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Research Article

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An Intelligent Crime Reporting System: A Proactive Method for Crime Prevention

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Abstract *Purpose:* This paper describes an intelligent crime reporting system that was designed to meet the surveillance and policing needs of the law enforcement agencies.
Design/ Methodology: The structured system analysis and design methodology was adopted as the methodology for designing the application. In designing the Intelligent Crime Reporting System, Flowcharts, Use Case Diagrams and Data Flow Diagrams (DFD) were also employed. The resulting design was implemented using internet programming tools and frameworks such as JavaScript, React, Firebase Real – time Database and Express web server.
Results: The system created, presented a secure platform for informers' data protection during the crime reporting process. The system also integrates geo – location mapping technology for mapping reported crime incidents to the exact location. A functionality test was also carried out on the developed system where some persons posed as informers appraising the system by filling out the electronic questionnaire.
Originality: Numerous crime reporting systems have been designed for varying uses. This system however was specially designed for use within Ebonyi State and had security capabilities inbuilt into its design to protect informers' data. This originality though peculiar to the adopted case study can be used for developing other kinds of applications. The system was designed for law enforcement agencies within Ebonyi State, Nigeria but can be easily adapted for use in other states within Nigeria.
Practical Implications: It can be concluded that the Intelligent Crime Reporting System incorporates all the features of a traditional reporting system but offers an alternative method of reporting crime that is less stressful and with less risk. Hence, recommended for use as a tool for crime analysis, investigation and control.

Keywords Intelligent Crime Reporting, Crime Analysis, Geo–location mapping, Law Enforcement Agencies

1. Introduction

Crime is believed to be an act, default or conduct, prejudicial to the community, the commission which, by law, renders the person responsible to punishment by a fine, imprisonment or other penalty. Crime is a phenomenon which is collective in its anecdotal forms in all cultures and societies, at all stages of organization. It is an act against a person (for example, theft and property damage) and regulation (for example, traffic violations) (Onyewuchi and Eke, 2015). The escalating rate of criminal activities in Nigeria, as reported daily in the media disregards class distinction in the society, as both high (haves) and low (have nots), experienced similar and equal visitation of the hoodlums from time to time. The consequential tragedy, suffering, colossal loss and distress, occasioned by those inimical visits, have been pervasive and had left a negative impression on our

national image and societal tranquility (Balogun *et al.*, 2014). In Nigeria there are rising incidents of armed robbery, assassination and ransom-driven kidnapping, which are now ravaging the polity like a tsunami and spreading fears and anxieties about public safety. This type of crime for decades are traceable to poverty, poor parental upbringing, greed among the youth, get rich quick mentality and inadequate crime control model of national security among other crimes (Dambazau, 2007). Events of past few years show that the spate of crime has assumed an unbearable proportion and requires the intervention of policy makers in this regard. Crime portrays the inability of government to provide a secure and safe environment for lives, properties and the conduct of economic activities. A Third Report on Violence in Nigeria (2006 - 2011) by Nigeria Watch Database noted that the second main cause of violence is crime. This is heavily concentrated in the South, especially in highly populated areas like Lagos and Port Harcourt. Yet the Middle Belt is not immune from armed robbery and banditry, especially in Plateau State, which records higher crime rates (Nigeria Watch, 2011). The statistics on the trend and patterns of violent crimes are alarming and needs urgent attention from a multi-dimensional approach by stakeholders.

Background of Study

Ebonyi State is in southeastern Nigeria. It lays on latitudes 5^0 40 and 6^0 54N, longitudes 7^0 30 and 8^0 30E. It is inhabited and populated primarily by igbo with the city of Abakaliki as its capital and largest city. Other major townships include Afikpo, Onueke, Ezzamgbo, Edda, Effium, Aba Omege, Amasiri, Unwana, Echara Ikwo, Egu – Ubia, Uburu, Onicha etc. There are several igbo dialects spoken in Ebonyi State including Edda, Ehugbo, Unwara, Akpoha, Okposi, Onicha, korri, Effium, and Uburu.

Crime Statistics in Ebonyi State as reported by nigerianstat.gov.ng (2017) include the followings:

- Offences Against Persons - 1,275
- Offences Against Property - 2,787
- Offences Against lawful Authority - 152

Grievous Harm Wounding (690) is the highest Offences against Persons. Theft/ Stealing (1,272) is the highest offences against Property. Gambling (72) is the highest offences against lawful Authority.

Despite the presence of crime reporting systems in most communities in Ebonyi State -Nigeria, some people are still afraid to report crimes, as they fear for their own safety should their identities become known to those they report. The existing system is primarily manual where people need to go to the police station to report crime incidents. The Nigeria Police currently collects crime data with the use of paper – based method called dockets. These so-called 'dockets' are then circulated around to members of the police with the authority to validate the data as well as to make these data forms available to all stake holders. Afterwards, the data is then stored in central filing facility called the Crime Register. The main advantage of paper – based systems is that the forms are easily human auditable. The disadvantages outweigh the advantages. For instance, the need to print the paper forms is a slow, expensive, inflexible, environmentally hostile process. Also, visual impairments, or literacy limitations plus some changes to the crime register are difficult to accommodate amongst others. Over the last few years, a number of crime experts have advocated that law enforcement agencies should introduce an electronic crime reporting (Olajuyigbe *et al*., 2016). A general observation is that as more business is done using electronic media, it should not be difficult to carry out reporting and analysis of crime using electronic platforms rather than using the so-called 'dockets'. Evidently, the phenomenal use of internet as a vehicle for improving communication, access to information and electronic commerce has led to the claim that the internet could be used as either a replacement to manual crime reporting or as an additional crime analyzing option (Igwe and Aderemi, 2019).

