CRIME REPORTING MANAGEMENT SYSTEM : CASE STUDY MBALE CITY UG

JOSHUA TUMUSIIME

S21/MUC/BSIT/013

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I **TUMUSIIME JOSHUA** declare without any reasonable doubt that the work presented in this attachment report is my own original and independent work and it has not been presented before to the faculty of Engineering Design and Technology for the award of a Bachelor of Science in Information Technology at Uganda Christian University. No part of this report shall therefore be duplicated without my prior consent and that of the university.

NAME…… **TUMUSIIME JOSHUA**… REG. NO…… **S21/MUC/BSIT/013**

SIGNATURE……  ……. DATE……**15th August, 2024**

I hereby certify that this research, conducted by Tumusiime Joshua, is an original work that has been thoroughly developed and reviewed under my supervision. It is now ready for submission to the Department of Computing, Technology, Engineering and Design for further consideration and academic evaluation.

Signature: ……  …… Date: ……01/10/2024.....

DR. EILU EMMANUEL

(SUPERVISOR)

ONLINE CRIME REPORTING MANAGEMENT SYSTEM PROJECT PROPOSAL

CHAPTER ONE

Chapter One of this project present the background information to the study highlighting the problem statement, objectives, scope and significance to the study.

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- **1.1 Background to the study**

In Mbale City, Uganda, the current approach to crime reporting and management is predominantly manual, which has resulted in significant inefficiencies. Citizens must physically visit police stations to report crimes, leading to long queues, delays in filing reports, and sometimes even discouraging individuals from reporting crimes altogether. This manual system also poses challenges for police officers in managing and processing crime reports, often leading to backlogs and reduced effectiveness in responding to criminal activities.

With the rise in crime rates and the increasing need for timely and accurate crime data, there is a pressing need for an Online Crime Reporting Management System. Such a system would streamline the process of reporting crimes, making it more accessible for citizens and more efficient for law enforcement agencies.

An Online Crime Reporting Management System is a digital platform that enables citizens to report crimes via the internet. It allows for real-time submission of crime reports, which can include detailed descriptions, evidence such as photos or videos, and the location of the incident. This system would also facilitate the tracking of the status of reported crimes, providing transparency and updates to the complainants.

According to studies by Lee and Park (2020), implementing an online crime reporting system can significantly improve public safety by enhancing the speed and accuracy of crime data collection, thus enabling law enforcement agencies to respond more swiftly and effectively. Additionally, such a system would alleviate the congestion and delays currently experienced at physical police stations, allowing police officers to focus more on crime prevention and investigation.

1.2 Problem Statement

Currently, the crime reporting process in Mbale City is highly inefficient due to its reliance on a manual, paper-based system. Citizens are required to physically visit police stations to report crimes, which often leads to long queues, significant delays, and frustration among complainants. This cumbersome process not only discourages some individuals from reporting crimes but also overwhelms the limited resources of law enforcement agencies, leading to delays in responding to and investigating reported incidents.

The manual system also lacks the ability to efficiently manage and track crime reports, making it difficult for police officers to prioritize and allocate resources effectively. As a result, critical

information may be lost or mishandled, and victims may not receive timely updates on the status of their cases.
There is, therefore, a pressing need for an Online Crime Reporting Management System that allows citizens to report crimes easily and securely from anywhere, at any time. Such a system would reduce congestion at police stations, speed up the reporting process, and provide a centralized platform for managing and tracking crime reports. This would not only improve the efficiency of law enforcement operations but also enhance public trust in the justice system by ensuring that all reported crimes are handled promptly and transparently.

1.3 Main Objective

The main objective of this study is to develop an Online Crime Reporting Management System that will enable citizens to report crimes online and allow law enforcement agencies to manage, track, and respond to these reports more efficiently. The system aims to streamline the crime reporting process, reduce congestion at police stations, and improve the overall effectiveness and transparency of law enforcement operations in Mbale City.

1.3.1 Specific Objectives

i. To study the current crime reporting and management processes used by law enforcement agencies in Mbale City in order to identify system requirements.

ii. To design an Online Crime Reporting Management System for Mbale City using the identified requirements.

iii. To implement the designed Online Crime Reporting Management System using various programming languages like PHP, MySQL, and JavaScript among others.

iv. To test and validate the Online Crime Reporting Management System to check for any errors and to ensure that it meets the user requirements and enhances the efficiency of crime reporting and management.

1.4 Scope

The Online Crime Reporting Management System will be designed and developed for use by law enforcement agencies in Mbale City to facilitate the reporting, management, and tracking of criminal activities. The system will primarily serve the citizens of Mbale City, allowing them to report crimes online, submit evidence, and receive updates on their cases.
Law enforcement officers will use the system to manage and prioritize crime reports, assign cases to relevant departments, and track the progress of investigations. While the initial implementation will focus on Mbale City, the system could potentially be extended to other regions to serve a broader area and enhance the efficiency of crime reporting and management across Uganda.
The system will interact with existing law enforcement databases and possibly integrate with national crime databases to ensure comprehensive data sharing and coordination among various

law enforcement agencies.

1.5 Significance

The current crime reporting process in Mbale City relies heavily on manual methods, which are inefficient and prone to delays. The development and implementation of an Online Crime Reporting Management System offer the following advantages:

i. **Facilitates Easy Crime Reporting:** The system allows citizens to report crimes online at any time, without the need to visit a police station, making the process more accessible and convenient.

ii. **Enhances Efficiency for Law Enforcement:** By automating the crime reporting process, the system enables law enforcement agencies to manage, prioritize, and track crime reports more effectively, leading to quicker response times and better resource allocation.

iii. **Improves Data Management and Accessibility:** The system provides a centralized platform for storing and retrieving crime reports, making it easier for law enforcement officers to access and manage case information. This reduces the risk of lost or mishandled reports.

iv. **Increases Transparency and Public Trust:** The system allows complainants to track the status of their reports and receive updates, improving transparency in the handling of cases and fostering greater trust between the public and law enforcement agencies.

v. **Reduces Congestion at Police Stations:** By enabling online crime reporting, the system reduces the need for citizens to physically visit police stations, thereby alleviating congestion and reducing waiting times for those who need in-person assistance

Literature Review of a Crime Reporting Management System

Chapter Two

Literature Review

2.0 Introduction

Chapter One presented the background information to the study highlighting the objectives, scope and significance to the study. This chapter is about the literature review of the financial management systems. It specifies what a Crime Reporting Management System is, what it needs and how it works for its enhancement.

2.1 Crime Reporting Management System (CRMS)

A Crime Reporting Management System (CRMS) is a technology-driven platform designed to facilitate the reporting, recording, management, and analysis of criminal activities. It aims to streamline the communication between the public and law enforcement agencies, improve the accuracy of crime data, and enhance the efficiency of crime management processes. The integration of information technology in crime reporting is a response to the limitations of traditional manual systems, which are often plagued by inefficiency, delays, and inaccuracies (Johnson & Mason, 2019).

2.2 Types of Crime Reporting Management Systems

2.2.1. Web-Based CRMS

Web-based CRMS platforms are accessible via internet browsers and are designed to allow citizens to report crimes online. These systems typically feature user-friendly interfaces where users can submit detailed reports of criminal incidents, upload evidence such as photos or videos, and track the status of their reports. An example of such a system is the UK's "Action Fraud" website, which allows users to report fraud and cybercrime directly online (Smith & Jones, 2020).

2.2.2. Mobile App-Based CRMS

Mobile app-based CRMS provides a convenient and portable solution for crime reporting. These apps are designed for smartphones and tablets, offering features similar to web-based systems but with added functionality such as

GPS location tagging and instant notifications. The "Citizen" app in the United States is a notable example, providing real-time crime alerts and allowing users to report incidents through their mobile devices (Brown & Davis, 2021).

2.2.3. SMS-Based CRMS

SMS-based CRMS is designed for areas with limited internet access, leveraging the ubiquity of mobile phones. Citizens can report crimes by sending text messages to a designated number, often accompanied by automated responses to gather more information. This system has been effectively implemented in various regions in Africa, where internet connectivity can be sporadic (Oluoch & Mugendi, 2020).

2.3 Other Related Systems

2.3.1 Emergency Response Management Systems (ERMS):

These systems manage the dispatch and coordination of emergency services. They often integrate with CRMS to provide a comprehensive response to reported incidents

Emergency response systems, such as the 911 service in the United States, are integral to immediate crime reporting and management. These systems provide a direct line to emergency services, ensuring rapid response to incidents. However, they often lack the detailed data collection and long-term management capabilities of CRMS (Williams et al., 2018).

Emergency Response Management Systems (ERMS) are designed to manage and coordinate the response to emergencies such as natural disasters, medical crises, and criminal incidents. These systems ensure a timely and organized response to incidents, mitigating their impact and improving public safety (Williams et al., 2018).

2.3.1.0. Case: 9/11 Emergency Response System, United States

On September 11, 2001, the 9/11 Emergency Response System in New York City was a critical component of the response efforts following the terrorist attacks on the World Trade Center. The system enabled immediate communication and coordination among first responders, including firefighters, police officers, and emergency medical personnel. The effectiveness of the system highlighted the importance of real-time communication and coordination during large-scale emergencies (Smith, 2002).

2.3.1.1. Modules

- **Incident Detection and Reporting**: Identifies and logs incidents as they occur.
- **Resource Allocation**: Manages the deployment of emergency services like police, fire, and medical units.
- **Communication**: Facilitates communication between emergency responders and command

centers.

- **Monitoring and Reporting**: Tracks incident status and generates reports.

2.3.1.2. How the System Works ERMS typically starts with the detection or reporting of an incident, followed by the allocation of appropriate resources. Communication modules ensure that all responding units are informed and coordinated. The system monitors the progress of the response and provides real-time updates and post-incident analysis.

2.3.1.1. Strengths/Benefits

- **Rapid Response**: Ensures quick deployment of emergency services.
- **Coordination**: Enhances coordination among different response units.
- **Real-Time Monitoring**: Provides real-time updates and situational awareness.

2.3.1.2. Weaknesses/Problems

- **Complexity**: Can be complex to implement and maintain.
- **High Costs**: Often involves significant financial investment for setup and training.

2.3.1.3. Conclusion: While emergency response systems are crucial for immediate incident management, they are not designed for comprehensive data management and analysis, which are strengths of dedicated CRMS.

ERMS enhance the effectiveness of CRMS by ensuring timely and coordinated emergency responses (Perry, 2013).

2.3.2 Incident Reporting Systems (IRS):

Used in various industries to report and manage incidents, these systems share similarities with CRMS but are broader in scope, often including non-criminal incidents.

Incident Reporting Systems (IRS) are platforms designed to facilitate the reporting of various types of incidents, including workplace accidents, safety hazards, and criminal activities. They aim to streamline the process of incident documentation and follow-up (Smith & Jones, 2020).

2.3.2.0. Case: Action Fraud, United Kingdom

Action Fraud is the UK's national reporting center for fraud and cybercrime. Managed by the City of London Police, Action Fraud allows citizens to report fraudulent activities online. This system has been instrumental in collecting data on fraud cases, providing law enforcement with the necessary information to investigate and combat these crimes. In 2019, Action Fraud received over 800,000 reports, showcasing its critical role in incident reporting (Jones & Williams, 2020).

2.3.2.1. Modules

- **Incident Entry**: Allows users to report incidents.
- **Incident Tracking**: Tracks the status and progress of reported incidents.
- **Data Analysis**: Analyzes incident data to identify patterns and prevent future occurrences.
- **Notification System**: Sends alerts and updates to relevant parties.

2.3.2.2. How the System Works Users report incidents through a user-friendly interface. The system then tracks the incident, updating its status and notifying relevant personnel. Data analysis modules help identify trends and generate reports to inform preventive measures.

2.3.2.3. Strengths/Benefits

- **Efficiency**: Streamlines the reporting and tracking of incidents.
- **Data-Driven Decisions**: Enables organizations to make informed decisions based on incident data.
- **Accountability**: Ensures incidents are followed up and resolved.

2.3.1.3. Weaknesses/Problems

- **Underreporting**: May suffer from underreporting if users are unaware of the system or reluctant to use it.

Data Privacy: Ensuring the privacy and security of reported data can be challenging

Conclusion: While IRS are versatile, they may lack the specific features required for efficient crime reporting and management (Johnson & Anderson, 2014).

2.3.3. Public Safety Management Systems (PSMS):

These systems encompass a range of tools and technologies used to ensure public safety, including crime reporting, traffic management, and disaster response.

Public Safety Management Systems (PSMS) integrate various functions related to maintaining public safety, including crime prevention, emergency management, and community engagement. They aim to enhance the effectiveness of public safety operations (Johnson & Mason, 2019).

2.3.3.0. Case: CompStat, New York City Police Department (NYPD)

CompStat is a performance management system used by the NYPD to reduce crime and improve public safety. Implemented in the 1990s, CompStat involves collecting and analyzing crime data to identify trends and allocate resources effectively. This data-driven approach has significantly contributed to the reduction of crime rates in New York City by enabling more strategic and proactive policing (Silverman, 2006).

2.3.3.1. Modules

- **Crime Reporting**: Allows citizens to report crimes.
- **Emergency Management**: Coordinates responses to emergencies.
- **Community Engagement**: Facilitates communication and cooperation between law enforcement and the community.
- **Data Analysis**: Analyzes public safety data to guide decision-making.

2.3.3.2. How the System Works PSMS collect data from multiple sources, including crime reports and emergency incidents. The system coordinates responses and engages with the community through various channels. Data analysis helps in strategic planning and resource allocation.

2.3.3.3. Strengths/Benefits

- **Comprehensive Approach**: Integrates multiple aspects of public safety.
- **Improved Coordination**: Enhances coordination among different public safety departments.
- **Community Involvement**: Encourages community participation in safety initiatives.

