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A Senior Semester project

Android and Web-based Crime Record Management System

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V. Abstract

The project Criminal Record Management System is a Criminal record management system that uses to record crime activities of criminals and suspects. It can be used to report crime activities. This project is mainly useful for law and enforcement agencies in Ethiopia. The law and enforcement authority can preserve records of the criminals and search any criminal using the system. This is a web and a mobile application with database system in which police uses the web app to keep the record of criminals who have been arrested. While the mobile app is for the society which helps them to report incident and get notification about their security from the police department. We have used HTML, JavaScript, CSS, Django, MySql, Bootstrap and other technologies to develop this project. The project's interface is very user friendly and helpful for authority.

VI. LIST OF ACRONYMS

CRMS - Crime Record Management System

FIR - First Information Report

Cr.P.C. - Criminal Procedure Code

MVT – Model View Template

SHO - Station House Officer

PM - project monitor

NISS-National and regional intelligence and security service

1. Chapter One

1.1. Introduction

Police is body of officers representing the civil authority of government. Police typically are responsible for maintaining public order and safety, enforcing the law, and preventing, detecting, and investigating criminal activities. Police are often also entrusted with various licensing and regulatory activities.

The police and police stations have adequate importance all around the world in this era where the crime rate is very high, the situation for our country police is the same, where they have to work day and night tirelessly to fight and stop crime in the country. In order to fulfil its targeted people, hood objective and profitable, police have been working in connecting the process of its work step by step to timely needed situation and also succeeded in different directions.

Today the developed world has digitized every job of the police in order to fight crime and sustain the peace of their country. The police departments in the developed countries are using surveillance cameras, gunshot detection systems, automated license plate readers, facial recognition software, body cameras, drones, and numerous databases to prevent, respond and investigate crimes. The use of these technologies has advanced them in fighting advanced and complicated crimes the face in a short time. But on the other hand, developing countries are still fighting crimes in the traditional way which is cost a lot of resource and time as regard to the developed countries.

The present world is technology driven as it is employed by many fields in the performance of their operation. In the case of law enforcement agencies, this is evident in the use of automated crime record management systems (CRMS) worldwide to keep record of crime and criminals involved. Crime being an act against the law of a society is a threat to the well-being of the populace and so, requires efficient and effective monitoring. For this reason, CRMS have been developed to achieve this purpose.

This project is among such efforts with the intention of developing a computerized System for Police Administration on crime records management system.

Generally, this project looks at the development of a Crime record, prevention and control of information System. The main project focus is digitalizing the traditional crime recording system which is paper based and enabling the society to make compliant through their mobile phone. This project would also focus on making information for crime analysis available and easily accessible so as to enhance police efficiency in responding to crime and designing crime prevention and control strategies.

1.2. Background of the Organization

The history of Ethiopian police goes back to 1913, during the reign of Emperor Menelik II, the Ethiopian police were founded for the first time in our history. These police were called 'YeketemaZebegna' which means guard of the city. Through time the police structure and form have been changing till the Emperor Haile Selassie come to power.

After Emperor Haile Selassie take over the throne, he established modern police. The police force was governed by British citizens, according to the book by Brigadier General Moges Beyene entitled "PolicenaGize" (Police at Different Times) published in 1972. The downfall of the Emperor Haile Selassie in 1974, the military junta which was called the "DERGE" that came to power. The Derge used the socialist structure to shape its military and it police force.

After the downfall of Derge, it was found necessary to re-establish the police institution for better organizational capabilities. In so doing, the police force has become in better shape to discharge its duties of enforcing the constitution of the Federal Democratic Republic of Ethiopia and laws issued based upon that constitution; the police establishment is also better suited to contribute its share to the nationwide activities of development of a democratic system, to maintain peace and to expedite development.

The police institution in Ethiopia is classified in regions, zones, and weredas, each of them having their own investigation team. This institution has served the people in many cases and situations of society. If any crime is conducted in the society the police arrest the suspect and take their word about the crime while recording every word of the suspect on paper. This information about the suspect will be used by the prosecutor to form a legal case on the suspect then the case will be sent to court. All this process is based on paper, and this has a significant effect on information privacy and tampering of crime information.

1.3. Mission of the Organization

To maintain and ensure sustainable peace and security of the public and the state by respecting and ensuring the observance of the Constitution, the constitutional order and other laws of the region and by preventing and investigating crime through active participation of the public.

The police Department's overriding mission is to enhance the safety and quality of the life for the citizens and to ensure a long-lasting rule of law, peace and security through modern and competent police force that works to maximize interest of the public, targeted to prevention and investigation of crime.

1.4. Vision of the Organization

The main vision of the Ethiopian police commission is to create a stable and peaceful country in the east Africa which has low crime rate and enhance the police system with the modern technology in fight crime.

1.5. Background of the Project

Crime Record Management System (CRMS) is an agency-wide system that provides for the storage, retrieval, retention, manipulation, archiving, and viewing of information, records, documents, or files pertaining to law enforcement operations. CRMS covers the entire life span of records development from the initial generation to its completion. An effective CRMS allows single entry of data, while supporting multiple reporting mechanisms. For the purposes of this document, CRMS is limited to records directly related to law enforcement operations. Such records include incident and accident reports, arrests, citations, warrants, case management, field contacts, and other operations-oriented records.

CRMS does not address the general business functions of a law enforcement agency, such as budget, finance, payroll, purchasing, and human resources functions. However, because of operational needs, such as the maintenance of a duty roster, law enforcement personnel records and vehicle fleet maintenance records are included within a CRMS.

This is a comprehensive reference document for law enforcement and support staff who are in the process of procuring crime management and case tracking technology. It identifies and defines the common capabilities and functions required of this technology. Law enforcement, in conjunction with staff and technology support entities, can use this document to assess the specific needs and requirements of their organization; by using this standard approach; they are then able to inform the procurement process. First, this document looks at the business and organizational needs of law enforcement and how software applications should address those needs. These include key crime management activities. Next, it looks at broader technology-oriented requirements that law enforcement need to successfully implement an effective crime record management system (CRMS) such as system interfaces, records/document management, and security.

This project looks at the development of a Crime record, prevention and control of information System. The main project focus is on making information for crime analysis available and easily accessible so as to enhance police efficiency in responding to crime and designing crime prevention and control strategies.

1.6. Statement of the Problem

Society always requires peace and stability to sustain and develop. In this regard, the contribution of institutions like police and the court are of paramount importance especially in maintaining the existing stability and pave the way for the community to engage in economic, social and political development of a nation. In Ethiopia, the police have been working tirelessly to effectively play this responsibility even though the return is not paying off due to the traditional way of doing things in all its efforts.

Notable among these were:

- **Lack of centralized data base**: - the organization lack a well-organized database where every records and file are stored.
- **Unproductive use of resources:** - Paper takes up a massive amount of room in the site and it required large amount human resource.
- **Lack of immediate data retrievals: -**The information is very difficult to retrieve and to find particular information like- E.g. To find out particular suspected person information, the police have to go through various lists of all suspected person information. This results in wastage of time.
- **Deficiencies in crime intelligence and investigations**: - this is due to lack of a searchable crime database for cross referencing.
- **Possible irregular and unauthorized manipulation of crime records**: - Sometimes the people/criminal who are against the success of police department also involves in offence to demolish the paper-based record. Frequent case of missing files /documents because records are not properly secure.
- **Lack of system support for retrospective reporting:** - which is used to enhance police operations and crime profiling.
- **Delay in decision making and service delivery: -** due to disorganized evidence management system, etc.

This project is conduct to address the above problem by developing a web-based crime management system and a mobile application which will help the police department make connection with the society.

1.7. Objective of the Project

1.7.1. General Objective of the Project

The main objective of this project is to develop android integrated web-based crime management system for police administration and society of the city and enhance the work of the police department in fighting crime in a modern way.

1.7.2. Specific Objective

In order to achieve the above general objective of the project, the following specific objectives will be accomplished.

- Understand the work process of the existing system.
- To identify and design the requirement of the new system.
- Select an appropriate tool which is in with our skill base.
- To develop the application software based on our requirement for the existing system.
- To implement, test and install the new system in good manner.
- To establish a secured data base system on the management of crime and criminal records at the Administration Police Quarter/Division.
- Developing a system that Controls records not to be stored again/to avoid data redundancy.

1.8. Scope and Limitation of the Project

1.8.1. Scope of the Project

The project is aimed to develop a computerized software system for automating the task done in the police division in order to improve the service delivery for the police administration division.

The project has mobile application where the society uses it and web-based system for the police station staffs.

The **WEB-BASED SYSTEM** includes the following main features: -

- **Incident Reporting**

Incident reporting is the function of capturing, processing, and storing detailed information on all law enforcement-related events handled by the department police. The data captured in this module must support the preparation and submission of all required crime reporting and provide the capability to print a copy.

- **Investigative Case Management**

Incidents that require further investigation or follow-up may be referred to an investigator before they are closed or submitted to the prosecutor for a charging decision. Depending on the department's size and policies, the assignment may be made to a patrol officer, generally the officer who responded to the original incident, or the department's investigative unit. The system should be able to assign case responsibility and task responsibility.

- **Property and Evidence Management**

Property refers to any tangible item that can be owned, consumed, or otherwise used (e.g., stolen or recovered items, currency, narcotics, vehicles, animals, and evidence of any form) that is to be tracked by the agency. Law enforcement agencies can take custody of property during the investigation of cases and preserve it for possible use at trial.

- **Traffic Accident Reporting**

Traffic accident reporting involves the documentation of facts surrounding an accident. Typically, these are incidents that involve one or more motor vehicles but also may include pedestrians, cyclists, animals, or other objects. Traffic accident reporting also may be referred to by the term's "collision" or "crash." Typically, Traffic Accident Reporting is a module where information is typically captured at the location of the incident; transcribed into electronic forms (e.g., in the field or office).

- **Search a criminal from the criminal record using biometric**

By using the criminal's fingerprint, the system should find and display criminal's information. This could help the police force in finding the data about the criminal from the data base easily.

The **MOBILE APPLICATION** also includes the following features: -

- **Crime reporting**

This crime reporting is a mobile application in which anyone can report a crime using his mobile phone by providing the necessary information about the incident.

- **Notice board**

The notice board is used if there is urgent notice from the police department to the society for example if an arrested person is escaped its image and other information will be displayed on the notice board.

- **Reporting Missing person**

This is used by the society to notify the missing of their beloved ones to the police by filling the necessary data about the missing person.

- **Request for Crime Free Certificate**

The citizen or society can request for a crime free certificate for the purpose of proofing the have committed any crime yet.

- **Wanted Person Notification**

The app displays the wanted persons which police are looking for. These persons are persons who are involved in a crime or who have escaped from jail.

The project also includes a feature that sends a message to a captured suspect or criminal to suspect's or criminal's parent or relative if the suspect gave a real information of his/her parents information. This is very helpful for the criminal's or suspects' parent they will get a notification that the suspect is in the police station for he is suspected or committed a crime.

1.8.2. Limitation of the Project

The mobile app for the society can only be accessed through the internet and the users need to have a smart phone to use it.

And also, the web-based system which is developed for the police staff requires IT knowledge the user of this system has to have basic knowledge about IT. So, it requires training the user of this

system. The system is developed for police administration and the society which means it does not support or include the jail and judicial system in it.

1.9. Feasibility Study

A feasibility study is a study that incorporates software analysis in case it is economically advantageous, in case it can satisfy the technical requirement and if it is adoptable in the required environment. It also conditions the basic work and decides whether to accept the project.

The system is analyzed in three different types of feasibility test.

1.9.1. Technical Feasibility

It deals about the existing system is compatible with the proposed system or the new system, like hardware and software compatibility. Technical Feasibility study is about testing if the existing technology has a potential to develop or unable to acquire the proposed system. Assuming required hardware and software resources are available for the development and implementation of proposed system, it is technically feasible.

1.9.2. Operational Feasibility

Measure how much the proposed system solves the existing system problems. This project is surely operationally feasible because the proposed system (the project) is a good solution maker of the problem or specific solution will work in the existing system and create a good environment towards the user of the system.

1.9.3. Economic Feasibility

Economic feasibility of the project is determined by comparing costs and benefits of the proposed system provide. Here, the project is economically feasible if and only if the benefits of the project have a higher importance in spite of cost. Tools that the proposed system requires are inexpensive. That means the cost used for developing the system is less than the cost of manual. So, the system does not need additional employee, paper cost and also save time, there for it is economical feasible.

1.10. Significance of the Project

When the project is completed and implemented it would no doubt increase the general efficiency of police and their measures of keeping criminal records that would be easy to retrieve information

from, by crime investigator(s) and approved persons. It will also assist the police in their bid to solve crimes with timely and useful information about criminals and/or their mode of operations. So, the system should be able to:

- Support the general complaints or criminal reports that can be managed within a single database.
- Support crime intelligence and investigations because cross referencing of crime on a database is easy and fast
- To replace paper-based work with computer.
- Support to manage irregular and unauthorized manipulation of crime records.
- Support to avoid frequent case of files /documents missing.
- Support the availability of data all the time
- Support crime prevention and control strategies.
- Better exploit Information, Communication and Technology (ICT) capabilities between the stations.
- Capacitate police personnel/ professionals in dealing with their duties
- Speed up the service delivery of the institution to satisfy the community
- Improve the responsiveness of the police to the needs of the community
- Helps the stations to interconnect to each other and prevent crime

1.11. Beneficiaries of the Project

The project to be developed have many beneficiaries to different organization and governmental institutes. The project is mainly developed for police department but other than the police department the organization and the institutes listed below could be benefited from the project. Governmental organizations and institutes can use the reports generated from the system and improve the governments work towards fighting crime and sustaining pace and order.

Not only governmental institutes and organization is benefited from the project but also the people of the country because the system is developed to help the police department in securing and maintaining the peace of the country using modern technologies and system to enhance the speed of the justice and helping to improve the connection between the police and the people.

This project could mainly be handful to the following Governmental institutes and organizations other than the Police Departments: -

- **Central Statics Agency**: this agency conducted survey monthly and annually so that the country could robust economically and sustaining peace of the country. Governmental office make decision based on the data they get from central statics agency. This agency can use the proposed system so that it could get accurate data about crime and crime related activities in the city.
- **Legal System/ Judicial System**: - judicial system is the system of courts that adjudicates legal disputes and interprets, defends, and applies the law in legal cases. The proposed system would be beneficiary to this department by speeding up the process.
- **National and regional intelligence and security service (NISS)**: - this institute have the objective to protect and safeguard the national security of the country by providing quality intelligence and reliable security service. The NISS could be benefited from the proposed system because it can analyze the crime which are making the country less secure from the system.
- **Department for Immigration and Nationality Affairs**: - the immigration and nationality affairs are governmental organization which is responsible for activities related to immigrations and nationality which includes providing passport of the country to its people.
- **Higher educational/ Universities: -** researches and studies about the problems that the country face is high conducted by the higher educational institutes.
- **Insurances: -**insurances companies which includes private and governmental assess the risk and charge premiums for various types of insurance coverage.

1.12. Methodology

1.12.1.Data Source

In order to develop the proposed system, it is mandatory to have a data source which help us to understand the existing and the requirements for the system. The main data sources are the documents and files which are found in the police stations and from interviews we conducted people who are participating in the judicial system. Other data sources are literatures about the police system and governmental structures. Beside the above data sources, we have collected data from city administration offices.

1.12.2.Data Collection Methods

This project is going to adopt the following data collection methods in order to gather the data for the proposed system from the data source stated above. The method used for data collection includes these three main methods: -

- Observation
- Document analysis
- Interview

1.12.2.1. Observation

The first data collection method used for the project in our data gathering and analysis journey was making observation how the existing system work. The development team went to different police stations and made observation/ studied how they work and took notes based on the observation made. The observation helped the team to generalize the workflow and also the structure of the existing system and how it functions.

1.12.2.2. Document Analysis

In all police stations and other administration offices documents such as forms, records, reports, and manuals are available. These documents are curial for studying the existing system and understanding the overall workflow of the system. The documents gathered by the team was analyzed using the following analysis models.

1.12.2.3. Interview

Other than observation and document analysis the development team conducted interviews to the main actors of the system and the workers of the organization. The interview was need because the team could clear up their mind with topics that was not fully understood by the team.

The development team choose these three methods of data gathering because these methods help the team to gather detailed information about the existing system.

1.12.3.System Development Methodologies

In order to finish and deploy the system choosing the best system development methodology is necessary. After comparing different system development methodologies, we have chosen agile approach for the following reasons.

The agile methodology is a way to manage a project by breaking it up into several phases. It involves constant collaboration with stakeholders and continuous improvement at every stage. Once the work begins, teams' cycle through a process of planning, executing, and evaluating. Continuous is vital, both with team members and project stakeholders.

The principles and advantage we get from the agile methodology is listed below as follows: -

Principles of Agile Methodology

- To satisfy the customer through early and continuous delivery of valuable software is the highest priority of Agile Software.
- With a preference to the shorter timescale, from a couple of weeks to a couple of months, delivering working software frequently.
- Working together of developers and business people, daily throughout the project.
- Good Design and Technical excellence enhance agility by continuous attention.

Advantages of Agile Methodology

- **Continuous improvement:** the agile methodology helps to improve the future iteration, throughout the whole project, agile encourage feedback from users and team members.
- **Change is Embraced:** as the planning cycles are shorter, it easy to accept changes and accommodate them at any point of time, throughout the project.
- **End-Goal can be Unknown:** for that kind of project where the end-goal is not defined, Agile is very beneficial. The goals will come to light as the project processes.
- **Faster, High-quality Delivery:** the team focuses on high-quality development, collaboration, and testing, by breaking down the project into manageable units. The bugs get identified and solve more quickly by conducting testing during each iteration
- **Strong Team Interaction:** to take responsibility and own parts of the project, Agile highlights the importance of team working together with frequent communication, and face-to-face interaction.

Based on the above principle and advantages of the agile methodology it becomes clear that using this method it is possible to develop a fully functional system with the time available.

The Agile Iteration Workflow which would be used to develop the system

The Agile software development lifecycle is dominated by the iterative process. Each iteration results in the next piece of the software development puzzle - working software and supporting elements, such as documentation, available for use by customers - until the final product is complete. Each iteration is usually two to four weeks in length and has a fixed completion time.

Due to its time-bound nature, the iteration process is methodical and the scope of each iteration is only as broad as the allotted time allows.

Multiple iterations will take place during the agile software development lifecycle and each follows its own workflow. During an iteration, it is important that the customers and business stakeholders provide feedback to ensure that the features meet their needs.

A typical iteration process flow can be visualized as follows:

- **Requirements** - Define the requirements for the iteration based on the product backlog, sprint backlog, customer and stakeholder feedback
- **Development** - Design and develop software based on defined requirements
- **Testing** - QA (Quality Assurance) testing, internal and external training, documentation development
- **Delivery** - Integrate and deliver the working iteration into production
- **Feedback** - Accept customer and stakeholder feedback and work it into the requirements of the next iteration

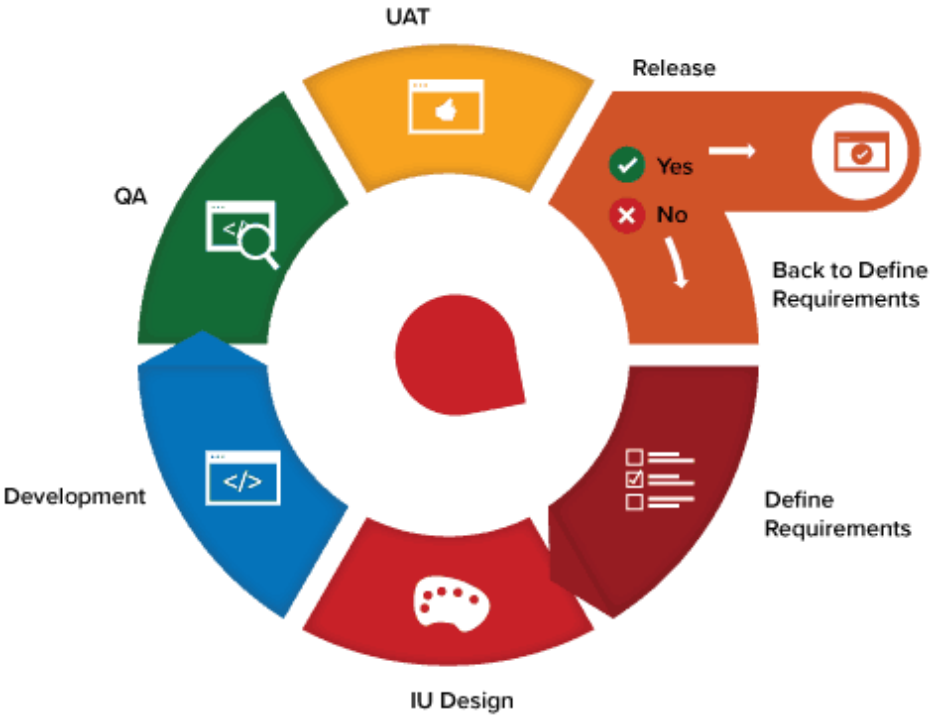


Figure 1 Agile Development Phase

1.13. Testing

The proposed system should be tested before and after it have been completed and deployed. Therefore, while developing the proposed system it should pass through different testing techniques and methods in order to get a fully functional system which fulfill the requirements.

The goal of utilizing numerous testing methodologies in our development process is to make sure our system can successfully operate in multiple environments and across different platforms. These can typically be broken down between functional and non-functional testing. Functional testing involves testing the application against the business requirements. It incorporates all test types designed to guarantee each part of a piece of the system behaves as expected as uses cases. These testing methods are usually conducted in order and include:

- Unit testing
- Integration testing
- System testing
- Acceptance testing

Non-functional testing methods incorporate all test types focused on the operational aspects of a piece of the system. These include:

- Performance testing
- Security testing
- Usability testing
- Compatibility testing

- **Unit Testing**

Unit testing is the first level of testing which will be conducted by us and is performed by the us (the development team). It is the process of ensuring individual components of a piece of the system at the code level are functional and work as they were designed to. Unit testing can be conducted manually, but automating the process will speed up delivery cycles and expand test coverage. Unit testing will also make debugging easier because finding issues earlier means they take less time to fix than if they were discovered later in the testing process.

- **Integration Testing**

After each unit is thoroughly tested, it is integrated with other units to create modules or components that are designed to perform specific tasks or activities. These are then tested as group

through integration testing to ensure whole segments of an application behave as expected. These tests are often framed by user scenarios, such as logging into an application or opening files.

- **System Testing**

System testing also will be conducted which is a black box testing method used to evaluate the completed and integrated system, as a whole, to ensure it meets specified requirements. The functionality of the software is tested from end-to-end and is typically conducted by a separate testing team than the development team before the product is pushed into production.

- **Acceptance Testing**

Acceptance testing is the last phase of functional testing and is used to assess whether or not the final piece of software is ready for delivery. It involves ensuring that the product is in compliance with all of the original business criteria and that it meets the end user's needs. This requires the product be tested both internally and externally, meaning you'll need to get it into the hands of your end users for beta testing along with those of your QA team. Beta testing is key to getting real feedback from potential customers and can address any final usability concerns.

- **Performance Testing**

Performance testing will be conducted to determine how an application will behave under various conditions. The goal is to test its responsiveness and stability in real user situations. Performance testing can be broken down into four types:

  - **Load testing** is the process of putting increasing amounts of simulated demand on your software, application, or website to verify whether or not it can handle what it's designed to handle.
  - **Stress testing** takes this a step further and is used to gauge how your software will respond at or beyond its peak load. The goal of stress testing is to overload the application on purpose until it breaks by applying both realistic and unrealistic load scenarios. With stress testing, you'll be able to find the failure point of your piece of software.
  - **Endurance testing,** also known as soak testing, is used to analyze the behavior of an application under a specific amount of simulated load over longer amounts of time. The goal is to understand how your system will behave under sustained use, making it a longer process than load or stress testing (which are designed to end after a few hours). A critical piece of endurance testing is that it helps uncover memory leaks.

- **Spike testing** is a type of load test used to determine how your software will respond to substantially larger bursts of concurrent user or system activity over varying amounts of time. Ideally, this will help us understand what will happen when the load is suddenly and drastically increased.

- **Security Testing**

With the rise of cyber-attacks and the system needs to be highly secure because it holds the criminal records, there is a growing concern and need for the security of data being used and stored in software. Security testing is a non-functional software testing technique used to determine if the information and data in a system is protected. The goal is to purposefully find loopholes and security risks in the system that could result in unauthorized access to or the loss of information by probing the application for weaknesses. There are multiple types of this testing method, each of which aimed at verifying six basic principles of security:

- Integrity
- Confidentiality
- Authentication
- Authorization
- Availability
- Non-repudiation

- **Usability Testing**

Usability testing is a testing method which is used by the development team to measures an application's ease-of-use from the end-user perspective and is often performed during the system or acceptance testing stages. The goal is to determine whether or not the visible design and aesthetics of an application meet the intended workflow for various processes, such as logging into an application. Usability testing is a great way for teams to review separate functions, or the system as a whole, is intuitive to use.

- **Compatibility Testing**

Finally, we use Compatibility testing which is used to gauge how an application or piece of software will work in different environments. It is used to check that your product is compatible with multiple operating systems, platforms, browsers, or resolution configurations. The goal is to ensure that your software's functionality is consistently supported across any environment you expect your end users to be using.

1.14. Deployment

After finalizing of a fully tested and developed proposed system, it would be deployed on a dedicated computer server in order to provide the service. But before deploying the system every requirement software and hardware will be fulfilled in order that the proposed system preforms as expected.

Because the system would be developed using the python web-frame work called Django, and Django currently supports two interfaces: WSGI and ASGI.

- **WSGI** is the main Python standard for communicating between Web servers and applications, but it only supports synchronous code.
- **ASGI** is the new, asynchronous-friendly standard that will allow your Django site to use asynchronous Python features, and asynchronous Django features as they are developed.

We would be deploying our system on **Apache mod_wsgi** which is an Apache module which can host any python WSGI application, which includes Django which our system is going to be developed on it.

1.15. Overview of the Project Phase

These project pass through five different phases so that it is deployed satisfy the end users. These five phases have different phases under themselves.

PHASE 1: Project Initiation

The project initiation phase is the first stage of turning an abstract idea into a meaningful goal. In this stage, we need to identify the goal and scope of the project. Once we have the project goals and project scope the next step is to identify key project stakeholders-the people who are to be involved in the project.

PHASE 2: Project Planning

The project planning stage requires complete diligence as it lays out the project's roadmap. In this phase, the primary tasks are identifying technical requirements, developing a detailed project schedule, creating a communication plan, and setting up goals/deliverables.

There are several methods of setting up the project's goals but **S.M.A.R.T** and **C.L.E.A.R** are the most popular.

SMART Goals:

The 'SMART' criteria ensure that the goals we set for our project are critically analyzed. It is an established method that reduces risk and allows managers to make clearly defined and achievable goals.

CLEAR Goals:

The 'CLEAR' method of setting up goals is designed to cater to the dynamic nature of a modern workplace.

PHASE 3: Project Execution

This is the phase where deliverables are developed and completed. This often feels like the meat of the project since a lot is happening during this time, like status reports and meetings, development updates, and performance reports. A "kick-off" meeting usually marks the start of the Project Execution phase where the teams involved are informed of their responsibilities.

Tasks completed during the Execution Phase include:

- Develop team
- Assign resources
- Execute project management plans
- Procurement management if needed
- PM directs and manages project execution
- Set up tracking systems
- Task assignments are executed
- Status meetings
- Update project schedule
- Modify project plans as needed

PHASE 4: Project Monitoring Controlling

This is all about measuring project progression and performance and ensuring that everything happening aligns with the project management plan. Project managers will use key performance indicators (KPIs) to determine if the project is on track. A PM will typically pick two to five of these KPIs to measure project performance:

- **Project Objectives**: Measuring if a project is on schedule and budget is an indication if the project will meet stakeholder objectives.
- **Quality Deliverables**: This determines if specific task deliverables are being met.

- **Effort and Cost Tracking**: PMs will account for the effort and cost of resources to see if the budget is on track. This type of tracking informs if a project will meet its completion date based on current performance.
- **Project Performance**: This monitors changes in the project. It takes into consideration the amount and types of issues that arise and how quickly they are addressed. These can occur from unforeseen hurdles and scope changes.