Purpose of Study

This paper describes an intelligent crime reporting system that was designed to meet the crime analysis needs of law enforcement agencies, and also tackles the inherent problems of the manual crime reporting system. This

current system – paper – based systems – is characterized by fear, inconveniences, error – prone, delays, lot of paper work and irregularities which plague the system and defeat the whole aim of crime detection and control (Onyewuchi and Eke, 2015). In view of the rapid development of computer technology in virtually all fields of operations and its use in relation to information management, it has become pertinent to look into the development of an intelligent crime reporting system that can achieve the following:

- Provide a user-friendly web based crime reporting system.
- Safeguard data and information in the system.
- Reduce workload in the process of gathering crime information.
- Keep accurate record of crimes.
- Integrate encryption techniques for protecting informers' data
- Integrate a one-time password (OTP) for identity verification.

The objectives of the proposed Intelligent Crime Reporting System is to use information communication technology to simplify the crime analysis process and to:

- Review the existing/ current crime analysis process or approach in Ebonyi State, Nigeria;
- Design an automated crime reporting system that should be able to handle extremely large volumes of data;
- Implement an automated crime reporting system that should support multi – user environment;
- Validates the system to ensure that only legitimate voters are allowed to use the system.

2. Literature Review

The Intelligent Crime Reporting system is made for the informers to be able to report crime anywhere within the state. It is web - based and as such can also be called a Web – based Crime Reporting System. Web– based Crime Reporting systems are appealing for several reasons but mostly because people are generally getting more acquainted with using computers to do all sorts of things, like shopping, electronic transactions etc and it allows people to report crime easily, helping to reduce the rate of delay which affect prompt detection and control of crime which ranks as the highest malady plaguing the policing process all over the world.

Intelligence Reporting

Reporting information about criminal activity, also widely known as reporting intelligence, is key in building cases and convicting criminals. The intelligent crime reporting tool is a smart decision-making system used by the law enforcement agencies. Generally, there are steps following an intelligence report:

Intelligence Report is received; this would usually be via online reporting services; however this could also be via officers and staff on duty or by telephoning.

The information would then be assessed by a trained Intelligence officer; this involves researching the people, location, vehicles involved etc. but also opportunities of threat, risk or harm to the people involved.

The information would then be linked to relevant cases, investigations and people.

The intelligence officers will then look at opportunities to develop the intelligence further or take action, if it is required.

If needed, it will be passed onto relevant people with the research completed.

Types and Variation of Crime Reporting Systems

i) *Intelligent reporting system*: Intelligent reporting system is a mobile system for reporting any cases of insurgency. The system assists law enforcement agencies to trail any case of insurgency attack reported. Igwe and Aderemi (2019) in the paper, 'tackling Boko Haram insurgency through intelligent reporting system', proposed an internet based mobile application that run on Android

platform which makes it easier to report cases of insurgency in Nigeria through chat room with the option of uploading concrete evidence such as images or video.

ii) *ePolicing*: The importance and relevance of an e-policing system in Nigeria cannot be over emphasized as the country is still lacking behind in automating some of its key security system such as E-policing and so on. E-policing system is a boost to the efficiency of crime reporting, with the deployment of an e-policing system, crime reporting becomes easy and faster. Citizens can easily report criminal incidence wherever they are, at any time. For the police, the e-policing system in Nigeria provides an organized record of complaints, criminal data, cases and records that can be easily accessed by the authorities (police force). Also for the police, the e-policing system delivers convenient and cost effective services. The e-policing system provides a platform for affiliations with corporate organizations that are technologically inclined. With the current state of internet availability through mobile networks and phones, citizens in the villages, remote and rural areas can access the internet and report their cases. Most citizens dread the word "police station", so they are unwilling to go to the police station to write statements, this e-police system makes it easy to report cases without visiting the police station (Omoregbe *et al*., 2019).

iii) *Smart Police Application*: The Smart Police Application is created by a Company Called Cyberspace to assist citizens anonymously report cases involving rape, robbery, assault and theft. Users can also interact with the police officers through the application (pulse, 2016).

iv) *Smart Police Station (SPS):* The Smart Police Station is the world's first unmanned autonomous police station providing around – the – clock services (www.dubaipolice.ae).

It strengthens information exchange and crime investigations in the following ways:

- Enable public to track criminal investigations.
- Pay traffic tickets.
- Report lost items or suspicious behaviour.
- Get information on a variety of community services without having to wait in line or take the time to speak to a law enforcement officer.
- It allows citizens to report crime virtually.
- It features private rooms where a person reporting a crime participates in a video call with multilingual police officer that forwards paperwork to the victim to allow them to follow the procedure online.
- It is fully monitored by smart cameras, with touch screens to complete transactions and service centres connected through a screen and smart device to an investigator on duty to receive reports.
- It offers community services to support victims of family violence.
- It is confidential services point where citizens can speak freely with officers through video conference.

Informers' Reporting System

The informers' reporting system is a secure platform for informers' data protection during the crime reporting process. The system integrated geo - location mapping technology for mapping reported crime incidents to the exact location. According to Chukwuemeka (2020), he listed the benefits of the proposed system to include:

- Identity protection to encrypt informers' data during the crime reporting process to prevent unauthorized access.
- Geo- location mapping to locate reported crime incidents on a map.
- Analyze reported crime to reveal the criminals.
- Visualize reported crime scene for possible surveillance and arrest.
- Integration of a one – time password for identity verification.