2.3.3.4. Weaknesses/Problems

- **Implementation Challenges**: Can be difficult to implement due to the need for integration across different systems.
- **Cost**: Often requires significant investment in technology and training.

Conclusion: PSMS provide a holistic approach to public safety but can be complex and costly to implement (Smith et al., 2018).

2.3.4.Community Policing Platforms (CPP)

Community policing platforms focus on fostering collaboration between police and community members to address local crime issues. These platforms may include features for reporting minor crimes, community alerts, and forums for discussion. Examples include platforms like "Next-door" in the US, which allows residents to report local issues and communicate with law enforcement (Garcia & Henderson, 2019).

Community Policing Platforms (CPPs) focus on building relationships between law enforcement and the community to collaboratively address crime and safety issues. They emphasize preventive measures and community engagement (Garcia & Henderson, 2019).

2.3.4.0. Case: Nextdoor, Various U.S. Cities

Nextdoor is a private social network for neighborhoods that has been adopted by various police departments across the United States to enhance community policing efforts. Police departments use Nextdoor to

communicate with residents about crime alerts, safety tips, and community events. For example, the San Francisco Police Department has used Nextdoor to increase community engagement and collaboration, leading to improved trust and cooperation between the police and local residents (Garcia & Henderson, 2019).

2.3.4.1. Modules

- **Reporting and Feedback**: Enables citizens to report crimes and provide feedback.
- **Community Alerts**: Sends alerts and updates to community members.
- **Discussion Forums**: Facilitates discussions between community members and law enforcement.
- **Resource Sharing**: Shares resources and information about safety measures.

2.3.4.2. How the System Works CPPs allow community members to report issues and engage in discussions through online platforms. Law enforcement can send alerts and updates, fostering a collaborative approach to community safety.

2.3.4.3. Strengths/Benefits

- **Enhanced Trust**: Builds trust between the community and law enforcement.
- **Preventive Policing**: Focuses on preventing crime through community involvement.
- **User-Friendly**: Designed to be accessible and easy to use.

2.3.4.4. Weaknesses/Problems

- **Dependence on Participation**: Relies heavily on active community participation.
- **Scope Limitations**: May not be suitable for addressing serious crimes requiring immediate response.

Conclusion: Community policing platforms emphasize community engagement and preventive measures but may not offer the structured and systematic approach to crime reporting and management provided by CRMS.

2.3.5. Integrated Law Enforcement Management Systems (ILEMS)

Integrated law enforcement management systems are comprehensive platforms used by police departments to manage all aspects of their operations, including crime reporting, case management, personnel management, and resource allocation. Systems like the "National Crime Information Center" (NCIC) in the US provide extensive databases and tools for law enforcement agencies (Miller & Roberts, 2020).

Integrated Law Enforcement Management Systems (ILEMS) are comprehensive platforms designed to

enhance the operational efficiency and effectiveness of law enforcement agencies. These systems integrate various functions such as crime reporting, case management, personnel management, and resource allocation into a single, cohesive platform. The primary goal of ILEMS is to streamline police operations, improve data accuracy, and facilitate better decision-making (Miller & Roberts, 2020).

2.3.5.0. Case: National Crime Information Center (NCIC), United States

The NCIC, managed by the FBI, is an integrated database system that provides criminal justice agencies with access to a wide range of criminal records, including stolen property, missing persons, and criminal histories. The NCIC is used by law enforcement agencies across the United States to share information and coordinate efforts. It has been pivotal in solving crimes, apprehending fugitives, and enhancing the overall efficiency of law enforcement operations (Miller & Roberts, 2020).

2.3.5.1. Modules of ILEMS

ILEMS typically consist of several interconnected modules, each focusing on a specific aspect of law enforcement operations:

1. **Crime Reporting**: Allows for the electronic submission and recording of crime reports from both citizens and officers.
2. **Case Management**: Manages the lifecycle of criminal cases, from initial report to investigation and resolution.
3. **Personnel Management**: Handles the administration of police personnel, including scheduling, training, and performance evaluations.
4. **Resource Allocation**: Manages the distribution and utilization of resources such as vehicles, equipment, and personnel.
5. **Data Analysis and Reporting**: Provides tools for analyzing crime data, generating reports, and identifying trends and hotspots.
6. **Communication and Collaboration**: Facilitates communication within the department and with other agencies, improving coordination and response times.

2.3.5.2. How the System Works

ILEMS integrate data from various sources and modules, creating a centralized database that law enforcement officers and administrators can access in real-time. When a crime is reported, the system logs the details and assigns a case number. Investigators can update the case status, add notes, and upload evidence, all of which are stored in the centralized system. Resource allocation modules help ensure that the necessary personnel and equipment are assigned to each case. Data analysis tools allow administrators to generate reports and analyze crime patterns, aiding in strategic decision-making (Miller & Roberts, 2020).

2.3.5.3. Strengths/Benefits of the System

1. **Operational Efficiency**: By integrating various functions into a single platform, ILEMS streamline

operations and reduce the administrative burden on law enforcement personnel (Miller & Roberts, 2020).

2. **Improved Data Accuracy**: Centralized data management ensures that information is consistent and up-to-date, reducing errors associated with manual data entry (Johnson & Mason, 2019).
3. **Enhanced Decision-Making**: Advanced data analysis tools enable law enforcement agencies to identify crime trends, allocate resources effectively, and make informed decisions (Miller & Roberts, 2020).
4. **Better Coordination**: Communication and collaboration modules improve coordination within the department and with other agencies, leading to faster response times and more efficient operations (Williams et al., 2018).

2.3.5.4. Weaknesses/Problems of the System

1. **Complexity and Cost**: ILEMS are often complex systems that require significant investment in terms of both time and money for implementation and maintenance. This can be a barrier for smaller law enforcement agencies with limited budgets (Miller & Roberts, 2020).
2. **Training Requirements**: The complexity of ILEMS necessitates extensive training for personnel to use the system effectively. This can be resource-intensive and time-consuming (Miller & Roberts, 2020).

2.4 Comparison of related systems

Table 1: Comparisons for the Related Systems

System Type	Strengths	Weaknesses	Technology Used
ERMS	Immediate response to emergencies, High reliability and quick action, Well-integrated with emergency services	Limited long-term data management. Primarily reactive, not preventive. Limited scope for detailed crime analysis	Direct lines (e.g., 911) Radio communication, dispatch systems. GPS and real-time tracking
IRS	Facilitates detailed incident documentation. Improves accuracy and detail of reports.	Often limited to specific types of incidents. May not be integrated with broader law enforcement systems.	Web-based platforms, mobile apps. Database management systems. Cloud storage and data analytics

	Allows for attachment of multimedia evidence.	Can be underutilized without proper awareness and training	
PSMS	Comprehensive management of public safety resources. Enhances coordination among various public safety departments. Supports strategic planning and resource allocation.	Complexity and high cost of implementation. Requires significant training for effective use. Potential data privacy and security concerns	Integrated software solutions. Real-time data integration and dashboards. Predictive analytics, GIS mapping
CPP	Encourages community engagement and trust, Focus on preventive measures and community collaboration, User-friendly and accessible	Limited data management capabilities, Dependent on active community participation, may not handle serious crime reporting effectively	Web-based platforms, social media integration, Mobile apps with notification systems, Discussion forums, real-time alerts
ILEMS	Comprehensive management of all law enforcement operations, Powerful tools for data, analysis and case management, Enhances operational efficiency and resource allocation.	High complexity and implementation costs, Requires extensive training for personnel, Integration challenges with existing systems	Advanced databases and interconnected modules, Secure and scalable IT infrastructure, Real-time data processing, personnel management software

2.5 Conclusion

This chapter mainly described the literature review of the online financial transfer management systems where we gathered information about other related systems, how they function and the enhancements needed in order to improve the current Crime Reporting Management System.

Chapter three

Research methodology

3.0. Introduction

The methodology focuses on the patterns of research, approaches to data collection, techniques for analysis and tools that were used for designing and implementation of the system. The Methodology was in line with the specific objectives of the proposed Online Crime Reporting Management System.

3.1. System Study and Analysis

The system study and analysis phase of developing a Crime Reporting Management System (CRMS) involves a comprehensive examination of the current processes, identification of requirements, feasibility analysis, and formulation of a solution that meets the needs of all stakeholders.

3.1.1. System Study:

The system study involves understanding the existing system, its limitations, and the requirements of the new system. The existing system is predominantly manual, with crime reporting and management processes relying on physical paperwork and face-to-face interactions. This can lead to inefficiencies, delays, and issues with data retrieval and analysis.

The proposed system aims to digitize the entire process, providing an online platform for crime reporting, centralized data storage, and real-time case management. It addresses the limitations of the manual system by offering accessibility, efficiency, and improved data management.

3.2. Data Collection Techniques

Data collection is critical to understand the needs and expectations of the stakeholders, and to gather the necessary information for system design and development. Various techniques are used to collect data:

3.2.1. Interviews: Conduct interviews with police officers, administrative staff, and citizens to gather qualitative data about the current process, pain points, and desired features.

3.2.2. Surveys: Distribute questionnaires to a larger audience to collect quantitative data on the usage patterns, satisfaction levels, and requirements.

3.2.3. Observation: Observe the existing crime reporting and management processes in police stations to understand workflow, data handling, and interactions.

3.2.4. Document Review: Analyze existing documents such as crime reports, case files, and administrative records to understand the data structure and information flow.

3.3. Data Analysis Methods

Data analysis involves processing the collected data to extract meaningful insights and identify patterns. Various methods can be employed:

3.3.1. Descriptive Analysis: Summarize the data using statistics such as averages, percentages, and frequencies to understand the general trends and patterns.

3.3.2. Qualitative Analysis: Analyze interview and observation notes to identify common themes, issues, and suggestions.

3.3.3. Comparative Analysis: Compare the current system with best practices and similar systems in other regions to identify gaps and areas for improvement.

3.4. System Analysis and Design

The analysis and design of the system was done by clearly identifying the inputs, the processes that transform the inputs into outputs while satisfying the system constraints. Data flow diagrams and entity relationship diagrams were used to clearly demonstrate the processes of data transfer in the system as well as the relationship among entities in the system respectively.

3.4.1. System Analysis

Systems analysis is the process of identifying and summarizing data with the intent to extract useful information and develop conclusions. In system analysis requirements were determined. The requirements included functional and non-functional base on the system study.

3.4.1.1. Functional Analysis:

Functional analysis involves identifying the core functionalities that the system must perform. For a CRMS, these functionalities include:

3.4.1.1.1. User Management: Registration, authentication, and role-based access control for different users (citizens, police officers, administrators).

3.4.1.1.2. Crime Reporting: Allow citizens to report crimes through an online form, capturing details such as location, type of crime, description, and date.

3.4.1.1.3. Case Management: Enable police officers to view, update, and manage reported cases, including assigning cases to officers and updating the status of investigations.

3.4.1.1.4. Notifications: Send automated notifications to relevant users about case updates, critical alerts, and reminders.

3.4.1.1.5. Data Analysis: Provide tools for generating reports and analyzing crime data trends for strategic planning and decision-making.

3.4.1.2. Non-Functional Analysis:

Non-functional requirements define the quality attributes of the system, such as:

3.4.1.2.1. Performance: The system should handle multiple concurrent users and large volumes of data efficiently.

3.4.1.2.2. Security: Ensure data privacy and protection against unauthorized access with encryption, secure authentication, and access controls.

3.4.1.2.3. Usability: Design user-friendly interfaces for ease of use by citizens and police officers.

3.4.1.2.4. Reliability: Ensure high availability and minimal downtime with robust infrastructure and backup systems.

3.4.2. System Design

3.4.2.1. Process Modeling:

Process modeling involves mapping out the workflows and processes within the system. Techniques such as flowcharts, Data Flow Diagrams (DFDs), and Business Process Model and Notation (BPMN) can be used to represent the processes visually. This helps in understanding the flow of information, identifying bottlenecks, and designing efficient workflows.

3.4.2.2. Data Modeling:

Data modeling involves defining the structure of the database that will store the information. Entity-Relationship Diagrams (ERDs) are used to represent the data entities, their attributes, and the relationships between them. For a CRMS, entities might include Users, Crime Reports, Cases, Police Stations, and Updates. Data modeling ensures that the database is well-organized, scalable, and supports the required functionalities.

3.5. System Implementation

This is whereby the physical realization of the database and the application design was done. This involved the implementation of both the database and the application programs. It was achieved using the Data Definition Language (DDL) of the selected Database Management System (DBMS).

3.5.1. Implementation Tools:

3.5.1.1. Programming Languages: Languages like PHP, JavaScript, and Python can be used for developing the application. PHP is often used for server-side scripting, while JavaScript handles client-side interactions.

3.5.1.2. Database Management Systems: MySQL or MariaDB can be used for database management, providing reliable and scalable solutions for data storage and retrieval.

3.5.1.3. Web Frameworks: Frameworks such as Laravel (PHP) or Django (Python) can speed up development by providing pre-built components and structure.

3.5.1.4. Version Control: Tools like Git ensure version control, allowing multiple developers to work on the project simultaneously and track changes.

3.5.1.5. Development Environment: Integrated Development Environments (IDEs) like Visual Studio Code or Php-Storm provide robust development tools and debugging capabilities.

3.6. System Testing and Validation

3.6.1. Testing:

Testing ensures that the system functions correctly and meets the specified requirements. Different types of testing include:

3.6.1.1. Unit Testing: Test individual components or modules for correctness.

3.6.1.2. Integration Testing: Ensure that different modules work together as expected.

3.6.1.3. System Testing: Test the entire system as a whole to verify that it meets the requirements.

3.6.1.4. User Acceptance Testing (UAT): Involve end-users in testing to ensure the system meets their needs and is user-friendly.

