

Interactive Map Application for Real Time Crime Reporting

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Abstract—In an ideal world, a society is governed by laws and any member of the society that breaks these laws faces measurable consequences. In such a case, a citizen is expected to report any violation of law to the concerned authorities. Illegal activities are an issue for every nation, and the majority of crimes committed go unreported due to fear and inconvenience of travel. This causes a need for an alternative investigative system, with non-interactive capabilities. In this work, we focus on developing a system for filing complaints online, along with a real time map for viewing hotspots and understanding crime dynamics in a neighborhood. The application comprises four functional modules, user verification, file a complaint with details and location, distributed database for storing the details of the complaint, and a live map of reported events in a web dashboard. This system paves the way for civilians to report crime incidents with the location pinpointed on a real time map along with detailed information regarding the same. Keeping in mind the restricted outdoor travel and exposure in situations of global pandemics such as the COVID-19, the proposed system could be a great alternative for offline crime reporting since crimes like domestic violence have been surfacing.

Index Terms— Online Crime Reporting, Real Time Map, Police, Web Application, GPS, e-Policing, Distributed Database, Crime Management.

I. INTRODUCTION

Crime is an issue that pervades every community on Earth. Civilizations have long attempted to reduce crime in their communities, usually through a form of policing. In most modern civilizations, law is upheld through the interaction of local law enforcement and judiciary apparatus. Recently, the popularity and accessibility of the internet has made it an attractive pursuit in the domain of modern crime prevention. In this work, we aim to take advantage of this by building an interactive platform for crime reporting, accessible to the public through the internet. It is our aim to create a transparent and reliable system that common citizens can depend on for immediate action from law enforcement.

II. LITERATURE SURVEY

Alicia Iriberry et al. [1] a crime reporting and investigative interview system, which emulates a police officer conducting a cognitive interview, as compared to a non-interactive text-box computer system. The results of this system show that this Internet reporting system significantly outperforms non-interactive systems, in measures of completeness of report, and amount of information elicited from the witness.

Flora Dilys Salim et al. [2] describes a futuristic mobile platform which aims to precisely impart to the public crime statistics in cities of Australia, so as to avoid incorrect perceptions that may act as social barriers to visitors and locals traversing proposed within and through the city. This data is supplemented by supporting users to report violations, wrongdoings, misdemeanours, and crimes that they witness, as well as provide information about transportation and immediate care services around where the users are located.

Murat Dağlar et al. [3] has proposed a policy suggestion respecting implementation after conducting a literature review in Crime Analysis on the geographical information system (GIS) and crime mapping. Crime Analysis being the most acknowledged policing trends, helps find the crime patterns, resources and solutions for addressing the issues. To achieve this goal, the data of GIS and crime mapping will be accessed and evaluated post which the terms of assessing the problems related to the crime will be elucidated in detail. In this study, the crime mapping and GIS supports a huge range of problem solving and decision-making applications in crime, crime locations and crime patterns. It also focuses on the policy suggestions for the police departments that use this technology.

Akpan Abasiama G et al. [4] elaborates on a system designed to empower the Law Enforcement officers by completely developing a new digitized platform instead of the current paper-based system for maintaining and recording crime reports. CARAT (Crime/Accident Reporting and Tracking), an electronic mobile application has been developed along with the PolyLORF platform to help communication between the web servers and the devices. This system facilitates the user to upload pictures or videos as evidence for the case and the GPS finds the exact location of the crime. The system also makes use of Geographic Information System (GIS), a very robust tool for identifying the hotspots and tracking the crime patterns.

Tomas U et al. [5] discusses the implementation of an Online Crime reporting management system. This study focuses on giving an overview on the process of investigation and identifying the most accurate approaches for the investigation and detection processes in handling a number of crimes. This work focuses on solving issues like privacy, inconveniences and distance factor for a common man. The researchers have used the modified waterfall model because the approach is assertive and rational. The flow consists of Brainstorming and planning, Requirement analysis, System analysis and designs, Implementation and testing, Deployment and finally Maintenance. As a result of the online portal developed by this work, statistics on level of satisfaction through criteria such as functionality, efficiency, usability, reliability and security were used for evaluation. The developed online system is thus user friendly, simple, flexible and provides a user manual for all its users. It also provides recommendations for further study regarding the same.

