CRIME REPORTING AND INTELLIGENCE SYSTEM: CASE OF BURUBURU POLICE DIVISION-NAIROBI

BY

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UNITED STATES INTERNATIONAL UNIVERSITY-
AFRICA.

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A Project Report Submitted to the School of Science and Technology in Partial Fulfillment of the Requirement for the Degree of Master of Science in Information Systems and Technology

UNITED STATES INTERNATIONAL UNIVERSITY-AFRICA.

SPRING 2018
STUDENT’S DECLARATION

I, the undersigned, declare that this is my original work and has not been submitted to any other college, institution or university other than the United States International University in Nairobi for academic credit.

Signature____________________________ Date______________________________

Mr. Paul Ochieng Oketch (ID NO 649303)

This project has been presented for examination with my approval as the appointed supervisor:

Signature____________________________ Date______________________________

Joshua Rumo Ndiege, PhD

Signature____________________________ Date______________________________

Dean, School of Science and Technology
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ABSTRACT

Security problems have become a major concern in most urban settlements across the globe. The use of technology can be incorporated into the security systems to enhance operational measures that have been deployed. The aim of this study was to examine the challenges stakeholders face in crime reporting and develop a mobile-based system that would support intelligence collection and real-time reporting. The study employed design science to develop the proposed system. Primary data was collected from one hundred members of the public and twenty-eight police officers serving within Buruburu police division, Nairobi County. The survey design used structured questionnaires which were administered to respondents independently, followed by developing a mobile-based application aimed at sealing the loopholes identified from the survey. Consequently, the application was tested for usability by both the public and police officers. The test was successful and all key operation tests had positive and acceptable outcomes. The survey indicated that, the current crime reporting method has numerous failure, which include late response to criminal cases, inaccuracy in documentation of acts, non-coordinate specific response by the police, longer duration for response, hence non resolving of issues raised by the public and human resource related issues such as bribes before the police can act on reported cases. The viability of the phone-based reporting was justified by the presence of more than half (85%) of the sampled population owning, and using smartphone which would support the application and more than 90% of police officers agreeing that mobile-based reporting would lead to efficiency in intelligence collection and solving crime. The findings of the study concluded that the current crime reporting and information collection system are part of the problem that negates the policing sector hence encouraging criminal acts. The study recommends that if the application will be used by the sector, then there is a need for training police officers on usage and massive education and awareness to the public as it presents a viable tool for solving crime, improving intelligence collection and reducing resource waste in the entire policing value chain.
ACKNOWLEDGEMENT

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DEDICATION

To my mother Salome Moth, my wife Zainah Ramadhan, my son and daughter Hashim Ali and Ilham Nazmin for all their love, support and troubles that made me press on.
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ABBREVIATIONS

GPS            Global Positioning System
ATM            Automated Teller machine
SOCOs          Scenes of Crime Officers
US             United States
OCS            Officer Commanding Station
SPSS           Statistical Package for the Social Sciences
NACOSTI        National Commission for Science, Technology and Innovation
RAM            Random Access Memory
GB             Gigabyte
IDE            Integrated Development Environment
OS             Operating System
MySQL          My Structured Query Language
MB             Megabyte
STS            Spring Tool Suite
PC             Personal Computer
JSON           JavaScript Object Notation
REST           Representational State Transfer
GUI            Graphical User Interface
JAVAFX         Java Special Effects
ERD            Entity Relationship Diagram
TC             Test Case
ID             Identity
HTTP           Hypertext Transfer Protocol
UML            Unified Modelling Language
CASE           Computer Aided Software Engineering
JDK            Java development Kit
ODBC           Open Database Connectivity
JDBC           Java Database Connectivity
Chapter 1: Introduction

1.1 Background of the Study
Security has become a serious concern across several countries in the world. For example, terrorism has become highly rampant in various major global cities. In Kenya, particularly Nairobi has been a victim of terrorist attacks orchestrated by groups located in the country and others in neighboring countries, especially Somalia (Omboto, Ondiek, Odera, & Ayugi, 2013; Pokhariyal, Muthuri & Muthur, 2003). Gang-based crimes and individual criminal acts have been documented in Kenya with more concentrations reported in Nairobi-County (Gimode, 2001; Mutahi, 2011). On the other hand, technology advancement has increased. Internet access and ownership of “smartphone” is currently a normal phenomenon for a big proportion of the county's residents (Choo, Smith, McCusker & Australian Institute of Criminology, 2007). This has raised the interest, whether technology can be used to improve the state of security within Nairobi and the country at large. Neighborhoods in cities have high crime rates that sometimes goes unresolved because of inefficient reporting mechanisms (Arnot, Luckert & Boxall, 2011). This has motivated the need to find a more lasting and flexible solution that will solve problems associated with crime reporting, and offering an amicable solution to all stakeholders (Gastrow, 2011; Van Dijk, 2007). Using a mobile application to fight crime will be highly efficient and effective if implemented and executed well in conjunction with the police service (Ruteere & Pommerolle, 2003).

Technology is an avenue that can be used to improve security and help in fighting crime. Victims of these crimes require an efficient and effective method of getting assistance when need arises. The country’s middle class population is constantly increasing. This means that criminals are getting motivated by the increasing suitable targets. The most prone criminal area in the city is the eastern area of Nairobi (Gastrow, 2011; Karake, 2014; Mburu, 2014). This is mainly because the region is highly populated making it an easy target of criminal activities and large impact from associated outcomes (Abrahamsen & Williams, 2008). Improved security measures are important for the city because it supports improvement of the resident’s livelihood. Enhanced security measures will increase the level of productivity of the workers within the country, consequently translating into improved economic growth (August & Tunca, 2006).
1.2 Statement of the Problem
Crime and suspect human activities have always been part of the society. However, there has been acknowledged increase in crime within Nairobi area as documented by Mburu (2014), with most of them not being reported or the reporting done too late. Such cases go unresolved and victims have limited options of acquiring justice. It is essential to have well organized and widely available method for reporting criminal activities to the relevant authorities and support for quick response units. This information needs to be transmitted instantly and remotely without the technical and the cumbersome need to physically access police stations. Smartphone-based application accompanied by a geographical position system coordinate, and real-time relay of information to the security agencies by the victims would improve this scenario. The reporting approach should be real-time, hence encourage quick response to a point of alarm.

1.3 Purpose of the Study
1.3.1 General Objective
The general objective of this is to develop a mobile-based crime reporting system that will facilitate solving of criminal incidences timeously.

1.3.2 Specific Objectives
The following specific objectives were used to address the main objective of the study

1. To identify current methods, and challenges with crime reporting within Nairobi area
2. To develop a contextually relevant mobile application for crime reporting
3. To evaluate the usability of the proposed mobile application

1.4 Justification of the Study
Traditional crime reporting can be tedious and discouraging for many people. Developing a supportive mobile application will ensure that individuals report crimes remotely from their mobile phones. The study will help to improve the security sector by offering solutions to the challenges currently experienced.

1.5 Significance of the Study
The study outcome identified key challenges faced by people while reporting cases. The findings will improve aspects of real-time response to crime alerts, GPS coordinated point of alert response, remote reporting, remote statement writing and visual evidence capturing.
There is a gap in the city’s security sector because of inefficient information capturing and low police to civilian ratio, hence lower response time and limited resource allocation for evidence capturing.

1.6 Scope of the Study
The study sampled the hot spot regions within the Nairobi namely: Dandora, Shaurimoyo, Jogoo, and Buruburu. Respondents were selected at random. Respondents from the police station were selected using the employee record contained in the station. The study covered people of between 18 years and above. Persons of all genders were included in the study.

1.7 Definition of Terms
Server: A computer and associated computer system which plays the role of centrally managing services from a network.
Java: A programming language that produces a software that can be used in different platforms such as windows OS, Linux OS, etc.
Ethernet: A family describing local area networks connected for sharing information or internet services
Platform: computing system that operates by processing data in numerical, texts and images within an information processing support system
Android: An operating system for mobile phones developed by google with basis on a modified Linux kernel and operated as an open source application targeting touch screen phones
iOS: the mobile phone operating system developed by the apple company for use in their hardware only.
Compilers: The compiler produces compile time errors and usually indicates what line of the source code is causing the problem.
Cellular network: Cellular network is a communication network where the last link is wireless.
Test data: Test data refers to data which has been specifically identified for use in tests, typically of a computer program.

1.8 Chapter Summary
The chapter provides some background on issues of crime reporting and intelligence systems operation. The chapter has background information, problem statement, objectives, justification and scope of the study. Several countries across the world are
making efforts towards improving the level of security for their citizens. Technology has been identified as an avenue through which security can be enhanced because various security forces can get assistance from the citizens in fighting. Chapter two presents literature on the role of security agencies tasked with the responsibility of conducting investigations of criminal activities at a global and the Kenyan context. Moreover, it provides information in regards to gaps in information and needs assessment of the subject matter will also be documented. The information discussed also include the problems faced by citizens in the process of reporting crimes and problems of police response.
Chapter 2: Literature Review

2.1 Introduction
This section analyzed the current security situation within the city of Nairobi and the improvements that have been made to the situation. Security flaws that have been witnessed in the city have been analyzed and recommendations made on how they would have been avoided and how they can be managed in the future. Technology has been examined to determine how it would have been useful in these situations. There are some challenges that victims face when reporting crimes to the relevant authorities. These challenges have been examined to determine how they can be improved.

2.2 Global Security Status
The state of security has become a great issue globally. For example, terrorism and radicalization has become a great problem in almost all major economies. The United States of America will forever remember the terrorism attack of September 11, 2011 (Goodrich, 2012). There have been increased criminal activities in Paris, Denmark and even London. Also, organized crimes and gangs have been reported in many countries, including Russia, Venezuela and Columbia (Xu & Chen, 2004). Appropriate solutions to handling crime in most of these global context has been attributed to inclusion of technology in service delivery. Effective and efficient link analysis techniques are needed to help law enforcement and intelligence agencies fight organized crimes such as narcotics violation, terrorism, and kidnapping. Therefore, without appropriate intelligence with high precision, then solution to these issues will remain a far-fetched goal as it has been over the years (Vidgen & Wang, 2009).

2.3 State of Security in Kenya
Currently, the main source of criminal information and reporting is the reports developed from the police investigations and occurrence books at the police stations across the country (Goodrich, 2012). The police often rely on the use of public information to piece together their investigation. The process of reporting crimes is generally slow in Kenya and ineffective. Getting through to the designated phone lines is often difficult and faces numerous technical barriers. Previous studies in the same region have revealed that corruption is one of the major challenges that have hindered crime-fighting within the country.
Lack of financial support has played a role in the high level of inefficiency within the security sector of the country (Abrahamsen & Williams, 2005). Typically, victims often report crimes long after the offense has been committed. The victims are required to visit the nearest police station to receive assistance that in most instances is discouraging because of associated time wastage along the way (Bachmann & Hönke, 2010). In some cases, the victims might not even get there because of the long distances covered before getting there. The first responses they get are from their neighbors and the nearest stationed law enforcers. Therefore, there has been a need for the victims to be able to send out criminal information to police station or police post remotely using their mobile-based applications (Boone, 2012).

There is a weakness in the existing methodology that the security agencies use to receive information. In most cases, the reporting happens when it is already too late making it difficult for the relevant authorities to act on the information they have gathered. The use of the software system will increase the level of effectiveness and efficiency in the crime-fighting activities within the city. This is because the implementation of real-time reporting would ensure an immediate response, hence the immediate reaction from security agencies. Police officers are not capable of patrolling the whole region because their ratio to the residents in the country is severely low (Vidgen & Wang, 2009). These are some of the challenges that are faced by the police officers when they try to fight crime in the city. When victims manage to get through to the emergency police numbers, the call handlers are not well-trained to handle the callers on the other end of the telephone call (Mogire, 2009). The government should create awareness of the existing emergency numbers and allocate well-trained personnel to become call handlers at the call centers. They should be trained on how to deal with emergencies they face. Victims often go through different situations that affect them in various ways (Park, 2011). For this reason, the officers should be capable of accommodating the strangest type of calls they may receive from victims.

Technologies and application would assist the situation. The first points of contact for the victims are the people around them and the doctors, for severe incidences. Therefore, there is a need for the victims to share this information more rapidly to the security agencies. This will reduce the response time for the security agencies to the crime scenes and consequently discourage criminal activities within the city (Harris, Collins & Hevner, 2009). Also, police investigations do not have efficient processes, requiring long durations.
of investigations and documentation. The police do not have the necessary resources or equipment required to conduct an effective investigation process. With the right equipment, the police will reduce their reliance on eyewitness accounts that are not as accurate when conducting an investigation exercise. For example, the police can set up a command center that can be used by victims to send information directly to the police stations. Also, security cameras can be installed across the city to increase the visible search area for the police (Boh, Slaughter & Espinosa, 2007). However, more research activities need to be conducted to determine the usefulness of the security cameras installed across the city and how they can be integrated with mobile-based applications available to citizens for reporting any crime. The study needs to investigate how the mobile-based applications used for reporting crime can be fully useful to the police and how they can be managed more efficiently. Therefore, a software system will come in handy to improve the communication process within the various security agencies.

2.4 Analysis of the Security Forces in Response to Crime Reports

Security agencies are tasked with the responsibility of conducting the investigations on criminal activities that have taken place. Statistics indicate that the level of crime often reduces as the case are being solved. Reporting the criminal activities to the security agencies is highly dependent on the victims and the means of communication with the security agencies. The security agencies then initiate the relevant investigations to ensure that they are completed within the shortest time possible and the culprit is apprehended (Pokhariyal, Muthuri & Muthuri, 2003). The use of a mobile application will increase the rate at which the investigations are conducted. However, there is no indication that faster detection rates directly relate to the largely populated areas. Security agencies often concentrate their efforts on largely populated regions within the community. Highly populated regions mean that there is a lot of property that is present in one location. This makes it very tempting for bunglers in the region. The high level of population increases the chances of criminal activities within the region. For this reason, security agencies ensure that they are vigilant in such areas (Tarling & Morris, 2010). When comparing with lower populated regions, there are fewer instances of criminal activities. Security agencies are usually less vigilant in such locations. However, criminal gangs often take advantage of such instances. They ride on the fact that they may not be detected as fast as in highly populated regions of the city. For example, Nairobi has suffered a terrorist attack in one of the most popular shopping malls in the city. This was a target because of the large population at the
location at any time. Conducting an operation at the location means that they will affect a large group of people. After all, this was the intention of the terrorists when they attacked the premises. Their goals were achieved as this was one of the worst terrorist activities ever witnessed in Kenya. Therefore, an investigation was conducted to evaluate the response time of the security forces. It was concluded that security agencies needed improvement to their response time because they appeared to be too slow while responding to emergencies (Xie & Lauritsen, 2012). The victims should have a means of communicating their experiences to the relevant authorities within the shortest time possible. Currently, there is no known mobile-based technology that can be used to fight crime in the city of Nairobi. The level of mobile phone penetration in the city is relatively high. This indicates that a large percentage of the population within the city have and use mobile phones. Additionally, a large percentage of the people with mobile phones have smartphones. For this reason, it is very viable to use a mobile-based application to report criminal activities in the country. This will make the service available in other parts of the country as well. All this information will be relayed in real-time. This is made possible because of the internet.

