

A Scalable Online Crime Reporting System

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ABSTRACT

Crime is part of human activities and needs to be managed. No human society has ever been totally free of deviants and it is unlikely that society will ever be. The more populated and complex a society becomes the wider the range of anti-social conducts that must be controlled by the government through the armed forces and other agencies especially the Police Force. The incident-based system reports on a much broader range of crimes and includes data on the circumstances of the crime, the victim, and the defendant. The current crime reporting system is faced with several difficulties as there is no instant means of reporting crime other than telephone calls, messaging or perhaps face-to-face which is usually cumbersome especially where the reporter wishes to keep anonymity. The proposed crime reporting system aims to assist the Nigerian Police in their bid to solve crimes with timely and useful information about criminals and/or their mode of operations so as to nip in the bud criminal activities in a given locality. Finally, a prototype crime reporting system was designed that relies on four reporting forms: a complaint or dispatch reporting form, a crime event report form, follow-up investigation report form, and an arrest report form. The system consists of three functional modules: a data capture module, a report management and control module, and a data utilization module. Future work on crime reporting system can be tailored towards accessibility (mobile version), awareness and improvement on the usage.

Keywords: Crime reporting, incident-based, victims, criminals

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1. INTRODUCTION

Modern society is characterized by increasing levels of global social mobility and uncertainty relating to levels of risk posed by internal and external security threats. Within this climate security driven by technology is increasingly being used by governments, corporate bodies and individuals to monitor and reduce risk [1]. There has been an acceptance that the criminal justice system is limited in its capacity to control crime which has led to the exploration of other avenues for tackling crime [2] and this has provided a market for private companies to push forward the growth of technological security innovations. Crime is a human experience and is as old as the human race. Crime is geographical. It occurs at a specific place, specific time and for a specific reason. It can affect everyone and anyone at any time [3].

Both Information Technology (IT) and crime are complex and constantly changing. Social and technological changes introduce new targets, tools and motives for crime. E-crime targets include confidential information, technical infrastructure and denial of service. Improved and faster technology and worldwide communications make it easier to both organise and conceal crime. Software to help criminals is available, even as commercial products: criminals have used attack-testing software to probe the security of target systems. Motivations now include terrorism and revenge as well as traditional desires for financial gain.

Terrorists might not be rational in their motivation; casual opportunists look for an open door; organised crime will evaluate potential gains against investment – which might be massive if the potential rewards are attractive enough [4].

1.1 Problem Statement

Crime is part of human activities and needs to be managed. No human society has ever been totally free of deviants and it is unlikely that society will ever be. The more populated and complex a society becomes the wider the range of anti-social conduct that must be controlled by government using police power. The incident-based system reports on a much broader range of crimes and includes data on the circumstances of the crime, the victim, and the defendant [3]. The current crime reporting system is faced with several difficulties as there is no instant means of reporting crime rather than telephone calls, messaging or perhaps face-to-face which is always cumbersome in a case the reporter might want to keep anonymity. To strengthen crime reporting system, an online system is enhanced to fully take the responsibility of reporting crime in a manner that will be useful to the Nigerian Police Force (NPF). For instance, in cases involving property crime the incident-based system will report on the:

- type and description of the article;
- its value;
- type of loss (e.g., stolen, vandalized);

- type of victim (e.g., individual, business);
- and location of crime (e.g., convenience store, residence).

1.2 Research Objectives and Significance

The aim of CRIS is to assist the Nigerian Police Force (NPF) in their bid to solve crimes with timely and useful information about criminals and/or their mode of operations so as to nip in the bud criminal activities in a given locality.

The objectives of the research work are as stated below:

1. To provide a deterministic crime reporting model
2. To create a distributed data warehouse for crime reporting based on the model.

The enhanced data quality of the incident-based reporting system will be of significant benefit to state and local governing bodies, criminal justice agencies, and the public. Data from the incident-based system will enhance both strategic and tactical decision making in criminal justice. Because incident-based data will provide a more accurate picture of a community's crime patterns, decisions regarding law enforcement, judicial, and correctional resources can be made based on empirical data. Similarly, the level of detail provided by incident-based data can assist law enforcement agencies and the community to identify crime problems in their community such as:

- crime hotspots
- populations who are at risk and
- Drug and alcohol problems.