III. SYSTEM ARCHITECTURE

The main objective of this work is to design an application that allows users to report crime in real time, along with the details like location and pictures on any PC or mobile phone that has a modern browser. The user can register or login to the dashboard and make a report of the incident. The user can track the complaint procedure and view the status.

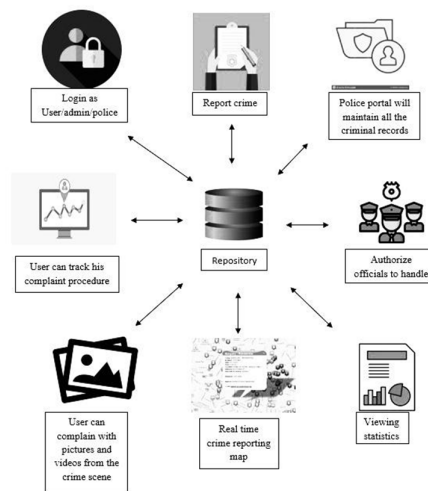


Figure 1. System Architecture of the Proposed System

Once the information has been recorded, the data is supplied to the repository containing a live map. The web application will also provide secure access to all data for authorized police personnel and also allows them to assign the cases to the officers. Citizens and police can view a live map of reported events in a web dashboard that helps raise awareness to the prevalence of crime in certain areas, and informs citizens to be vigilant when they visit those locations. Police can use this data to properly allocate ground personnel according to the frequency of crime in certain areas. The system architecture of the proposed system represents the data centred architecture which specifies the details of the server, storage networking racks etc. it also determines how the resources are connected and how logical and physical security workflows are arranged. The system architecture for the proposed system is depicted in Figure 1.

IV. PROJECT DEVELOPMENT

The development of this project was accomplished through the practice of Agile methodologies. The decision to use Agile development was made by taking into account this project's requirements, time frame, security objectives, and our team dynamics. We started this process through inception planning, laid out our initial requirements, and constructed epics and user stories for our team. Sprints were taken to be 2 weeks long, after which we would gain feedback from the customer to adapt to their changing requirements, and address any defects. We continuously tested functionality and performance, and ensured a smooth user experience. As part of our project development we also finalized system and user documentation, to properly illustrate user and data flows.



Figure 2. Agile Scrum Model of the Proposed System

V. DESIGN OF A PROPOSED SYSTEM

The Online Crime reporting system with real time interactive map web application is designed to create a system that caters to reporting various kinds of crimes, gives feedbacks and handles the process of investigation and correction. This system is based on three different levels i.e. the user can login into the system either as a citizen or a police force or the highest authority that is the police head.

A. Citizen Action

The users will first need to register onto the web application following which a through credential validation is performed and the user is redirected to a dashboard to view and interpret different crime report incidences. The web application allows a user to access various modules such as reporting a crime which involves crime details such as type of crime, time at which the incident occurred, details about the victim etc. And along with these details a user is asked to provide location details which enables access to an interactive real time map at all times. The user can stay updated about the progress of investigation along with the map and provide feedbacks as well.

B. Police Head Action

The crimes reported by the citizens or the users are stored in the database and categorized based on location. The duty of the police head is to assign the case to the Police staff authorized to take action in their respective jurisdiction. The police head can stay updated on the progress through the website. Once the case has been dealt with, the case is closed and removed from the website. Although, a copy of the document is maintained in the database just for the record and future requirements.

C. Police Force Action

When a Police Headquarter receives a crime report as assigned by the police head, the police officials are deployed to take action. As the investigation progresses, they update the status as evidence collected, arrested, fined etc. based on the investigation. They also get access to the location details and hence the real time map to track down the crime location and the criminals. Once the case is handled, the case is closed and updated accordingly on the website.

This design will be able to facilitate a platform to report all kinds of criminal activities. It allows different representatives at different levels to be registered. Through this, the general public will also be able to freely report without any inconveniences. The web application focuses on being data driven along with making user experience responsive and consistent.

VI. DESIGN DIAGRAM OF PROPOSED SYSTEM

A. Use Case Diagram of Interactive Map Application for Real Time Crime Reporting

The Use cases form a method of analysis for the software requirements of a system. It specifies the expected behaviour of the system. Use cases are depicted pictorially in the form of a use case diagram. It is significant in understanding the system from an end user's perspective. It explains the external perception of the system and thus allows for the effective communication of the user's terms. The use case Diagram for the proposed system is depicted in Figure 3.