When the police respond in good time, there will be increased chances of apprehending the culprits. The general idea is to reduce the time criminals have to escape and cover their tracks. Security agencies should respond to the crime scene within the shortest time possible to increase their chances of restoring peace in the region. Additionally, the citizens will gain confidence in the police and trust that they can to protect them against such incidences (Dudziak, 2006). Installing confidence in the region is of great significance since it ensures that citizens gain confidence in their government. The use of the mobile-based application will shorten the time spent by the victims in reporting criminal activities that they experience. Once the police receive the notifications, they should respond to the crime scene as fast as possible. Currently, technology is lacking in the society that can be used to report a crime to the police officers that can allow them to respond to the scene of the crime immediately.

Some of the benefits associated with the use of technology in fighting crime in the city includes (Schwartz & Randall 2003):

- Installation of confidence in the public domain
- Prompt response to reported criminal incidences
• Increasing the level of security in the city
• Discouraging criminal gangs from carrying out their malicious activities
• Making the city an attractive place for people to invest and live

2.5 Experiences Encountered when Reporting a Crime to the Police
Currently, the crime is majorly reported in person by walking into a police station. A member of the public walks into the police station to record a statement. The items that were reported through this manner were the loss of personal items such as an identification card, and ATM cards, among others. This occupied a lot of time that could have been used by the victims to go about their businesses (Hafez, 2014). Moreover, the police officers have a reputation of being unfriendly. This discouraged most people from visiting a police station to record a statement. A lengthy process that discouraged people from visiting the premises characterized visiting the police station. Upon reporting the incidences at the police station, one would obtain an abstract form that will be stamped at the police station. However, other more valuable items will require a report to be submitted. The report will allow the relevant authorities to launch investigations to determine how they were lost and apprehend the culprits. This provides a lengthy process that often discourages the victims from seeking police intervention. Some victims are afraid of being discriminated against based on the experiences they have gone through. For example, a victim who has been raped will find it difficult to repeat the ordeal to the police station. This is because they fear being discriminated against for their experience (Klopp & Sang, 2011). Stigmatization is often very common within the city. However, the police force should be trained and taught to refrain from such acts of stigmatization or discrimination. This will provide a challenge for them to go and report the ordeal publicly at a police station. For this reason, such cases often go unreported. Therefore, the culprits often go free and may perform similar acts of other unsuspecting individuals. In such scenario, the use of mobile-based application in Nairobi to report crime will come in handy. The victims will be in a position to air their experiences anonymously to the relevant authorities. This way, these events will be reported and the appropriate action will be taken to ensure that justice is served to the victims. Additionally, it will discourage other people from performing this act to other victims (Daniel et al., 2011). After reporting an incident using the mobile application, the relevant security department will have the responsibility of following up with the request that has been submitted. This will improve the level of service delivery in the city by the
police officers. Additionally, they will have statistics of the crimes that are committed within the city. This information can then be used to map out the hot spots in the city and increase security surveillance in the region. This will guarantee that people are safe and free to go about their business activities. Reporting crimes should be made more efficient and effective. This will encourage people to interact with the police officers.

2.6 Unit Dispatch and Arrival at the Scene

2.6.1 Nature of the Initial Police Response

In the majority of cases where the police attend a volume crime scene, uniformed officers undertake initial attendance. Coupe et al. (2002) found that over 80 percent of 765 nonresidential burglaries examined were responded to by vehicle patrols; although in less urgent incidents foot patrols were frequently dispatched. A study by Coupe and Griffiths (1996) on residential burglaries revealed that, in most cases, the closest response vehicle unit staffed by uniformed officers attended the scene (with either local beat officers or detectives attending only occasionally as the first response). An HMIC (1991) inspection of 2,477 burglary dwellings in Cambridge shire indicated that typically uniformed officers first visited around 70 to 80 percent of scenes, with the balance attended by detectives or scenes of crime officers (SOCOs).

2.6.2 Response Time

A number of factors influences the time taken for officers to respond to incidents. These include the time taken for the incident to be reported; the grade allocated to the incident; the availability of officers and their distance from the scene. Coupe et al., (2002) found clear differences in the response times between the two emergency grades used in the force studied; cases graded as immediate were attended on average in 4.5 minutes, whereas the police took an average of 9.6 minutes to attend cases graded as requiring an early response. Burglaries that were reported ‘in progress’ were more likely to be graded as emergencies/immediate and hence were usually attended more quickly than others. Further analysis of the data indicated that the response times were dependent on both pre-travel times (which reflected what officers were doing at the time of dispatch) and travel times (duration taken to travel to the scene).

Newiss (2002) found big differences in the times taken to respond to robberies. Of all robberies, nearly one fifth had been attended to within a quarter of an hour, with over 40
percent of incidents attended within one hour. As with the non-residential burglaries examined by Coupe et al., (2002), the time taken to respond to robberies was dependent on the time lag between when the incident was occurring and it being reported. However, of those robberies reported in progress, or within five minutes of taking place (n=69), over half were attended within 15 minutes. Response times were, however, also affected by the availability of resources, regardless of the urgency and grading.

A study by Smith (2003) on personal robbery has also shed some light into reporting delays, although as the report focused on examining characteristics of personal robberies, no assessment of the effects of reporting delays was covered. Of the 1,721 cases examined, 62 percent were reported within an hour. However, nearly one-fifth (18%) were recorded between one and four hours after the offense, and a further 16 percent after eight hours or more. The author does point out that there may be many reasons for delays, such as the victim being in shock, under the influence of alcohol, or in some cases where mobiles were stolen, reporting the offense was only done for insurance purposes.

2.6.3 Response Times and Outcomes

The relationship between the likelihood of identifying an offender and response times has received considerable attention in the research literature. A study by Burrows (1986), which focused on burglaries in six policing areas examined factors that account for differences between high and low clear-up (including the effects in response times). Overall, no evidence was found to indicate that quicker response times were linked with higher detection rates. However, this study looked at the impact of response times on all burglaries rather than focusing only on burglaries reported in progress or reported soon after execution – the outcome of these cases would be more likely to be influenced by the speed of response. In addition, the sample of burglaries studied included offenses that had been detected through the case being taken into consideration – these cases would not have been affected by response times. The author acknowledges that aiming for quick response times may be a waste of resources unless the offense is reported immediately. It illustrates a central feature of the relationship between the ability of the police to detect and respond to crime, and the critical influence of the context of individual cases on this relationship.

A US study by Clawson and Chang (1977) examined the relationship between police response times and case outcomes/focused on arrests rather than detections. The research aimed to assess the effectiveness of police response regarding increasing the likelihood of
arrest. The study analyzed 2,532 cases from one force. Response times were measured by three variables: dispatch time, travel time and response time. Possibility of apprehending the culprits were significantly associated with both response and travel times, although not with dispatch times. The likelihood of apprehending the offender increased as the travel and response times decreased. This pattern was evident in burglaries, thefts, vehicle thefts and robberies. The study also included analysis using data from a previous research on the relationship between response times and arrests made during follow-up investigations. Although the results were mainly inconclusive, there was some indication that quick response times were also related to increases in the number of arrests from follow-up investigations. However, as the authors point out, although more arrests and shorter travel times are interconnected, the results prove that shorter travel times lead to more arrests. Higher likelihood of arrests was associated with shorter travel and response times. This in fact, reflect the tendency to assign quicker responses to cases where the possibility of an arrest is higher. Faster response times are related to emergency grading which in turn is connected to a prior assessment that, based on the call, detection will be achieved. Therefore, the variables are confounded and their relevance is hard to assess.

The Kansas City response time study (Bieck and Kessler, 1977) explored the effects of police response times by analyzing data related to 949 calls about crime. The study looked at how response times affect the likelihood of arresting at the place of incident. The availability of witnesses at the scene are linked to victim injuries (including the type of medical care needed) and, citizen satisfaction with the police. As only, the first two areas are of interest to the current study, the discussion will be limited to these. Three separate measures relating to the phases of police response time used in the analysis were: reporting, dispatch and travel time; 11 the sum of these measures amounted to the overall police response time.

The study categorized crimes into two discrete categories: those crimes where a citizen was involved in the occurrence of the crime, e.g., by witnessing the crime; and those where the crime was discovered sometime after it had occurred. These were labeled ‘involvement’ and ‘discovery’ crimes respectively. Some crime types, such as burglaries could be grouped as either involvement or discovery crimes depending on whether these were witnessed (involvement) or not (discovery). Unsurprisingly, the reporting times for involvement crimes were shorter than discovery crimes.
The study examined the effects of response times on the possibility of making on-scene arrests. The results showed that when looking at all cases, possibility of arresting at the scene was not related to response times. The possibility was, however, linked to call grading with more on-scene, arrests associated with cells that received the immediate grade. However, when the discovery and involvement crimes were analyzed separately, a slightly different picture emerged. On-scene, arrests were found to be rare in discovery crimes, and no relationship between response times and the likelihood of making an on-scene arrest. However, in cases of involvement crimes the speed of response was related to an increased chance of arresting the suspect at the scene. Of the three different elements of response times, reporting time (for example, between offense occurring and reporting to the police) had a huge impact on the likelihood of arresting at the scene in ‘involvement’ crimes. Furthermore, the relationship between the speed of response and the likelihood of arresting at the scene of an involvement, crime only applied to cases which were reported very soon after the offense occurred. The increase in the likelihood of arresting disappeared after only a few minutes’ delays in reporting the offense. The analysis did not take into account the victim-offender relationship, which may have affected the findings, as involvement crimes are likely to include a great proportion of crime where it is possible the victim will know the offender.

Travel times were also found to influence the likelihood of arresting in involvement crimes, in particular for ‘involvement’ burglaries, was to an extent dependent on the duration taken to report the crime. Reporting times had such a major impact that with delays of ten minutes or more in reporting the crime, there’s no relationship between the travel times and the likelihood of making an on-scene arrest. The authors also examined the extent to which response times were related to witness availability. The findings suggest there were considerably more witnesses available in ‘involvement’ crimes (in 49% of cases) than in discovery crimes (4%), however, there was no relationship between response times and witness availability for ‘discovery’ crimes. In involvement crimes, however, longer response times were associated with decreased chances of a witness (other than the victim) being available to contact at the scene. The length of reporting time mainly determined this relationship; delays in reporting the offense were associated with fewer chances of witnesses being available at the scene.
This study provides evidence of the importance of rapid response for certain types of incidents. The results showed that increases in the likelihood of arresting at the scene only applied to cases where:

- There had been some interaction between a member of the public and the offender (involving crimes);
- There had been a very small delays in reporting the offense, for example, offenses that were recorded within five minutes of their occurrence; and,
- There were differences between the types of involvement crimes speed – of response was most critical in producing response-related arrests in involvement burglaries, but the effects were less likely for robberies, as only eight of the 127 cases reported on progress was an arrest made.

The results of the Kansas City Response Time Analysis study had serious implications for the way that the police had traditionally responded to calls – by attending all of them quickly as possible in the hope of increasing the chances of making an on-scene arrest. The study was therefore replicated to assess the extent to which the results applied to other police departments and areas in the US. A research by Spelman and Brown (1981) gathered information from four cities in the US on 3,332 crimes: burglaries, robberies, aggravated assaults, motor vehicle thefts, and, in three cities, rapes (as in the original Kansas City study). Also, 4,095 interviews were carried out with victims, witnesses and bystanders. Following the methodology employed in the Kansas City research, the crimes were categorized into involvement and discovery crimes, and the overall police response times were analyzed by looking at the three stages: reporting times, dispatch times and travel times.

The results of the study supported those obtained in Kansas City. In only a small proportion (less than 5%) of reported crimes was an on-scene arrest made; moreover, three percent of the crime was an on-scene arrest made due to a rapid police response. The overall response times, and all the three components of the response times (reporting, dispatch and travel times), were longer for discovery crimes than involving crimes, indicating that the public took longer to report and the police took longer to send a unit and to travel to the scene in discovery crimes in comparison to involvement crimes. For both discovery and involvement crimes, in all areas, a huge proportion of the response times were accounted for by the time taken to report the crimes: reporting times accounted for between 39 and 59
percent for discovery crimes (average reporting time 10 to 10.5 minutes) and between 28 and 47 percent of involving crimes (average reporting time between four and five and a half minutes). The authors focused on examining the relationships between reporting times by the public and the possibility of making response-related arrests, because the data on police response times were not sufficiently accurate. Three groups of crimes were analyzed separately: discovery crimes, involving crimes reported in-progress and involvement crimes not reported while happening. Approximately 25 percent of the crimes were involved crimes, and of these 13 percent were reported in progress (just over half of involvement crimes were recorded within five minutes). The findings supported those from the Kansas City Study in that:

- There was no association between reporting times and the likelihood of making a response-related arrest for discovery crimes.
- The reporting times for involvement crimes were related to the likelihood of making a response-related arrest. However, this only applied to involvement crimes reported in progress or immediately after the crime had occurred. Response-related arrests for an involvement were very unlikely unless the crime was recorded while happening. Only seven percent of crimes reported between one and five minutes of occurring resulted in an arrest.
- Where the crime was reported five minutes or more after it had occurred, the chances of making a response-related arrest was the same as for those reported 60 minutes after they had occurred.

2.7 Challenges Associated with Crime Reporting in Kenya

There is a paucity of literature on crime reporting in Kenya. Few studies like (Ruteere and Pommerolle, 2003) observed that modern way of reporting crimes is through call centers which have disadvantages like:
A member of the public reporting a crime might make a call and end up not being attended to since the phone rings for a long time without anyone picking.

A caller might be put on hold for a long time making it possible for the criminals to get to him/her or even get away before the notice is given to the authorities.

Sometimes it might not be possible to make a call due to the nature of the danger a victim is in, for example, it could be the victim is among very dangerous robbers who are armed and any mistake like a call can cost a life.

Calling will require both parties to make a conversation, which might not be very secretive making it dangerous especially where notifying the authorities requires very secretive measures.

It does not leave a report in the system just in case a call was not picked but instead shows a missed call which can be easily assumed.

Network failures sometimes will hinder any successful call.

Reporting in person has several disadvantages too:

By the time the victim reaches the police station, the crime has already been committed especially where the nearby police station is a bit far.

- A victim will in most cases report after the crime is committed which imply that the person had to suffer first then seek justice. Therefore, this method is very reactive as opposed to proactive.

- This method of crime reporting is very slow because a lot of time is consumed to access the police station and give a statement.

- Witnesses might not dedicate their time to go to the police station and make a report probably because of fear, apathy, attending to personal matters or the nearby police station is very far.

- This way of reporting a crime rarely encourages reporter anonymity which is very important for the security of the member of the public who volunteered to bring the matter to the attention of the authorities (Sahle, 2012).

### 2.8 Proposed E-Security Platform Structure

Below is the proposed system platform/structure. The E-Security mobile application is installed on a mobile device which provides an interface where the user (citizens) can register their details and report crime remotely. The web server processes incoming
network requests over the HTTP protocol. It provides a communication link between the Android application and the database. It receives requests from the Android app, processes and returns the result. In this case, Apache-Tomcat-8.0.20-windows-x64 was used. Database Management System (DBMS) are tools used to manage the database and carry out performance tuning. It deals with the retrieval, storage, and updating of data. MySQL Server 5.6 is the database. The software for administration interface was MySQL Workbench and SQLYOG enterprise. The police crime management system provides an administrative interface where police officers monitor all the incoming crimes reported by the public members (Al-Mudimigh, Zairi & Al-Mashari, 2001).

