

Final Report



Smart Internz

Technology Stack: Google Artificial Intelligence and Machine Learning

Project Title: A Holistic Frame Work For Crime Prevention Response And Analysis With Emphasis On Women Safety Using Technology And Societal Participant

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ABSTRACT

Ensuring women's safety in smart cities is a need of the hour. Even though several legal and technological steps are adopted worldwide, women's safety continues to be an international concern. Criminal records are maintained by law enforcement agencies and are most often not available to the public in an easily comprehensible form. While some wearable devices and mobile applications are available which are touted to aid in ensuring women's safety, they utilize limited societal intervention and are not very efficient in ensuring the safety of the women as and when required. Most often the crime response, crime analysis, and crime prevention schemes are not integrated, leading to gaps in ensuring women's safety. The proposed project contributes in developing a holistic system encompassing the three crucial aspects, i.e crime analysis and mapping, crime prevention, and emergency response by leveraging societal participation for women safety management. This work applies the Geographic Information System (GIS) for the identification of hotspots and patterns of crime. The proposed system uses data generated from the mobile application and/or wearable gadget prototyped as a part of this work along with the criminal history records for crime response, analysis, and prevention. While the common man is provided a cost-effective solution via the developed mobile application or wearable gadget, the various components are integrated into a website for supervisory management and can be utilized by law enforcement agencies. By using some machine learning techniques like Decision Tree Classifier, SVM, the proposed project provides a holistic framework is to leverage technology and societal participation, particularly focusing on women's safety, to prevent, respond to, and analyze crime using machine learning for effective interventions and solutions.

Keywords: Crime analysis, Decision Tree Classifier, SVM, Women Safety, Geographic Information System.

CHAPTER 1- INTRODUCTION

In today's world, ensuring safety, especially for women, is a pressing concern. With the advent of technology and the increasing integration of machine learning into various domains, there lies a unique opportunity to develop a holistic framework for crime prevention, response, and analysis, with a specific emphasis on women's safety.

Gender-based disparities are one of the major issues of the current century. Even though constitutional rights have vouched for gender equality, it is a reality that gender-based disparity exists in several sections of societies across the world. The 21st-century women have to a certain extent succeeded in contributing to society and working shoulder to shoulder with men in several fields. However, violence against women is being increasingly reported in recent times across the world. According to António Guterres, the ninth Secretary-General of the United Nations, violence and abuse against women are among the world's most horrific human rights violations, affecting 1 in every 3 women in the world. Gender equality is the prerequisite for a better world. Gender-based violence on females limits women's participation in decision making leading to a decline in life quality. Women's equal participation is vital to stability, to prevent conflict, and to promote inclusive and sustainable development.

Though the intensity of violence against women may vary, no country has remained unaffected and there is a need to understand the root cause behind the crimes and find solutions. Today, the crime mapping and crime response remain majorly a responsibility of law enforcement agencies. Crime record data is maintained by law enforcement agencies and is most often not available to the public in an easily comprehensible form to take necessary precautions. Even though crime prevention is a major concern of the police force, since the human resource capacity of the police force is small relative to the population, their services sometimes tend to get limited to crime response than crime prevention. Some wearable devices and mobile applications are developed over the years towards ensuring women's safety. However, most of these applications and wearables either raise an alarm in the form of visual or audio cues or sent messages to the contact (guardians) or law enforcement agencies. If a woman moves out of the city or away from their guardians these systems do not serve the purpose. These systems utilize limited societal intervention and are not very efficient in ensuring the safety of the women as and when required.

Most often the crime response, crime analysis, and crime prevention schemes are not integrated leading to gaps in ensuring women's safety. In this paper, we present a holistic framework encompassing the three crucial aspects, i.e crime analysis and mapping, crime prevention, and prompt emergency response leveraging community participation. Geographic Information System (GIS) techniques are utilized in the proposed system to identify hotspots and patterns of crime by integrating socio-economic attributes of the area along with the criminal history. Using the information generated regarding the crime statistics using the GIS techniques, the user can take necessary preventive measures before visiting an area. A prototype of a wearable device and mobile application is developed. The mobile application and the wearable gadget can be used to trigger a panic signal to alert the volunteers in proximity, in addition to the contacts and law enforcement agencies. The mobile application and gadget allows tracking of the person/volunteer and generates data for further crime analysis. This caters to the prompt crime response as societal participation is also leveraged. An interactive website is developed for the visualization of GIS analysis, and data generated through wearable and mobile applications. Through this website, the administrator (law enforcement agencies) can track the movement of victims and nearby volunteers in real-time and assist both in an emergency. The administrator can also update the database of criminal records regularly and the crime hotspot analysis will be updated automatically. The prototype of the framework developed for crime mapping, prevention, and crime response can be easily scaled up geographically and updated easily as a safety strategy in smart cities.

1.2 FEATURES:

A holistic framework for crime prevention, response, and analysis with emphasis on women's safety using technology involves several key features:

- 1) **Data Collection and Analysis:** Utilize machine learning algorithms to gather and analyze data from various sources such as crime reports, social media, and public surveys to identify patterns and trends related to crime against women.
- 2) **Predictive Modeling:** Develop predictive models to anticipate potential crime hotspots and times, enabling proactive deployment of resources and interventions to prevent incidents.

- 3) **Smart Surveillance:** Implement intelligent surveillance systems equipped with facial recognition, anomaly detection, and geospatial analysis to monitor public spaces and identify suspicious activities in real-time.
- 4) **Emergency Response Systems:** Integrate technology-enabled emergency response systems that allow women to quickly and discreetly seek help in threatening situations, such as panic buttons, mobile applications, or wearable devices with GPS tracking capabilities.
- 5) **Community Engagement:** Foster community participation through mobile apps or online platforms where users can report incidents, share safety tips, and access resources for support and education on women's safety.
- 6) **Policy Recommendations:** Generate insights from data analysis to inform policy recommendations aimed at addressing systemic issues contributing to gender-based violence and promoting gender equality.
- 7) **Privacy and Ethical Considerations:** Ensure that privacy and ethical considerations are prioritized throughout the design and implementation process, safeguarding individuals' rights and minimizing the risk of unintended consequences or misuse of technology.

By integrating these features into a comprehensive framework, we can work towards creating safer environments for women while leveraging the power of technology and community collaboration to prevent and respond to crimes effectively

1.3 PROBLEM STATEMENT:

Despite significant advancements in technology and societal awareness, women continue to face various forms of violence and harassment in public spaces globally. Traditional crime prevention approaches often lack the necessary agility and inclusivity to address the dynamic nature of these challenges. There is a critical need for a comprehensive framework that integrates cutting-edge technology, community engagement, and data-driven methodologies, particularly leveraging machine learning, to enhance women's safety and prevent crimes against them in urban and public environments.

1.4 OBJECTIVE:

A holistic framework for crime prevention, especially focusing on women's safety using technology and societal participation, has vast potential for future development. Incorporating machine learning can enhance predictive analysis and response mechanisms. As technology evolves, integrating real-time data and advanced algorithms can further refine this framework, making it more effective in addressing evolving crime patterns and societal needs. Additionally, ongoing collaboration with communities and stakeholders will be crucial for its success and sustainability.

1.5 SCOPE:

The project endeavors to establish a multifaceted framework for crime prevention, emphasizing women's safety, by leveraging technology and engaging societal participants. Through the utilization of machine learning techniques, it aims to analyze crime data comprehensively to identify patterns and develop more effective response strategies. By integrating technological solutions and community engagement, the project seeks to create a cohesive approach to enhance women's safety and contribute to a safer society overall. The scope of a holistic framework for crime prevention, response, and analysis with an emphasis on women's safety using technology and societal participation utilizing machine learning is broad and multifaceted. Here are some aspects of its scope:

- 1) **Data Integration:** Incorporating data from diverse sources such as crime records, social media, public surveys, and demographic information to provide a comprehensive understanding of the factors influencing women's safety and vulnerability to crime.
- 2) **Machine Learning Algorithms:** Implementing machine learning algorithms for predictive modeling, anomaly detection, and pattern recognition to identify high-risk areas, predict potential threats, and optimize resource allocation for crime prevention efforts.
- 3) **Technological Solutions:** Developing and deploying a range of technological solutions including smart surveillance systems, mobile applications, wearable devices, and online platforms tailored to address the specific safety needs of women and facilitate rapid emergency response.

CHAPTER 2 - LITERATURE SURVEY:

2.1 Research Article 1

["VIOLENCE AGAINST WOMEN A BARRIER TO PEACEFUL FUTURE FOR ALL

"As we go about our business, one woman in three that we encounter has been or will be subjected to violence," said Maria Luiza Ribeiro Viotti, UN Chef de Cabinet, speaking on behalf of the Secretary-General.

"In some regions, and for some groups of women, the rate is even far higher—and this is only the violence that is reported, so the real level is indeed far higher."

"A culture of violence against women also has serious consequences for our efforts to eradicate poverty and promote inclusive, sustainable development."

2.2 Research Article 2

"10 SAFETY APPS FOR WOMEN"

1. Eyewatch SOS for Women

Eyewatch SOS for Women captures audio and video of the user's surroundings and sends it to the registered contacts along with an alert message. This app has been praised for high location accuracy, functioning without GPRS and Safety confirmation feature. On reaching the location safely the user can inform their near ones by pressing the I am Safe button. It is available on Google Play store and iTunes.

2. SpotnSave Feel secure

Labelled as one of the most advanced safety application, SpotnSave Feel secure sends an alert message along with the location to the pre-selected contact in every two minutes. In case the user does not have access to phone, he can make use of the wristband, which comes with the app and press button given on the band. This works via Bluetooth in the same way the phone does. This app is available on Google Playstore and iTunes.

3. iGoSafely

iGoSafely sends alert messages, emails and/or GPS position to emergency contacts on activation. The app keeps on sending messages, every minute unless the alarm is turned off using the secret disarm code. Along with the above mentioned information, iGoSafely sends a thirty-second audio recording captured by the phone's microphone. It can be activated by shaking the phone or simply by removing the headphones.

4. Smart 24×7

Safety 24X7 is an app, which helps the user to call the police by pressing the panic button. Additionally, an option of calling some pre-designated contact is available on this app. In case of non-functioning of GPRS, location is sent via SMS. Along with providing features like tracking, customer care and chat, this app also clicks photos and records audio-video of situation. It is available on Google Playstore and iTunes.

5. bSafe

bSafe is an all in one safety app for woman providing varieties of features. It has bSafe alarm which sends exact location and audio-video of the surrounding areas to the contact previously selected by you. Another feature 'Follow me' enables virtual tracking of the user via GPS tracking, until you reach the situation. Fake call feature in this app allows you to fake call to escape from some unpleasant situation and 'timer alarm' helps you to set an auto alarm to keep your guardian informed about your whereabouts. This app is available on Google Playstore and iTunes.

6. Shake2Safety

This app sends an emergency SOS message or makes a call instantly to the previously selected numbers after pressing the power button four times or after shaking the phone. Shake2Safety works without internet connection and even with the locked screen. This app is also useful for reporting cases of robbery, accident or natural disaster.

7. Trakie

Trakie enables you to get all the real-time information about the movement, location, battery percentage, signal strength and speed of travelling of your close ones. Along with providing all

these features, the app also allows the user to chat with their contact. Registration of genuine and authentic numbers is possible through this app as it is verified through OTP and SIM serial number.