The Concept of Crime Analysis

In 2014, International Association of Crime Analysts (IACA) in the white paper on the Definition and Types of Crime Analysis, defined crime analysis as a profession and process in which a set of quantitative and qualitative techniques are used to analyze data valuable to police agencies and their communities. It includes the analysis of crime, criminals, crime victims, disorder, quality of life issues, traffic issues and internal police operations

(Akpan and Onu, 2019). Crime Analysis results support criminal investigation, prosecution, patrol activities, crime prevention and reduction strategies, problem solving, and the evaluation of police efforts. Alex and Kate (2001) indicated that crime analysts spend varying percentages of their time on the following types of analysis:

i) Tactical Crime Analysis
ii) Strategic Crime Analysis
iii) Administrative/ Academic Crime Analysis
iv) Operations Crime Analysis
v) Intelligence Crime Analysis
vi) Investigative Crime Analysis

Steps in Crime Analysis

Shiju *et al.* (2014) posited steps as shown in figure 2 for carrying out crime analysis. These steps are as follows:

i) *Data Collection*: In data collection, data is made available by National Crime Bureau of Records. This data is in the form of number of cases recorded all over the nation throughout the year. The data is in unprocessed form and contains some wrong as well as missing values. Hence pre-processing of data is crucial task in order to bring the data in proper and clean form.
ii) *Classification*: The dataset is classified into various groups based on certain characteristics of the data object. Grouping of crimes is done according to states and cities.
iii) *Pattern Identification*: In this phase, proposed system must identify trends and patterns in crime. The result of this phase is the crime pattern for a place. Here corresponding to each location.
iv) *Prediction*: In the prediction phase, corresponding to each place is a model. So, for getting the crime prone areas we pass current date and current attributes into the prediction software. The result is shown using some visualization mechanisms.
v) *Visualisation*: In the visualisation phase, crime prone areas can be graphically represented using a heat map which indicates level of activity, usually darker colours to indicate low activity and brighter colours to indicate high activity.

3. Methodology

The structured system analysis development methodology was used for the development of this application. The structured system analysis development methodology follows the waterfall life cycle model starting from the feasibility study to the physical design stage of development. One of the main features of SSADM is the intensive user involvement in the requirements analysis stage. SSADM breaks up a development project into stages, modules, steps and tasks which helps for easy debugging and modularization.

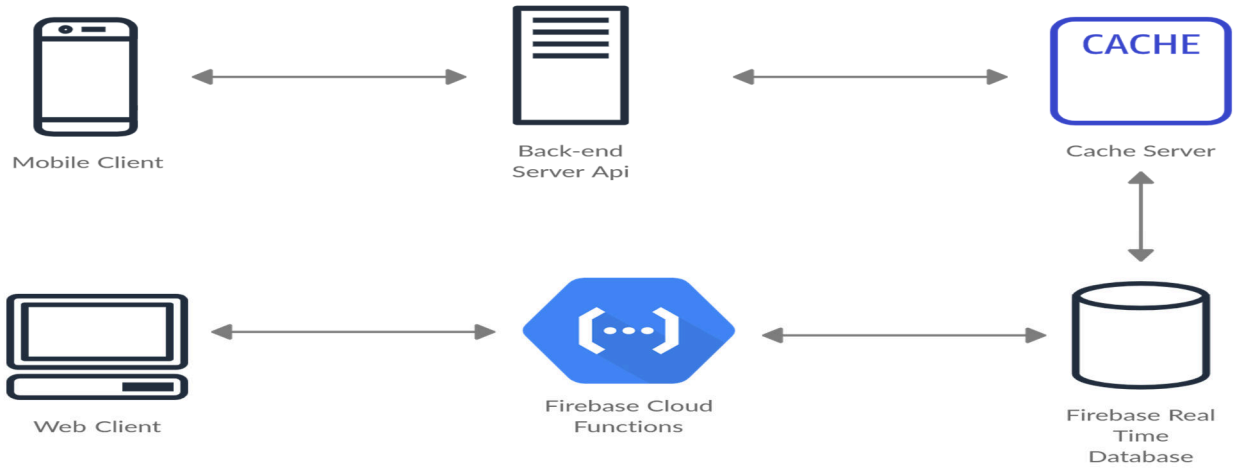

Figure 1: The System architecture of the Intelligent Crime Reporting System

The System architecture of the Intelligent Crime Reporting System

The design of the system is an important aspect of the system to achieve the desired aim and objectives. In view of this, the design provides a blueprint of how the input, processing and output components are progressively integrated.

The system is designed to achieve the following objectives:

- To enable informers' report crime effectively without the fear for their own safety should their identities become known to those they report. This is achieved using identity protection technology where informers' data is encrypted in the database.
- To build a platform that supports geo-location mapping, crime data analysis and visualization

Quick Design and Prototype Building

User Requirements for the Proposed System

The Intelligent Crime Reporting System should:

- Be able to display all crime reported in the database to the Admin.
- Have a user – friendly interface and user guides understandable by people of average computer skills.
- Be robust enough so that users do not corrupt it in the event of voting.
- Be able to handle multiple users at the same time and with the same efficiency.
- Be scalable (for future expansion).

Security Requirements

The security requirements of the system are:

- An individual not created with credentials must not be able to report crime.
- An informer must not be able to erase previously reported crime.
- The privacy of the report has to be guaranteed during the reporting and analysis of crime.
- The identity of the must be protected by the system
- Each report is recorded precisely as the informer intended.
- Each informer is ensured a 'clean slate' of the system to ensure equality and confidence.
- System operations are logged and audited.
- The system cannot be re – configured during operation.

