A Model of a Collaborative Crime Handling for Law Enforcement Agencies

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ABSTRACT

Crime as a threat to any nation affects development and reduces quality of life. Security agencies are threatened with challenges that negatively impact their crime fighting capabilities especially in the developing nations. This paper presents a real-time collaborative crime handling model to assist LEAs on crime management. The quantitative method was adopted and a hybrid database architecture was used to design the model for the Police, Custom services and NDLEA in Nigeria. These agencies were integrated with a middleware application developed. A mobile phone emulator was developed for crime reporting. Data exchange was achieved using HTTP and XML web services. Object oriented method was adopted in the analysis and design of the proposed system. AJAX, CSS, PHP, Web2.0 HTML5, and JavaScript, were programming tools, one-time-password as second level user authentication and biometric for criminal's authentication. The system demonstrated how collaboration will enhance the law enforcement agencies' productivity and improves public safety.

Keywords: Model; Integrated System; Middleware; Crime; Law Enforcement A

INTRODUCTION

Information technology adoption allows effective performance of numerous life activities including governance, businesses, crime prevention and control (Onunga, 2021; Mulauzi, 2020; Addo & Agyepong, 2020; Ahmad et al, 2022). Crime is an omission of an act, which is forbidden and punishable by law (Nnadimma, 2018; Ganiron et al, 2019; Oyelade, 2019). Criminality is a hazard to social security, political and economic, of any nation (Martinu & McEwen, 2018; Rout, 2022; Tyagi & Sharma, 2020), and a one of the main cause of underdevelopment (Etim & Nwagboso, 2019; Anthony 2013; Kishor & Prasannakumar, 2016). The increasing rate of crime is caused by over population, unemployment, illiteracy, economic recession, and lack of modern technological tools in the police force (Dereje & Nixon, 2020). Thus, the predominance of criminality in the world of today demands for a proactive attention (Priya et al, 2019), and the degree at which a society manages crime centres on how efficient Law Enforcement agency (LEA) operates. LEA are responsible for statutorily protecting public officials, public facilities and infrastructure, maintain order and provide public safety (Yunus, 2015; Abomaye-Nimenibo et al, 2020), and hence, deserves maximum attention by any nation (Tafa, 2006).

Numerous approaches have been employed by Nigerian Government to control or prevent criminality including instituting security agencies (Anthony 2013), support of vigilante groups for community crime control (Nwaeze, 2010) and hitherto, criminality is still on the relentless rise. This is because crime has shifted from the traditional method of operation to digital realm society (Tombul & Cakar, 2015). Some challenges negatively affect the effective operation of the Nigerian LEAs comprising lack of integrated systems for

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collaboration, ineffective method of crime data capture (manual), delay in information dissemination, and lack of functional databases for proper crime management. Modern Technology tools e.g. Internet, smart mobile phones, cybercrime, etc. are

now key components of most, if not all, criminal activities carried out by criminal groups in our society (Ganiron et al, 2019). Therefore, the research aims at designing and developing a Real-time Collaborative Crime Model (RCCM) for an effective crime management for the Nigerian LEAs. This RCCM was developed based on the current structure of the Nigeria LEA, with emphasis on the Nigeria Custom services, Nigeria Police Force, National Drug Law Enforcement Agency. Currently, information integration is not just about building and merging massive databases to a single system, rather, integration also include having access to information from distinct, personalised databases and its display in a uniform format (Washington's State-wide, 2009). LG CNS Police Integrated Information System, 2003, observed that there are three reasons for an integrated crime system including shortened response time to crime incident; timely arrest and enhanced crime control, and increased quality of the agencies' productivity. Available information shows that integration has played a vital role to effectively manage crime in developed countries, thus, Nigeria and other developing nations must accept it as a strategy in the jobs of LEAs to enhance the security standard of the country.