8. My SafetyPin

If you are stuck in a crossroad, then My SafetyPin app acts as your guide in choosing the best and safest route. On entering an unsafe location, this app gives alerts and you can invite family or friends to track you. Safety of an area is measured using various parameters like public transport, visibility, security etc. My SafetyPin app is available on Google Playstore and itunes.

9. CitizenCop

By using this app, any citizen can report criminal cases or illegal activity in their area anonymously. Cases of lost or stolen articles can also be reported by calling the police. CitizenCop app creates a safety zone for woman through what it calls eLakshmanRekha and provides several features like live tracking, emergency calls and SOS alerts. All android phone users and iPhone users can download this app through Google Playstore and iTunes respectively.

10. Chilla

A woman unable to press the button of her phone while facing some problem can activate Chilla app by shouting loudly. On activation, this app sends an alert message to the woman's guardian. Apart from this feature, Chilla app sends alert messages to pre-configured contacts on pressing the power button five times. It can be downloaded from Google Playstore and iTunes.

2.3 Research Article 3

"ORANGE THE WORLD - APPS FOR WOMEN'S SAFETY IN INDIA". ACCESSED ON JUNE 15, 2020. [ONLINE]. AVAILABLE AT: .

Violence against women has become a grave cause of concern all around the world. From domestic violence to eve-teasing, women have been subjected to a lot of negative actions which has put their safety and peace of mind in jeopardy.

In the era of digitalization, technology is often employed to solve problems in every arena, including the prevention of violence against women. Information Communication Technology (ICT) has been both, a bane and boon to women's safety. With the advent of social media, the cases of cyber harassment against women have increased and their privacy is often compromised. However, it is the ICT that also offers new and innovative ways to battle violence against women and to provide women and girls with more protection, security and independence.

Smartphones are no more a luxury. It is owned by almost everyone around the world. This has made the use of apps for fighting violence against women very desirable. Let us look at some of the apps that are working towards improving safety for women.

2.4 Research Article 4

["SPOTNSAVE: YOUR ULTIMATE GUARDED SECURITY DEVICE". ACCESSED ON JUN 16, 2020. [ONLINE]. AVAILABLE AT: .

Women are the most integral part of any economy primarily. Many crimes against them are not being reported because of society's hypocritic point of view. Various types of humiliations and mistreatment are being faced by the victims who try to report their assaults from society. Only one of four cases lead to conviction trails in India. In this project, a smart device for women's safety which automates the emergency alert system by using pressure sensor, pulse-rate sensor and Gyroscope sensor to detect a possible atrocity automatically. The system also have manual system with a push button which can be press by the women in critical situation, but during panic situation it is not possible to press the push button. The automatic system help in this situation. A GSM and GPS system is used in order to alert about the unusual situation and location to the relatives and police, image of attacker also sent to police by a camera system which helps to identify the criminal. Another module of shock system is implemented along with the system. A cancel button is also added to avoid false message to the authorities.

2.5 Research Article 5

E. Brooke, Meet Siren, a Ring Designed to Prevent Assault - Fashionista. Accessed on Jun 16, 2020. [Online]. Available: <https://fashionista.com/2014/10/siren-ring>.

The world is getting unsafe for women in all aspects. The crimes against women are adding at an advanced rate. The employed women are feeling unsafe due to adding crimes. This paper proposes a quick responding medium that helps women during trouble. This paper covers descriptive details about the design and perpetration of "Smart band". The device consists of a detector, microcontroller(ATmega328), IoT Module (ESP- 8266), GPS module(Neo-6M), tazer, Buzzer and wobbling Sensor. In this design, when a woman senses peril she has to hold ON the detector of the device. Once the device is actuated, it tracks the current position using GPS (Global Positioning System) and shoot to the IoT Module to the update the pall and near police station. IoT module is used to track the position continuously and modernize into the webpage. Tazer will produce on-lethal electric shock in exigency situations to descry the bushwhacker, buzzer is used as an alarm to warn the near people so that they may understand that someone is in need and vibrating sensor will shoot the last position in case if the device gets defected. The main advantage of this design is that this device can be carried far and wide since it's small.

2.6 Research Article 6

C.M.Carter, Meet the Millennial Who Created Athena, A Safety Wearable For The 21st Century. Accessed on Jun 16,2020, [Online]. Available on: <https://www.forbes.com/sites/christinecarter/2017/08/28/meetthe-millennial-who-created-athena-a-safety-wearable-for-the-21stcentury/4c991be2c06d>. [Accessed: 16-Jun-2020]

Safety wearables have become increasingly important in the last few years. These innovations are incredibly beneficial to both employers and workers when appropriately used. Not only can wearable safety technology prevent accidents and injuries from occurring, but it can also collect crucial data for movement and body positions, environmental factors, biometric data, auditory data and other forms of important worker data. This fosters a symbiotic connection between workers and data, enhancing safety leadership and cultivating an optimal workspace. This article details several pertinent wearable safety technologies available today.

Augmented Reality Glasses:

Augmented reality (AR) glasses are a wearable technology that can be used in many situations and are especially innovative regarding safety. AR glasses can be implemented into work situations to display helpful metrics and data inside the lens while one is working. This technology also utilizes built-in cameras to share and display real-time data as workers are at their stations. In addition to data such as biometrics and location, the technology is hands-free which is incredibly beneficial in a work setting such as in industrial or Realwear currently has a related wearable technology that is an excellent safety solution for industrial environments. This technology connects workers to experts instantly to work through situations or issues in real time to formulate solutions. There are several benefits involved with this technology which include real-time collaboration, increased productivity, visualization of IoT data, quality improvement, and more.

2.7 Research Article 7

A. Sciarretto, This Charm Could Save You from Assault, Accessed on Jun 16, 2020. [Online]. Available: <https://www.bustle.com/articles/56441-stiletto-security-charms-could-prevent-assault-by-providing-a-discreet-way-to-call-911-if-youre>

For the most part, wearable tech is more about utility than life-or-death necessity, thanks to things like Opening Ceremony varsity jackets with built-in chargers that transform the fashionable user into a human mobile charging station. While wearable tech can be about necessity for power users, since accessibility is crucial to business pursuits, the Stiletto is an essential advancement in wearable tech. Stiletto charms could save you from being assaulted.

2.8 EXISTING SYSTEM

There are a lot mobile applications available for women safety. Most of these applications are reactive, i.e. can raise an alert when the user is in danger. These applications provide a means to contact the police, selected contact persons, or guardians when triggered. If the user goes to a distant location away from the contacts, only the police force will be available for help, and sending alerts to contacts at a distant place may be of limited use. Most of the applications do not offer assistance in warning women about a danger prone area.

MOBILE APPLICATIONS FOR WOMEN SAFETY LIKE : My SafetiPin app classifies a public area as ‘unsafe’ or ‘safe’ at night, based on parameters such as lighting conditions, openness, visibility, number of people in the vicinity, number of police station. These factors thus cause limited use of the available applications in ensuring women’s safety.

WEARABLE DEVICES FOR WOMEN SAFETY : The Sonata watch ‘ACT’ paired with a smartphone can send out panic messages to a set of contact numbers. If the phone is lost, thrown away by the attacker, or if phone is out of charge then the wearable will not serve its purpose.

DISADVANTAGES:

- In the existing work, the system did not implement Geographic Information System (GIS).
- This system is less performance due to Bluetooth connection which will connect only within a few meters.

CHAPTER 3 – SYSTEM ANALYSIS

3.1 PROPOSED SYSTEM

We propose a holistic framework leveraging societal participation and four major components as described below and depicted in the system.

- 1) Mobile application
- 2) Prototype of the wearable device
- 3) GIS analysis for the identification of hotspots of crime
- 4) Website for integrated crime monitoring, response, and Analysis

Each city is unique and hence we propose that the safety of the women can be best addressed by leveraging societal participation rather than completely relying on law enforcement agencies. Through our system, the users are provided with raise an alert when they are in danger. The crime response is leveraged through community participation. The volunteers who are in the vicinity of the person in danger will receive notifications regarding the users in danger and can track the person in danger and assist her in addition to the police or guardian. The use of wearable gadget is optional. Wearable gadget designed in the system can be utilized as a standalone device and hence, can be used to trigger alerts even when the smartphone is not active. In case if the user do not want to invest on buying the wearable, the mobile application can be used for raising the alert. The website developed acts as an integrator between several components of the system such as mobile application, wearable device, and GIS-based hotspot visualization. The GIS visualization of hotspots of crime will help the user to identify possible threats in a locality and take necessary precautions. The supervisory management of the website can be done by the law enforcement agencies. The system is designed in such a way that the website administrators can update the crime records from time to time and the hotspots of crime will be updated in the website accordingly. The website administrators or law enforcing agencies can monitor the users in danger and responses of volunteers to the alert.

3.2 ADVANTAGES OF PROPOSED SYSTEM:

- 1) Understanding of various socio-economic factors that lead to violence against women so that effective measures for social reforms can be designed,
- 2) Crime analysis and mapping to identify hotspots of crime and hotspot shifting,
- 3) Effective use of technology through which a woman can raise alerts in case of danger.
- 4) Prompt emergency response leveraging community participation, all of which are addressed in the proposed solution. Even though some prior work is available in each of these areas, a holistic system encompassing crime prevention, crime analysis, and crime response is not available.

3.3 SOFTWARE REQUIREMENT SPECIFICATION:

3.1.1 FUNCTIONAL REQUIREMENTS

In software engineering, a functional requirement defines a function of a software system or its component. A function is described as a set of inputs, the behaviour, and outputs (see also software). Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish. Behavioral requirements describing all the cases where the system uses the functional requirements are captured in use cases. Generally, functional requirements are expressed in the form “system shall do <requirement>”. The plan for implementing functional requirements is detailed in the system design. In requirements engineering, functional requirements specify particular results of a system.

Outputs from computer systems are required primarily to communicate the results of processing to users. They are also used to provide a permanent copy of the results for later consultation.

The various types of outputs in general are:

- External Outputs, whose destination is outside the organization.
- Internal Outputs whose destination is within organization.
- User’s main interface with the computer.
- Operational outputs whose use is purely within the computer department.

- Interface outputs, which involve the user in communicating directly.

3.1.2. NON-FUNCTIONAL REQUIREMENTS:

NON-FUNCTIONAL REQUIREMENT (NFR) specifies the quality attribute of a software system. They judge the software system based on Responsiveness, Usability, Security, Portability and other nonfunctional standards that are critical to the success of the software system. Example of nonfunctional requirement, “how fast does the website load?” Failing to meet non-functional requirements can result in systems that fail to satisfy user needs. Non- functional Requirements allows you to impose constraints or restrictions on the design of the system across the various agile backlogs. Example, the site should load in 3 seconds when the number of simultaneous users are > 10000.

Description of non-functional requirements is just as critical as a functional requirement.

- Usability requirement
- Serviceability requirement
- Manageability requirement
- Recoverability requirement
- Security requirement
- Data Integrity requirement
- Maintainability requirement

HARDWARE REQUIREMENTS:

- Processor - Intel(R) Core(TM)
- RAM - 4 GB (min)
- Hard Disk - 20 GB

SOFTWARE REQUIREMENTS:

- Operating system: Windows.
- Coding Language: Python.
- Designing : Html, css.
- Front-End : Python
- Back-End : Django-ORM
- Data Base : MySQL (WAMP Server).