Crime prevention strategies may then be developed and evaluated based on empirical evidence.

This study will also assist policy analyst to understand both factors that impedes the efficiency and effectiveness of the police and the ways by which the situation could be improved upon so as to bring crime and disorders in the society to its barest minimum. Finally, this study will go a long way in contributing to the knowledge of police work. Besides, other researchers and students in higher institutions especially those in sociology department can derive various secondary data from this study.

2. RELATED WORKS

The review of literature is a critical crossroad in any research effort, it presents new windows of opportunities to re-assess the knowledge base for the purpose of expanding the frontiers of intellectual horizon. Knowledge cannot and does not exist in an intellectual vacuum, a rigorous blend of knowledge through the review of other scholarly works add a touch of value to the research activity by giving it a crucial underlay of thoroughness thereby providing an escape route from merely restarting knowledge. It provides the researcher an opportunity to add to the existing stock of knowledge with subsequent sustenance of the upward trend of the knowledge base and thus opens a wholly new vista for knowledge accumulation.

The Nigerian Police Force is a security outfit of the Nigerian State established to combat crime and ensure security of lives and property of the citizenry.

2.1 Crime Management

The occurrence of crime is not random. It is spatially distributed in patterns some patterns are discovered while others are not. Factor such as social class, income level and environment play parts in the types of crime that are committed. Resources and/or a lack of resources can influence the probability of crimes committed in any given area [5]. Because of the complexity of crime, crime has to be managed. Crime as various definitions depending on which perspective one is looking at it from. For this research crime is defined as "violation of law, or an instance of this, punishable by the state," [6]. Management on the other hand is the process of directing and controlling the resources of an organization such as its personnel, materials, and equipment to achieve the goals of the organization. Crime management is therefore defined as controlling, directing, and coordinating police resources (money, equipment, and personnel) to prevent the violation of law and where it has been violated, to apprehend the criminals and take them to court.

2.2 Blueprint for Citizen Patrols

Citizen patrols are volunteers who survey an area to report incidents and problems to the police and provide a visible presence that deters criminal activity. Some use bicycles, motorcycles, vans or cars to cover large areas. They generally have no policing powers, carry no weapons, are non-confrontational, and always coordinate with law enforcement. Citizen patrols can cover a village, a neighborhood, an apartment complex, a business district, or a park. They contact the police dispatcher or crime desk through two-way radios or cellular phones donated by a local business. Cameras or video equipment may be used to record suspicious activity. Many are based in a Neighborhood Watch group.

The citizen patrol should:

- Undergo training by law enforcements
- Work in teams
- wear identifying clothing or ID
- Never carry weapons such as guns or knives
- Always carry a pad and pencil, and a flash light if it is dark
- Be courteous and helpful to residents of the area being patrolled
- Keep logs and file reports

Citizen patrols can take on extra duties, such as escort services, traffic control, and crowd control at community events, identifying neighborhood nuisance concerns, checking on homebound residents, and identifying and reporting abandoned vehicles.

2.3 Crime Education

According to [3] in a crime summit, he lays much emphasis was on Crime Education. To start or strengthen a crime reporting system, you need:

- Committed people
- A system for both anonymous and face-to-face reporting
- Education for those who run the system, handle reports and respond helpfully to victims
- Education for the school or neighborhood on what to report, how to report, and why to report

Education for those who run the system includes teaching those who might receive crime reports in how to take a useful report, how to treat reports confidentially, how to help victims, and how to teach others to use the system. Operational details of the system, such as how often reports are collected, what information is vital for a report to be useful, and what happens to a report once it's received are important for this group.

Education for those who use the system on what should be reported - specific kinds of crimes or crimes-in-the-making, tips about who committed particular crimes, and so on; information that the report should contain; how to report crime when time is critical, what will happen to reports, and how reporting helps prevent crime and build a sense of security. Education can happen in many ways - fliers and brochures advertising the system, presentations at assemblies or in classes or meetings, videos that can be shown at meetings or in classes, posters throughout the area, bookmarks, and articles in the local paper are few examples.