REVIEW OF LITERATURE

Available literature shows that many dissimilar systems such as banking system (Razis & Mitropoulos, 2022), educational system, healthcare, criminal justice system, etc. have been effectively integrated to enable collaboration information sharing for better output and effective decision-making. Two most popularly used database architectures that support system integration were explained in [Newton and Sergey 2007], [Illinois Criminal Justice information authority Information 2011] and it includes distributed model and the centralised. The distributed model enables information sharing amongst heterogeneous systems using middleware software while centralized is designed to allow all agencies to store their data on one computer. In this study, the author reviewed some existing integrated criminal justice systems in developed countries including:

Colorado Integrated Criminal Justice Information System (CICJIS) (Holmes et al. 2001). Here, a distributed database design was used and a middleware technology to integrate the information systems of five participating agencies (Kaz, 2006) was adopted. CICJIS was designed to handle event-driven transfers, queries between systems, and data extracts for decision support and public access (Holmes & Robert, 2001; Illinois Criminal Justice information authority Information, 2011). The system receives data entered by the originating agency and automatically updates the systems as a case moves from one agency level to another.

Nebraska Criminal Justice Information System (NCJIS) (Nebraska Strategic Plan, 1997) is a distributed system that provides a just-in-time access to complete, secured, and correct information in Nebraska criminal justice system (Nebraska Strategic Plan: State of Nebraska Criminal Justice Information System, 2000).

The National Crime Information Centre (NCIC) serves as a centralized database for criminal justice information in the United States. It operates in conjunction with state-based systems, linked securely through the National Law Enforcement Telecommunications System. Managed by the Federal Bureau of Investigation's Division of Criminal Justice Information Services since 1967, the NCIC plays a vital role in facilitating the seamless exchange of information within the criminal justice community. The database encompasses two primary record categories: property records and personal records. (Department of Justice, 2006; Ioimo & Ralph, 2016; National Crime Information Centre, 2008).

In the same vein, the Kentucky Unified Criminal Justice Information System (KUCJIS) has embraced a hybrid approach, featuring a centralized database to facilitate seamless sharing of information across agencies and a middleware for efficient data exchange. At the heart of Kentucky's criminal records management system (RMS) lies the Kentucky Information and Intelligence Fusion Centre. This central database serves as a valuable resource for inquiry, reporting, and data analysis, while also functioning as a reliable data backup from which interested agencies can access crucial information. (Illinois Criminal Justice information authority Information, 2011, and State of Kansas Criminal Justice Information System, 2009;).

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The European Criminal Records Information System (ECRIS) employs a distributed database design to facilitate the exchange of criminal conviction information among the 27 EU countries (Brussels: Council of the European Union, 2011). To ensure secure communication, ECRIS utilizes the Secure Trans-European Services network known as S-TESTA, which employs encryption measures. Additionally, an interconnection software enables seamless data exchange between the criminal record databases of Member States (House of Commons London, 2008; Catalogue, 2011). The control of these databases is vested in the Central authorities of the respective Member States. This integrated system facilitates the flow of crime information from Law Enforcement, Prosecutors, Courts, and Correctional agencies, as needed for each case. Whenever a crime is reported to any agency, the case is handled, updated, and forwarded to the appropriate next agency until it reaches a resolution within the justice system. As a result, the criminal justice systems benefit from timely access to relevant information, electronic sharing of crime data, effective arrest procedures, crime prevention measures, and increased productivity. The proposed model empowers both the public and Law Enforcement Agencies (LEAs) to combat crime through instant access to information and seamless crime information handling.

METHODOLOGY

The study employed a quantitative research method and utilized a combination of distributed and centralized design tools for three key agencies: Police, Customs, and NDLEA. Information sharing in the distributed systems was facilitated through a middleware application. The central database was responsible for data analysis and backup, while the distributed repository allowed each agency to maintain full independence over their data. For ease of access, a mobile application was implemented to retrieve area codes and report crimes.

The analysis phase adopted the Object-Oriented Analysis and Design Methodology, utilizing Unified Modeling Language as a tool. To implement the ICIS, a mix of technologies including PHP, HTML5, CSS, JavaScript, AJAX, and Web 2.0 were employed. Data exchange relied on Hypertext Transfer Protocol (HTTP) and Extended Markup Language (XML) web services. In the database, multiple tables were designed using SQLyog managed by MySQL.

The application featured several input and output designs. To ensure security, a one-time-password concept was implemented as a second-level authentication method to grant access to authorized users. For criminal authentication, biometric technology was employed.