Database Design

The database schema for the proposed solution is represented as the following:

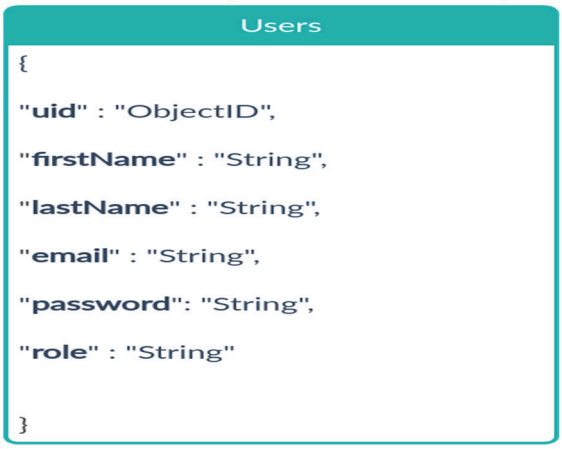

Figure 2: A Schema for Users Collection

Figure 3: A Schema for Crime report Collection

Design Tools

In designing the Intelligent Crime Reporting System, Flowcharts, Use Case Diagrams and Data Flow Diagrams (DFD) were also employed. The resulting design was implemented using internet programming tools and frameworks such as JavaScript, React, Firebase Real – time Database and Express web server.

Use Case Diagram

Below is the use case diagram that describes the system

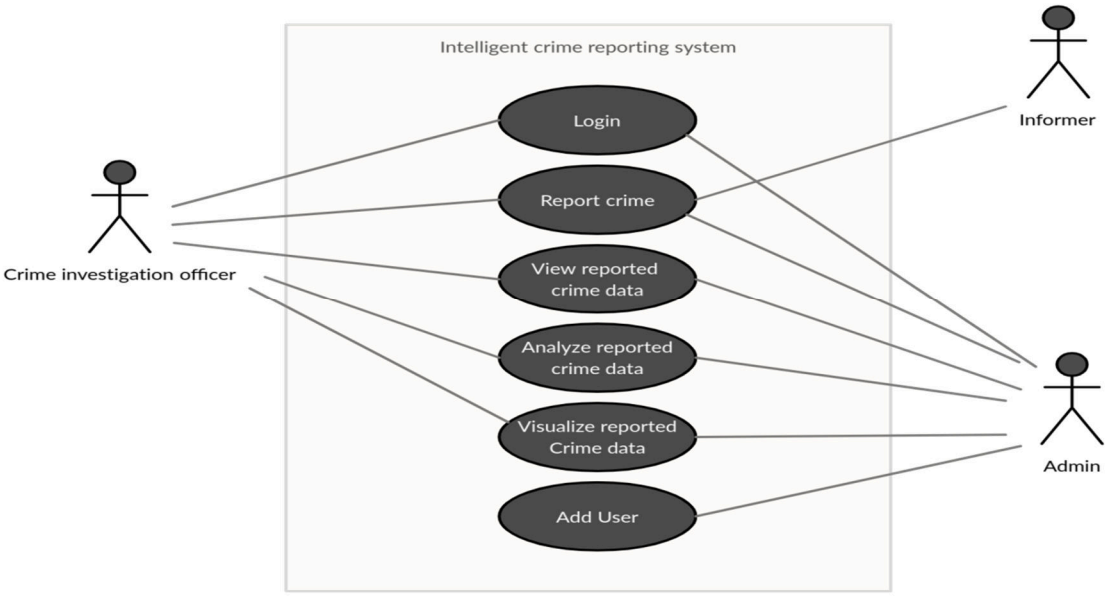

Figure 4: A Use case diagram of the proposed system

Figure 4 is a use case diagram for the proposed crime reporting system. The crime investigation officer in the cause of accessing the system is expected to perform the following activities as specified in figure 4.

- The system verifies the user by authenticating the inputs
- On successful authentication, the crime investigation has the full privilege to report crime, view reported crime data, analyze and visualize reported crime data.

The admin has all privileges to access report crime, view, edit and delete crime data, analyze and visualize reported crime data. While the informer has only one privilege which is to report crime.

Flowchart of informers' reporting crime

The flowchart diagram used for the application is shown in Figure 5.

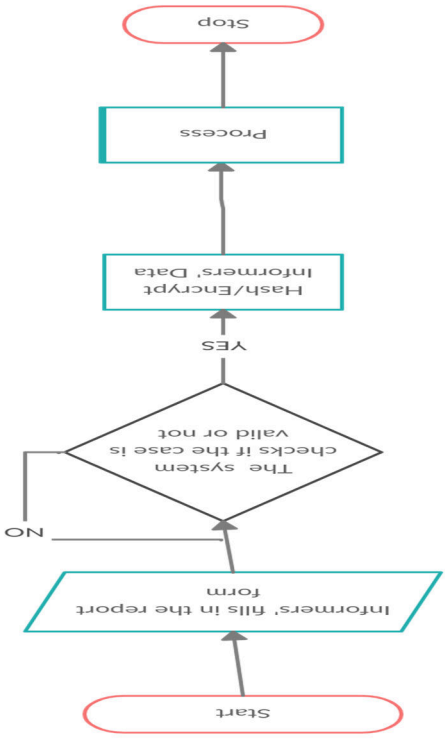

Figure 5: Application Flowchart

4. Results

Implementation of the Proposed System

System implementation is the practice of creating or modifying a system to create a new or replace an existing business process. It consists of converting hardware and files to the new system and also of training the user on how to handle the system. The system was developed as an interactive mechanism between user at the interface and the database using a web – browser. In the database design of the application, the collections are the most important database objects used for storage of information. The built-in procedures are carefully scripted queries intended to accomplish one of these actions Insertion, Update, Delete. As users interact with the application, certain built-in procedures are triggered to effect some specific changes or return some dataset to the client. The progressive component interfaces are built using React and styled using cascading style sheets (CSS) and Bulma. The role access is separated by creating different master pages with appropriate user privileges. A master page is a user view that can be assigned to different users based on their access rights. The master page also ensures that users have a common and consistent view across the application. The analytics functionality of the system is built using D3js where reported crime incidents data is aggregated and parsed to D3js for model analysis and visualization. The server application programming interface (API) is built using express js, redis and firebase functions. The dropdown items across the application are created as setups. The specific category codes and setup names are generated and used for setting up any specific item. E.g. Crime types, Filter etc.