3.6.2. Validation:

Validation involves checking that the system meets the needs and expectations of the stakeholders. It includes:

1. Requirement Validation: Ensure that all requirements are correctly implemented.

2. Performance Validation: Test the system under load to ensure it performs well with multiple concurrent users.

3. Security Validation: Conduct security audits and penetration testing to identify and fix vulnerabilities.

3.6.3. Conclusion

Developing a Crime Reporting Management System involves thorough system study and analysis to understand current processes and requirements, effective data collection and analysis to inform design decisions, comprehensive system analysis to define functional and non-functional requirements, detailed process and data modeling for efficient design, and careful implementation using appropriate tools. Rigorous testing and validation ensure that the system

meets the specified requirements and provides a reliable, secure, and user-friendly solution for crime reporting and management.

Chapter Four

System Study, Analysis and Design

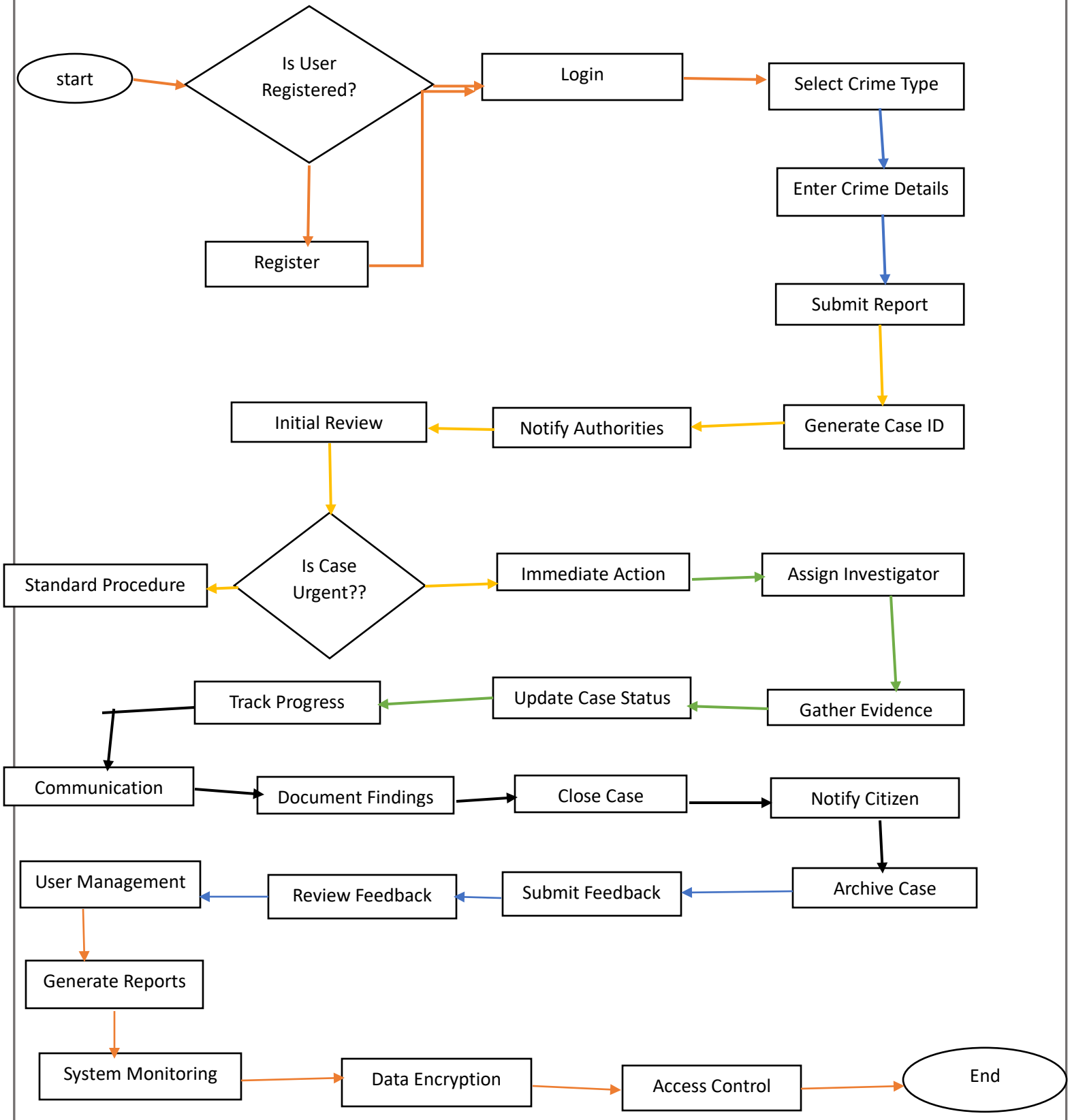
This chapter concerns the study of the existing system, analysis of the requirements for the system, process and data modeling

4.1 The study of the Existing System

The study of a Crime Reporting Management System (CRMS) involves a thorough examination of the current processes used for reporting and managing crime incidents. This includes analyzing how data is collected, processed, and stored within the system. By conducting interviews with law enforcement officials, reviewing existing documentation, and observing system usage in real-time, researchers can identify both the strengths and weaknesses of the current CRMS. This study often highlights challenges such as inefficient data handling, delayed response times, and user dissatisfaction, which can hinder the effectiveness of crime management. The goal is to gain a comprehensive understanding of the system's performance and its impact on law enforcement operations, which will guide the development of recommendations for improvement.

The design of an enhanced CRMS focuses on addressing the identified shortcomings while leveraging modern technology to improve system efficiency, usability, and security. A well-structured system design includes a user-friendly interface, robust data encryption methods, and seamless integration with other law enforcement databases. The system should allow for real-time crime reporting, automated case management, and efficient data retrieval. Additionally, it must be scalable to handle varying volumes of crime reports and adaptable to different jurisdictions. The design phase also emphasizes the importance of user training and support to ensure that the system can be effectively utilized by all stakeholders, ultimately leading to more efficient crime management and improved public safety.

4.1.1 Workflow for the Crime Reporting Management System



4.1.2 Strength of the existing System

1. Improved Accessibility:

- **Multiple Reporting Channels:** The existing CRMS allows citizens to report crimes through various channels, such as online forms, mobile apps, or in-person at police stations. This improves accessibility and encourages more people to report crimes, contributing to higher crime detection rates.

2. Efficient Data Management:

- **Centralized Database:** A centralized database allows for the efficient storage and retrieval of crime reports, evidence, and case files. This reduces redundancy and ensures that all relevant information is easily accessible to authorized personnel.

3. Real-Time Updates:

- **Timely Case Tracking:** The system provides real-time updates on the status of crime reports, enabling law enforcement agencies to monitor ongoing investigations and make informed decisions promptly. This enhances coordination among different departments and ensures that cases are handled efficiently.

4. Enhanced Accountability:

- **Audit Trails:** The existing CRMS often includes features like audit trails, which record all actions taken within the system. This ensures transparency and accountability, as it is easier to track who accessed or modified data, and when these actions occurred.

5. Streamlined Workflow:

- **Automated Processes:** Many existing CRMSs automate routine tasks such as categorizing crime reports, assigning cases, and notifying relevant parties. This reduces the administrative burden on law enforcement officers and speeds up the overall crime management process.

6. Data Security:

- **Secure Access:** The system typically employs robust security measures, such as user authentication and data encryption, to protect sensitive information. This ensures that crime reports and personal data are secure from unauthorized access.

These strengths contribute to the effectiveness of the CRMS, enhancing the ability of law enforcement agencies to manage crime reporting and investigations efficiently.

4.1.3 Weakness of existing System

1. Limited User-Friendliness:

- **Complex Interface:** The existing system may have a complicated or non-intuitive user interface, making it difficult for users—especially those who are not tech-savvy—to navigate and use effectively. This can lead to errors in data entry and frustration among users.

2. Insufficient Integration:

- **Lack of Interoperability:** The CRMS may not be well-integrated with other critical systems, such as national databases, forensic systems, or other law enforcement agencies' platforms. This lack of integration can lead to data silos, requiring manual data transfer and increasing the risk of errors.

3. Inadequate Scalability:

- **Limited Capacity:** The system may struggle to handle high volumes of crime reports or scale effectively as the demand for its services grows. This can lead to slow processing times, system crashes, or delays in case management.

4. Data Security Concerns:

- **Vulnerabilities:** If the CRMS lacks advanced security measures, it may be vulnerable to cyberattacks, unauthorized access, or data breaches. This is especially critical given the sensitive nature of the information stored within the system.

5. Poor Data Validation:

- **Inconsistent Data Quality:** The existing system might not have robust data validation mechanisms, leading to the input of incomplete or inaccurate information. This can result in incorrect categorization of crimes, misassigned cases, or flawed reports, undermining the system's overall reliability.

6. Limited Reporting and Analytics:

- **Weak Analytical Capabilities:** The system may lack comprehensive reporting and analytical tools, making it difficult for law enforcement to generate insights from the data. This can hinder strategic decision-making, resource allocation, and trend analysis.

7. Inadequate User Support and Training:

- **Lack of Training Resources:** Users may not receive sufficient training or support to effectively use the CRMS, leading to underutilization of the system's features or misuse. This can reduce the system's overall efficiency and effectiveness.

8. Limited Mobile Support:

- **Inaccessibility on Mobile Devices:** If the system does not have a mobile-friendly interface or app, it limits the ability of users to report crimes or access the system on-the-go, reducing its accessibility and responsiveness.

These weaknesses highlight areas where the existing CRMS may fall short in meeting the needs of law enforcement agencies and the public, pointing to opportunities for system improvement or redevelopment.

4.2 Data analysis results

Researchers employed various data collection techniques, such as interviews, questionnaires, observations, and document reviews, to gather and analyze information on the current Crime Reporting Management System (CRMS). The analysis revealed several challenges associated with the system. Among the most significant issues were delays in processing crime reports, which led to frustration among users and slowed down the investigation process. Additionally, the system experienced congestion during peak usage times, resulting in slow performance, extended processing times, and occasional system crashes. Users also reported inefficiencies in case management, including misassignments and a

lack of timely follow-up, which further delayed the resolution of cases. Moreover, accessibility issues were identified, particularly in rural or remote areas where internet connectivity and technological infrastructure are limited. These challenges were highlighted in the data analysis, which was represented in tables and graphs to facilitate easier interpretation and provide clear insights into the areas requiring improvement within the CRMS.

4.2.1 The tabular representation of the challenges associated with the current Crime Reporting management system

Table 1: Challenges Associated with the Current Crime Reporting Management System

Challenge	Description	Frequency (%)	Impact Level
Delays in Processing Crime Reports	Slow processing of crime reports causing delays in investigations	**45%**	High
System Congestion	High usage periods causing system slowdowns and crashes	**30%**	Medium
Inefficient Case Management	Misassignments and lack of timely follow-up on cases	**15%**	Medium
Limited Accessibility for Users	Difficulty accessing the system, especially in remote areas	**10%**	Low

In this table:

- **Frequency (%)** represents the percentage of users or instances where this challenge was reported.
- **Impact Level** indicates the severity of the challenge on the overall system's performance.

This table gives a clear statistical representation of the key challenges, providing insight into their prevalence and severity within the current CRMS.

4.2.2 The Graphical Representation of the Challenges faced by the current Crime management system.

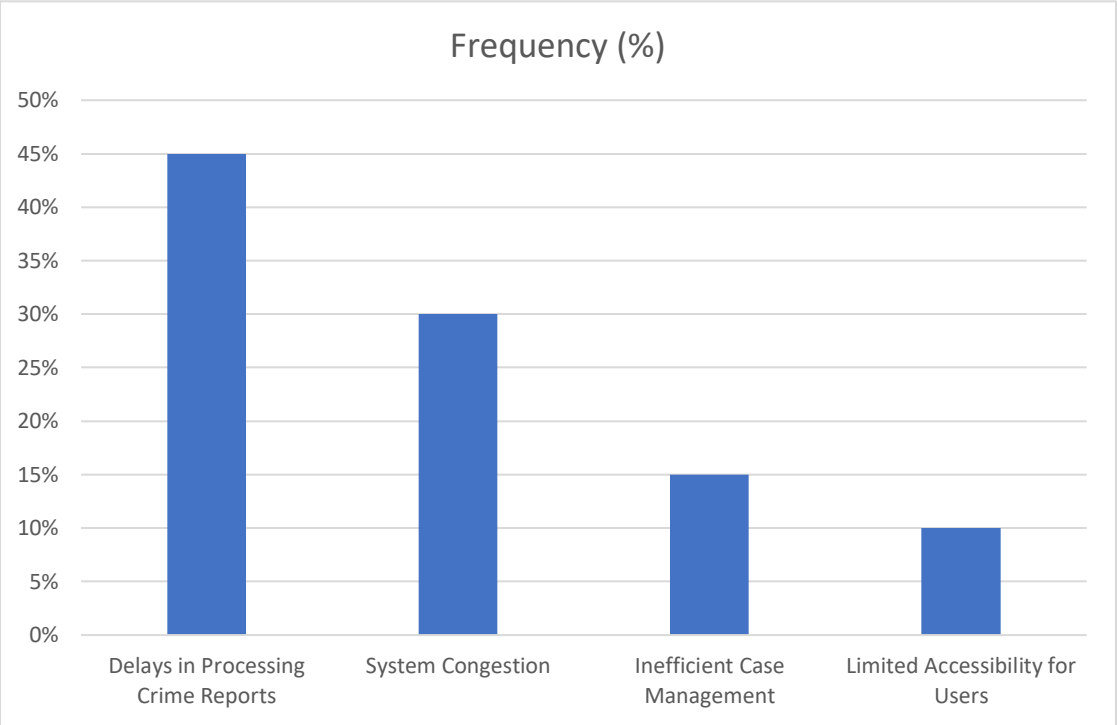


Figure 4. 1: A graphical presentation of the challenges faced by the current crime reporting management system.

