Software Requirement Specification Document for Chronicles of the Corpse: AI's Murder Tale

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Table 1: Document version history

Version	Date	Reason for Change
1.0	20-Dec-2023	SRS First version's specifications are defined.
1.1	1-Jan-2024	Overview , Context , Usecase , UML , EER Diagrams
1.3	7-Jan-2024	Function and Non-Function requirements are specified
1.4	11-Jan-2024	Github repository link updated and Refrences are added

GitHub: https://github.com/Ahmed-Ehab-mohamed/Graduation-Project

Contents

Abstract

In the ever-evolving terrain of criminology and the forensic analysis sciences, the utilization of Artificial Intelligence (AI) stands as a transitive force poised to revolutionize traditional investigative methodologies This system presents the world of AI-driven forensic analysis, shedding light on its potential to uncover concealed evidence, recognize complex patterns, and accelerate investigations. Mainly, the investigators use the AI system to limit the circle of suspects in the crime through analyzing forensic evidence. it is powered and accessed by the government and federal investigators which is accomplished By using AI algorithms and computer vision capabilities. providing solutions to these challenges furthermore, the results would be accessible to the lawyer of the suspects. In this project we show why artificial intelligence is a strong complement in forensic analysis as ethical considerations and privacy concerns are addressed, underscoring the importance of developing responsible AI models that respect individual rights and maintain the integrity of evidence. emphasizing the limitations posed by human biases and the sheer volume of digital data. Additionally, we aim to put forward enhanced algorithms for serial killer analysis and pattern recognition, face sketching reconstruction and recognition, fingerprint analysis, autopsy report, blood stain and splatter, and crime scene glass identification. to be able to achieve the required challenges of being free of human biases and ensuring an impartial analysis of evidence we need to objectively have the data quality for accuracy that depends on trained data. research result has proved that using AI in forensic analysis is more efficient when it comes to data integrity, safety, and more accuracy in results.

1 Introduction

1.1 Purpose of this document

The SRS documentation works on clarifying the system's features and set the guidance for development and provides the instructions about what to be implemented

1.2 Scope of this document

The SRS documentation explains the system's detailed description, setting the functional and non-functional requirements and describing the interface

1.3 Business Context

As the crime field is very wide and has many factors , abstracts the business context is slightly different between the systems . for the forensic science international ; a cost benefit analysis of 3d scanning technology for crime scene investigation . Within the past 15 years, 3D surface scanning technology has garnered attention from law enforcement units and has been used for certain investigations, such as traffic accidents, criminal assaults, and homicides. Terrestrial LiDAR scanners traditionally have a cost of $20,000 to $70,000 (USD), a high cost for typical law enforcement agency budgets.so instead of consuming time and effort , the law enforcement is expected to invest in artificial tools for crime scene analysis and also afford and benefit the buyers.

2 Similar Systems

2.1 Academic

The proposed systems are about three key components of modern forensic analysis: glass identification, wrist, and fingerprint analysis, and serial killer analysis system.

2.1.1 Glass Identification System

The glass identification system employs state-of-the-art spectral analysis techniques to categorize and match glass fragments found at crime scenes. Leveraging the unique properties of glass, this subsystem aims to identify and classify glass types [1], aiding in establishing connections between crime scenes and suspects.

Figure 1: Glass Shater Photo

Researchers have been applying many data mining techniques including fuzzy clustering and many variants of KNN techniques such as feature weighting, AdaBoost, locally adaptive KNN, bagging, kernel density, and support vector machine over the same glass identification dataset. Thus the results as classification accuracy.

Table 2: classification accuracy

Method	Accuracy Rate
Boosting NN [2]	75.6%
Naive KNN [2]	73.2%
Adaptive metric NN [3]	75.2%
Descriminant Adaptive NN [3]	72.9%
Deciction Tree [3]	68.2%
Wilson Editing [4]	67.4%
Multi-edit [4]	60.1%
Citation Editing [4]	70.0%
Supervised Clustering [4]	71.5%

2.1.2 Wrist and Fingerprint Identification System

Utilizing fingerprint analysis technology, this system provides identification of criminals through wrist recognition and fingerprint analysis [5]. The system's accuracy offers a solution for law enforcement in suspect identification and criminal investigations.

Figure 2: Wrist And Finger Print

Using image segmentations , and feature extraction the system does wrist identification , fingerprint analysis and tattoo matching to identify gang criminals.

2.1.3 Serial Killer Analysis System

The serial killer analysis system analyzes behavioral data and patterns of serial killers. By analyzing serial killer profiles, this system assists in analyzing the behavior of serial killers [6].

The data is classified using random forest, decision tree, and naïve-bayes and then is represented by a confusion matrix.

2.2 Business Applications

Forensic Assessment is platform for an independent forensic consultancy offering comprehensive nationwide forensic science services in the UK. The platform provides forensic scientists for the clients to examine crime details and evidence to provide forensic analyses for the support legal proceedings. [7]

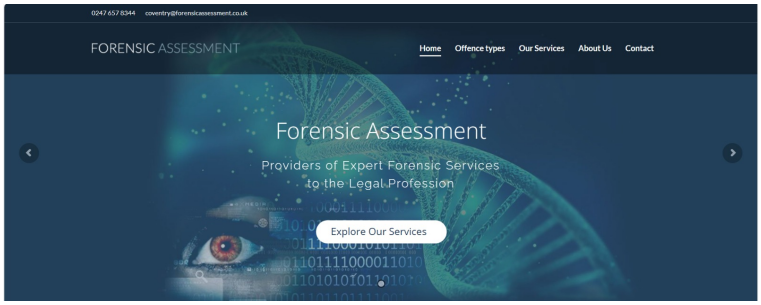


Figure 3: business application

3 System Description

3.1 Problem Statement

Murder cases, encompassing a wide spectrum of motives and circumstances, pose a significant challenge for law enforcement agencies and the criminal justice system. This project seeks to address several critical aspects of solving murder cases, including serial killer Murder cases exhibiting various patterns. The lack of a comprehensive system for identifying and analyzing these pat- terns hinders the ability to efficiently solve and prevent such crimes. Creating detailed profiles of serial killers is crucial for understanding the dynamics of a murder case. These profiles can provide valuable insights into potential motives and suspect characteristics. Existing methods often lack the integration of advanced technologies, resulting in incomplete or outdated profiles. Some murder cases remain unsolved due to their seemingly unrelated nature. Connecting these disparate cases is essential not only to bring justice to the victims but also to prevent future incidents. Existing investigative methods may fall short in facilitating the connections between these seemingly unrelated murders. Analyzing data from crime scene details, forensic evidence, and autopsy reports is pivotal for solving murder cases. However, the current processes are often labor-intensive, and time-consuming, and may not always be successful. By integrating these advanced features into a unified system, our project aims to empower law enforcement agencies with the means to efficiently identify serial killer patterns, construct detailed profiles, connect seemingly unrelated murder cases, and streamline the analysis of crucial data, ultimately enhancing their ability to investigate and solve murder cases. This, in turn, contributes to public safety and justice by bringing perpetrators to account and providing closure to victims' families.