3.2 FEASIBILITY ANALYSIS

Feasibility Study is a high-level capsule version of the entire process intended to answer several questions like: What is the problem? Is there any feasible solution to the given problem? Is the problem even worth solving? Feasibility study is conducted once the problem is clearly understood. Feasibility study is necessary to determine that the proposed system is Feasible by considering the technical, Operational, and Economical factors. By having a detailed feasibility study the management will have a clear-cut view of the proposed system. The following feasibilities are considered for the project in order to ensure that the project is viable, and it does not have any major obstructions. Feasibility study encompasses the following things.

- Technical Feasibility
- Economic or financial feasibility
- Operational feasibility

TECHNICAL FEASIBILITY:

In this step, we verify whether the proposed systems are technically feasible or not. i.e., all the technologies required to develop the system are available readily or not.

Technical Feasibility determines whether the organization has the technology and skills necessary to carry out the project and how this should be obtained. The system can be feasible because of the following grounds.

- All necessary technology exists to develop the system.
- This system is flexible, and it can be expanded further.
- This system can give guarantee of accuracy, ease of use, and reliability.
- Our project is technically feasible because, all the technology needed for our project is readily available.

ECONOMIC FEASIBILITY:

In this step, we verify which proposal is more economical. We compare the financial benefits of the new system with the investment. The new system is economically feasible only when the financial benefits are more than the investments and expenditure.

Economic Feasibility determines whether the project goal can be within the resource limits allocated to it or not. It must determine whether it is worthwhile to process with the entire project or whether the benefits obtained from the new system are not worth the costs. Financial benefits must be equal or exceed the costs. In this issue, we should consider:

- The cost to conduct a full system investigation.
- The cost of h/w and s/w for the class of application being considered.
- The development tools.
- The cost of maintenance etc.

Our project is economically feasible because the cost of development is very minimal when compared to financial benefits of the application.

OPERATIONAL FEASIBILITY:

In this step, we verify different operational factors of the proposed systems like manpower, time etc., whichever solution uses less operational resources, is the best operationally feasible solution. The

solution should also be operationally possible to implement. Operational Feasibility determines if the proposed system satisfied user objectives could be fitted into the current system operation.

- The methods of processing and presentation are completely accepted by the clients since they can meet all user requirements.
- The clients have been involved in the planning and development of the system.
- The proposed system will not cause any problem under any circumstances.
- Our project is operationally feasible because the time requirements and personnel requirements are satisfied. We are a team of four members, and we worked on this project for three working months.

CHAPTER 4 – SYSTEM DESIGN

4.1 UML DIAGRAMS:

A UML diagram is a way to visualize systems and software using Unified Modeling Language (UML). Software engineers create UML diagrams to understand the designs, code architecture, and proposed implementation of complex software systems. UML diagrams are also used to model workflows and business processes.

1. Structural Diagrams:

Structural diagrams depict a static view or structure of a system. It is widely used in the documentation of software architecture. It embraces class diagrams, composite structure diagrams, component diagrams, deployment diagrams, object diagrams, and package diagrams. It presents an outline for the system. It stresses the elements to be present that are to be modelled:

- 1) **Class Diagram:** Class diagrams are one of the most widely used diagrams. It is the backbone of all the object-oriented software systems. It depicts the static structure of the system. It displays the system's class, attributes, and methods. It is helpful in recognizing the relation between different objects as well as classes.
- 2) **Composite Structure Diagram:** The composite structure diagrams show parts within the class. It displays the relationship between the parts and their configuration that ascertain the behavior of the class. It makes full use of ports, parts, and connectors to portray the internal structure of a structured classifier. It is similar to class diagrams, just the fact it represents individual parts in a detailed manner when compared with class diagrams.
- 3) **Object Diagram:** It describes the static structure of a system at a particular point in time. It can be used to test the accuracy of class diagrams. It represents distinct instances of classes and the relationship between them at a time.
- 4) **Component Diagram:** It portrays the organization of the physical components within the system. It is used for modeling execution details. It determines whether the desired functional requirements have been considered by the planned development or not, as it depicts the structural relationships between the elements of a software system.

- 5) **Deployment Diagram:** It presents the system's software and its hardware by telling what the existing physical components are and what software components are running on them. It produces information about system software. It is incorporated whenever software is used, distributed, or deployed across multiple machines with dissimilar configurations.
- 6) **Package Diagram:** It is used to illustrate how the packages and their elements are organized. It shows the dependencies between distinct packages. It manages UML diagrams by making it easily understandable. It is used for organizing the class and use case diagrams.

2. Behavioral Diagrams:

Behavioral diagrams portray a dynamic view of a system or the behavior of a system, which describes the functioning of the system. It includes use case diagrams, state diagrams, and activity diagrams. It defines the interaction within the system.

- 1) **State Machine Diagram:** It is a behavioral diagram. it portrays the system's behavior utilizing finite state transitions. It is also known as the State-charts diagram. It models the dynamic behavior of a class in response to external stimuli.
- 2) **Activity Diagram:** It models the flow of control from one activity to the other. With the help of an activity diagram, we can model sequential and concurrent activities. It visually depicts the workflow as well as what causes an event to occur.
- 3) **Use Case Diagram:** It represents the functionality of a system by utilizing actors and use cases. It encapsulates the functional requirement of a system and its association with actors. It portrays the use case view of a system.

3. Interaction Diagrams:

Interaction diagrams are a subclass of behavioral diagrams that give emphasis to object interactions and also depicts the flow between various use case elements of a system. In simple words, it shows how objects interact with each other and how the data flows within nteraction diagrams are a subclass of behavioral diagrams that give emphasis to object interactions and also depicts the flow between various use case elements of a system. In simple words, it shows how objects interact with each other

and how the data flows within them. It consists of communication, interaction overview, sequence, and timing diagrams.

- 1) **Sequence Diagram:** It shows the interactions between the objects in terms of messages exchanged over time. It delineates in what order and how the object functions are in a system.
- 2) **Communication Diagram:** It shows the interchange of sequence messages between the objects. It focuses on objects and their relations. It describes the static and dynamic behavior of a system.
- 3) **Timing Diagram:** It is a special kind of sequence diagram used to depict the object's behavior over a specific period of time. It governs the change in state and object behavior by showing the time and duration constraints.
- 4) **Interaction Overview diagram:** It is a mixture of activity and sequence diagram that depicts a sequence of actions to simplify the complex interactions into simple interact

4.2.1 USE CASE DIAGRAM:

Use case diagram represents the functionality of the system. Use case focus on the behavior of the system from external point of view. Actors are external entities that interact with the system.

Use cases:

A use case describes a sequence of actions that provide something of measurable value to an actor and is drawn as a horizontal ellipse.

Actors:

An actor is a person, organization, or external system that plays a role in one or more interactions with the system.

The “user model view” encompasses a problem and solution from the perspective of those individuals whose problem the solution addresses. The view presents the goals and objectives of the problem owners and their requirements of the solution.

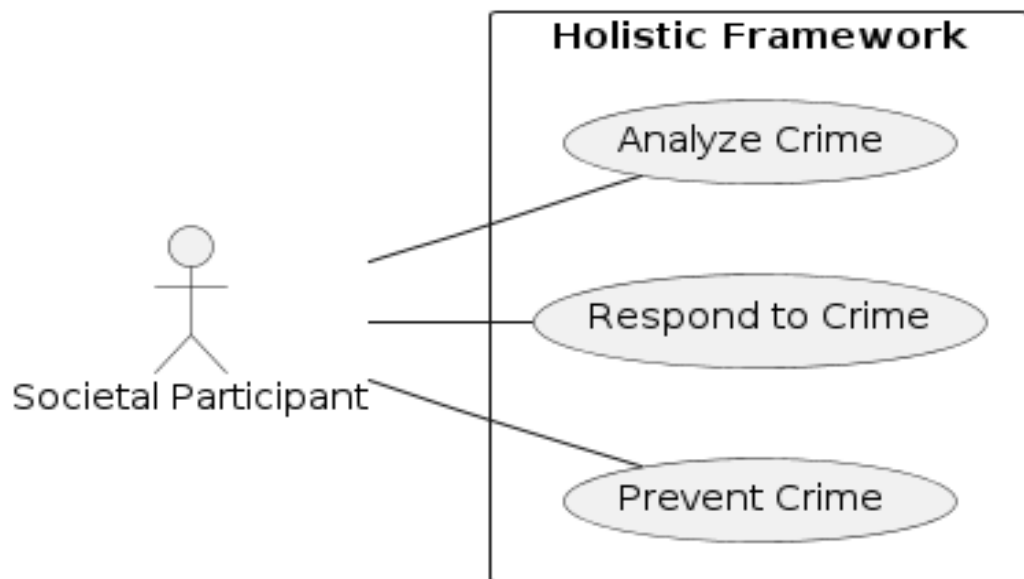


Fig 4.2.1 Usecase Diagram

4.2.2 ACTIVITY DIAGRAM:

An Activity Diagram in UML is a graphical representation used to model the workflow or flow of control within a system or process. It visually depicts the sequence of activities, actions, decisions, and transitions that occur from start to finish. It signifies the termination point of the workflow.

Activity diagrams provide a high-level overview of the system or process's behavior, illustrating the sequence of actions and decisions involved. They are particularly useful for understanding complex workflows, business processes, or system interactions.