System Architecture

The system was designed using 3 tier architecture as highlighted in Figure 1.

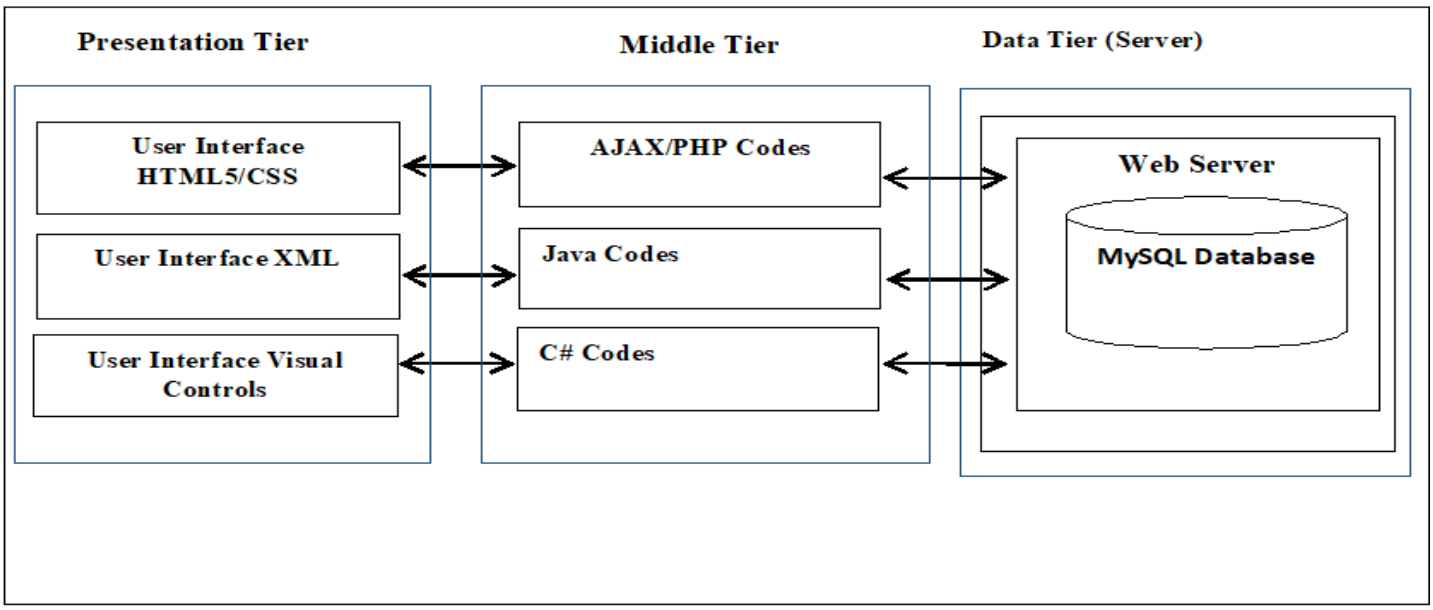

Figure 1. System Architecture

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue III March 2025

The Proposed Integrated Crime Information Model

Figure 2 illustrates the proposed model of the integrated system, which comprises various components. An informant initiates crime reporting through SMS, using an Android mobile phone equipped with a crime reporting application. The application ensures the crime information is directed to the appropriate agency among the three agencies involved: Police, NDLEA, and Nigeria Custom Services, each operating at local, state, and federal levels. To facilitate seamless data exchange between the agencies, a middleware is employed. Individual agencies maintain their own databases, while a centralized database serves as a repository for all generated data. Internet connectivity enables efficient communication, and bidirectional arrows depict the flow of information.

The crime reporting process is as follows: When an informant detects a crime, they send a message in the format 'area code * crime type * crime detail', with the area code uniquely identifying the reporting location (refer to Table 1 for examples). The crime type specifies the nature of the crime, such as car theft, rape, or drug trafficking, while the crime detail provides a brief description of the incident. Sample messages using the mobile app are shown in Table 2.