2.4 Crime Reporting

The previous findings are enough to convince readers of the relevance that reporting behaviour has for the criminal justice system and the community. Citizens, through the reporting of their crime experiences, start the criminal justice machinery which in turn enables investigation of crimes by police, the prosecution and trial of offenders, and their punishment. The deterrent effect of criminal justice is potentiated as well. On the other hand, non-reporting precludes access to compensation schemes, offenders not being arrested, and the goal of a more equitable criminal justice system being achieved [7].

However, not all the victimization incidents are crimes in a technical sense, and of those which are, some are very minor indeed. The police will complete criminal offence reports in only a small number of these incidents. Increased willingness to report what people perceive as crimes would result in increased police efforts in dealing with minor incidents, not all of which may result in satisfactory outcomes to the victims; an issue with potentially negative consequences for the reporting of perhaps more serious future incidents. Crime victimisation is an expression of social conflict [8].

Reporting of perceived victimization experiences to the police depends upon a complex set of factors ranging from seriousness of incidents to confidence in the criminal justice system. A more complete understanding of non-reporting, its distribution and its correlates will help us assess the performance of our criminal justice agencies [9].

Reporting Methods

Effective methods of anonymous reporting include [7]:

- The tip box
- The telephone coupled with an answering machine or voice mail
- E-mail to a central address
- A web site that directs reports to a central address
- Oral reports

The tip box usually consists of several locked boxes at key points around the school or neighborhood. Each box has a slot for inserting written reports. Boxes need to be located in places that are reasonably populated - not deserted and not in the middle of heavy traffic. The box (and education about using it) should remind students and citizens of what's needed for a good report - a dated, legible note describing as much as possible what happened where, when, how and by whom. Advantages of the tip box include low cost, low reliance of technology, and written records. Disadvantages include unreadable reports and limited access. Tip boxes also require that someone physically visit and collect reports from each of the boxes.

Telephone reporting systems offer a number of variations. Some include a toll-free line directed to a cell phone. Some reporting lines are partnered with a hotline. Calls left on a voicemail or answering machine can be retrieved from anywhere. The report taker doesn't have to visit boxes. The telephone approach allows students to call from school, from home, from a friend's or from a pay phone. People tend to be comfortable talking on the phone, so this approach leaves no lasting record of the report, unless messages taped or transcribed and checked for accuracy. It also requires resources - funds or in-kind donations for the equipment, the telephone service, and a secure area in which to house the equipment.

E-mail and web sites have proved successful in reaching out to those who are electronically literate. Some systems have both an e-mail box and a web site for crime reports. Both e-mail and web approaches can provide printed reports to send to appropriate authorities. There are drawbacks - setting up the web page or e-mail properly (though a youth can probably provide help). The fact that many Nigerians still may not have convenient access to computers and the need to ensure security of the system to protect reporters' anonymity is required at all cost.

Written and oral reports have the advantage that many people trust the human link more than the plastic box or the electronics of phones and e-mails.

Education about crime reporting is an ongoing process. New participants come in every year; the system acquires new features; or reporting methods change. Education should target adults in the community as well as young people. It should emphasize the preventive power of reporting, not just the need to report crimes that happened or information on criminal suspects.

2.4 New Technology of Crime Prevention

Crime prevention is a concept that has been applied in a number of ways to the problem of crime: it has been used to refer to both *activities* (e.g. crime prevention programs and/or strategies) and *outcomes* (e.g. lower levels of crime in communities and/or lower levels of offending/re-offending by individuals). In the name of crime prevention, researchers have examined the influence/role of *formal* social control mechanisms (e.g. the deterrent effects of police, courts, and corrections) and *informal* social control mechanisms, with a focus on the influence (through mechanisms such as attachment, commitment, and involvement) of family, peers, school, work, community and the role of shame and belief systems/religion). In addition, crime prevention strategies have been targeted on different levels of prevention (primary, secondary, tertiary) and on the need for individual (i.e. private actions), parochial (group actions by neighborhood residents), and public actions (i.e. decisions to call the police) to prevent crime. Understanding crime prevention requires studying intentions, as well as consequences.