Figure 2-1: Proposed E-Security Platform Structure

2.9 Tools Used in System Implementation

Android application developer was used because the developer can develop Android applications on any operating system whether he has windows OS, Linux or even iOS. Android applications is portable to mobile OS operating systems like Symbian, Ubuntu and, Blackberry. Along with this, Android applications can be easily ported to Chrome OS and so on. Android Studio is based on IntelliJ IDE which is fast and iterative IDE than other development tools. It is a super-fast and highly efficient integrated development environment designed for Android application development (Charland & Leroux, 2011).

MySQL was used as the database because it is easier to learn compared to other databases. You don't have to spend as much time and money either training existing staff/ hiring developers with fancy certifications. It is also ubiquitous, for example, it’s an open source
software which is popular and can easily be found everywhere (Roth, 2006).

**Java programming language:** Java programming language is platform-independent, for example, its ability to move from one computer system to another. The ability to run the same program on many different systems is crucial to World Wide Web software, and Java succeeds at this by being platform-independent at both the source and binary levels (Horstmann & Cornell, 2002). It's easy to learn and also object-oriented (allows you to create modular programs and reusable codes)

**Apache Tomcat:** This was used as a server because it’s incredibly lightweight. It offers only the most basic functionality necessary to run a server, meaning it provides relatively quick load and redeploy times compared to many of its peers. Also being an Open source software, it’s free, and the source code for the server is readily available to anyone who’d care to download. Tomcat is an extremely stable platform to build on – and using it to run your applications will contribute to your server’s stability, as well (Brittain & Darwin 2007).

**2.10 Chapter Summary**
The chapter covered the literature on issues affecting and determining crime reporting and intelligence gathering with the emphasis on how they assist in providing security solutions. Global context and problems of crime reporting and solution in cases of major cities like New York, London and Paris have been discussed in depth. The Kenyan topic and issues faced by the Kenya police and citizens in reporting and solving crimes are also discussed. The literature has sections on security force response to crime reports, experiences of the general public when reporting the crime within the city and their challenges. Finally, the proposed system structure and the tools used in the implementation of the E-security system discussed.
Chapter 3: Methodology

3.1 Introduction
This chapter dealt with the research methodology that was used in carrying out the study. This included the research design, population and sampling design, and sample size, data collection method, research procedures, implementation approach, data analysis, and chapter summary. The study focused on the police stations within Buruburu Police Division in Nairobi County, Kenya; Dandora, Buruburu, Jogoo and Shaurimoyo police stations. This is one of the largest police divisions in the capital city. It is characterized by the highest reported, attempted and unreported crime cases. Therefore, it presented a justifiable study area for the study.

3.2 Research Design
According to Kothari (2004), research design functions as the research blueprint for measurement and analysis of data. A survey design as described by Mugenda & Mugenda (2008) is an attempt to collect data from members of a population to determine the status of that population on one or more variables. The study has adopted a descriptive survey research. According to Cooper and Schindler, 2003, a descriptive study design is concerned with finding out the what, where and how of a phenomenon.

3.2.1 Design Science
The research applied the design science in information systems research (Osterle et al, 2011). The research design is anchored in approaches that link behavior as a paradigm that can justify theories with the ultimate objective of developing technologies and artifacts of predicting human behaviors hence solving underlying problems. These associations form the foundation of Information systems and has been applied in this study research (Von Alan et al, 2004). Osterle et al (2011) further explains that such design of Information system has significance to populations and business sector. The seven principles of design science have been included in this research and an explanation on how they relate to this particular study as indicated in Table 3-1.
<table>
<thead>
<tr>
<th>RESEARCH DESIGN PRINCIPLE</th>
<th>HOW APPLIED IN THE STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design as an Artifact:</strong> Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.</td>
<td>In this study, an application that would help in crime reporting and intelligence collection was developed and tested by both the public and police.</td>
</tr>
<tr>
<td><strong>Problem Relevance:</strong> Design science focuses on developing technology-based solutions and relevant business challenges as one of its objectives.</td>
<td>The problem of this research was clearly stated under the justification of study; Traditional crime reporting can be tedious and discouraging for many people. Developing a supportive mobile application will ensure that individuals report crimes remotely from their mobile phones. The technology will help to improve the security sector by offering solutions to the challenges currently experienced by both police and the public.</td>
</tr>
<tr>
<td><strong>Design Evaluation:</strong> The utility, quality, and efficacy of a design artifact must be demonstrated via well-executed evaluation methods.</td>
<td>The application was evaluated by surveying some selected police officers and few members of the public and testing it on the planned models of hosting it on local computers. The findings of this evaluation report were used to address the third objective of the study which was to “To evaluate the usability of the proposed mobile application.”</td>
</tr>
<tr>
<td><strong>Research Contribution:</strong> Effective design-science research must provide understandable and verifiable contributions in the areas of the design artifact, design foundations, and design methodologies.</td>
<td>The literature review part of this study covers research done by different authors about crime reporting process in different parts of the world. Finally, it settles on challenges associated with crime reporting methods used in Kenya.</td>
</tr>
<tr>
<td><strong>Research Vigor:</strong> Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.</td>
<td>In this study, the research gap was realized after considering all the available means of crime reporting in Kenya. The literature review was done and finally, technology-based application was developed to achieve the research objective.</td>
</tr>
</tbody>
</table>
Criteria-based evaluation method was used to evaluate the system. Criteria-based evaluation means the evaluation is done according to predefined checklists, heuristics, or principles. Therefore, it determines the types of outcomes that can be acquired (Cronholm 2003). A checklist of test cases was carried out to ascertain that the system met the requirements set. For example, user sign in, reporting crime successfully, checking the reported crimes and the investigative officer assigned to them, reporting lost items, attaching crime evidence, etc. These were the functional checklist on which the evaluation was based on for the mobile application. Furthermore, for the administrative side of the designed system (for police officers) has a functional checklist against which the evaluation was done. For instance, view the crime reported, search reported crime based on date or any other attribute, locate on google map the location of the device at the time the crime was recorded, add configuration items such as a new police stations, police titles into the system to allows for system scalability, amongst others.

Conclusively, the criteria to evaluate the system were defined specifically to check if the system development achieves the objectives of the study. The checklist highlighted was in reference to the set objectives and functional requirements. A pass on each evaluation checklist item implies that system was built in accordance to the set objectives, functional and non-functional requirements and principles of the organization.

### 3.3 Population and Sampling Design

#### 3.3.1 Population

The respondents from the public were selected randomly using the snowball approach. One respondent was asked to identify another respondent who can assist in providing the relevant information to help the research exercise (Atieno, 2007). The respondents from
the police station were selected using a fixed selection process. One respondent was selected from, each available department. This provided an even response process to the researcher. Randomly chosen members of the public within the study area together with police officers were chosen to test the developed application.

### 3.3.2 Sample Design and Sample Size

The sample size is an important feature of any research study in which the goal is to make inferences about a population from a sample. Mugenda and Mugenda (2003) recommended sample sizes of must be representative of the study population. The sample size was determined using the formula developed by (Chow et al., 2007). Sample size \( n \); 

\[
n = \left( \frac{\frac{Z_{\alpha/2} \sigma}{E}}{2} \right)^2
\]

Where: The \( Z_{\alpha/2} \) is the critical value. The positive \( z \) value is the vertical boundary of the area of \( \alpha/2 \) in the right tail of the standard normal distribution, \( \sigma \) is the population standard deviation and \( n \) the sample size. Fixing the margin of error as 1.32 and the estimated population variance from the sample household as 6.95 then the sample size is given by;

\[
n = \left( \frac{1.96 \times 6.95}{1.32} \right)^2 = 106.49
\]

**Approximately 100**

This is then approximated to 100 members of the public who were sampled. Four representative subsample per station formed part of the selected population hence twenty-five members of the public served by a single police station were sampled.

A convenience sampling was done on police officers selected from all the four police stations, the sample size divided into three strata; all four (there is only one for every station) officers commanding four police station (OCS), two sergeants per station and four constables from each police station included totaling to 28 police officers. Gender balance was considered in each station and, equal numbers of male and female officers were considered in sampling and inclusion into the study.

The following figure shows the number of police officers interviewed
Table 3-2: Number of Police Officers Interviewed

<table>
<thead>
<tr>
<th>Category</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCS</td>
<td>4</td>
</tr>
<tr>
<td>Sergeants</td>
<td>8</td>
</tr>
<tr>
<td>Constables</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
</tr>
</tbody>
</table>

3.4. Data Collection Methods

Data collection methods presents the researchers with various optional techniques that can be used to obtain relevant data that fits and can be used or applied their area of study. Cooper & Schindler (2003) noted that data collection methods entails the gathering of facts from the environment of study, and presenting it to the researcher. The study used primary data which was collected from respondents, who interacted with the system, using both open and closed-ended questionnaires. The questionnaire had clear instructions for the respondents. The answers to the open-ended questions were to be provided by the respondents. Babbie (2008) observed that a greater uniformity of responses was provided by employing the use of open-ended questions, which were easier to process in comparison to the closed-ended questions. A five-point Likert scale and ranking was used regarding the closed-ended questions. The ranking used ranged from excellent to unacceptable. The questionnaire was developed by the researcher drawn from the objectives. The questionnaire was divided into two sections two sections, the police and public questionnaire. The confidentiality while the respondents were filling the questionnaire was observed. The questionnaires were divided into two sections, section A contained questions concerning the respondent’s and general information while Section B contained questions regarding crime reporting process and experiences of police officers police officers while handling the reported crimes. Both sections had questions with a direct significance for statistical analysis regarding the area of study.

3.5 Data Analysis Methods

Data was analyzed at 95% confidence interval in SPSS version 20. All the data underwent descriptive statistics analysis (mean and standard deviation). Analysis of the qualitative data involved content analysis where the views, ideas, feelings and opinions were
evaluated. In this case, the key ideas and themes for each variable were generated and further used in data analysis and interpretation.

The analyzed data was presented in a manner displaying all available comparisons obtained in the study. Graphs and tables were used to present the information in a way that is easy to understand. The data presentation was used to show other areas that require further study and analysis.

3.6 Research Procedures

The questionnaire was prepared and administered to ensure its objectivity and clarity. It had clear instructions and was pre-tested through pilot study to test the research data collection tool and determine if it is feasible for the final data collection on objective one of the proposal. Fifteen selected respondents were given the questionnaire to ensure that the data collected from the study was reliable. This was to test the objective “To identify current methods and challenges associated with crime reporting within Nairobi area.”

The pilot study was proper and technically efficient approach of testing. The questionnaire underwent a rigorous testing and shortfalls for information collection, question comprehension and post data collection, analysis have been corrected based on the field data collections findings. Therefore, the data collection tool, the kind of data collected and training data obtained by collectors when testing this tool contributed to quality output. Factoring the lessons learnt from this field work and reported results, the tool was able to provide statistically reliable and applicable data sets. The final questionnaires were distributed to respondents physically at the police station and to the public members at different locations within Buruburu police division. The researcher took the questionnaires to the respondents in person, hence it was easy to seek any clarifications and immediate responses were given. The confidentiality of the respondents was also guaranteed, and an emphasis of the relevance of the research study was also explained to them. Finally, the user ability questionnaire was developed by the researcher and administered to test if the system meets the requirements of the users and to test the third objective of the research, which was to “To evaluate the usability of the proposed mobile application” The response rate was improved by enabling respondents to interact with the system directly and demonstrating its functionality, hence enhancing their interest in experiencing how it works, and anticipation of the expected outcome.
3.7 Tools Used in Design Development and Implementation of the System

Below is the description of various categories of tools that were used in the development, design and implementation of the E-Security crime reporting system, they include:

- CASE tools
- Compilers, interpreters and runtimes
- Visual editors
- IDE (Integrated Development Environment)
- Web servers
- DBMS (Database Management System)
- Testing tools
- Installation tools

**CASE tools:** CASE tools (Computer Aided Software Engineering) are tools that support Unified Modelling Language (UML). To implement E-Security, Visual Paradigm tool was used to design the UML diagrams such as use case, ERD, flowchart and sequence diagram. This tool was selected because it is user-friendly and readily available as a trial version.

**Compilers, interpreters and, runtimes:** Different programming languages require different tools. E-Security was developed using Java language which requires Javac compiler and Java interpreter to run the program, it necessitated the installation of Java Development Kit (JDK) which is a combination of both Javac compiler and Java runtime environment (interpreter).

**Visual editors:** These tools provide a way of designing graphical user interfaces by dragging and dropping text fields, buttons, labels, etc., into a window. The administration window of E-Security was developed on JavaFX. The graphical user interface was designed by JavaFX Scene Builder 2.0.

**IDE (Integrated Development Environment):** These tools help manage many files in the project and dependencies. They use compilers to build the project and recompile what has changed and also provide debugging facilities. May also include visual editors. In this project, a couple of them were used, all using java compilers. They include NetBeans, Spring Tool Suit, and, Android Studio.
Web server: Web server is software that processes incoming network requests over the HTTP protocol. Web server was used to provide a communication link between the Android application and the database. It receives requests from the Android app, processes and returns the result. Apache-Tomcat-8.0.20-windows-x64 used in this case.

DBMS (Database Management System): These are tools to manage the database and carry out performance tuning. They are client software (administration interfaces, ODBC and JDBC drivers). MySQL Server 5.6 has been used as the database, the software for administration interface was MySQL Workbench and SQLYOG enterprise.

There are also tools that have been used globally in system/application design, development and implementation. Examples include the following:

Component manager tools: They are used to manage the parts and provide mechanisms to add, search, browse, and, maintain versions of the components.

Installation tools: These tools automate the extraction of files from an archive and the setting up of configuration files and registry entries. They also help in the generation of installation package the project. Installation package for E-Security is generated by Inno Setup Script tool (Al-Mudimigh, Zairi & Al-Mashari, 2001).

3.8 Ethical Considerations
Ethical consideration in research are actions taken to ensure safety and privacy of the participants are not violated whatsoever (Resnik, 2005). These standards include voluntary participation, informed consent, and confidentiality of information, the anonymity of research participants and approval for the study from relevant authorities. The researcher obtained a permit and research authorization letter from the National Council for Science and Technology in the Ministry of Higher Education, Science and Technology. Secondly, the researcher obtained a permit approving the study of the research instrument together with the Transmittal Letter from the University and seek permission from the Sub-County Director of Education, area Education Officer and the administration of police stations. In this regard, no respondents were forced to participate in the study unwillingly, and no individual’s right infringed in the process of data collection. Further, complete anonymity of the respondents in the study ensured.
3.9 Chapter Summary
The study was carried out in all the four police stations within Buruburu police division. The study adopted a descriptive survey design to collect the necessary data to accomplish project requirements. The samples were gathered using a snowballing design and they included; the public, OCS, sergeants, and constables. Data analyzed in SPSS to deliver inferential statistics and extrapolate on broader community. All these information and data collection part of the research were done after obtaining research permit from the University.
Chapter 4: System Implementation

4.1. Introduction
The section answers the main objective of the study “to develop a mobile-based crime reporting system that will facilitate solving of criminal incidences timeously” It underscores the aspect aiming to reduce the time taken to report a crime. Therefore, cell phone security reporting system (E-Security) designed, developed, and implemented using Microsoft Technologies (Bernstein & Bergstraesser, 1999). The system design and development of E-Security System involved various steps discussed in detail in this chapter. These steps include carrying out of system feasibility studies, requirements engineering, system analysis and design, system development and implementation, and eventually a system deployed on the Microsoft Azure Cloud Services.