Upon receiving a crime report at the local level of any of the Law Enforcement Agencies (LEAs) via SMS, the mobile application automatically identifies the crime type and directs the information to the relevant agency. For instance, if the crime type is 'car theft,' the application routes the report to the Police. At the local level, the agency assesses whether the case falls within its jurisdiction. If so, the agency proceeds with the investigation and handling of the case, ultimately resolving it within the Comprehensive Criminal History Information System (CCHIS). If the case is beyond the local agency's capacity, it is forwarded to the higher level (state level), and if necessary, from the state level to the federal level.

Throughout this process, all relevant information is automatically stored in both the agency's individual database and the centralized database. Biometrics (fingerprint) technology is utilized to prevent redundancy in capturing existing criminals' data. The criminal record repository allows LEAs and legislative bodies to access statistics on the percentage of cases prosecuted or handled among all reported criminal cases within a specified timeframe. Due to space constraints, the model algorithm cannot be included in this paper.

Table 1. First Five Enugu State LGA Area Codes

#	LGA	Code
1	Aninri	1401
2	Awgu	1402
3	Enugu-East	1403
4	Enugu-North	1404
5	Enugu-South	1405
6	Ezeagu	1406

Table 2. Sample Informant Crime Report

Message	Short Code
1413*Car theft* a Toyota car was snatched from Mr. Obi inside UNN campus around 2pm	1112
1413*robbery*armed robbers are in Mr. Okeke’s house now at No 10 Odenigbo road.	1112

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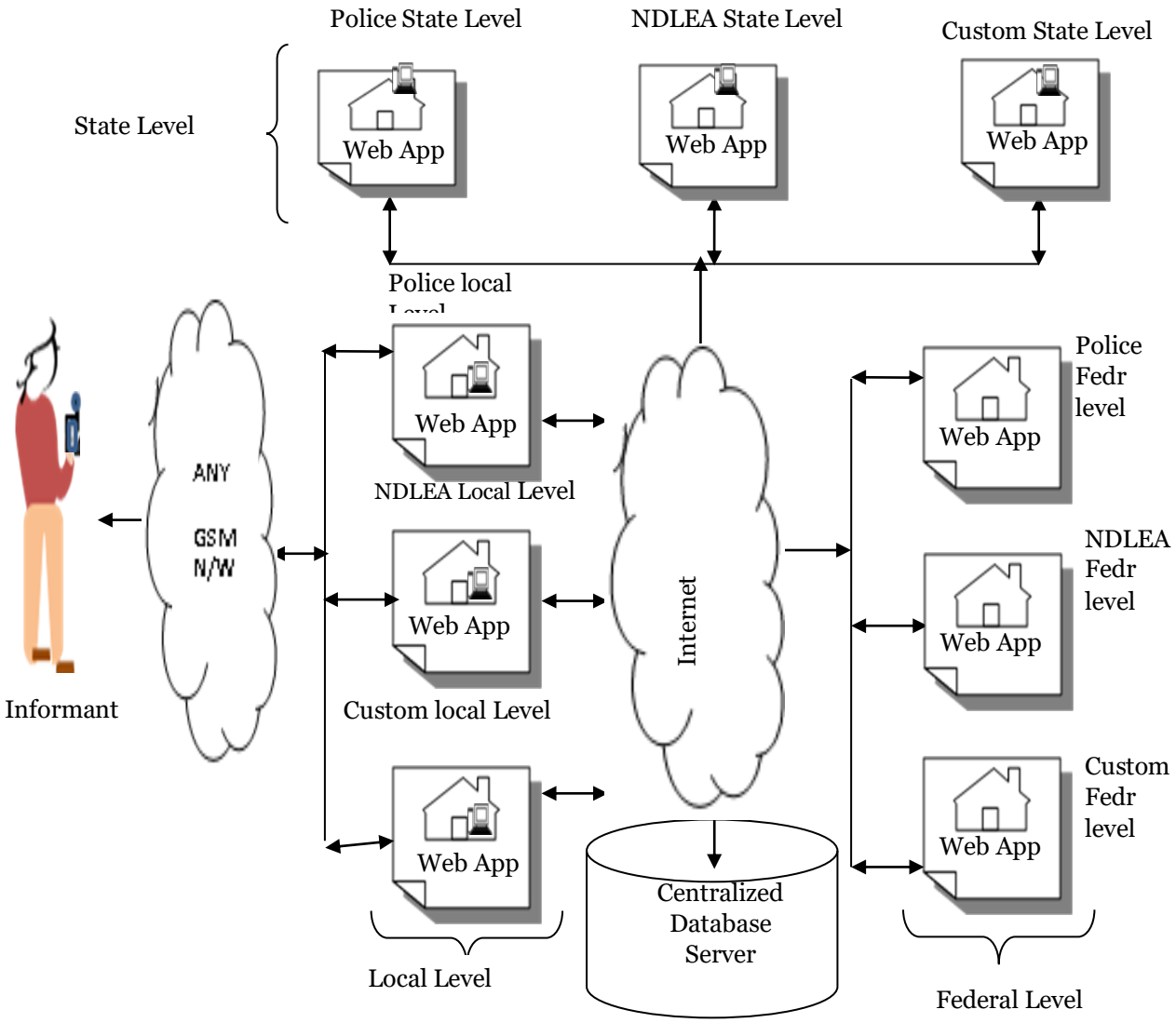