3.2 System Overview

The system interacts with a various features in order to achieve it's functional and non-functional requirements as achieving justice. A connection with a database management system backend as establish for inserting and retrieving the data.

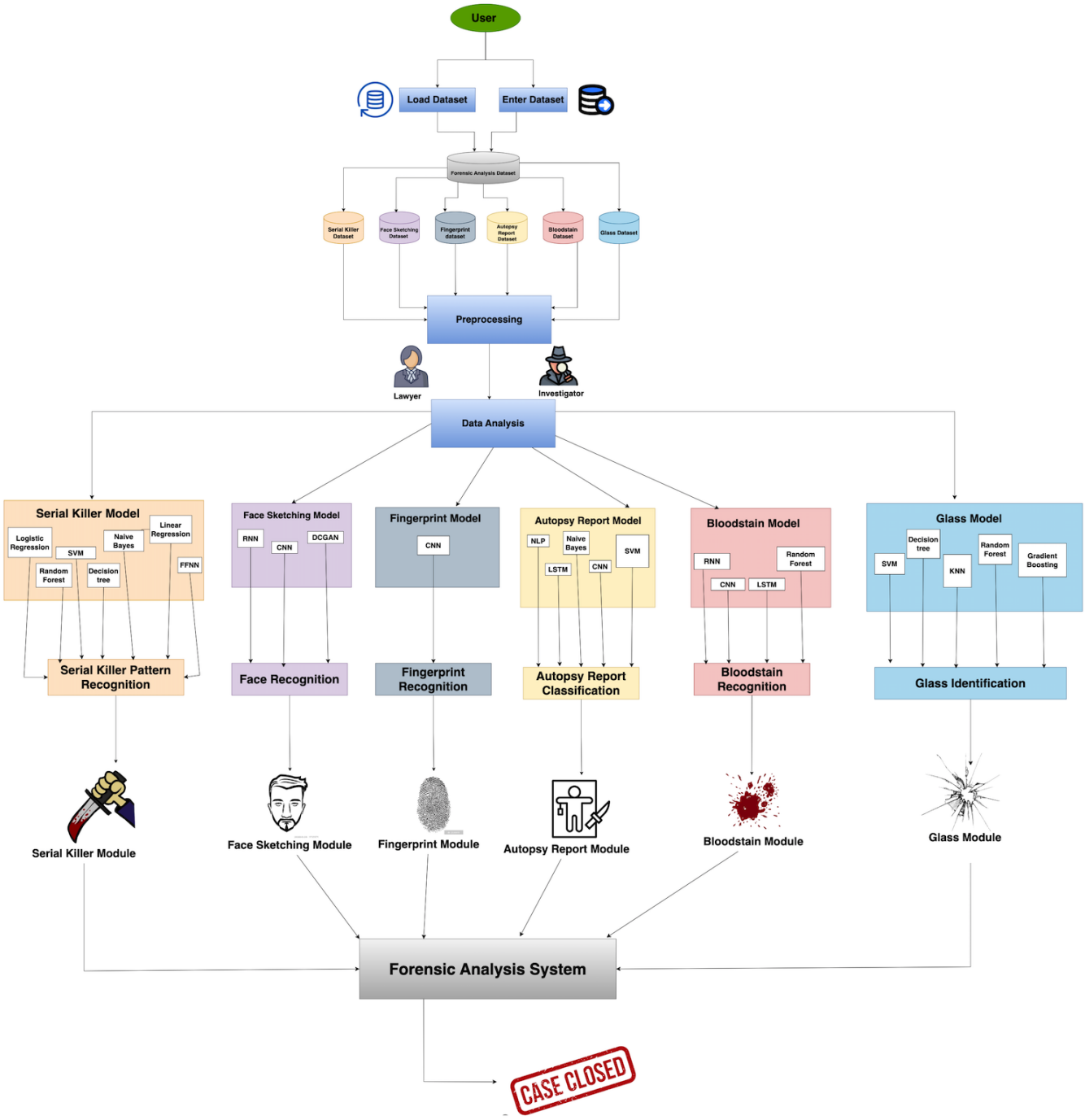


Figure 4: Overview Diagram

Analyzing and Identifying Patterns in Serial Murder Cases,this involves the use of machine learning and deep learning models to detect and interpret patterns in serial murder cases, providing vital insights for forensic investigators. Constructing Detailed Profiles of Serial Killers,this aims to create comprehensive profiles of serial killers, leveraging data analysis and pattern recognition techniques.Performing Face Sketch Reconstruction and Recognition, this feature utilizes image processing techniques to reconstruct and recognize faces from crime scene evidence. Analyzing Forensic Evidence such as Fingerprints, Blood Stains, and Glass, the system applies advanced analytical methods to various types of forensic evidence to aid in crime scene investigations.

3.3 System Scope

The proposed System will help with Forensic analysis. In order to assist Forensic investigators. The system will analyze the crime scene evidence like glass, fingerprints, and blood stains. The system will use machine learning, deep learning models, and image processing techniques to perform the wanted tasks. The forensic analysis system shall:

- analyze and identify patterns in serial murder cases.
- construct detailed profiles of serial killers
- perform face sketch reconstruction and recognition.
- Analyze the forensic evidence such as fingerprint, blood stain, and glass.

These tasks involve training models to recognize patterns.

3.4 System Context

The system is built to interact with various module for analyzing the crime scene accurately. All the analysis is guide lined in the functional and non-functional requirements.Through the connection between the dataset and the backend we can load and send the data for analysis. After the data preprocessing , is analyzed with the appropriate module or more than one module using feature engineering.