4.2 Analysis
In system development, the analysis is always conducted to understand what system will do, who will use the system, where it will be used, and the requirements (Denis Alan, 2014)

4.2.1 Proposed System Specification
The following are the system specifications of the E-Security system;

<table>
<thead>
<tr>
<th>Table 4-1. Hardware Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
</tr>
<tr>
<td>RAM</td>
</tr>
<tr>
<td>Hard Disk</td>
</tr>
<tr>
<td>Monitor</td>
</tr>
<tr>
<td>Peripherals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4-2. Software Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating System</td>
</tr>
<tr>
<td>Language</td>
</tr>
<tr>
<td>Database</td>
</tr>
<tr>
<td>Browser</td>
</tr>
<tr>
<td>IDE</td>
</tr>
</tbody>
</table>
Justifications of systems specifications

The IDE tools for development purposes require enough memory, for instance, spring tool suite alone starts with a minimum memory of 1024MB of heap space. Typically, STS/Eclipse will use a significant amount of memory on startup as things get initialized, but this memory usage will level off and decrease over time. Same applies for NetBeans. On the other hand, Apache Tomcat server consumes memory depending on traffic (how many connections it receives may per second or minute). The default is to allow around 255 connections per second. In normal operations with average connections, around 2GB to 4GB of RAM will be needed.

Android Studio also consumes RAM up to 1.5GB. MYSQL Server also consumes memory depending on connections; it also consumes much space on the hard disk since this is where the database is and the database size grows every one hour, therefore, memory size of 500GB is advisable. Since in the Android application, users can attach photos, audio, video, etc., these files are all direct to a memory location in this computer by Apache Tomcat server, for a few users, and the test, 500GB hard drive serve this purpose as well. However, for a full-blown production process by users in a county, a district on a location, this hard disk can get full within a short period.

The recommended processor speed is corei5/i7 because of the heavy applications likes STS/Eclipse, Android Studio, NetBeans IDE needed for development. Apache also relies on this speed, otherwise processing requests with files from the Android application might take time. Tomcat receives requests in the form of Bytes which it converts into a file while preserving the file extension then saves in a specified memory in the system. In summary, running all those applications on one machine at once requires a powerful processor to reduce the lags.

Windows 7/8 is the best; some of the applications might struggle in lower versions of windows. The browsers are important when testing the java services running on Apache Tomcat server. Mouse and keyboard will be necessary for typing and navigating the PC or laptop in use for development or production purposes.

4.2.2 System Services

This section outlines the various functional and non-functional requirements of the E-Security software system. These requirements were informed by literature review (secondary data) and the survey (primary source).
(a) Functional Requirements
These are requirements that capture specific behavior of the system under development. These define various things like data processing and manipulation, system calculations and interaction with application and other functionality that show how user requirements are satisfied. The following table shows functional requirements related to reporter’s activity.

Table 4-3: Functional Requirements as per Reporter

<table>
<thead>
<tr>
<th>Functional requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log in</td>
<td>The system requires all users to log in before accessing any system functionality. The system provides a Graphical user interface with fields for username and password.</td>
</tr>
<tr>
<td>Sign up</td>
<td>The system allows a new user to register and set their username and password. This is allowed by register user functionality.</td>
</tr>
<tr>
<td>Report Crime</td>
<td>The system allows civilians to report a crime happening around them. They are also able to attach any evidence in the form of file such as an image, audio, video or document. This capability is provided by report crime functionality.</td>
</tr>
<tr>
<td>View Reported Crime</td>
<td>The system allows civilians to see all the crimes they have reported so far. The users can track the changing status of the reports as updated by the investigating officer working on the incidence. The users will also are also to know the investigating officer working on their cases.</td>
</tr>
<tr>
<td>Report lost item</td>
<td>The system allows civilians to report any lost property remotely.</td>
</tr>
</tbody>
</table>

The following table shows functional requirements related to a police officer’s activity.

Table 4-4: Functional Requirements as per the Police

<table>
<thead>
<tr>
<th>Functional Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log in</td>
<td>The system requires all users to log in before accessing any system functionality. The system provides a graphical user interface with fields for username and password.</td>
</tr>
<tr>
<td>Functional Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Sign up</td>
<td>The system allows registration of a new officers by the administrators. It’s the responsibility of the system administrators to register officers who are entitled to use the system.</td>
</tr>
<tr>
<td>Searching Incidence/crime</td>
<td>The system allows an officer to search for a crime based on selected attribute out of the possible first nine attributes of the case. By just typing on the search text field, the system will be filtering instantly. The instant search does not retrieve messages from the database but searches from the cached table data.</td>
</tr>
<tr>
<td>Assign crime/Incidence</td>
<td>The system allows the system administrator to assign a crime to an investigative officer who will be working on the reported case.</td>
</tr>
<tr>
<td>Update Crime Status</td>
<td>The system allows only the investigative officer assigned the crime to make progress update on the case from time to time as he/she works on it. The investigative police officer can also attach any new file related to the case at this point.</td>
</tr>
<tr>
<td>Check details of reporter</td>
<td>The system allows the officers to check the details of the reporter by righting clicking the reported crime.</td>
</tr>
<tr>
<td>See the list of reporters</td>
<td>The application enables retrieval of all reporters registered in the system.</td>
</tr>
<tr>
<td>Searching reporters</td>
<td>The system allows searching of reporters based on any attribute. Just by typing in the search field, the system filters instantly.</td>
</tr>
<tr>
<td>See the list of police officers</td>
<td>The system enables retrieval of the names of all police officers registered as the users of the application.</td>
</tr>
<tr>
<td>Searching for police officers</td>
<td>The system allows searching of police officers based on any attribute. Just by typing in the search field, the system filters instantly.</td>
</tr>
<tr>
<td>Adding system configurations</td>
<td>The system allows for adding a new polices stations, police titles, and crime status. These configurations will also be visible from the Android application used by civilians.</td>
</tr>
</tbody>
</table>
| Print                  | The system allows printing of:  
  - List of reporters  
  - List of police users  
  - List of police attachments. |
(b) Non-Functional Requirements

These are requirements that define system characteristics or attributes. They describe how a system should behave and what limits are there on its functionality.

The following table shows non-functional requirements of E-Security.

Table 4-5: Non-Functional Requirements

<table>
<thead>
<tr>
<th>Non-Functional Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security</td>
<td>The system ensures the security of its user’s credentials. The system has several security features to protect user’s credentials at various levels such as: Database Level: The database is password protected. Passwords are encrypted. Application Level: Every user has credentials only known to them. To access the system, the users must log in. Changes done to a reported crime are stored for tracking due to sensitivity of the case, and they must be known. Deployment Level: The system runs on Java platform which is very secure.</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response time concerning user requests should be within 1 to 3 seconds.</td>
</tr>
<tr>
<td>Throughput</td>
<td>The system allows many users to access it concurrently.</td>
</tr>
<tr>
<td>Reliability</td>
<td>The system is 99% operational.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>The system present accurate data to the users to maintain its credibility and that of the users as well.</td>
</tr>
<tr>
<td>Access Reliability</td>
<td>The system is accessible 99% of the time.</td>
</tr>
<tr>
<td>Availability</td>
<td>The system is available to users 24 hours every day.</td>
</tr>
<tr>
<td>Portability</td>
<td>The system supports various platforms available.</td>
</tr>
<tr>
<td>Usability</td>
<td>The system is usable in various ways including user-friendly interface, help, and navigation links, easy to use with minimal training.</td>
</tr>
<tr>
<td>Friendliness</td>
<td>The system is very friendly with attractive user interface.</td>
</tr>
<tr>
<td>Scalability</td>
<td>The system has been developed in such a way to allows expansion in the future to handle more users and functionality.</td>
</tr>
</tbody>
</table>
4.3. System Architecture

Architectural models describe the structure of a software system, and they are the output of any architectural design process. These models consist of sets of various components of the system that communicate together and they are the direct links to the system’s requirements (Scheer & Nüttgens, 2000). The software can be architecture at two abstraction levels of architecture in the large and architecture in the small. Software architecture in the large involves architecting complex systems, while software architecture in the small concerns architecting individual programs, where more emphasis is put on the composition of a single program (Sommerville, 2009). Separation of concern and independence are major factors to be considered when architecting a software application to enable any changes to be localized.

Following are the layers of E-security as seen by the reporter of the case.

a) E-Security Android Presentation Layer

It is the client side of the application for the civilians or victims of a crime who want to report this to the police. The layer presents a graphical user interface for log in or registration of a new user, reporting a case, tracking the progress of crime reported and also reporting lost items. This layer is implemented using Android development and can run on all phones running on Android platform.

b) E-Security Application Layer

This layer carries the methods which receive data from the application layer, packages it and sends to the Domain layer. It also receives data from the domain layer, repackages it from the JSON object for presentation to the user. This is implemented by Java controllers within Android.

c) E-Security Domain Layer

This is where the REST services are. These services receive POST or GET requests from the application layer which are then unpackaged, processed in connection with the database and JSON object result sent back to the application layer. The process is supported by Dynamic Java web application.

d) Database Layer

This layer entails the database which is the central repository of the system where data is stored. MySQL server is the host.
Figure 4-1: E-Security Layers as Seen by the Person Reporting Crime

Following are the layers of E-security as seen by the investigative police officer.

a) **E-Security Android Presentation Layer**
   It is the client side of the application for the police investigative officers. It provides a graphical user interface where the officers can see the cases reported, registered reporters, update status of the cases as investigation continues. In summary, it’s a GUI where officers manipulate data on reported crimes. It is executed by JavaFX Scene Builder tool to design the Graphical user interface.

b) **E-Security Application Layer**
   This comprises of the controllers which organize data from the presentation layer in form of java objects which they pass to Models.

c) **E-Security Model Layer**
   Model layer consist of the models which receive data objects from the controllers and manipulate it using methods that may also connect to the database and return the required result. It mainly carries the java methods for data manipulation or implementation of business logic.
d) **Database Layer**: Consist of the database which is the central repository of the system where data is stored. MySQL server is the host.

![Diagram showing layers of E-Security System](image)

**Figure 4-2: E-Security Layers as Seen by the Investigation Police Officer**

**E-Security Data Model**

It is the logical inter-relationships and data flow between different data elements involved in the information system. They facilitate technical, business and communication development by accurately representing the requirements and designing responses needed for these requirements.

The following diagram shows data model for E-security system. It shows the logical inter-relationships and data flow between different data elements involved.
This model describes the components hardware and software that will be deployed into the target environment. It shows items such as hardware platforms, network connectivity, and software components.

The following diagram shows physical model for E-security system.
4.3 Interaction Models

Interaction model is a design model that binds an application together in a way that supports the conceptual models of its target users. The models include use case diagram, sequence diagram, flowchart diagram, among the rest.

4.4.1 E-Security Use Case Diagrams

Use case diagram summarizes the details of a system’s users (also called actors) and their interactions with the system.

The following diagram shows the use case diagram for E-Security for persons reporting the crime.

Figure 4-4: E-Security Physical Model
The following diagram shows the use case diagram for E-Security for crime-investigating officers. It shows what an investigations officer can be able to do on the system after registration. These include locating reporter’s position during crime reporting, updating crime status, searching of crimes reported, viewing of registered reporters, among the rest.
4.4.2 E-Security Flowchart Diagrams

Flowchart visually represents sequence of steps and decisions needed to perform a process. Each step is not within a diagram shape which is then linked by connecting lines and directional arrows.

The following diagram shows flowchart diagrams of E-Security for crime reporter.
The following diagram shows flowchart diagrams of E-Security for police officers handling the reported crimes.

Figure 4-7: Flowchart Diagram for a Person Reporting Crime
Figure 4-8: Flowchart Diagram for Police Officers Dealing with Reported Crimes
4.4.3 Structural Model Diagram

The diagram below shows the relationship between the database tables using primary and foreign key. The relationship type is one to many (1: n). The arrows begin with # symbol to represent 1 and ends with symbol to represent the many side. There are three diagrams on this, the first is at higher zoom level therefore not very readable, the second and third are at lower zoom level, whereby they represent the upper half and the lower half respectively.

The following figure shows structural Model diagram of E-Security system.
Figure 4-9: Structural Model Diagram
Closer view of structural model is as shown below:
4.4.4 Sequence Diagrams

Sequence diagram describe interactions among classes in terms of an exchange of messages over time.

The following figure shows sequence diagram for a user reporting a crime.

---

**Figure 4-10: Sequence Diagram of Civilian User Reporting a Crime**

The following figure shows sequence diagram for a police officer working on a reported crime.
Figure 4-11: Sequence Diagram of Police Officers Working at the Administrator Side

4.4.5 Database Design

Crimes reported by users/civilians from the mobile app are stored in the CRIME table. One of the most important functionality is GPS coordinates (for example, latitude, longitude) which are taken by the mobile application to represent the exact location where the mobile was used to report the crime at specified data and time. This can be compared to data given in crime location, and reporter current location so that officers sent to the field are not misled or lost due to users not knowing well where they are.

The following screenshot shows a table that stores data for crimes reported.
Crime History Table

This is a table for tracking any modifications done on the crime that was reported. Only system administrators and investigative officers assigned to the case can update or attach any file about it. So this table carries the ID of the crime, status, user who updated the crime and the exact date and time when this happened.

The following screenshot shows the structure of the crime history table.

Figure 4-13: Crime History Table
Crime Police Documents
This table has only 2 columns. The crime id and the document attached to it by the police officer to support the case. Could be new evidence found after visiting the crime scene. The path is important when opening the file from the application.

The following screenshot shows the structure of crime_police_documents table. The attached document is copied from any location such as flash disk and pasted in the system folder after which that new path is saved on this table.

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Data Type</th>
<th>Length</th>
<th>Default</th>
<th>PK?</th>
<th>Not Null?</th>
<th>Unsigned?</th>
</tr>
</thead>
<tbody>
<tr>
<td>crime_id</td>
<td>int</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>file_path</td>
<td>varchar</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4-14: Crime Police Documents

Crime Status
This table carries the crime statuses. Such as:

- No Leads Found
- No Action Yet
- Investigation Begun
- Incident Closed
- Case in Court
- case Finished/Solved
• Culprits Arrested

The status is having codes which are unique in this table. This code is foreign key in CRIME table (column is state).

The following screenshot shows the structure of crime_status table.

![Crime Status](image)

**Figure 4-15: Crime Status**

**Police Stations**

This holds the list of police stations in a given area. This later appears as a drop down in the form to report a crime as the nearest police station.

The following screenshot shows the structure of police_station table. This table has a code which is primary key and foreign key in crime_table (column is police station). Any new police station added here will be reflected on the drop down on the mobile app.
The table is used to store all possible titles for police officers who will be registered in the system for example, OCS. The following screenshot shows the structure of police_title table. Any new title added is reflected on the drop down list available on the form for user registration. The code column is primary key. It is also referenced from POLICE_USERS table via a column called USER_PORIFLE.