PHASE 5: Project Closing

This phase represents the completed project. Contractors hired to work specifically on the project are terminated at this time. Valuable team members are recognized. Some PMs even organize small work events for people who participated in the project to thank them for their efforts. Once a project is complete, a PM will often hold a meeting – sometimes referred to as a "post mortem"– to evaluate what went well in a project and identify project failures. This is especially helpful to understand lessons learned so that improvements can be made for future projects.

1.16. Development Tool

This project will be developed using different tools. These tools are categorized into two parts, software tools and hardware tools.

1.16.1. Software Requirements

All software used for development are open source. The software used in the development includes the following: -

Tools	Used for
Python 3.9.1	Python is a general-purpose coding language. Which is used as the programming language for the backend of the project.
Django 3.1.6	Django is a high-level web framework that enables rapid development of secure and maintainable websites.
MySQL workbench 8.0.23	MySQL is a unified visual tool for database architects, developers, and DBAS. Used as the Back-End Database Server.

PyCharm 2020.1	PyCharm is an integrated development environment used in computer programming for the project.
Metronic	Metronic is an open source WebApp template for admin dashboards and control panels.
HTML5	HTML is a markup language used to design the user interface of the project.
CSS	CSS is a style sheet language used for making user friendly web pages in the project.
JS	JS is a programming language used for making user friendly and interactive web pages in the project.
MS-word	MS- Word used for documentation of the project.
Chrome / Firefox browser	Browsers are used to test, run and display the projects.
Enterprise Architect	EA is used to draw different diagrams
Windows OS	Windows OS is used to run different development environment
GitHub	To collaborate and maintain the entire history and version of the codebase and other related resources of the project

Table 1 Software Tools

1.16.2. Hardware Requirements

The proposed system requires some hardware to function as expected. These hardware are listed below: -

Tools	**Used for**

Computer	Is used to work the development process
Fingerprint scanner	Is used to scan fingerprint
Digital camera	Is used to capture photos

Table 2 Hardware Tool

1.17. Required Resources with Cost

In order to develop the proposed system, we require some resource and the cost of these resources includes the following: -

Types of Cost	**Materials**	**Amount**	**Unit per Birr**	**Total price per Birr**
Hardware and software costs	Fingerprint scanner	1	1000	1000
	Digital Camera	1	2000	2000
Other costs	Paper	1pack	300	300
	Pen	1pack	500	500
	Printing	Max of 100pages	100*4	400
	Mobile card	5	100	500
	Flash drive	2 (4gb)	200	400
Total cost				5100 birrs

Table 3 Project Budget Breakdown

1.18. Task and Schedule

Phase	Months

Requirement gathering and analysis	**Feb 26 2021 – Apr 2 2021**
Design	**Apr 5 2021 – Jun 11 2021**
Implementation	**Jun 14 2021 – Aug 13 2021**
Testing	**Aug 16 2021 – Sep 10 2021**
Deployment	**Sep 13 2021 – Sep 30 2021**

Table 4 Project Schedule Timetable

1.19. Gantt chart of the Project

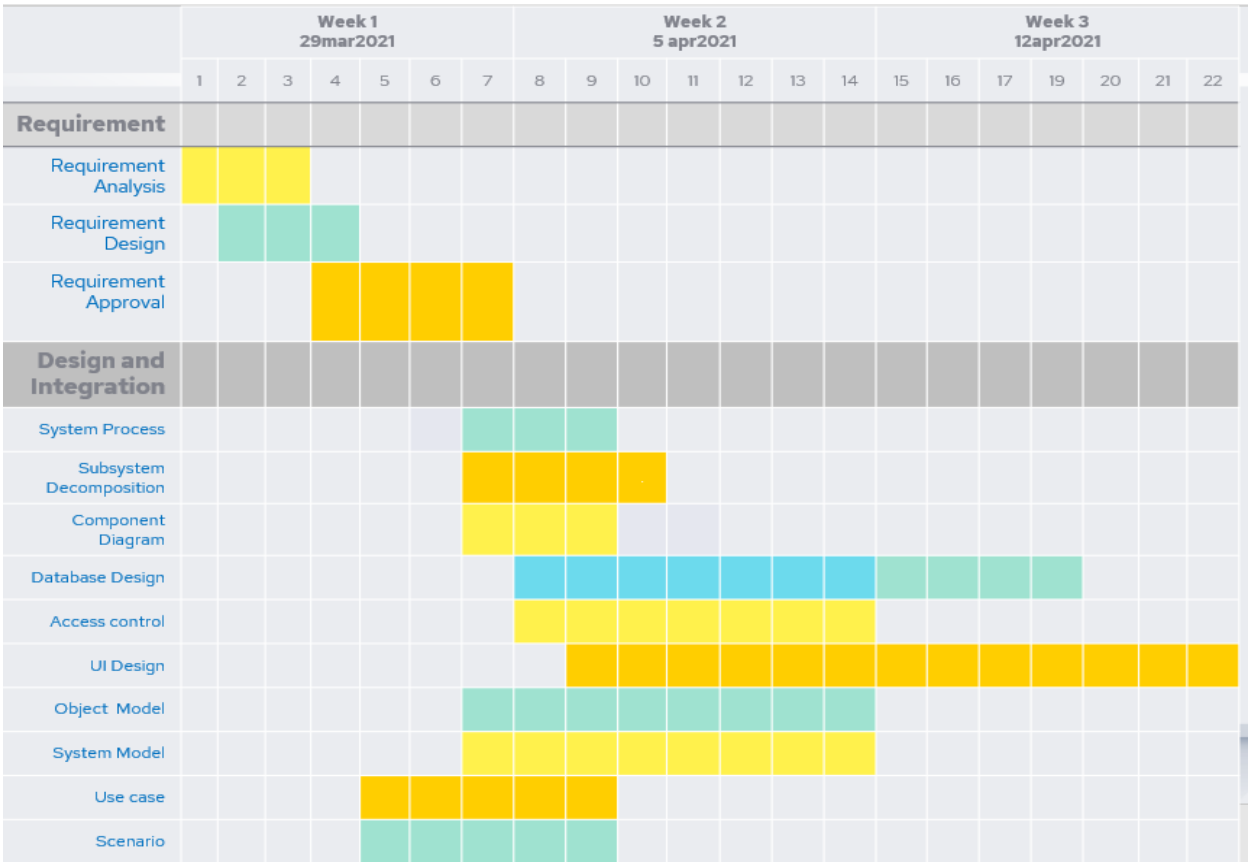


Figure 2 GanntChar

1.20. Team Composition

No.	Name	Id	Email	Responsibility
1	Mama Mohammed	A/ur4867/09	Mamamohammed31@gmail.com	Documentation, implementation and programming, designing, testing
2	Mubarek Ismael	A/ur48536/09	Muba9289@gmail.com	Documentation, Requirement gathering, coordinating, designing
3	Muhidin Misbah	A/ur4541/09	Misbahmuhidin3@gmail.com	Team leader, Documentation, Analysis, implementation, testing, programming
4	Seid Shemsu	A/ur4905/09	Seidshemsu4866@gmail.com	Documentation, Analysis, implementation, testing, programming
5	Shemsedin Seifedin	A/ur4554/09	Shemsedinseyfedin7@gmail.com	Documentation, Requirement gathering, designing, testing, analysis

Table 5 Team composition and Role

2. Chapter Two

2.1. Description of the Existing System

Police organization, in any society, is said to be the chief law enforcement agency of the criminal justice administration. Crimes and offences of general nature are, therefore, registered and investigated by the police stations. Police station is the primary and basic unit of crime registration in the society. The common man whether victim, complainant or informer contacts police stations in the event of commission of a crime. It is expected that the police station will immediately take action on the report received by it and would register the crime for initiating appropriate and adequate action in the matter. Any lapse on the part of police in this regard will land them in a situation of criticism. Registration of crime and recording of an FIR (first information report) is thus, one of the fundamental duties of the police.

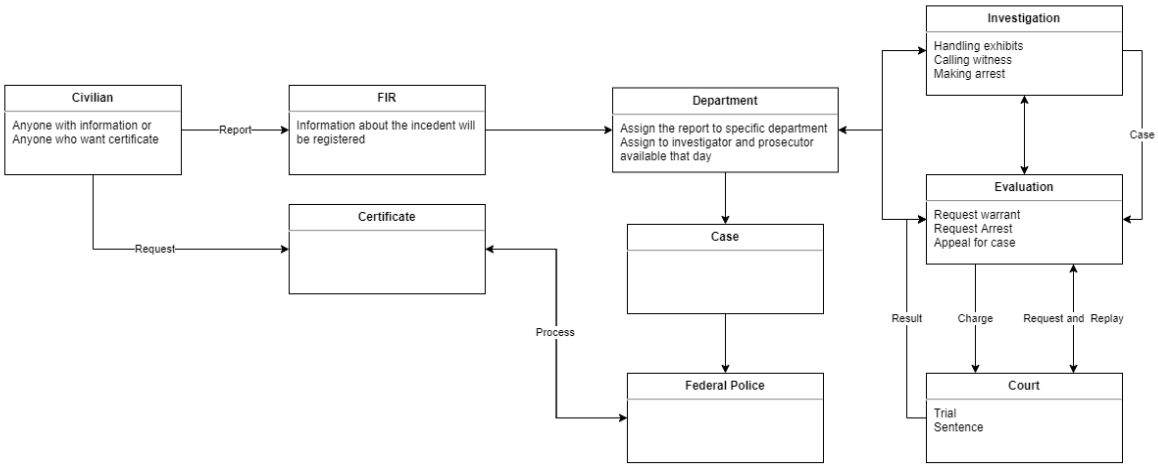


Figure 3 Existing System Diagram

Investigation

Police Station is the chief center of registration of crime and, accordingly, the staffs posted there have legal powers and prescribed duties to investigate the crimes and cases. Various provisions of the Cr.P.C. (criminal procedure code) and other enactments empower police to register crimes and take up investigation for their legal and logical conclusion. The police, thus, are empowered to investigate offences both cognizable and non- cognizable ones. The cognizable offences are investigated by police in so facto and the non-cognizable ones are investigated by them after

obtaining permission from the appropriate authority. Power to Investigate Cognizable and non-cognizable Offences.

The officer in-charge of a police station is empowered to investigate every cognizable offence within the jurisdiction of that police station. Even if the police officer investigates a cognizable offence registered in his police station but beyond that jurisdiction, it cannot be questioned. Police officers, of and above the rank of Head Constable, posted at the police station are empowered to investigate cognizable cases on behalf of the SHO (station house officer). Visit Scene of Crime without Delay.

After registration of the offence and sending FIR, the police officer has to proceed in person or he shall depute one of his subordinate officers to proceed to the spot for investigation and also for taking measures for discovery and arrest of the offender

In case the offence is not of a serious nature, the police officer need not proceed in person or depute a subordinate officer to make investigation on the spot. (Section 157 Proviso (a) Cr.P.C.). If it appears to the police officer that there is no sufficient ground for entering on investigation, the police officer need not. This would include police functions like:

- **Crime Registration**

It starts from taking report about commission of crime and also include guarding, Visit Scene of Crime Without Delay, Protection of Crime Scene, Examination of the Scene of Offence, Search of Scene of Crime, first aid to the Injured, Preservation of Evidence, Recording of the Crime Scene and Sketching the Crime Scene.

- **Lifting, Handling and Packing of Exhibits**

Evidence is stored as exhibits in a store for pressing charge on the criminal.

- **Calling Witnesses** and serving notices to them. And recording all witness

Investigation is a process of connecting the offender to the offence. This is a method by which various events are connected with one another. A chain of events is prepared which illustrates and elaborates various steps and activities involved in the commission of crime. Relating each of such activity with another one will require the support of evidence of one nature or the other. The job of investigation and particularly that of collection of evidence is a serious, sensitive and complicated one. This requires use of utmost intelligence, competence, presence of mind, skills of observation along with utilization of various tools and techniques of evidence collection. Collection of various types of evidences through scientific interrogation and with the help of scientific aids to investigation can absolve the police of all the allegations with regard to use of third-degree methods.

Nature of Evidence

The evidence to be collected during the course of investigation should be relevant and it should pertain to the facts in issue. Various provisions of Indian Evidence Act should be kept in mind, while collecting and recording evidences of various types. Only that evidence should be collected, which is admissible in the court of law. Collection of inadmissible and irrelevant evidence is wastage of time and even dilutes the quality and status of investigation.

- **Police Make an Arrest**

When a crime is committed in a police officer's presence --- or the officer has probable cause to believe that certain misdemeanors or any felony was committed that the officer did not see happen --- an officer may arrest a suspect on the spot without an arrest warrant. The officer will later submit a charging/warrant request to the Prosecuting Attorney, suggesting potential charges to be authorized.

Generally, the police's role in criminal cases is an investigation of the offence. The investigation includes seizure of articles/documents, questioning witnesses and recording their testimony, arrest of the accused (if necessary), protecting the Complainant etc.

The police effort in a criminal case ends with the filing of a charge sheet/final report. If the police have completed the investigation and have compiled satisfactory materials to proceed with the trial of the accused, they file a charge sheet. If they complete investigation and don't find sufficient material to proceed against the accused, they file a final report. Upon filing a charge sheet, police no longer conduct the progress of a criminal case. That role is taken up by the Public Prosecutor.

However, even though the Public Prosecutor begins conducting the case once a charge sheet is filed, the police aren't totally excluded from the trial. The Investigating Officers who had been involved with the case will have to depose in court as prosecution witnesses during the trial, where they will be examined and cross-examined. They also have to assist the Public Prosecutor with the conduct of the trial, although that is a secondary role they play.

Generally, one Criminal case pass through those steps: -

Step 1. Acquisition/police

Step 2: Police Investigate

Step 3: Police Make an Arrest

Step 4: Charging Request Reviewed by Prosecuting Attorney

Step 5: Warrant Issued

Step 6: Suspect Arrested

Step 7: Trial

Step 8: Sentence

Step 9: Appeals

The case registration: -

- The suspect who made a crime is arrested and brought to the police station or victim come to the police station report case.
- The police officer will ask any question: like name, address, and any kind of question regarding the case the suspect is arrested/ or victim went to report.
- While asking Police Officer write down any information on paper.
- Then depending on case, the officer transfer case to related department for more investigation.

2.2. Major Function of Existing System

The major function of the existing system includes the following: -

- **Crime reporting: -** one of the major functions of the existing system is crime reporting where accuser reports a crime made on him or others. This reporting is made by filling a paper-based form and stored in a store room where many documents are stored other after the case is closed.
- **Crime registration: -** the other major functions of the existing system is crime registration. Crime registration includes recording information about crime and criminals.
- **Crime investigation: -** after crime have been report detectives start to investigate the crime reported. The crime investigation is divided into four different departments.
    - **Investigation of corruption & government revenue: -** this department of the investigators investigate crime related to corruption.
    - **Investigation of various crimes, contraband & illegal trade: -** this department of the investigators investigate various crime which includes contraband and also illegal trades.

- **Investigation of murder crime & traffic accident division: -** this department of the investigators investigate crime related to murder and traffic accident.
- **Investigation of crime against women & children: -**this department of the investigators investigate crime against women and children.

- **Statistics and report generation**: - the other major function of the existing system is report generation. Reports are need by the higher officers and authorities for analyzing how the police work force is doing regarding crime fighting and assuring pace for the society. These reports are prepared monthly, 6 months, and annually by the statistic department going through the paper-based files. Which is a very time-consuming job to do.
- **Evidence and exhibit material handling**: - one other major function of the existing system is evidence and exhibit material handling.

2.3. Users of the Current System

2.3.1. Police

Police are a group of people whose job is to enforce laws, help with emergencies, solve crimes and protect property. Police are trained in first aid and rescue, because police officers are often one of the first people to get to a place where people are sick or injured, such as a car accident, or a fire.

Police is responsible for the following activities:

- Preventing and detecting of criminal activities
- Maintaining public order and safety
- Recording of the crime and criminal's information
- The detective in charge creates a file for every case and send to the prosecutor.

Other tasks that the police have to perform is as follows:

A. Investigation

Investigation includes interviewing the suspects, victims, witnesses, identifying suspects. Other physical evidences like visiting, viewing, measuring, photographing crime scene.

B. Make an arrest or request a warrant

When a crime is committed in a police officer's presence or the officer has probable cause to believe that certain felony was committed that the officer did not see happen; an officer may arrest

a suspect on the spot without an arrest warrant. The officer will later submit a warrant request to prosecuting attorney, suggesting potential charges to be authorized.

2.3.2. Prosecutor

The prosecutor's job is to see that all the relevant facts, including those favorable to an accused, are placed before the court and to present those facts in an ethical, fair, dispassionate, firm and clear manner. Prosecutors must refrain from all actions which could lead to the conviction of innocent persons. Prosecutors are attorneys who work for the government on a local, state and federal level. They represent the interest of public safety and work with law enforcement agencies to bring accused criminals to justice.

Their responsibilities are:

- getting new cases from the police
- coordinate and keep track of the status of the case in court representing the police
- investigating the crime either coordinating with the police or separately
- forwarding cases to the court

There are also other tasks which are performed by the prosecutor:

A. Charging suspects

If a suspect is arrested a prosecutor must look at the evidence and decide whether or not to file charges of a crime against the person. After making determination he files the formal paperwork to charge the suspect with specific crime. It’s the job of the prosecutor to determine which specific charges to file. For instance, if someone has died, the prosecutor looks at the evidence and decides whether to file charges for manslaughter, second degree murder or first-degree murder. There are specific evidence requirements for each charge and the penalties differ greatly, so it’s important to choose the correct charge for the crime.

B. Research and Preparation

After the prosecutor files charges, the prosecutor continues to research the case. The prosecutor is responsible for convincing the judge that a suspect is guilty, and must do so using evidence and testimony. Prosecutors interview witnesses, law enforcement officers, and experts, review police files and video or photos and look at evidence collected from the crime scene. They also study past cases and review applicable statutes to ensure that they proceed in accordance with the law.

C. Plea Bargains

In many cases, a prosecutor will present a plea bargain to a suspect and his attorney. There are many reasons for a plea bargain. The prosecutor may not feel confident that a jury will vote to convict, so he/she may opt for a plea bargain, which ensures that the criminal faces some

punishment rather than none. Or, if there are extenuating circumstances, such as a first-time offender with a minor, non-violent charge or a large number of current cases, a prosecutor may offer the suspect a plea bargain in order to focus on cases with more serious charges.

D. Working in court

When a prosecutor takes a case to court, he/she must convince a jury that the suspect is guilty. They do this by questioning witnesses for the prosecution and cross-examining the defendant's witnesses. They present evidence to the jury, including photos, videos, audio recordings, and physical evidence. They may also have experts testify so that the jury can understand some of the evidence.

E. After Conviction

Once a jury has convicted a criminal, the prosecutor presents a sentencing recommendation to the judge. They may also present the victim(s) or friends and family members of the victim(s) to speak to the judge regarding the impact of the crime.

2.4. Drawback of the Current System

As the world is going through process of digitizing and maintaining information and data because of technological advancement, files and data has to be stored digitally and maintained in a well manner.

But in the current system, files and data in every station of police office are found to be stored and maintained manually with file shelf and with their local computer file. This type of data handling and management is inefficient and hard for data management.

Victims of any crime wants to get service from any police station as fast as possible. But the current manual or file-based system cannot provide the service in a quick manner due to lack of good communication between different sectors of the station. This kind of situation make the work environment slow.

This manual system is vulnerable for many natural and human made accidents like fire accident, destroying files intentionally and many more. And also, it's more likely vulnerable for corruption activities.

The following points are considered to be drawback of the existing system:

- Vulnerable for different criminal activities including corruption
- It is file based
- It is difficult for data management

- It is time taking
- It is cost a lot

2.5. Business Rule

The business model rules provide a way of formally defining the business rules, which are sequenced.

Business rules often pertains to:

- Principle of the organization
- Business calculations or operating policies and
- Access control issues

The existing system has the following business rules: -

Business rule ID	Rule definition	Type	Must/Want	May change
BR1	Anyone who has information on a crime can report a crime	Constraint	Want	Dynamic
BR2	Depending upon the report, crimes will be categorized to their respective categories (Department)	Constraint	Must	Static
BR3	These crimes will be assigned to a specific inspector and prosecutor by the department	Constraint	Must	Static
BR4	The inspector will gather evidence and forensic and pass the report and data gathered to the prosecutor	Fact	Must	Static
BR5	The prosecutor will evaluate it and will pass it to the court	Constraint	Must	Static
BR6	The court will evaluate and give the final decision such as we need more evidence, postpone the date or sentence the accused person for guilt	Fact	Want	Static
BR7	If the court have decided for further inspection the	Constraint	Must	Dynamic

	inspectors will have to do the forensic again			
BR8	Citizens who want to apply for clearance certificate will send their data to Federal police for further identification and certificate.	Constraint	Must	Static
BR9	Cases related to federal crime will be forwarded to Federal police with the gathered evidence and data.	Fact	Must	Static
BR10	Every person identifier data including fingerprint are sent to federal police for storage purpose	Fact	Must	Static
BR11	If the police want warrant, they must first apply for it in the court	Fact	Must	Static
BR12	The police have to send a warrant to the suspect so that they would appear in the court and give their word	Fact	Must	Static
BR13	If the suspect has not appeared in the court the police will have to send him/her another warrant request	Fact	Must	Dynamic
BR14	If the police force has not gathered enough evidence, they have to send a letter to the court to allow the more investigation time	Fact	Must	Dynamic
BR15	The police will write letter to witnesses to appear in police station and give their word to the investigators	Fact	Must	Static

BR16	The police will write letter to the court for house search warrant prior to the action	Fact	Must	Static
BR17	The defendant will give their word to the investigator prior to the court appearance	Fact	Must	Static
BR18	The accuser will give their word to the investigator prior to the court appearance	Fact	Must	Static
BR19	The witnesses will give their word to the investigator prior to the court appearance	Fact	Must	Static
BR20	The police can ask hospital or other organization for forensics help	Fact	Must	Static
BR21	The system will inform the families of any captured individual	Constraint	Want	Static
BR22	The system will map the areas of accident reports for more statistic purpose.	Constraint	Want	Dynamic
BR23	The system should be able to identify the suspects based on their fingerprint or facial data.	Fact	Want	Static
BR24	The system should not allow any duplicate data entry.	Fact	Must	Static
BR25	The system should post want and lost individuals in clear way.	Constraint	Want	Dynamic

Table 6 Business law

3. Chapter Three

3.1. Overview of the System

The police and police station have its adequate importance all around the world. In this era, where the crime rate is very high, the situation for our country police is also the same, where they have to work day and night tirelessly to fight and stop crime in the city. Currently the police 7 stations utilize the traditional method (hard paper) and which requires extra effort to maintain the record of the criminals and tracing someone's record. This method requires unnecessary resource (time, energy, finance, material, etc.) which can be saved by digitalizing the police station records through the utilization of software technologies

The present world is technology driven as it is employed by many fields in the performance of their operation. In the case of law enforcement agencies, this is evident in the use of automated crime record management systems (CRMS) worldwide to keep record of crime and criminals involved. The system we are going to develop is automating process of record crime, reporting crime activities using application, searching criminals depend on specific feature, increasing communication between police and the system develop depend on easily usable features.
The main goal of this project is to develop web-based and android mobile application system that manages crime and crime related records for police administration and society.

3.2. Functional Requirement

The functional requirements highlight the specific functions the system should be able to carry out. Pertaining to the CRMS, the system should:

- Register information about crime and criminals.
- The system generates urgent notice for user on the notice board.
- Can generate crime free certificate
- System can generate Incident Reporting
- Manage users (police officers and their detail) and assign them their different level of privileges
- Perform search functions based on some face, fingerprint or other criteria's (like name, age...).
- The detective in charge of investigating a crime should be able to record every new finding of the investigation including personal information.
- The system should be able to generate an activity log file in order to track who accessed a particular file and crime report on a requested area.

- Perform crime analysis and statistics as well as to generate adequate reports.
- Civilian (mobile user) can report incidents, view wanted list, report missing person, receive notification, call for help.

3.3. Non-Functional Requirement

The non-functional requirements for the proposed web-based crime management system specify the information attributes such as user-friendliness, and performance of the system that are critical for the increased user-acceptance of the system. The non-functional requirements are:

Accuracy

The level of accuracy in the proposed system will be higher. All operation would be done correctly and it ensures that whatever information is coming from the center is accurate.

Reliability

The reason for the reliability of the system is that now there would be proper storage and access to information and again the system will generate error message when error happens at any time.

Accessibility

Since it is a web-based system, it only requires internet connection and any web browser. So, it's accessible at any time.

No Redundancy

In the proposed system extreme care would be used to avoid unnecessary data redundancy. This would assure economic use of storage space and consistency in the data stored.

Availability

The proposed system should work 24/7 as long as internet connection is there, it can be available at any time using mobile application and web browser.

Usability

The system should be easy to learn and operate for the user to achieve the quantified objectives with effectiveness, efficiency, and satisfaction.

Compatibility

The system should have to be compatible: - since this system is web based it is compatible with any operating system environment if a web browser installed in the computer and internet connection is available.

Maintainability

The system will be maintained by developers over the time as it needed. Changes made on our system must not affect the current system state. Our system is easy to maintain because we use well known software and hard ware tools such Django, MySQL, android studio for application and etc... So the system easily maintainable at any time of failure.

Security

Since the file registered on the system is crime related its sensitivity is high so it must be secured to fulfil this issue, we are going for different approach starting from implementing encryption algorithm, logging activities. Also, classify authorization level according to their managing level and restrict unauthorized access to files.

Performance requirements

Performance requirements define acceptable response times for system functionality.

- The load time for user interface screens shall take no longer than 5 seconds.
- The log in information shall be verified within 5 seconds.
- Queries shall return results within 10 seconds.

3.4. System Model

3.4.1. Scenario

A scenario is a scene that illustrates some interaction with a proposed system. A scenario is a tool used during requirements analysis to describe a specific use of a proposed system. Scenarios capture the system, as viewed from the outside. Sequence diagrams show the interactions and event processing inside a use case.