4.2.1 User Requirements

These are statements, in a natural language, of what services the system is expected to provide and the constraints under which it must operate. Below are the user requirements for the system;

- **User Registration and Authentication:** The system should allow users to create accounts, log in securely, and manage their profiles. Different roles (e.g., citizen, police officer, admin) should have varying access levels.

- **Crime Reporting:** Users should be able to report crimes through an online form, providing detailed information and uploading evidence like photos or documents.

- **Incident Management:** The system should enable police officers to review, assign, and manage crime reports. It should track the status and progress of each case.

- **Communication and Notifications:** Users should receive notifications (via email or SMS) about updates to their reports. The system should also facilitate communication between users and law enforcement.

• **Data Security and Privacy:** The system must ensure that all user data is securely stored and accessed only by authorized personnel, adhering to data protection regulations.

• **Search and Filtering:** Users and administrators should be able to search and filter crime reports based on various criteria, such as date, location, and type of crime.

• **Reporting and Analytics:** The system should generate reports and analytics on crime data, helping administrators monitor trends and allocate resources effectively.

• **Location Tracking:** The system should integrate with mapping services to allow users to report the exact location of crimes and for authorities to visualize crime hotspots.

• **Mobile Accessibility:** The system should be accessible via mobile devices, with a responsive design or dedicated app to allow users to report crimes on the go.

• **User Support and Help:** The system should provide a help section with FAQs and user guides, as well as support channels for users needing assistance.

4.2.2 Functional requirements

A Functional requirement is a description of activities and services that the Online Crime Reporting Management System provides in terms of proceeding and data handling. So according to the tools used to collect data from the users, the following functional requirements were met;

1. **User Registration and Login:**

- The system allows users to create accounts and log in securely with unique credentials.
- Different user roles (e.g., citizen, police officer, admin) are supported.

2. **Crime Report Submission:**

- Users can submit detailed crime reports through an online form.
- The system accepts file uploads, such as photos, videos, or documents, as evidence.

3. **Incident Management:**

- The system enables police officers to review, assign, and update the status of crime reports.
- An incident history log is maintained for each reported crime.

4. **Notification System:**

- Users receive automated notifications about the status of their reports via email or SMS.
- The system alerts relevant authorities in case of critical incidents.

5. **Search and Filtering:**

- The system provides a search function to find specific crime reports.
- Users can filter reports by criteria such as date, location, or type of crime.

6. **Reporting and Analytics:**

- The system generates reports and analytics on crime data.
- Administrators can view dashboards displaying crime trends and statistics.

7. **Data Security and Privacy:**

- The system ensures secure storage and access to user data.
- Encryption and access controls are implemented to protect sensitive information.

8. **Location Tracking:**

- The system integrates with mapping services to track and display the location of reported crimes.
- Users can report crimes by selecting locations on a map.

9. **Mobile Accessibility:**

- The system is accessible via mobile devices, with a responsive design or dedicated app.
- Users can report crimes and check status updates on the go.

10. **User Support:**

- The system provides a help section with FAQs and user guides.
- Support channels are available for users' needing assistance.

4.2.3 Non-functional requirements

A non-functional requirement is description of other features, characteristics and constraints that define the satisfactory of the system therefore it describes how the Online Crime Reporting Management System was to perform. Some of these requirements which were considered during the design of the system include;

I. **Performance:**

- The system should be able to handle multiple simultaneous users without significant slowdowns.
- Crime reports should be processed and stored within a few seconds of submission.

II. **Scalability:**

- The system should be scalable to accommodate an increasing number of users and reports over time.
- It should support the integration of additional features and modules in the future.

III. **Security:**

- The system must ensure the confidentiality, integrity, and availability of all user data.
- Strong authentication and encryption mechanisms should be implemented to prevent unauthorized access.

IV. **Usability:**

- The user interface should be intuitive and easy to navigate for all user roles.
- The system should provide clear instructions and feedback to users during each interaction.

V. **Reliability:**

- The system should be highly reliable, with minimal downtime or disruptions.
- It should have mechanisms for data backup and recovery in case of failures.

VI. **Compatibility:**

- The system should be compatible with various web browsers and operating systems.
- It should also function smoothly on mobile devices, including smartphones and tablets.

VII. **Maintainability:**

- The system should be designed for easy maintenance and updates.
- The codebase should be well-documented to facilitate future modifications and bug fixes.

VIII. **Accessibility:**

- The system should be accessible to users with disabilities, adhering to relevant accessibility standards (e.g., WCAG).
- It should support screen readers and provide alternative text for images and multimedia content.

IX. **Availability:**

- The system should be available 24/7 with minimal downtime for maintenance.
- It should have redundancy and failover mechanisms to ensure continuous operation.

X. **Response Time:**

- The system should provide quick response times for user interactions, with pages loading within a few seconds.

- Critical operations, like submitting a crime report, should complete within a reasonable time frame.

XI. **Auditability:**

- The system should maintain detailed logs of user actions for auditing and monitoring purposes.
- Administrators should be able to generate audit reports as needed.

XII. **Localization:**

- The system should support multiple languages and regional settings to accommodate users from different locations.
- It should be adaptable to the cultural and legal requirements of various regions.

4.2.4 System requirement

The system requirement includes requirements that are needed to include certain functionality in the system. It involved describing the system and the properties in that system. They include the hardware and software requirements as follows;

4.2.4.1 Hardware Requirements

Table 2: Hardware requirements

Hardware component	**System requirement**	**Justification**
Processor	Minimum: Intel Core i3 or equivalent Recommended: Intel Core i5 or higher	Ensures the system can handle basic operations and processing tasks. Provides faster processing for smoother performance under load.
RAM	Minimum: 4 GB Recommended: 8 GB or higher	Sufficient for basic multitasking and handling of smaller data loads. Allows for efficient multitasking and handling larger data processes.
Storage	Minimum: 500 GB HDD	Provides adequate space for system files, applications, and data storage. Offers faster access to data and

	Recommended: 1 TB HDD or SSD	additional storage capacity for large datasets.
Network	Minimum: Ethernet (100 Mbps) Recommended: Ethernet (1 Gbps) or Wi-Fi 6	Basic network speed sufficient for regular data transfers and communication. Ensures faster data transfer speeds, better connectivity, and supports higher network traffic.
Display	Minimum: 17 monitor with 1280x1024 resolution Recommended: 20 monitor with 1920x1080 resolution	Offers a better visual experience and more screen real estate for complex tasks. Offers a better visual experience and more screen real estate for complex tasks.
Backup Power	Minimum: 600 VA UPS Recommended: 1000 VA UPS	Provides basic protection against power interruptions, ensuring minimal data loss. Offers extended backup time and protection for critical system operations during power outages.

4.2.4.2 Software Requirements

Table 3: Software requirements

Software Component	System Requirement	Justification
Operating System	Windows 10 or later, Linux (Ubuntu 18.04 or later)	Provides a stable and secure environment for running the system. Supports necessary software and development tools.
Web Server	Apache 2.4 or Nginx	Reliable and widely-used web servers for hosting the application. Supports PHP and handles HTTP requests efficiently.
Database Management System	MySQL 5.7 or later, or PostgreSQL 11 or later	Provides a robust and scalable database system for storing and managing crime report data.
Programming Language	PHP 7.4 or later, HTML5, CSS3, JavaScript	Core languages for building and styling the web application, ensuring

		compatibility with the web server and database.
Frameworks	Bootstrap 4 or later, Laravel 7 or later (if using MVC framework)	Ensures responsive design and efficient development with MVC architecture, enhancing user experience and maintainability.
Browser	Google Chrome, Mozilla Firefox, Microsoft Edge (latest versions)	Modern browsers with full support for HTML5, CSS3, and JavaScript, ensuring compatibility and performance.
Email Server	Sendmail, Postfix, or SMTP service (e.g., Gmail SMTP)	Required for sending notifications and communication between the system and users.
Security Tools	SSL/TLS Certificate, Firewall, Antivirus Software	Ensures secure communication, protects data integrity, and defends against unauthorized access and malware.
Version Control	Git, GitHub or GitLab	Facilitates collaboration, version tracking, and code management throughout the development lifecycle.
Development Tools	Visual Studio Code, PhpStorm, or similar IDE	Provides a rich development environment with debugging, syntax highlighting, and other essential features for efficient coding.

4.3 System Design

In the system design phase, process modeling involved use of Data Flow Diagrams (DFD), and Data modeling involved use of Entity Relationship Diagrams (ERD).

4.3.1 Architectural Design for the System

The architectural design shows how the OFTMS is comprised of the different subsystems namely Data collection, Data Processing, Data Storage and Data Display. The figure below shows an architectural diagram of the Online Crime Reporting Management System.

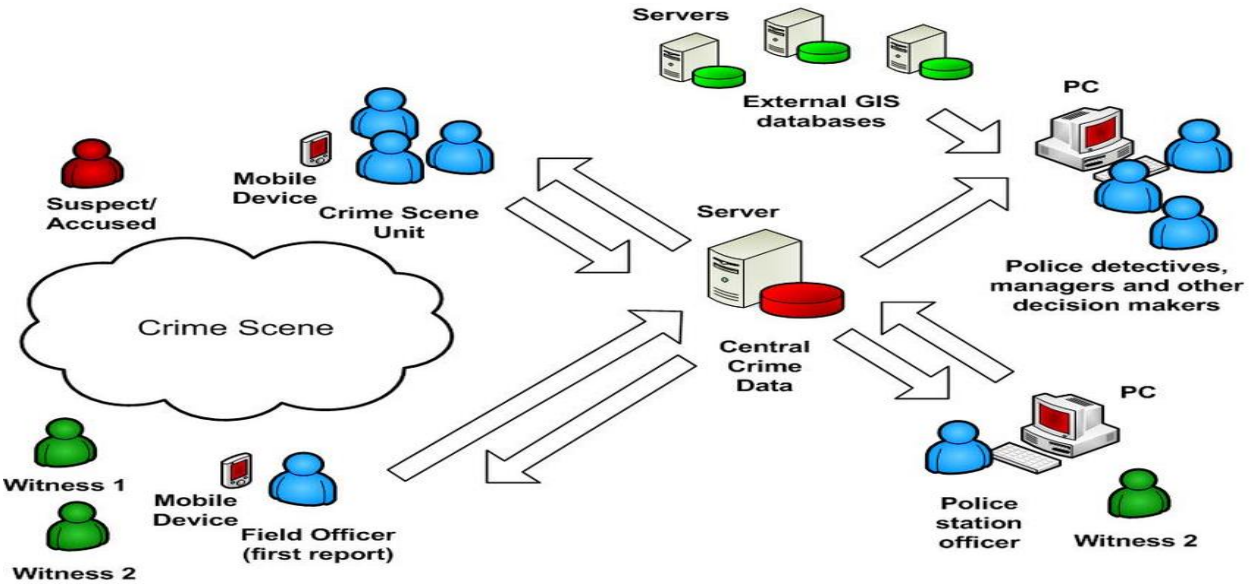
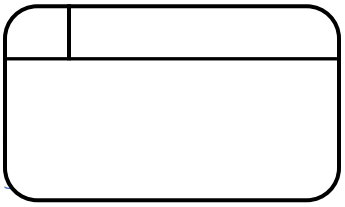


Figure 4. 2: The Architectural Design for a Crime Reporting management system

4.3.2 Process Modeling

These show how information or data will be moving around the Crime Management System from the entry to various repositories or data stores.

4.3.2.1 Key Symbols

Symbol	Name
	External entity
	Data store
	Data flow
	

Process

Description of the above key symbols;

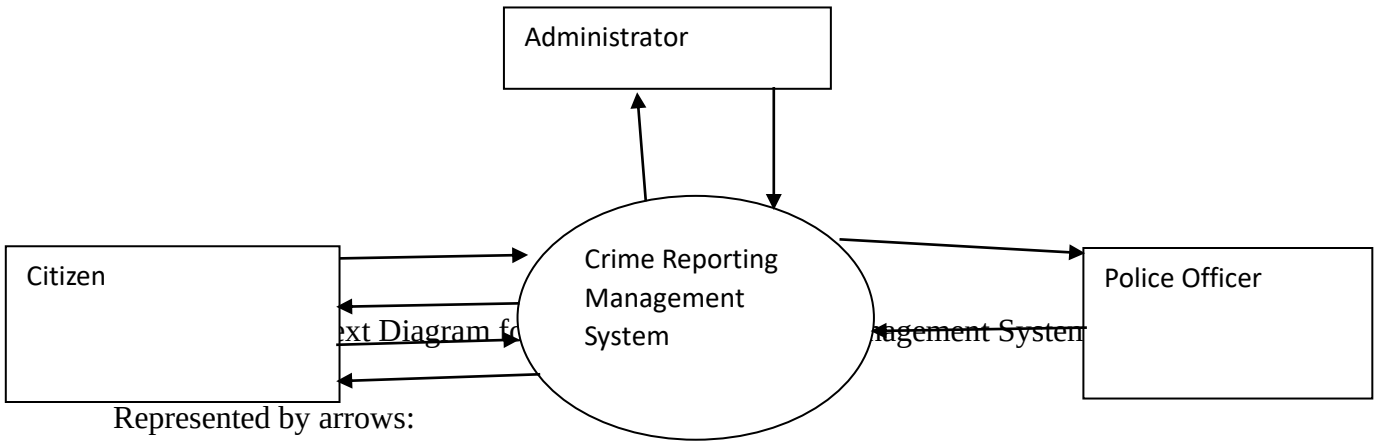
i. An Entity is a real life object with an independent existence that interacts with the system.
ii. Data store shows where data is stored after being processed. This can be a database or a file.
iii. Data flow shows the movement of data within the system and also connects processes, data stores and external entities.
iv. A Process is a series of activities or actions to accomplish a desired task.

