*0.063837426	**0.79187463**
R	(1/4)*0.601241138	(1/2)*0.189728747	1*0.145192689	3*0.063837426	**0.581879624**
PR	(1/7)*0.601241138	(1/3)*0.189728747	(1/3)*0.145192689	1*0.063837426	**0.261369496**
SUM	**1**	**1**	**1**	**1**	

Calculate λ□lλ□ and lλ□max λ□□□ = (criteria weighted sum) / weighted Criteria

Criteria	Criteria Weighted Sum	Weighted Criteria	landa i
S	2.57751761	0.601241138	4.286995
P	0.79187463	0.189728747	4.17372
R	0.581879624	0.145192689	4.007637
PR	0.261369496	0.063837426	4.094299

λ□□□Lambda max = Average (λlambda)

λ□□□lambda = (4.286995+4.17372+4.007637+4.094299)/4

= 4.14066

Synthesis of Results.

Let’s consider our 3 deferents CRIMES with the following specifications

	S(degree)	P(m)	R(area in m*m)	PR(Qty)
Rape	3	4354	Emombo(540)	5
Armed Robbery	5	5053	Emia(200)	5
Minor Terror in Quater	9	3127	Poste(740)	20

To evaluate the overall weight of each alternative by its criteria weight.

	S(degree)	P(m)	R(area)	PR(Qty)	Total Item Weight
Rape	210434.4	189.728747	0.3049	1.0214	210625.5
Armed Robbery	165341.31	94.8643736	0.46462	1.0214	165437.7
Minor Terror in Quarter	225465.43	189.728747	0.5107	5.5107	**225656.1**

From the synthesis we can see that **Minor Terror In Quarter** is the best option because it has an overall item weight

CONCLUSION

Arrived at the end of this experience where we were asked to implement a software by putting in practice all the concepts seen in class. In conclusion, developing a platform where victims can report crimes anonymously is a big step towards building safer communities in our country. The process was not that easy but to overcome that and ensure a successful project we put in practice almost all of scrum practices . It was essential to have a complete SCRUM team with clearly defined roles and responsibilities, a well-defined product backlog, and sprint backlog that prioritize user needs and specific objectives that guide the development process.