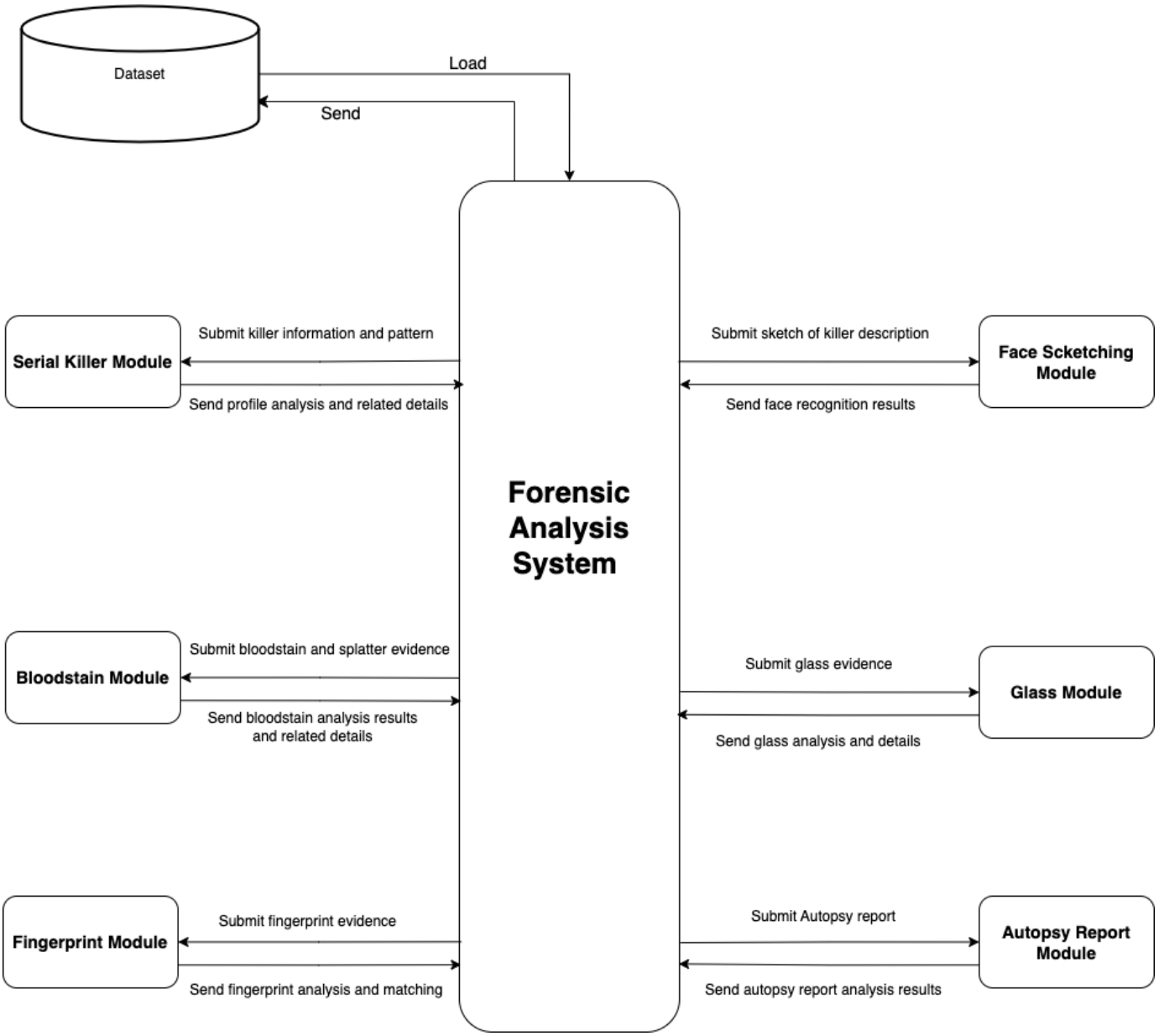


Figure 5: System Context

3.5 Objectives

- To reconstruct a sketching of the suspect based on the witness description using neural network and image processing.
- To do serial killer pattern recognition from serial killers profile and dataset.
- For the murder cases analysis we use autopsy report so we can know cause and circumstances of the murder case.
- To minimize the circle of suspects we used machine learning and deep learning models for analyzing forensic evidence in the crime scene like fingerprint, blood stain, and glass.

3.6 User Characteristics

The system mainly target the law enforcement and investigators to achieve the justice. Also, the system will be fully assessed by the investigator and law enforcement for maintenance and a high accuracy for crime analysis. In addition, the system is designed to keep the human in the loop.

However, all users must have

- Basic Web handling skills e.g connecting to the internet, and signing into a software.
- A brief understanding of what the forensic system is and how it works.
- A brief of working with database system and how AI works.

4 Functional Requirements

4.1 System Functions

The below use case diagram in figure 6 demonstrates the system functional requirements. The system is composed of four user types: Lawyer, Investigator, Forensic Scientist, Law Enforcement.

1. General Requirements
    - The system shall select the appropriate feature for the case.(GR01)
    - The system shall recognize the related cases for pattern recognition.(GR02)
    - The system shall understand the cases with no evidence and make reports for them.(GR03)
    - The system shall match the fingerprint with the suspects' ones.(GR04)
    - The system shall label the glass in the crime scene with its type.(GR05)
    - The system shall profile criminals that are legally proven suspected.(GR06)
    - The system shall analyze the serial killer input data after proving the evidences.(GR07)
    - The system should analyze blood stain and splatter.(GR08)

- The system should analyze Autopsy Reports(GR09)
- The system should recognize face sketching (GR10)
- The system should provide an intuitive user interface for better user experience.(GR11)

2. Investigator module

   - The investigator shall access his section in the system after entering the security ID.(IM01)
   - The investigator shall be sign in before entering the security ID.(IM02)
   - The investigator shall access the database and load the wanted cases.(IM03)
   - The investigator shall enter a new case information to the database.(IM04)
   - The investigator shall create a case report after finishing the case.(IM05)

3. Law Enforcement Module

   - The law enforcement shall approve account to the system after checking the account's info.(LEM01)
   - The law enforcement shall access the database system for any requirements.(LEM02)
   - The law enforcement shall view case report after finishing it for keeping up with the system and investigator.(LEM03)
   - The law enforcement shall send external evidences about the crime scene for analysis.(LEM04)
   - The law enforcement should provide more efficient features of analysis in the system.(LEM05)

4. Forensic Scientist Module

   - The forensic scientist shall access the system after entering the security id to enter his section.(FSM01)
   - The forensic scientist shall send the external evidence analysis for more information to the case.(FSM02)
   - The forensic scientist shall send feedback about the forensic analysis to maintain the system results.(FSM03)
   - The forensic scientist should be more in the loop in the system for more precious evaluation.(FSM04)

5. Lawyer Module

   - The lawyer shall access the system after entering the security id to enter his section.(LM01)

- The lawyer shall view case report prepared from the investigator and viewed by the forensic scientist and law enforcement to be prepared for legal defense.(LM02)