4.3.3 Data Flow Diagrams (DFD).

It is one of the most important modeling tools used by system analysts. It is used to illustrate how data flows in a system. DFD's use a number of symbols to represent systems. There are four kinds of symbols. These are used to represent four kinds of system components. Processes, data stores, data flows and external entities.

4.3.3.1 The Context Level DFD

A Context Level Data Flow Diagram (DFD) provides an overview of the entire Crime Reporting Management System by illustrating the system's interactions with external entities. The context-level DFD is also known as a Level 0 DFD and includes the main process, external entities, and data flows between them.



xt Diagram fo ngement Syste

Represented by arrows:

- From Citizen to the system: Report Crime.
- From the system to Citizen: Crime Report Acknowledgment.

- From Citizen to the system: Status Update Request.
- From the system to Citizen: Status Update.
- From the system to Police Officer: Review Crime Reports.
- From Police Officer to the system: Update Report Status.
- From Administrator to the system: System Management.
- From the system to Administrator: Reports and Analytics.

In figure 4.3: user logs into the online crime reporting management system and when user is authenticated, can requests for resources and the feedback is then sent to the user. The administrator also logs into the system and when authenticated can query for data and receives immediate feedback.

4.3.3.2 The Level 1 DFD for the Crime Reporting Management System

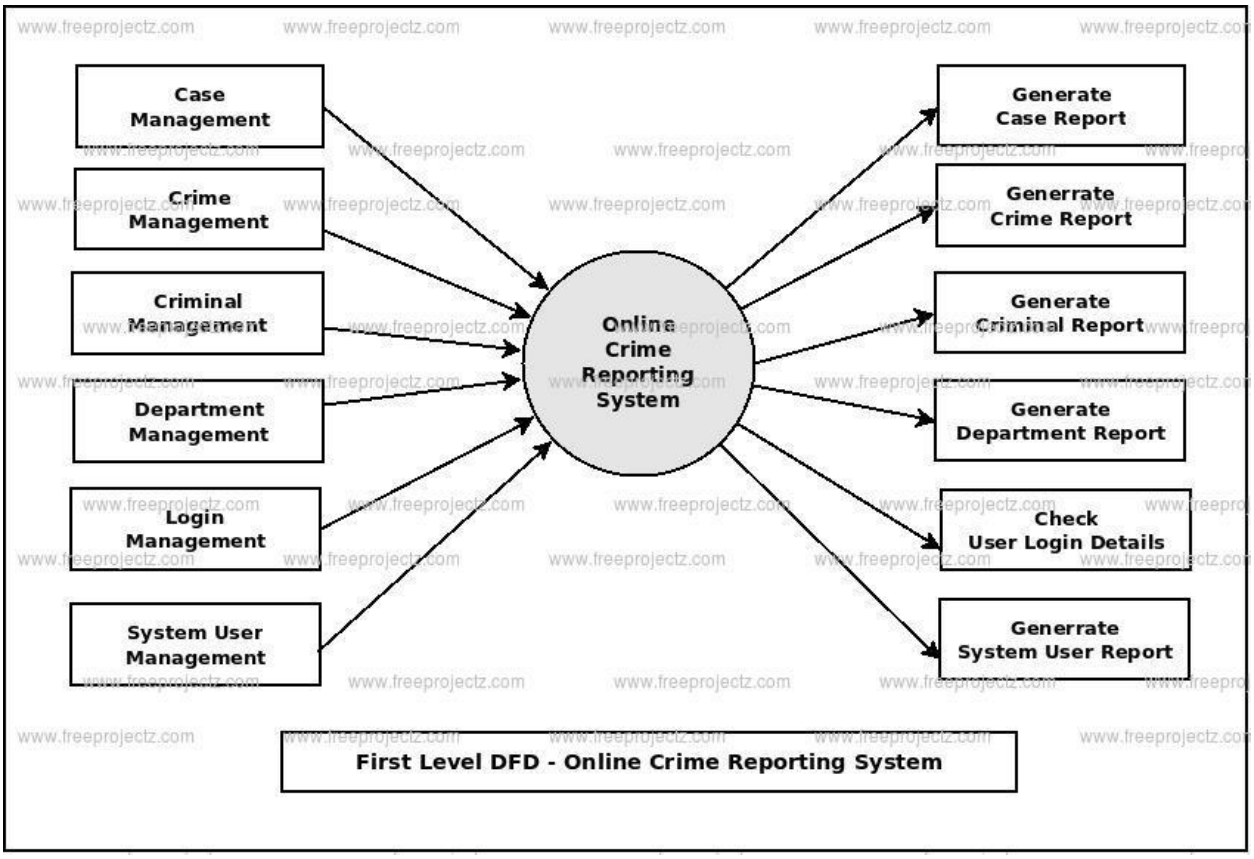


Figure 4. 4: Level 1 DFD for the Online Crime Reporting Management System

Description for the level 1 DFD

In this subsection, there are tables describing all the design objects used in developing the system. They include Processes, Data flows, Data stores and the External entities.

Description for Processes

Table 4: Description of Processes

Process	Description
Crime Report Filing	The process of receiving and documenting a new crime report. This includes completing the report form, gathering initial details, and filing the report in the Crime Report Files.
Initial Investigation	Preliminary investigation of the crime, including visiting the crime scene, collecting initial evidence, and interviewing witnesses. Notes and findings are recorded in the Investigation Notes.
Victim and Suspect Identification	Gathering and recording personal information about victims and suspects involved in the crime report. This information is stored in Victim and Suspect Records.
Case Assignment	Assigning a case to a law enforcement officer or department for further investigation. Officer details and case assignments are recorded in Officer Files and Department Records.
Ongoing Investigation	Continuous investigation activities, including follow-up interviews, evidence collection, and analysis. Updates and actions are recorded in Case Logs.
Evidence Management	Handling and documenting physical evidence related to the crime, including collection, storage, and maintaining chain of custody. Evidence Records are updated accordingly.
Case Review	Periodic review of ongoing cases to assess progress, update case status, and ensure proper handling of evidence and documentation.
Case Resolution	Finalizing the case once the investigation is complete. This includes closing the case, filing final reports, and archiving all related documents and evidence.
Reporting and Documentation	Preparing and maintaining various reports and documents related to the crime, investigation, and case outcome. This includes generating summaries, reports for legal proceedings, and administrative documentation.

Description of Data Stores

Table 5: Description for Data stores

Data Store	Description
Crime Report Files	Physical files or folders containing detailed records of each reported crime, including report forms, investigation notes, witness statements, and attachments.
Victim and Suspect Records	Files or folders with personal information about individuals involved in crime reports, such as names, addresses, contact details, and criminal history.
Officer Files	Records or files containing details about law enforcement officers, including personal information, case assignments, and any reports or logs they have created.
Department Records	Records related to the various departments within the law enforcement agency, including department details and case assignments.
Case Logs	Handwritten or typed logs tracking updates and activities for each crime report, including log entries, dates and times, and the officers involved.
Evidence Records	Records documenting physical evidence collected from crime scenes, including descriptions, storage locations, and chain of custody information.

Description for External Entities

Table 6: Description of External Entities

Entity	Description
Complainant	The complainant is an individual who reports a crime to the police. They provide personal information, crime details, and any relevant evidence to the system.
Police Department	The Police Department receives crime reports, assigns officers to cases, conducts investigations, and maintains records of crime reports and investigations.
Court	The Court system handles the prosecution of criminal cases, receiving investigation reports and evidence from the Police Department for legal proceedings.
Witness	A witness provides testimony or evidence related

	to a crime, supporting the investigation and prosecution of a case.
Victim	The victim is the individual or entity harmed by a crime. They may provide information about the crime and participate in legal proceedings.

4.3.4 Identification of Entities and their Attributes

Table 7: Identification for Entities and their Attributes

Entity	Description	Attributes
Complainant	The individual who physically visits a police station to report a crime. This entity includes all personal details and the details of the complaint they provide.	- `Complainant ID` (assigned manually or through a physical logbook) - `Name` - `Address` - `Phone Number` - `Identification Type` (e.g., ID Card, Passport) - `Identification Number`
Crime Report	A physical form or document where the complainant provides details of the crime. This report is filled out by the complainant or a police officer during the visit.	`Report ID` (manual numbering) - `Complainant ID` (linked manually to the complainant) - `Crime Type` - `Crime Description` - `Date and Time of Incident` - `Location` - `Witnesses` - `Physical Evidence` (described or attached) - `Report Date`
Police Officer	The officer who records the crime report, investigates the crime, and updates the status manually. This entity represents the officers involved in managing the report.	`Officer ID` (badge number or manually assigned) - `Name` - `Rank` - `Department` - `Assigned Cases` - `Contact Information`
Investigation Record	A manual log or folder where investigation details and progress are recorded by the officer. This includes notes, updates, and final outcomes of the investigation.	`Investigation ID` (linked manually to the crime report) - `Report ID` - `Investigation Start Date` - `Assigned Officer` - `Investigation Notes` - `Outcome` (e.g., case closed, suspect

		apprehended)
Witness	Any individual who provides testimony or evidence in the crime report. Their details are recorded manually as part of the report or investigation.	`Witness ID` (if multiple witnesses, manually assigned) - `Name` - `Contact Information` - `Statement`
Evidence	Physical evidence collected related to the crime. This entity represents the objects or documents associated with the crime and is manually logged or stored.	`Evidence ID` (manually assigned or tagged) - `Report ID` (linked to the related crime report) - `Evidence Type` - `Description` - `Storage Location`
Crime Logbook	A physical logbook where all reported crimes are recorded chronologically. This serves as a master record of all cases handled by the station	`Logbook ID` - `Entry Date` - `Report ID` - `Complainant Name` - `Crime Description` - `Assigned Officer`

4.3.5 Modeling Relationships between Entities

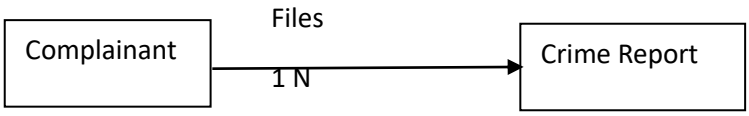


Figure 4. 5: Relationship between complainant and Crime Report

Complainant and **Crime Report** have a one-to-many relationship, meaning one complainant can file multiple reports.

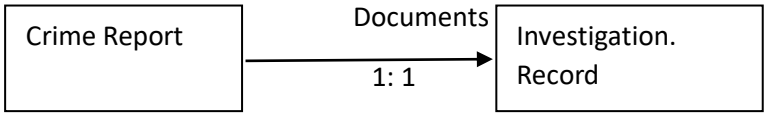


Figure 4.7: Relationship between crime report and investigation record

Each crime report will have a corresponding investigation record that documents the progress and outcome of the investigation.

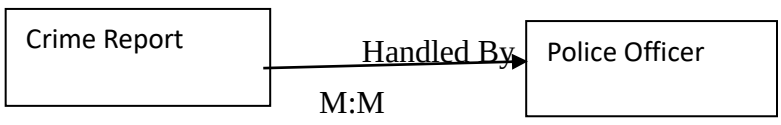


Figure 4. 8: Relationship between crime report and police officer

Multiple police officers may be involved in handling a single crime report, especially if it requires a team. Conversely, a single police officer can handle multiple crime reports.

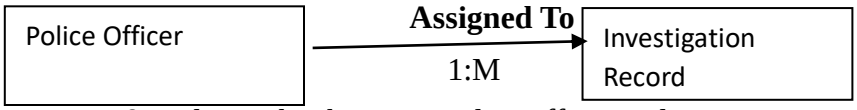


Figure 4.9: Relationship between police officer and investigation record

A single police officer can be responsible for multiple investigations, but each investigation record is managed by one primary officer.

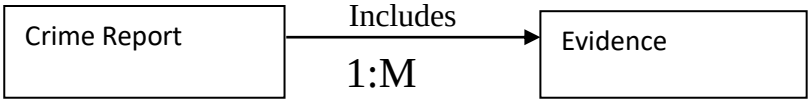


Figure 4.10: Relationship between crime report and evidence

Each crime report can be associated with multiple pieces of evidence, but each piece of evidence is tied to a single crime report.

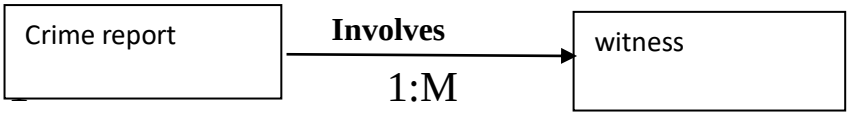


Figure 4.11: Relationship between crime report and witness

Each crime report can have statements from multiple witnesses, but each witness statement is linked to a single crime report.

