

# Utilisation of ICTs in Crime Reporting and Monitoring: A Case of Zambia

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**ABSTRACT:**The proliferation of mobile handheld devices has made them a viable medium for carrying out a wide range of business activities in areas such as education, agricultural, healthy and security. In the area of security, one major problem hindering crime detection and reporting is lack of efficient communication platform between the police and the general public. Mobile technologies using mobile devices is proving to be a more effective implementation for crime detection and monitoring. In this study, we are proposing a crime reporting and management model using GSM and GIS technologies in order to mitigate the challenges faced by most developing countries in reducing the crime rates. We began by a baseline study that was carried out to ascertain how citizens report crime to the police. This was followed by a study that looked at how the Police receive and manage crime information. Based on the baseline study, we then designed a Public Crime Reporting and management System that integrates GSM and GIS Technologies. In our baseline study, the results showed that 68% of the citizens walk to the police station, 30% made phone calls and less than 1% used Short Message Service (SMS), Internet or social media platforms to report crime. In crime reports management, our results showed an absence of an electronic capturing/recording system by the police with 98% of the police stations using a physical log book to record crimes. Using the results from the baseline study, a mobile crime reporting and management system model was developed. Using this model, we developed the prototype which showed improved results in terms crime reporting by the public using mobile devices and improved management of reports due to automation of crime reporting and monitoring.

**KEYWORDS:**Crime Reporting and Monitoring ,Mobile Application, Geographical Position System (GPS),Geographical Information System (GIS), Global System for Mobile communication (GSM).

## I. INTRODUCTION

Crime is one of the major challenges that most governments around the world are strangling with [1] [2]. Every family and business has been directly or indirectly affected by robberies, burglaries, vandalism, sexual and other crimes [3] [4] [5] [6]. Recent research has identified mobile handheld devices as a possible tools for effective crime detection and reporting [7][8].The high computational power of phones, smart phones, tablets and PDAs accounts for their high demand and usage by the general public. Smartphone shipments worldwide reached 485 million in 2011, increased to about 655 million in 2012, and expected to rise over one billion smart phones by 2016 [9],[10]. Another key factor making mobile phone technology a viable medium for fighting crime is the advancement of cellular networks technologies. The introduction of 3G/4G cellular network technologies by most mobile network operators has improved the communication demands for mobile users [11]. With these two factors in place, development of dedicated mobile platforms for detecting and reporting criminal activities is a great possibility.

In this paper, we propose a model for reporting and management of crime reports through mobile technologies such as GSM and GIS. The rest of the paper is organised as follows; Section I gives the Introduction, Section II gives the related works, Section III is the methodology while Section IV gives the implementation results. Section V gives the discussion while Section VI gives the conclusion.

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## II. RELATED WORK

The advancement of computer technologies has led to the advancement of computer technologies has led to more effective ways of detecting and fighting crime in society [12]. Today, engineers and researchers have proposed and developed a number of computer based systems, especially for crime detection and reporting. This section presents an overview of some of the most powerful computer based crime fighting systems developed within the past six years. The overview pays attention to functionalities and principles of operations of these systems.

### 3.1 Tip Submit

Crime Stoppers, New Orleans has launched a new free mobile crime-fighting app, for Android and iPhone platforms, called Tip Submit [12]. The app was created by Tip Soft and Crime Reports and is known to be the first anonymous tip submission mobile software. By design, Tip Submit allows citizens to submit crime tips to Crime stoppers securely and anonymously. The system identifies tipsters by their tip number only, which it assigns to the tip. The Mobile App allows tipsters to upload photos or video and is able to send the location of the video by a GPS locator. Other key feature of TipSubmit is that, it has no limits on the amount of text as with sending SMS text messages. Also, it maintains two way dialogue and real-time chat between the tipster and Crime stoppers.

### 3.2 Web Cast

Engineers in the University of Virginia have developed software which helps the police easily access crime data online [13]. The system, called Webcast allows establish trends on the data, showing the types of crimes that commonly occur, and the places with which they are associated. By typing in specific dates, types of crimes, locations, and selecting names of weapons used, web-Cat produces graphs, reports, and maps of high crime areas.

### 3.3 Mobile Vic

Another powerful computer based crime fighting tool is Mobile Vic PD [14]. Mobile Vic PD is a recently releases mobile application, released by the Victoria police in Canada for fighting crime. The mobile application can be used to report minor crimes, offer anonymous tips to police, stay updated on crimes in progress, receive missing child reports or check on stolen property. Report Crime: Report crimes where the suspect is unknown to you and the total loss is less than \$5000 from the convenience of your iPhone, Is This Yours?: Reconnect with your lost or stolen property through this photo catalogue. Crime Maps: See reports of crime in your geographic location, Photos: View and search for the latest images of VicPD in action in our Flickr archives, Videos: Watch videos from the VicPD You Tube Channel Audio: Listen to VicPD News features, media releases and interview, Traffic Complaints: After a 24-hour cooling-down period, report traffic violations online, with actions ranging from general information for our traffic section, warnings, or issuing a ticket.

### 3.4 Accurint

Accurint is produced by LexisNexis for the iPhone and iPad. This Mobile app connects government and law enforcement agencies to more than thirty billion public records and critical investigative tools needed to verify information in the field, and rapidly follow-up on new leads as they develop. Accurint is a powerful investigative public-records research tool used by thousands of government and law enforcement agencies to enforce laws and regulations, fight fraud, waste and abuse, and provide citizen-centric services. Accurint's next generation search technology enables researchers and investigators to instantly search through billions of public records and perform their jobs more efficiently and effectively. Some of the features of Accurint are; advanced Person Search, People at Work Search, Phones Search, Death Records Search, Business Search, Corporate Filings Search and Fictitious Business Name [15].