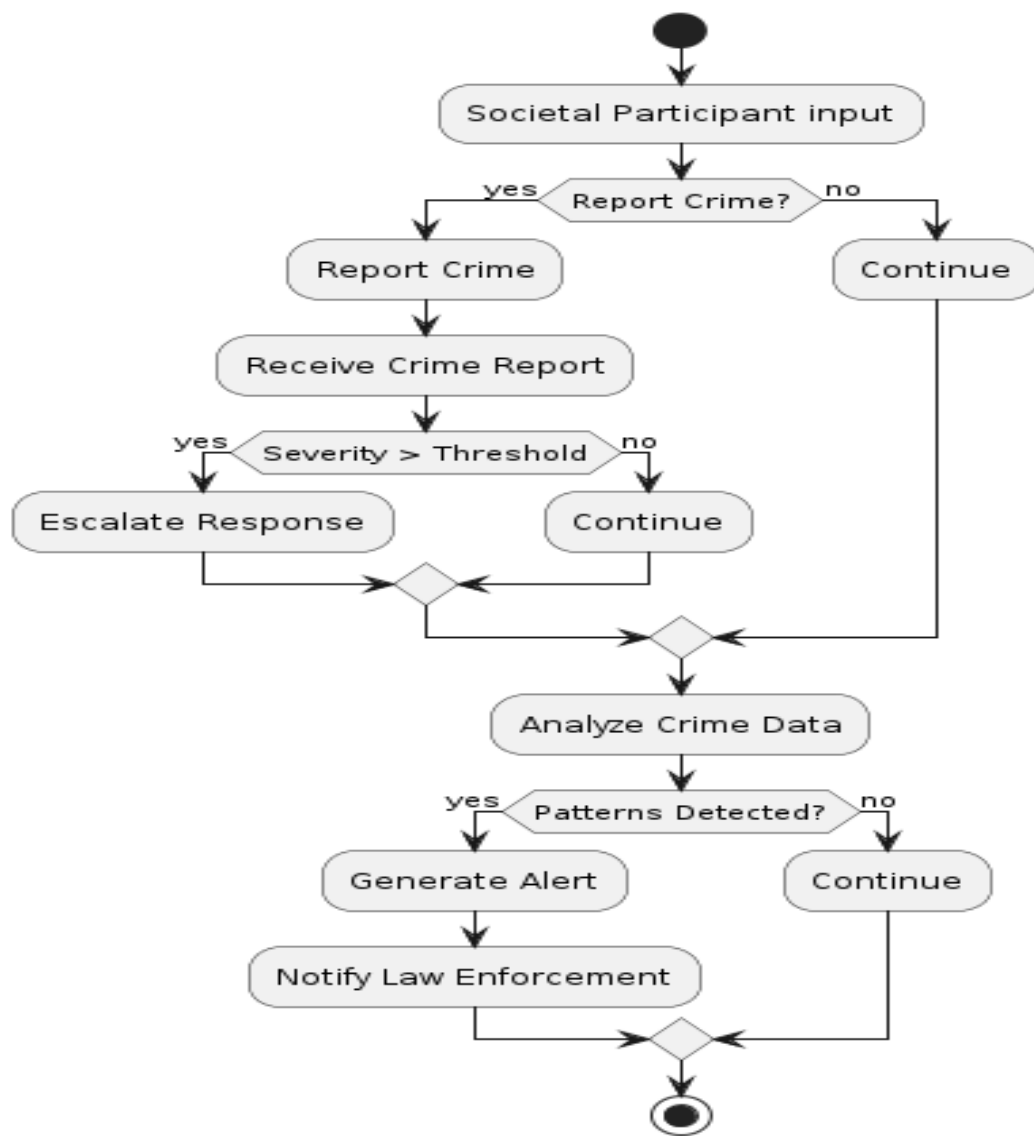


Fig :4.2.2 Activity Diagram

4.2.3 CLASS DIAGRAM:

A UML Class Diagram is a visual representation of the structure and relationships within a system or software application. It depicts classes, their attributes, methods, and the associations between them. Classes are represented as rectangles with compartments for attributes and methods. Relationships such as associations, aggregations, compositions, inheritance, and dependencies are depicted using various symbols and lines connecting classes. Class diagrams provide a high-level overview of the system's architecture, aiding in design, analysis, and communication among stakeholders. They are a fundamental tool in object-oriented modeling and software engineering.

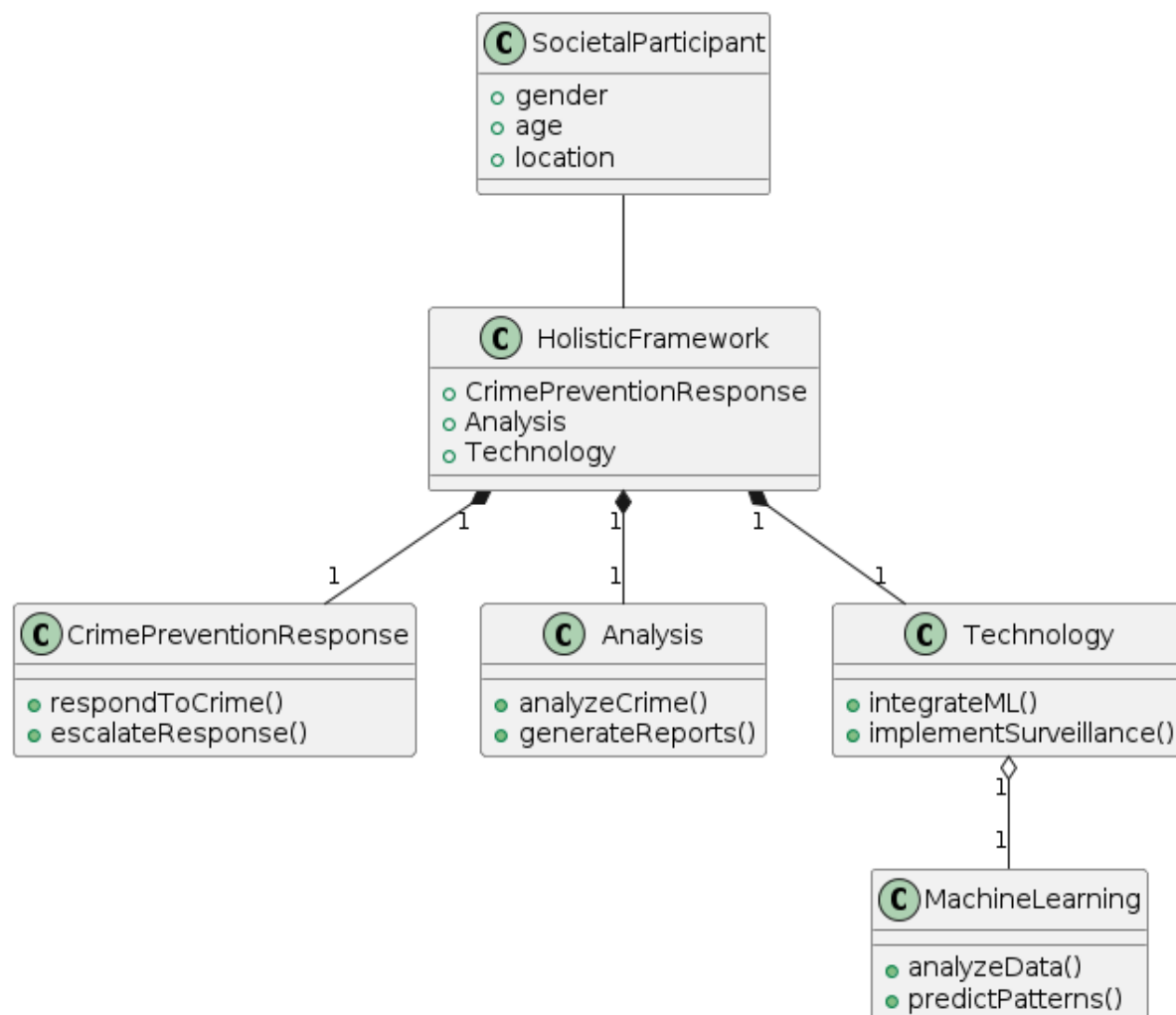


Fig 4.2.3 Class Diagram

4.2.4 SEQUENCE DIAGRAM:

A UML Sequence Diagram is a dynamic diagram that illustrates the interactions between objects or components within a system over time. It represents the flow of messages exchanged between objects to accomplish a specific task or scenario. Objects are depicted as vertical lifelines, and messages between them are represented by horizontal arrows. The sequence of messages conveys the order of interactions, including method calls, returns, and exceptions. Sequence diagrams are valuable for visualizing the behavior of a system and understanding the communication patterns between its components, aiding in design, analysis, and documentation of software systems. They provide a clear and concise representation of the runtime interactions, helping stakeholders grasp the system's functionality and behavior.

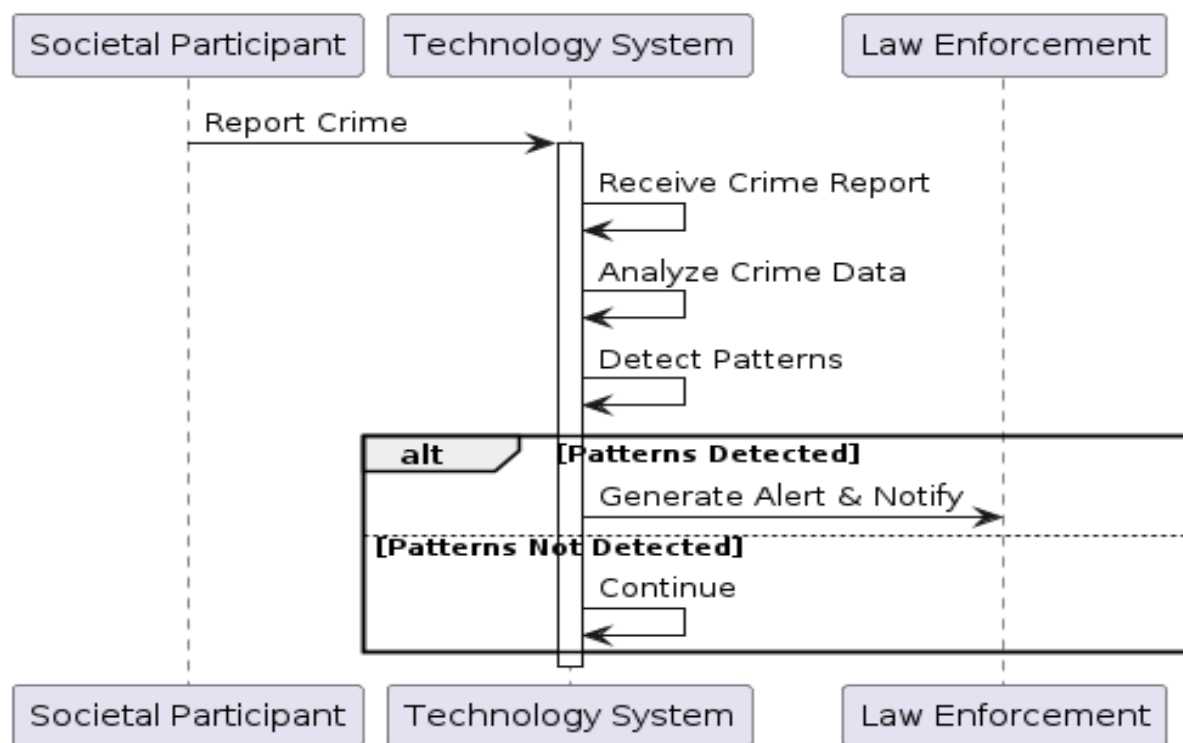


Fig 4.2.4 Sequence Diagram

4.2.5 OBJECT DIAGRAM:

An Object Diagram in UML (Unified Modeling Language) is a static diagram that provides a snapshot of the instances of classes and their relationships at a specific point in time. It represents concrete instances of classes and their attributes, showing how objects interact with each other within the system.

Object diagrams consist of objects, each representing an instance of a class, and links between objects representing relationships. Attributes and values of the objects are typically shown alongside the object, providing additional context. These diagrams are usually created after class diagrams and can be used to validate the design before implementation.