The User Login Page

The user can log into the system by entering email and password in the input fields as shown in figure 6 below. The login interface has an email, password and login button as seen in the figure 6. The login details provided are associated with an admin and an investigation officer. This will enable the system to ensure that authenticated users can only access what he or she is permitted to see. The user enters the email and password, and then clicks on the login button. If the information provided is verified to be successful, then the user is authorized to access the system.

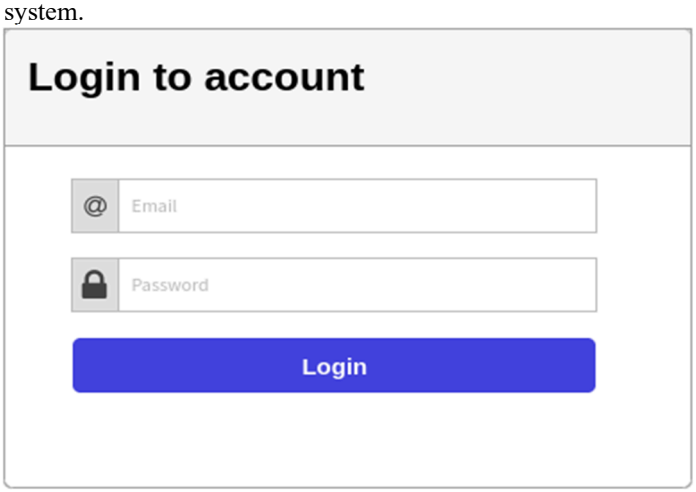

Figure 6: Login for the admin

Dashboard Main Interface

Once the admin officer is authenticated, he will present the dashboard screen (Admin Dashboard Interface) which renders recent reported crime incidents with an action button to view the details of each reported crime incident including the location of the crime incident on a map. If he does not wish to continue, he can exit the application by clicking on the logout button. The Admin interface consists of Navbar Section and Main Body Section. The Navbar Section contains nav menu links such as crime reports, analytics, visualization and authenticated user's name while the Main Body Section contains a table of recent reported crime incidents.

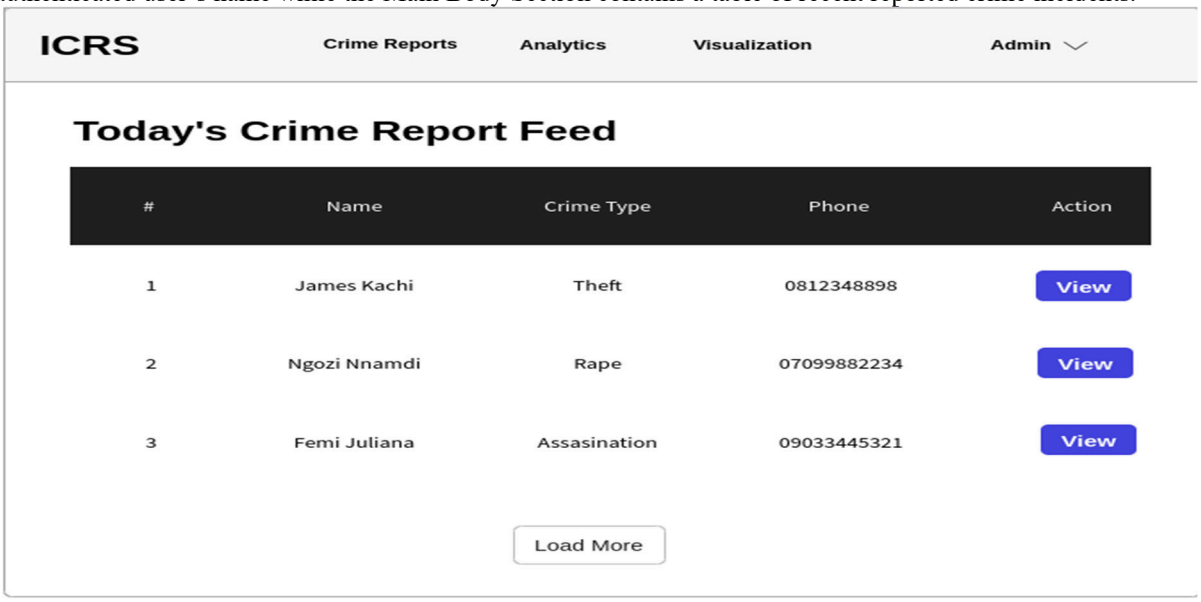

Figure 7: Dashboard Main Interface

Dashboard Crime Report Interface

The informer can fill in the crime report form without the need to login into the system. To report a crime, the informer clicks on the "Report a crime" nav link and fills out the form. When the informer submits the report form, the system encrypts the informers' data to prevent unauthorized users from viewing the informer's data.