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## 3.5 Cop Link

The most widely used tactical lead generation tool for law enforcement in the United States is Cop Link mobile plus app, created by i2 [16]. The app runs on iPhone, iPad and Android platforms. The app enables officers to achieve better situational awareness with automated geospatial searches of recent events, as it allows the searching of state and local criminal records from multiple jurisdictions' databases. Another great feature of the app is its ability to organize vast quantities of seemingly unrelated data to assist in making tactical, strategic and command-level decisions.

## 3.6 IPOL-Mobile

IPOL-mobile is an iPhone application used for crime fighting by police in Geneva, Switzerland [17]. Trends in local authorities [18]. It enables the police to have immediate access to various information such as the latest burglary or violence incident as well as the identities of culprits of such crimes. It enables the police to have immediate access to various information such as the latest burglary or violence incident as well as the identities of culprits of such crimes, IPOL-Mobile tracks the statuses and stages of the crime. Officers can track ownership information of vehicles by simply entering its number plate into the Smartphone application and officers can also get important real time information about their duties (patrol hours and location), police directories, lawyers and translators and their availability hours using the application.

## 3.7 Hatari

Hatari.co.ke is a web based platform that enables citizens in Kenya to report to report various crimes by sending a text message containing the location and the type crime you are reporting to a number, the message will be displayed on the platform including a position on the map where it was reported from[19]

## III. METHODOLOGY

### 4.2 Demographic Landscape of Zambia

The Zambia is one of the most highly urbanized countries in Sub-Sahara Africa with estimated population of 13.5 million. The rate of urbanization has resulted into unplanned, informal settlements commonly known as Peri- urban areas. The Peri-urban population is estimated to range from about 40% in smaller towns to 80% in big cities. Lusaka City has 29 Peri-Urban Areas. Although local authorities regard these settlements as “illegal” or “Squatter” compounds, they continue to grow without planning controls [20]. Lusaka is the capital city of Zambia and it is the focal point of Zambia's economic, political and international affairs. Currently the city is a fast growing town, with estimated Population of about 3 million .The Population density of Lusaka is 100.1 persons per square kilometre [20]. Lusaka is a sprawling city featuring considerable spatial, social and digital divides [21]. While in recent years the city of three million has experienced rapid economic growth, the dividends have not been evenly shared [22]. 5 Indeed, the gap between the wealthy elite and the poor majority is widening as the city's poor population continues to expand [23]. It is estimated that approximately half of Lusaka's population lives in informal settlements the city is also young. The majority of the population in the informal settlements is under 22 years of age [20].

In this paper, we give a brief over view of the crime pattern in Zambia as compared to other African countries around the world and in Africa. The ever increasing crime rate in Zambia is a serious problem that needed to be attended to urgently [36]. Today, every family and business has been directly or indirectly affected by robberies, burglaries, vandalism, sexual and other crimes [20] [21]. The significant increase in criminal activities impairs the overall development of a nation, undermines people's spiritual and material well-being, compromises human dignity, and creates a climate of fear and violence that erodes the quality of life [21][22]. Therefore, Sound Police – Community Relations are indispensable in the fight against crime in Zambia. Without adequate involvement by the local communities in fighting crime, for example, police officers are not likely to succeed in their endeavours [22]. Burglary,

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House Breaking and Other Breakings in High, Middle and Low Density Residential Areas of Lusaka Urban District are rampant. The most common crimes are Theft, robbery, rape/defilement, murder, burglary and assault.

For this study, 200 questionnaires were distributed to the general public and 80 were distributed to various police stations around Lusaka. Audio recording and oral interviews were also used as means to obtaining information. The study focussed on the integration on ICTs in crime reporting.

It is worth emphasizing that Lusaka is also a comparatively violent city. However, residents are exposed to different forms and levels of crimes. Residents of densely populated settlements experience the most crime while medium populated areas are moderate. The low density areas experience the least crime incidents.

The utilization of ICTs in crime reporting by citizens is mainly at the point of reporting the crime while the police utilises the ICTS from the point monitoring crime reports and also recording the crime. Crime capturing and recording is one of the most important stages in any crime documentation process. This offers an opportunity for law enforcement officers such as the police to fully document and capture the specifics of the crime. This study tries to uncover the utilisation of ICTs in crime reporting and monitoring which can be achieved through the development of a mobile application that will allow the citizens report crimes and the police to monitor them in real time.

## 4.2 Crime Reporting and Monitoring Application Model Design and Implementation

This section looks at the development of a mobile crime reporting and monitoring tool. This tool will be used by the general public to report crimes and allow the police to monitor them in real-time. The system consists for two main parts; the mobile application (front end) and the Graphical User Interface (GUI) a backend system that is used to monitor and act on the reported crime. The solution is based on client-server architecture. The front end has an Android application and web based Graphical User Interface (GUI) for the police to monitor whatever crimes are reported within a certain radius. The technology that was used to develop the mobile crime reporting application frontend is android, it runs on any android powered phone. The web based Graphical User Interface (GUI) was developed using PHP, The system database is implemented using MYSQL. For location mapping, the Google API was used and a web service was developed to listen for web requests from the mobile application.