Figure 2. The Proposed Integrated Crime Information System Model

RESULTS AND DISCUSSION

The CCHIS was designed and implemented. The crime report platform enables informants (public) to report crime information to LEAs through Android mobile devices. Figure 3 (a) displays location awareness when one sends the first three letters of name of any state in Nigeria (eg.'enu' for Enugu state) to 1112. These location awareness (area codes) identifies a crime scene where an informant is reporting the crime from. Figure 3 (b) shows a sample crime incident to be reported by an informant using the crime reporting format as follows: '**Area code * crime type * details'.** If the message is delivered, it is stored in the database of the agency that is in-charge of such crime with the aid of 'crime report directing application' developed. Figure 4, displays list of uninvestigated crimes. List of uninvestigated crimes is a table that captures all reported crimes as raw as it was reported before investigation commences. There are tables for crimes under investigation all investigated crimes and also a table that captures concluded cases. Figure 5 shows a platform where one agency can redirect crime mistakenly sent to her to the agency responsible for that crime type for an instant action. Figure 6 shows screenshot of criminal information search within an agency database while Figure 7 shows screenshot of criminal information search in another agency's database. Figure 8 shows criminal's details retrieved from criminal record.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue III March 2025

(a) (b)

Figure 3. (a) Phone emulator – location awareness, (b) crime report message format screenshot