A broad array of measures needs consideration beyond the traditional number of criminal events or offenders. Additional factors include the amount of harm prevented or the number of victims harmed or harmed repeatedly [10],[11],[12]. An even broader definition of crime prevention can be seen in the concern with newer factors such as reduction of risk factors for crime (e.g., gang membership or failure to complete high school). While crime prevention currently is used as a ubiquitous, catch-all phrase that can be applied to both criminal justice-based and non-criminal justice-based initiatives, our focus is on strategies that utilize new technological innovations to either prevent crime (in particular places) or prevent re-offending by targeted groups of offenders (e.g. sex offenders, mentally ill offenders,) that do *not* rely exclusively on traditional actions by the police (arrest), courts (prosecution), and/or corrections(punishment, control, reform).

2.5 New Technology of Policing

Changes in both the hard and soft technology of policing appear to be transforming local, state, and federal policing departments in a number of fundamental ways; but some scholars have raised questions about how much has really changed [12]. Two recent reviews [10], [11] of technology and the police describe this transformation process, review the evidence of its impact on police practices and outcomes, and discuss the implications of technological changes in policing for the public. The following conclusions were arrived at: police technology has not been found to significantly improve police performance [10], [12].

Similar assessments of the limited measurable impact of police technology on police performance have been reached by others who have reviewed the available research on the impact of recent technological innovations on police performance [12].

3. REQUIREMENTS DESIGN AND SYSTEM DEVELOPMENT METHODOLOGIES

The existing system in which a victim has to visit the nearest police station makes crime reporting a very strenuous action as a result of difficulties involved before information on a particular crime is lodged. Most victims prefer to report directly to court as to maintain law and order in a bid to seek justice. The police approach as regards FIR (FIRST INVESTIGATION REPORT) encumbers rigid investigation and analysis of crime thereby render innocent sometime culprit.

The same difficulties are faced by volunteers who wish to report crime occurrence within their vicinities. This is a quite critical process by which the victim has to undergo before lodging his/her FIR (FIRST INVESTIGATION REPORT). At times, the criminal parties gave the bribe to the police officers for not to lodge the FIR. As a result, the victim was not being able to lodge his/her FIR and he/she has to visit the court. It is also possible that when the victim is going to police station the criminal party attacks on him/her. In this case, the victim was not be able to visit the police station and may be killed by the criminal party.

The existing system is fully manual i.e. a lot of paper work has to be done by the authorities as well as by the victim. With the current trend in Information Technology, most of our daily activities are encapsulated by the standardization and advent of innovation, therefore the era of constituting police services and operation in a confused systemic approach needs to end and a total embracement of Information Technologies should be a concern. On the other hand, maintaining the paper based records and duplicating them when required is another tedious process. For instance if a police officer is asked for a separate file of any criminal record/file it may take few hours or days to locate it depending on the size of the record. If the same case arises with the computerized system, it will take only few seconds for duplicating the records/files. We can also print the hardcopy of these records.

Also, protecting the files of important records from the reach of criminal parties/ pesticides/ rodents etc. is another cumbersome task. Huge amount of monies are expended for the physical safety of the important files/records. Thus there are various challenges for manually maintaining the records instead of the modern computer systems. As earlier discussed, the existing problem is associated with potential problems as a result of epileptic operation with the use of manual approach.

The followings are the problems gathered from existing system

- Accuracy – The present system cannot be ascertained as containing accurate information as regards any information on a crime gathered by the police. The system is corrupt and porous to accommodate any manipulation by corrupt officer(s) in charge. Due to bulkiness files, cases might be thrown aboard and new ones formulated which will suit their (corrupt officers) whims and caprices.
- Waste of Time – It leads to waste of time as there is much paper work involved which requires flipping through loads/stocks of file before information is fetched.
- Lack of integrity
- Efficiency

3.1 System Capabilities

The portal has the following few sections, which are discussed below:

Administrator

- An Administrator page is provided through which handles the site, databases and allow detectives, citizens and Defense Officials access to the site. A FIR (FIRST INVESTIGATION REPORT) form is provided through which citizens can enter details of the crime reported. This data once entered can be edited/deleted as required.
- There are sections provided for Defense Officials, Detectives and citizens.