### 4.2.1 Basic Concept and Design

The architecture of the mobile crime reporting application is client-server. The client side is a mobile application running on the handheld device of the user (general public). The user can report a crime by pressing the 'Hot Button' and the nearest police station receives the crime incident notification as a pop up on the screen. A two way SMS messaging system also kicks in, The police officer receives the phone number of the crime reporter and the crime reporter receives the phone number of the police station. The running on the users' handheld device communicate directly with the server; retrieving in real time the crime incident reports that the user reported. Fig 1 below shows the basic architecture of the mobile application

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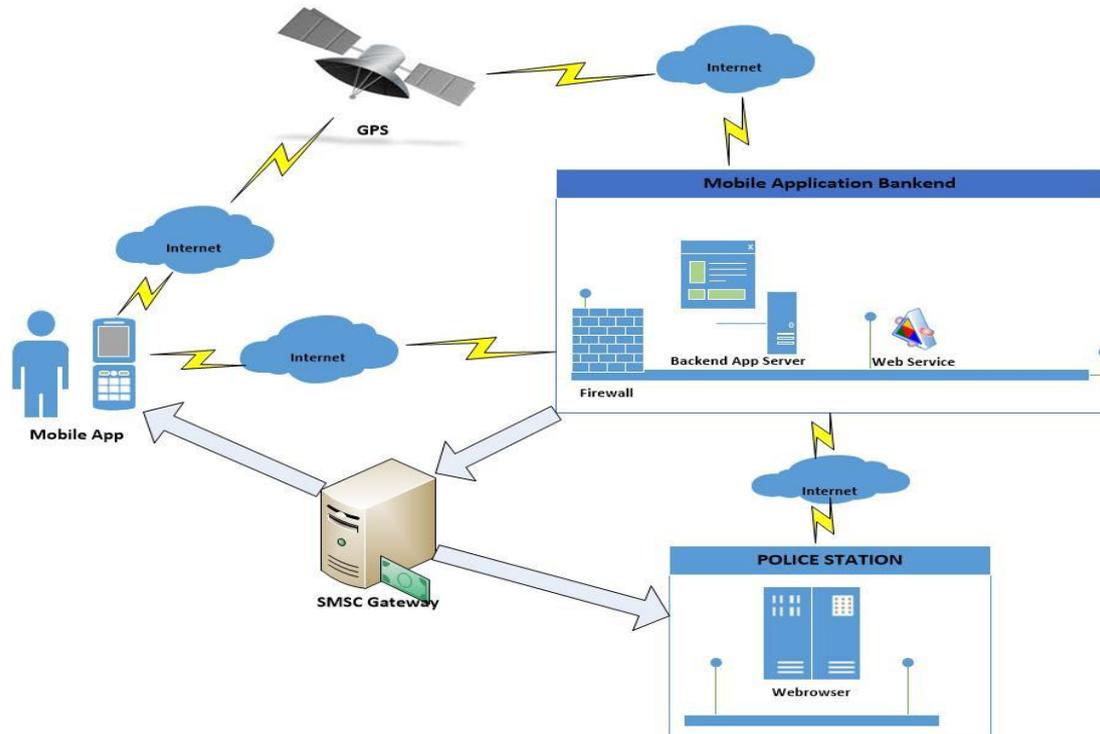


Fig. 1 Mobile Application Architecture

## 4.2.2 Platform User Interaction

The mobile application will enable users to report crimes in two different ways namely;

1. The Normal Way
2. Panic Mode Way

*The Normal Way:* The will able to log in the Mobile App, Select the type of crime they want to report and add a description. The nearest police station will be able to pick it up.

*The Panic Mode:* The user will be able to press a 'Hot Button' on the app and the nearest police will be able to pick the incident report. The user will also be able to view the crimes they reported. For activities that citizens will be able to conduct on the platform, a Use Case will be used. The Use Cases depict the activities that a user will be able to do in the system. Fig 2 shows the citizens use case and they will be able to conduct the following activities in the system.

1. Create an account in the mobile application.
2. Report a crime.
3. View reported crime.

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Fig. 2 Citizen Platform Interaction

The Police will be able to conduct the following activities on the system.

1. View reported crime incidents
2. Assign reported crime incidents
3. Analyse reported crime trends
4. Call crime reporter

The Use Case in Fig 3 depicts these activities

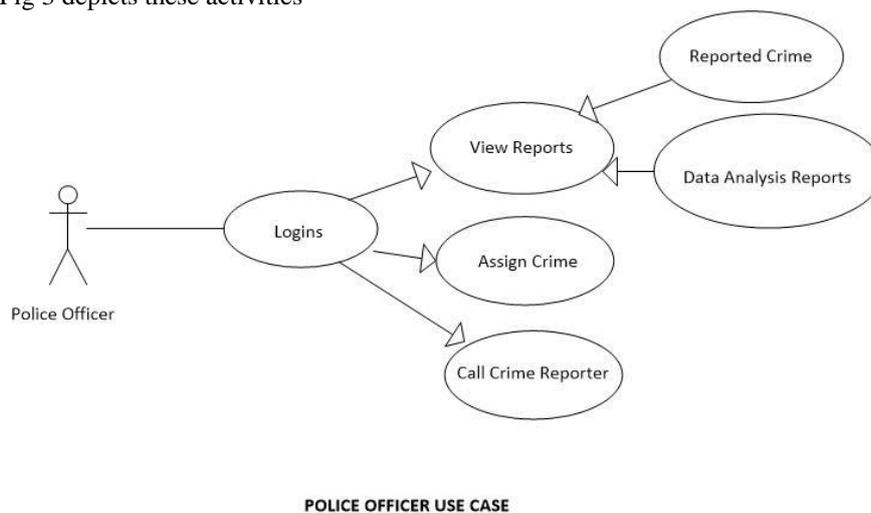


Fig. 3 Police Platform Interaction

### 4.2.3 Mobile Application Sequence Diagram

The sequence diagram below depicts the chain of events in the system. There are two main actors, the citizen and the police officer and their roles and the order of the activities in the system have been defined. Fig 4 below shows the Use Case for the mobile application.