Scenario: 1

Name of scenario: Register

Entry condition:

1. Internet connection must be stablished
2. User must be logged in to the system

Event flow:

1. User click on create user

2. User fills the correct form and click on create
3. Success message is displayed

Alternate flow:

1. User provide wrong entry
2. System generate error

Exit condition:

1. System logs the entry
2. System saves the data to its corresponding table

Participating actor:

1. System Admin

Special requirements:

1. Any web browser has to be installed

Scenario: 2

Name of scenario: Report Incident/ make compliant

Entry condition:

1. Internet connection must be stablished

Event flow:

1. User click on report incident
2. User fills the form correctly and click report
3. Success message is displayed

Alternate flow:

1. User provide wrong entry
2. System generate error

Exit condition:

1. System logs the entry
2. System saves the data to its corresponding table

Participating actor:

1. Civilian

Special requirements:

1. Special app must be installed
2. Or physically go to the police station

Scenario: 3

Name of scenario: File Incident Report/FIR (first information report)

Entry condition:

1. Internet connection must be stablished
2. User must be logged in to the system

Event flow:

1. User click on incident form
2. User fills the form correctly and click fill
3. Success message is displayed

Alternate flow:

1. User fills form wrong
2. System generate error

Exit condition:

1. System logs the entry
2. System saves the data in the according table

Participating actor:

1. Customer service (Police)

Special requirements:

1. Any web browser has to be installed

Scenario: 4

Name of scenario: Request for crime free certificate

Entry condition:

1. Internet connection must be stablished
2. User must be logged in to the system

Event flow:

1. User clicks on certificate
2. User fills the form and click send
3. Success message is displayed

Alternate flow:

1. User provide wrong form
2. System generate error

Exit condition:

1. System logs the entry
2. System saves the data to its corresponding table

Participating actor:

1. Civilian

Special requirements:

1. Any web browser has to be installed

Scenario: 5

Name of scenario: Call for help

Entry condition:

1. Internet connection must be stablished

Event flow:

1. User click on call for help menu
2. User click on call button
3. Call is made

Exit condition:

1. System logs the entry

Participating actor:

1. Civilian

Special requirements:

1. Special app must be installed

Scenario: 6

Name of scenario: Search Suspect & Criminal

Entry condition:

1. Internet connection must be stablished
2. User must be logged in to the system

Event flow:

1. User click on search criminal
2. User is presented options to search using name, id, picture (photo) of the suspect or the fingerprint of it.
3. User choose and use one of the choices and click search
4. System comperes it with others in the database
5. System presents the comparison or identify the suspect

Participating actor:

1. Investigator
2. Prosecutor
3. Customer service(police)
6. Chief police (head of police)

Special requirements:

1. Camera and fingerprint scanner must be present
2. Any web browser has to be installed

Scenario: 7

Name of scenario: File Evidence & Forensic Report

Entry condition:

1. Internet connection must be stablished
2. User must be logged in to the system

Event flow:

1. User click on forensic
2. User fills the form and click send
3. Success message is displayed

Alternate flow:

1. User provide wrong form entry
2. System generate error

Exit condition:

1. System logs the entry
2. System saves the data to its corresponding table

Participating actor:

1. Investigator (Police)

Special requirements:

1. Any web browser has to be installed

Scenario: 8

Name of scenario: View Case

Entry condition:

1. Internet connection must be stablished
2. User must be logged in to the system

Event flow:

1. User click on view case
2. System displays list of case with their status

Participating actor:

1. investigator
2. Prosecutor
3. Customer service
4. Chief police

Special requirements:

1. Any web browser has to be installed

Scenario: 9

Name of scenario: Update Case Status

Entry condition:

3. Internet connection must be stablished
4. User must be logged in to the system

Event flow:

1. User click on view case
2. System displays list of case with their status

Participating actor:

1. Investigator
2. Prosecutor

Special requirements:

1. Any web browser has to be installed

Scenario: 10

Name of scenario: Request warrant

Entry condition:

C. Internet connection must be stablished
D. User must be logged in to the system

Event flow:

1. User click on request warrant menu

2. User fills correct form and click print
3. Success message is displayed

Exit condition:

1. System logs the entry
2. System Prints the warrant request form

Participating actor:

1. Prosecutor
2. Investigator

Special requirements:

1. Any web browser has to be installed

Scenario: 11

Name of scenario: View report

Entry condition:

1. Internet connection must be stablished
2. User must be logged in to the system

Event flow:

1. User click on the view report menu
2. User gets a summarized generated report

Participating actor:

1. Chief Police

Special requirements:

1. Any web browser has to be installed

Scenario: 12

Name of scenario: Send notification/message

Entry condition:

1. Internet connection must be stablished

2. User must be logged in to the system

Event flow:

1. User click on notification menu
2. User choose who to send to
3. User write the notification and click send
4. Success message is displayed

Exit condition:

1. System logs the entry
2. System saves the data to its corresponding table

Participating actor:

1. Chief police
2. Customer service

Special requirements:

1. Any web browser has to be installed

Scenario: 13

Name of scenario: Press charge

Entry condition:

2. Internet connection must be stablished
3. User must be logged in to the system

Event flow:

1. User click on case list
2. User choose the case to press charge
3. User then clicks press charge on the case

Participating actor:

1. Prosecutor

Special requirements:

1. Any web browser has to be installed

3.5. Use case Model

A scenario-based technique in UML which identify the actors in an interaction and which describe the interaction itself. Used also to clarify the system boundaries. A set of use cases should describe all possible interactions with the system.

3.5.1. Actor identification

An actor can be a user, or another software system that interfaces with the system being designed. The use case should focus on one success. Possible error conditions or other failures are simply noted as extensions to the main success scenario.

Name:	**Admin**
Description:	A person who is from ICT department and have access to manage user accounts, view log of users and manage every point of the system.
Role:	Login, change user credential, change user status and permissions, view logs, create user, update user, deactivate user, and update crime type.

Table 7 Actor Identification-Admin

Name:	**Chief Police (Head of Police)**
Description:	Is the head of the police station, who is responsible to oversee the general operation of the police stations
Role:	Login, view police officers list, view statistics, view report, send messages.

Table 8 Actor Identification-Chief Police

Name:	**Customer Service (Police Officer)**

Description:	Is a police officer who is responsible for filling FIR and sending it to its corresponding investigation departments.
Role:	Login, file FIR (first incident report) form, update FIR form, generate crime free certificate for civilians, post wanted person to civilian mobile app.

Table 9 Actor Identification-Customer Service

Name:	**Investigator (Detective Police)**
Description:	A person who is responsible of conducting investigation, taking statement from the accuser, defendant and witness. Responsible for searching the suspect and evidences and working with the prosecutor of that specific case.
Role:	Login, View FIR, Start Case, register and manage evidence and forensic findings, take statement from accuser, defendant and witness, forward case to prosecutor, search suspect and criminal in the database.

Table 10 Actor Identification-Investigator

Name:	**Prosecutor**
Description:	A person who is responsible for filing a case to court and decide which case are good enough to take it to court.
Role:	Login, view statement of the accuser, witness and the suspect, View case, update case and case status, request for warrant, request for arrest, press charge.

Table 11 Actor Identification-Prosecutor

Name:	**Civilian**
Description:	A civilian is a person who is not police. Civilian reports an incident and make accusation. Civilian also requests the police for a crime free certificate. Civilian will also report a missing person.
Role:	report incident, report a missing person, request a crime free certificate, view notification, for help

Table 12 Actor Identification-Civilian

3.5.2. Use case Diagram

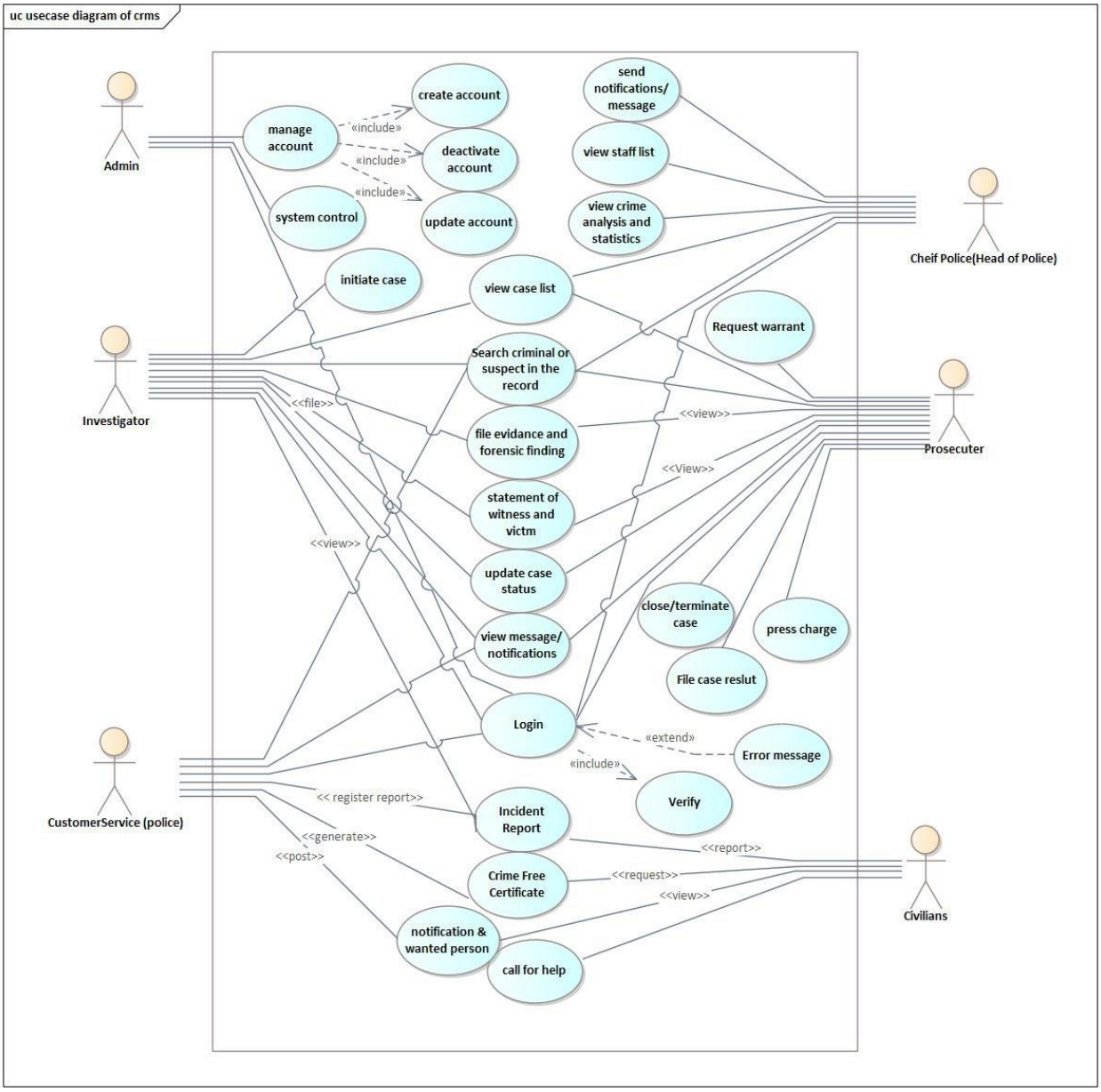


Figure 4 Use case diagram for CRMS

3.5.3. Use-Case Description

Description 1

Use case Name	**Register**
Use case id	1
Use case description	The admin registers new user
Participating actors	1. Admin
Pre-conditions	1. Internet connection must be established 2. User must have valid credentials which is recognized by the system
Flow control	1. The Admin clicks on the create user 2. The Admin fills the information correctly and clicks on create button 3. The system displays a successful message
Post condition	A new user is added to the system
Alternative flow of events	1. The Admin enters incorrect information 2. The system displays an error message accordingly

Table 13 Use Case Description-1

Description 2

Use case Name	**Report incident**
Use case id	2
Use case description	A mobile user reports an incident using his his/her mobile phone or physically
Participating actors	1. Civilian (mobile user)
Pre-conditions	1. Connection must be established 2. User must be logged into the system
Flow control	1. The system shows homepage to the mobile user and clicks on report crime button 2. The mobile user fills the report crime form and clicks send button
Post condition	A new crime is reported

Alternative flow of events	If the mobile user entered incorrect information the system shows error message accordingly

Table 14 Use Case Description-2

Description 3

Use case Name	**File incident report**
Use case id	3
Use case description	The user fills the incident in the fill incident page
Participating actors	1. Customer service (police officer)
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system
Flow control	1. User click on incident form 2. User fills the form correctly and click save 3. Success message is displayed
Post condition	An incident is filled successfully
Alternative flow of events	If the user enters incorrect information the system displays an error message

Table 15 Use Case Description-3

Description 4

Use case Name	**Request for crime free certificate**
Use case id	4
Use case description	The user fills the incident in the fill incident page
Participating actors	1. Customer service
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system
Flow control	4. User click on incident form 5. User fills the form correctly and click save 6. Success message is displayed

Post condition	An incident is filled successfully
Alternative flow of events	If the user enters incorrect information the system displays an error message

Table 16 Use Case Description-4

Description 5

Use case Name	**Call for Help**
Use case id	5
Use case description	The civilian calls the police for help
Participating actors	1. Civilian
Pre-conditions	1. The user needs smart phone 2. The user needs to install the application on the phone
Flow control	1. User opens the application 2. User clicks on call for help 3. User tell the police officer about the situation
Post condition	Police offers arrive at the place

Table 17 Use Case Description-5

Description 6

Use case Name	**Search Suspect & Criminals**
Use case id	6
Use case description	The user searches a suspect to check whether the suspect has a criminal record or not
Participating actors	1. Investigator 2. Prosecutor 3. Customer service
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system

Flow control	1. The user clicks on search a suspect 2. The user inputs the finger print or image of the suspect 3. If the suspect has a record before, the system displays the record to the user
Post condition	The criminal's record is displayed to the user
Alternative flow of events	1. The user enters incorrect information 2. The system generates an error message

Table 18 Use Case Description-6

Description 7

Use case Name	**File Evidence and Forensic Report**
Use case id	7
Use case description	The user fills forensic form and sends to the…
Participating actors	1. Investigator
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system
Flow control	1. User clicks on Evidence and forensic form 2. User fills the form correctly and click send 3. Success message is displayed
Post condition	An Evidence and forensic form are filled successfully
Alternative flow of events	1. The user enters incorrect information 2. The system displays an error message

Table 19 Use Case Description-7

Description 8

Use case Name	**View Case**
Use case id	8
Use case description	User with privilege is able to see the detail of cases
Participating actors	1. Admin 2. Investigator 3. Prosecutor 4. Chief police
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system
Flow control	1. User clicks on case lists 2. User choose one case from the list 3. User is represented with the detail of the case
Post condition	The system displays case detail
Alternative flow of events	1. The user enters incorrect information 2. The system displays an error message

Table 20 Use Case Description-8

Description 9

Use case Name	**Update Case Status**
Use case id	9
Use case description	User with privilege is able to update the status of the case.
Participating actors	1. Investigator 2. Prosecutor
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system
Flow control	User clicks on case lists User choose one case from the list User is represented with the detail of the case User updates the status of the case

Post condition	The system displays as success message that says status successfully updated.
Alternative flow of events	1. The user enters incorrect information 2. The system displays an error message

Table 21 Use case description-9

Description 10

Use case Name	**Request warrant**
Use case id	10
Use case description	The user requests warrant form
Participating actors	1. Prosecutor
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system
Flow control	1. User click on request warrant 2. The user fills the information correctly and clicks on print
Post condition	The warrant request is sent to court system
Alternative flow of events	1. The user enters incorrect information 2. The system displays an error message

Table 22 Use case description-10

Description 11

Use case Name	**View Crime Reports & Statistics**
Use case id	11
Use case description	User is able to see overall reports about the organization
Participating actors	1. Chief police (head of police)
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system
Flow control	1. User click on view report 2. User choose what type of report it needs to view 3. The user is represented with the report he needs to see

Post condition	The system displays the report to the user
Alternative flow of events	1. The user enters incorrect information 2. The system displays an error message

Table 23 Use case description-11

Description 12

Use case Name	**Send Notification/message**
Use case id	12
Use case description	The user sends to other user or to the civilians.
Participating actors	1. Chief police 2. Customer service
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system
Flow control	1. The user clicks on notification 2. The system displays the notification page 3. The user writes the message he intended to send 4. The user chooses to whom to send
Post condition	The system displays message sent successfully
Alternative flow of events	1. The user enters incorrect information 2. The system generates an error message

Table 24 Use case description-12

Description 13

Use case Name	**Press Charge**
Use case id	13
Use case description	The user registers judge and then assign a judge to a case
Participating actors	1. Prosecutor
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system

Flow control	1. The user clicks on case lists 2. The user chooses a case from the case list 3. The user clicks press charge
Post condition	The system displays successfully filed a charge on a case and the case is sent to the court system
Alternative flow of events	1. The user enters incorrect information 2. The system generates an error message

Table 25 Use case description-13

Description 14

Use case Name	**File Case Result**
Use case id	14
Use case description	The user registers the result of the case.
Participating actors	1. Prosecutor
Pre-conditions	1. Internet connection must be established 2. User must be logged into the system
Flow control	1. The user clicks on case list 2. The user fill details about the case result 3. The user clicks approve result
Post condition	The system displays success message that the judge filed the case result
Alternative flow of events	1. The user enters incorrect information 2. The system generates an error message

Table 26 Use case description-15

3.6. Object Model

3.6.1. Class Diagram

The Class diagram captures the logical structure of the system; the classes and things that make up the model. It is a static model, describing what exists and what attributes and behavior it has, rather

than how something is done. Class diagrams are most useful to illustrate relationships between classes.

It shows the classes of the system and their interaction which are typically used to

- Explore domain concept
- Analyze requirement in the form of conceptual analyses model

A class diagram is typically modeled rectangles with three-section:

- The top one indicates the name of the class
- The middle one lists the attributes of the class and
- The third one lists the methods.

The diagram below illustrates the class diagram of the proposed system: -

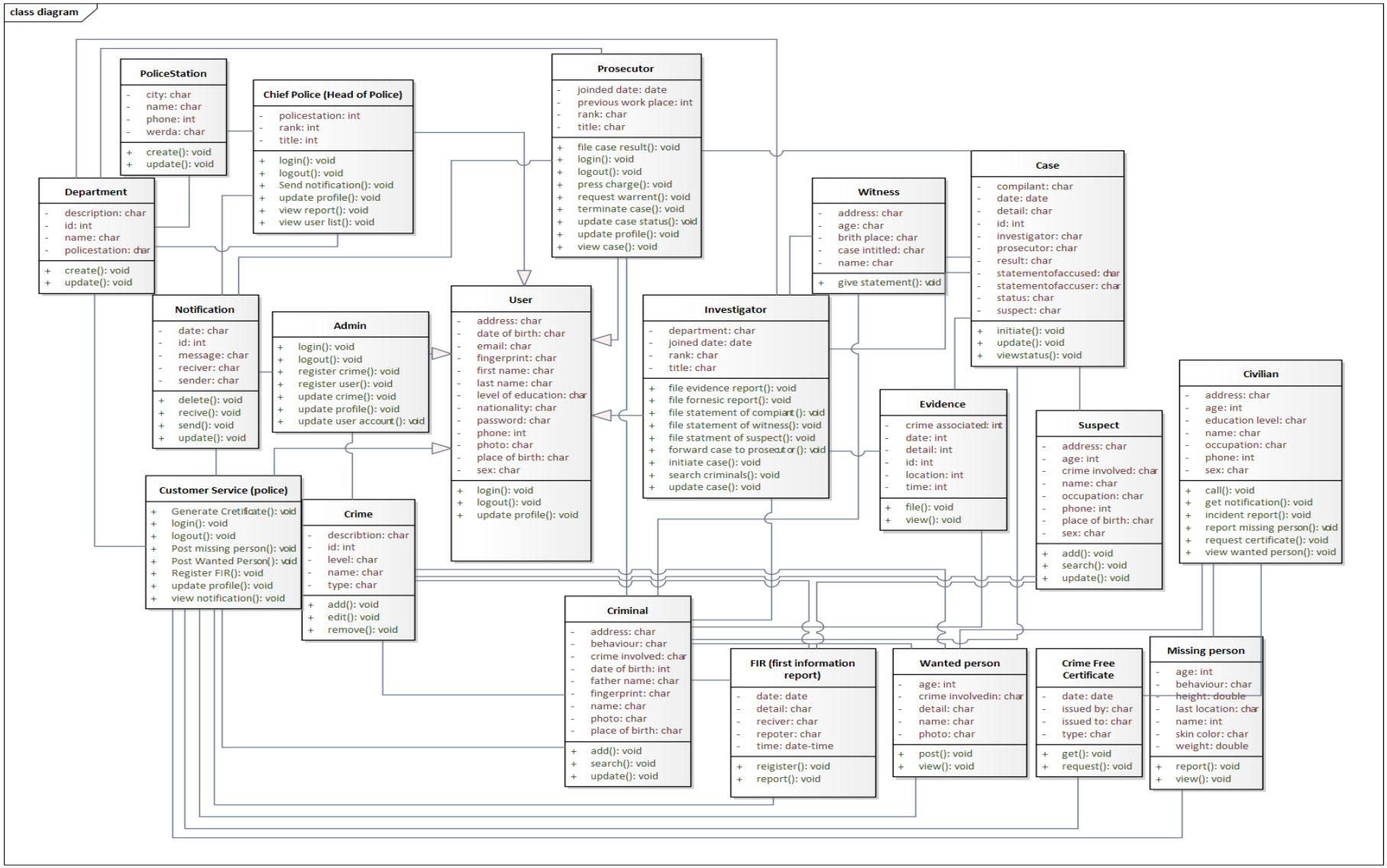


Figure 5 class diagram

3.6.2. Data Dictionary

Class	Attribute	Operation	Description
User	id, name, username, password, type	login() logout()	Allows the user to login and logout into and from the system respectively
CustomerService	id	File FIR() Generate Certificate() postWantedPerson() forwardCase() postMissingPerson()	Allows the customer service officer to create new case, request crime free certificate and post wanted as well as missing person to the society
Investigator	id, department	getCase() forwardCase() searchCriminal() updateCase()	Allows the investigators to get and update and forward case and search for criminals
Prosecutor	id, department	getCase() setResult() requestWarrant() updateCase() viewCase()	Allows the prosecutor to get update and view crime case and set result of case.
Chief	id	viewReport() sendNotification() viewUserList()	Allow the chief officer to view report and statistics about the overall crime and send notifications to appropriate users
Admin	id	addUser() updateUser() De-activate User() addDepartment() updateDepartment() De-activate Department() addCrime() updateCrime() De-activate Crime() viewLog()	Allows the admin to manage users, crimes, and departments. And also view log activities of users.

Incident	date, time, location	register() report()	Allow incident to be reported and registered accordingly.
MissingPerson	id, name, age, date, detail	view() report()	Allows to view and report missing persons.
Crime	id, level, name, type	add() edit() remove()	Allow crime to be added, edited, and removed.
Criminal	id, name, age, sex, appearance, level	updateProfile() search() add()	Allows criminals to be registered, updated and searched.
Case	id, date, status, result, accusedWord, accuserWord	viewStatus() create() update()	Allows cases to be created, updated and managed accordingly
Civilian	Name, phone, address	missingReport() incidentReport() getNotification()	Allows civilians to report missing person, criminal incidents and get different notification from customer service
Profile	id	viewProfile()	Allow the users to view their profile
Report	id, date, report, sender, receiver	get() create() view()	Allows report to be created, send and received by different users
Log	id, date, user	setLog() getLog()	Allow to set and get log of any activity
Notification	id, date, message, receiver	receive() send()	Allows to send and receive notifications
Login	username, password	getLogin() verify()	Allows to authenticate users
Registration	id, name, accessLevel, department	register()	Allows the admin to register new user.
Department	id, name, description	create() update()	Allow the admin to create and update departments
Form	type	fill() get() view()	Allows users to fill, get, and view any forms that required during the process.

Table 27 Data Dictionary

3.7. Dynamic Model

The dynamic model is used to express and model the behavior of the system over time. It includes support for activity diagrams, state diagrams, and sequence diagrams. The proposed system dynamic models are as follows.

3.7.1. Sequence Diagram

Sequence diagrams are used to display the interaction between users, screens, objects and entities within the system. It provides a sequential map of message passing between objects over time. Frequently these diagrams are placed under Use Cases in the model to illustrate the use case scenario - how a user will interact with the system and what happens internally to get the work done. These are the sequence diagrams of our proposed system.