4.3.6 The Entity Relationship Diagram

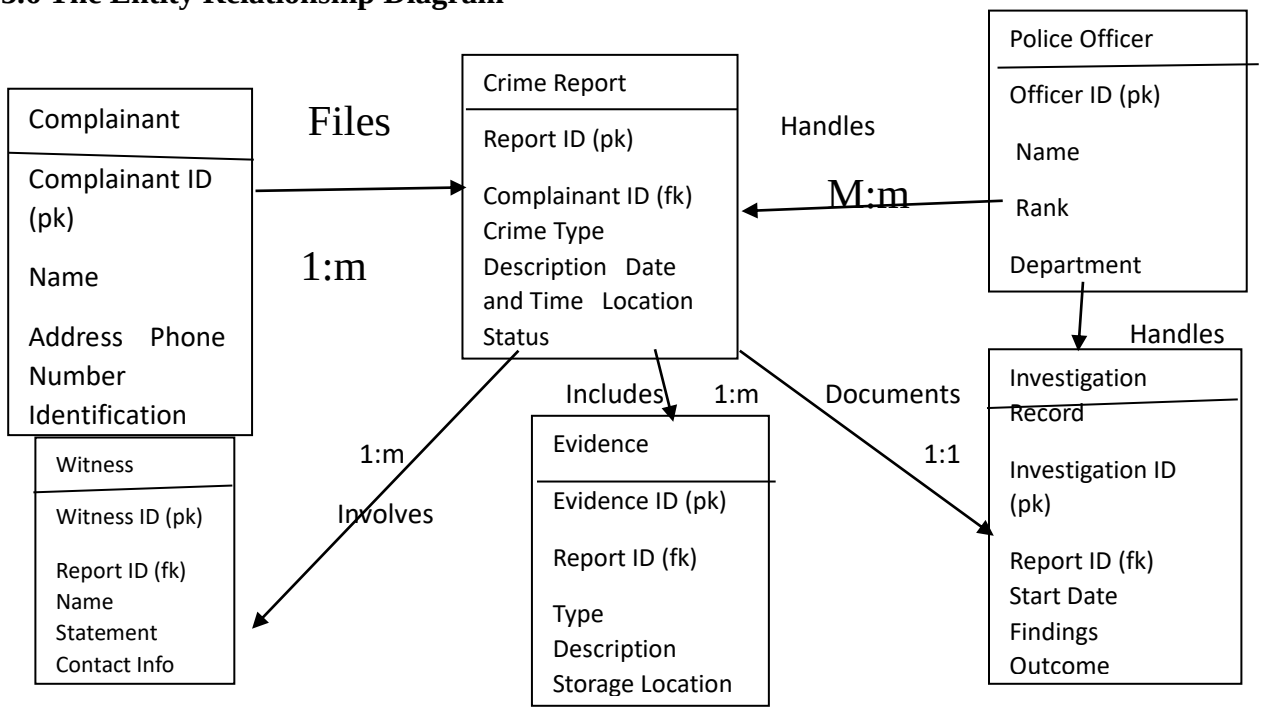


Figure 4. 6: The Entity Relationship Diagram

4.3.7 Mapping of ERD to Relational Schema

4.3.7.1 Complainant

Table 8: The Complainant table

Field Name	Data Type	Constraint
complainant_id	INT	PRIMARY KEY
name	VARCHAR(100)	NOT NULL
address	VARCHAR(255)	NOT NULL
phone_number	VARCHAR(15)	NOT NULL
identification	VARCHAR(50)	UNIQUE, NOT NULL

4.3.7.2 Crime Report

Table 10: The Crime Report *table*

Field Name	Data Type	Constraint
report_id	INT	PRIMARY KEY
complainant_id	INT	FOREIGN KEY REFERENCES Complainant(complainant_id), NOT NULL
crime_type	VARCHAR(100)	NOT NULL
description	TEXT	NOT NULL
date_time	DATETIME	NOT NULL
location	VARCHAR(255)	NOT NULL
status	VARCHAR(50)	NOT NULL

4.3.7.3 Police Officer

Table 11: The Police Officer *table*

Field Name	Data Type	Constraint
officer_id	INT	PRIMARY KEY
name	VARCHAR(100)	NOT NULL
rank	VARCHAR(50)	NOT NULL

department	VARCHAR(100)	NOT NULL

4.3.7.4 Investigation Record

Table 12: The Investigation Record *table*

Field Name	Data Type	Constraint
investigation_id	INT	PRIMARY KEY
report_id	INT	FOREIGN KEY REFERENCES Crime_Report(report_id), NOT NULL
start_date	DATE	NOT NULL
findings	TEXT	NOT NULL
outcome	VARCHAR(255)	NOT NULL

4.3.7.5 Evidence

Table 13: The Evidence *table*

Field Name	Data Type	Constraint
evidence_id	INT	PRIMARY KEY
report_id	INT	FOREIGN KEY REFERENCES Crime_Report(report_id), NOT NULL
type	VARCHAR(100)	NOT NULL
description	TEXT	NOT NULL
storage_location	VARCHAR(255)	NOT NULL

4.3.7.6 Witness

Table 14: The Witness table

Field Name	Data Type	Constraint
witness_id	INT	PRIMARY KEY
report_id	INT	FOREIGN KEY REFERENCES Crime_Report(report_id), NOT NULL
name	VARCHAR(100)	NOT NULL
statement	TEXT	NOT NULL
contact_info	VARCHAR(100)	NOT NULL

4.4 Conclusion

In summary, this chapter was mainly based on the study of the existing system, analysis of the requirements for the system, processes and data modeling.

Chapter Five

System Implementation, Testing and Validation

This section describes the implementation of the design models in of the system and also shows the different results generated by the system. Therefore, screen shots of the system will be displayed to show how the system displays results given a command.

5.1 System Functions

The Online Crime Reporting Management System offers a comprehensive suite of functions tailored to different user roles. Administrators have the ability to manage user accounts, including creating and updating roles for law enforcement officers and other staff, and they oversee the verification of crime reports to ensure accuracy. They also analyze system performance to maintain efficient operations. Employees are tasked with receiving and entering crime report details into the system, updating case information as investigations progress. Public users can file crime reports online, view the status of their reports, and access their personal details related to the crime. This structured approach ensures seamless interaction among administrators, staff, and the public, facilitating effective crime reporting and case management.

5.1.1 Administrator Functions:

- **Manage User Accounts**: Administrators can create, update, deactivate, and delete user accounts, including law enforcement officers and other system staff. They assign roles and permissions to ensure appropriate access levels.
- **Verify Crime Reports**: Administrators review and verify the accuracy and completeness of crime reports submitted to the system, ensuring that all required information is provided and valid.
- **Monitor System Performance**: Administrators track system performance, analyze usage metrics, and oversee the operational aspects of the system to ensure efficient functioning and adherence to protocols.
- **Generate Reports**: Administrators can generate various reports on system activity, crime report statistics, and user performance for analysis and decision-making.

5.1.2 Law Enforcement Officer Functions:

- **Receive and Process Crime Reports**: Officers receive new crime reports from the public and enter detailed information into the system, including evidence, witness statements, and case notes.
- **Update Case Status**: Officers update the status of ongoing investigations, add new findings, and modify case details as needed. They also manage and track evidence related to their cases.
- **Communicate with Public**: Officers can communicate with individuals who have reported crimes to provide updates, request additional information, and facilitate further investigation.

5.1.3 Public/User Functions:

- **File Crime Reports**: Users can submit crime reports online through a user-friendly interface, providing necessary details such as the incident description, location, and involved parties.
- **Track Report Status**: Users can track the status of their submitted reports, view updates on the investigation, and receive notifications regarding any changes or progress.
- **View and Update Personal Information**: Users can access and manage their personal details related to crime reports, including contact information and any additional documentation required for their cases.

5.1.4 System Functions:

- **Data Storage and Management**: The system securely stores and manages all crime reports, user information, case details, and evidence, ensuring data integrity and accessibility.
- **Search and Retrieval**: Users and administrators can search and retrieve specific crime reports, case details, and other relevant information using various search criteria.
- **Notifications and Alerts**: The system sends automated notifications and alerts to users and administrators about report status changes, upcoming deadlines, and important updates

5.2 System map

Figure 5.1: System Map showing functions provided by the system to each user

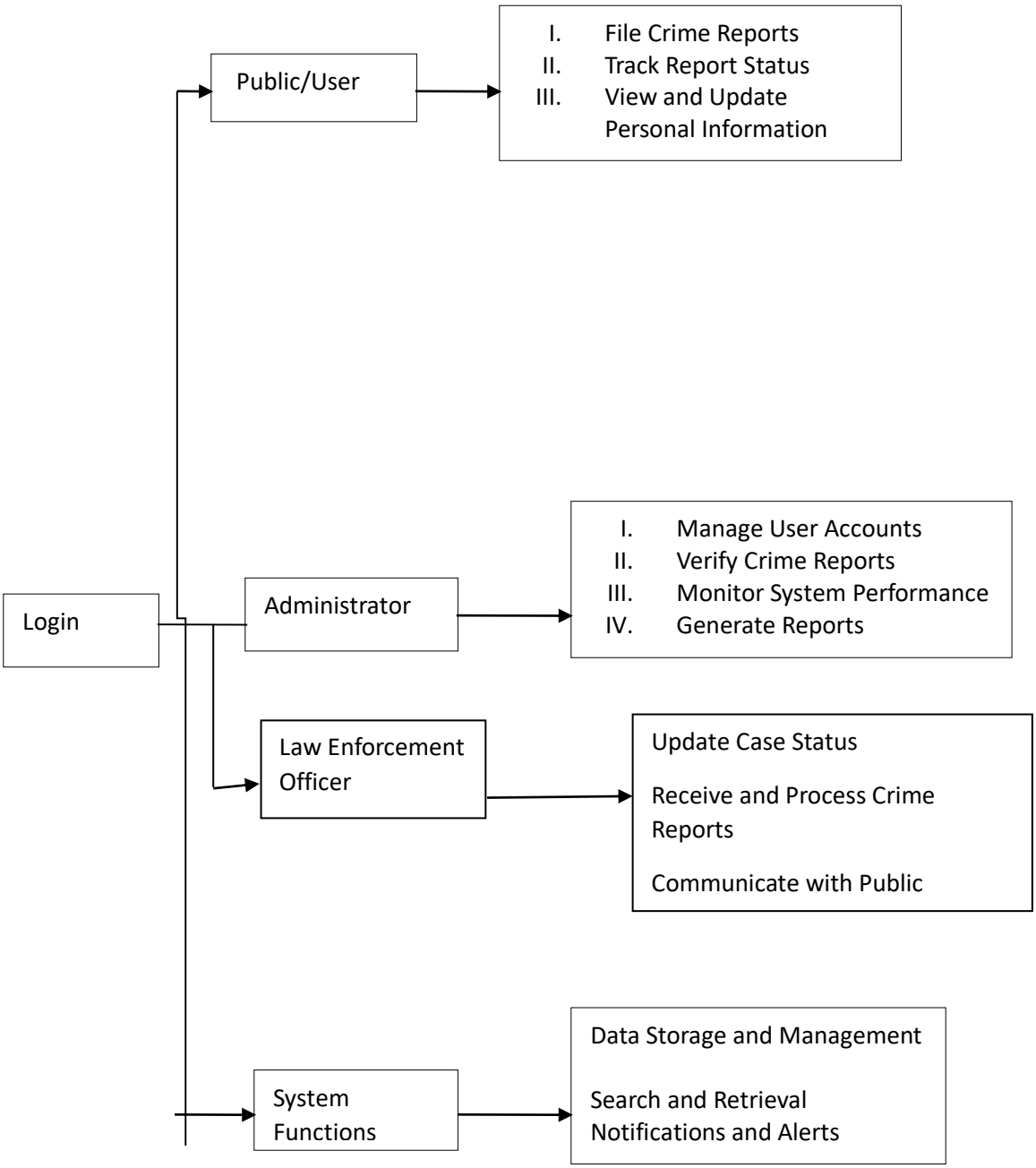


Figure 5. 1: System Map

5.3 Sample Screen-shots

5.3.1 System home page

Figure 5.2 Shows the homepage that allows law officials, and users to login into the system in order to access their pages and perform their tasks. On selecting the login option especially by the administrator, login page for the administrator will be displayed as shown on the screenshot below, for complainant has to first sign up and logs-in.

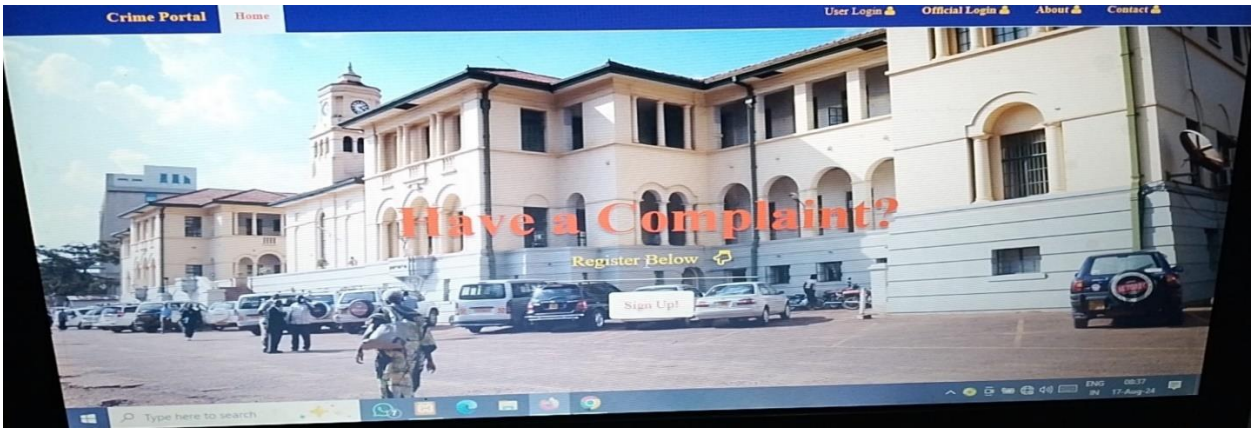


Figure 5. 2: System home page

5.3.2 Administrator's login page

Figure 5.3 Shows the administrator's login page where he or she selects the admin option and fills in his or her password to login into the system. The admins include the head or headquarter (he is the overall overseer of the crime process, he adds police stations and the in-charge of those stations), in-charge (is responsible for assigning cases to the police and adding police), and police responsible for handling the assigned case.