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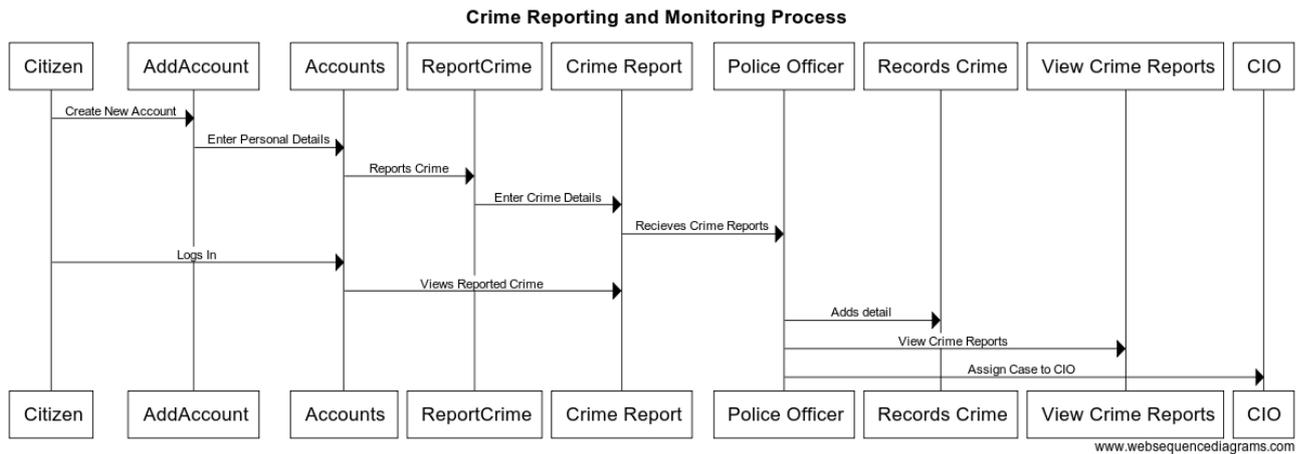


Fig 4 Police Sequence Diagram

## 4.2.4 Entity Relationship Diagram

An Entity Relationship Diagram (ERD) is a graphical representation of an information system which shows the various entities and their attributes. Fig 5 below shows the Entity Relationship Diagram (ERD) of the Mobile Application.

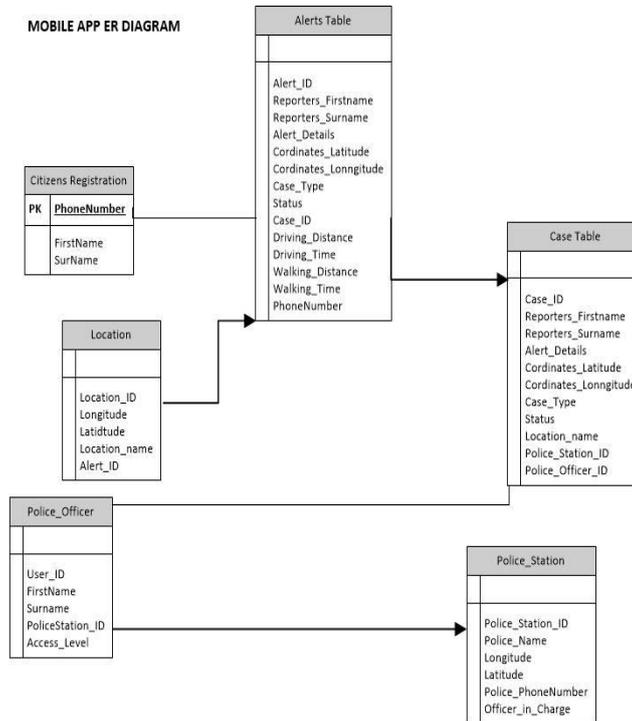


Fig 5 Entity Relationship Diagram

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## IV. RESULTS

This section looks at the results of the survey based on the questionnaires, oral interviews and audio recordings. The results are organised according to various specific areas that the study set out to answer.

### 5.1 Baseline study

#### 5.1.1 Mobile Device Landscape of Lusaka

To fully understand the type and nature of the devices on the ground ,A questionnaire was distributed to residents of densely populated settlements of Lusaka such as John Howard, John Howard, Kabanana, John Leigh, Kalingalinga, Kanyama, Matero, Chawama, Chibolya, Garden Compound .Medium populated areas such as Chelstone ,Kabwata, Kamwala, Libala, Munali, Nyumba Yanga were also part of the study. The low density areas such as Avondale, Ibex, Kabulonga, Makeni, New Kasama and Rhodepark completed the last category of the study.

In terms of the mobile phone technological space, Lusaka has a whole spectrum. Figure 6 below shows the percentages of internet capable phones from the study that was done. 74% of all the phones considered in the study were internet enabled while 26% were not.

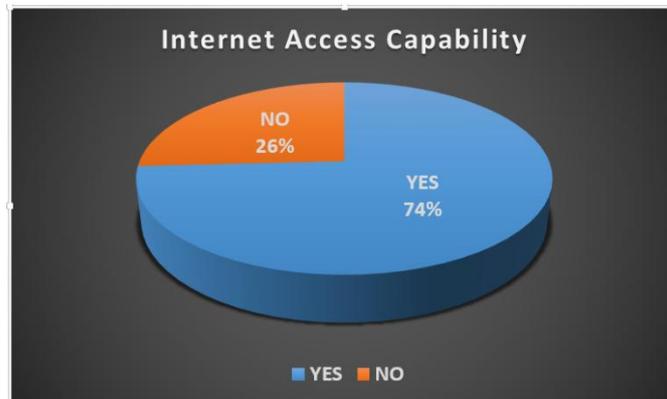


Fig. 6 Mobile Phone Internet Capability

The study also wished to uncover the various operating systems that the mobile devices considered in the survey were running. From the results as shown in Fig 7, 40% of the phones in the study run on android, 24% run of Blackberry IOS, 2% run on windows, 2% run and Apple iOS, 2% run in Symbian and rest which account for about 24% run an unknown operating system.