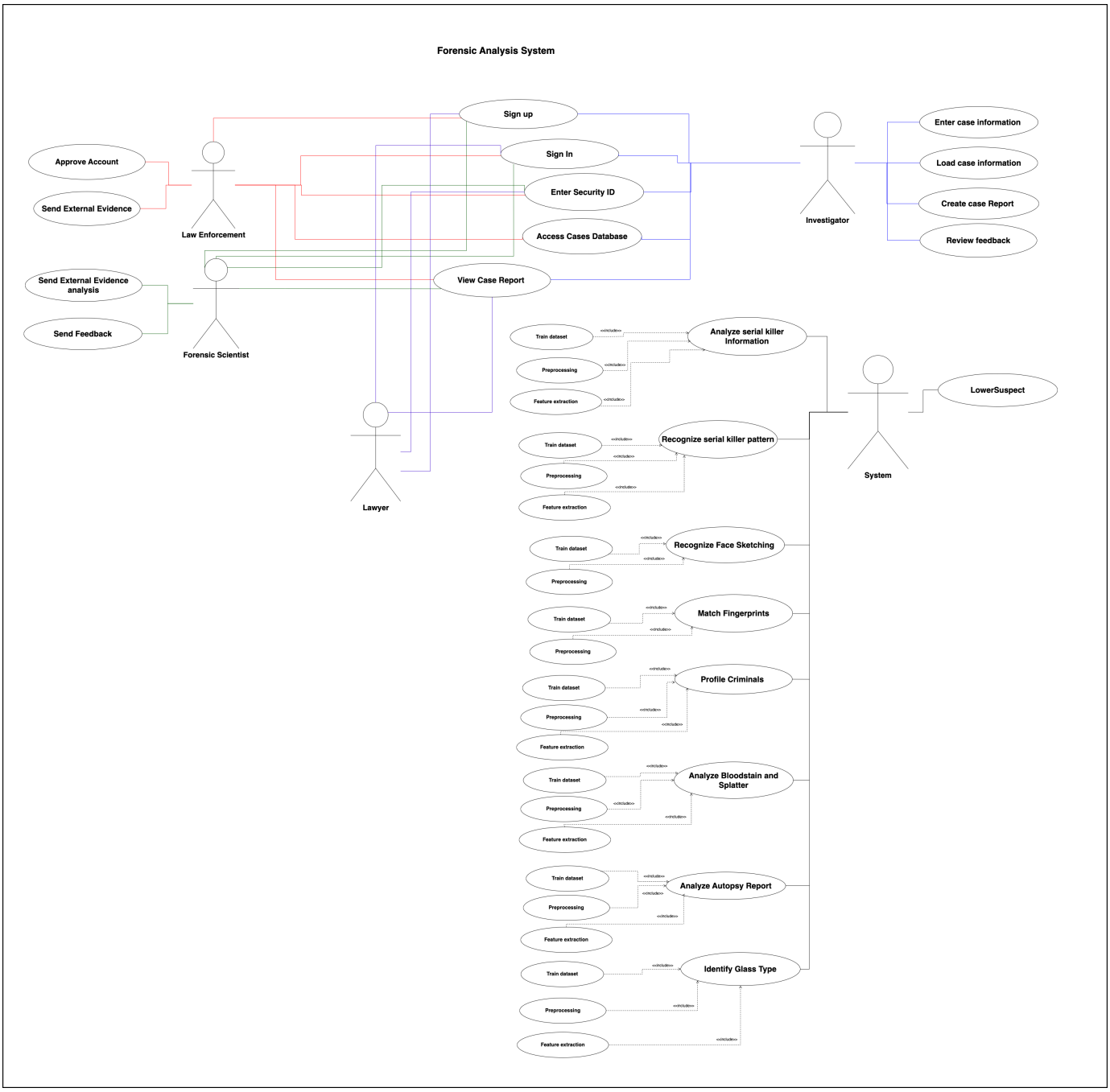


Figure 6: Use Case Diagram

4.2 Detailed Functional Specification

Table 3: Fingerprint Match Function Description

Name	Fingerprint match
Code	GR04
Priority	Extreme
Critical	Essential for identifying suspects based on fingerprint evidence collected from crime scenes
Description	the system aims to analyze fingerprints, and match them with prisoners ID
Input	image of fingerprint
Output	The matching prisoner ID and the fingerprint and finger number
Pre-Condition	Each prisoner has a fingerprint in the dataset
Post-condition	the matching fingerprint is displayed with prisoner ID and finger number
Dependency	Fingerprint evidence data
Risk	High Risk

Table 4: Glass Identification Function Description

Name	Glass Identification
Code	GR05
Priority	Extreme
Critical	Crucial for analyzing glass fragments found at crime scenes, which can provide vital clues
Description	Identifies the type of glass found at the crime scene
Input	the different elements the go into glass
Output	the type of the glass
Pre-Condition	glass shatters in the crime scene
Post-condition	the type of glass
Dependency	Glass evidence data
Risk	Moderate

Table 5: Serial killer analysis Function Description

Name	Serial killer analysis
Code	GR07
Priority	Extreme
Critical	Crucial for the safety of potential future victims by aiding in quicker apprehension of serial killers.
Description	Analyzes and identifies patterns in serial murder cases
Input	the attributes of the killer
Output	analysis on serial killers Profiles and patterns
Pre-Condition	The attributes of the killers
Post-condition	the different attributes of the killer
Dependency	Serial killer data
Risk	High

Table 6: Serial killer pattern recognition Function Description

Name	Serial killer pattern recognition
Code	GR02
Priority	Extreme
Critical	Important in understanding the pattern of serial killers and profiling them , assisting in investigation strategies
Description	Recognizes patterns and behaviors of serial killers
Input	the pattern that the killer used
Output	Serial killer pattern and profile
Pre-Condition	killer caught
Post-condition	pattern analysis
Dependency	GR07
Risk	High

Table 7: Autopsy Report Function Description

Name	Autopsy Report
Code	GR09
Priority	Extreme
Critical	Essential for analyzing autopsy reports to extract key information about the cause and manner of death
Description	Processes and analyzes autopsy reports
Input	attributes for the death information
Output	Autopsy Report analysis
Pre-Condition	Death information
Post-condition	the Autopsy report analysis
Dependency	Autopsy report data
Risk	Moderate

Table 8: Bloodstain Function Description

Name	Bloodstain
Code	GR08
Priority	Extreme
Critical	Critical for analyzing bloodstain patterns which can reveal a lot about the crime scene events
Description	Analyzes bloodstain evidence
Input	image for bloodstain
Output	the bloodstain analysis
Pre-Condition	bloodstain image
Post-condition	blood type, bloodstain age and bloodstain analyses
Dependency	Bloodstain data
Risk	High

Table 9: Recognize face sketching Function Description

Name	Recognize face sketching
Code	GR10
Priority	Extreme
Critical	crucial for generating leads on killer descriptions.
Description	Identifies and matches face sketches with potential suspects
Input	sketch of the killer
Output	a photo of the killer
Pre-Condition	a sketch from someone that knows the description of the killer
Post-condition	a image to help with finding the killer
Dependency	Face sketch data
Risk	low

Table 10: Profile Criminals Function Description

Name	profile killers
Code	GR06
Priority	Extreme
Critical	Essential for creating detailed profiles of criminals based on killer information. - Aids in understanding the behavior and characteristics of suspects.
Description	Creates or updates criminal profiles based on evidence and criminal information
Input	criminal information
Output	criminal profile
Pre-Condition	the description of the criminal
Post-condition	the profile of the criminal
Dependency	GR07
Risk	Moderate

5 Design Constraints

Data is include images and texts.