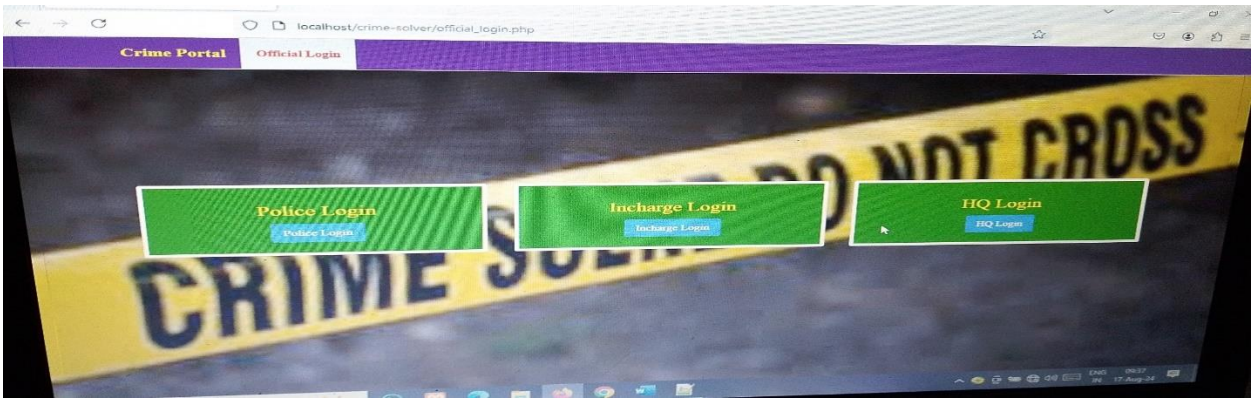
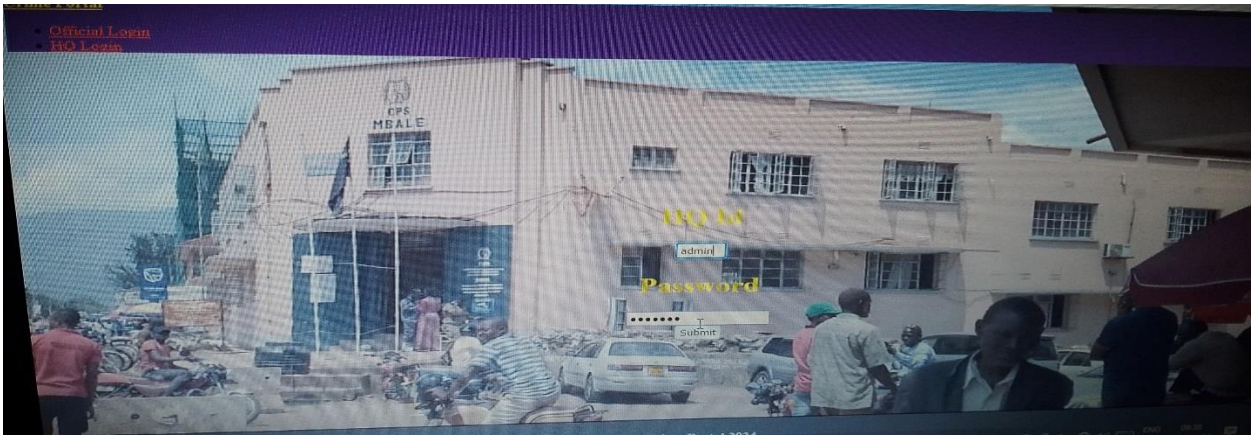
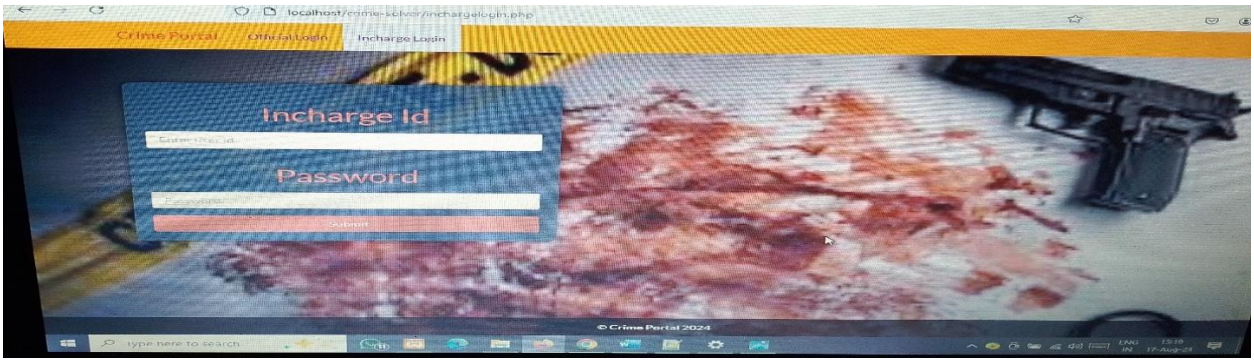


Figure 5. 3: Administrator login page

5.3.2 Headquarters Login



In charge login



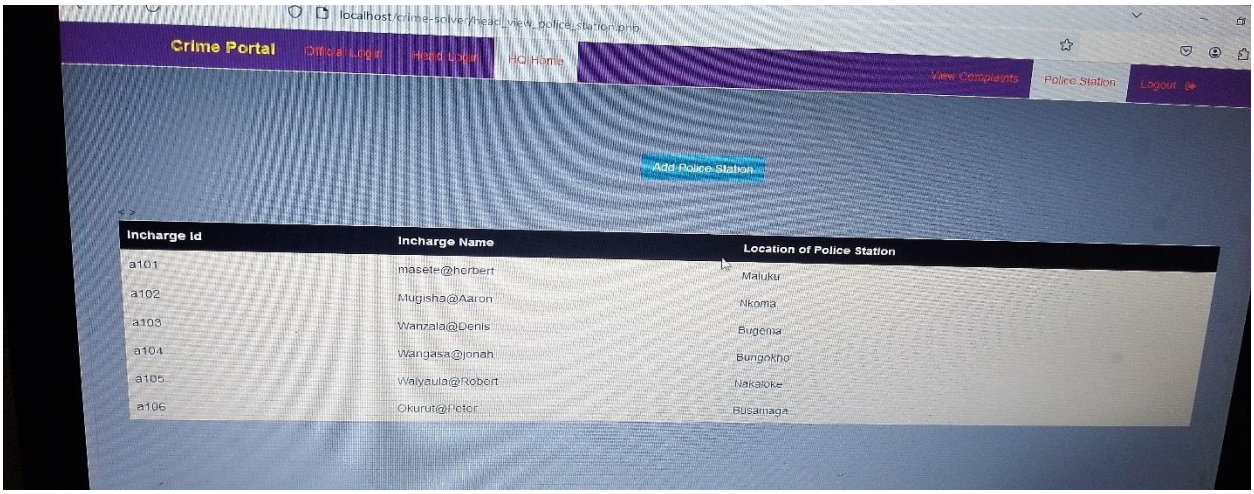
Police login

Figure 5. 4: Administrator login page

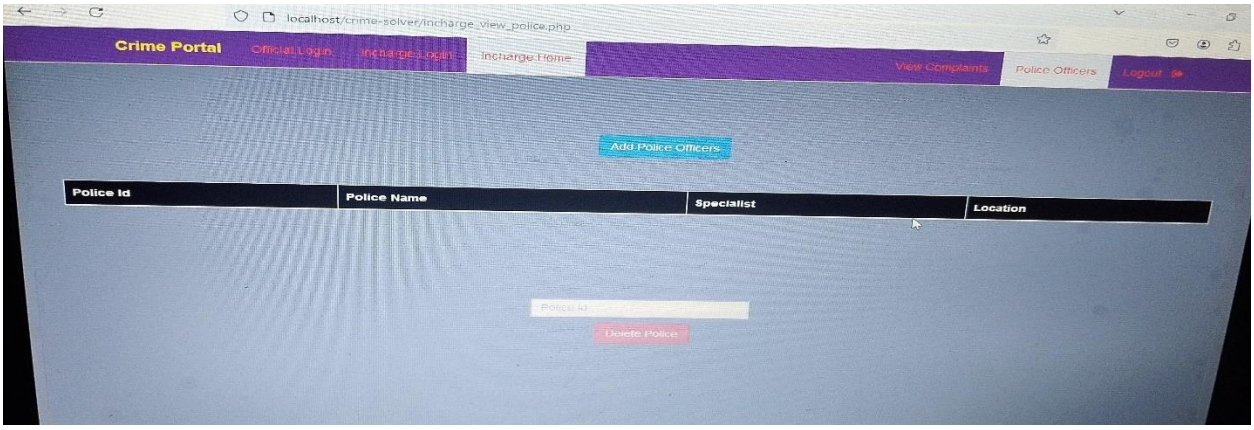
5.3.3 Administrative view page

Figure 5.4: Shows the administrator fully logged in where he can perform all duties assigned to him through navigating on the links shown on the screenshots in red color below. He can create accounts, set the passwords, view different account types, view transactions, manage crimes and verify and validate all crimes of the complainants.

Headquarters page



Incharge page



Police page

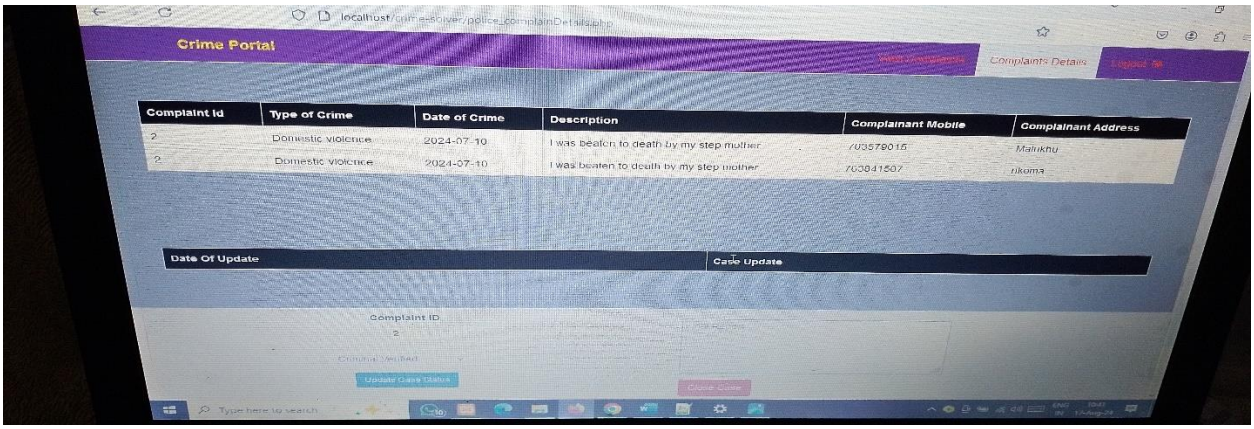


Figure 5. 5: Administrative view page

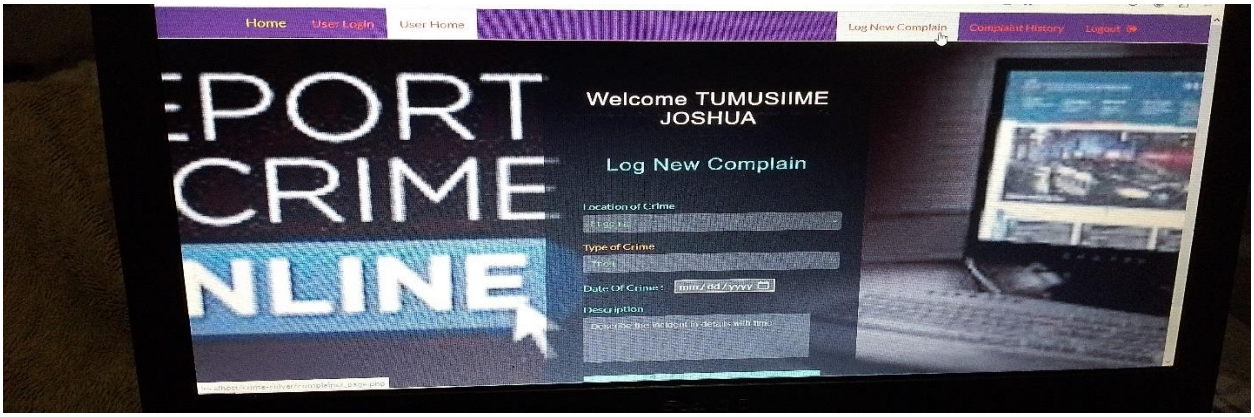
5.3.4 User login page

Figure 5.5: Shows a user's login page where he or she selects the user option as his or her username and fills in a password to login into the system where he or she can either file a complaint or register as new user or also view the complaint details.

Figure 5. 6: Employee's login page

5.3.5 Complainant page

Figure 5.6: Shows the complainer'sdetails from where a complainant enters a user's details about the crime and also views details about the complaint.