1. **Sequence Diagram of Register**

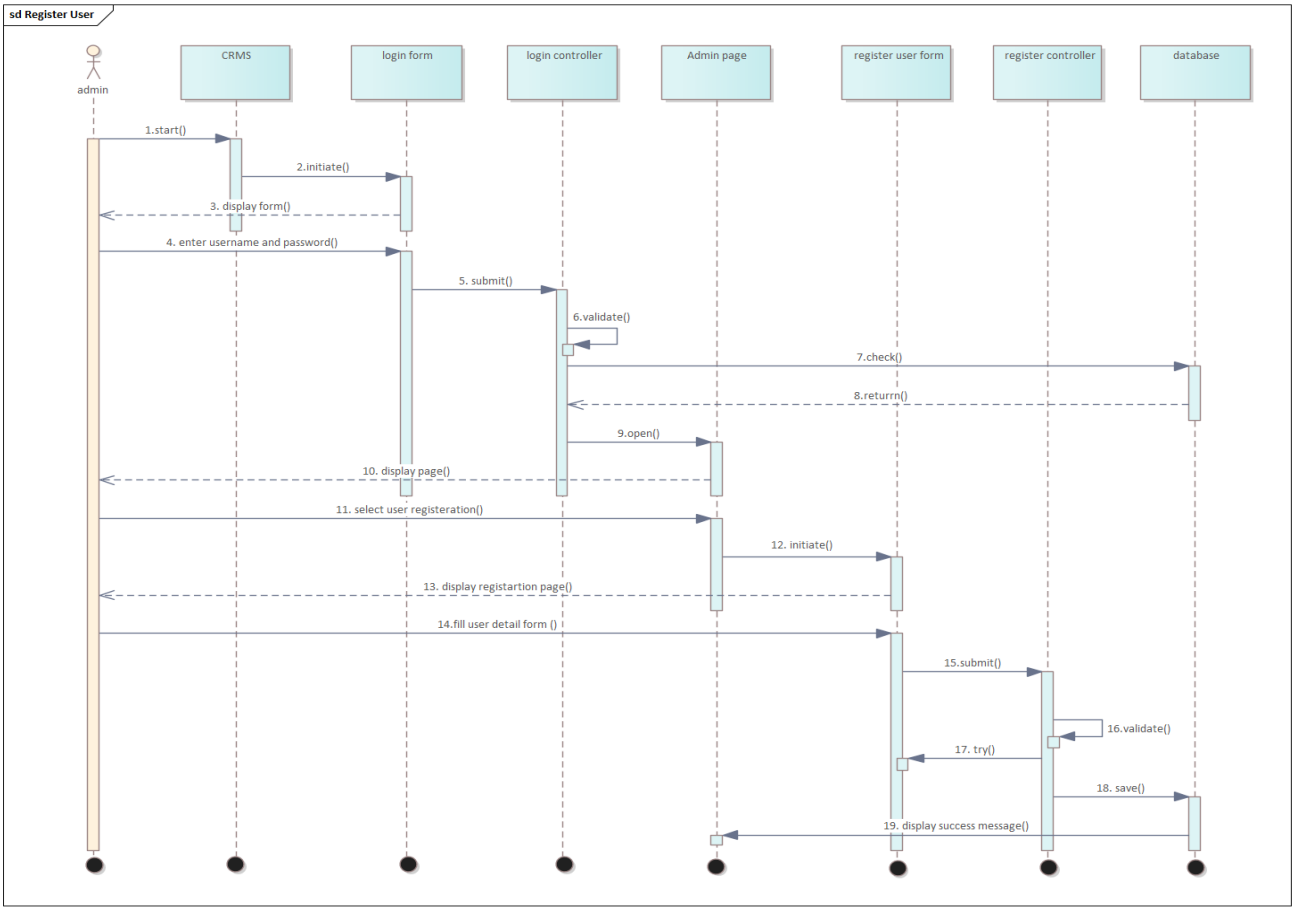


Figure 6 sequence diagram of register

2. Sequence Diagram of Login

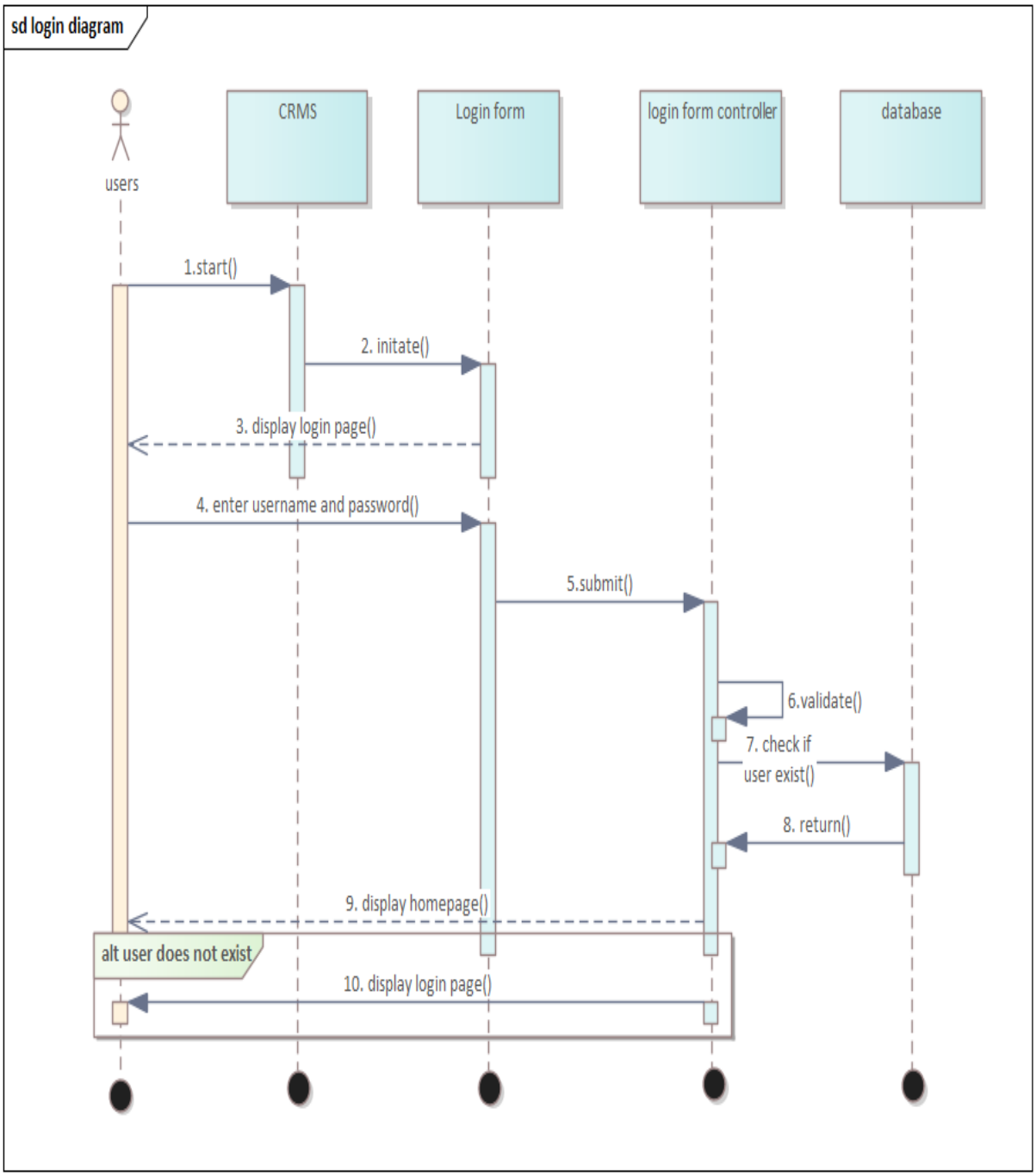


Figure 7 sequence diagram of login

3. Sequence Diagram of Reporting incident by civilians through their mobile app

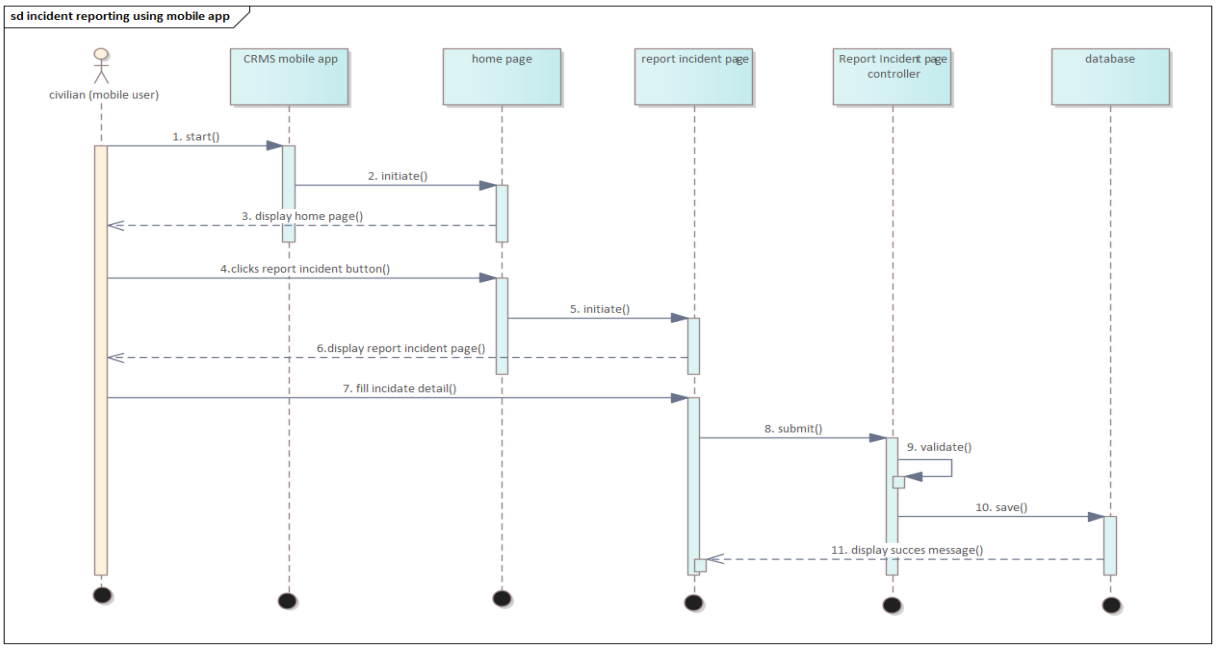


Figure 8 sequence diagram of incident reporting by civilians

4. Sequence Diagram of Filing Incident Report/FIR

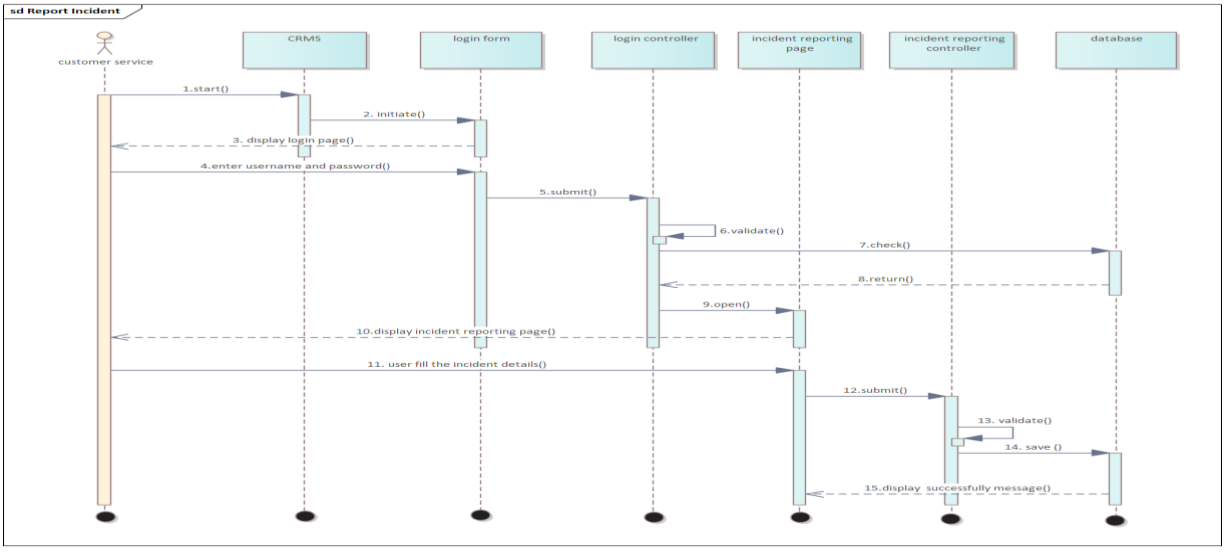


Figure 9 sequence diagram of File Incident report

5. Sequence Diagram of Request for Crime free certificate

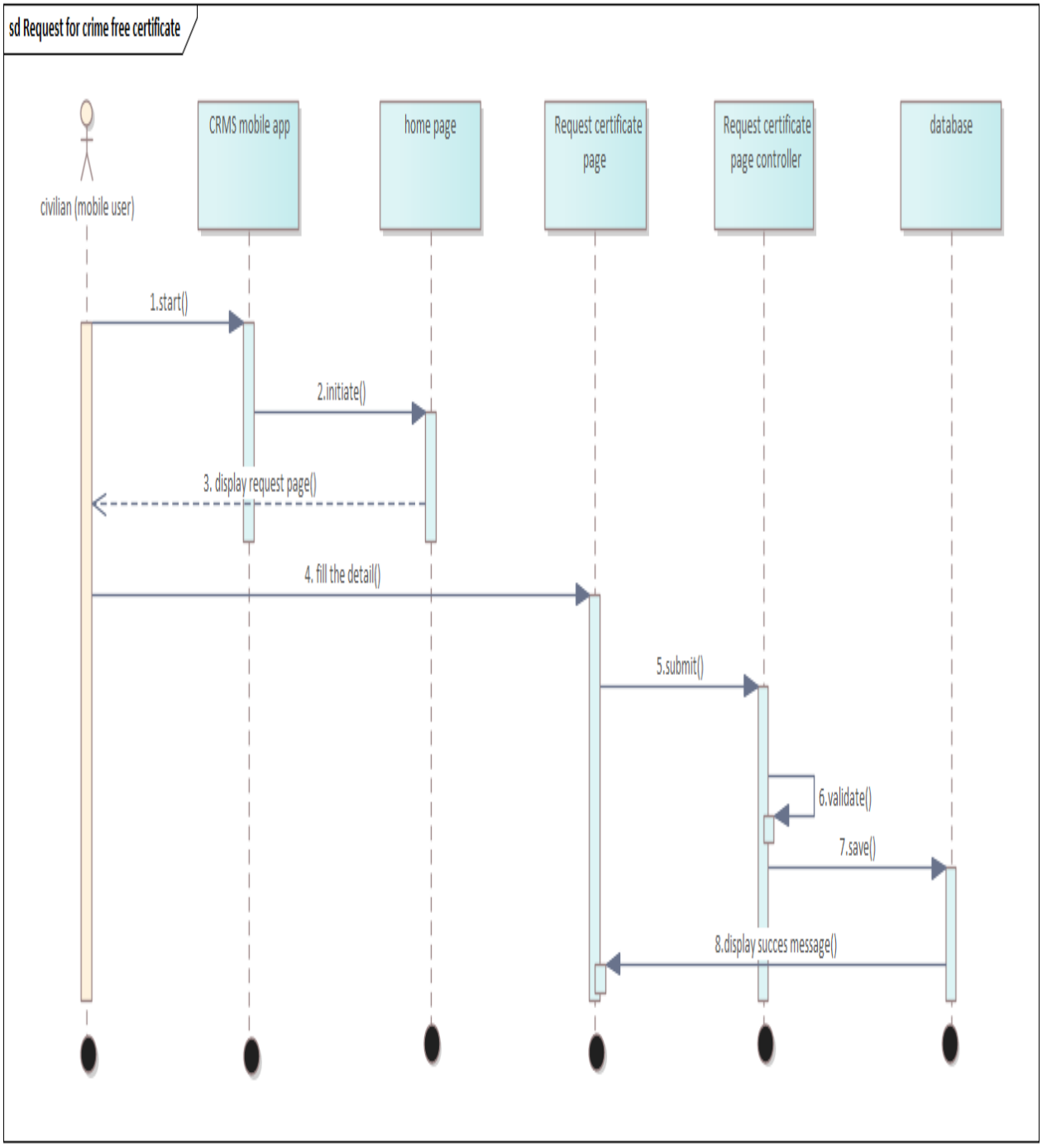


Figure 10 sequence diagram of File Incident report

6. Sequence Diagram of Search Suspects & Criminals

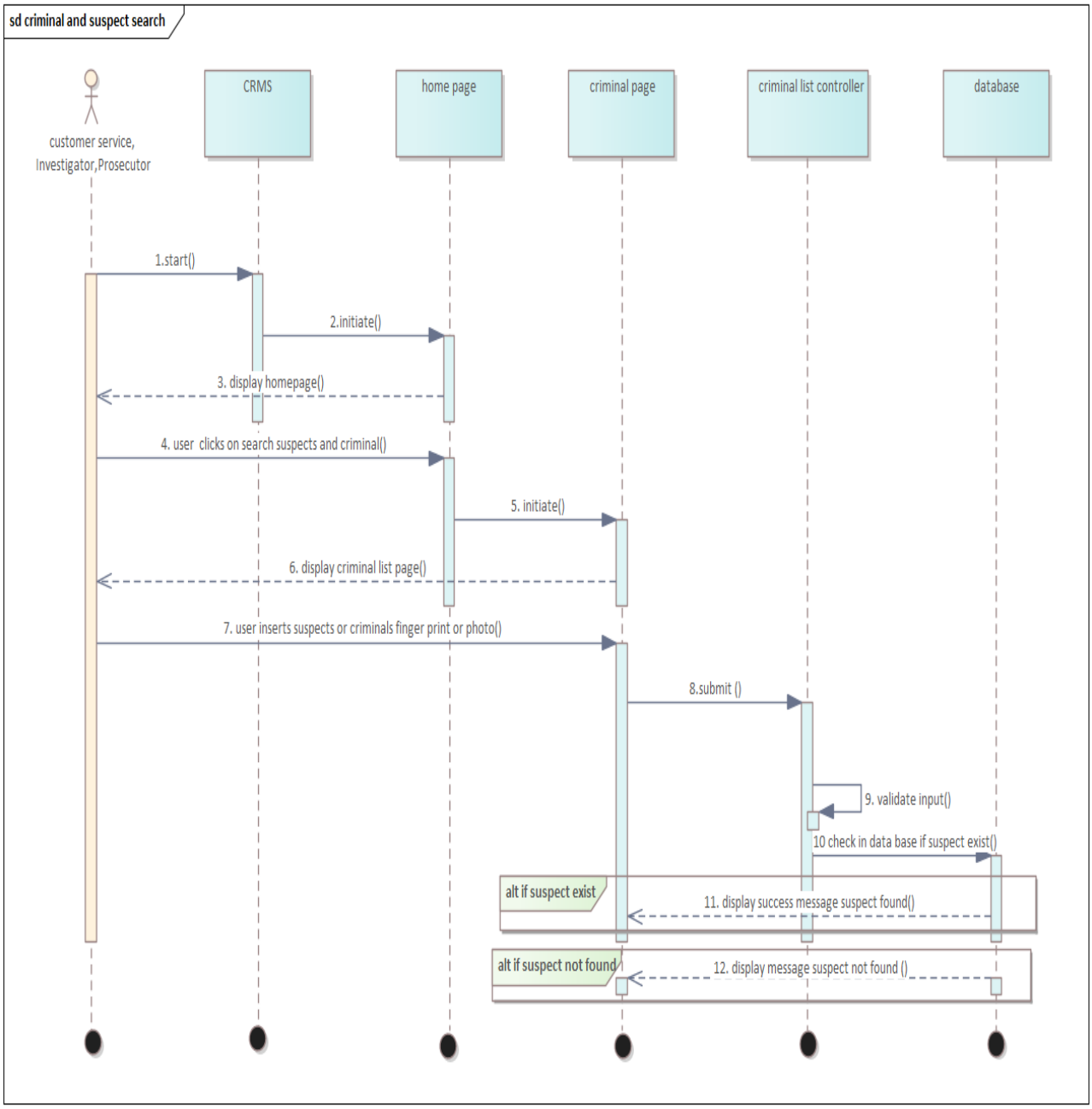


Figure 11 sequence diagram of Search criminal and suspect

7. Sequence Diagram of File Evidence & Forensic Report

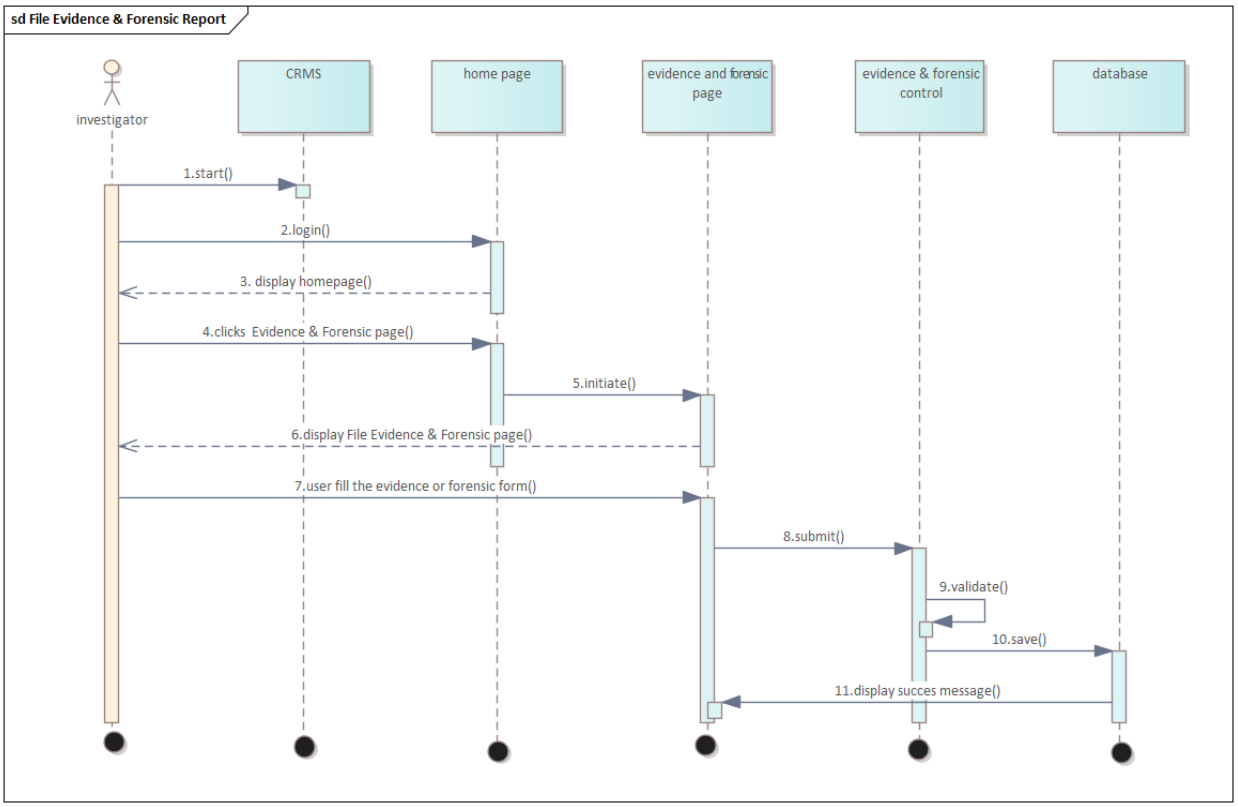


Figure 12 sequence diagram of File Evidence & Forensic reports

8. Sequence Diagram of Request a Warrant

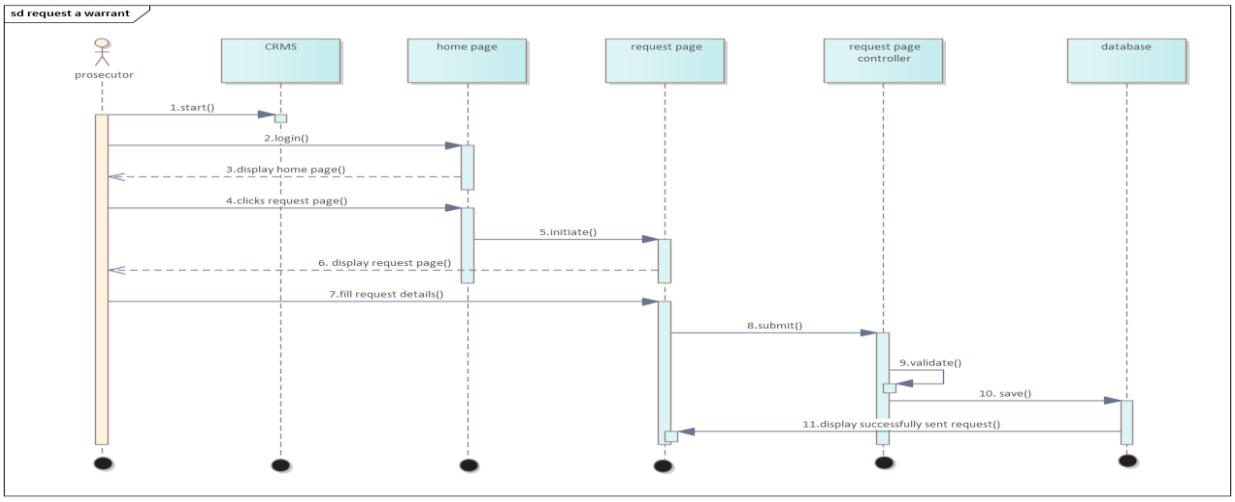


Figure 13 sequence diagram of Request a warrant

9. Sequence Diagram of View Report

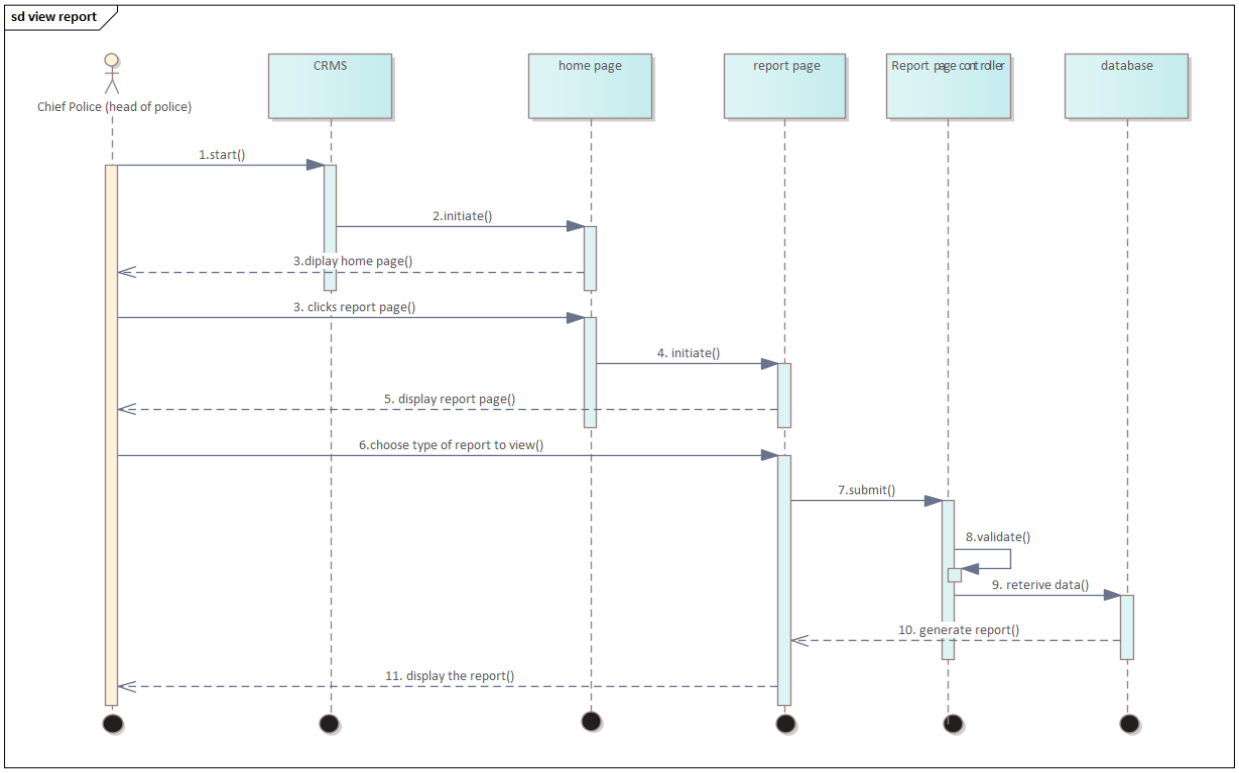


Figure 14 sequence diagram of View Report

10. Sequence Diagram of Send Notification/Message

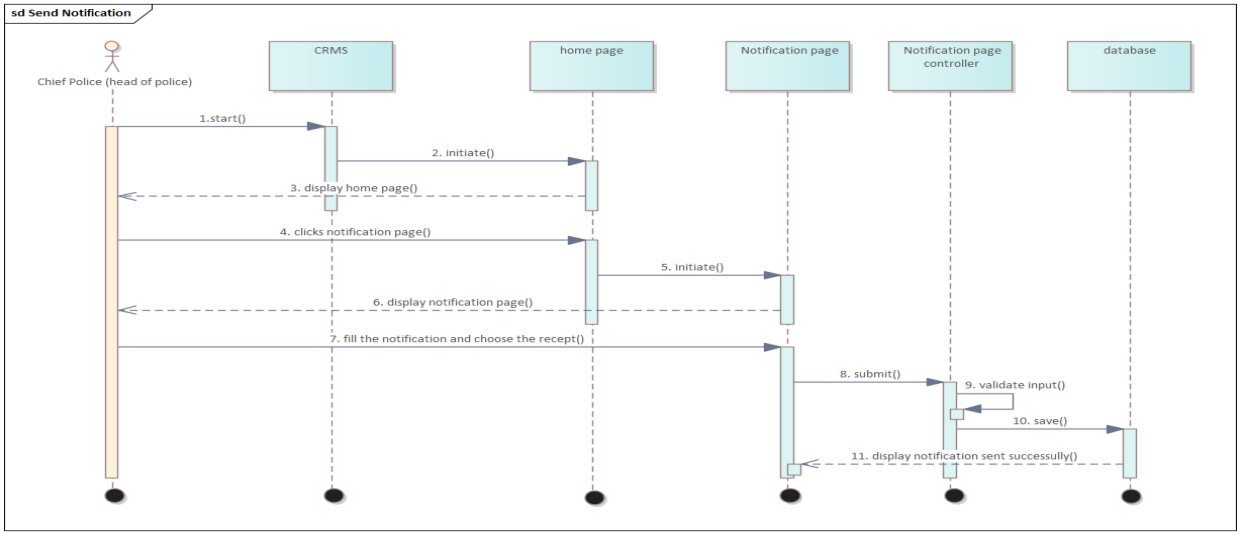


Figure 15 sequence diagram of Send Notification

3.7.2. Activity Diagram

Activity diagrams are used to show how different workflows in the system are constructed, how they start and the possibly many decision paths that can be taken from start to finish. They may also illustrate the where parallel processing may occur in the execution of some activities.