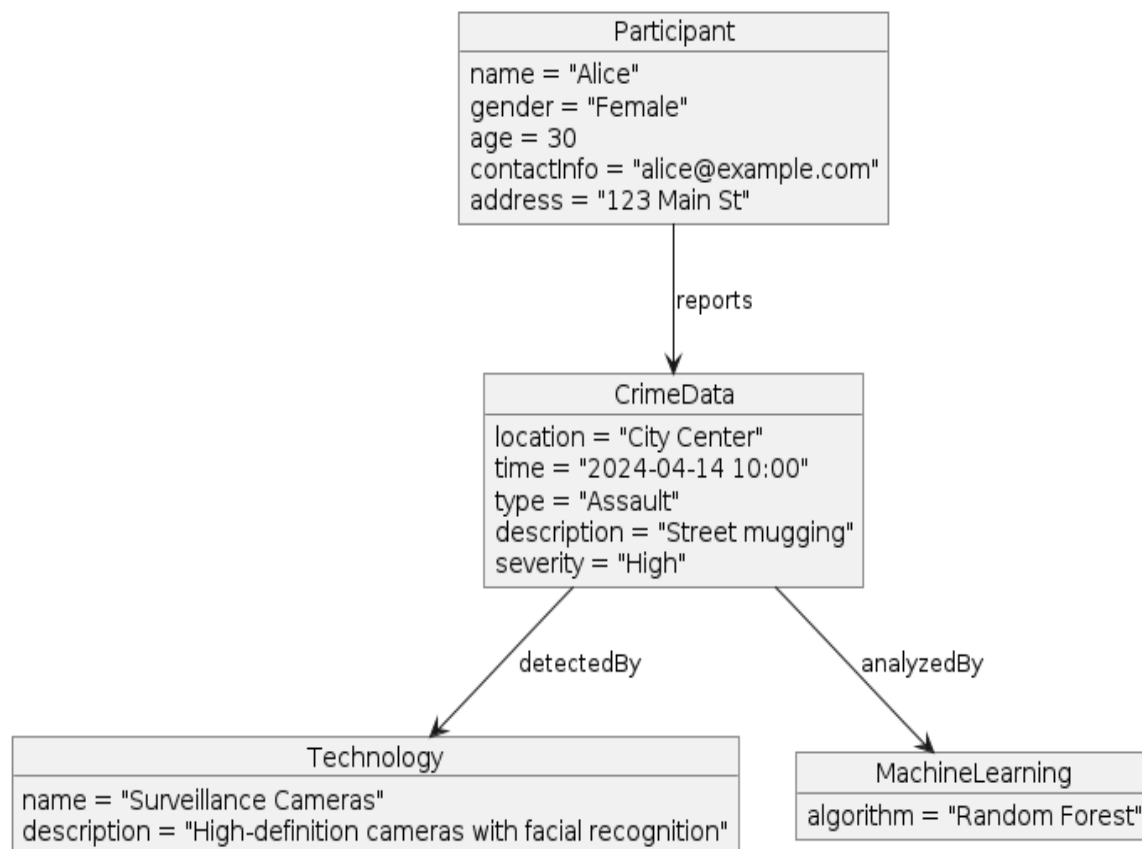


Fig 4.2.5 Object Diagram

4.2.6 COLLABORATION DIAGRAM

A UML Collaboration Diagram, also known as a Communication Diagram, is a type of interaction diagram in the Unified Modeling Language (UML) that visualizes the interactions and relationships among objects or actors within a system or a scenario. Collaboration diagrams focus on the structural organization of objects and the messages exchanged between them to accomplish a particular task or scenario.

Collaboration diagrams are particularly useful for visualizing the dynamic behavior of a system or a scenario, showing how objects collaborate to accomplish a specific task or achieve a particular goal. They help stakeholders understand the sequence of interactions and the roles of different objects within the system. Collaboration diagrams complement other UML diagrams, such as sequence diagrams and class diagrams, providing a comprehensive view of the system's structure and behavior.

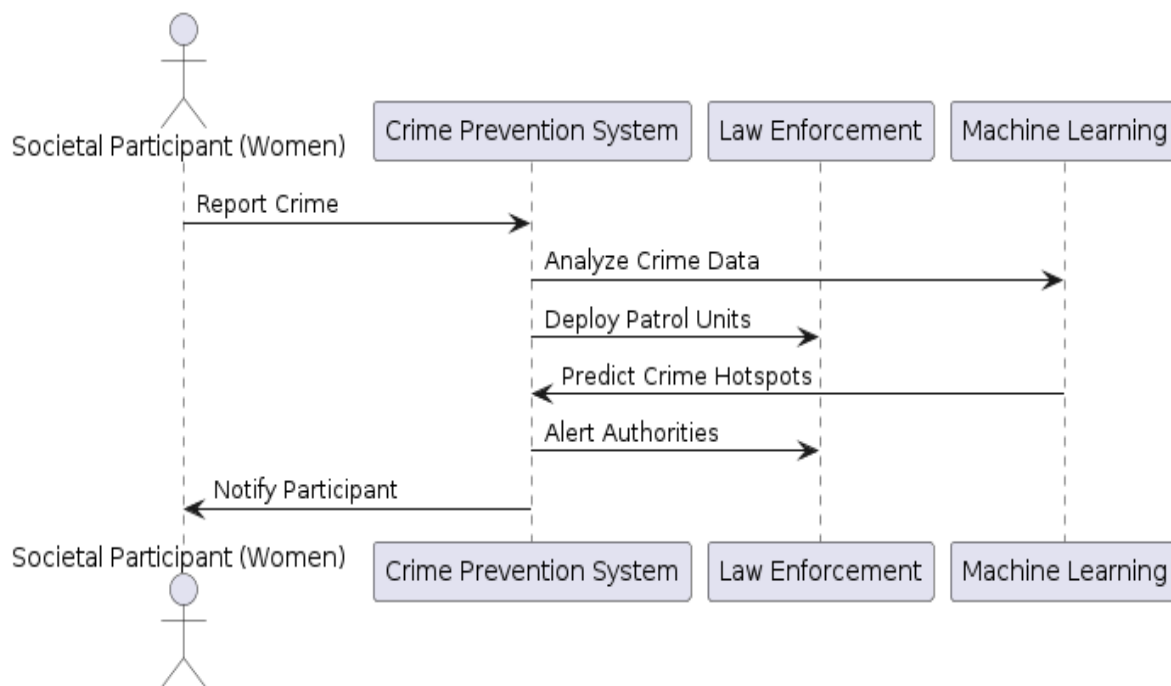


Fig :4.2.6 Collaboration Diagram

4.2.7 COMPONENT DIAGRAM

A UML Component Diagram is a type of structural diagram in the Unified Modeling Language (UML) that illustrates the components of a system and their relationships. It depicts the high-level organization of software components and their interactions within a system or application. Component diagrams focus on the physical or modular aspects of a system, showing how different parts of the system are interconnected and interact to fulfill the system's functionality.

Component diagrams are valuable for understanding the structure of complex systems, identifying reusable components, and defining the boundaries between different parts of the system. They facilitate modular design, support component-based development, and help in managing dependencies between components. Component diagrams are often used in the early stages of software design to plan the architecture of the system and communicate the design decisions among stakeholders.

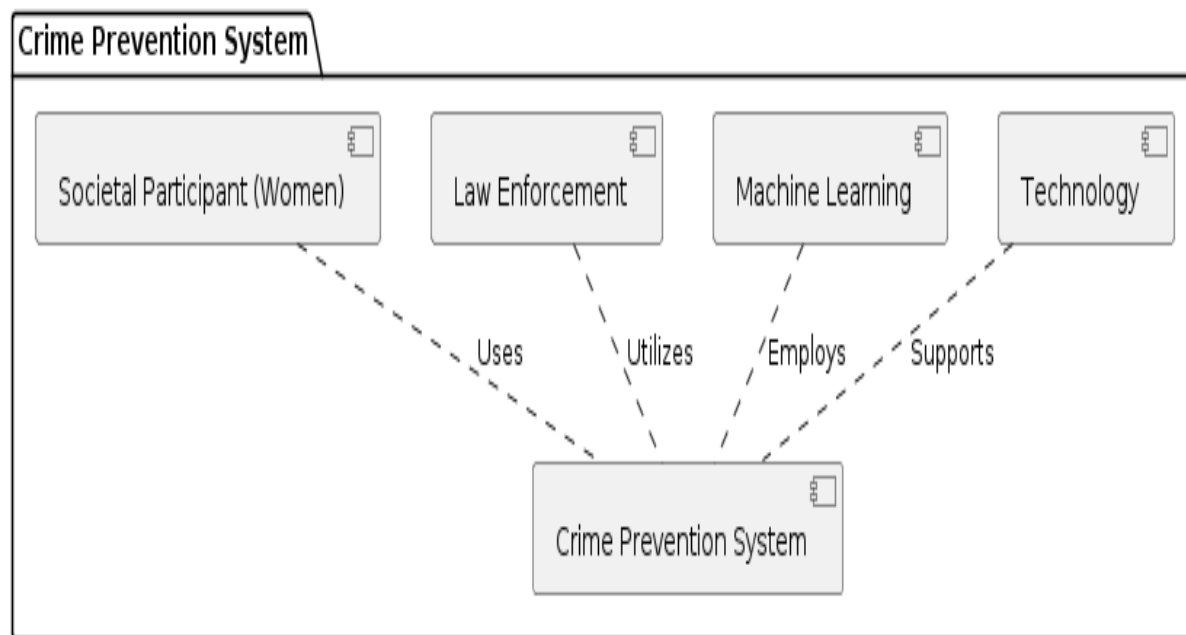


Fig: 4.2.7 COMPONENT DIAGRAM

4.2.8 DEPLOYMENT DIAGRAM

A Deployment Diagram in UML illustrates the physical deployment of artifacts on nodes. It shows how software components are deployed on hardware nodes and how they interact with each other at runtime. Deployment diagrams are typically used to visualize the architecture of a system's deployment, including the hardware and software components involved, their relationships, and the physical distribution across different nodes or servers in a network.

A UML Deployment Diagram is a type of diagram in the Unified Modeling Language (UML) that visualizes the physical deployment of software artifacts (such as components, executables, and databases) onto hardware nodes (such as servers, devices, or containers). Deployment diagrams show how software components are distributed across different nodes in a system and how they interact with each other to achieve the system's functionality.

In a Deployment Diagram:

Node: Represents a physical computing resource, such as a server, device, or container. Nodes are depicted as rectangles with the node's name.

Artifact: Represents a software component, executable, or data file that is deployed on a node. Artifacts are typically represented as rectangles with the artifact's name.

Deployment Relationship: Represents the deployment of an artifact onto a node. It indicates which artifacts are deployed on which nodes. Deployment relationships are depicted as lines connecting artifacts to nodes, typically with an arrow pointing from the artifact to the node.

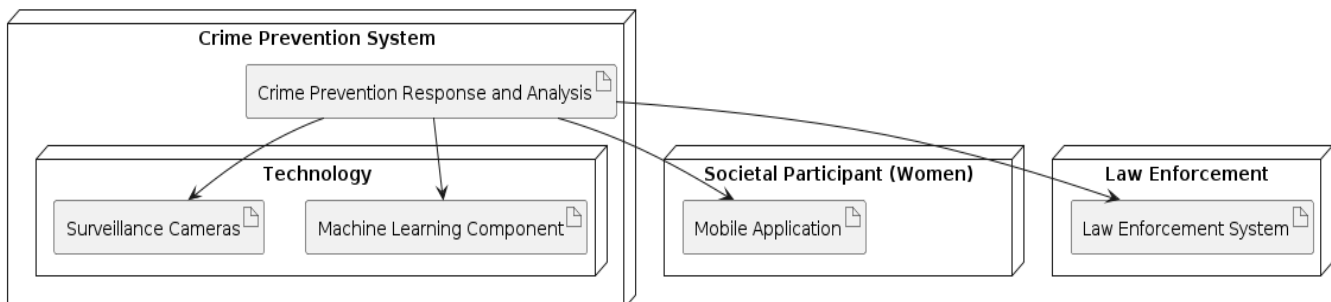


Fig: 4.2.8 DEPLOYMENT DIAGRAM

4.3 MODULES:

Service Provider

In this module, the Service Provider has to login by using valid user name and password. After login successful he can do some operations such as

Login, Train and View GIS Women Safety Data Set Details, Find GIS Women Safety Ratio on Data Sets, View All GIS Women Safety Crime Type, Download Trained Data Sets, View All Remote Users, View GIS Women Safety Crime Type Ratio Results, View Women Safety Crime Type Ratio in Bar Chart, View Train and Test Results.