**Figure 4-17: Police User**

The following screenshot shows the structure of police_user table. The table carries all police officers who are registered as users of the system to work on the cases.
Registration number is primary key in this table and foreign key in officer column in CRIME.

![Figure 4-18: Police User](image)

**Users**: The table holds the list of users/civilians who registered themselves before reporting a crime or with an aim of reporting crime in future using the mobile application. The ID number is primary key and referenced by CRIME table (column is user_id) as shown in the following screenshot.

![Figure 4-19: Users](image)
**User profiles:** This table holds the available profiles for officers working on the cases. Officers with administrator profile have full privileges in the system except updating status of crime ones he/she has assigned to investigative officer.

The following screenshot shows the structure of user_profiles table. Query user profile is basically for data retrieval. Just querying data from the system. Id column is primary in this table and foreign in POLICE_USER table (column name is user_profile).

![User Profiles Table](image)

**Figure 4-20: User Profiles**

### 4.5 Testing

#### 4.5.1 Test Data

Test data refers to data which has been specifically identified for use in tests, typically of a computer program.

**State Transition Test Data Set:** It is the testing technique that helps you to validate the state transition of the Application Under Test (AUT) by providing the system with the input conditions. Below are samples of test data that were used to test the E-security application.
Log In Data Set

This table carries the test data which is the values entered while trying to login to the system.

Table 4-6: Log in Data Set

<table>
<thead>
<tr>
<th>No.</th>
<th>Test Case Data</th>
<th>No Data</th>
<th>Valid Data</th>
<th>Invalid data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Log in Username</td>
<td></td>
<td>Paul</td>
<td>Pablo</td>
</tr>
<tr>
<td>2</td>
<td>Log in Password</td>
<td></td>
<td>Jasuba</td>
<td>@8839</td>
</tr>
</tbody>
</table>

State Transition Test Data Set

This table carries the result of each attempt made to login to the system while using the data provided in the login data set table.

Table 4-7: Log in State Transition Test Data Set

<table>
<thead>
<tr>
<th>LOG IN ATTEMPTS</th>
<th>VALID PASSWORD</th>
<th>INVALID PASSWORD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Attempt</td>
<td>Access</td>
<td>Denied</td>
</tr>
<tr>
<td>2nd Attempt</td>
<td>Access</td>
<td>Denied</td>
</tr>
<tr>
<td>3rd Attempt</td>
<td>Access</td>
<td>Denied</td>
</tr>
</tbody>
</table>

Crime Reporting Data Set

This table carries the test data which is the values entered while trying to report a crime via the system.

Table 4-8: Crime Reporting Data Set

<table>
<thead>
<tr>
<th>No.</th>
<th>Test Case Data</th>
<th>No Data</th>
<th>Valid Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fill crime description</td>
<td></td>
<td>Robbery</td>
</tr>
<tr>
<td>2</td>
<td>Fill crime location</td>
<td></td>
<td>Buruburu</td>
</tr>
<tr>
<td>3</td>
<td>Fill current location</td>
<td></td>
<td>Umoja</td>
</tr>
<tr>
<td>4</td>
<td>Fill nearest police station</td>
<td></td>
<td>Umoja Police station</td>
</tr>
<tr>
<td>5</td>
<td>Attach any evidence</td>
<td></td>
<td>Photo/audio/video</td>
</tr>
</tbody>
</table>

Crime reporting State Transition Test Data Set

This table carries the result of each attempt made to report a crime via the system while using the data provided in the Crime reporting data set table.
Table 4-9: Crime Reporting State Transition Test Data Set

<table>
<thead>
<tr>
<th>LOG IN ATTEMPTS</th>
<th>VALID PASSWORD</th>
<th>INVALID PASSWORD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Attempt</td>
<td>Submit successful</td>
<td>Submit failed (field 1,2,3,4 cannot be null)</td>
</tr>
<tr>
<td>2nd Attempt</td>
<td>Submit successful</td>
<td>Submit failed (field 1,2,3,4 cannot be null)</td>
</tr>
</tbody>
</table>

Registration of New System User by Police System Administrator

This table carries the test data which is the values entered while trying to register a police user into the system.

Table 4-10: Registration of New System User by Police System Administrator

<table>
<thead>
<tr>
<th>TEST DATA</th>
<th>Reg. no</th>
<th>First name</th>
<th>Last Name</th>
<th>Username</th>
<th>Station</th>
<th>User profile</th>
<th>password</th>
<th>Confirm password</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVALID DATA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VALID DATA</td>
<td>001</td>
<td>Paul</td>
<td>Jasuba</td>
<td>Subanese</td>
<td>Buruburu</td>
<td>Investigating officer</td>
<td>12345</td>
<td>12345</td>
</tr>
</tbody>
</table>

State Transition Test Data Set of User Registration

This table carries the result of each attempt made to register a user as police officer who will be able to login to the system and work on the crime reported.

Table 4-11: State Transition Test Data Set of User Registration

<table>
<thead>
<tr>
<th>Registration Attempts</th>
<th>With all details filled and matching passwords</th>
<th>With unfilled details and mismatched passwords</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Attempt</td>
<td>User registration successful</td>
<td>All fields are required/passwords do not match</td>
</tr>
<tr>
<td>2nd Attempt</td>
<td>User registration successful</td>
<td>All fields are required/passwords do not match</td>
</tr>
</tbody>
</table>

Assigning Crime to Investigating Officer

This table carries the test data which is the values entered while trying to assign a police user to a reported crime in the system.
Table 4-12: Assigning Crime to Investigating Officer

<table>
<thead>
<tr>
<th>Test data</th>
<th>No data</th>
<th>Valid data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrator</td>
<td></td>
<td>Crime ID</td>
</tr>
<tr>
<td>Investigations officer and query officer</td>
<td></td>
<td>Investigations officer ID</td>
</tr>
</tbody>
</table>

State Transition Test Data Set of Assigning Crime Investigation Officer

This table carries the result of each attempt made to assign a reported crime to a police officer who will be able to work on the crime reported.

Table 4-13: State Transition Test Data Set of Assigning Crime Investigation Officer

<table>
<thead>
<tr>
<th>No. of attempts</th>
<th>Administrator</th>
<th>Investigations officer</th>
<th>Query officer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Crime assigned to 050-Paul Jasuba</td>
<td>User profile is not allowed to do this assignment</td>
<td>User profile is not allowed to do this assignment</td>
</tr>
<tr>
<td>2nd attempt</td>
<td>Crime assigned to 050-Paul Jasuba</td>
<td>User profile is not allowed to do this assignment</td>
<td>User profile is not allowed to do this assignment</td>
</tr>
</tbody>
</table>

4.5.2 Test Case

Application test case involve the development of an input, action and evaluation of an anticipated result. The entire test case is developed with the aim of determining any defects that may be improved as a result. Therefore, based on the pilot tests, serious defects that may crash the application are identified and reorganized before application release into the market. The test case exercised all the key features of the application with an emphasis on evaluating all the steps at play in the application (Elbaum, Malishevsky & Rothermel 2001, Ali et al., 2010).

The following table shows test case done in the system ranging from test scenario, test case, pre-condition, steps of the test, test data, expected results and actual results for crime reporting.
### Table 4-15: Test Case on Reporter Side (on the Android Application)

<table>
<thead>
<tr>
<th>TEST CASE ID</th>
<th>TEST SCENERIO</th>
<th>TEST CASE PRE-CONDITION</th>
<th>TEST CASE TEST STEPS</th>
<th>TEST DATA</th>
<th>EXPECTED RESULT</th>
<th>POST CONDITION</th>
<th>ACTUAL RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC_LOG_IN_001</td>
<td>Verify the log in</td>
<td>Enter valid username and valid password</td>
<td>Need a valid system account to log in</td>
<td>1. Enter Username &lt;Valid username&gt;</td>
<td>Successful log in</td>
<td>System main page is shown</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Enter password &lt;Valid password&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Click login</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC_CRIME_001</td>
<td>Report Crime</td>
<td>Enter valid details of the crime. Picking coordinates automatically and also attaching any evidence</td>
<td>Setting phone location enabled. Mobile device should be near the window or free space to connect to satellite for coordinates</td>
<td>1. Click on report crime button 2. Enter the details of the crime. 3. Attach any evidence in any form either video, audio, image etc. 4. Click save button</td>
<td>Crime saved successfully</td>
<td></td>
<td>Success message is shown</td>
</tr>
<tr>
<td>TC_CRIME_002</td>
<td>Check crime report status/history</td>
<td>Be able to see the previous crimes reported as well as their statuses and the officer working on the crime</td>
<td>This has to be at least one crime reported before otherwise the list will be empty.</td>
<td>1. Click on the see crimes button 2. A list is displayed with crime status and the officer assigned to that task</td>
<td>List is displayed</td>
<td></td>
<td>The page of crimes reported before persist.</td>
</tr>
</tbody>
</table>
Report lost Item

Enter valid details of the lost items and save.

1. Click on report lost item button
2. Enter the details of the lost items.
3. Click save button

Lost items saved successfully
Success message is shown.

<table>
<thead>
<tr>
<th>TEST CASE ID</th>
<th>TEST SCENERIO</th>
<th>TEST CASE PRE-CONDITION</th>
<th>TEST STEPS</th>
<th>TEST DATA</th>
<th>EXPECTED RESULT</th>
<th>POST CONDITION</th>
<th>ACTUAL RESULT</th>
<th>STATUS (PASS/FAIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC_LOG_IN_001</td>
<td>Verify the log in</td>
<td>Enter valid username and valid password</td>
<td>1. Enter username system account to log in</td>
<td>&lt;Valid username&gt;</td>
<td>Successful log in System main page is shown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Enter password</td>
<td>&lt;Valid Password&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Click log in button</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC_CRIME_001</td>
<td>Checklist of reported crime</td>
<td>Find Crime menu and New incidences sub menu then click on this sub menu</td>
<td>1. Go to crime menu.</td>
<td></td>
<td>List of reported crimes is displayed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. click new incidences sub menu</td>
<td></td>
<td>List of crime is displayed in a table</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following table shows test case done in the system ranging from test scenario, test case, pre-condition, steps of the test, test data, expected results and actual results for crime management by police officers.

**Table 4-16: Test Case on Officer Side**
| TC_CRIME_002 | Update crime status/details | Edit details of the crime and save. | Need privilege to update crime. | 1. Right click the tables with crimes reported.  
2. Click Update crime status  
3. Enter the details to edit.  
4. Click update button | Successful saving | Success message box appears |
| TC_CRIME_003 | See crime update history | View previous transactions that have modified the crime record. | See crime history option should be visible on right click | 1. Right click the tables with crimes reported.  
2. Click see crime history | Records of update history is displayed successfully | Crime update history page appears as current page. |
| TC_CRIME_004 | Check Details of Reporter | Find the complete details for the person who reported the crime | Check details of reporter option should be visible on right click | 1. Right click the tables with crimes reported.  
2. Click on check reporter details | Record of reporter appears in a table format with all the details | Reporter details page persist. |
| TC_CRIME_005 | Locate location where crime was reported | Check where the mobile device was at the time a crime was reported. | Locate crime location option should be visible on right click | 1. Right click the tables with crimes reported.  
2. Click on locate crime location | Default browser opens google map with a pin at the location | Google map is shown at the browser. |
| TC_CRIME_006 | Assign crime to investigative officer | Assign new crime reported to investigative officer | Need to have administrator privilege | 1.Right click the tables with crimes reported.  
2. Click on Assign to investigative officer | Crime is assigned to the selected officer successfully | Message for success appears |
| TC_CRIME_007 | Search crime among list of crimes | Search crime from the table of crimes by typing value of any column | 1.Type the value of what is to be searched in the search text field | A list or record is filtered automatically depending on the search value | Remaining list after the filter is displayed in the table. The page persists |
| TC_CRIME_008 | Print | Print the list of crimes reported before or after the filter, list of evidence attached, list of reporters | 1.Click the print button available at the bottom of every window | Report is generated in form of pdf and opened automatically. | PDF reader with the document open persist. |
| TC_LOST_ITEM_001 | See the list of lost items | Find Crime menu and Lost Item sub menu then click on this sub menu | Submenu need to appear under crime menu | 1. Go to crime menu.  
2.click lost item sub menu | List of lost item incidences displayed | The lost item page persist. |
<table>
<thead>
<tr>
<th>TC_LOST_ITEM_002</th>
<th>Update details of lost item incidence</th>
<th>Update details of lost item incidence as investigation progresses. Attach any evidence along as well</th>
<th>Need to have administrator privilege</th>
<th>1. Right click the tables with incidences reported.</th>
<th>Successful saving</th>
<th>Message box showing success pops up.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2. Click Update incidence status</td>
<td></td>
<td>3. Enter the details to edit. &lt;enter valid information&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Click update button</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC_LOST_ITEM_003</td>
<td>See history of lost item incidence</td>
<td>See history of all updates that affected lost item incidence</td>
<td>See incidence history option should be visible on right click</td>
<td>1. Right click the tables with incidences reported. 2. Click see lost item history</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.5.3 Proof of Concept

This section illustrates the system user interface usage. In E-Security, users are divided into two categories: ordinary users (civilians reporting crime) and back end users (officers working on various crimes). The illustration of how the system works covers both the ordinary user and a police officer. The practical system functionalities are well elaborated by use of screenshots below. Each screenshot showing specific action on the system.

**Crime reporting by civilians/ victims**

The screenshot below shows the login page displayed on android phone to allow a user login before reporting a crime.

![Login Page](image)

**Figure 4-21: Log in Page**

The following screenshots shows a page that allows a new user to sign up. The page has validation rules as shown in the second portion below.
The following screenshot shows the main page displayed after user login. It has 3 possible actions.
Figure 4.23: Main Page

The following screenshot shows a page that allows users to report crime. User gives details of the incidence or crime happening around them and can attach file or evidence by a click of a button then submit it. Once submit button is hit, the record is sent to police database who will see and assign an investigative officer.

Figure 4.24: Reporting a Crime

The following screenshot shows the page that is displayed on the android phone if a user clicked “attaches a file” option from the main page. It goes to the phone memory where one browse to find the file they wish to attach.
Figure 4-25: Attaching Video File to the Crime Being Reported

The following screenshot shows a message box of coordinates picked in the background after submitting a crime by a user. The current location coordinates of the reporter are picked automatically after sending the reported crime as shown in the above figure. This is the location of the device as at when the crime is/was reported.

Figure 4-26: Reporting Location Coordinates

The following screenshot shows an android page with a list of previously reported crimes. A user is able to see the crimes they reported before. User may want to see crimes reported,
their statuses and the investigative officer assigned to it. This is possible as shown in the figure.

**Figure 4-27: See Reported Crime Details**

The following screenshot shows a page for reporting lost items. The page allows users to report giving details of the lost items. Crime investigation and actions by the investigating police officer.

**Figure 4-28: Reporting Lost Items**
Crime Management/Administration by Police Officers
The following screenshot shows the login page for police desktop application. Police officers are able to log in using their user names and passwords.