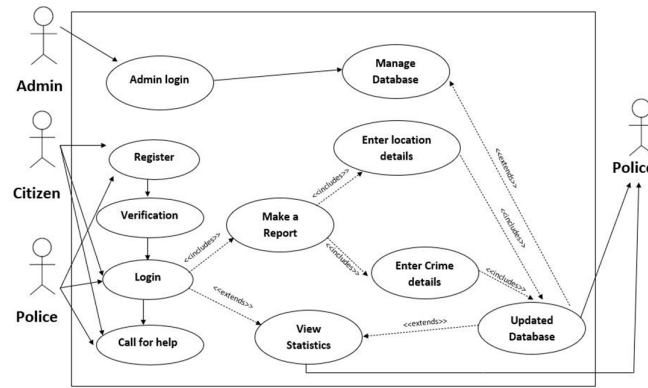


Figure 3. Use Case Diagram for Interactive Map Application for Real Time Crime Reporting

B. Activity Diagram for Interactive Map Application for Real Time Crime Reporting

Activity diagram is a behavioural diagram which is used to describe the dynamic aspects of a system. It illustrates the flow of a system and the steps involved in the execution of a use case.

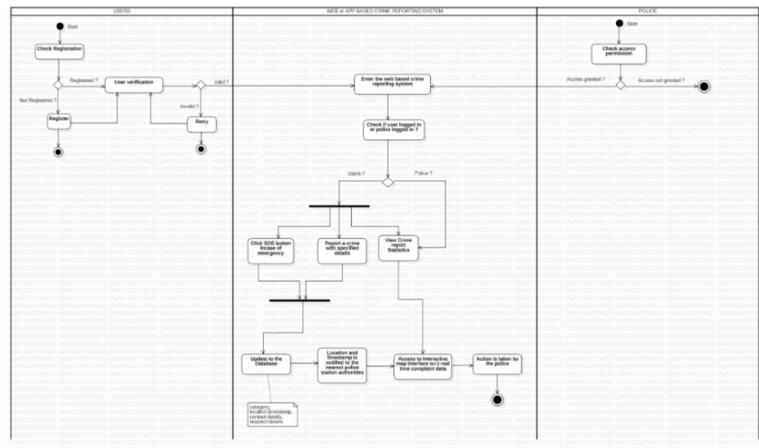


Figure 4. Activity Diagram of Interactive Map Application for Real Time Crime Reporting

It indicates the coordination of different subsystems in order to provide the required function. Any event is affected by different components that require coordination, and this is clearly depicted in activity diagrams. The activity diagram for the proposed system is depicted in Figure 4.

C. Data Flow Diagram of Interactive Map Application for Real Time Crime Reporting

A data flow diagram shows the way data flows over a process or system. It incorporates point by point information sources and yields, information stores, and the different sub forms the information travels through. DFDs are assembled utilizing normalized images and documentation to portray different elements and their connections. Information stream charts outwardly speak to frameworks and procedures that would be difficult to portray in a piece of text. They are utilized to delineate a current framework and make it better or to design out another framework for execution. The data flow diagram for the proposed system is depicted in Figure 5.

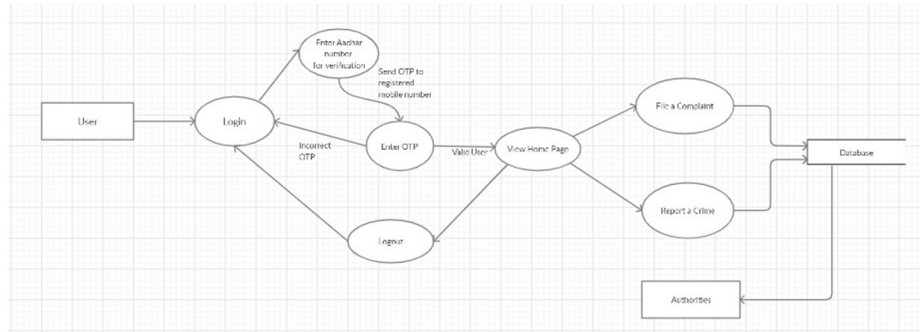


Figure 5. Data Flow Diagram of Interactive Map Application for Real Time Crime Reporting

D. Class Diagram for Interactive Map Application for Real Time Crime Reporting

Class diagram is a static structure diagram. It illustrates the structure or foundation of a system by showing all the classes in the system. It includes the class attributes, their operations or methods as well as the relationship between the objects. All of these features are compartmentalized and depicted pictographically. The class diagram for the proposed system is depicted in Figure 6.