1. **Activity Diagram of Register User**

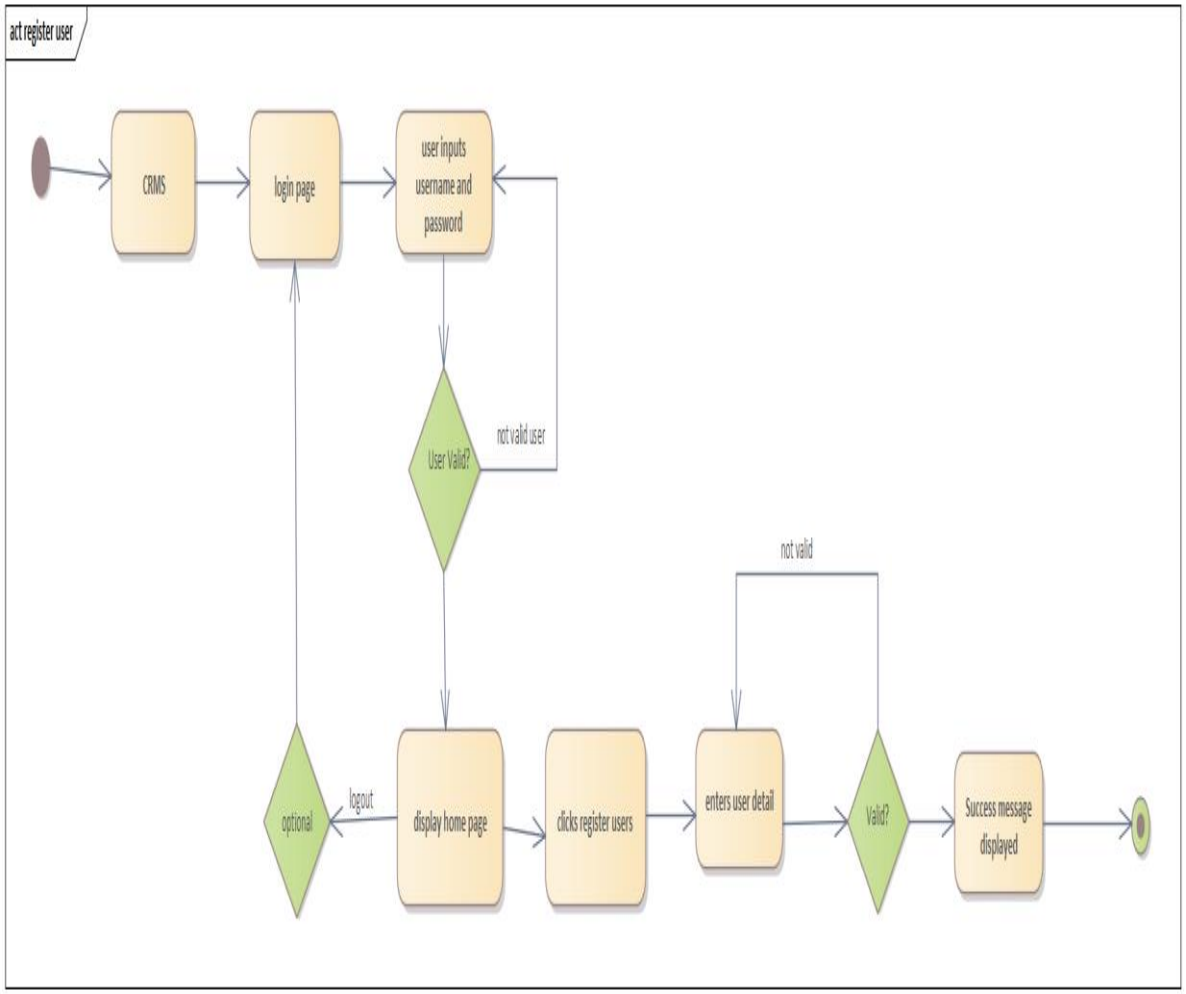


Figure 16 Activity diagram of User Registration

2. **Activity Diagram of Reporting incident by civilians through their mobile app**

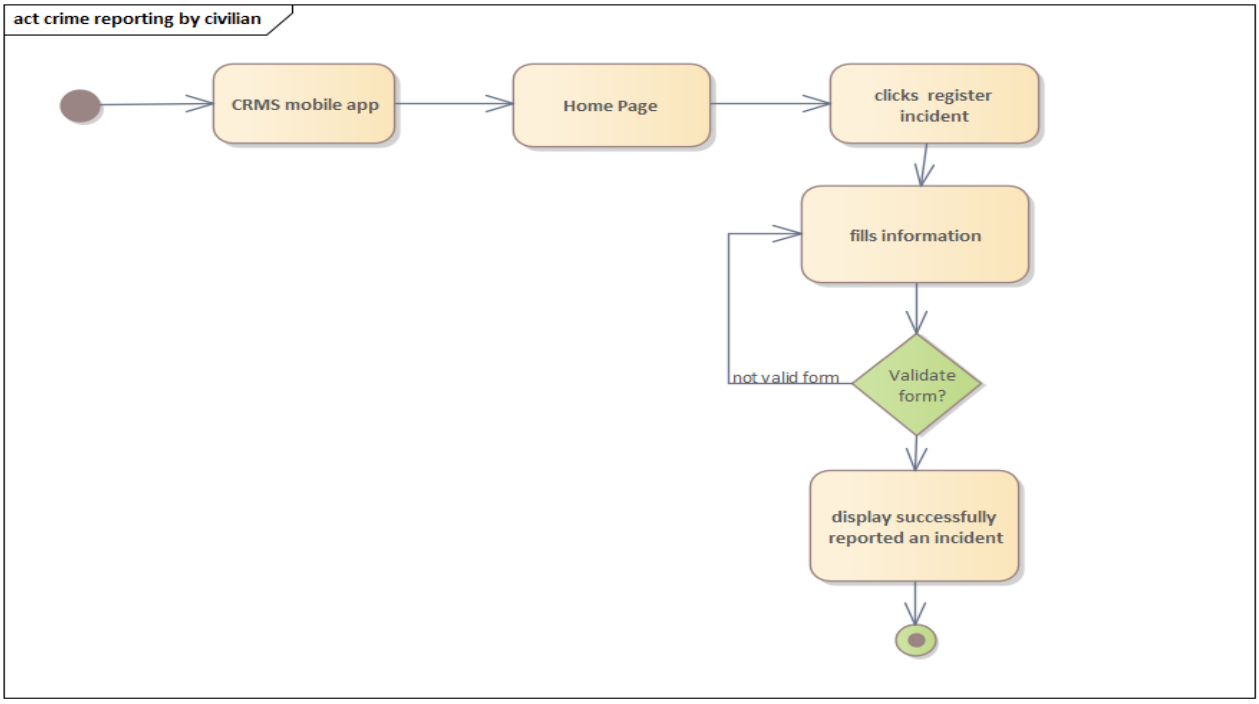


Figure 17 Activity diagram of civilian reporting incident

3. Activity Diagram of File Incident Report

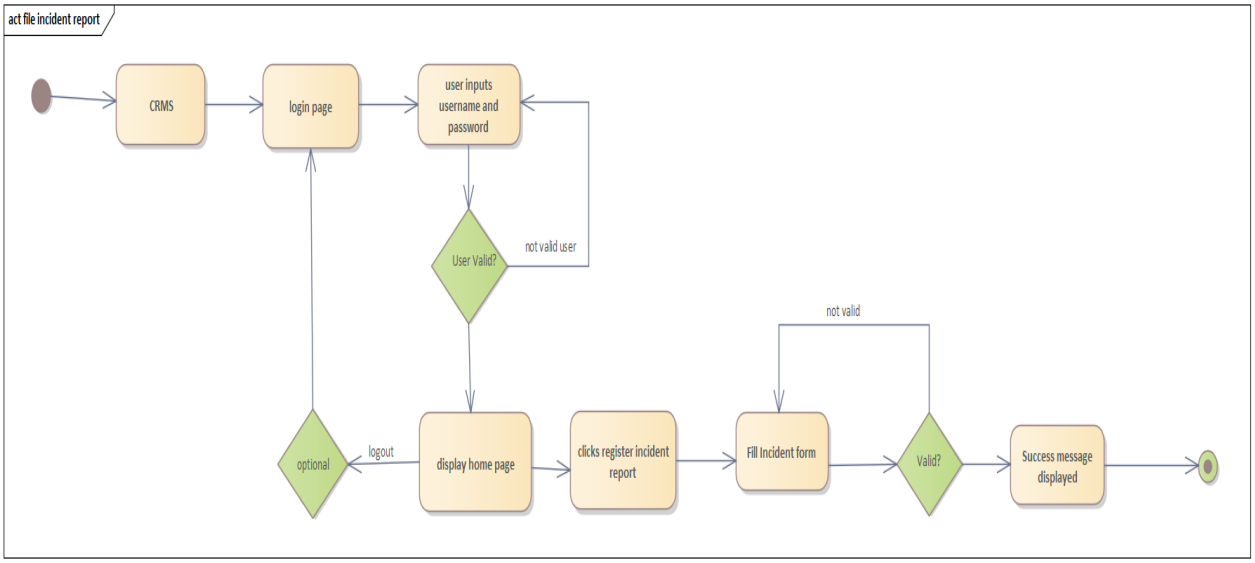


Figure 18 Activity diagram of file incident report

4. Activity Diagram of Request for Crime free certificate

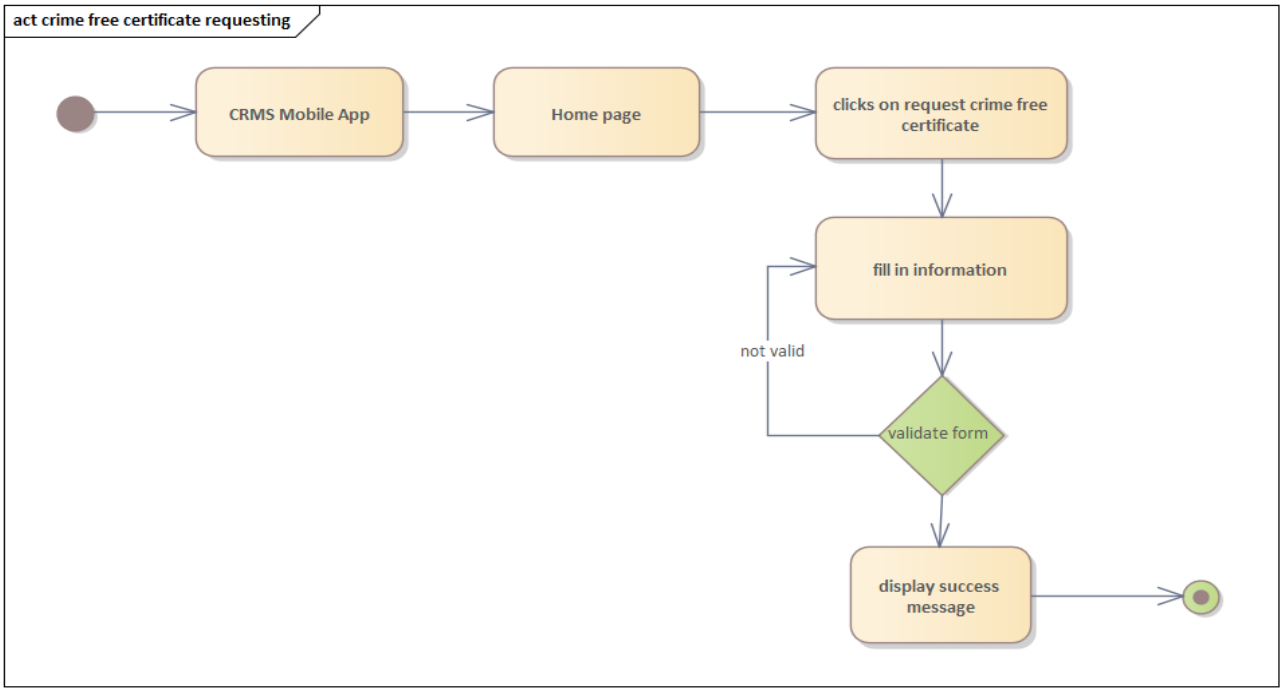


Figure 19 Activity diagram of Requesting a crime free certificate

5. Activity Diagram of Search Suspects & Criminals

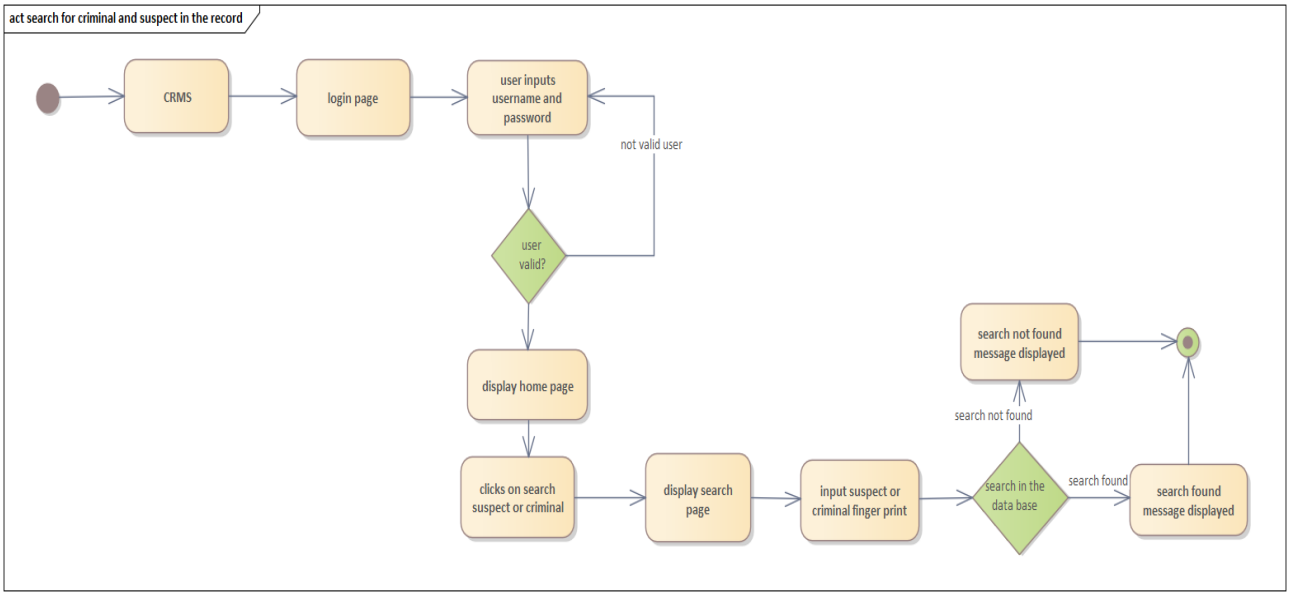


Figure 20 Activity diagram of Search Suspect & Criminals

6. Activity Diagram of File Evidence & Forensic Report

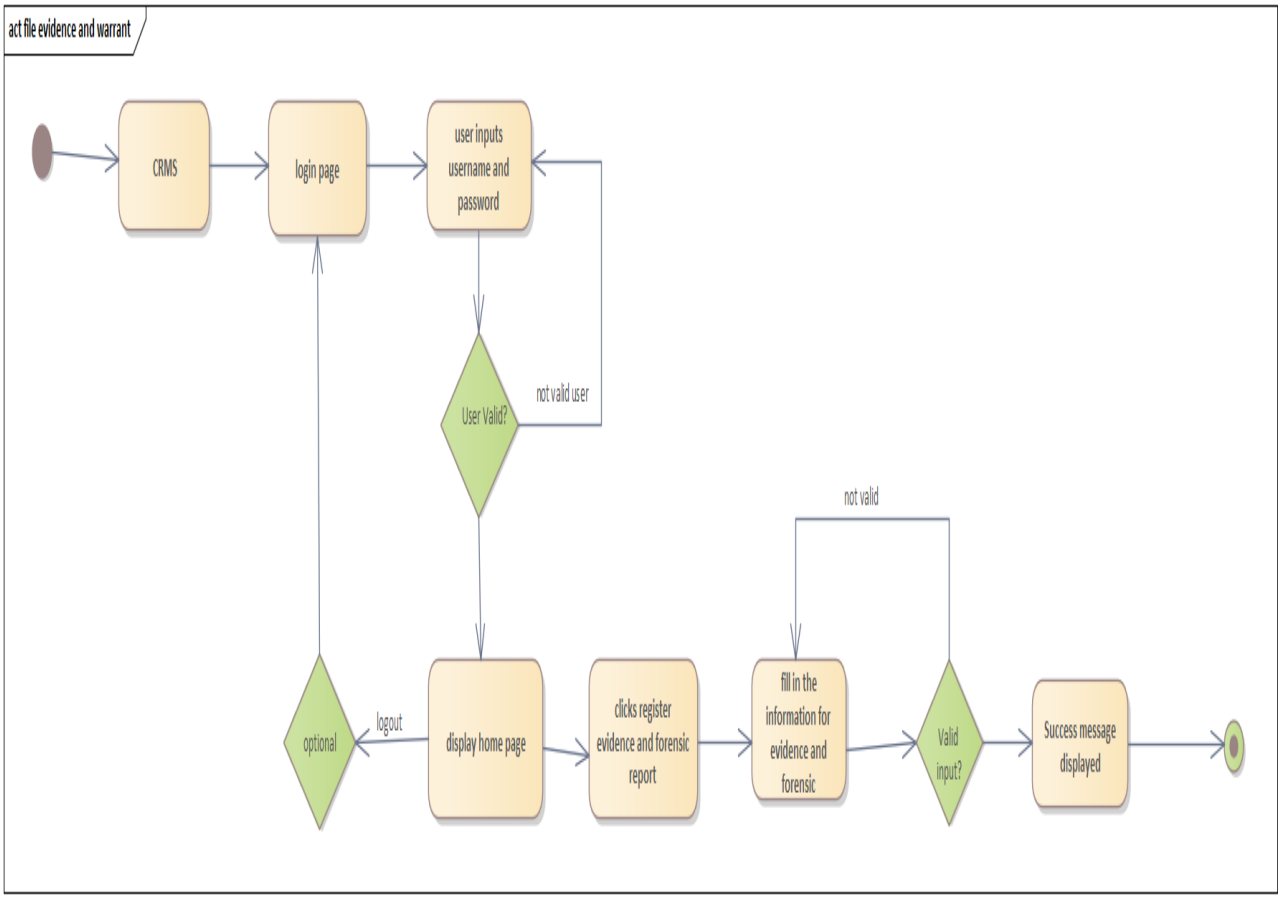


Figure 21 Activity diagram of File Evidence & Forensic Report

7. Activity Diagram of Request a Warrant

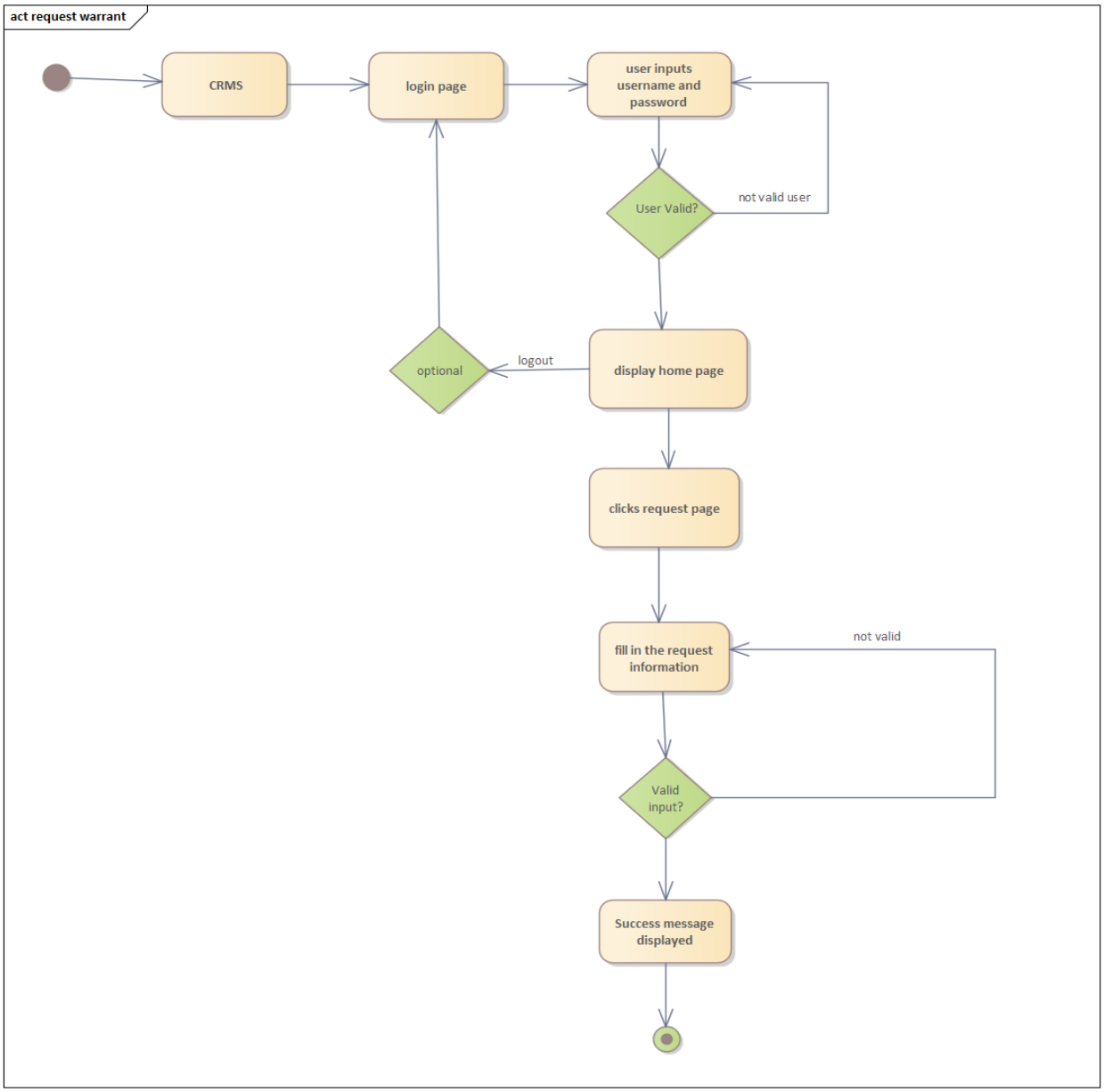


Figure 22 Activity diagram of Request Warrant

8. Activity Diagram of View Report

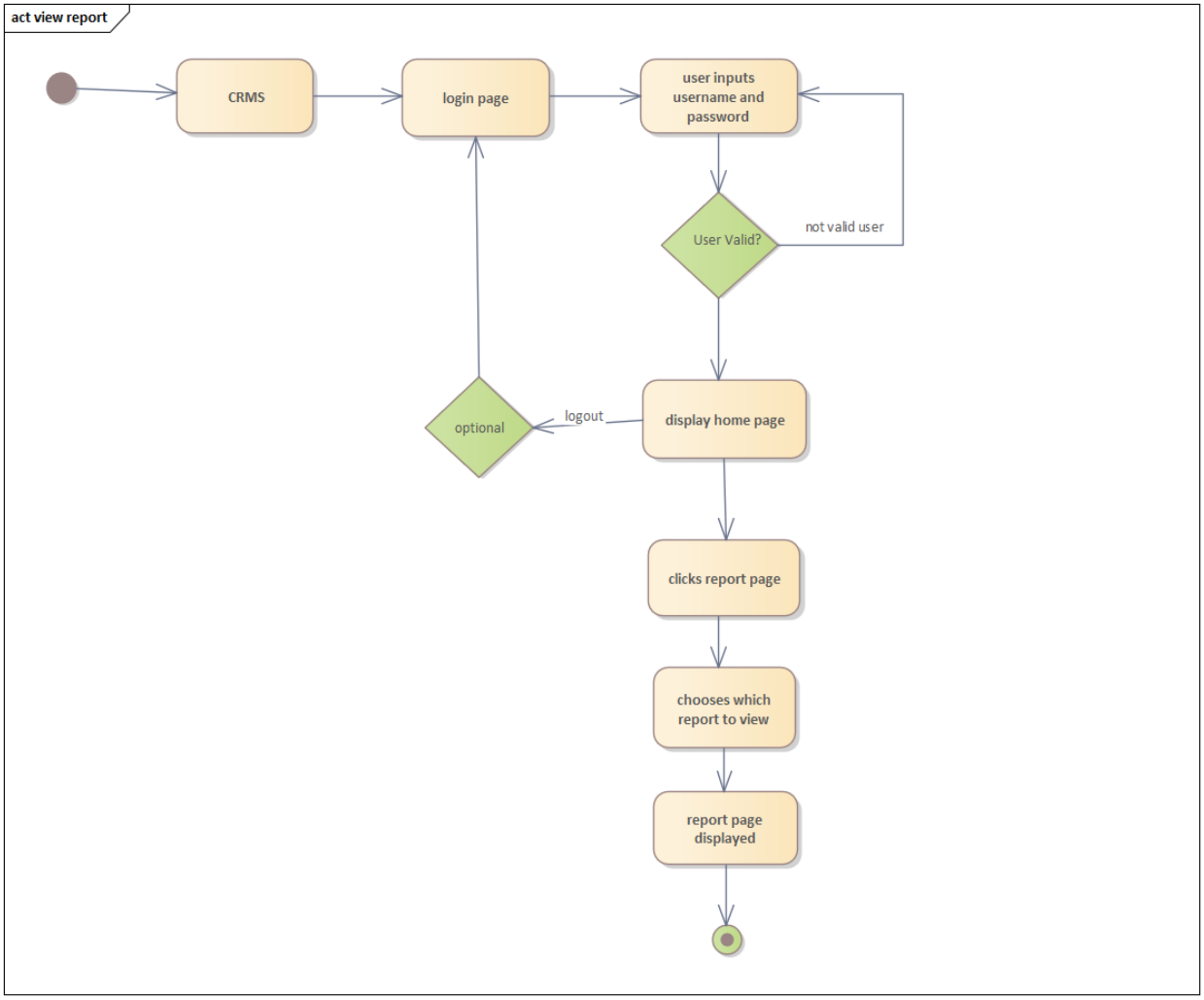


Figure 23 Activity diagram of View Report

9. Activity Diagram of Send Notification

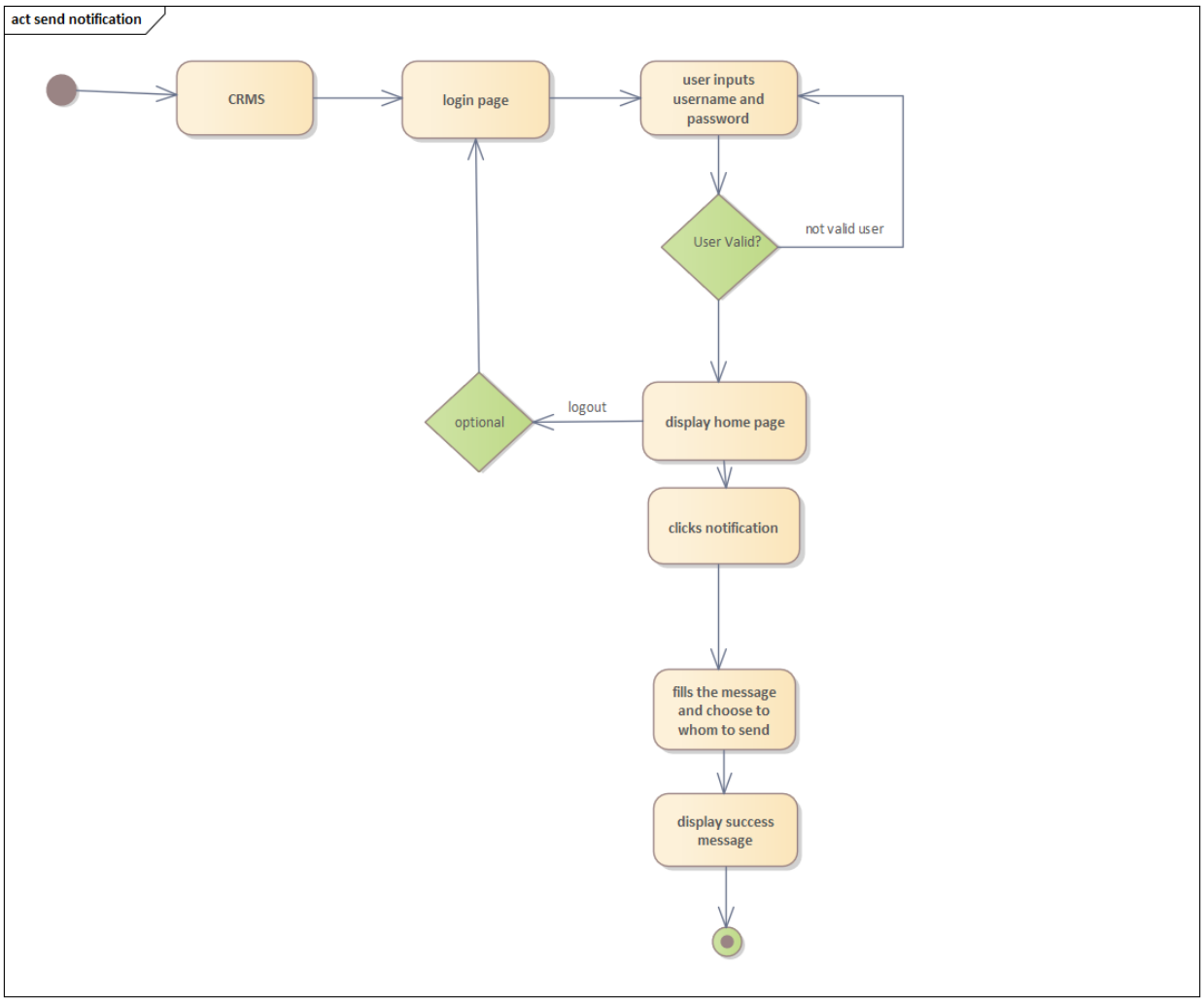


Figure 24 Activity diagram of Send Notification

10. Activity Diagram of File Case Result

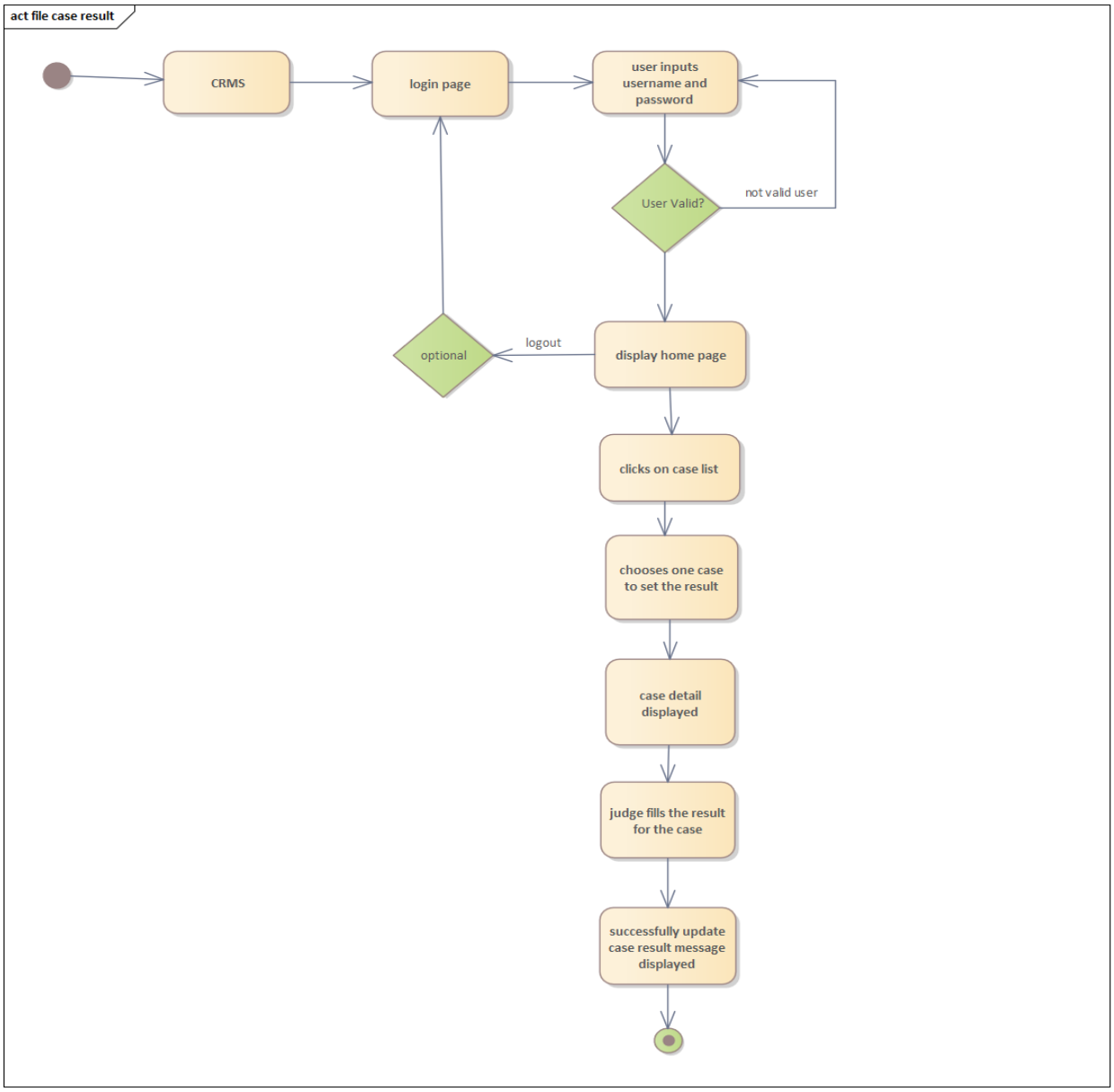


Figure 25 Activity diagram of File Case Result

3.7.3. State Chart Diagram

State charts are used to detail the transitions or changes of state an object can go through in the system. They show how an object moves from one state to another and the rules that govern that change. State charts typically have a start and end condition.