Figure 4-29: Police Officer Log In

The following figure shows the main page which is displayed after an officer logs in. It gives the police officers options to view registered reporters, incidents reported and also to add more configurations.
The following figure shows a page with a list of all reported crimes. Police officers are able to see the lists of all crimes reported, location of the reporter, crime ID, date reported, etc.
Figure 4-31: List of Reported Crimes as Seen By Officers

The following figure shows a page with a list of filtered crimes based on what the user types on the search text field. The search can be done on all the columns from status to the left. As typing is done on the search field, the system filters automatically from the cached data on the table making it faster.
The following screenshot shows a PDF generated after a print button was clicked for the crimes displayed in figure 33. It is an example of how the pdf looks after clicking the print button.

Figure 4-33: Printing List of Crimes on the Screen in Pdf

<table>
<thead>
<tr>
<th>Crime Code</th>
<th>Description</th>
<th>Crime Location</th>
<th>Reporter Location</th>
<th>Police Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>501</td>
<td>Jugg</td>
<td>Banduri</td>
<td>with</td>
<td>ke npf</td>
</tr>
<tr>
<td>502</td>
<td>Central Police</td>
<td>Njuag</td>
<td>their version</td>
<td>nil test</td>
</tr>
<tr>
<td>503</td>
<td>Shantou</td>
<td>high</td>
<td>gora</td>
<td>Ruanka</td>
</tr>
<tr>
<td>504</td>
<td>high</td>
<td>go</td>
<td>Central Police</td>
<td>bit</td>
</tr>
<tr>
<td>505</td>
<td>high</td>
<td>Banduni</td>
<td>ke</td>
<td>john</td>
</tr>
<tr>
<td>506</td>
<td>skin</td>
<td>high</td>
<td>nil</td>
<td>nil</td>
</tr>
<tr>
<td>507</td>
<td>high</td>
<td>high</td>
<td>nil</td>
<td>nil</td>
</tr>
<tr>
<td>508</td>
<td>skin</td>
<td>high</td>
<td>nil</td>
<td>nil</td>
</tr>
<tr>
<td>509</td>
<td>skin</td>
<td>high</td>
<td>nil</td>
<td>nil</td>
</tr>
</tbody>
</table>

Figure 4-32: Example of Filtering Based on Date
The figure below shows a screenshot with possible options when a crime is right clicked. It gives the police officer an options such as update crime status, see crime history and find any evidence attached.

Figure 4-34: Actions Possible on a Crime when Right Clicked

The following figure shows how to find any evidence that was attached alongside a crime while reporting by following crime ID number and the file path.
Figure 4-35: Finding Evidence on a Reported Crime

The following screenshot shows the path of the evidence as well as an option to open it directly from the system. If the evidence attached by the officer is found, the system allows for opening it directly by just right clicking and selecting open.

Figure 4-36: Checking Any Evidence Attached, Previously by Investigative Officer
The following screenshot shows a page where a police officer can update the status of a crime after investigations. They can also attach any more evidence they found to the crime. Only an officer assigned to the crime can update it. Crime id is read only because that is primary key and does not require any edition. Police station can be updated since the reporter might not have been sure of that. Status and any observation/ comment or recommendation and any file can be tagged along from time to time as the investigation continues.

![Figure 4-37: Updating Status of Crime by Investigative Officer](image)

The following figure shows crime history with records of all the previous transactions that changed its status as well as when and by whom. This is for tracking cases, for instance, who is changing which crime and why did that happen? This prevents any malicious or intentional update on the case that might jeopardize the investigation or seeking of justice.
The following screenshot shows how the details of a reporter for a specific crime can be seen. The figure below is a simple page that allows police officers to see reported details just by right clicking a particular case. There might be need to contact the victim or reporter for more information that might speed up the work of the police or for any other reason as dictated by the case.
Figure 4-39: Checking Details of Reporter of a Crime

The following screenshot shows how an officer can view the location of the user at the time the crime was reported. The system allows locating of the current location of the reporter when the crime is reported using the google maps. Locating reporter’s current location opens google map in a browser (either Mozilla, Google chrome or Internet explorer) and passes the latitude and longitude.

Figure 4-40: Locating of the Current Location of the Reporter on Google Maps

The following screenshot shows how police administrator can assign a reported crime to police officers in the system so that he/she can work on the crime. All the investigative
officers registered in the system will be appearing in the drop down except those with query user profile.

Figure 4-41: Assigning Crime to Investigative Officer

The following screenshot shows list of all reporters available in the system at the moment, their names, gender, ID number, phone numbers and the date they were added into the systems.

Figure 4-42: List of All Reporters
The following screenshot shows a paged used by police administrator to register new officers in the system. It shows how an administrator of the system can be able to register new police officers in the system. The values in Police station, police title, police profile tables appear as drop down here. Therefore, the codes which are primary keys in those respective tables becomes foreign key at the police user table.

![Police Crime Report Management System](image)

**Figure 4-43: Admin Registering a New Police Officer**

The following screenshot shows a list of all registered police officers’ details such as last name, first name, station, username, their profiles, etc.

![List of All Police Officers Investigating Cases](image)

**Figure 4-44: List of All Police Officers Investigating Cases**
The following screenshot shows how police administrator can add more police stations, police titles and crime status. This can only be done by administrator. Select the type of item to be added and the value. The type dictates which table the data will be stored.

Figure 4-45: Configuration for Adding New Police Station, Police Title or Crime Status

**System Privileges**
The following screenshot shows the error message that pops up when a police officer without administrator rights tries to add a new item into the system. The system has checks such that only administrator profile has many rights.

Also new users can only be introduced into the system by the administrator. See the error below in figure 47 when any user tries the same.
The following screenshot shows the error the pops up when a police officer without administrator rights tries to register a new officer. Only users with administrator profile can assign a crime to investigative officer, any attempt by other users of various profiles to assign a crime gives the error as show in figure below.

**Figure 4-46: Rights of the system administrators**

**Figure 4-47: Introduction of New Users in the System**
The following screenshot shows the error the pops up when a police officer without administrator rights tries to assign a crime to another police officer. Updating crime details as investigation progress is restricted to the investigating officer in charge. If any other user tries the same, the error below pops up.

Figure 4-48: Assigning of New Reported Crime to Investigating Officers

The following screenshot shows the error the pops up when a police officer not assigned to the crime tries to update the status.

Figure 4-49: Updating Crime Status by Investigating Officers
4.6 Chapter summary
The chapter covered system implementation requirements and answered the questions like:

1. What hardware specifications are required for development and deployment?
2. Which languages are used to program the system?
3. Which software IDEs aided in this development process?
4. How many kinds of users are in the system and what are their roles?
5. How can a test be done to ascertain that the system meets the requirements?

These are the questions among many others that are discussed in this chapter. It also summarizes the database structures using entity relationship diagram. System user roles are well represented in the use case diagrams which depicts clearly what each user can do in the system. The order of occurrence is represented using sequence diagrams and flowcharts. Furthermore, to show how the system looks like after development, a screenshot of each activity or transaction page is captured. The test case is also made available for tests aimed at making sure the system met the set objectives of the project. This chapter elaborates on how the theoretical idea discussed in the previous sections was changed into reality. Condensing all the concept discussed into a workable system called E-Security.
Chapter 5: Results and Findings

5.1 Introduction
All the interviewed public respondents were residents of subdivisions under Buruburu police division. Moreover, all had reported cases at the police station using the traditional methods. Not all the collected questionnaires could be used for analysis with 10% being rejected hence 90 questionnaires were used for reporting. The findings of this chapter are used to address only objective one and three of this study. The second objective of the study “Developing a contextually relevant mobile application for crime reporting” had been addressed through system implementation in Chapter four.

5.2 Analysis of Responses from the Public
The section presents the results and findings obtained public responses. The results are analyzed and discussed as per the study contexts. The section also addresses the first objective of the study.

5.2.1 Demographic Characteristics of Public Respondents
The collected demographic characteristics of the residents included gender and education levels. The education level was to be used to gauge whether they were able to use technology as an alternative to traditional method. Higher percentage (58.89%) of the total respondents had attained secondary education followed by those with tertiary education (22.22%) while only a few (5.56%) had no formal education. The highest percentage indicates that most of the respondents were able to understand and use technology as an alternative to traditional method of reporting crime. The gender was documented to ensure that the data collection does not skew to one particular set of respondents. Despite the sample collection being random, the gender balance could not be attained at 50-50 because some of the selected women indicated that despite having cases, in most scenarios, the husbands took the role of reporting. Male respondents formed 55.56% while 44.44% were females.

Duration of Residence
Most of the respondents, 35.56% had stayed in the area for more than four years and the least period of residents is 7.8% (those who have stayed for less than one year). The sample population had resided in the areas for relatively long durations. Most of the respondents had stayed within Buruburu police division for over four years hence can report on the
social and crime issues under investigation. Previous studies have indicated that understanding urban neighborhood issues in context and various perspectives are dependent on duration of residence (Brook-Gunn, 1997). Therefore, the relatively long period of respondents justifies the possibility of quality responses (Chavis & Wandersman, 1990).

The following figure shows the distribution of time of stay in the study area.

![Figure 5-1: Duration of Stay in Buruburu Division](image)

**Smartphone Ownership**

Kenya has had an increase in smartphone ownership and use and this has also been recorded in the study with more than three-quarters of the sample population (88.89%) indicating that they own and use smartphones for their daily communication.

The population having a smartphone is significantly higher. This shows the potential that smartphone has in improving livelihood. Statistics has it that there is growing ownership and use of smartphones in various sectors including health care, agriculture and social events in the developing economies (Poushter, 2016). Similarly, in Kenya, attempts have been made to include the use of phone-based technologies among health care workers and caregivers. The results have shown significant improvement in outcomes as a large
percentage of populations either own or can access these devices and use them to enhance quality of services (Zurovac et al., 2013). The police and other security agencies can equally apply these emerging technologies and improve general service delivery like crime reporting as shown in the figure below.

The following figure shows the comparison in percentage of citizens who possess and those who does not own smartphones in the study area.

![Ownership of Smartphone](image)

**Figure 5-2: Reporting Alternative as Smartphones**

### 5.2.2 Case Reporting and Solutions

Table 5-1 shows crime response efficiency, police assistance, resolved reported cases, and proportion of the public that is comfortable with using phone-based system as a solution to the problem under study.

Generally, the traditional method of reporting cases has been documented to be associated with the late response by the police as shown in table 5-1. A significant proportion of the reported cases (70%) indicated that the police response was not timely. However, despite the late response, 72.22% of these cases received assistance from the police, this is a justification that improving reporting approach would have better results regarding faster
response. On the other hand, despite the police response, most cases were not resolved at over 70%, and this can be explained either by the officers reaching incident scene late hence could not get the suspects on site or information shared by individuals reporting not being quite substantive to support evidence-based prosecution. Therefore, reporting through mobile phones would solve this scenario efficiently. The key aspect of over 80% of the respondents opting to report cases remotely supports the hypothesis that technology-based crime reporting is one of the possible alternatives for solving the underlying problem herein.

Akech 2015, in his study of crime reporting in Kenya, documented that the level of crime in Kenya urban areas have risen exponentially. The study further explains that criminal activities are common in Nairobi. The role of the police is majorly to document occurrences and make it part of statistics as reports reach stations at late stages. Similar findings have been reported in Johannesburg and Dare-salaam respectively (Singh, 2016; Burton 2005). Therefore, there is a need for more efficient approaches that would improve crime reporting hence enhanced solutions.

The figure following table shows the duration of police response to the reported crime, cases resolve in time and options of using remote reporting system in the study area.

Table 5-1: Reporting Cases and Options of Using Mobile Phone Reporting

<table>
<thead>
<tr>
<th>Variable</th>
<th>% Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Police response duration to crime report</td>
<td></td>
</tr>
<tr>
<td>1. On time</td>
<td>16.67</td>
</tr>
<tr>
<td>2. Late response</td>
<td>70</td>
</tr>
<tr>
<td>3. No response</td>
<td>13.33</td>
</tr>
<tr>
<td>Assistance received from police</td>
<td></td>
</tr>
<tr>
<td>1. YES</td>
<td>72.22</td>
</tr>
<tr>
<td>2. NO</td>
<td>27.78</td>
</tr>
<tr>
<td>Cases resolved</td>
<td></td>
</tr>
<tr>
<td>1. YES</td>
<td>28.89</td>
</tr>
<tr>
<td>2. NO</td>
<td>71.11</td>
</tr>
<tr>
<td>Option of using remote reporting</td>
<td></td>
</tr>
<tr>
<td>1. YES</td>
<td>83.3</td>
</tr>
<tr>
<td>2. NO</td>
<td>16.7</td>
</tr>
</tbody>
</table>

5.3 Analysis of Responses from the Police Officers

The data presented in this section are those obtained from police officers across the study locations. Their views have been explained in depth and correlated with underlying issues under study.
### 5.3.1 Demographic Characteristics of Police Officers

The variables discussed in table 11 are majorly descriptive of the police officers interviewed. The main issues documented are their gender, levels of education, duration they have served in their current police station, and the number of years they have taken in the police service since their employment.

The following table shows the demographic characteristics of police officers in terms of gender, education level, years served in current police station and number of years he or she has in police service in the study area.

#### Table 5-2: Demographic Characteristics of Police Officers

<table>
<thead>
<tr>
<th>Variables</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>70</td>
</tr>
<tr>
<td>Females</td>
<td>30</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>30</td>
</tr>
<tr>
<td>Certificate</td>
<td>26.7</td>
</tr>
<tr>
<td>Diploma</td>
<td>33.3</td>
</tr>
<tr>
<td>Bachelor</td>
<td>16.7</td>
</tr>
<tr>
<td>Masters+</td>
<td>3.3</td>
</tr>
<tr>
<td>Years serving in current police station</td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>10</td>
</tr>
<tr>
<td>5-10</td>
<td>43.3</td>
</tr>
<tr>
<td>10-15</td>
<td>33.3</td>
</tr>
<tr>
<td>15+</td>
<td>13.3</td>
</tr>
<tr>
<td>Years in the police service</td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>3.3</td>
</tr>
<tr>
<td>5-10</td>
<td>26.7</td>
</tr>
<tr>
<td>10-15</td>
<td>33.3</td>
</tr>
<tr>
<td>15-20</td>
<td>30</td>
</tr>
<tr>
<td>20+</td>
<td>6.7</td>
</tr>
</tbody>
</table>

The male respondents were more because in most stations, the ratio of male officers to female colleagues were generally higher, this is because in most police recruitments, higher chances are always given to male candidates than female. Secondly, most of the females doesn’t always prefer police work due to the kind of hardship involved in training. Most of the police officers had a diploma degree indicating that at least a significant number can be trained to use the proposed case reporting and resolving application. However, it was notable that the second highest qualification at 30% were those officers whose highest level
of academic qualification was the O level certificates. This is the basic level of academic qualification used in the country as a cut off point for recruitment to the service. This level may pose a challenge when training officers on the application use. However, there are officers with higher certificates who can easily be trained to handle the applications used in reporting and documenting crime. About service in the current police station, the majority of the officers (43.3%) had served for between 5 to 10 years. This is a sufficient period enabling them to understand the underlying problems facing the region. Moreover, the majority of the officers had served in the service for over ten years indicating that they understand the underlying issues that face the current mode of crime reporting and solving approaches. There is a relationship between the experience of work and ability to deliver better services. Such long officers understand the problems facing the force and the public hence their answers and recommendations would provide good results.