View and Authorize Users

In this module, the admin can view the list of users who all registered. In this, the admin can view the user's details such as, user name, email, address and admin authorizes the users.

Remote User

In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful user will do some operations like REGISTER AND LOGIN, POST GIS DATA SETS, PREDICT WOMEN SAFETY ON GIS DATA SETS, VIEW YOUR PROFILE.

CHAPTER 5 : IMPLEMENTATION

5.1 ALGORITHMS:

5.1.1 Decision Tree Classifiers

Decision tree classifiers are used successfully in many diverse areas. Their most important feature is the capability of capturing descriptive decision making knowledge from the supplied data. Decision tree can be generated from training sets. The procedure for such generation based on the set of objects (S), each belonging to one of the classes C_1, C_2, \dots, C_k is as follows:

Step 1. If all the objects in S belong to the same class, for example C_i , the decision tree for S consists of a leaf labeled with this class

Step 2. Otherwise, let T be some test with possible outcomes O_1, O_2, \dots, O_n . Each object in S has one outcome for T so the test partitions S into subsets S_1, S_2, \dots, S_n where each object in S_i has outcome O_i for T. T becomes the root of the decision tree and for each outcome O_i we build a subsidiary decision tree by invoking the same procedure recursively on the set S_i .

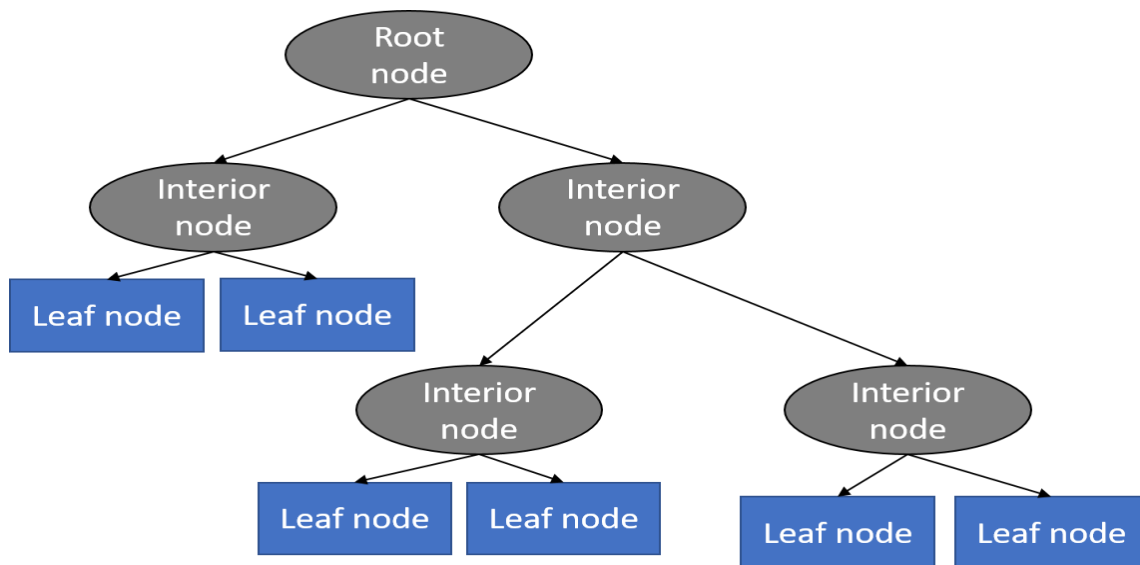


Figure 5.1.1: Decision tree flow chart

These models are working likewise a tree, as showed in figure above. It basically breaks the whole dataset into smaller portions and the process continuous in the sub portions from the root. It goes to reach to a tree with leaf nodes and decision nodes. The second one is a type of tree which is named root node. The advantage is that it can process both types of data including categorical and numerical data.

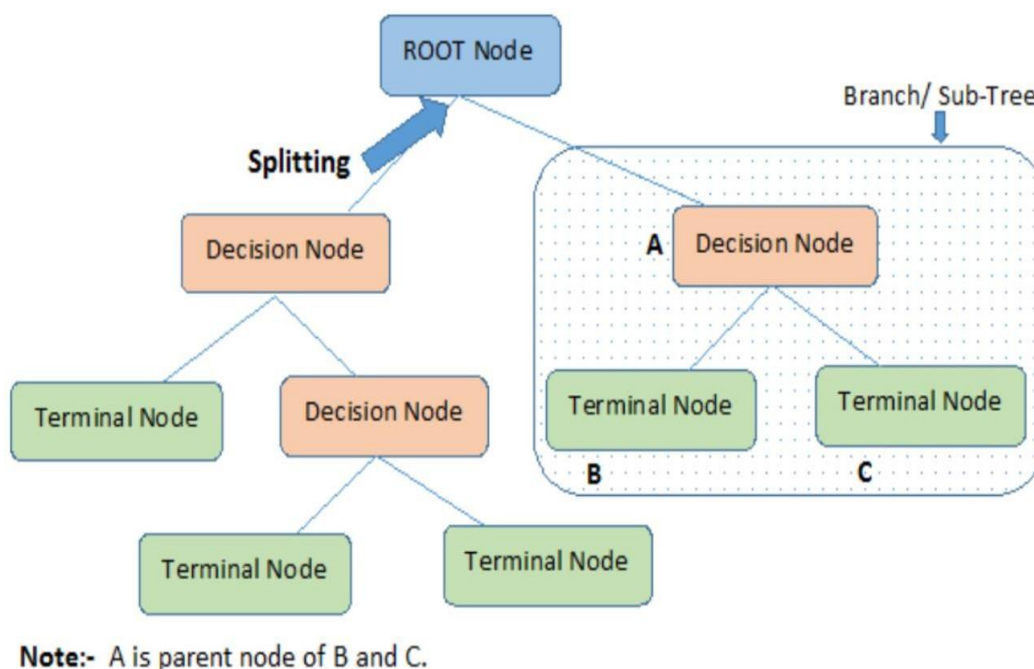


Figure 5.1.1.1 Nodes representation

5.1.2 Gradient boosting

Gradient boosting is a machine learning technique used in regression and classification tasks, among others. It gives a prediction model in the form of an ensemble of weak prediction models, which are typically decision trees.^{[1][2]} When a decision tree is the weak learner, the resulting algorithm is called gradient-boosted trees; it usually outperforms random forest. A gradient-boosted trees model is built in a stage-wise fashion as in other boosting methods, but it generalizes the other methods by allowing optimization of an arbitrary differentiable loss function.

5.1.3 K-Nearest Neighbors (KNN)

KNN is one of the most essential classification algorithms in machine learning. It belongs to the supervised learning domain and finds intense application in pattern recognition, data mining, and intrusion detection.

It is widely disposable in real-life scenarios since it is non-parametric, meaning it does not make any underlying assumptions about the distribution of data (as opposed to other algorithms such as GMM, which assume a Gaussian distribution of the given data). We are given some prior data (also called training data), which classifies coordinates into groups identified by an attribute. Whenever we have a new data to classify, we find its K-nearest neighbors from the training data

➤ Example

- Training dataset consists of k-closest examples in feature space
- Feature space means, space with categorization variables (non-metric variables)
- Learning based on instances, and thus also works lazily because instance close to the input vector for test or prediction may take time to occur in the training dataset.

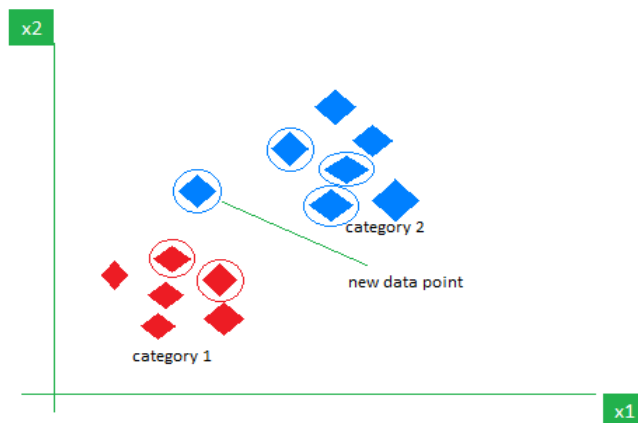


Fig 5.1.3 KNN

5.1.4 Logistic regression Classifiers

Logistic regression analysis studies the association between a categorical dependent variable and a set of independent (explanatory) variables. The name logistic regression is used when the dependent variable has only two values, such as 0 and 1 or Yes and No. The name multinomial logistic regression is usually reserved for the case when the dependent variable has three or more unique values, such as Married, Single, Divorced, or Widowed. Although the type of data used for the dependent variable is different from that of multiple regression, the practical use of the procedure is similar.

Logistic regression competes with discriminant analysis as a method for analyzing categorical-response variables. Many statisticians feel that logistic regression is more versatile and better suited for modeling most situations than is discriminant analysis. This is because logistic regression does not assume that the independent variables are normally distributed, as discriminant analysis does.

This program computes binary logistic regression and multinomial logistic regression on both numeric and categorical independent variables. It reports on the regression equation as well as the goodness of fit, odds ratios, confidence limits, likelihood, and deviance. It performs a comprehensive residual analysis including diagnostic residual reports and plots. It can perform an independent variable subset selection search, looking for the best regression model with the fewest independent variables. It provides confidence intervals on predicted values and provides ROC curves to help determine the best cutoff point for classification. It allows you to validate your results by automatically classifying rows that are not used during the analysis.

5.1.5 Naive Bayes Theorem:

The naive bayes approach is a supervised learning method which is based on a simplistic hypothesis it assumes that the presence (or absence) of a particular feature of a class is unrelated to the presence (or absence) of any other feature .

Yet, despite this, it appears robust and efficient. Its performance is comparable to other supervised learning techniques. Various reasons have been advanced in the literature. In this tutorial, we

highlight an explanation based on the representation bias. The naive bayes classifier is a linear classifier, as well as linear discriminant analysis, logistic regression or linear SVM (support vector machine). The difference lies on the method of estimating the parameters of the classifier (the learning bias).

While the Naive Bayes classifier is widely used in the research world, it is not widespread among practitioners which want to obtain usable results. On the one hand, the researchers found especially it is very easy to program and implement it, its parameters are easy to estimate, learning is very fast even on very large databases, its accuracy is reasonably good in comparison to the other approaches. On the other hand, the final users do not obtain a model easy to interpret and deploy, they does not understand the interest of such a technique.

Thus, we introduce in a new presentation of the results of the learning process. The classifier is easier to understand, and its deployment is also made easier. In the first part of this tutorial, we present some theoretical aspects of the naive bayes classifier. Then, we implement the approach on a dataset with Tanagra. We compare the obtained results (the parameters of the model) to those obtained with other linear approaches such as the logistic regression, the linear discriminant analysis and the linear SVM. We note that the results are highly consistent. This largely explains the good performance of the method in comparison to others. In the second part, we use various tools on the same dataset (Weka 3.6.0, R 2.9.2, Knime 2.1.1, Orange 2.0b and RapidMiner 4.6.0). We try above all to understand the obtained results.