Citizens

In Citizens sections, user can enter the details of FIR (FIRST INVESTIGATION REPORT) through the help of portal. The portal has forms that will ask for the details of victim(s), crime id /name /location/ address /city /country /contact person /contact number /contact, Email-Id. After entering the details the data will be saved by clicking save button and the details will be stored in the FIR database. Each FIR will be given a unique ID.

Administrator(s)

In Administrator section, various data is available for searching details of criminals, FIRs, judicial results, case hearings and other. Administrator can update databases for the required fields.

- **Proofing** - Crime Reporting forms, progress tracking, and proof attachments.
- **Search-** In Search section, authorized detectives and Defense Officials will search for matching records of criminals, FIR details, missing people etc.
- **Alert Services-** An alert can be sent to the citizen regarding the FIR ID and an alert can be sent to a concerned person of the area regarding the CRIME.

3.2 System Functionalities

Crime reporting forms, progress tracking, proof attachments.

- On form submission an e mail goes to regional police officer in case if it's serious category crime where quick attention is required.
- Facilitate crime and criminals search – region, crime-type, gender, age group wise etc.
- Missing citizen or valuables reporting and search
- Secure registration and profile management facilities for detectives and security agencies
- Facilitate communication between all stakeholders – Discussion forum/chat/mail/polls
- Help book & time-to-time instructions to users through mail

3.3 Requirements Specification

This proposed software runs effectively on a computer system which has the minimum requirements. The requirements are split into two categories, namely:

Software Requirements

The minimum software requirements to run the program are listed below

- i. Microsoft Windows XP (Home and Professional Editions), Windows 7
- ii. MySQL
- iii. JavaScript, PHP/HTML, CSS, jQuery
- iv. Browser e.g. Mozilla Firefox, Safari, chrome, Flock e.t.c.
- v. Local Server e.g. WAMP Server, XXAMP or EasyPHP Server

Hardware Requirements

The minimum hardware required to run the program are listed below

- i. Hard disk of 20 Giga bytes
- ii. System memory (RAM) of 512 Mega bytes
- iii. Dot Matrix, Laser jet Printer
- iv. Compatible flash drive or external Hard disk

4. SOFTWARE DEVELOPMENT METHODOLOGY

4.1 Architecture of the Proposed System

The proposed system is aimed at providing a flexible platform that enhances user friendliness.

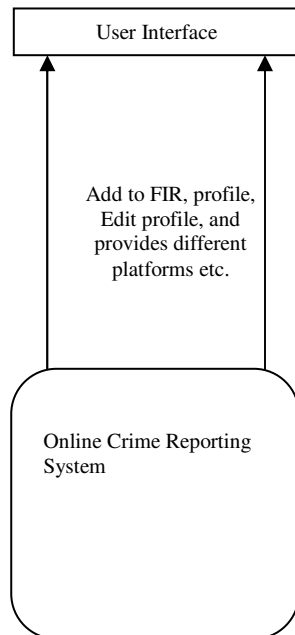


Figure1: Context Diagram

4.2 Description of Architectural Design

In this context diagram, the information provided to and received from the 'Online Crime Reporting System' is identified. The arrows represent the information received or generated by the application. The closed boxes represent the set of sources and sinks of information. In the system, we can observe that the user interacts with the application through a graphical user interface (GUI). The inputs to the system are the FIRs, profile, police detail etc. criteria provided by the user and a new review written by the user to some certain entries unlike FIRs. Also, the output is in the form of repeater and grid views which present the users (Police) with the list of FIR available. The users (police) can view complete FIRs or complaints; view Images and reviews by other users (public).

4.3 Object-oriented System Analysis and Design System Description

- Victim/Volunteer reports officially or lodges FIR
- FIR ID number is generated to assist easy referencing rather than a muddle up
- Victim/Volunteer performs a follow-up as a confirmation if the report is being taken care
- Police examines the report for further analysis and identification
- Police marks a particular area as notorious (**this is not system requirement**)
-

4.4 Identifying the Actors

The actors in the system are the victim/volunteer, the police and the reporting system consisting of form processing, record documentation, Analysis and report generation. The victim/volunteer is a passive user-actor who initiates the process and lodges FIR, a goal of measurable value. The police are an active user-actor, who triggers the system and has the role of performing investigation with the responsibility of collecting the correct information from the victim/volunteer, which is a measurable value. Predesigned and deployed crime reporting system at the back end is a system actor-user to ensure that crime report/investigation processing is done correctly and different system statuses are updated on handling the FIR. This actor has an active role and responsibility at the back end.