1. State Diagram of user Register

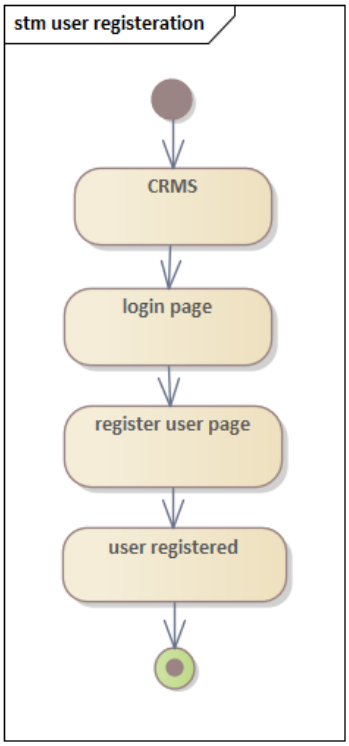


Figure 26 State diagram of User Registration

2. State Diagram of Reporting incident by civilians

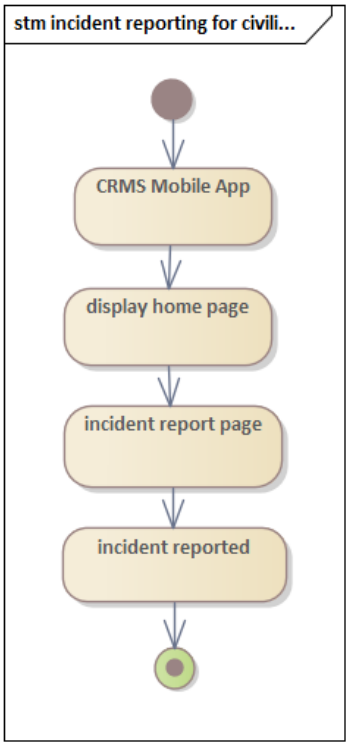


Figure 27 State diagram of Incident reporting by user

3. State Diagram of File Incident Report

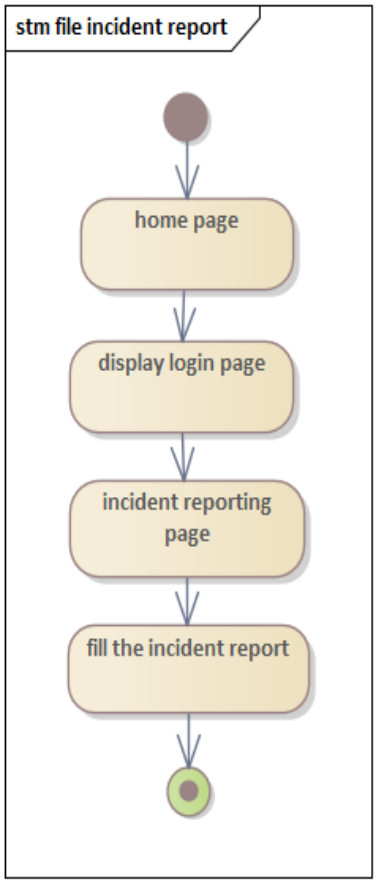


Figure 28 State diagram of File Incident Report

4. State Diagram of Request for Crime free certificate

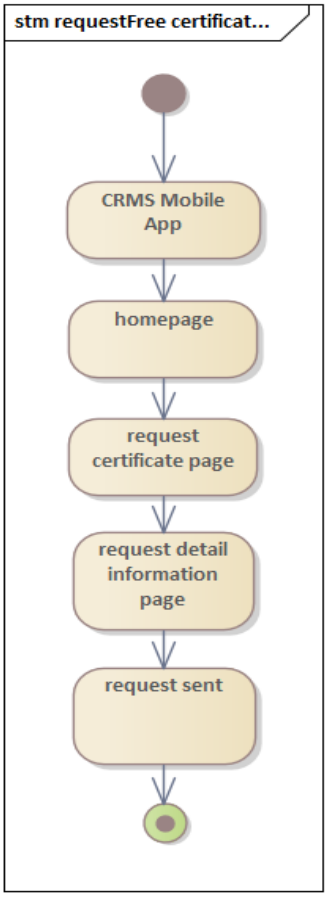


Figure 29 State diagram of Request Certificate

5. State Diagram of Search Suspects & Criminals

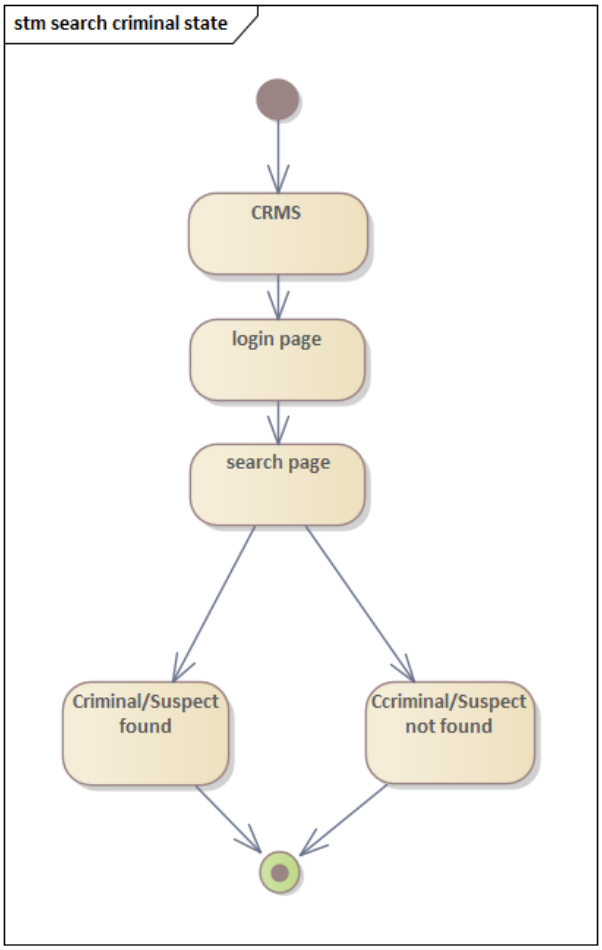


Figure 30 State diagram of Search Criminal or Suspect

6. State Diagram of Send Notification

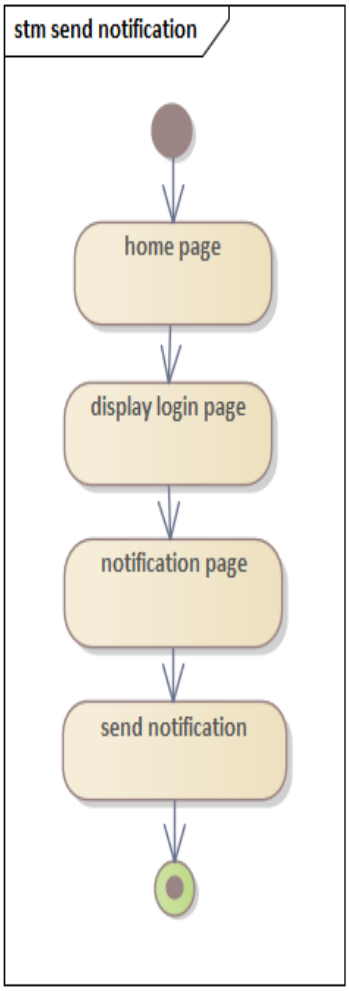


Figure 31 State diagram of Send Notification

4. Chapter Four

4.1. Overview of System Design

This is the system design document to the crime management for police administration. This document includes the design goal, the proposed system and the object design.

4.2. Purpose of the System Design

The purpose of design is to determine how the system is going to be build and to drive the actual implementation of the system. It is intended to capture and express the significant architectural decisions which have been made on the system as well as to obtain the information needed to manage crime.

4.3. Design Goal

The designing part is very important so as to make the implementation or the coding part very easy.

The design goals describe the qualities of the system that are derived from the non-functional requirements which can lead to decisions of developers. These goals can be inferred from the nonfunctional requirements. These are:

- Performance
- Dependability
- Maintenance
- End-user

4.3.1. Performance

With limited amount of memory and optimum time frame for the users, the system will perform its tasks.

Response time: -Depending on the network connection that the user machine has the system is going to interact and respond to user's request in a maximum of a second if the user is just viewing the pages. But if ○the user's request requires the processing of the data base, like searching for schedule, is going to take an average of 1-5 seconds of communication latency with the server system. And streaming of trailers is going to have a response time up to 2-4 seconds**.**

Memory: -The client system requires an average of 10-15megabits of RAM memory to be loaded on a user's web browser and streaming of trailers require additional memory up to 20

megabits. The server system is going to require up to 40 GB of memory to store all the data and other components of the system

4.3.2. Dependability

The CRMS system should achieve the following dependability characteristics in order to resist crash and be available and reliable.

Robustness: -since the system is a web-based system, that mainly use a menu driven entry there wouldn't be an input problem by the user side. But for the server side there might be an error during the process of entering a data. In this time the system will provide an error page and the system will continue without failure or crush.

Availability: -as long as there is an internet connection the system will be available 7 days a week and 24 hours a day.

Security: -by the user side there is low security issue to be considered, the only thing that must be controlled is in the action of rating a movie that, they can rate or click the like or dislike button only one at a time. But by the official user side the system will provide a user name and password that will manage their own page according to their level of access.

Reliability: the information provided by the system is as reliable as it is presented on the web page interface, and this is maintained by the persistent database.

4.3.3. Maintenance

In time of failure or need modification the system needs to be maintained. To be maintainable the system should meet the following maintenance criteria

Extensibility: - if it is needed to add new functionality to the system, this must be achieved by only making a separate page and integrate this page with the existing system.

Modifiability: - if in the system, some functionality requires to be modified, this modification must be done specifically to that function or page without affecting the overall system organization.

Portability: -the system is developed to be viewed and retrieved from any web browser regardless of their version and platform it resides in it.

Readability: -the system code can be viewed by clicking on the current web page and choose "view the source code" option

4.3.4. End User

From the user point of view the system should provide the following end user criteria's so that the system can achieve At least a90% usability by the user

Utility: -in order to help the user, to easily understand and interact with the system, the system must provide the following utilities

- Mouse over tips
- Keyboard alternative

Usability: to enhance the usability of the system, the system should be designed incorporating the following usability concepts

- Site mapping
- Consistent page pattern
- Less overcrowded interface.

4.4. Proposed System Architecture

Overview

The proposed system is mainly based on the SRS document that's already developed and submitted. It mainly deals with subsystem decomposition – dividing the system in to manageable components. Another major task in system design deals with hardware/software mapping which deals with which components would be part in which hardware. Yet another aspect of system design deals with persistent data management, which illustrate as to how persistent data (file, database, etc.) are stored and managed and at last Access control will be presented.

Our system is three tires architectural it has client side, server and database.
Client side: here it can be accessed either via mobile app (civilians) or it can be accessed via work station computers browser (prosecutors, chief police, customer service …).
Server side: here the web servers to connect the data base application are found; mean that the application logic to perform the application by the client is found.
Data base: here the data bases that store the information are found.

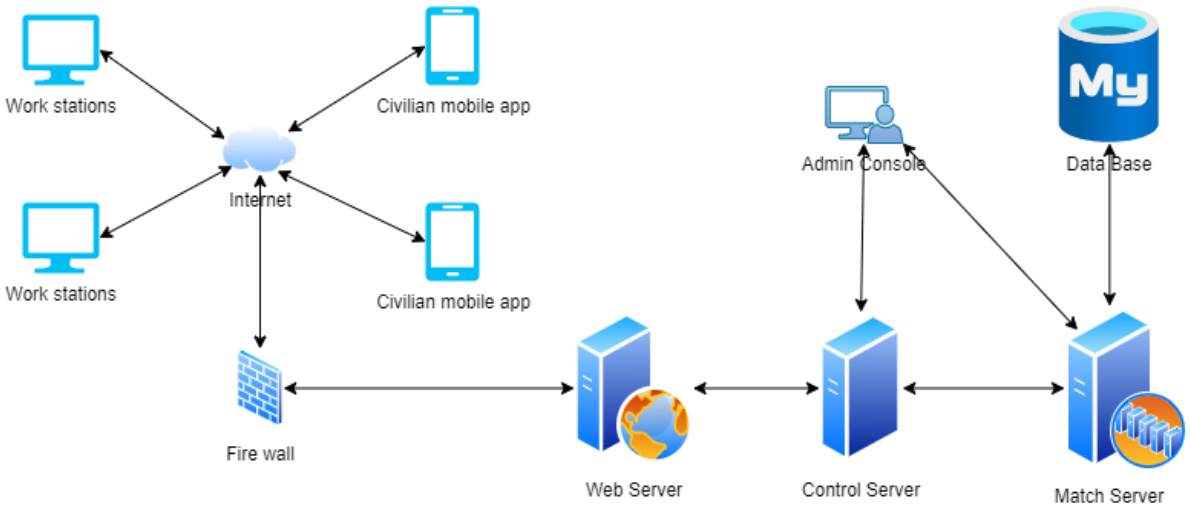


Figure 32 System Architecture1

4.5. System Architecture

The system architecture of our system looks as follows.