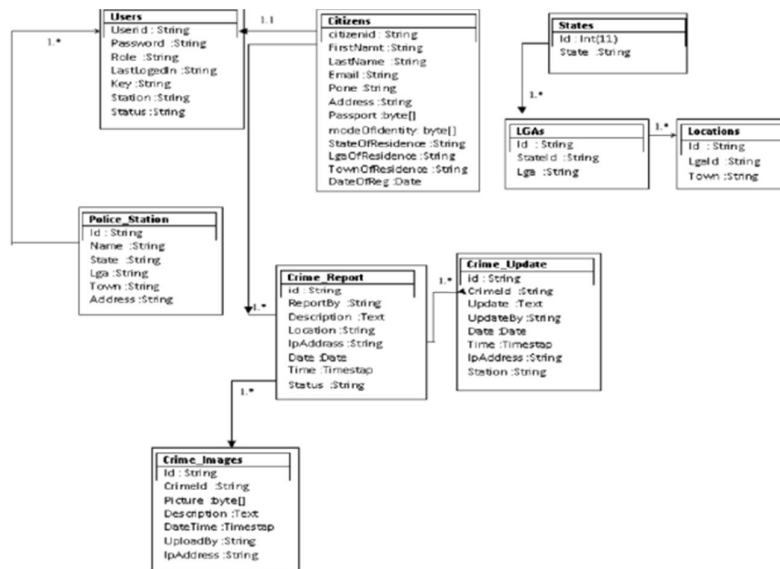


Figure 6. Class Diagram of Interactive Map Application for Real Time Crime Reporting

E. Sequence Diagram of Interactive Map Application for Real Time Crime Reporting

Sequence diagrams are interaction diagrams. It shows the object interactions in time focus. It consists of parallel vertical lines called as the time dimension and horizontal arrows called as the object dimension illustrating the

order of interaction between the objects. It captures high level interactions between the users, the system, other systems and sub systems. The sequence diagram for the proposed system is depicted in Figure 7.

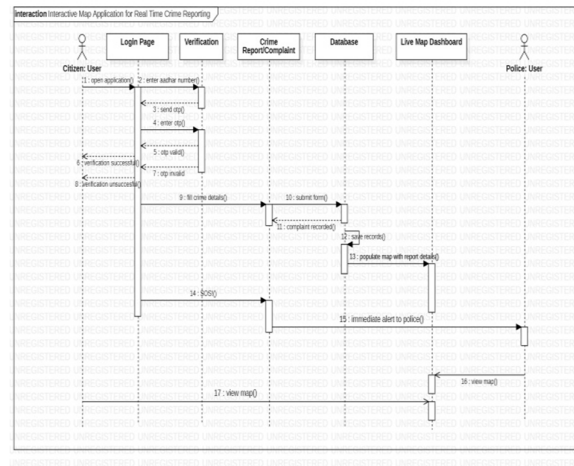


Figure 7. Sequence Diagram of Interactive Map Application for Real Time Crime Reporting

F. Deployment Diagram for Interactive Map Application for Real Time Crime Reporting

A deployment diagram describes the physical deployment of the work after fruition and maps the designed software architecture to physical system architecture that executes it. It consists of hardware components which include the web server, application server and the database server which are called collectively as the nodes and software components which run on each node like database and WebApp which are collectively known as the artifacts. The purpose of the deployment diagram is to describe the interaction between the hardware and software components of the developed system. The deployment diagram for the proposed system is depicted in Figure 8.