4.5 Process Model –Crime Reporting System

Based on the system observation by the analyst, a high-level activity diagram is drawn modeling the process of crime report lodged by the victim/volunteer.

The activity diagram brings everybody concerned with the system on the ground to a common understanding of the system as it functions.

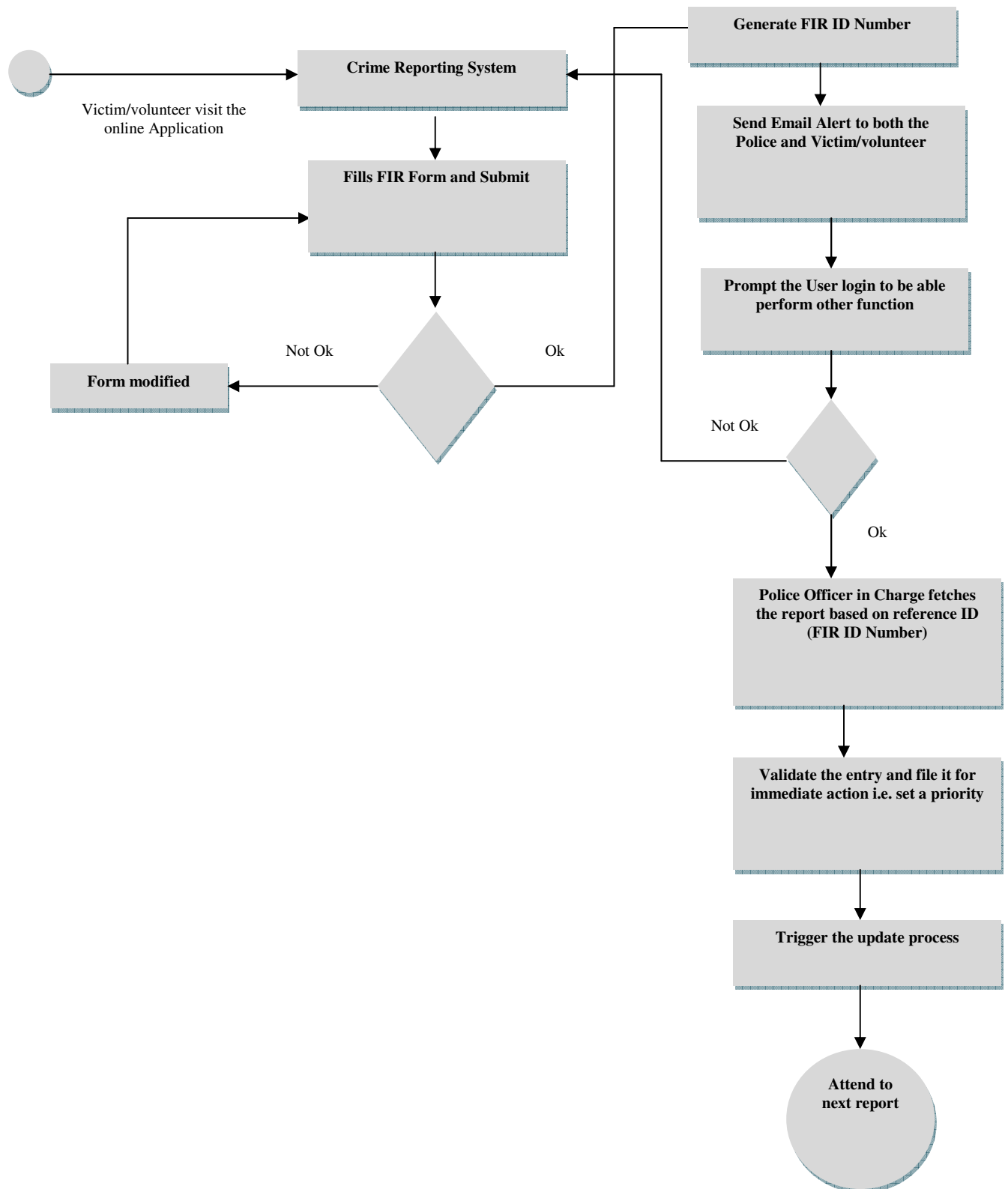


Figure 2: The Activity Diagram of Crime Reporting System

4.6 Use Cases

In the Crime Reporting systems, users are the victims/volunteer, the Police and Crime Reporting System (CRS). Take each user and identify the roles played, which would lead us to identify the roles played, an identification of use case. Table 3.1 shows the result of the process of identifying the use cases.

The system has three users, eight roles and eleven use cases. To illustrate the process of identifying the use cases, let us take the victim/volunteer (a user of the system). A victim/volunteer as a user may play one or more of three roles.

The roles are

1. Lodging FIR/Complaints about a crime.
2. Assist the police with adequate and necessary information required for swift investigation
3. Follow-up to ascertain that the report is treated or considered by the police