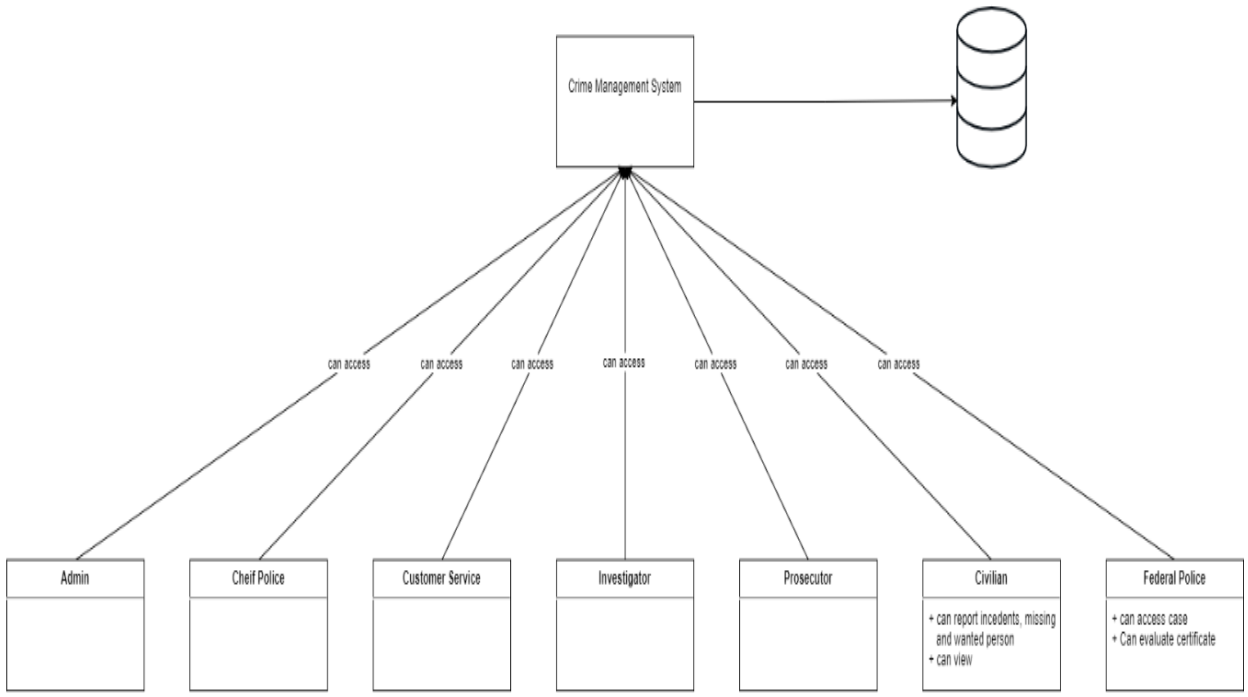


Figure 33 System Architecture2

4.6. System Process

The whole system process of the proposed system is as follows: -

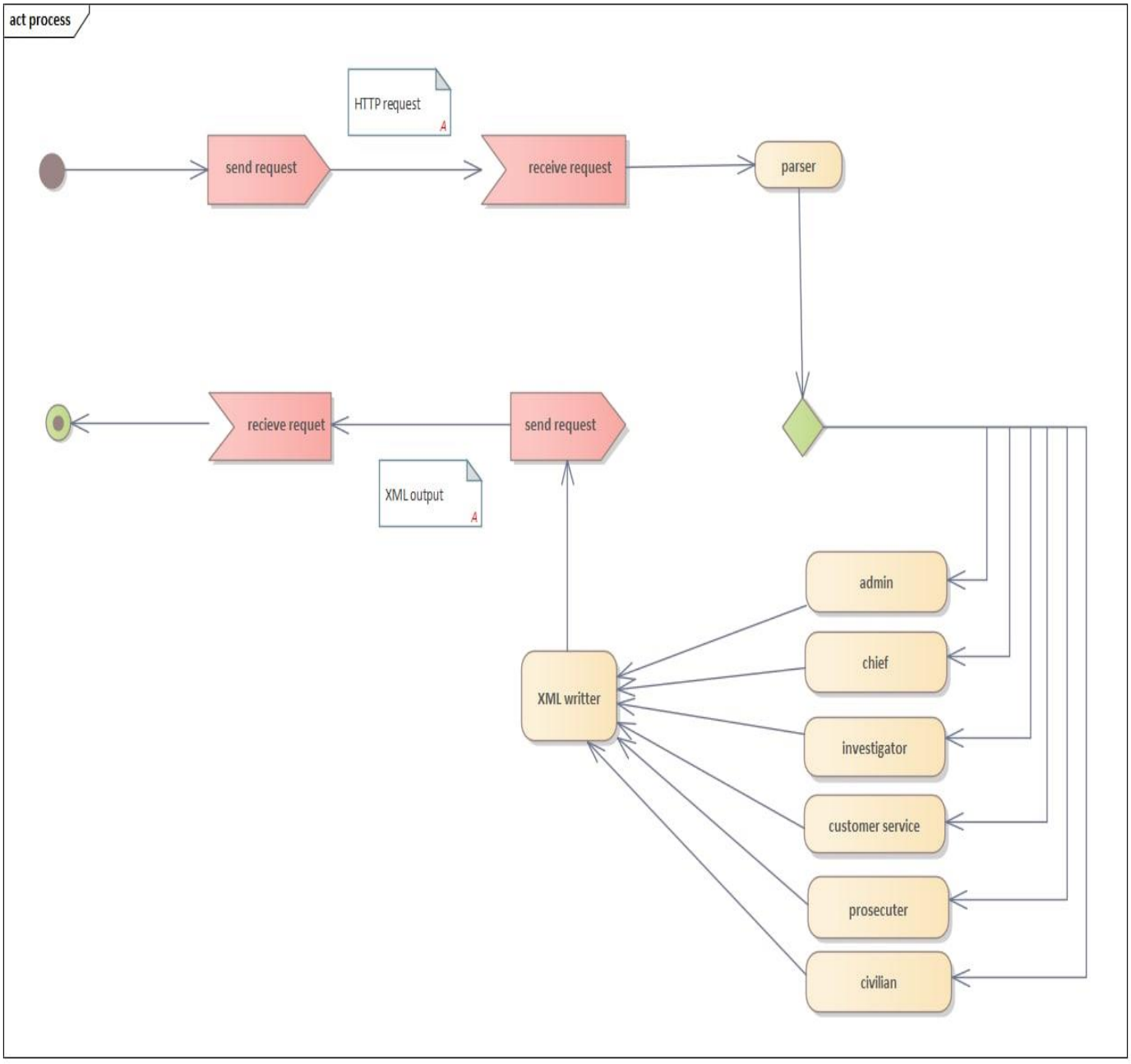


Figure 34 System Process

The system process of the proposed system for the actor Admin: -

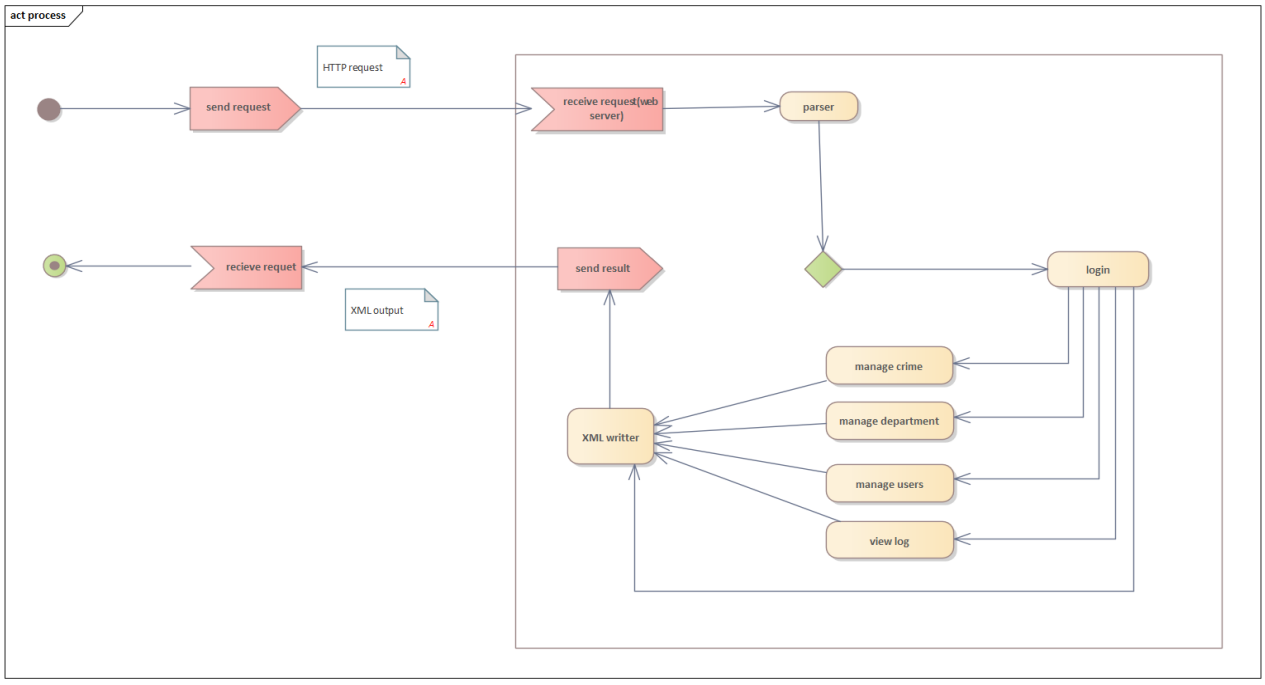


Figure 35 system process for admin user

The system process of the proposed system for the actor Chief Police: -

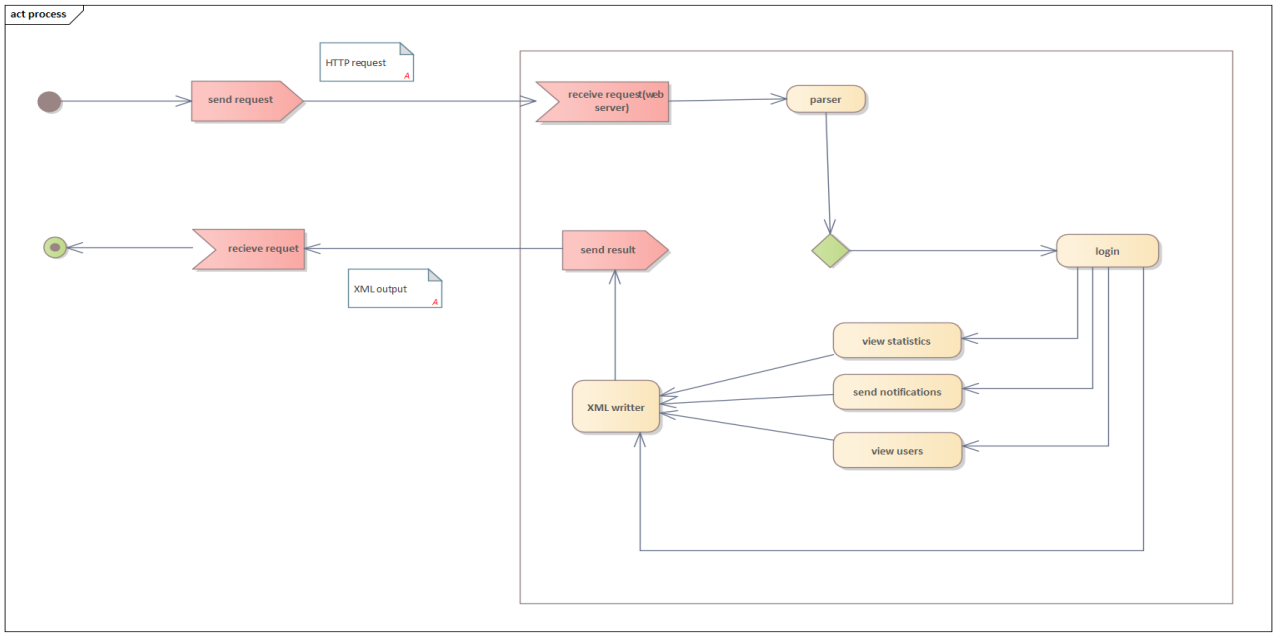


Figure 36 system process for Chief Police user

The system process of the proposed system for the actor Civilian: -

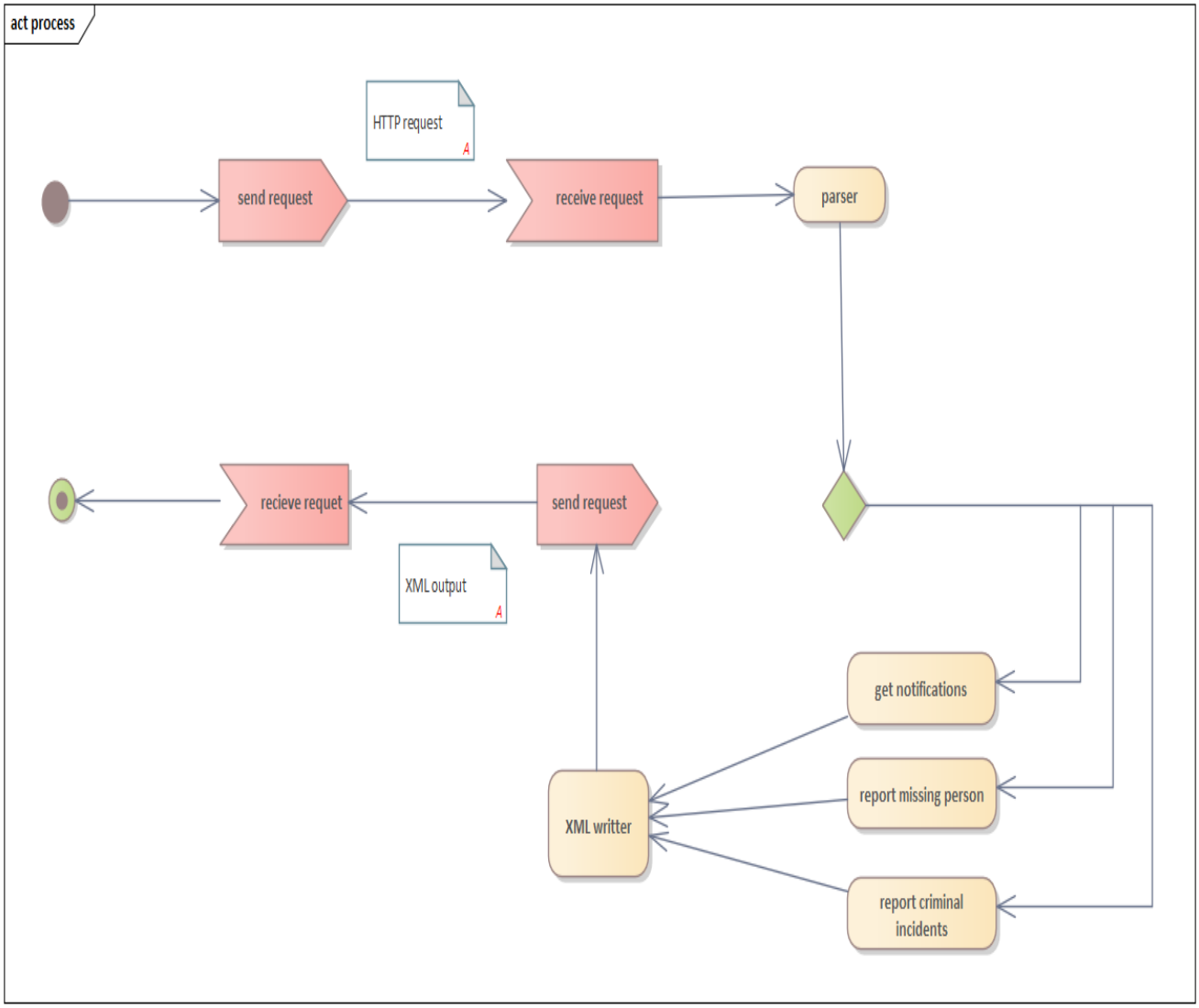


Figure 37 system process for Civilian user

The system process of the proposed system for the actor Customer service: -

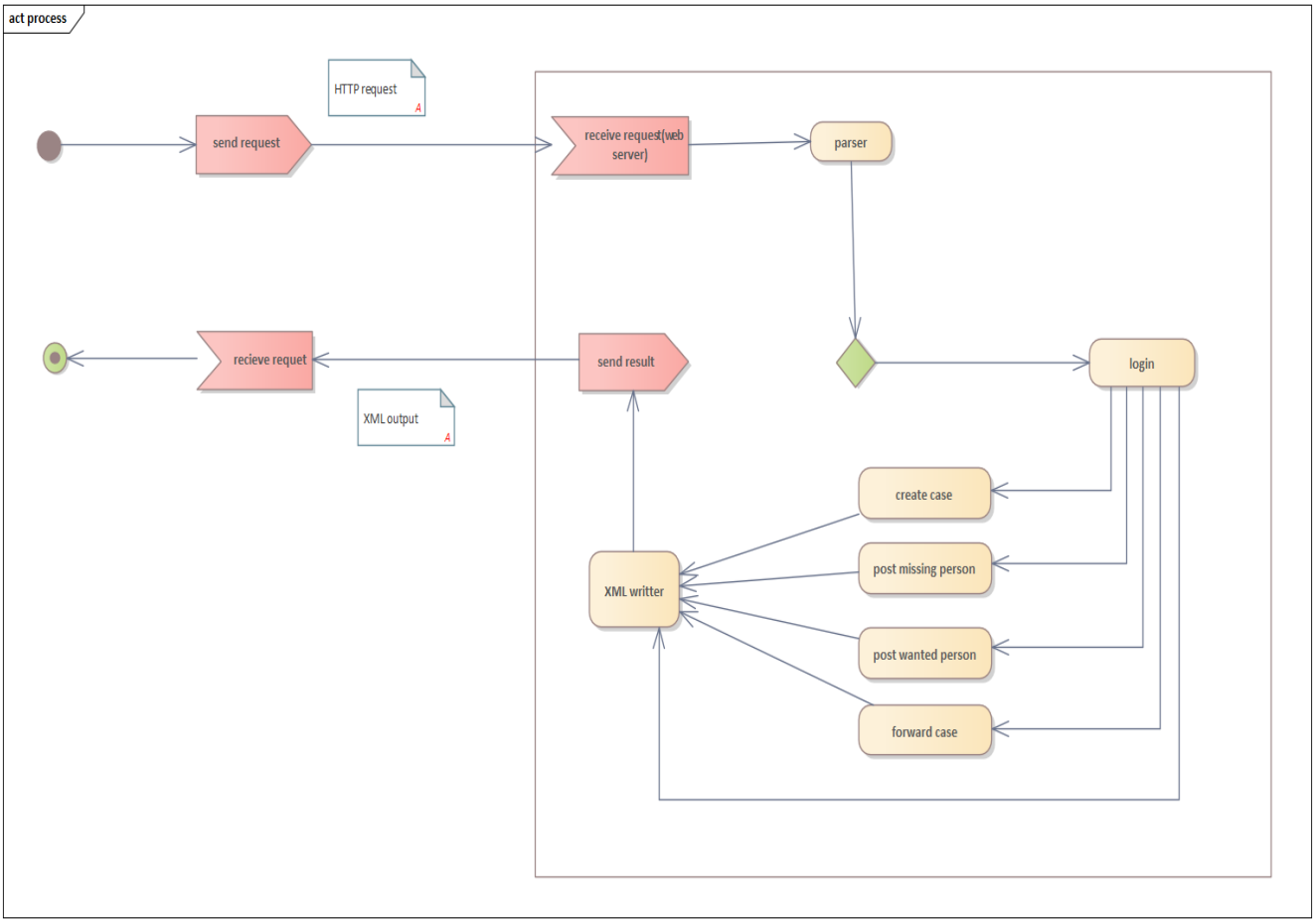


Figure 38 system process for Customer service user

The system process of the proposed system for the actor Investigator: -

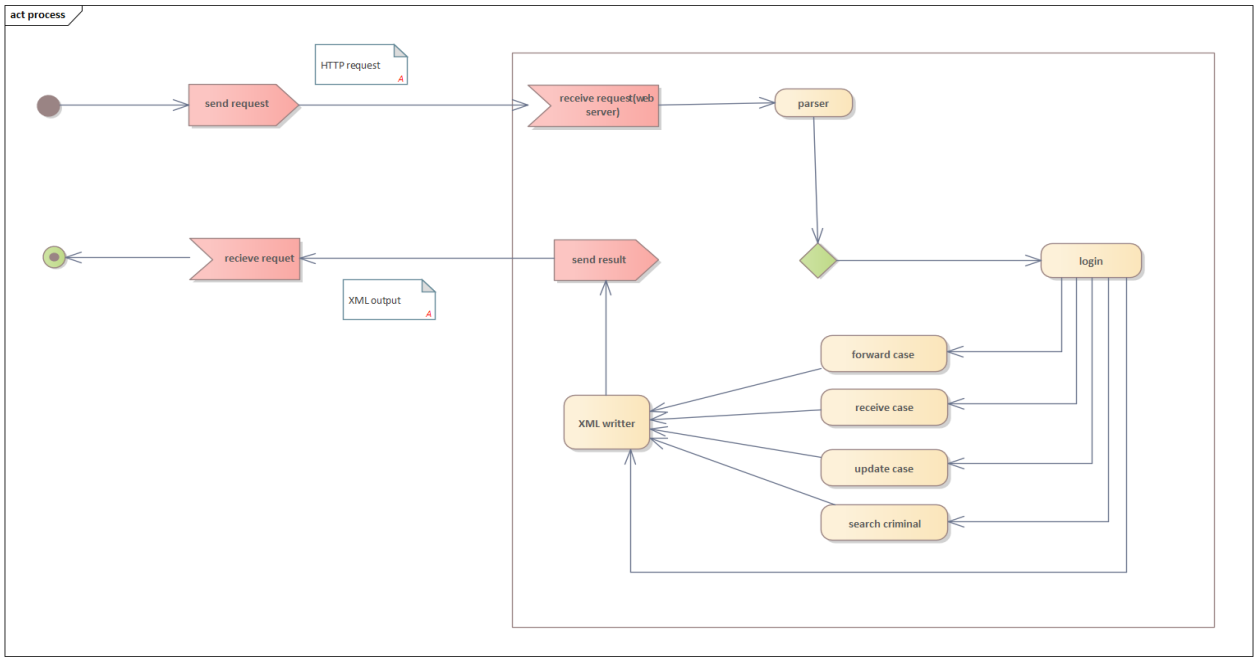


Figure 39 system process for Investigator user

The system process of the proposed system for the actor Prosecutor: -

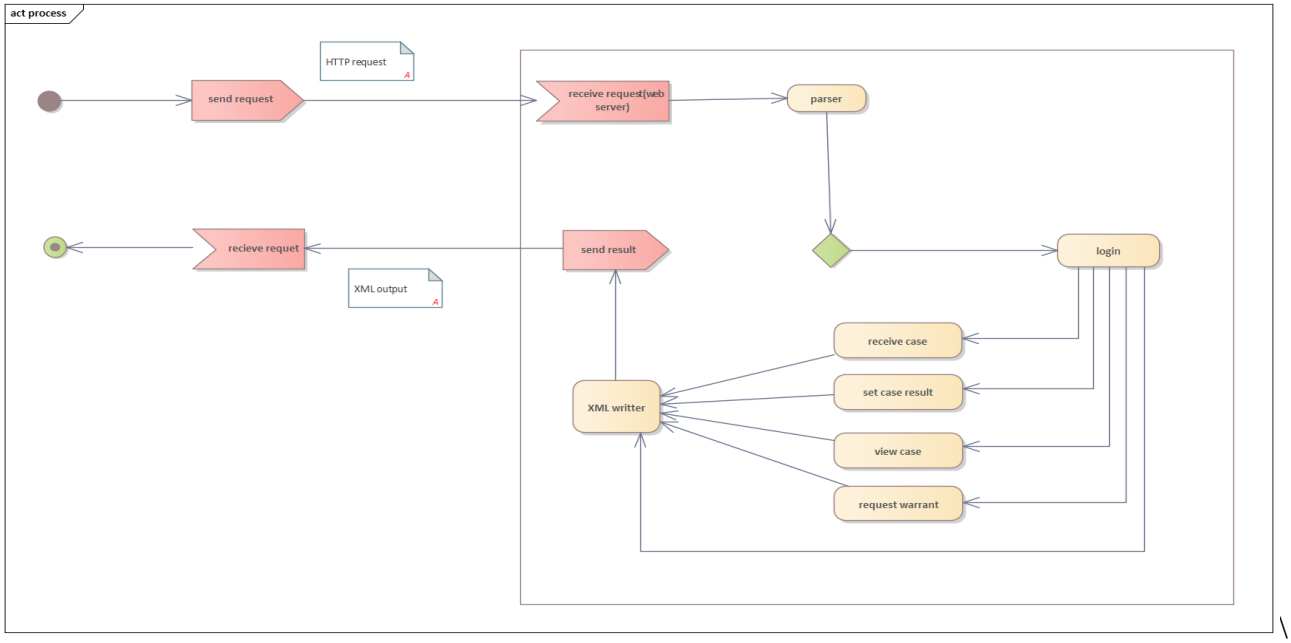


Figure 40 system process for Prosecutor user

4.7. Subsystem Decomposition

In order to reduce the complexity while development we have reduced the system into sub systems. Decomposing the system into sub system would help us manage our development more easily and help us reduce the time it takes to develop the system. We have decomposed the system into three sub systems and again these sub-systems are decomposed in to sub-systems.

The diagrams below illustrate the sub-system decomposing.

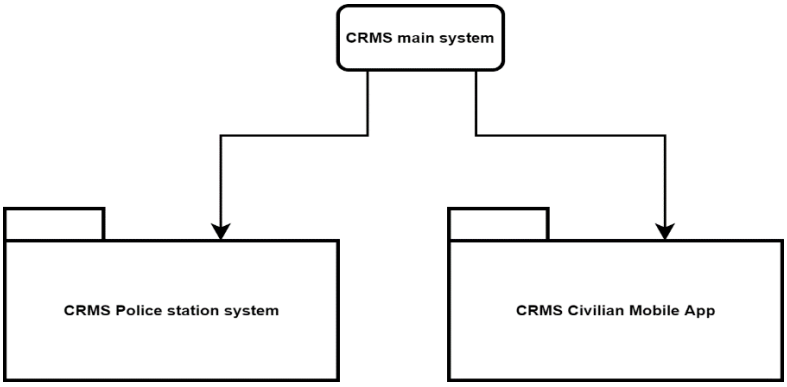


Figure 41 subsystem decomposition

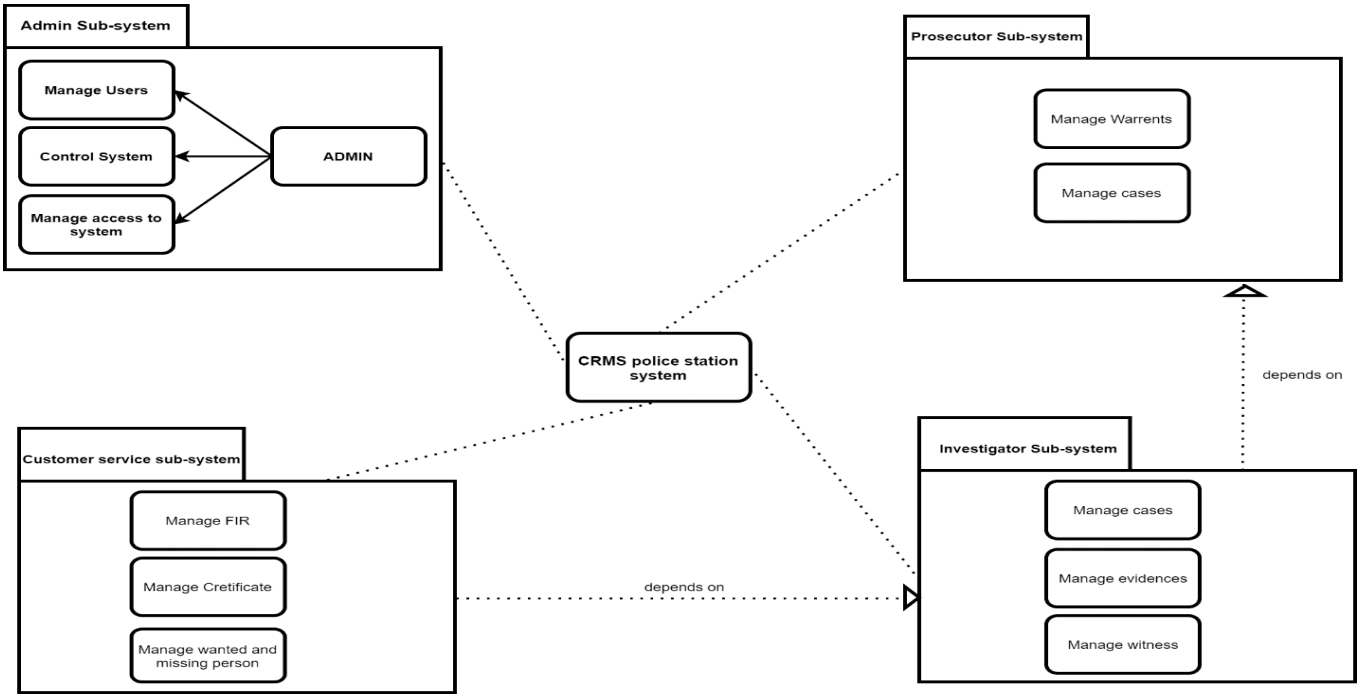


Figure 42 sub-system of police station system

4.8. Hardware/Software Mapping

The system deployed in single or separate machine, that run in parallel, on the internet web server will be used to host the web pages of the system and process clients' request. The database process, which runs on MYSQL database engine, is responsible for maintaining data process operations. Where us the web server process is responsible to host the web pages of the system and process clients' request. In case of the client side, smart phone, standard computer and browser with internet connection is required to access the system.

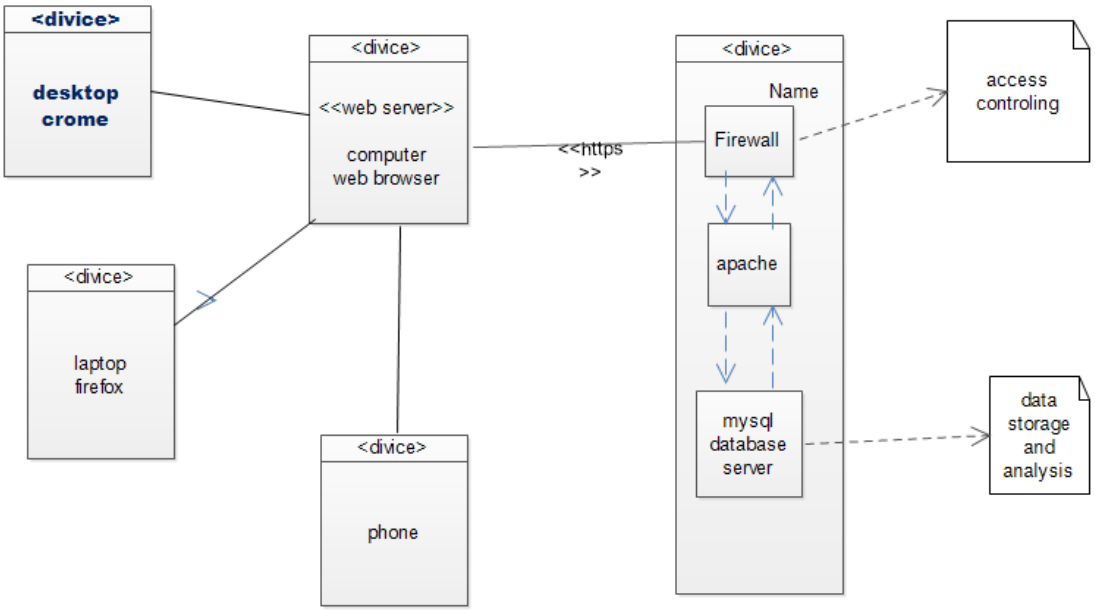
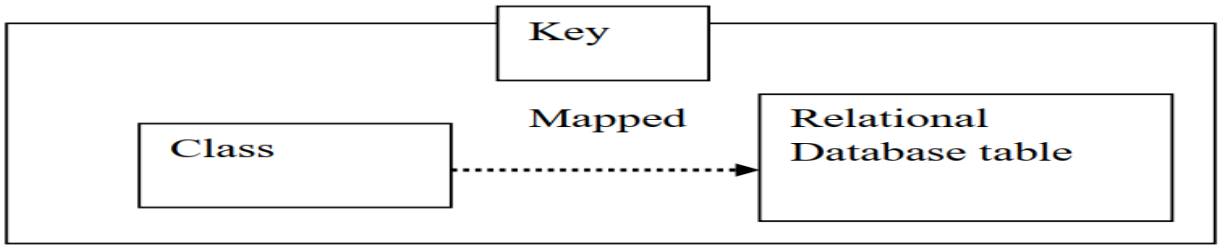


Figure 43 Hardware software mapping

4.9. Persistent Data Management

The purpose of this section is to show the mapping of the objects/classes of the system, identified during the analysis stage, in to the corresponding relational database.