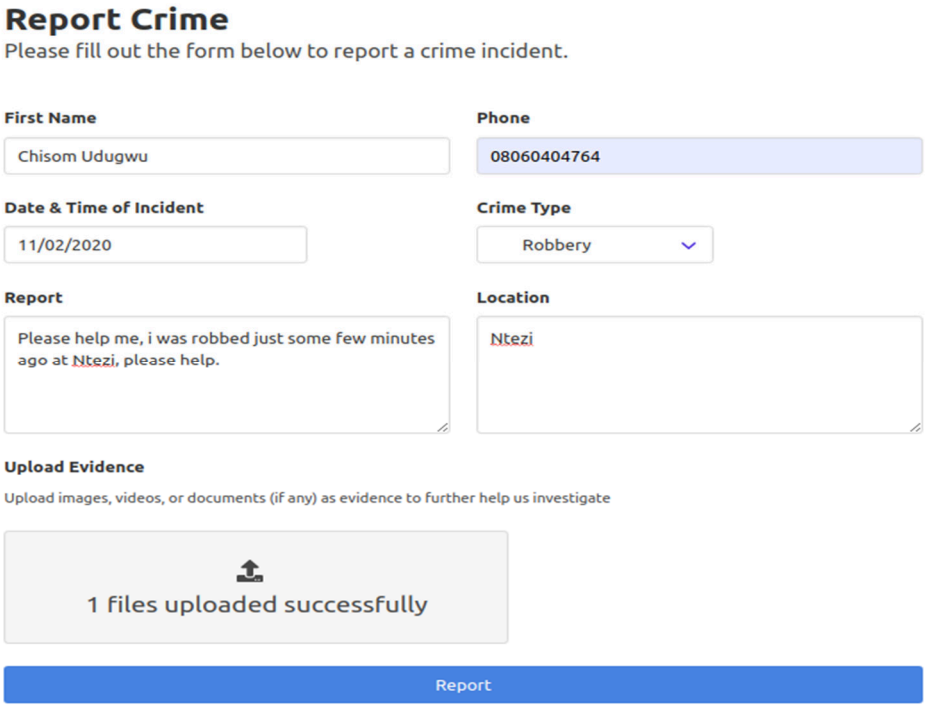

Figure 8: Dashboard crime report interface

Dashboard for Crime Analytics

Figure 9: Dashboard analytics interface

The dashboard analytics section contains a navbar section and a main body section. The main body section consists of a rendered graph analysis of reported crime incidents data and a filter dropdown widget to sort reported crime incidents by last 24 hours, last 7 days and all time.

Dashboard for Visualization

The dashboard visualization interface consists of a navbar section and a main body section. The main body section consists of rendered visualizations of reported crime incidents data and a filter dropdown widget to sort reported crime incidents by last 24 hours, last 7 days and all time.

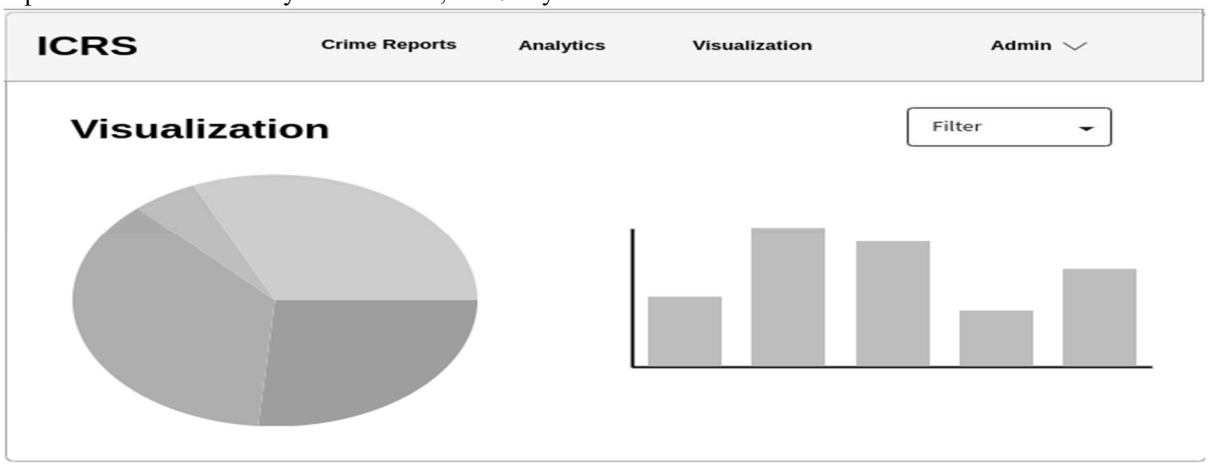

Figure 10: Visualization interface

Dashboard for Profile settings

The profile settings interface consists of a navbar section and a main body section. The main body section consists of a profile form which contains input fields for first name, phone, email and role of authenticated user.