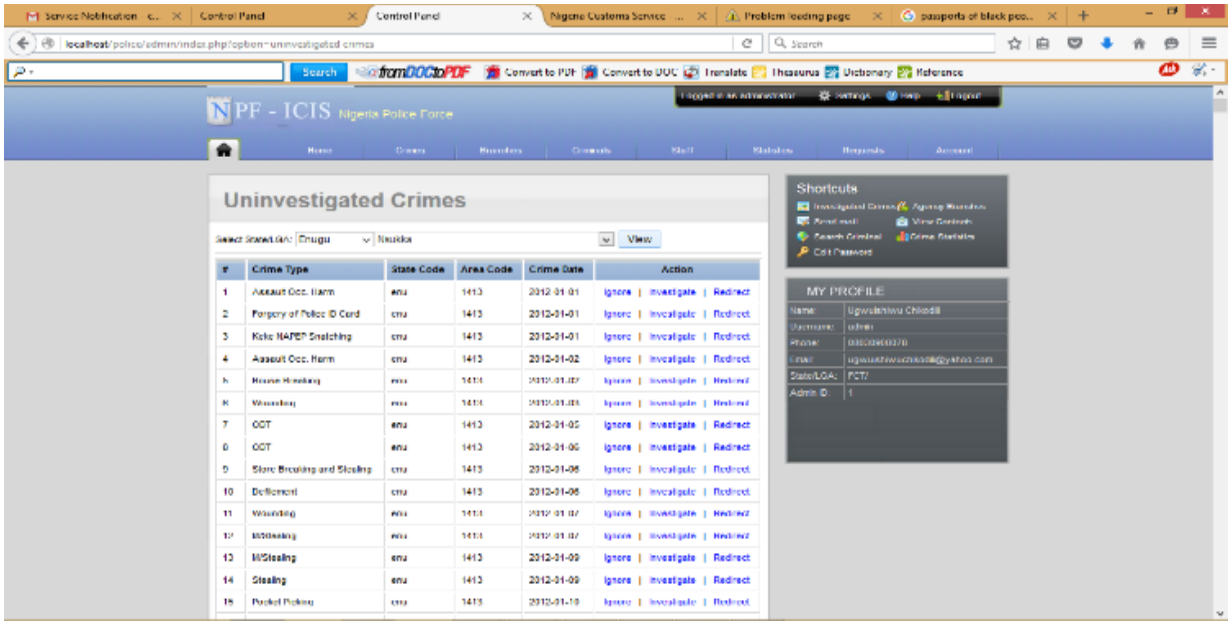

Figure 4. List of uninvestigated crime cases

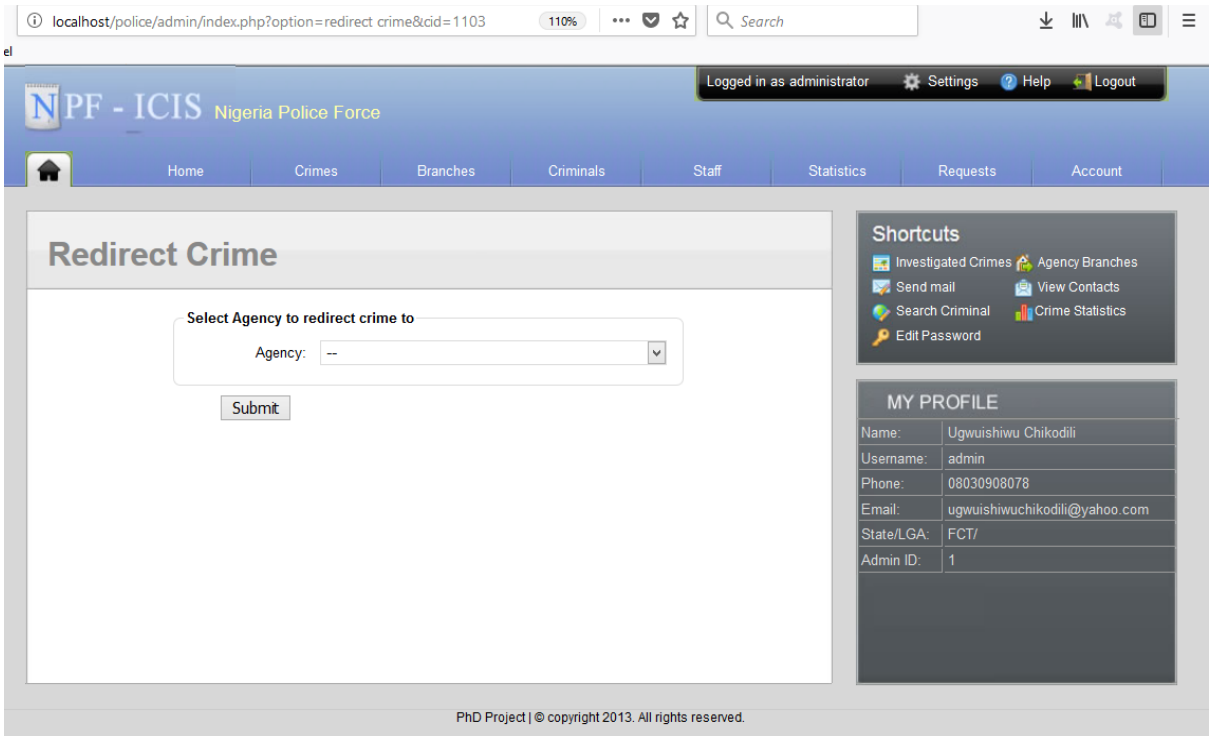