5.3.2 Case Quantity and Reporting Time

Daily quantity of cases handled per varied within and across stations. The officers indicated that some days the reports are higher and others low as shown in figure 51. The police stations receive occurrence reports for 24 hours a day.

The following figure shows the number of cases reported daily in the police station.

![Documented Daily Cases](image)

**Figure 5-3: Average Volume of Cases Reported Per Day**
Most of the stations had more than 150 cases reported daily, meaning that the occurrence station is always busy with manual reporting. Electronic and offline reporting would improve efficiency in case reporting. The result would be faster response and crime resolving. The traditional method takes longer durations to document hence means more personnel are required. Also, the individual reporting crime has to offer more descriptions for the police to understand the issues and his/her location. Offering alternative IT supported reporting and guided response would lead to better outcomes. Majority of the cases were reported after one day; there were variations as shown in the figure in the next figure.

The following figure shows the duration of the time taken before reporting cases and how they varied across and within police divisions.

![Time Taken Before Reporting](image)

**Figure 5-4: Time Taken Before Reporting Criminal Activities**

The large percentage of late case reporting can be attributed to the time and resources necessary to travel to stations. Immediately after a crime incident, the victim may be too scared to go to the station and report or he may have lost significant resources that would have facilitated his movements. Therefore, options that do not force the individual to move to stations immediately would be a better alternative in this scenario.
Solving criminal activities requires democratization and devolving the crime management in Kenya (Ruteere & Pommerolle, 2003). Immediate and efficient reporting plays a significant role in crime management value chain. Therefore, if better outcomes are to be achieved, then all the stakeholders must embrace mechanisms that would ensure faster results dependent on local perspectives.

5.3.3 Response Characteristics and Reporting Options
This section gives the findings to police in regards to research objective one “to identify current methods and challenges with crime reporting within Nairobi area.” It explains police response to reported cases and their view towards technology-based reporting process. More than two-thirds of the reported cases do not have an immediate response, and most of the police response is between 12-24 hours. However, more than 80% of the police officers prefer mobile-based reporting as a possible solution to the current issues. Table 5-3 shows the documentation of these characteristics.

**Table 5-3: Variables Defining Case Reporting**

<table>
<thead>
<tr>
<th>Variable</th>
<th>% Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate response to reports</td>
<td></td>
</tr>
<tr>
<td>1. Yes</td>
<td>23.3</td>
</tr>
<tr>
<td>2. No</td>
<td>76.7</td>
</tr>
<tr>
<td>Duration of police response</td>
<td></td>
</tr>
<tr>
<td>1. &lt;1 hour</td>
<td>20</td>
</tr>
<tr>
<td>2. 2-5 hours</td>
<td>16.7</td>
</tr>
<tr>
<td>3. 5-10 hours</td>
<td>16.7</td>
</tr>
<tr>
<td>4. 12-24 hours</td>
<td>24.47</td>
</tr>
<tr>
<td>5. &gt;24 hours</td>
<td>12.23</td>
</tr>
<tr>
<td>Recommending mobile reporting</td>
<td></td>
</tr>
<tr>
<td>1. Yes</td>
<td>86.7</td>
</tr>
<tr>
<td>2. No</td>
<td>13.3</td>
</tr>
</tbody>
</table>

The immediate response by the police is at the center of crime management. However, the study shows that the police do not respond immediately because most of the cases are reported too late. The officers visit the crime-scene with the objective of attempting to obtain evidence for prosecution purposes. Majority of police officers agreed (86.7%) that real-time technology-based reporting would be a better approach to reducing time wasted in traditional reporting and case recording. Due to the sporadic and often perfunctory
recording of recorded crime, the current data are used when analyzing resolved cases. The non-resolved and unreported scenarios do not get into statistics that may aid informed decisions and policies. Technology-based reporting would be easier to track and understand trends. Such tools would be better in comparison to what exists currently in the Kenyan context. Studies in the UK have shown that poor crime reporting methods can make even the victims to fear the process of reporting which may lead to numerous unresolved scenarios hence worsening the loss already experienced by victims both in short and long-term (Jaehnig, Weaver & Fico, 1981). Technology-based crime reporting would mean that victims do not have to meet the police officers. Despite faster and efficient service delivery, it would also lead to institutional stability hence a more sustainable approach to crime handling (Soares, 2004).

5.4 System Usability Evaluation Report

This section gives the findings to objective number three of this research “to evaluate the usability of the proposed mobile application.” After realizing the second objective of the study through system implementation in chapter four, the application was evaluated by surveying some selected police officers and few members of the public and testing it on the planned models of hosting it on local computers. The outcome of the survey was as explained in the section below. Table 5-4 shows the experience and time required to understand and use the application.

Table 5-4: Experience and Time Required to Understand and Use the Application

<table>
<thead>
<tr>
<th>Variable</th>
<th>Descriptions</th>
<th>Proportion</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience during use</td>
<td>Ease of data entry</td>
<td>a. Very easy</td>
<td>73.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Reasonable easy</td>
<td>13.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Somewhat difficult</td>
<td>13.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Difficult</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ease of producing reports</td>
<td>a. Very easy</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Reasonable easy</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Somewhat difficult</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Difficult</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ease of reading reports</td>
<td>a. Very easy</td>
<td>73.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Reasonable easy</td>
<td>6.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Somewhat difficult</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Difficult</td>
<td>20</td>
</tr>
</tbody>
</table>
The population that used the application generally found it usable regarding understanding the processes involved through short training. Also, they understood its operational environment which was very important when establishing the scalability of the system to main stakeholders and public consumption as described by Osterle et al., 2011.

Table 5-5 illustrates the user’s perception and overall opinion of the design. Also, it presents information on the usefulness of the product in the target niche.

**Table 5-5: Overall Opinion about the Application by Users**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Opinion</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training on system usage</td>
<td>a. Excellent</td>
<td>53.33</td>
</tr>
<tr>
<td></td>
<td>b. Good</td>
<td>46.67</td>
</tr>
<tr>
<td></td>
<td>c. Okay</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>d. Poor</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>e. Unacceptable</td>
<td>0</td>
</tr>
<tr>
<td>Application installation process</td>
<td>a. Excellent</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>b. Good</td>
<td>26.67</td>
</tr>
<tr>
<td></td>
<td>c. Okay</td>
<td>13.33</td>
</tr>
<tr>
<td></td>
<td>d. Poor</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>e. Unacceptable</td>
<td>0</td>
</tr>
<tr>
<td>Data entry process</td>
<td>a. Excellent</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td>b. Good</td>
<td>73.33</td>
</tr>
<tr>
<td></td>
<td>c. Okay</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>d. Poor</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>e. Unacceptable</td>
<td>0</td>
</tr>
<tr>
<td>Variable</td>
<td>Opinion</td>
<td>Proportion</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>Usefulness</td>
<td>a. Excellent</td>
<td>86.67</td>
</tr>
<tr>
<td></td>
<td>b. Good</td>
<td>6.67</td>
</tr>
<tr>
<td></td>
<td>c. Okay</td>
<td>6.67</td>
</tr>
<tr>
<td></td>
<td>d. Poor</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>e. Unacceptable</td>
<td>0</td>
</tr>
<tr>
<td>Meets expectation</td>
<td>a. Excellent</td>
<td>73.33</td>
</tr>
<tr>
<td></td>
<td>b. Good</td>
<td>20.00</td>
</tr>
<tr>
<td></td>
<td>c. Okay</td>
<td>6.67</td>
</tr>
<tr>
<td></td>
<td>d. Poor</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>e. Unacceptable</td>
<td>0</td>
</tr>
</tbody>
</table>

There were challenges in evaluating this emerging technology among the police service that does not have in-depth training on such aspects in information and data collection. From community perception and reports, the product is generous and easy to understand. Therefore, they felt that it meets and fills the current technology gap that would improve intelligence collection.

Some of the recommendations from the community included the need for the following:

- Aggressive public awareness of the role of the application.
- Involving police management and decision makers along the design stages and testing phase. The need for a backup system to avoid cases of jamming and potential hacking by criminal elements in the society.
- Training of such approaches to be included at the police training college level.

5.5 Chapter Summary

This chapter presents the survey results of obtained from members of the public and the police about research objective one. It gives insight into opinions and facts documented and reported by the citizens in regards to the problems they face when reporting crime using the traditional methods that they have used. It also looks at similar issues expressed by police officers who handle the case reporting and associated response with the aim of achieving solutions. The major outcome is that the police also feel frustrated with the current crime and intelligence collection approaches in play and they prefer the use of technology-based approaches which is backed by the finding that a significant number of
members of the public can afford, access, and use smartphones. Finally, the chapter covers the evaluation stage and presents its outcome in regards to research objective three which positively supports the design and applicability of the system design within the public domain. Therefore, the section highlights the merits and demerits of using technology as a tool to assist in crime intelligence collection with the ultimate aim of efficiency in handling.
Chapter 6: Discussions, Conclusions and Recommendations

6.1. Introduction
This Chapter tends to review the findings and results of the previous Chapter. The Study findings are based on the results obtained from the Public concerning their opinions and insight opinions they reported. It also highlights the predicaments faced by the officers assigned specific the case reporting and response structures. The chapter also provides the researcher’s discussions and views of the findings from the research study respondents bearing the research objective to serve as a pinpoint in improved intelligence response systems. The chapter finally provides the researcher’s discussions, conclusions, and recommendations which can be used for future improvements.

6.2 Chapter Summary
The chapter gives a conclusion of the findings for each objective. The main objective of this study was to develop a mobile-based crime reporting system that will facilitate solving of criminal incidences timeously.

The first specific objective of this study was to “To identify current methods and challenges with crime reporting within Nairobi area.” The literature documents the challenges in crime reporting and case processing. The modern way of reporting crimes is through call centers. Call centers have disadvantages like a member of the public reporting a crime might make a call and end up not being attended to since the phone rings for a long time without anyone picking, be put on hold for a long time whereas some incidences require quick and immediate responses, etc. The findings show that significant proportion of the reported cases (70%) indicated that the police response was late. On the other hand, despite the police response, most cases were not resolved at over 70%, and this can be explained either by the officers reaching incident scene late hence could not get the suspects on site or information shared by individuals reporting not being quite substantive to support evidence-based prosecution. Therefore, reporting by mobile phones would solve this scenario better.

The second specific objective was to “to develop a contextually relevant mobile application for crime reporting.” It focuses on E-Security application that was developed and documented in Chapter four of this study and how it will achieve its objectives regarding
improving security and reporting of crime plus associated intelligence gathering as per the spirit and benchmark of the entire system.

Third objective was “to evaluate the usability of the proposed mobile application.” The results have shown significant improvement in outcomes as a large percentage of populations either own or can access these devices and use them to improve quality of services. This has also been documented in the study with more than three-quarters of the sample population (88.89%) indicating that they own and use smartphones for their daily communication. The application was evaluated by surveying some selected police officers and few members of the public and testing it on the planned models of hosting it on local computers. The population that used the application in evaluation stage generally found it usable regarding understanding the processes involved through short training. Also, they understood its operational environment. The responses also indicated over 70% ease of data entry, 80% ease of producing report, and 80% ease of training. This plays an important role in gauging the scalability of the system to the users. Therefore, they felt that it meets and fills the current technology gap that would improve intelligence collection.

Majority of police officers (86.7%) agreed that real-time technology-based reporting would be a better approach to reducing time wasted in traditional reporting and case recording.

6.3. Discussions

This Section finds ways of giving meaning and sense to the findings of this particular research regarding its key objective “developing a mobile-based crime reporting system that will facilitate solving of criminal incidences timeously.” The Study makes an expanded view of the issues affecting victims because of the delays in crime reporting and response.

6.3.1. The Impact of the Proposed Mobile Application

Technology has been examined to determine how useful it can be in the Criminal investigation situations and unlike the old methods of crime reporting where individuals walked long distances to the police stations, the study displays various benefits that are associated with the use of technology in fighting crime in the city (Schwartz & Randall 2003) which in this case, the mobile phones They include the following:

- Installation of confidence in the public domain
- Prompt response to reported criminal incidences
- Increasing the level of security in the city
• Discouraging criminal gangs from carrying out their malicious activities

The use of a mobile-based application in reporting crime will increase the rate at which the investigations are conducted and will shorten the time spent by the victims in reporting criminal activities that they experience. Once the police receive the notifications, they will respond to the crime scene as fast as possible. The Proposed current method will also enable the security agencies to receive the exact locations of the place of incident or crime. Evidences can also be obtained and presented during the prosecution of the perpetrators as the reporters might capture and have live feeds of the happenings.

6.3.2. Factors Affecting Usability of the Proposed Mobile Application

The first objective was “To identify current methods and challenges with crime reporting within Nairobi area.” There has been a need for the victims to be able to send out criminal information to the police stations or police posts remotely using their mobile-based applications (Boone, 2012). However, this has not been practical. As much as technology has gripped the nation and Nairobi region to be specific, not every individual is privileged to have moved with the technological space and get to own a phone that can host the applications that the study proposes to use in the fight against crime. Nairobi region is diverse and some citizens, in fact so many individuals, still operate the old ways with no phones and worse the Android type which has proved to be a challenge. Network failures is another hindrance to the usability of the same. Unfavorable and adverse weather conditions are likely to hinder the proper information relay from one end to the other. Large Population. The police to citizen Ration in Nairobi region has also been an issue.

6.3.3. Challenges and Limitations Associated with Crime Reporting in Nairobi and the Impact on the Livelihoods on the Citizens

The first objective of this study was to “To identify current methods and challenges with crime reporting within Nairobi area.” The challenges during crime reporting and case processing are as reported in the Kenyan context by (Ruteere and Pommerolle, 2003). The modern way of reporting crimes is through call centers. Call centers have disadvantages like a member of the public reporting a crime might make a call and end up not being attended to since the phone rings for a long time without anyone picking, be put on hold for a long time whereas some incidences require quick and immediate responses. And sometimes it might not be possible to make a call due to the nature of the danger a victim
is in, for example, it could be the victim is among very dangerous robbers who are armed and any mistake like a call can cost a life. This system does not leave a record to in case some calls are picked for tracing and rescue attempt operations after that. This fight might be in vain if fight against such evil is left to individuals alone, team work and personal commitment is important. Witnesses might not dedicate their time to go to the police station and make a report probably because of fear, apathy, attending to personal matters or the nearby police station is very far.

6.4 Conclusion

Two assumptions are made while implementing the study. The mobile application is based on Android phones, assuming that all or majority of reporters shall own mobile phones running on Android platform. Secondly, the ordinary users who are reporters, if they own an Android phone, then it means they can easily use it, and will be able to find E-Security application, start it and operate it properly after awareness campaigns.

However, the system remains very easy, reliable, faster and safer to use while reporting a crime. It takes about 10 minutes to demonstrate to a new user on the phone about using this application which implies that the system usability requirement was considered in design. It is also important to note that many cases reported via hotline numbers do not come with any evidence, but in E-Security, a user can attach evidence together with the crime to support the case.

The mobile application picks the location of the mobile device when reporting a crime. It sends this in the form of latitudes and longitudes which is later opened by police in google map. This location data is used when validating location of the crime against the reporter location details provided. The reporter can be contacted and a few questions in case he/she stated a different place than the one given by the device. This also helps in discarding false alarm incidence quickly. Location functionality on the mobile device should always be on when reporting, otherwise, the application will prompt the user to activate it.