Figure 11: Dashboard for profile settings interface

Add User Interface

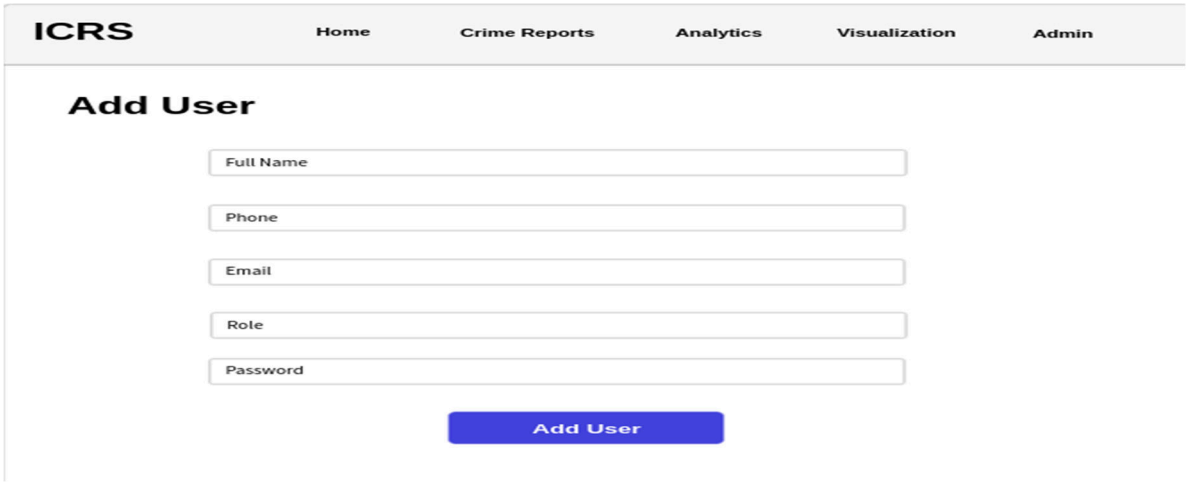

Figure 12: Dashboard for add user interface

Subsystem / Program modules design

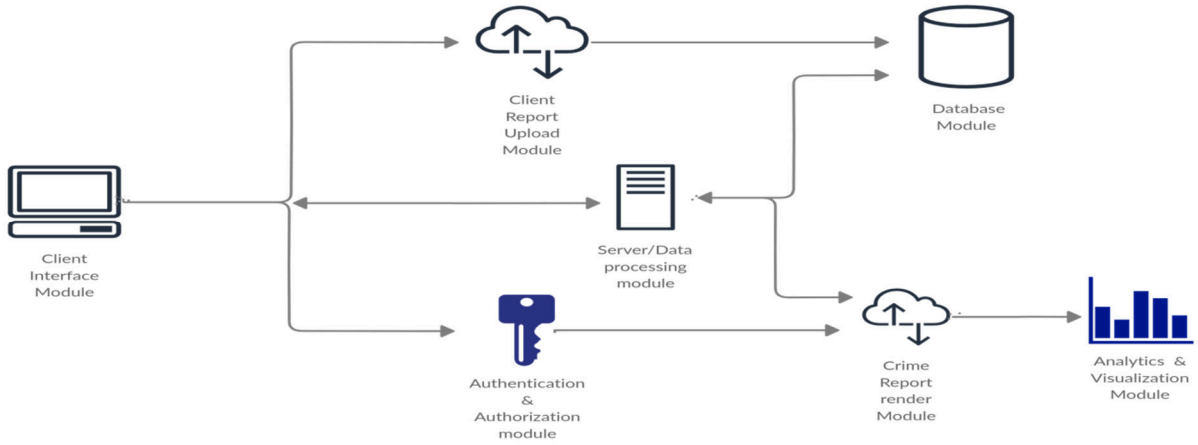

Figure 13: Subsystem / Program modules design

Subsystems/Modules Implementation

Client Interface Module

The client interface module contains visual elements or widgets which enables the user to easily interact with the application. The client interface module is built with front-end web development languages and frameworks like HTML, CSS, Javascript and React. The client module consists of several progressive components built independently to communicate with each other via a communication service called props.

Client Report Upload Module

The client report upload module contains several front-end components (File upload, form and button widget) which communicate with each other to enable the user upload files and report crime incidents.

Database Module

This module comprises all the essential services required to store, retrieve and manage data from the database. It includes middleware, Database management systems (DBMS), queries and Database models.

Authentication and Authorization Module

Authentication is the process of recognizing a user's identity. It is the mechanism of associating an incoming request with a set of identifying credentials. The credentials provided are compared to those on a file in a database of the authorized user's information on a local operating system or within an authentication server.

This module handles all the components required for authenticating and authorizing users.

Server Processing Module

The server contains all necessary components or modules required for handling, processing and parsing HTTP requests from client to return response. It handles data formatting, optimizations and error checking of incoming requests.

Crime Report Render Module

This module handles all the requests from the client to fetch reported crime data from the database via the server, parse it and render it to the client.

Analytics and Visualization Module

Visualization is nothing, but representing data in a visual form, while Data analytics is the method of examining data sets (structured or unstructured) in order to get useful insights to draw conclusions about the datasets. The analytics and visualization modules render visual representation of reported crime data by occurrence.

User Training and Awareness

The User Training Guide was developed to create awareness and to educate the users on the functionality of the system.

System Testing

System testing is an essential step for the development of a reliable and error free system in a software development project. Errors can be introduced at any stage during the development phase. Each phase has its own technique for the detection and correction of errors in that phase. However, some requirements and design errors are still likely to remain undetected. Ultimately these errors will be reflected in the code. Since the code is the only product that can be executed and whose actual behaviour can be observed. Testing is the process of detecting and correcting as many errors as possible in the developed software before deployment.

Test Result

This is the result obtained after testing the system with the test plan and test data. During the testing, the actual and expected results were compared to ensure they produced the same result or if there is a difference, it should be slight and negligible. Hence the result:

Test Conducted	Expected Result	Actual Result
Admin Login to the system	Authorized and validated user should be granted access to the system	Authorized user was validated and granted access to the system
Admin create new user	New user login credentials and profile is generated	New user login credentials was successfully generated
User report crime	User fills in report crime details and report is created	User fills in report crime details in report crime form and report is created successfully
Data Analytics and Visualization	Data analytics and visualization module fetches reported crime data, analyse it and visualize it	Data analytics and visualization module fetched reported crime data, analyzed and visualized it

System Evaluation

The system was hosted and evaluated by 10 registered informers. The basic test was a functionality test. Informers were made to use the system and to fill some questionnaires that contained questions used as test cases. A few of the responses were analyzed using SPSS.