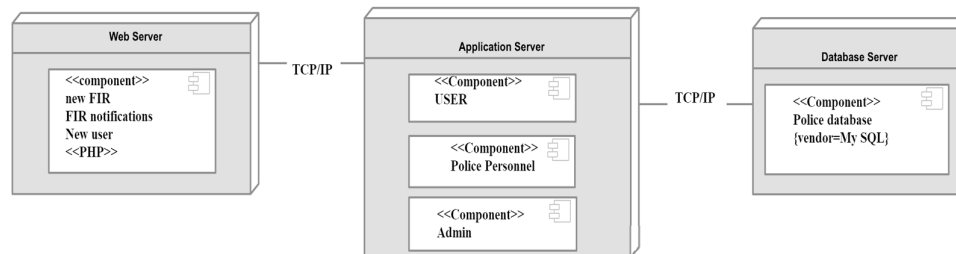


Figure 8. Deployment Diagram for Interactive Map Application for Real Time Crime Reporting

VII. IMPLEMENTATION

This work produces a preliminary implementation of an Interactive Website for Real Time Crime Reporting. This implementation is built upon the assumption that we have three categories of users, namely, the general public, individual police officers, and head of police, who all interact throughout the lifecycle of a submitted complaint. Our aim was to build a user friendly, cloud-based platform that make it effortless for the public to ensure their safety by getting in touch with authorities as quickly as possible.

Common citizens can access our website through a publicly available domain name, after which they are presented with the option to file a complaint. We register the user's complaint along with required identification, location, and description details through our web dashboard, and later persist this information in our database. This complaint information is retrieved from the database to be viewed in the administrator's dashboard, which is secured through a separate login page, preventing any malicious third parties from accessing sensitive complaint and identification information.

The administrator is allowed to assign this complaint to any of the operating police officers within the district specified by the complainant. The complaint status is updated to represent that it has been assigned to a police officer, who will follow up on it's progress. Each individual police officer can log in to their personal dashboard,

where they can view the cases that have been assigned to them, and take appropriate action. We also provided functionality for the officer to periodically update the status of the complaint, so that both the complainant and administrator are ensured that the case is being pursued.

Our front-end was implemented using HTML, CSS, and Bootstrap, while our database and business logic was implemented using PHP and MySQL. The implementation of this system is illustrated below.



Figure 9. Home Page

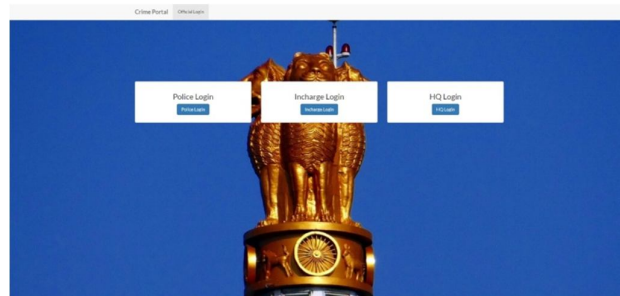


Figure 10. Login Page for all Users

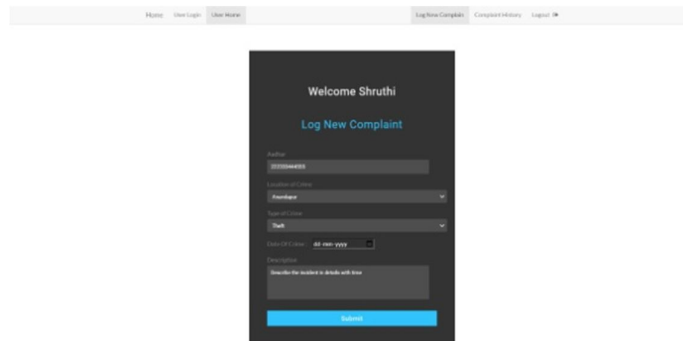


Figure 11. Report Crime along with Location Details



Figure 12. Interactive Map

VIII. CONCLUSION AND FUTURE SCOPE

This work presents the development of an online crime reporting system paired with an interactive real time map at the same time exploiting the active participation of citizens. Since exact location is already identified by respondents, the data can be automatically displayed in the map without overburdening the police to encode it again. Police and the user have the same WebApp due to which transparency can be well maintained. This alternative permits the civilians to register complaints without causing the delay of response. Additionally, these options reduce face-to-face interactions, thus minimizing the potential of exposure to COVID-19 for both officers and civilians. We look forward to a time when the current features of the crime reporting system could be further expanded using the latest technologies to achieve predictions and more. Various machine learning algorithms and models like boosted decision trees, KNN etc. can be used to predict crimes and region based geographical analysis can be done to understand the pattern of crimes. These features will further make the application better and strengthen the security and justice system in various parts of India.

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