5.1 Standards Compliance

- The application must have access to an internet connection to use any online features.

5.2 Hardware Limitations

With the high increase of data volume the device would be supported with GPU to run the system.

5.3 Other Constraints as appropriate

- The system will provide a definition for new expression or complex expression for the user explanation.
- Only supported in English.
- In order to be analyzed correctly, the photo should be in clear view to the system.

6 Non-functional Requirements

6.1 Performance

- The system should process evidence analysis requests (e.g., fingerprint matching, face sketch recognition) within a specified time frame.
- The system should support concurrent use by multiple users without significant performance degradation.

6.2 Reliability

- The system must have a high availability, with a target uptime of 99.9% or higher.
- There should be redundancy mechanisms in place to ensure that the system can recover quickly from hardware or software failures.

6.3 Security

- All user data, especially law enforcement and forensic scientists, must be encrypted in transit and at rest.
- Access to sensitive data such as case reports and criminal profiles should be restricted to authorized users only, with role-based access control.

6.4 Scalability

- The system should be scalable to handle increasing amounts of data and users as the organization grows.
- It should be able to integrate with other databases and systems, such as national criminal databases or other forensic analysis tools.

6.5 Usability

- The system should have an intuitive user interface that requires minimal training for investigators, lawyers, and forensic scientists.
- The system should provide clear error messages and guidance for corrective actions when user input is invalid or operations fail.

6.6 Maintainability

- The system should be designed to allow for easy updates and maintenance without significant downtime.
- Proper documentation should be maintained to support system maintenance and future enhancements.

6.7 Compliance

- The system must comply with legal and regulatory standards pertaining to data protection, privacy laws, and criminal justice information services.

6.8 Auditability

- The system should keep detailed logs of user activities, data access, and changes to ensure traceability and support audits.

7 Data Design

7.1 Dataset

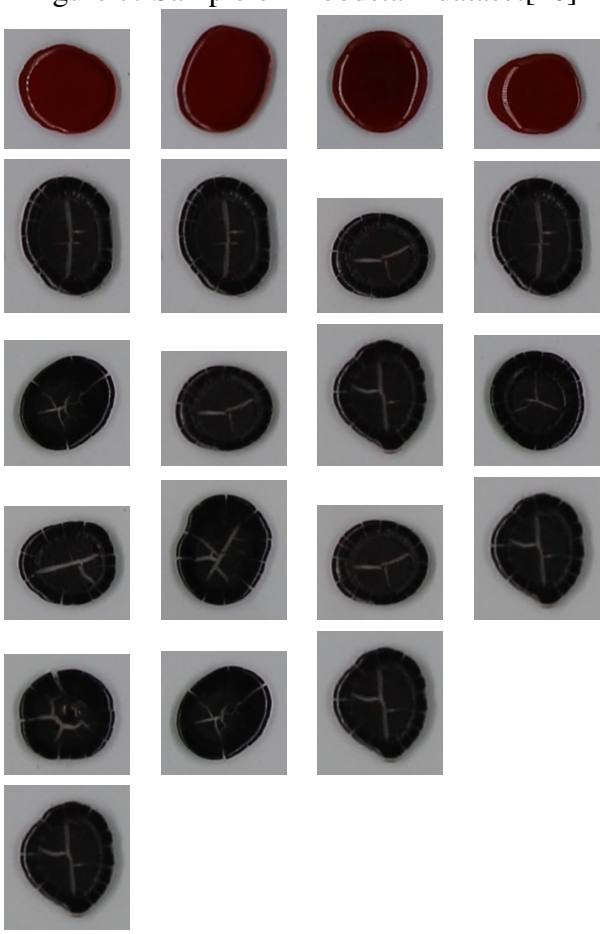
- Serial killer dataset from florida gulf coast university
- face sketch dataset from the Chinese university of hong kong
- fingerprint dataset from images from NIST SD27
- autopsy report dataset from cook county government website
- blood stain dataset from zenodo.org website
- glass identification dataset from the central research home office forensic science service

In this phase, our primary emphasis was on two distinct datasets, each playing a pivotal role in diverse forensic applications. The first dataset comprises 12,000 images sourced from 1,200 unique individuals incarcerated as prisoners. Specifically, the images capture scans of all ten fingers of each individual.[8] This fingerprint dataset serves as a rich resource for biometric analysis,

enabling the development and refinement of identification systems crucial for law enforcement and security applications.[9]

Concurrently, our investigation delved into the second dataset, which pertains to the aging of blood stains. Comprising a staggering 30,000 images, this dataset provides a comprehensive representation of blood stains at various stages of aging, spanning from a mere 1 day to a substantial 28 days. Understanding the morphological transformations and color variations in blood stains over time is imperative in forensic science, aiding in the determination of the temporal aspects of crime scenes. The amalgamation of these datasets equips our research with a diverse set of forensic tools, encompassing both biometric identification through fingerprints and temporal analysis of blood stains, contributing significantly to advancements in the field of forensic investigation and criminal justice.

Figure 7: Sample of Bloodstain dataset[10]



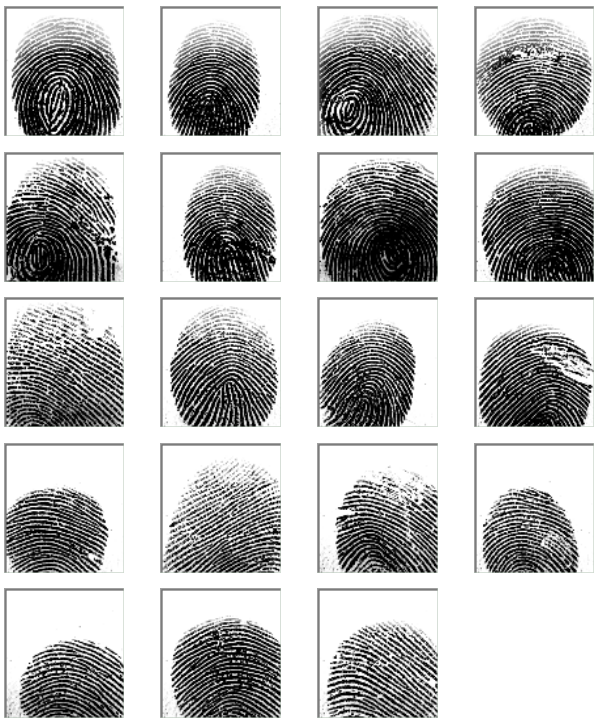


Figure 8: Dataset Sample of Fingerprint [11]

RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
1.52101	13.64	4.49	1.1	71.78	0.06	8.75	0	0	1
1.51761	13.89	3.6	1.36	72.73	0.48	7.83	0	0	1
1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0	0	1
1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0	0	1
1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0	0	1
1.51596	12.79	3.61	1.62	72.97	0.64	8.07	0	0.26	1
1.51743	13.3	3.6	1.14	73.09	0.58	8.17	0	0	1
1.51756	13.15	3.61	1.05	73.24	0.57	8.24	0	0	1
1.51918	14.04	3.58	1.37	72.08	0.56	8.3	0	0	1

Figure 9: Sample of Glass dataset

Name	Country	Years active	Proven victims	Possible victims	Notes
Karl Denke	Germany	1900 to 1924	30	42+	Killed and cannibalized poor travelers and homeless vagrants. Kept a ledger recording his murders with at
Francisco das Chagas Rodrigues de Brito	Brazil	1989 to 2003	30	42	Pedophile who sexually abused, murdered and mutilated children in Maranhão and Pará; sentenced to 21
Luis Gregorio Ramírez Maestre	Colombia	2010 to 2013	30	30	Killed motorists in various municipalities before his 2012 capture. Was sentenced to 34 years in prison.
David Thabo Simelane	Swaziland	2000 to 2001	28	45	Sexually assaulted women he befriended in forests, stabbing or strangling them afterward; sentenced to
Zhang Jun	China	1993 to 2000	28	28	Robbed 22 stores in several Chinese provinces, killing 28 people in the process. Executed in 2001.

Figure 10: Sample of Serial Killer dataset

Figure 11: Sample of Face Sketching dataset

Case Number	Date of Incident	Date of Death	Age	Gender	Race	Latino
ME2022-07751	09/03/2022 01:30:00 PM	09/03/2022 01:30:00 PM	0		Black	False
ME2022-07906	09/10/2022 06:16:00 PM	09/10/2022 08:25:00 PM				False
ME2022-07963	09/13/2022 07:21:00 PM					False
ME2022-08514	10/10/2022 08:45:00 PM	10/11/2022 03:15:00 AM				False
ME2022-08560	10/12/2022 06:15:00 PM	10/12/2022 12:00:00 AM				False
ME2022-08592	10/13/2022 12:00:00 PM					False
ME2022-08597	10/13/2022 11:30:00 AM	10/13/2022 02:00:00 PM				False
ME2022-08748	10/21/2022 10:00:00 AM	10/21/2022 01:48:00 PM				False
ME2022-08988	10/04/2022 12:00:00 AM	10/04/2022 12:00:00 AM				False
ME2022-09006	11/02/2022 08:30:00 AM	11/02/2022 08:50:00 AM	37	Male	Black	False
ME2022-09036	10/31/2022 09:30:00 AM	11/03/2022 12:00:00 AM				False
ME2022-09120	11/06/2022 05:02:00 PM	11/06/2022 12:00:00 AM	37	Male	Black	False

Figure 12: Sample of Autopsy Report dataset

7.2 Database

The database outlined in the EERD is designed for a forensic analysis system, centralizing data on criminal cases, evidence, and individuals involved. It categorizes various evidence types, from fingerprints to bloodstains, and manages detailed profiles for criminals, including specialized data for killers and serial killers. User roles such as investigators, lawyers, and forensic scientists interact with the system, contributing to and extracting from a repository that supports case investigations and legal proceedings. Additionally, it incorporates external evidence like handwriting for comprehensive case analysis. This architecture ensures a streamlined process for storing, retrieving, and analyzing forensic data. The Enhanced Entity Relationship Diagram (EERD) in figure 12 demonstrates the structure of the stored data.