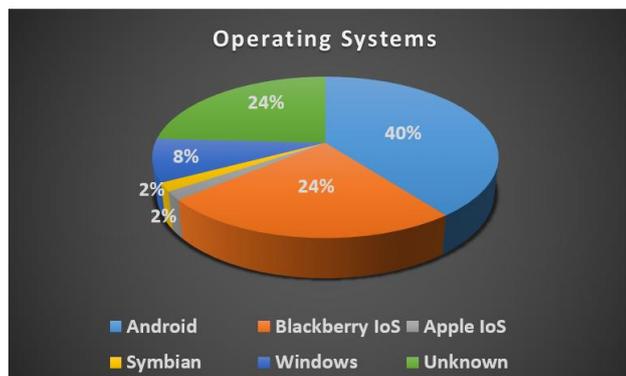


Fig. 7 Device Operating Systems

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From the survey results with regards Lusaka’s mobile devices landscape, it is evident that for any technology solution to be built that should capture a lot of people, that solution has to be web based or be built on Android

### 5.1.2 Ways Citizens Report Crime

The study also looked at ways the residents of Lusaka report crime the police, the objective of this study was to determine the mode of interactions that citizens have with the police. The results show that 68% of the citizens walk to the police station, 30% make phone calls and less than 1% use Short Message Service (SMS). In terms of ICT utilization in crime reporting ,only 32% of the sampled citizens use ICTs. Fig 8 below shows the study results

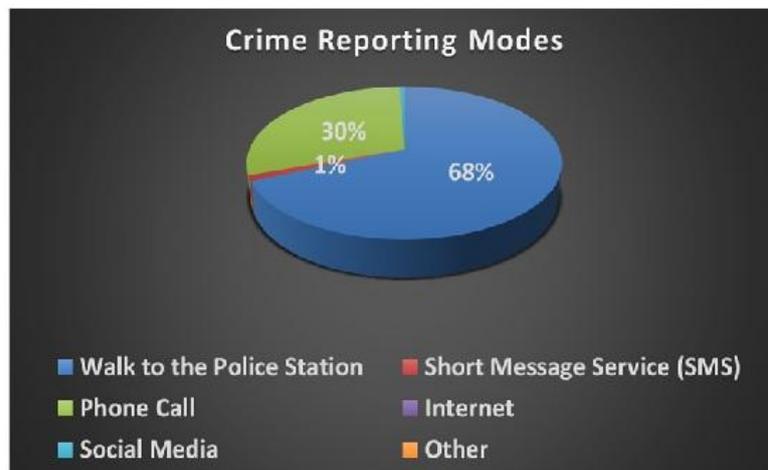


Fig. 8 Lusaka Crime Frequency

### 5.1.3 Ways Police Capture and Record Crime

Crime capturing and recording is one of the most important stages in any crime documentation process. This offers and opportunity for law enforcement officers such as the police to fully document and capture the specifics of the crime. The study results show that 68% of the citizens walk to the police station, 30% make phone calls and less than 1% use Short Message Service (SMS). In terms of ICT utilization in crime reporting ,only 32% of the sampled citizens use ICTs. Fig 9 below shows the pictorial depiction of the results.

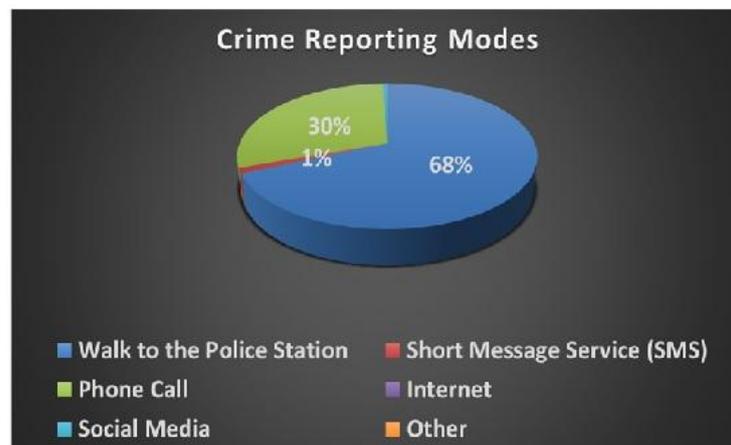


Fig. 9 Ways Police Receive Crime Reports

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The study shows that over 98% of the police respondents use manual processes to record crimes. 67% of all the crime reports are received via citizens walking into the police station. Only 33% of the reports are received via electronic means such as phone calls, SMS, Internet and social media platforms. Fig 10 shows the utilization of ICTs in crime recording process. The results show that 98% of the police use manual processes in the crime recording process and only 2% use electronic means.