5.1.6 Random Forest

Random forests or random decision forests are an ensemble learning method for classification, regression and other tasks that operates by constructing a multitude of decision trees at training time. For classification tasks, the output of the random forest is the class selected by most trees. For regression tasks, the mean or average prediction of the individual trees is returned. Random decision forests correct for decision trees' habit of overfitting to their training set. Random forests generally outperform decision trees, but their accuracy is lower than gradient boosted trees. However, data characteristics can affect their performance.

The first algorithm for random decision forests was created in 1995 by Tin Kam Ho[1] using the random subspace method, which, in Ho's formulation, is a way to implement the "stochastic discrimination" approach to classification proposed by Eugene Kleinberg.

An extension of the algorithm was developed by Leo Breiman and Adele Cutler, who registered "Random Forests" as a trademark in 2006 (as of 2019, owned by Minitab, Inc.). The extension combines Breiman's "bagging" idea and random selection of features, introduced first by Ho[1] and later independently by Amit and Geman[13] in order to construct a collection of decision trees with controlled variance.

Random forests are frequently used as "blackbox" models in businesses, as they generate reasonable predictions across a wide range of data while requiring little configuration.

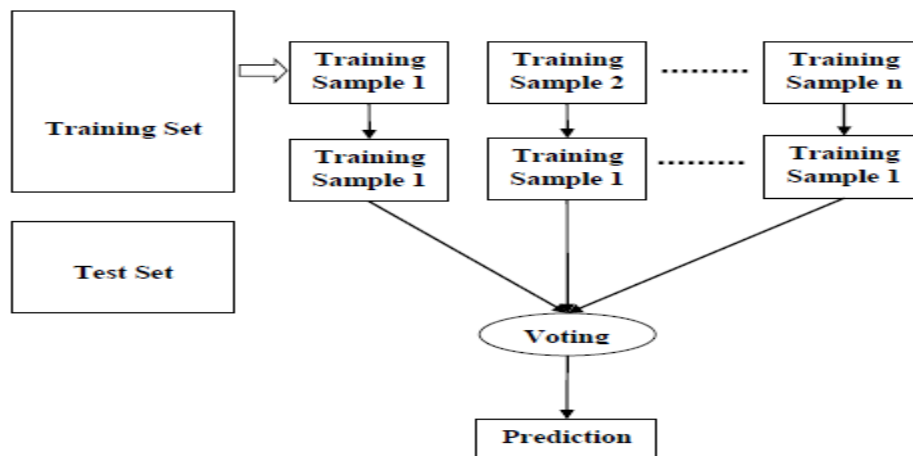


Fig Random Forest

5.1.7 Support Vector Machine:

In classification tasks a discriminant machine learning technique aims at finding, based on an independent and identically distributed (iid) training dataset, a discriminant function that can correctly predict labels for newly acquired instances. Unlike generative machine learning approaches, which require computations of conditional probability distributions, a discriminant classification function takes a data point x and assigns it to one of the different classes that are a part of the classification task. Less powerful than generative approaches, which are mostly used when

prediction involves outlier detection, discriminant approaches require fewer computational resources and less training data, especially for a multidimensional feature space and when only posterior probabilities are needed. From a geometric perspective, learning a classifier is equivalent to finding the equation for a multidimensional surface that best separates the different classes in the feature space.

SVM is a discriminant technique, and, because it solves the convex optimization problem analytically, it always returns the same optimal hyperplane parameter—in contrast to genetic algorithms (GAs) or perceptrons, both of which are widely used for classification in machine learning. For perceptrons, solutions are highly dependent on the initialization and termination criteria. For a specific kernel that transforms the data from the input space to the feature space, training returns uniquely defined SVM model parameters for a given training set, whereas the perceptron and GA classifier models are different each time training is initialized. The aim of GAs and perceptrons is only to minimize error during training, which will translate into several hyperplanes' meeting this requirement.

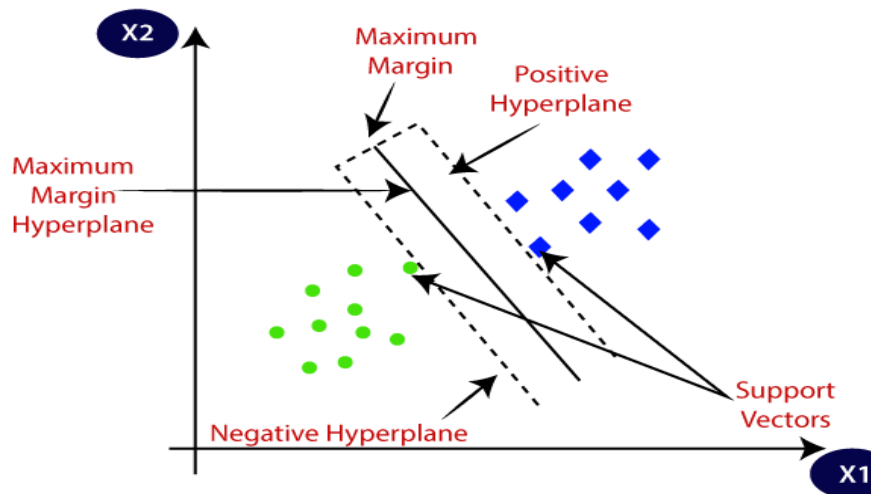


Fig 5.1.7 SVM

5.2 SAMPLE CODE:

```
#!/usr/bin/env python
"""Django's command-line utility for administrative tasks."""
import os
import sys

def main():
    """Run administrative tasks."""
    os.environ.setdefault('DJANGO_SETTINGS_MODULE',
'aholistic_framework.settings')
    try:
        from django.core.management import execute_from_command_line
    except ImportError as exc:
        raise ImportError(
            "Couldn't import Django. Are you sure it's installed and "
            "available on your PYTHONPATH environment variable? Did you "
            "forget to activate a virtual environment?"
        ) from exc
    execute_from_command_line(sys.argv)

if __name__ == '__main__':
    main()
```


CHAPTER 6: SYSTEM TESTING

6.1 TESTING:

Software testing is a critical element of software quality assurance and represents the ultimate reviews of specification, design and coding. Testing presents an interesting anomaly of the software. During earlier definition and development phases, it was attempted to build software from abstract concept to a tangible implementation.

The testing phase involves the testing of the developed system using various set data. Presentation of test data plays a vital role in system testing. After preparing the test data the system under study was tested using test data. While testing the system by using test data errors were found and corrected. A series of tests were performed for the proposed system before the system was ready for implementation. The various types of testing done on the system are:

- Unit Testing
- Integration Testing
- User Acceptance Testing
- System Testing

6.1.1 Unit Testing

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases.

Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail

Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

Features to be tested:

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

Sno	Test case	Type of Testcase	Result
1	Test case 1	Women was Sexual Harassment	Pass
2	Test case 2	Gold Robbery attack on women	Fail
3	Test case 3	The type crime on this women was Dowry demand.	Pass

Fig 6.1.1 Testing

6.1.2 Integration Testing

Integration testing is a systematic technique for constructing the program structure while at the same time conducting tests to uncover error associated within the interface. The objective is to take unit tested modules and build a program structure that has been dictated by design. All modules are combined in this step. The entire program is tested as whole. And chaos in interfaces may usually result. A set of errors is encountered in such a case.

The integration testing can be carried out using two methodologies:

1. Top Down Integration
2. Bottom Up Integration

The first one is done where integration is carried out by addition of major modules to minor modules. While Bottom Up integration follows combination of smaller ones to larger one. Here, Bottom Up

Integration is followed. Even though correction was difficult because the isolation of causes is complicated by the vastness of the entire program, all the errors found in the system were corrected and then forwarded to the next testing steps.

The navigation among all the screens have been thoroughly verified so that the user of the system can move from one form to another form.

The connectivity between the forms and the database has been checked. In case of any malfunctions, the user will be informed about the problem.

6.1.3 User Acceptance Testing

User acceptance of a system is the key factor for the success of any system. The system under consideration was tested for users acceptance by constantly keeping in touch with the perspective system user at the time of developing and making changes wherever required. This is done with the regards to the following points:

A system may be defined as a set of instructions combined in the same form and directed to some purpose.

Before any development is undertaken certain specifications are prepared which objectively describe the application system. The System specifications are made after consulting the end user managers of the relevant departments.

The success of system depends on how accurately a problem is defined, thoroughly investigated carried out through choice of solution. User need identification and analysis that are concerned with what the uses needs rather than what he/she wants. System explains how to perform specific activities or task, which does what and what.

6.1.4 System Testing

Testing the behavior of the whole software/system as defined in software requirements specification(SRS) is known as system testing, its main focus is to verify that the customer requirements are fulfilled.

CHAPTER 7 : IMPLEMENTATION

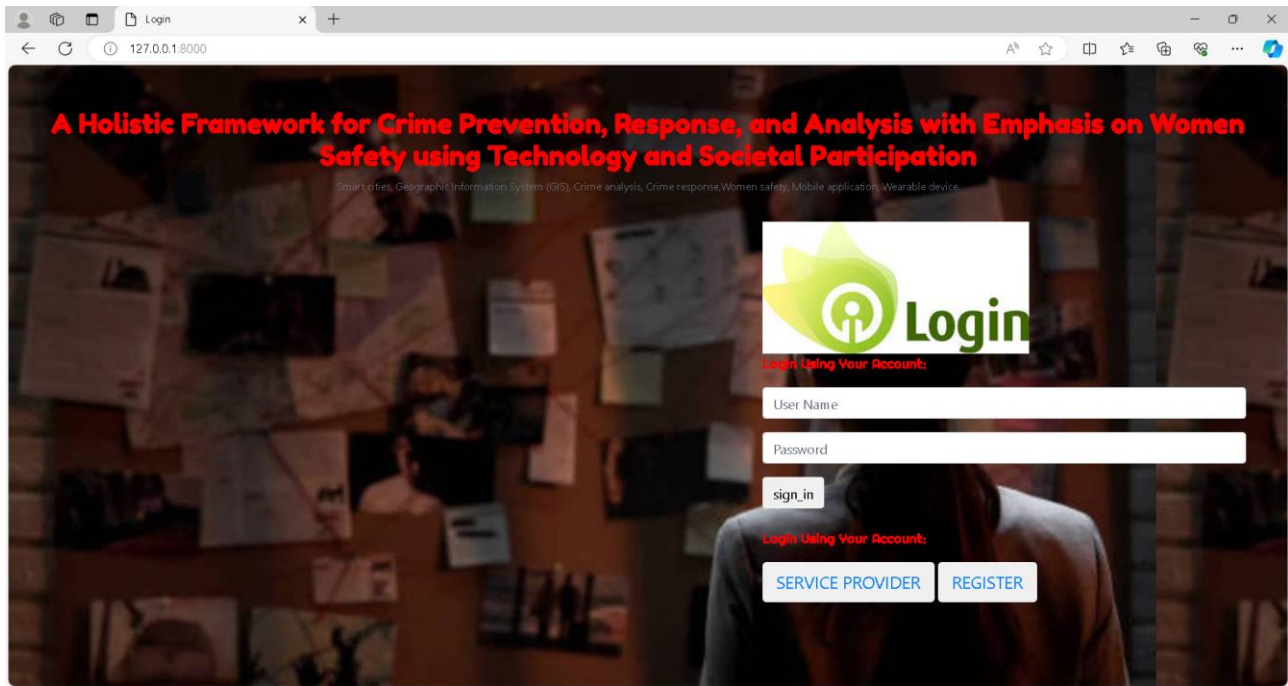


Fig 7.1 Login account



Fig 7.2 Service Provider Login Details

127.0.0.1:8000/Add_Dataset_Details/

A Holistic Framework for Crime Prevention, Response, and Analysis with Emphasis on Women Safety using Technology and Societal Participation