Security Features Built – in in the System

The following security features were built into the system:

- A User not registered on the system is not able to report crime.
- A user is authenticated using email and password. These features are another good security feature for checking all unauthorized attempts.
- Authentication of session and session timeout has been provided to prevent session hijacking.
- One – time password for identity verification.

Encryption techniques for protecting informers' data.

5. Conclusion and Recommendations

Despite the presence of an existing crime reporting system, some people are still afraid to report crimes, as they fear for their own safety should their identities become known to those they report. This results in an environment in which it is difficult to detect and control crime.

In order to address this problem, this paper has come to propose an intelligent crime reporting system with identity protection. The system not only addresses the concern that an informer's identity may be revealed, but in doing so unites communities in combating crime. The proposed system combines encryption and decryption technology to hash informers' data during the crime reporting process. Thus it is able to verify informer identities, prevent the exposure of those identities, as well as preventing reports being erased. The proposed system addresses all the security requirements to allow the reporting of crimes, while ensuring informers' safety, security, anonymity and convenience.

Furthermore, the proposed system integrates a geo-location technology to enable law enforcement agencies to locate reported crime incidents easily and effectively.

Recommendations

The following are recommendations based on this study presented in this section for consideration by system developers.

Provide for transparent auditing and certification

Intelligent Crime Reporting System should be certified by an independent agency and audits should be conducted throughout the process to allow independent confirmation of the results produced.

Certification and audits are important confidence – building measures and should be transparent, allowing stakeholder's access to related procedures and documentation.

Get Key stakeholders to buy in

Intelligent Crime Reporting System is a trade – off of advantages and disadvantages. So, make sure that there is wide agreement among stakeholders, that this technology is advantageous.

Be aware that significant opponents of the system can and will come up with objections, and the weaknesses of the system can create distrust in the system and potentially in the entire justice system.

Plan for training and professional development

Well – informed law enforcement personnel will not only find it easier to use the system for crime analysis; they will also find it easier to trust a new system if they understand why it is being introduced, what benefits it brings and various security measures that are built to support the integrity of the criminal justice system.

Infrastructural Review

The standards of ICT infrastructure in schools and the country at large should be reviewed and developed.

Use of Biometrics

There should be use of biometrics capturing devices, which will serve as a means of voter's authentication. There should also be adequate and proper public enlightenment before the system is fully implemented.

Further Study

An integrated Crime reporting system that incorporates suspects' Bank Verification Number (BVN) is proposed for enhanced crime reporting. The use of Biometrics (Finger print and Facial Recognition) and CAPTCHA could also be incorporated into the system in future to enhance the security strength.

References

[1]. Onyewuchi, C. N. and Eke, B.O. (2015). Developing a Crime Mapping GIS System for Law Enforcement: A Case Study of Owerri Metropolis, Nigeria. *International Journal of Computer Applications Technology and Research, 4(4),* 240 - 245, ISSN: 2319 – 8656.

[2]. Balogun, T. F., Okeke, H., and Chukwukere, C. I., (2014) Crime Mapping in Nigeria Using GIS. *Journal of Geographic Information System, 6(5),* 453-466.

[3]. Dambazau, A.B (2007). Criminology and Criminal Justice (2nd ed.). Ibadan: University Press.

[4]. Nigeria Watch (2014). Fourth Report on Violence in Nigeria (2006–2014). Retrieved from https://www.nigerianstat.gov.ng

[5]. Olajuyigbe, A, Omole, K., Bayode, T. and Adenigba, A. (2016). Crime Mapping and Analysis in the Core Area of Akure, Nigeria. *Journal of Remote Sensing and GIS, 5(4)*, 178- 182. doi: 10.4172/2469 – 4134.1000178.

[6]. Igwe, J.S. and Aderemi, D.O (2019). Tackling Boko Haram Insurgency through Intelligent Reporting System. The *Journal of Nigerian Computer Society, Vol. 26, No.1*, 149 – 158.

[7]. Omoregbe N., Misra S., Maskeliunas R., Damasevicius R., Falade A., Adewumi A. (2019) Design and Implementation of an E-Policing System to Report Crimes in Nigeria. In: Shukla R.K., Agrawal J., Sharma S., Singh Tomer G. (eds) Data, Engineering and Applications. Springer, Singapore. https://doi.org/10.1007/978-981-13-6351-1_21

[8]. Chukwuemeka, W. (2020). Intelligent Crime Reporting System. Unpublished B.sc Research Project submitted to the Department of Computer Science and Mathematics, Evangel University, Akaeze, Nigeria.

[9]. International Association of Crime Analysts (2014). Definition and Types of Crime Analysis Standards, Methods and Technology (SMT) Committee [White Paper 2014 - 02], Overland Park, KS.

[10]. Abasiama, G.A and Fergus, U. O. (2019). Crime Mapping Software: A tool for Effective Crime Detection and Control in Nigeria. International Journal of Research, Volume 06 Issue 10, 1269 - 1279.

[11]. Alex, H. and Kate, B. (2001). Mapping and Analysis Crime Data (2nd ed.). London: Taylor and Francis Publishing.

[12]. Shiju, S., Devan M.S., Surya Gangadharan. S., and Amrita, V.V. (2014). Crime Analysis and Prediction Using Data Mining. 8(4), 227 – 387.