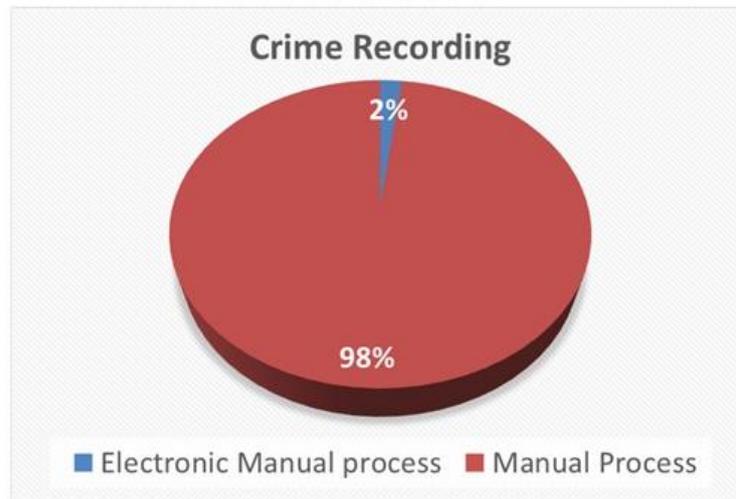


Fig. 10 Crime Recording Process

### 5.1.4 Utilisation of ICTs in Crime Reporting

The study also looked at utilization of ICTs in crime reporting, monitoring and capturing. The study results show that 32% of citizens use ICTs in any form of interaction with the police. In terms of ICT infrastructure, 50% of police stations had computers, scanners and other multimedia devices. With regards to the usage of ICTs in their daily works, only 30% of the police officers use technology in their work in form of video recorders, audio recorders and cameras. Fig 11 below shows the results.

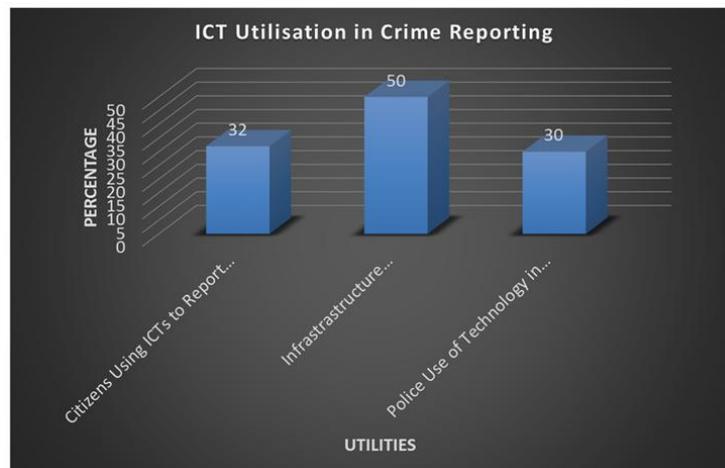


Fig. 11 Utilisation of ICTs in Crime Reporting and Monitoring

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## 5.2 Mobile Application Model Implementation Results

### 5.2.1 Application Front End

Fig 12 below shows the login in screen for the mobile application .This window will allow the citizens to log in and be able to report a crime. This landing screen ensures that the citizen enters s valid phone on which a confirmation SMS will be send to. A valid phone numbers makes it easier for law enforcement officers to call the citizen when a crime is reported.

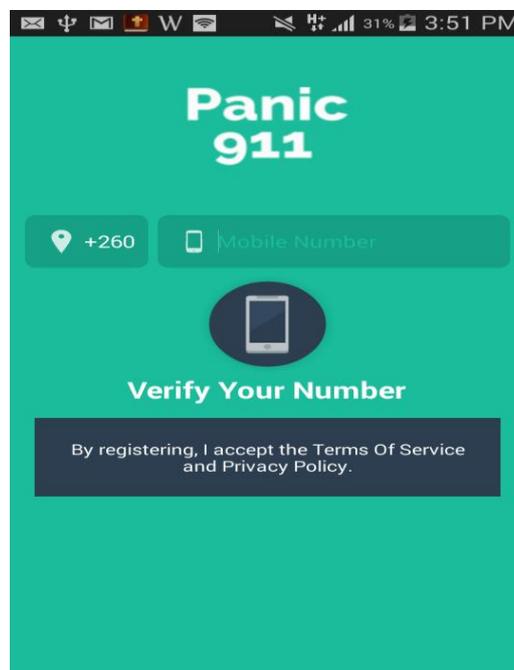


Fig 12 Phone Number Verification Window

Fig 13 below shows the account creation for the mobile application .This window will allow the citizens to enter their details in the mobile application. The registration in the mobile application is a one off process after which the crime reporter just needs to send their crime reports.This registration process is very important as it enables law enforcement officers to identify the crime reporter as soon as they report the crime.It eliminates the identification process which might be difficult to establish in an emergency.

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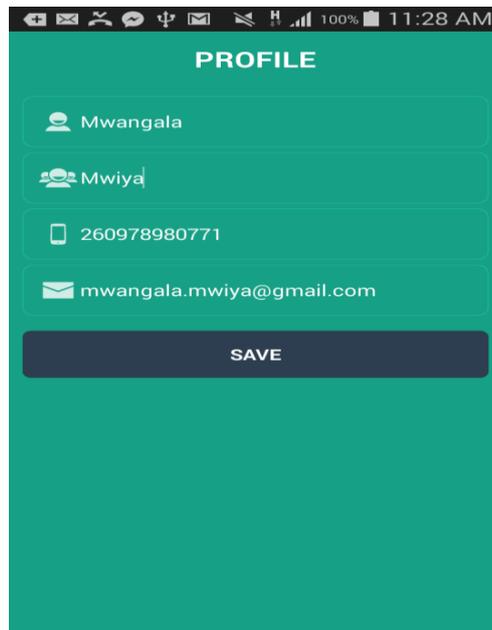


Fig 13 Account Creation Window

Fig 14 below shows the crime reporting window for the mobile application. This window will allow the citizens to select whether they are reporting an emergency crime or a normal crime. In emergency crime reporting, the citizen does not need to enter any details apart from just pressing on the 'Hot Button' called the Emergency Button. In normal crime reporting, the citizen must put a description of the crime and other details they can deem necessary.