POST GIS DATA SETS PREDICT RESULTS ON GIS DATA SETS VIEW YOUR PROFILE LOGOUT

Browse GIS Analysis Data Sets

City Name	Place Name	Area Name	Mobile Name	Aapp Name	Wearable Device Name	Affected Person Name	Safe Status	Crime Desc	Crime Date
Bangalore	Sivajinagar	commercial street	Vivo	GIS	Safelet	Sheela	Safe	The women was Sexual Abused	20/12/2020
Bangalore	Rajajinagar	West of Chord Road	Samsung	GIS	SafeBand	Mala	Unsafe	The type crime on this women was Sexual Harassment	23/03/2021

Fig 7.3 Post GIS Datasets

127.0.0.1:8000/Search_GIS_DataSets/

A Holistic Framework for Crime Prevention, Response, and Analysis with Emphasis on Women Safety using Technology and Societal Participation

POST GIS DATA SETS PREDICT RESULTS ON GIS DATA SETS VIEW YOUR PROFILE LOGOUT

PREDICT CRIME STATUS ON DATA SET DETAILS III

Enter Crime Description Here

The women was Sexual Abused

PREDICT CRIME STATUS =

Crime Arrested

Fig 7.4 Predict results on GIS Datasets



Fig 7.5 View Line Chart All GIS Women Safety Crime Type



Fig 7.6 View Pie Chart GIS Women Crime Type Ratio Results

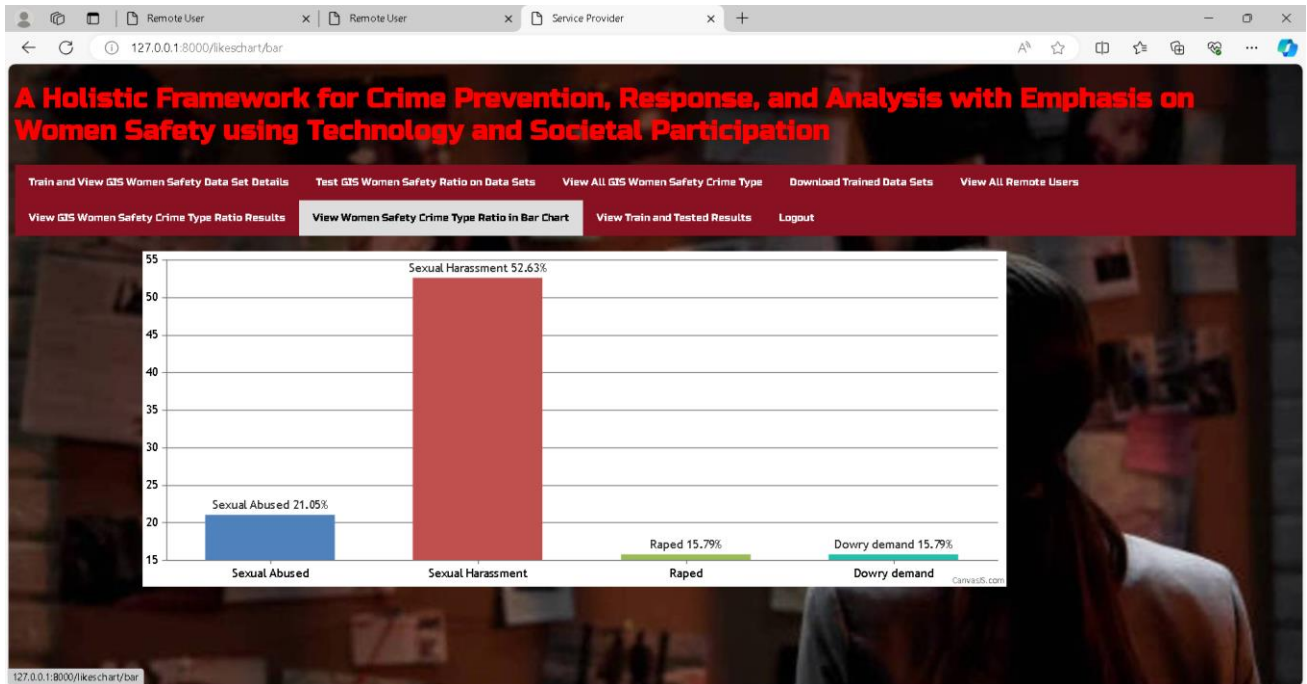


Fig 7.7 View Women Safety Crime Type Ratio In Bar Chart

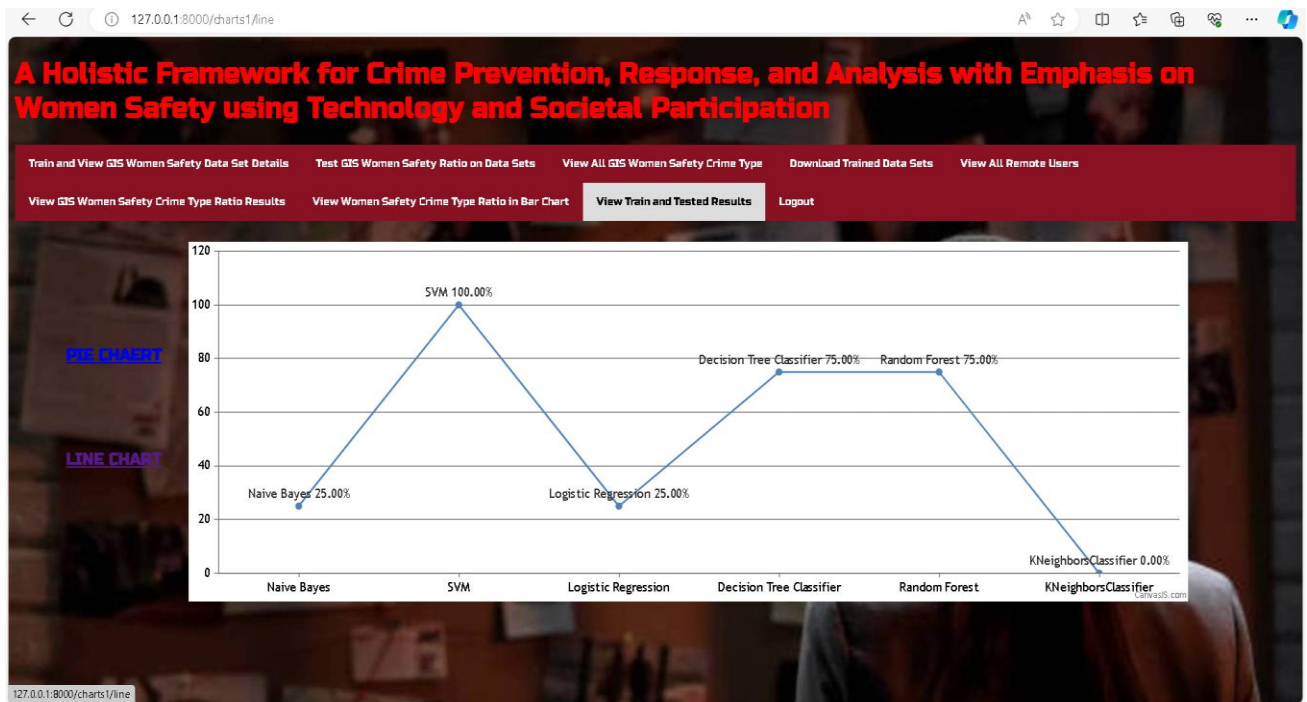


Fig 7.8 View Train and Tested Results.

CHAPTER 8 : CONCLUSION

Building safer cities for women requires holistic measures for crime prevention, analysis, and response. This will be effective only with the understanding of various socio-economic factors that lead to violence against women so that effective measures for social reforms can be designed. Also, technological interventions will not be effective in providing timely help if only law enforcement agencies or personal contacts are involved in rescue and response. The work presented in this paper describes the holistic framework for crime prevention, response, and analysis with emphasis on women safety using technology and societal participation. The Integrated system offers the components - Web GIS, including the geospatial database storing criminal records and for hotspot generation, analysis, and visualization. Mobile Application for raising alerts and enabling tracking of the person in danger, viewing the crime hotspots in the locality to enable taking precautionary measures. The mobile application is designed to ensure that the registered users receive alerts about the person in danger in the locality. A cost-effective wearable gadget with GPS/GSM/GPRS for raising alerts and can be used as a standalone device even when the smart phone is not active. Website which acts as an integrator for the various components developed such as mobile application, wearable device, and Web GIS system. The website provides visualization for the data collected from the mobile application, wearable device, geospatial server, and criminal records. The administrator can also update the crime data to the geospatial database through the website. The website allows viewing of important information such as the real-time location of the user, safety status of the user, the number of volunteers who responded to an SOS, details of the user such as name, phone number and emergency contacts, etc. It is thus possible to design proactive response measures whereby which the hotspots of crime can be identified, users in danger can be tracked and preventive actions can be planned. Societal participation, in addition to providing immediate relief to the victims, can also create awareness in society regarding crime against women and indulge a sense of shared responsibility towards ensuring the safety of women. The data collection for developing the GIS-based crime monitoring and analysis system was completed using fieldwork in the town of Pilani town in Rajasthan, India. This paper describes the system design process in detail, including system components, functional design, architectural choices, and experimental testing. The system will be subjected to continuous stress testing in the subsequent months before final deployment. The framework developed for crime analysis, prevention, and response can be easily scaled up geographically and can be used for safety in smart cities .

FUTURE ENHANCEMENTS:

The future scope of a holistic framework for crime prevention, with a strong emphasis on women's safety and leveraging technology and societal participation through machine learning, is wide-ranging. Here are some potential aspects:

- 1) **Advanced Predictive Analytics:** Machine learning algorithms can be utilized to analyze vast amounts of data, including crime statistics, social media feeds, and demographic information, to predict potential crime hotspots and patterns, thereby enabling law enforcement to deploy resources more effectively.
- 2) **Real-time Monitoring and Response Systems:** Implementing technologies such as surveillance cameras, wearable devices, and mobile applications can allow for real-time monitoring of public spaces and quick response to emergencies, particularly those affecting women's safety.
- 3) **Community Engagement and Empowerment:** Involving communities in the design and implementation of crime prevention initiatives fosters a sense of ownership and encourages active participation. Technology can facilitate community reporting mechanisms and feedback loops to improve responsiveness.
- 4) **Data-driven Policy Making:** Insights derived from machine learning analysis can inform evidence-based policymaking aimed at addressing underlying societal factors contributing to crime, such as economic inequality, access to education, and social support systems.
- 5) **Ethical and Privacy Considerations:** As technology plays an increasingly central role in crime prevention, it's essential to address ethical concerns related to data privacy, algorithm bias, and the potential for misuse. Building transparent and accountable systems is crucial to maintaining public trust.

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