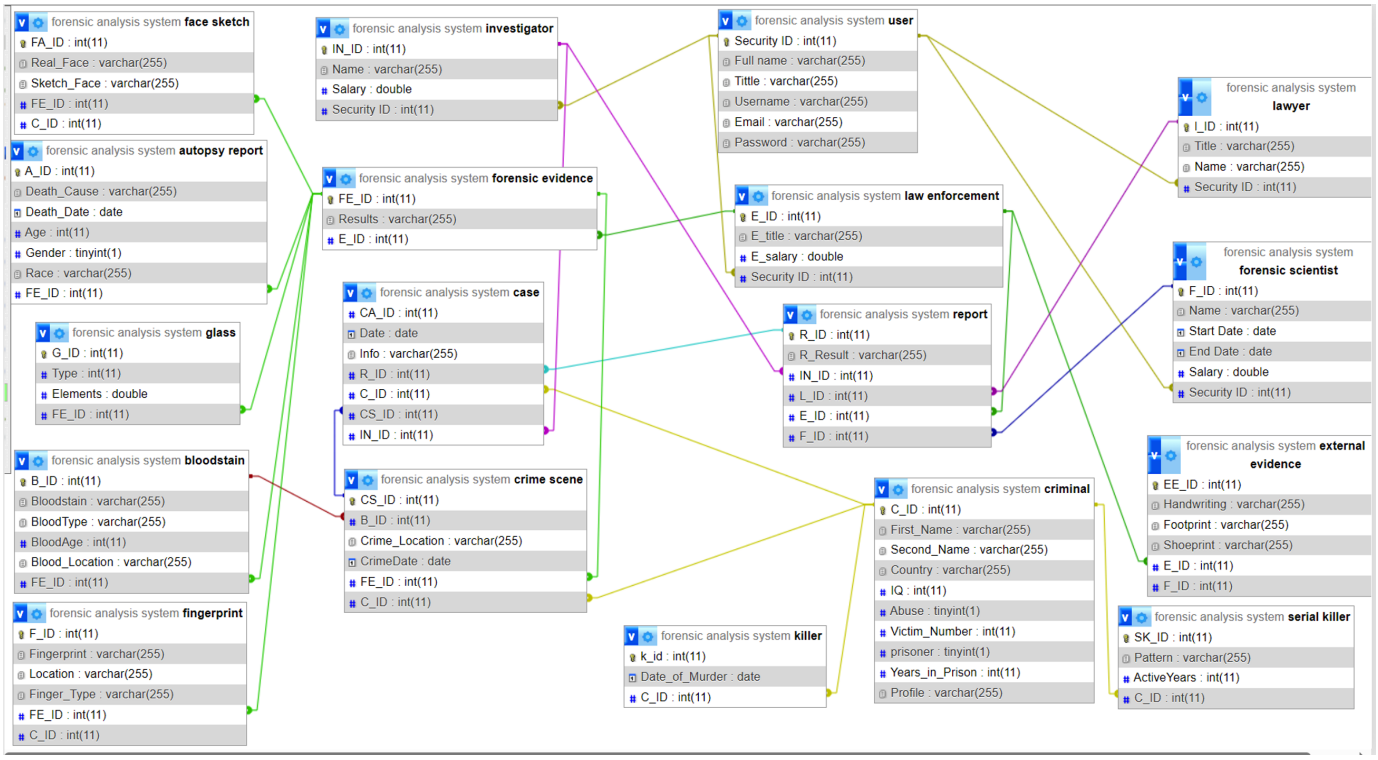


Figure 13: EERD

8 Preliminary Object-Oriented Domain Analysis

An initial Class Diagram of the system is found in Figure 14

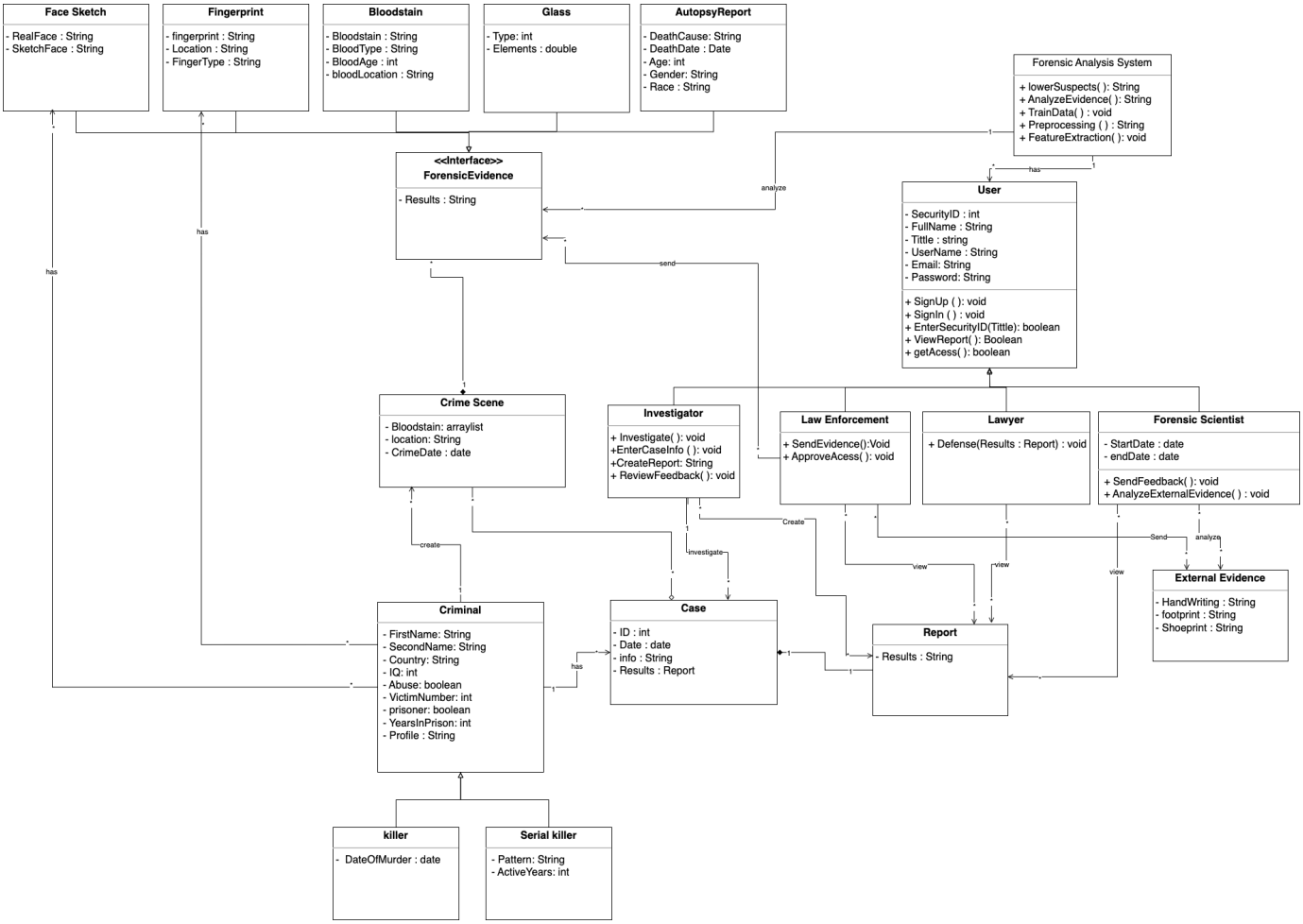


Figure 14: UML Diagram

9 Operational Scenarios

Scenario 1: Law Enforcement Requests Forensic Analysis

Initial Assumption: Law enforcement has access to the Forensic Analysis System and has collected new evidence from a crime scene.

Normal:

- Law enforcement logs into the system with their credentials.
- They select 'Request Analysis' and choose the type of evidence (e.g., fingerprint, bloodstain).
- They upload the evidence files and enter relevant details like the location and date of collection.
- They submit the request and receive a confirmation with an estimated time for analysis results.
- Law enforcement is redirected to their dashboard where they can track the progress.

What can go wrong:

- Incorrect evidence type selected, leading to improper analysis.
- Files fail to upload due to technical issues.
- Details entered are incorrect or incomplete, causing delays.

Scenario 2: Forensic Scientist Analyzes Bloodstain Pattern

Initial Assumption: A forensic scientist is assigned to analyze a bloodstain pattern uploaded by an investigator.

Normal:

- The forensic scientist logs into the system and navigates to their assigned cases.
- They select the case with the bloodstain pattern and review the uploaded images.
- Using the system's analysis tools, they enter the pattern details and run a simulation to determine the type of injury and weapon used.
- The scientist writes a report with their findings and uploads it to the system.
- The case is updated with the new information, and notifications are sent to the relevant parties.

What can go wrong:

- The analysis tool gives inconclusive results due to poor image quality.
- The report upload fails because of a system outage.

- The scientist's findings are inconsistent with other evidence, requiring further investigation.

Scenario 3: Lawyer Reviews Case Evidence

Initial Assumption: A lawyer is preparing for a case and needs to review all the associated evidence.

Normal:

- The lawyer logs into the system and locates the case by ID.
- They review the list of evidence, including forensic reports, investigator notes, and criminal profiles.
- The lawyer downloads the necessary files for offline review.
- They make notes within the system for potential arguments or questions for trial.
- The lawyer schedules a meeting with law enforcement through the system to discuss the evidence.