Figure 5. Interface to redirect crime by any agency

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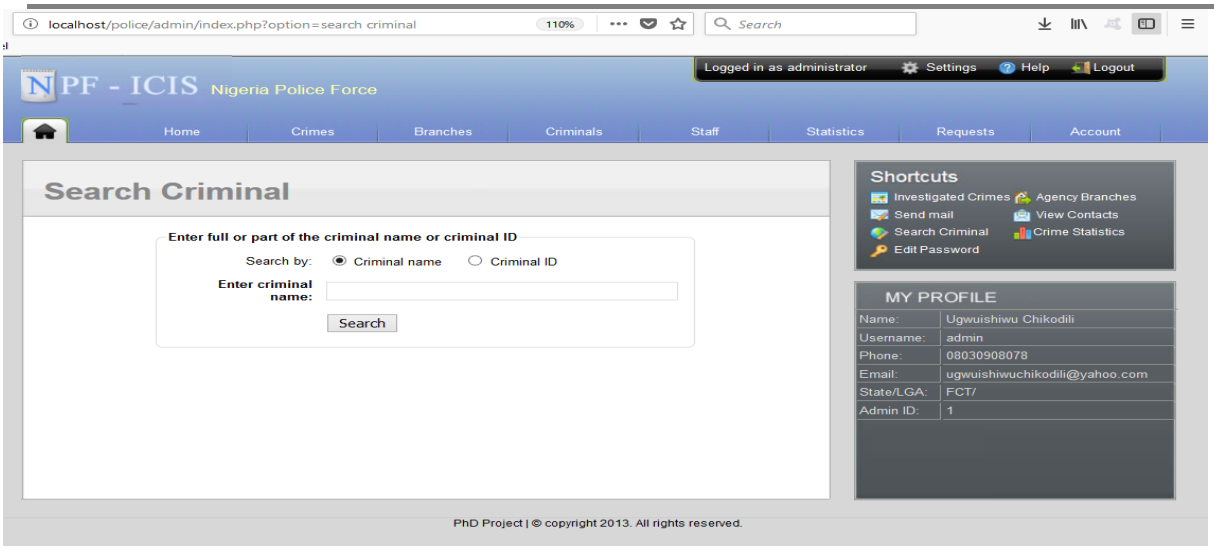