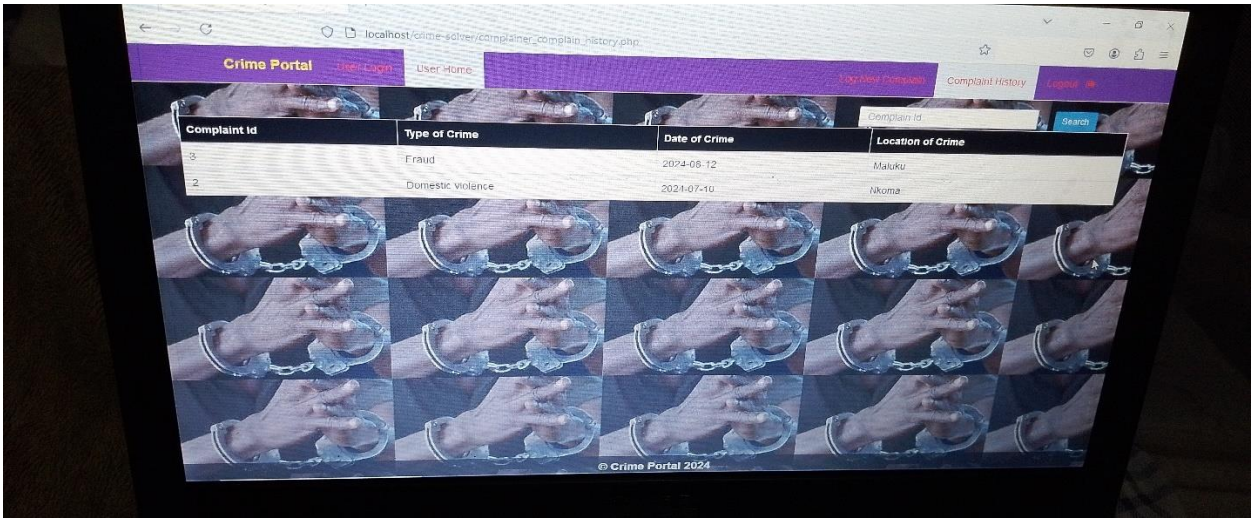


Figure 5. 7: User page

5.3.6 Registration page

Figure 5.7: Shows a user registration page where an user registers an account with the online crime reporting management system and becomes a valid member of the system. A user fills in user's credentials like the first name, last name, age, email address, password among others

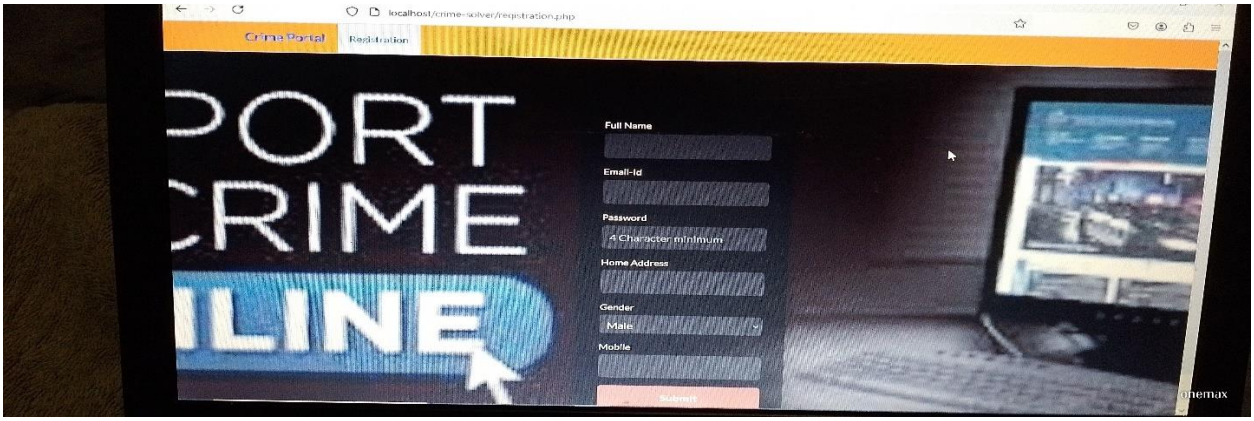


Figure 5. 8: User Registration page

5.4 System Testing and Validation Results

We carried out system testing with an aim of finding out errors that were in the system. We also performed system Validation to ensure that the system conformed to the then defined user needs and requirements. We presented the system to some of the users so as to get feedback about the system performance in relation to their requirements.

5.4.1 System Testing Results

The Online Crime Reporting Management System was presented to users with the intent of finding errors and observing if it behaved as expected. The faults were corrected and the process was repeated until the system was proven to be working according to users' specification and performance requirements.

We also tested the system to see whether it was capturing valid data, this was done by putting wrong data and then the system responded by alert messages displaying the type of error. Testing and validation was done successfully.

5.4.2 Validation Results

The Online Crime Reporting Management System was presented to different users so as to get feedback about the system performance as to whether the system met their needs or user requirements for which it was designed for. The process involved checking input and output data of the system to ensure that they are complete and accurate especially in the area of database to check whether the system conformed to the standards of similar systems under defined operating

conditions. Further tests on validation were carried out on the system to verify that it met the specified user requirements.

The users were satisfied with the system and concluded that the system was simple to use allowing them to navigate through the system with ease. The system was fast in responding to the different requests and that it satisfied the intended user needs or requirements. A questionnaire was also designed to capture their responses and thoughts (see Appendix III page 47).

Table 9: System Validation.

Feature	Number of users out of 5	Percentage of users
Learnability	4	80.0
User friendly	4	60.0
Improves the transaction process	3	60.0
Solves the problem of delays by customers wanting to make instant reports.	4	80.0

5.5 Conclusion

In summary, this chapter described the system functions provided to all users like complainants, judicial, administrators and the various screen shots used in the system. Testing and validation were performed where the system was checked to see if it had any errors and whether it met the specified user requirement respectively to which the results were gathered.

Chapter Six

Summary, Recommendations and Conclusion

6.1 Summary

All the stated objectives of the online Crime Reporting management system have been successfully achieved. The system has been designed to automate the manual crime reporting management system that is currently used. The user is able to report crime online, view crime details of his/her account. A user can change the account details and get new password by contacting the system manager and user name only is he/she has already been assigned an account into the system.

For security reasons, each user is given a user name and password and this will be the only way they will be able to log into the system but using a similar interface. The administrator has the overall privileges.

6.2 Recommendations

There is need for more research in this field so that the weaknesses of the system can be addressed as new crime institutions keep rising every day and have their own ways of carrying out their business operations.

Similar systems should be developed for the other crime institutions in the Uganda which are still using manual systems such as an online system for judicial management to make it easy for both complainants and judiciary to easily access and management their crime related information.

6.3 Future work

The system should be extended to;

i. Give users a chance to interact using inbuilt forum so that users can always discuss situations at hand.

- **Mobile Application Integration:**
    - Develop a mobile application to allow users to report crimes, track status, and communicate with authorities directly from their smartphones.
- **Advanced Data Analytics:**
    - Implement advanced data analytics features to identify crime patterns, hotspots, and trends, aiding law enforcement in proactive crime prevention.

- **Multilingual Support:**
    - Add support for multiple languages to make the system accessible to a broader audience, ensuring inclusivity for non-English speakers.
- **Automated Case Assignment:**
    - Integrate AI-driven algorithms to automatically assign cases to the appropriate police officers based on their expertise, location, and workload.
- **Real-Time Notifications:**
    - Enhance the notification system to provide real-time updates to complainants and law enforcement through SMS, email, or push notifications.
- **Integration with National Crime Databases:**
    - Connect the system with national and regional crime databases for cross-referencing reports, identifying repeat offenders, and sharing information across jurisdictions.
- **Victim Support Services:**
    - Incorporate a module for linking complainants with victim support services, such as counseling, legal assistance, and emergency shelters.
- **Enhanced Security Measures:**
    - Implement advanced security features, including two-factor authentication, biometric verification, and end-to-end encryption, to protect user data and ensure system integrity.
- **Public Awareness Campaigns:**
    - Add features to manage and disseminate public awareness campaigns on crime prevention, safety tips, and community engagement.
- **Crowdsourced Reporting:**
    - Enable crowdsourced crime reporting and community policing features, allowing citizens to collaborate with law enforcement in real-time.
- **Integration with CCTV and IoT Devices:**
    - Explore integration with CCTV cameras, IoT devices, and other surveillance technologies to provide real-time evidence collection and incident monitoring.
- **User Feedback and System Improvement:**

- Create a feedback loop within the system where users can suggest improvements, report issues, and participate in surveys to continuously enhance the system's performance.

6.4 Conclusions

The Online Crime Reporting Management System objectives were achieved. The major strength of this system is the ability to carry out proper online user and law officers' interaction. In this system online banking is done by a customer who has an account from administrator.

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Appendices

Appendix I: Interview schedule sample questions

i. What is your opinion in the organization about Crime management systems?
ii. What is your highest academic qualification attained?
iii. Do you have an efficient Crime management and system in your organization?
iv. What are the expected roles of management systems in your organization?
v. Does your organization set Crime?
vi. What are some of the difficulties you are facing with your current system?
vii. Is your system user friendly?
viii. What solutions do you think can work best in enhancing your current system?
ix. Does your system support data and information backups?
x. What are your expectations from the new system?
xi. How do you rate the system performance?
xii. How do you rate the system reliability?
xiii. How do you rate the system simplicity?
xiv. How do you rate the system security?

Appendix II: Questionnaires.

Dear Respondent,

We are final year BSIT students from MUC doing our final year research on Internet systems focusing on a topic: Online Crime Management System; A case study of Mbale city. The research is purely academic and the information you will give us will be treated with the highest level of confidentiality.

Any assistance you render us in answering these questions will be highly appreciated.

Please put a tick (√ in spaces provided

i. What is your position in the organization?

ii. Top Management ……. Middle Management ……. Operational Management …….

iii. Number of years worked

10 years and above……. 5-10 years ……. 3-5 years …… 0-3 years ….

iv. What is your highest education qualification?

Certificate …… Diploma …… Degree ……. Masters ……. PHD …….

v. Do you have a Crime Management system?

No …….. Yes ……

vi. Do you review your Crime Management system?

No ……. Yes ……..

vii. What should the new system provide?

……

……

viii. How do you rate your system costs?

Very expensive……. Expensive ……..cheap ……. Very cheap……..

ix. How user friendly is your system?

Good ……. Very good …….. Very fair …….. Fair……..

Appendix III: The System Validation Questionnaire

i. Is the new Crime system easy to learn?

Yes …….

No ……..

ii. Does the new system improve the transaction processes?

Agree ……

Disagree ……

Not sure …….

iii. How would you rate the user friendliness of the new online Crime transfer management system?

Below 40% …….

50% …….

60% ……

Above 80% ……..

iv. Does the new system capture all the information required from the applicant?

Yes …….

No …….

v. Does the new system solve the problem of congestions and delays by customers who have to line up in order to make transactions like money transfers?

Yes ……

No ……

vi. Give any other comments

……

……

……

……

Appendix IV: Pseudo code

```
BEGIN


 // Initialize databases

 Initialize CrimeReportsDatabase

 Initialize UserAccountsDatabase


 // Main Menu

 WHILE System is Running DO

  DISPLAY "1. Register"

  DISPLAY "2. Login"

  DISPLAY "3. Exit"

  INPUT UserChoice


  SWITCH UserChoice

   CASE "1": // Registration

    CALL RegisterUser()


   CASE "2": // Login

    CALL LoginUser()


   CASE "3": // Exit

    Terminate System
```

```
    DEFAULT:
      DISPLAY "Invalid option, please try again."
    END SWITCH
  END WHILE

END

// Function to register a new user
FUNCTION RegisterUser()
  INPUT UserName, Password, Email, PhoneNumber, Address
  IF UserName, Password, Email are valid THEN
    ADD UserDetails to UserAccountsDatabase
    DISPLAY "Registration successful"
  ELSE
    DISPLAY "Registration failed, please check your input."
  END IF
END FUNCTION

// Function to login a user
FUNCTION LoginUser()
  INPUT UserName, Password
  IF UserName and Password match records in UserAccountsDatabase THEN
```

```
    DISPLAY "Login successful"
    CALL DisplayUserDashboard(UserName)
  ELSE
    DISPLAY "Login failed, please try again."
  END IF
END FUNCTION

// Function to display user dashboard
FUNCTION DisplayUserDashboard(UserName)
  DISPLAY "1. Report a Crime"
  DISPLAY "2. View Report Status"
  DISPLAY "3. Logout"
  INPUT DashboardChoice

  SWITCH DashboardChoice
    CASE "1": // Report a Crime
      CALL ReportCrime(UserName)

    CASE "2": // View Report Status
      CALL ViewReportStatus(UserName)

    CASE "3": // Logout
      DISPLAY "Logging out..."
```

```
      RETURN to Main Menu


    DEFAULT:
      DISPLAY "Invalid option, please try again."
  END SWITCH
END FUNCTION

// Function to report a crime
FUNCTION ReportCrime(UserName)
  INPUT CrimeDetails (e.g., CrimeType, Location, Description, Date, Time)
  IF CrimeDetails are valid THEN
    ADD CrimeDetails to CrimeReportsDatabase with UserName and Pending status
    DISPLAY "Crime report submitted successfully."
  ELSE
    DISPLAY "Error submitting crime report, please try again."
  END IF
END FUNCTION

// Function to view report status
FUNCTION ViewReportStatus(UserName)
  FETCH all reports from CrimeReportsDatabase WHERE UserName matches
  DISPLAY each report with Status and CrimeDetails
END FUNCTION
```

```
// Function for Admin tasks (restricted to Admin users)
FUNCTION AdminTasks()
  DISPLAY "1. View All Crime Reports"
  DISPLAY "2. Update Report Status"
  DISPLAY "3. Generate Reports"
  INPUT AdminChoice

  SWITCH AdminChoice
    CASE "1": // View All Crime Reports
      FETCH all reports from CrimeReportsDatabase
      DISPLAY all reports

    CASE "2": // Update Report Status
      INPUT ReportID, NewStatus
      IF ReportID exists in CrimeReportsDatabase THEN
        UPDATE ReportStatus in CrimeReportsDatabase
        DISPLAY "Report status updated."
      ELSE
        DISPLAY "Invalid ReportID."
      END IF

    CASE "3": // Generate Reports
```

```
      CALL GenerateReports()


    DEFAULT:

      DISPLAY "Invalid option, please try again."

  END SWITCH

END FUNCTION


// Function to generate reports

FUNCTION GenerateReports()

  FETCH data from CrimeReportsDatabase

  GENERATE analytics and summaries

  DISPLAY or EXPORT report

END FUNCTION
```