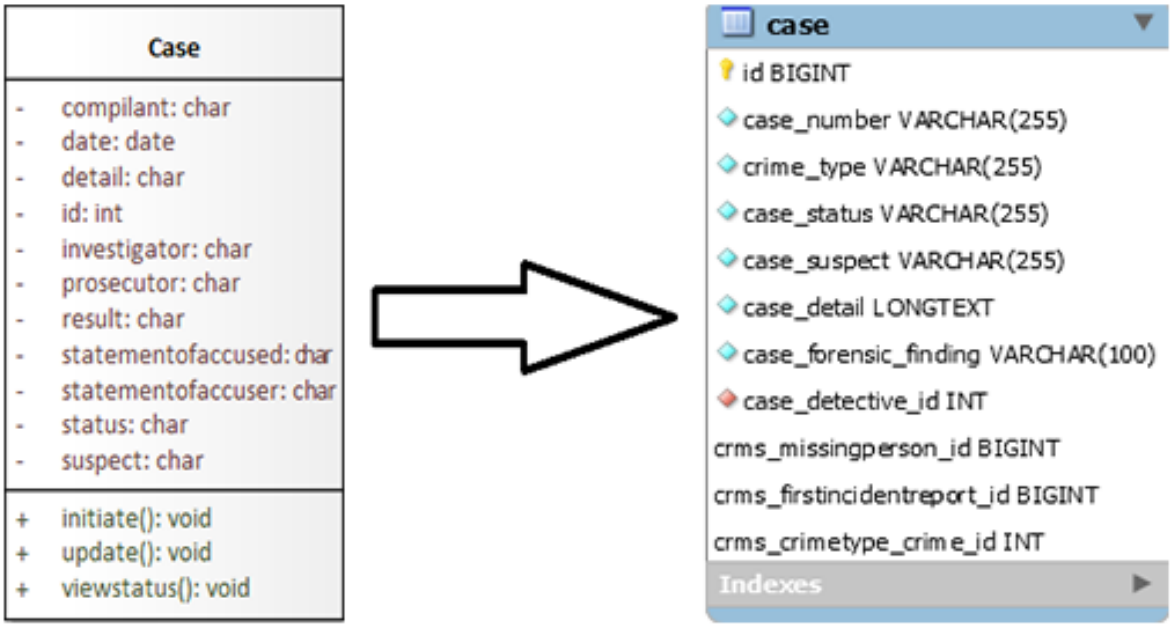


Figure 44 Case object mapping

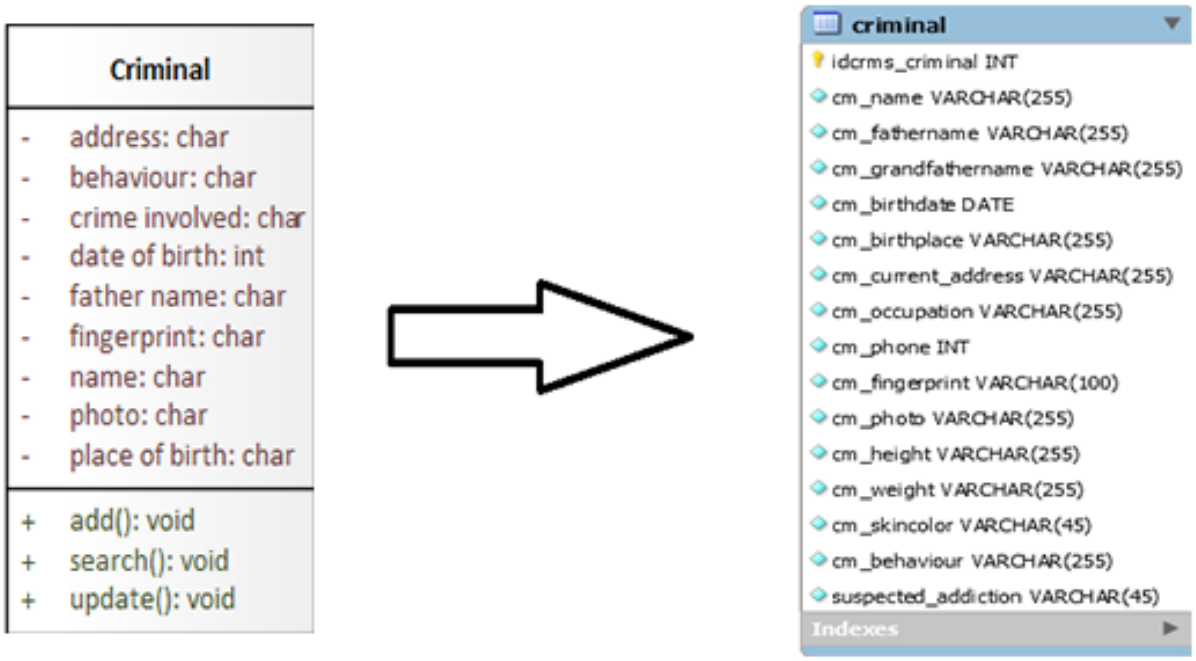


Figure 45 Criminal object mapping

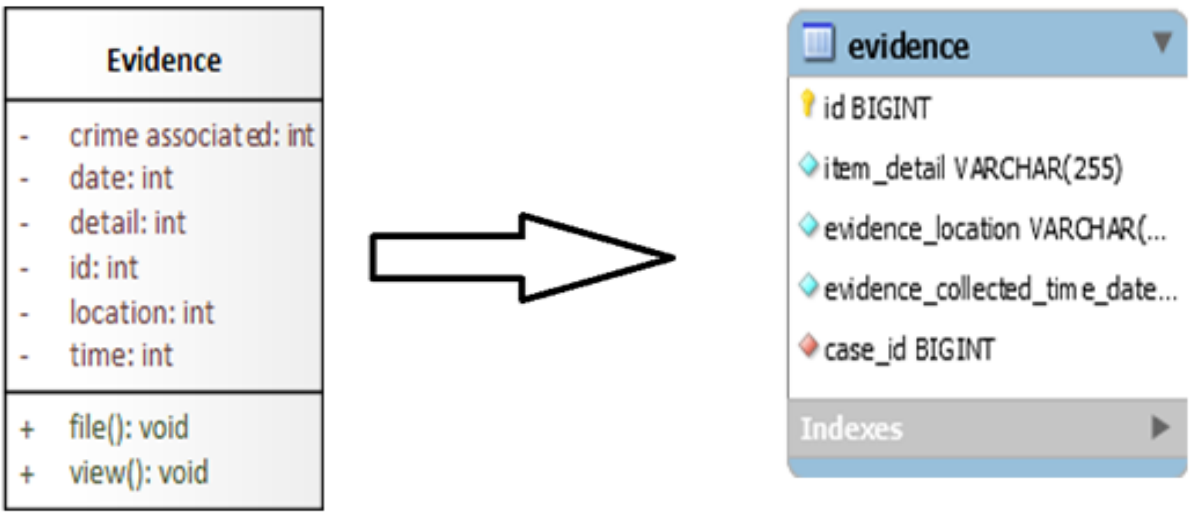


Figure 46 Evidence object mapping

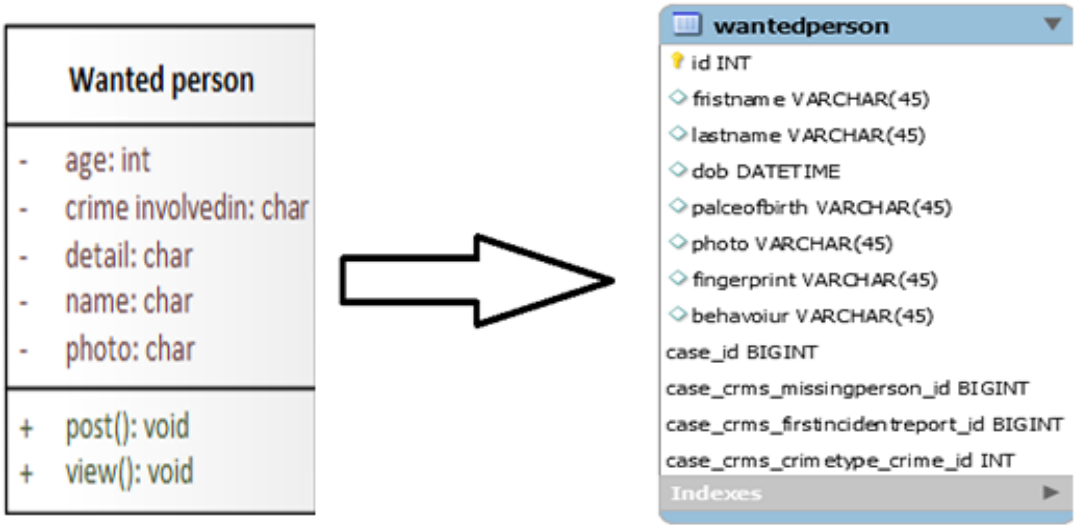


Figure 47 Wanted person object mapping

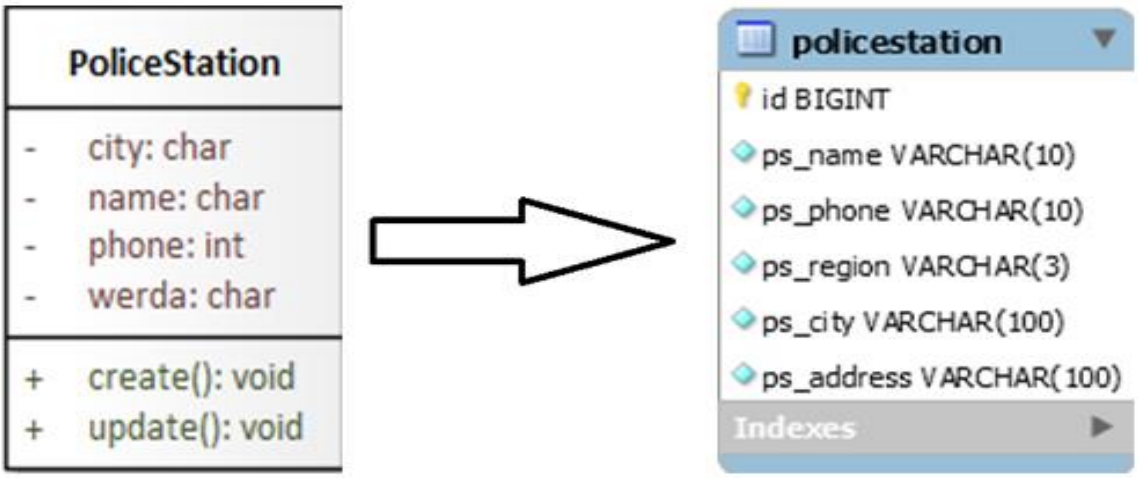


Figure 48 Police Station object mapping

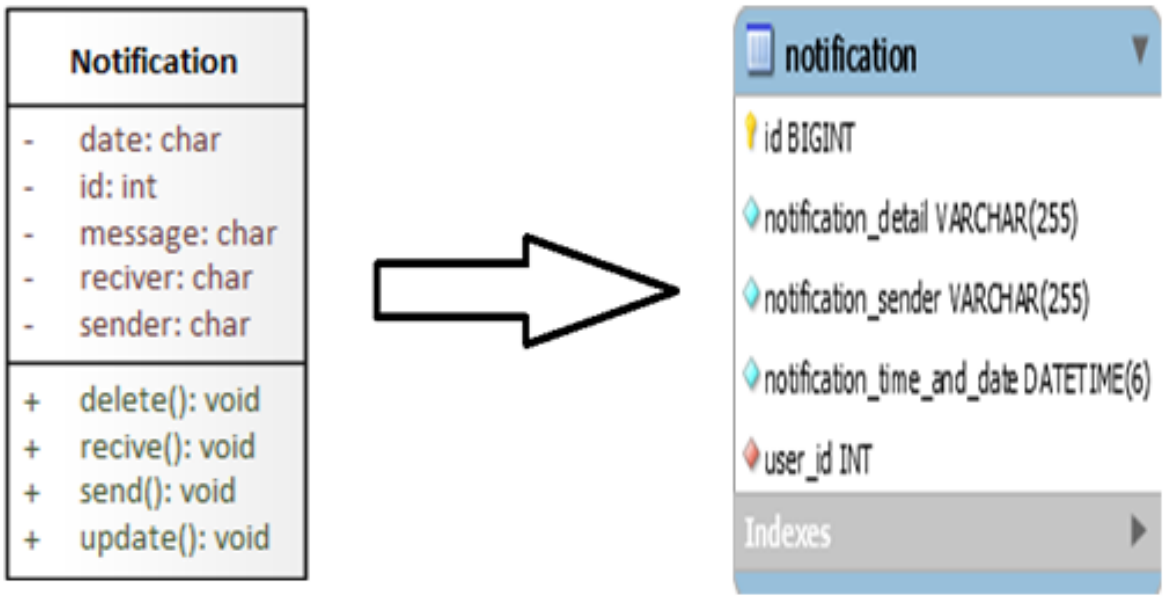


Figure 49 Notification object mapping

Figure 50 Missing person object mapping

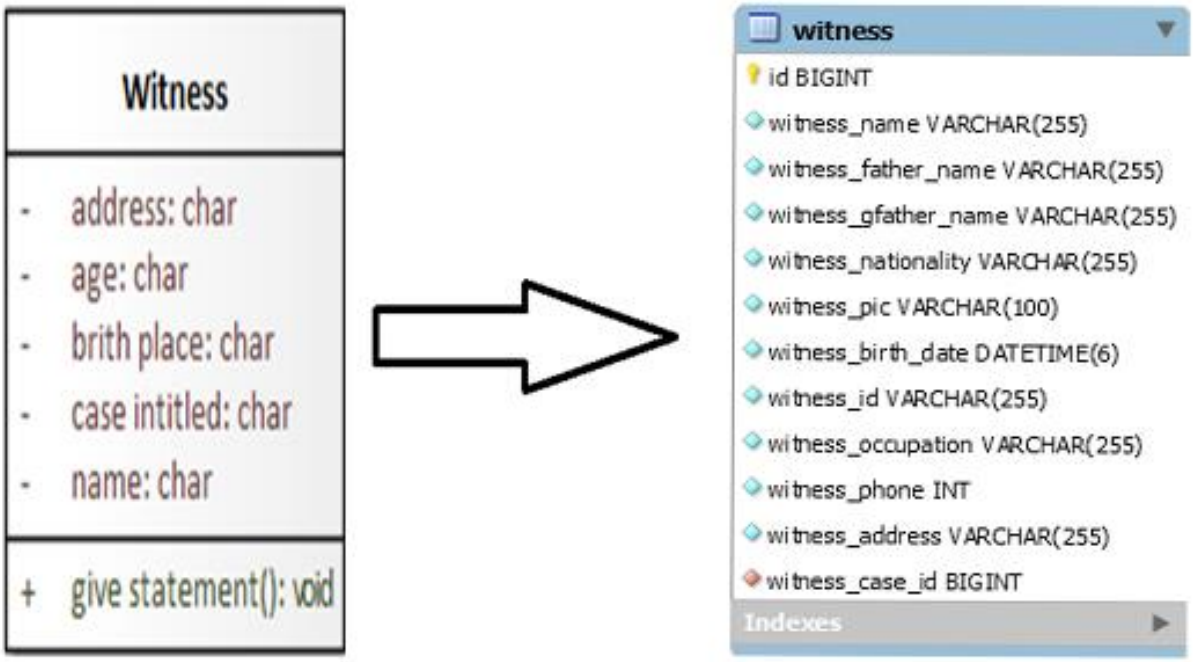


Figure 51 Witness object mapping

4.10. Component's Diagram

Component diagrams are used in modeling the physical aspects of object-oriented systems that are used for visualizing, specifying, and documenting component-based systems and also for constructing executable systems through forward and reverse engineering. Component diagrams are essentially class diagrams that focus on a system's components that often used to model the static implementation view of a system.

A component diagram breaks down the actual system under development into various high levels of functionality. Each component is responsible for one clear aim within the entire system and only interacts with other essential elements on a need-to-know basis.

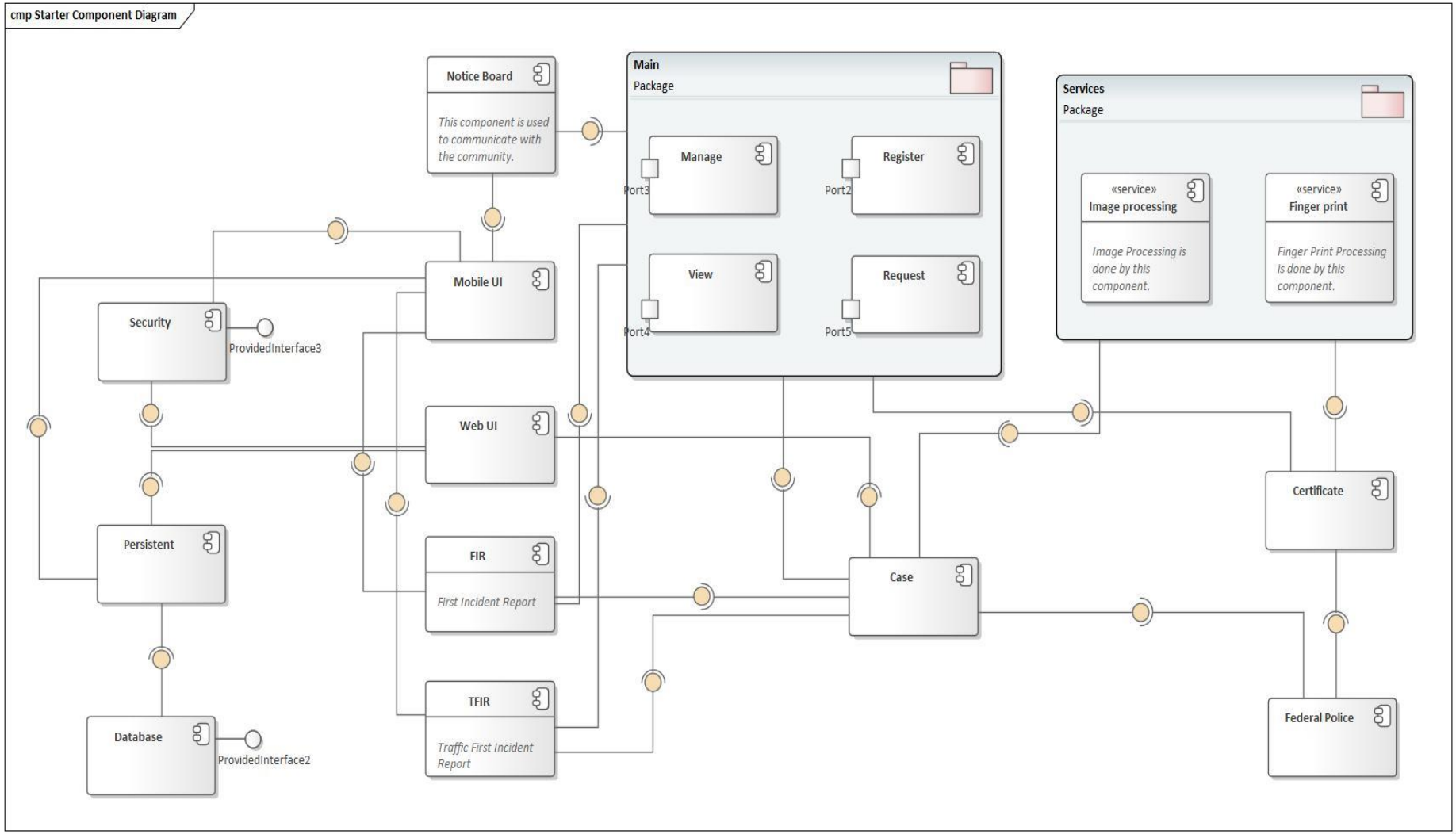


Figure 52 Component diagrams

4.11. Database Design

The database design for the proposed system is as follows: -

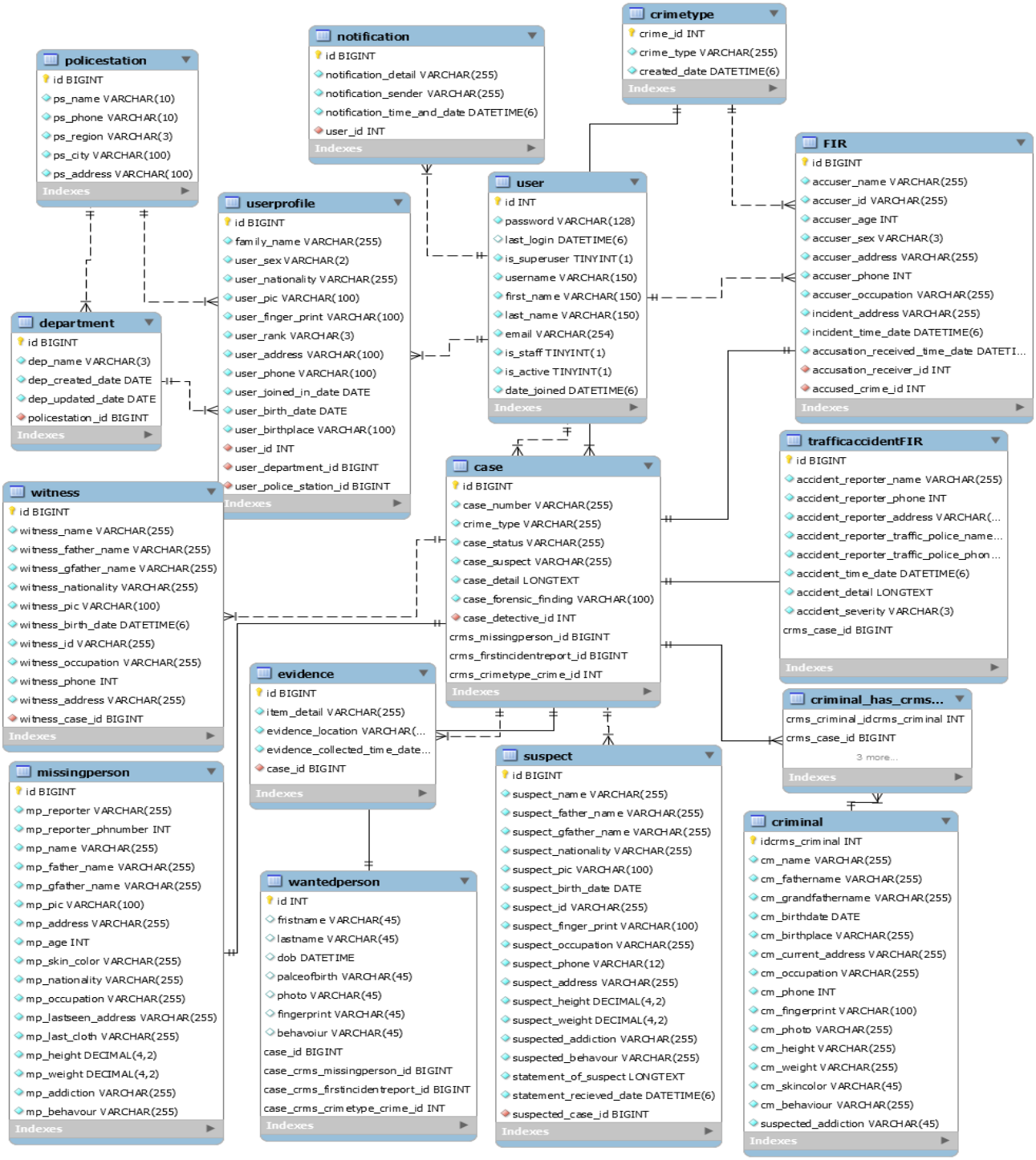


Figure 53 Database design

4.12. Access Control

Access control refers to the control of access to system resources after a user's account credentials and identity have been authenticated and access to the system has been granted. Access control is used to identify a subject (user/human) and to authorize the subject to access an object (data/resource). The information which is stored in the system we build must be secure. While storing and retrieving there is a security problem with file access. Every user has different level of Access (privilege) to the data stored and shared with in the system. The table below shows the access that each actor has.

Actors	**User**	**Case**	**Crime**	**Department**	**Log**	**Notification**	**Report**	**Criminal record**
Admin	Add () Update () De-activate ()	View ()	Add () Edit () De-activate ()	Add () Update () De-activate ()	View ()			View ()
Chief Police (head of police)	View ()	View ()				Send ()	View ()	View ()

Table 28 Access control table for user, crime, department management and others

Actors	**Case**	**Criminal**	**Criminal record**	**Case management**
Investigator	Get () forward to prosecutor () update ()	Search ()	View ()	
Prosecutor	Receive () View () Update ()		View ()	Request warrant () Set result ()

Table 29 Access control table for case, criminal and criminal record

Actors	Case	Missing person	Wanted person	Certificate	Incident
Customer service	Create () Forward to investigator ()	Post ()	Post ()	Request ()	
Civilian (mobile user)		Report ()	View ()		Report ()

Table 30 Access control table for missing person, wanted person and certificate request.

Actors	Case	Warrant request	Criminal record	Judge
Judge	View () Update () File case result ()	Approve ()	View ()	
Court registrar	View () Register ()	Register ()		Assign ()
Lawyer	View ()		View ()	

Table 31 Access control table for warrant request, judge and file case result.

4.13. User Interface Design

The image below illustrate some of the user interface design of our proposed system.

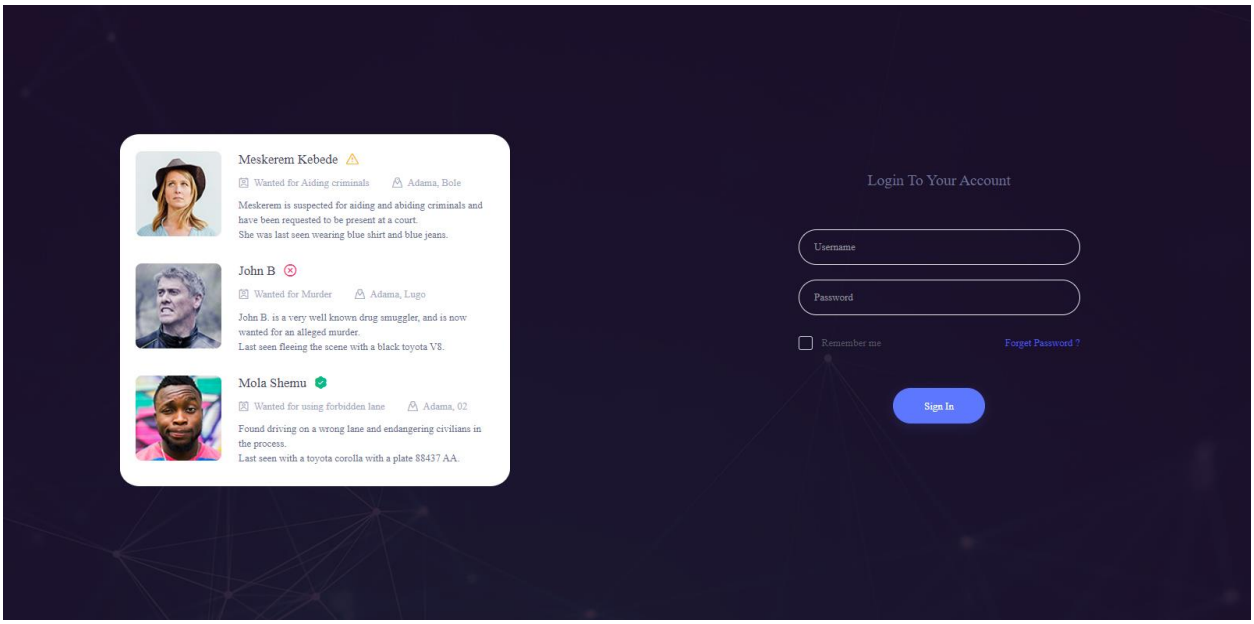


Figure 54 user interface of login page

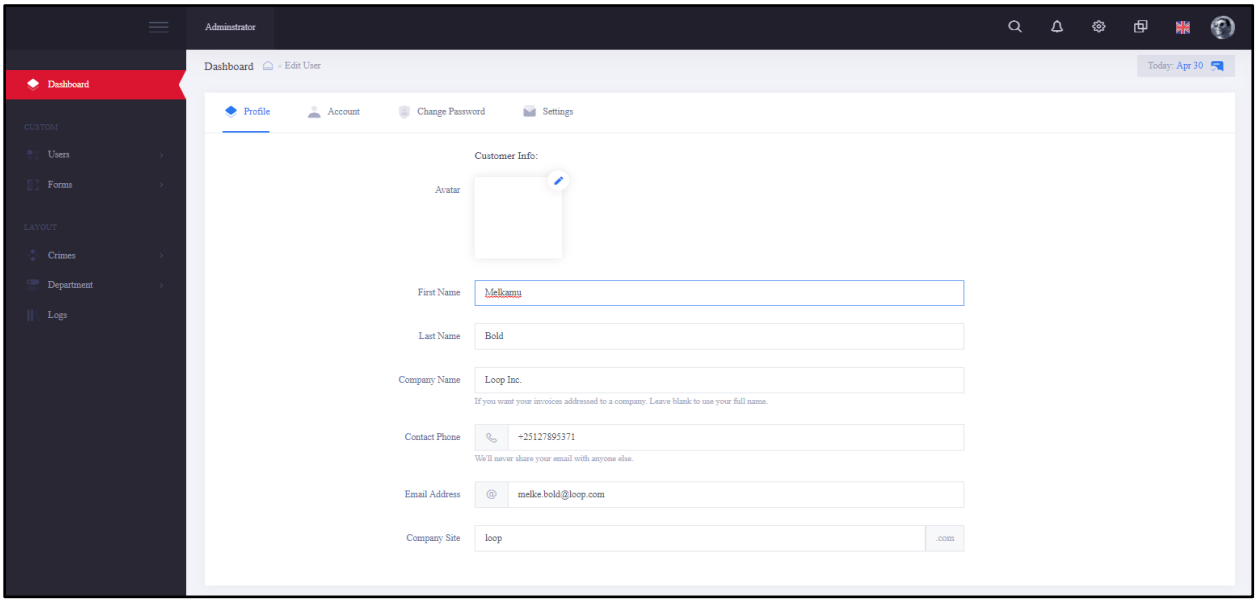


Figure 55 user interface of registration page

5. Chapter Five

5.1. Overview

Implementation is the process of integrating and developing the system functionality. It refers to the development, deployment (installation and testing) of all the system components. Our project implements the functional and non-functional requirements of the system.

5.2. Coding Standard

In order to develop the proposed system, we have used coding standards that forces us to work together uniformly and have consistency throughout our development.

The following are the coding standards we used to develop the proposed system.

1. Standards for Naming

In order to develop our proposed system, we should follow a common name standard throughout our codes. While we are naming variables, class, modules or methods we should use a proper name standard. The name standards we use are as follows: -

- ✓ The name we use should be meaningful and tell why they exist.
- ✓ The name should be short and pronounceable.
- ✓ Names for variables and methods should be lower case letters.
- ✓ Names for classes should start with Upper case.
- ✓ Numbers should not be used as naming.

2. Standards for Commenting

While coding we should also use standards for commenting a portion of our codes. So, the following are the standards we use for commenting while we code: -

- ✓ Comments should be short and should be informative.
- ✓ Comments should describe why the code is used not how it works.

3. Standards for Indentations

While coding we should take care of our Indentation because we are using python to code the system and python is indentation sensitive. So, we should use proper indentation and spacing while we code.

4. Standard for methods and modules

Python have a good guide how to use methods and modules starting from naming to how to import them and while we are coding, we would be using the python standards for the methods and modules.

5.3. Prototype

Prototype is a sample system which is similar to the proposed one but not fully functional. So, for our proposed system we have designed a prototype which mainly only function the CRUD functions which are Create, Read, Update and De-activate. The prototype mainly is consisting of the frontend of the system which means it mainly includes the user interface part which is developed using Metronic templates.

Even if the prototype is not fully functional, we have developed the database and developed the connection to it through Django framework. We used MySQL database as our database server and we have made the connection to the Django frame work.

Frontend/ Client Side: - this part of the system is the user interface part where users interact to it. The client side for our prototype is a Metronic template which is developed using bootstrap. We used Django frame work to develop the system and Django support MVT (model view template) architecture. For the Django architecture we use the template which is the frontend where we design the user interface.

Backend/ Server Side: - backend is the part of the system where routing of URLs and the logic takes place. So, we used Django as our backend and connected it to MySQL database. Django is a python framework which enables us to develop fast and code clean.

5.4. Implementation Detail

Since we are using a python web frame for developing the system, we use the MODEL, VIEW, TEMPLATE architecture where model is the database class and view is the function where the logic and template mapping is made, and template is the web-pages.

Components	**Functions**
Django user models	This is the user database table which is user for authentications.
Django URLs	This is a python code which routes the URLs to a view in the system.

Django Views	This also a python code which does the login and maps the URLs with templates.
Django templates	Templates are the HTML code which are served on the web browser.
Django static file	This is a folder which contains file that are static which are not changed often.
Django Media	This is the folder the user uploads file such as photos or other documents.
Gettext	It is a python package which is used to make the website Multilanguage.
Opencv	It is a python package which is used for biometrics which is used by our system in identifying fingerprints and face recognition
Pillow	This is also a python package used for manipulating image files.
Numpy	This another python package used for manipulating mathematical formulas and calculations.

Table 32 Implementation detail

5.5. Deployment

Deployment Diagram is a type of diagram that specifies the physical hardware on which the software system will execute. It also determines how the software is deployed on the underlying hardware. It maps software pieces of a system to the device that are going to execute it. The deployment diagram maps the software architecture created in design to the physical system architecture that executes it. In distributed systems, it models the distribution of the software across the physical nodes.

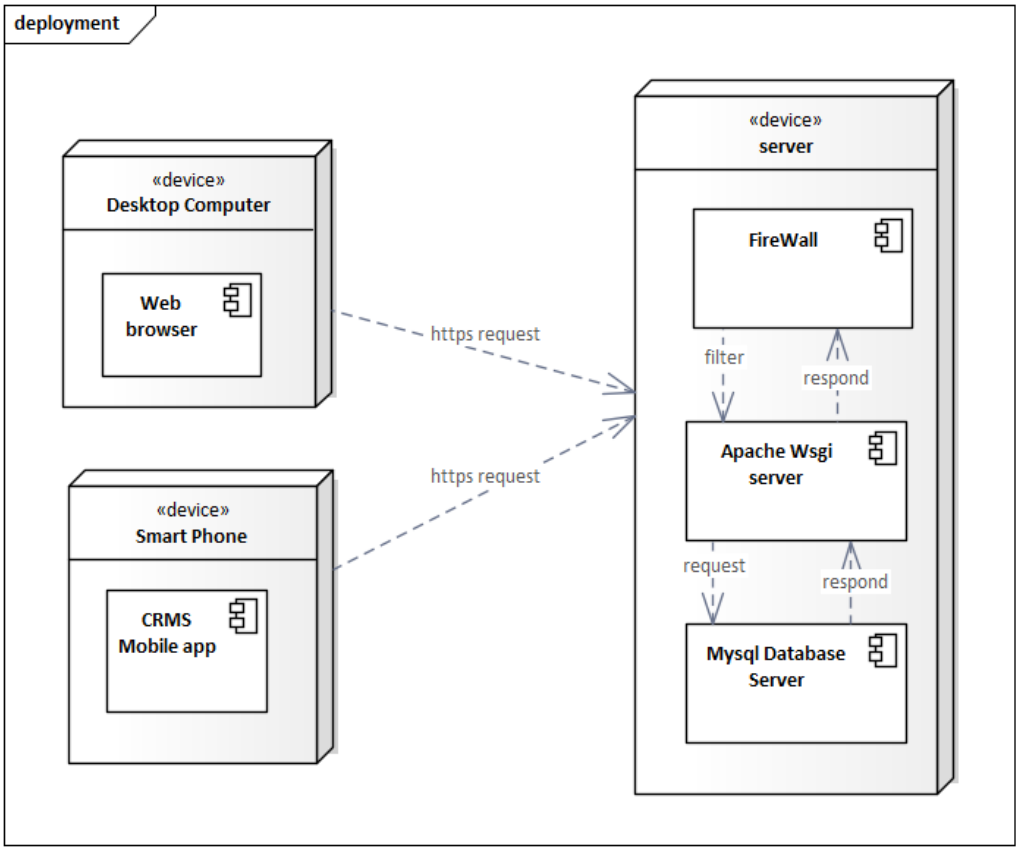


Figure 56 Deployment diagram

4. Reference

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