Figure 6. Criminal information search within an agency

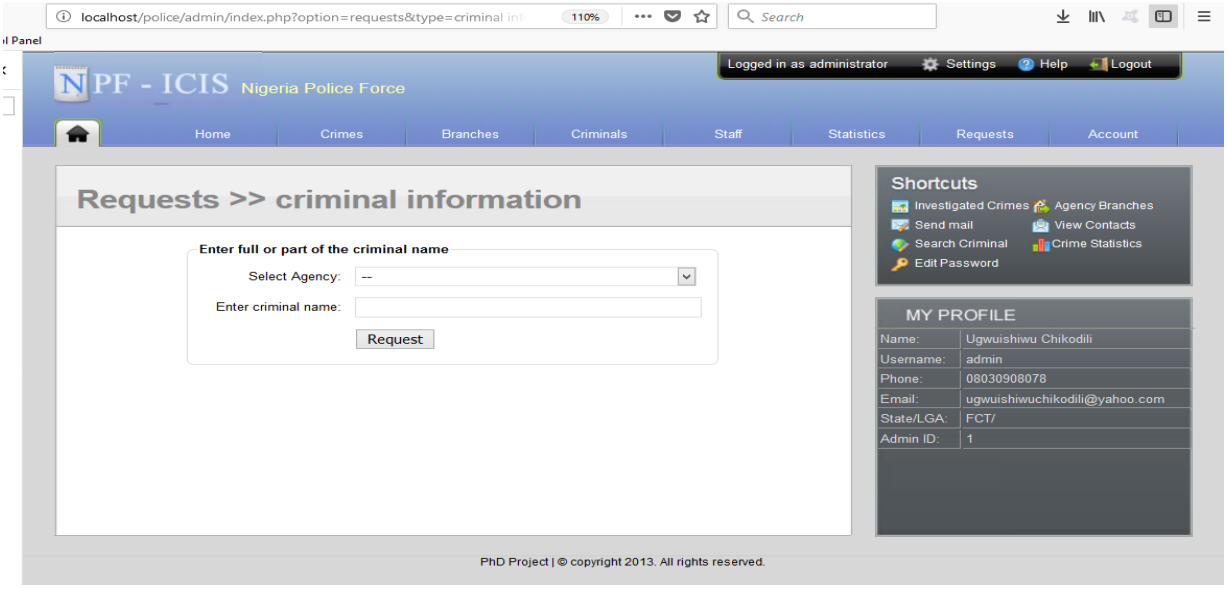

Figure 7. Criminal information search in another agency's database

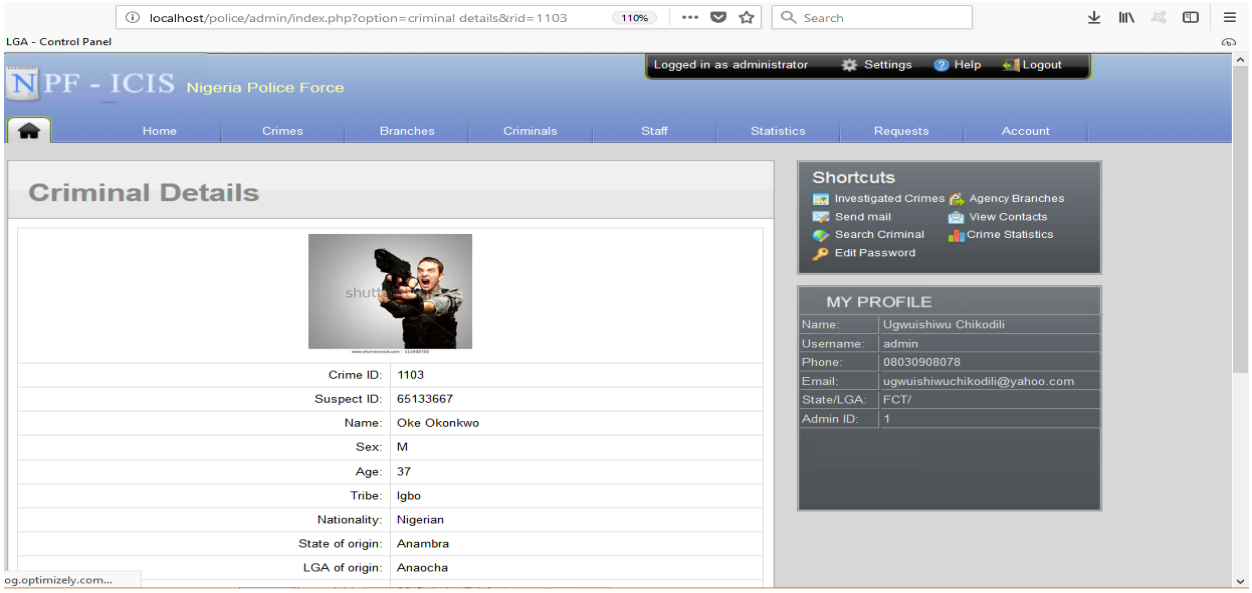

Figure 7. Criminal details/profile screenshot

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue III March 2025

CONCLUSION

The proposed model was developed and implemented with specific research objectives in mind. It allows the public to electronically report crimes to Law Enforcement Agencies (LEAs) through text messages, ensuring round-the-clock accessibility. The system empowers LEAs to manage reported crimes from the moment of reporting until their resolution. Through electronic information sharing, agencies can collaborate efficiently, redirecting misrouted crime information to the appropriate organization for swift action. A centralized repository was created for the participating agencies, encompassing all crime data.

The integration of biometric technology enables easy retrieval of existing criminal records from the database. This study demonstrates the immense benefits of adopting information technology, which serves as a powerful tool for enhancing the functionality of organizations, including LEAs. Digital technology plays a pivotal role in swiftly disseminating essential information to the relevant individuals within the LEA's global context.

In summary, the Comprehensive Criminal History Information System (CCHIS) facilitates integration, data analysis, and enhances productivity and decision-making for LEAs. The system is recommended for widespread use across the country, involving citizens, LEAs, and the Government. With slight modifications, other governmental, private, and public organizations can also leverage this system. The Government can utilize the application to monitor LEAs' efficiency in crime management, as the database provides periodic crime statistics and insights into how they are managed.

Future research efforts should concentrate on developing a model to evaluate the performance of CCHIS and explore the application of big data concepts to handle the substantial volume of data generated in the database.

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