What can go wrong:

- Some evidence files are restricted and require additional permissions.
- Downloading large files is slow and may disrupt the lawyer's preparation flow.
- Notes made in the system fail to save due to a software glitch.

Scenario 4: Criminal Profile Update

Initial Assumption: A criminal has been convicted, and their profile needs to be updated with the latest case information.

Normal:

- An authorized user accesses the criminal's existing profile in the system.
- They update the profile with new information, including the recent conviction and any new evidence.
- Changes are saved, and the system automatically updates the criminal's risk level and associations.
- Notifications are sent to relevant departments about the profile update.
- The user reviews the updated profile for accuracy before logging out.

What can go wrong:

- The system does not properly save the updated information due to a software bug.
- The criminal's risk level is calculated incorrectly.
- Notifications fail to send, leading to a lack of communication.

Scenario 5: External Evidence Submission

Initial Assumption: An investigator has external evidence (e.g., a handwritten note) that needs to be analyzed for a case.

Normal:

- The investigator logs into the system and navigates to the external evidence section.
- They upload a high-quality image of the handwritten note and fill in the metadata (case ID, date found, etc.).
- They submit the evidence for handwriting analysis and receive a submission confirmation.
- Once the analysis is complete, the investigator is notified and provided with a report on the findings.
- The investigator reviews the findings and integrates them into the ongoing investigation.

  What can go wrong:

  - The handwriting is too illegible for the analysis software to interpret.
  - The metadata entered is incorrect, leading to the evidence being associated with the wrong case.
  - The investigator does not receive the notification due to a system error, delaying the case progress.

10 Project Plan

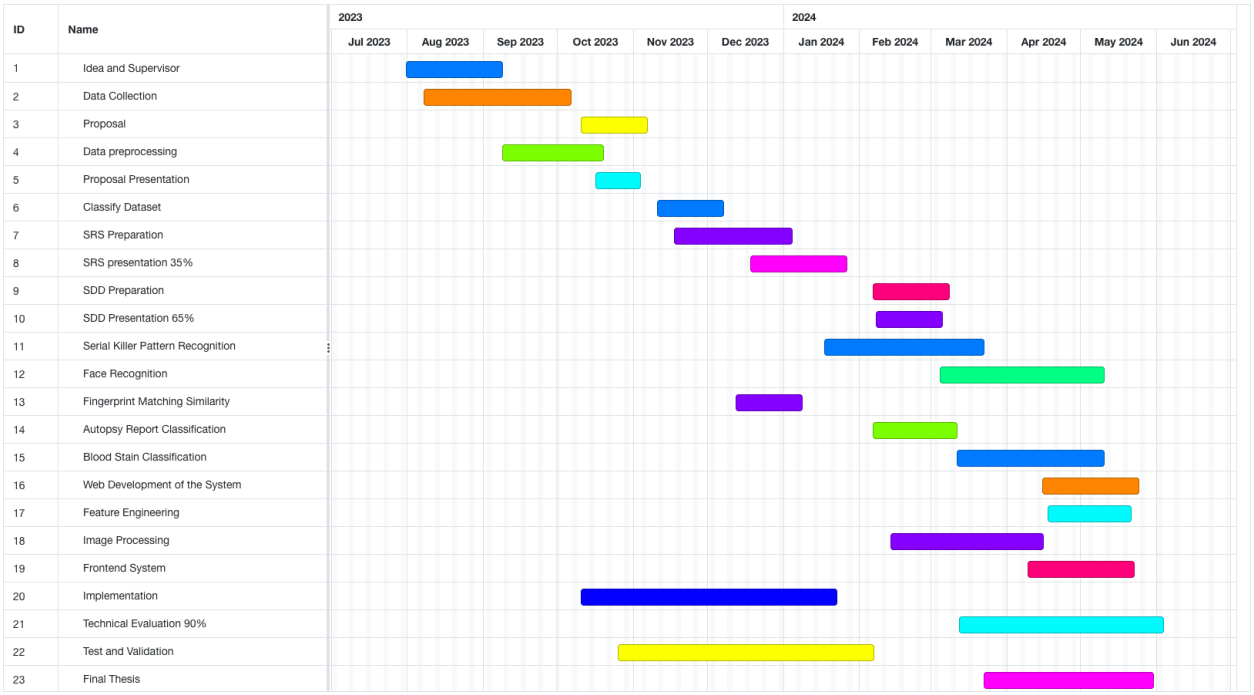


Figure 15: Gantt Chart

11 Appendices

11.1 Definitions, Acronyms, Abbreviations

Table 11: Appendices

SRS	Software Requirement Specification
UML	Unified Modeling Language
EERD	Enhanced entity-relationship diagram
GPU	Graphics Processing Units
CPU	Central Processing Units
Autopsy Report	Looks for signs and evidence
ML	Machine Learning
DL	Deep Learning
AI	Artificial Intelligence

11.2 Supportive Documents

11.3 Investigator Feedback

Mahmoud Ahmed <mano19155@icloud.com> Tue, Nov 14, 2023 at 9:32 AM
To: hana1907671@miuegypt.edu.eg

Dear Project Team,

I hope this email finds you all in good spirits. I wanted to take a moment to express my sincere appreciation for your outstanding efforts and hard work on the recent crime scene analysis project.

I am truly impressed by the expertise and skills each of you brought to the table during this project. Your meticulous attention to detail and ability to analyze complex crime scenes have been exceptional. The level of dedication and professionalism you displayed throughout the project was truly commendable.

Your collaborative approach and seamless communication within the team played a significant role in our success. The way you shared insights, exchanged ideas, and supported one another demonstrates the strength and unity of our team.

I want to acknowledge your tireless efforts in unraveling the evidence and uncovering the truth. Your commitment to accuracy, thoroughness, and adherence to scientific protocols have greatly contributed to the successful analysis of the crime scenes. Your invaluable contributions have not only served justice but have also brought closure to the victims and their families.

I am grateful for your ability to think critically, solve complex problems, and make sound judgments in challenging and often high-pressure situations. Your passion for justice and unwavering pursuit of truth make me proud to work alongside each of you.

Your dedication to upholding the highest ethical standards and maintaining the integrity of our investigations is truly commendable. Your work is vital in ensuring that the guilty are held accountable and the innocent are protected.

I want to express my sincere gratitude for your professionalism, commitment, and unwavering determination throughout this project. Your contributions as Team work have undoubtedly made a lasting impact on our team and in the pursuit of justice.

Thank you once again for your exceptional work. I am honored to be a part of this remarkable team.

Best regards,

[Investigator]

Figure 16 : Investigator Feedback

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