As explained in the case of victim/volunteer, the roles are use cases. Similarly, one can probe into the roles and use cases for police and crime reporting system.

Table 1: Roles in use case

Users	Roles	Use Case
Victim/volunteer	Lodging FIR/Complaint	Crime Reporting Process
	Provide necessary Information	
	Follow-up	
Police	Perform validation and verification of the information	
	Data Manager	
	Report Generation	
Crime Reporting System	Server System	Structures the report, process FIR and prepare documentation Updates the record, enforce data integrity and back-up

4.7 Interaction Diagrams

Interaction diagrams are used to show the interactions between user/actor and the system. Use case is a scenario that develops through interaction. Let us model different scenarios through interaction diagrams:

Use Case: Crime reporting process

1. Victim/volunteer fills form to lodge FIR
2. Police checks for validity and verifies the information source.

3. If OK, the police proceed with the investigation.
4. If not OK, the police ignore and file the report as counterfeit.
5. Document for an immediate action.
6. Steps 2 to 4 are repeated.

Figure 3 shows the steps in the activity diagrams of use case crime reporting process

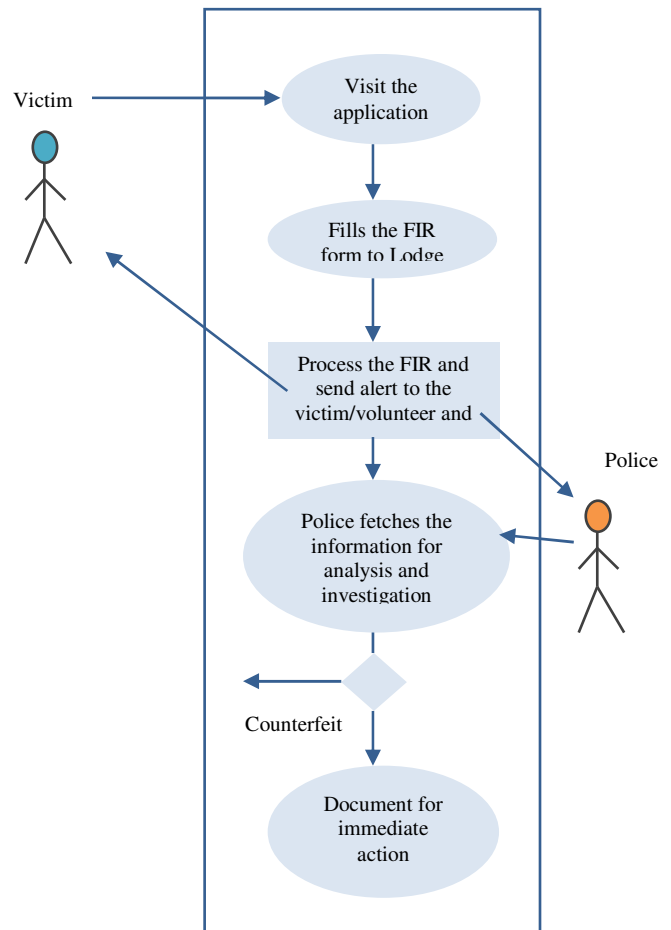


Fig 3: Use case Diagram of Crime Reporting Process

Use case: Police

The steps involved in this use case are:

1. Police logs in to the platform
2. Performs analysis on FIR lodged by a victim or volunteer.
3. Document the FIR for an immediate action

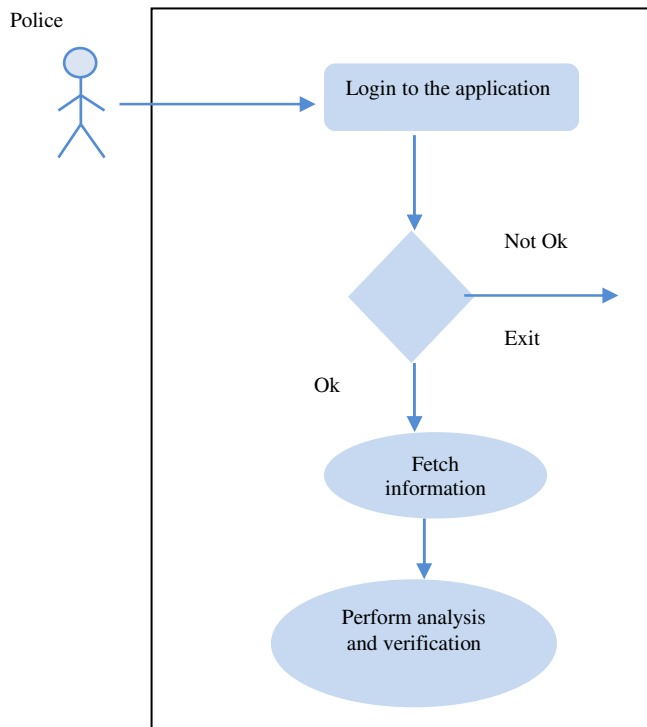


Figure 4: Access Use Case

5. APPLICATION SOFTWARE MODULES

- Password Module**
 In this module, user enters a password and the portal checks its validity. If the password is valid then he is allowed to enter, otherwise "Invalid User/Password" message is displayed. This is done to avoid unauthorized access.
- Search**
 In the Search section, authorized detectives and Defense Officials will search for matching records of criminals, FIR details, missing people etc.
- Contact of Concerned Authority**
 Contact details of the area official who is solving the case.
- Progress**
 Case study and progress of the case entered by the FIR can be found in this section. All the progress reports and special remarks can be entered in the database by Administrator(s).
- Queries**
 Detailed information of the crime can be entered and retrieved by administrator(s) only because of the security point of view.

- Registration**
 Secure registration and profile management facilities are available for detectives and security agencies.
- Validation of Data entered by the user and error handling**
 In this module, the validity of data entered by the user during the various processes is checked through various validation checks. For example, there shouldn't be any characters entered in the numeric fields. Likewise if there is any error it should handle that particular error and give the appropriate messages.

6. CONCLUSION

The world is experiencing an information knowledge revolution that is fundamentally transforming the way in which human activities are carried out. Governments worldwide are adopting e – government as a means of improving their services to businesses and citizens, promoting economic and social development, and enhancing the effectiveness and efficiency of government operations. In current competitive scenario every business/public establishment needs quality and systematic process to increase their working efficiency as well as improve their productivity. It is keeping in mind this business philosophy that we propose.

Crime Reporting System

In conclusion, we have, in this study, looked at the various definitions of criminal statistics. Finally, a prototype crime reporting system was designed that relies on four reporting forms: a complaint or dispatch reporting form, a crime event report form, follow-up investigation report form, and an arrest report form. The system consists of three functional modules: a data capture module, a report management and control module, and a data utilization module. The system maintains an event or case file and a police activity file. The conceptual crime reporting system design and data elements thus developed must now be tested and evaluated in an operational environment.

7. RECOMMENDATION

Societies all over the world expand and develop continuously, as such human relationship and activities also expands. The results of dynamism of the growing population give room for crime. These societies therefore strive to establish and develop institutions that can ensure peace as well as security of lives and property of its citizenry.

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