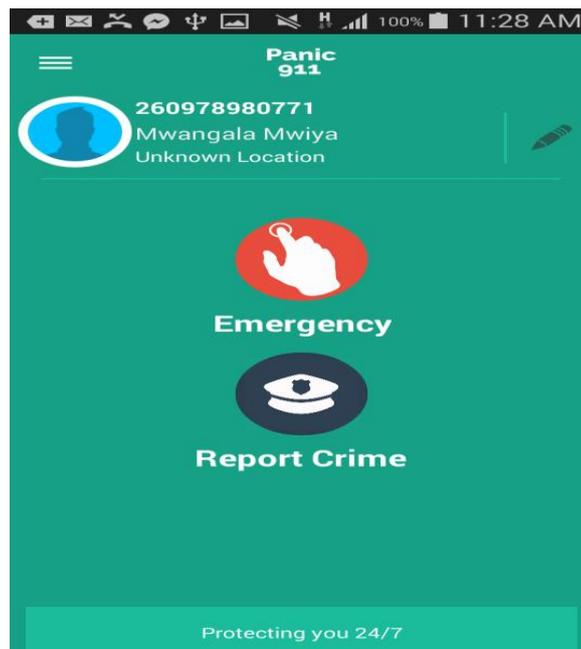


Fig 14 Crime Reporting Window

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Fig 15 below shows the crime reporting window which will allow the citizens to enter crime details of the crime to be reported. This feature will mostly be ideal in non-emergency situation where the reporter's life is not in any danger and they can narrate the crime or give a tip to the police. This functionality will enable law enforcement to have the details of the crime before they reach the crime scene.

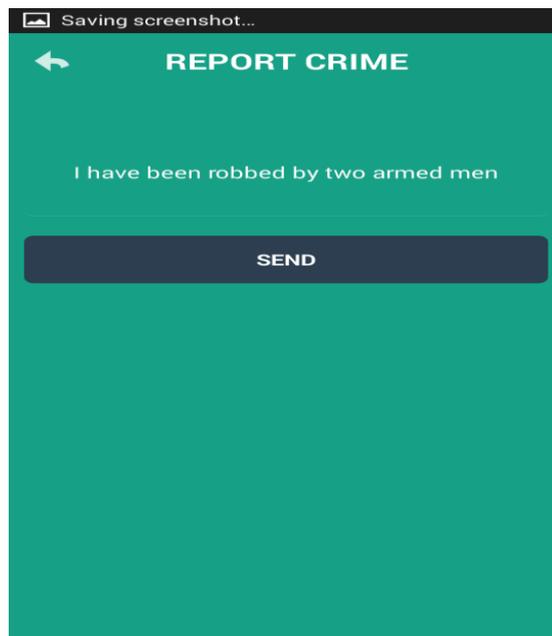


Fig 15 Crime Reporting Window

## 5.2.2 Application Back End

Fig 16 below shows a screenshot for a normal crime report. The normal crime report will have name of the crime reporter, their phone number, the description of the crime, the bearings (location) of where the crime took place from and the location name. The phone number will allow law enforcement to call the crime reporter and the location name will tell where exactly the crime happened.

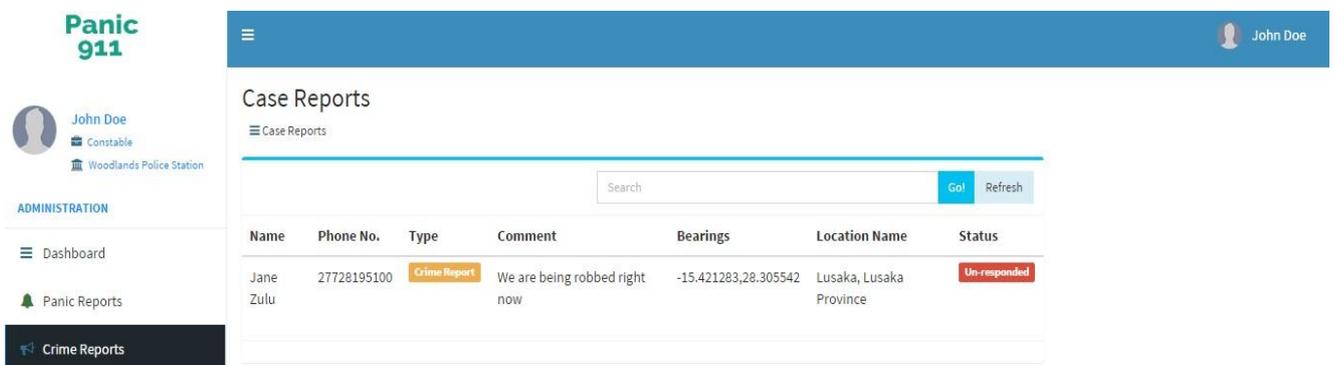


Fig 16 Normal Crime Report

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Fig 17 below shows the location of the person who reported the crime. When a citizen reports a crime, the location of the crime reporter will pop up on as an icon on the google maps. This will enable law enforcement to know exactly the location of the crime reporter. Knowing the location of the crime scene allows law enforcement officers to plan on how they will approach and handle the crime scene.