The study made the following conclusions based on research objectives and research findings from the area where the research was executed; The current methods for information collection are traditional and manual in nature hence are based on human support, affected by human errors and bias, not backed by technology
hence largely inefficient in combating the high crime reports, not supportive of fast response and crime solving.

The developed intelligence collection and crime reporting application would ensure the following:

- Guarantees anonymous identity of witnesses or victims.
- Is easy to use, offers privacy and reliable means of crime reporting.
- Is fast and ensures delivery of message to the security urgency
- Allows a person to attach any supportive evidence alongside the case.
- Allows a person to check the progress of the crime they reported, for instance, what is the status of the incidence, which police officer is leading the investigation, etc.

Also, to the police officers, they needed a way of monitoring the crimes reported from various locations. Some of the main issues they needed addressed are:

- A method that enables ordinary citizens to provide their details as users of the system so that it is easy to properly know who is reporting a crime. With this kind of details, users avoid giving false alarms since they know that they can easily be traced.
- A method that enables police to see the location of the mobile device or user when the crime was reported. This will help them validate the location data provided by the victim or witness when reporting the crime.
- A method that enables police to see any supportive evidence provided to support investigation reported crime.
- A method that enables police officers to attach their own evidence found while doing investigations on the case.
- A method that enables police to manage reported crime in a well-structured manner, by allowing assignment of incidences to lead police investigators and restricting any update on the incidence to those particular officers. Also keeping history of any updates and by who to each case.

The suggested application would be appropriate and usable within the public domain because more than 80% of residents own and use smartphone which can support the system, crime victims have complained about numerous unresolved crimes which could be sorted
out by using this application and there is massive support of the system by both the police and potential public users.

6.5 Recommendations

The police should keep confidential data received from users (like user data saved in the system after registration) safe and should not spill to wrong hands. Disclosing this information should be lawful or by the consent of the persons. They should keep crime reporters (who could be witnesses or victims) safe to protect them. Disclosing this information can lead to culprits of the reported crime harming the whistle-blowers.

Some crimes will require urgent response to save life, terror or attack. Therefore, close monitoring of the incoming incidences is of utmost importance.

Crime reporting awareness is necessary to inform the users of the new easy way of reporting criminal incidences and educating them on how to use it. Also giving assurance to the general public that registering as a user and reporting crime, whether the crime was detected or not shall not be used against them at all. Encouraging them to help make the society a safer place.

Giving police officers training that is aimed at imparting them with skills needed to use the back-end application for crime reporting. The back-end application is for incidence management.

The public should also have sufficient training to understand the operation and use of the application plus its real-time significance in intelligence gathering and resolving crime.

Finally, this system can be modified further in relation to different types of industries and organization sizes to determine its usability even for large enterprises, non-governmental organizations and governments.

6.3 Chapter Summary

The chapter gives a conclusion of the findings per objective. It also focusses on what the E security application will achieve regarding improving security and reporting of crime plus associated intelligence gathering as per the spirit and benchmark of the entire system. Finally, the chapter recommends the key issues that key components that must be factored in if the study findings are to have significant impact on society regarding intelligence gathering and resolving crimes.
References


Salvatore T. March Own Graduate School of Management Vanderbilt University Nashville, TN 37203 U.S.A.


APPENDICES

Appendix I: Research Questionnaire for Police Officers

This questionnaire is designed to collect data on the study titled ‘CRIME REPORTING AND INTELLIGENCE SYSTEM: CASE OF BURUBURU POLICE DIVISION-NAIROBI’. The data collected through this questionnaire is intended for academic purposes only and will not be divulged to any other person. Please complete all sections of this document. All questions are interrelated and are very important for the study. You have been identified as one of the respondents and you are requested kindly to fill in the information as appropriate.

SECTION A: BACKGROUND DATA

1. Gender:
   i. Male [ ]
   ii. Female [ ]

2. How long have you worked in this police station?
   i. Less than one year [ ]
   ii. 1-2 years [ ]
   iii. 2–3 years [ ]
   iv. State……………………………………………………………………

3. A part from training as an officer, do you have any other certifications?
   i. Certificate [ ]
   ii. Diploma [ ]
   iii. Degree level [ ]
   iv. Master and above [ ]
   v. State……………………………………………………………………
SECTION B: CASE REPORTING

4. How long have you been in the police service?

........................................................................................................

5. How many occurrence reports do you handle in a month?

   i. Less than 5 [ ]
   ii. 5-10 [ ]
   iii. 11-20 [ ]
   iv. 21-30 [ ]
   v. 31-40 [ ]
   vi. 41-50 [ ]
   vii. More than 50 [ ]
   viii. State average cases

........................................................................................................

6. How many hours from the time of the occurrence were the incidents reported?

   i. Less than 1 hour [ ]
   ii. 1-5 [ ]
   iii. 6-10 [ ]
   iv. 11-15 [ ]
   v. 16-24 [ ]
   vi. 1 day [ ]
   vii. 2 days [ ]
   viii. 3 days 1 week [ ]
   ix. More than a week [ ]
   x. State the duration

........................................................................................................

7. Was there immediate response to report incidences?

   i. Yes [ ]
   ii. No [ ]
8. How long did it take before response by officers?

   i. Within one hour [ ]
   ii. 1-2 hours [ ]
   iii. 2-3 hours [ ]
   iv. 3-4 hours [ ]
   v. 4-5 hours [ ]
   vi. 12 hours [ ]
   vii. Any other duration………………………………………………………………………

9. List the problems you have encountered when carrying out manual reporting of cases?

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10. Do you think remote reporting (through your mobile phone) would offer a solution to problems faced currently?

   i. Yes [ ]
   ii. No [ ]

11. How would remote reporting (through your mobile phone) improve crime response and resolution?

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THANK YOU.
Appendix II: Research Questionnaire for the Public

This questionnaire is designed to collect data for the study titled ‘CRIME REPORTING AND INTELLIGENCE SYSTEM: CASE OF BURUBURU POLICE DIVISION-NAIROBI’. The data collected through this questionnaire is intended for academic purposes only and will not be divulged to any other person. Please complete all sections of this document. All questions are interrelated and are very important for the study. You have been identified as one of the respondents and you are requested kindly to fill in the information as appropriate. Kindly note that only individuals who have had cases to police stations are the only ones allowed to answer this questionnaire.

SECTION A: BACKGROUND DATA

1. Gender:
   i. Male [ ]
   ii. Female [ ]

2. How long have you stayed in this area?
   i. Less than one year [ ]
   ii. 1 -2 years [ ]
   iii. 2 – 3 years [ ]
   iv. 3 years [ ]
   v. State any ………………………………………………………………

3. Do you own a smart phone or tablet?
   i. Yes [ ]
   ii. No [ ]
SECTION B

4. Have you reported a crime in any police station previously?
   i. Yes [ ]
   ii. No  [ ]

5. Were you assisted on time?
   i. Yes [ ]
   ii. No  [ ]

6. If No, what was the reason for police late response/assistance?

   …………………………………………………………………………………………………
   …………………………………………………………………………………………………

7. Did the police resolve the matter?
   i. Yes [ ]
   ii. No  [ ]

8. Would you opt to reporting remotely from your phone?
   i. Yes [ ]
   ii. No  [ ]

9. If yes, kindly state some of the reasons why you would opt for remote reporting

   …………………………………………………………………………………………………
   …………………………………………………………………………………………………

10. Suggest any reporting means that would have made the entire process more effective?

   …………………………………………………………………………………………………
   …………………………………………………………………………………………………

THANK YOU.
Appendix III: Questionnaire for System Evaluation

This questionnaire is designed to evaluate functionality of the police crime reporting application which is part of the study ‘CRIME REPORTING AND INTELLIGENCE SYSTEM: CASE OF BURUBURU POLICE DIVISION-NAIROBI’. The data collected through this questionnaire is intended for academic purposes only and will not be divulged to any other person. Please complete all sections of this document. All questions are interrelated and are very important for the study. You have been identified as one of the respondents and you are requested kindly to fill in the information as appropriate.

1. What is your level of experience in using the application?
   Experience using similar applications Much [ ] some [ ] little [ ] none [ ]

2. Please tell us about your experience using our application?
   a. Ease of data entry
      Very easy [ ] reasonably easy [ ] somewhat difficult [ ] difficult [ ]
   b. Ease of producing reports
      Very easy [ ] reasonably easy [ ] somewhat difficult [ ] Difficult [ ]
   c. Ease of reading reports
      Very easy [ ] reasonably easy [ ] somewhat difficult [ ] difficult [ ]

3. Please comment on user friendliness of our application.
   …………………………………………………………………………………………………………………………………………………
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4. Please rate the time requirements for training to use our application?
   a. Time required for data entry training
Unacceptable [ ] bad [ ] acceptable good [ ] excellent [ ]

b. *Time required for data entry*
Unacceptable [ ] bad [ ] acceptable good [ ] excellent [ ]

5. **What are your overall opinion on the following aspects of the application?**
   a. **Training on system usage:** Excellent [ ] good [ ] okay [ ] poor [ ] unacceptable [ ]
   b. **Application Installation process:** Excellent [ ] good [ ] okay [ ] poor [ ] unacceptable [ ]
   c. **Data entry process:**   Excellent [ ] good [ ] okay [ ] poor [ ] unacceptable [ ]
   d. **Reports generation:**   Excellent [ ] good [ ] okay [ ] poor [ ] unacceptable [ ]
   e. **Ease of use:**   Excellent [ ] good [ ] okay [ ] poor [ ] unacceptable [ ]
   f. **Usefulness:**   Excellent [ ] good [ ] okay [ ] poor [ ] unacceptable [ ]
   g. **Support:**   Excellent [ ] good [ ] okay [ ] poor [ ] unacceptable [ ]
   h. **Meets expectation:**   Excellent [ ] good [ ] okay [ ] poor [ ] unacceptable [ ]

6. Please comment on any aspect, negative or positive that you feel would be helpful for us to know?

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Thanks!
Appendix IV: Sample Codes

**Android application sample code**

**Application main page**

```java
import android.content.Intent;
import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.TextView;

public class MainPage extends AppCompatActivity {

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main_page);
        Button btnrptcrime = (Button) findViewById(R.id.btncrimereport);
        Button btnReportLostItems = (Button) findViewById(R.id.btnLostItem);
        TextView txtView = (TextView) findViewById(R.id.textView2);
        txtView.setText("Welcome To E-Security " + LoginActivity.user.getFullNames());
        btnrptcrime.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Intent rptcrime = new Intent(v.getContext(),ReportCrime.class);
                startActivityForResult(rptcrime,0);
            }
        });
        Button btnSeeCrime = (Button) findViewById(R.id.btncrimeReports);
        btnSeeCrime.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Intent crimeReports = new Intent(v.getContext(),UserCrimeReport.class);
                startActivityForResult(crimeReports,0);
            }
        });
        btnReportLostItems.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Intent lostItems = new Intent(v.getContext(),ReportLostItem.class);
                startActivityForResult(lostItems,0);
            }
        });
    }
}
```

**Police Administration sample code**

**Registering new users**

```java
import android.support.v7.app.AppCompatActivity;
```
import android.os.Bundle;
import android.view.View;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.EditText;
import android.widget.Spinner;
import android.widget.Toast;
import com.util.WebRequest;
import org.json.JSONObject;
import android.widget.TextView;

public class RegisterUser extends AppCompatActivity {
    private String array_spiner[];
    JSONObject jsonObject = null;
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_register_user);
        array_spiner = new String[3];
        array_spiner[0] = "Select Gender";
        array_spiner[1] = "Male";
        array_spiner[2] = "Female";
        final Spinner dropdown = (Spinner) findViewById(R.id.spinnerGender);
        ArrayAdapter<String> adapter = new ArrayAdapter<String>(this, android.R.layout.simple_spinner_dropdown_item, array_spiner);
        dropdown.setAdapter(adapter);
        Button btnsave = (Button) findViewById(R.id.btnSaveUser);
        final EditText fullNames = (EditText) findViewById(R.id.editText);
        final EditText idno = (EditText) findViewById(R.id.editText3);
        final EditText phoneNo = (EditText) findViewById(R.id.editText4);
        final EditText residence = (EditText) findViewById(R.id.editText5);
        final EditText userName = (EditText) findViewById(R.id.txtUsername);
        final EditText passWord = (EditText) findViewById(R.id.txtPassword);
        final EditText confirmPassWord = (EditText) findViewById(R.id.txtConfirmPwd);
        btnsave.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                try {
                    if ("".equalsIgnoreCase(fullNames.getText().toString())
                        || "".equalsIgnoreCase(idno.getText().toString())
                        || "".equalsIgnoreCase(phoneNo.getText().toString())
                        || "".equalsIgnoreCase(residence.getText().toString())
                        || "".equalsIgnoreCase(userName.getText().toString())
                        || "".equalsIgnoreCase(confirmPassWord.getText().toString())) {
                        Toast.makeText(RegisterUser.this, "All Fields Are Required!", Toast.LENGTH_SHORT).show();
                    } else {
                        if (passWord.getText().toString().equals(confirmPassWord.getText().toString())) {
                            jsonObject = new JSONObject();
                            jsonObject.put("fullNames", fullNames.getText());
                            jsonObject.put("IdNo", idno.getText());
                            jsonObject.put("phoneNo", phoneNo.getText());
                            jsonObject.put("residence", residence.getText());
                            jsonObject.put("gender", dropdown.getSelectedItem());
                            jsonObject.put("username", userName.getText());
                            jsonObject.put("password", passWord.getText());
                            new WebRequest(jsonObject, getApplicationContext(), ProjectVariables.BASE_WEB_URL + "UserService/saveUser/").execute();
                            fullNames.setText("*");
                            idno.setText("*");
                            phoneNo.setText("*");
                            residence.setText("*");
                        }
                    }
                } catch (Exception e) {
                    e.printStackTrace();
                }
            }
        });
    }
}
else {
    Toast.makeText(RegisterUser.this, "Passwords do not match!",
            Toast.LENGTH_SHORT).show();
}
} catch (Exception e) {
    e.printStackTrace();
}
});

**RESTful services sample code**

**Manage police station**

```java
package com.E-Security.crime;

import java.util.ArrayList;
import java.util.List;
import javax.ws.rs.GET;
import javax.ws.rs.Path;
import javax.ws.rs.Produces;
import javax.ws.rs.core.MediaType;
import com.usulama.dao.PoliceStationDao;

@Path("/policeUtil")
public class ManagePoliceStation {
    @Path("/policeStations")
    // @Consumes(MediaType.TEXT_PLAIN)
    @GET
    @Produces(MediaType.APPLICATION_JSON)
    public List<PoliceStation> postPoliceStation() {
        List<PoliceStation> pStation = new ArrayList<>();
        PoliceStationDao pls = new PoliceStationDao();
        pStation = pls.getPoliceStations();
        return pStation;
    }
}
```

**Police station**

```java
package com.E-security.crime;

public class PoliceStation {
    public int id;
    public String name;

    public int getId() {
        return id;
    }

    public void setId(int id) {
        this.id = id;
    }

    public String getName() {
```
return name;
}

public void setName(String name) {
    this.name = name;
}
}