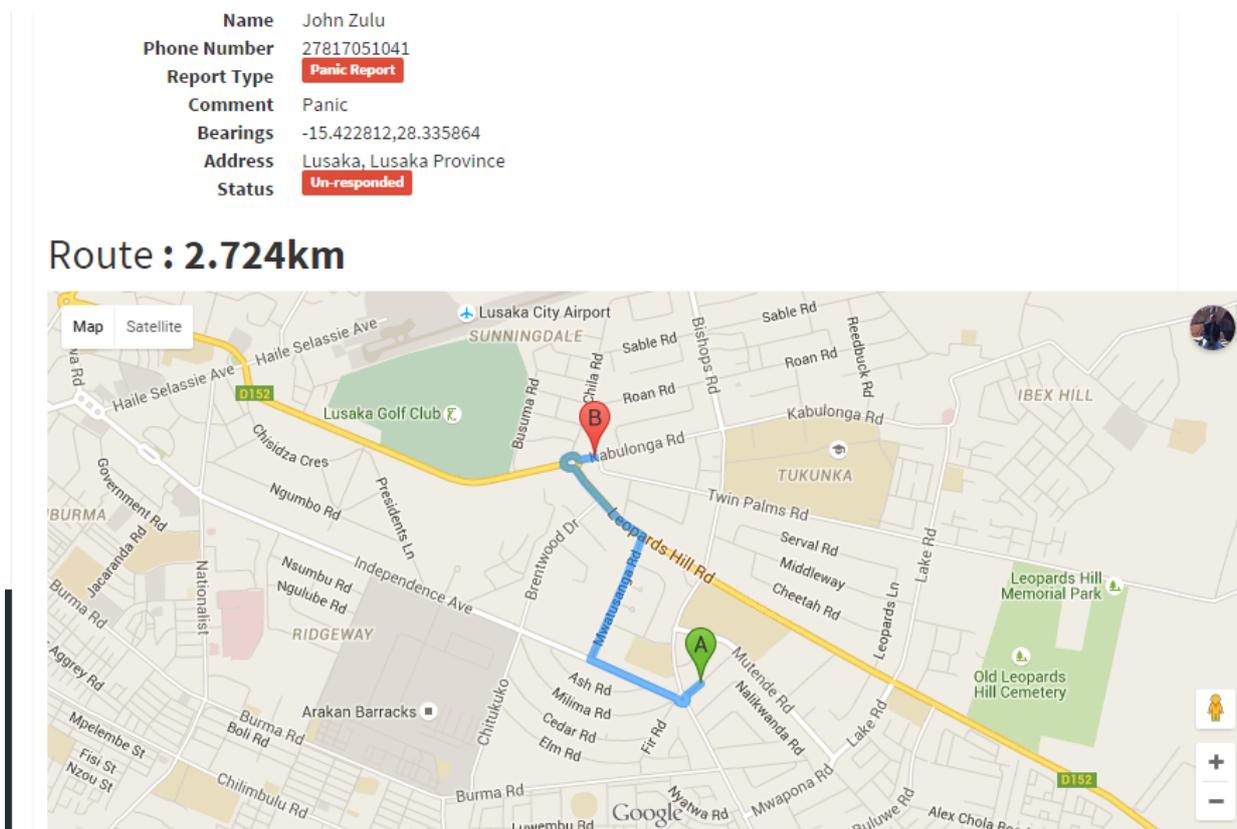


Fig.17 Normal Crime Report

### V. DISCUSSION

From the survey that was also conducted to establish the type of mobile devices on the ground, The results show that 40% of the phones in the study run on android, 24% run of Blackberry IOS, 2% run on windows, 2% run and Apple IOS, 2% run on Symbian and rest which account for about 24% run on an unknown operating system. These results mean that in order to enable us reach most people, any tool to be used to fight crime should be developed in Android. The survey also looked at how many of those phones were internet enabled, the results showed that 74% percentage of the phones are internet enabled and the rest are not. The survey results indicate that most of the phones on the market are internet enabled which allows them to access resources on the internet.

The study also looked at the different ways in which citizen's report crimes, the results show that 68% of the residents have to walk to the police station to report a crime, 30% make phone calls and the rest use other methods such as a texting, social media and internet. This results basically mean that most of the residents have to walk long

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distances sometimes and at awkward hours just to report a crime. This sometimes puts their lives in danger and gives criminals too much lead time before crimes are reported to law enforcement.

The study also aimed at establishing the various ways used by police to capture or receive crime incident reports. From the results of the study, the police receive 68% of crime reports via residents walking in and 30% by phone and 2% by other means. This basically means that most of the crimes reports that police document are done by a person having to walk into the police station. This means that for those that can't make it to the police, their crimes are never reported.

The study also looked at determining the utilization of ICTs in crime reporting. The results show that 32% of citizens use ICTs to report crimes. In terms of ICT infrastructures, 50 % of police stations had computers, scanners and other multimedia devices. ICT utilization in the police service is still quite low, only 30% of the police officers use technology in their work in form of video recorders, audio recorders and cameras.

The Mobile crime reporting too can further be enhanced to enable multimedia attachments and sharing so that the police can have graphic, audio or video evidence of the crime being reported. In order to incorporate multimedia into the mobile app, e need to ensure that the carrier networks are able to transmit that content at acceptable speeds otherwise the whole crime reporting process will be jeopardised.

### VI. CONCLUSION

In this paper, we conducted a study of the mobile devices landscape in Lusaka, Zambia. The study also looked at the crime rates and crime of frequencies in the city. From results, we can deduce that Lusaka is actually a very violent city and its residents are exposed to high levels of crime. Residents experience a lot of challenges with regards reporting of the crime because of the long distances to police stations and the fact that very few citizens even know the phone numbers of police stations and can therefore not contact them in case of an emergency. The other reason is that the Zambia Police toll free lines hardly work and calls made to the toll free number go unanswered. To safeguard people's lives and property, the integration of ICTs in crime reporting and monitoring process is key as this will effectively bridge the communication gap between the police and the general public in fighting crime. The ultimate result of this study is to therefore develop a mobile crime fighting application that will be used for crime reporting and monitoring.

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