

A REAL-TIME CRIME RECORDS MANAGEMENT SYSTEM FOR NATIONAL SECURITY AGENCIES

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ABSTRACT: *The present world is technology driven as it is employed by many fields in the performance of their operation. In the case of law enforcement agencies, this is evident in the use of automated crime record management systems (CRMS) worldwide to keep record of crime and criminals involved. Crime being an act against the law of a society is a threat to the well-being of the populace and so, requires efficient and effective monitoring. For this reason, CRMS have been developed to achieve this purpose. However, in Nigeria, the CRMS employed is majorly manual, which is, the use of pen and paper. This records are therefore susceptible to destruction from pests and uncensored manipulation by both authorized and unauthorized personnel. This crude method has resulted in problems in the areas of authenticity, security, retrieval, storage, and exchange of information within the NPF. This research aims to design and implement a computerized real time (CRMS) for the (NPF). In developing this CRMS, the waterfall model of system development was adopted through the stages of requirement elicitation from stakeholders of the CRMS to the systems design and analysis using tools such as entity relationship diagrams for the database and use case diagrams which describe user requirements. The system was implemented using Hypertext Mark-up Language (HTML) for a highly interactive graphical user interface, PHP and MySQL for a robust database. The CRMS enhances efficiency in correcting the problems earlier stated and it is an effective tool for easy analysis of data which will improve the NPF's law enforcement operations, it also allows for criminal records check by Background Check Companies (BCC). The application of the CRMS will result in lower threat level to the Nigerian citizens, thus, improving national buoyancy.*

KEYWORDS: Crime, Crime Records Management, First Incidence Report (FIR)

INTRODUCTION

Rules and regulations are paramount to all aspects of life and it accommodates both how one wishes to live, and how others should accommodate one's lifestyle. (Mubaraka, Jirgi, & Nanyanci, 2013) Certain proponents have asserted that crime which is a violation against laws of the society, is integral to the human nature and hence the society can never be completely free from it. Modern society is characterized by increasing levels of risk posed by internal and external security threats. Within this context, security driven by technology is increasingly being used by government, corporate bodies and individuals to monitor and reduce risk. (Ajocict, n.d.)

The widely employed CRM method in the NPF is the manual process. (Kawai & Samson, 2011) This approach entails the use of paper files in the documentation of criminal information by the NPF. A complainant fills in a First Information Report [FIR] form which includes his or her statement concerning the accused. When the accused is brought in, their details are handwritten into case files. Prior to the advent of computers, these files were kept in wooden or metal wardrobes under lock and key. This was susceptible to damage by pest and unfavorable environmental conditions.

In recent years, as a result of the global rise in application of computers in various aspects of life, desktop applications such as Microsoft Excel were adopted, thereby causing the approach to become both manual and slightly computerized in Nigeria. However, this method of record keeping results in inconsistencies, wastage of disk space and poor control and coordination of data. The employment of this method results from reasons such as:

1. Inadequate funding
2. Corruption and extortion and
3. Lack of necessary skills and resources for statistical and information management.

The proposed CRMS enhances the crime recording operations of the NPF. The data used by the CRMS is stored in a centralized database which holds information about criminals, crime and users of the system. The database is the basis for all actions in the system and can be easily updated and used to aid in all of the system's processes, that is, all of the required information is stored in one central location and thus is easily accessible. Furthermore, the correctness of the centralized database will allow functions such as crime report generation and statistical analysis of crime data. This is a more effective storage method than a paper-based file system.

In addition to the functions highlighted above, the system performs the basic functions of storage, retrieval and manipulation of crime and criminal data and information.

The benefits of the proposed system are as follows:

1. Interstation communication in real time
2. Centralized data handling
3. Reduced time consumption
4. Computerized record keeping with manpower
5. Cost reduction
6. Operational efficiency

REVIEW OF CLOSELY RELATED WORKS

In this section, we analyze systems that are akin to the proposed system. We will focus on the systems that are closest in functionality to the CRMS, highlighting their key features, similarities, advantages and disadvantages.

Criminal Records Management System

This system was aimed at the implementation of a Criminal Records Management System. It is a database system in which the police keep the record of criminals who have been arrested, to be arrested, or escaped. This will help the police department in enhanced management of information. The main entities in the whole process include; the petitioner (the person who files a First Incident Report (FIR)), victim, accused or criminal, case, and investigating officer. The

CRMS keeps records of the petitioner, victim, accused, FIR, case and investigation officer entities.

The system's strengths lay in that it allows for storage of multiple data for a criminal. A weakness observed in the system however, is that it lacks in covering all the necessary entities required for a CRMS built for the NPF, it has no interface; as only the database was designed, there is no proper distinction between an accused and the criminal in the system, there is no generation of crime analysis and report.

Crime Investigation System Using Biometric Approach

The system implements a biometric-based crime investigation system for the Nigeria Police Force. The software was designed using Visual BASIC programming language. A criminal's data is entered into a database where it is used for referential purposes and can be updated or modified regularly. Also, the ability to compare fingerprints whose unique patterns assist in redundancy control is an added attribute of the system. Advantages of the system include reduction of redundancies and inconsistencies in criminal information, ensures user defined rules to promote data integrity, enables sharing of data across all applications, and ensures proper access authorization for users. Its weaknesses are that the system was unable to generate reports and focuses more on criminal information than crime. (Falaye, Adama, & Agemerien, 2013)

METHODOLOGY

The model used for this project is the Waterfall model of software development. This model follows a sequential order which ensures that a phase is completed before another phase begins. This system model emphasizes planning in early stages, is used in projects where all the system requirements are known and in addition, its intensive documentation and planning make it work well for projects in which quality control is a major concern. (Govardhan, September 2010).

The stages of the waterfall model adopted by this project include;

1. Requirements analysis: this phase entails gathering of requirements from users of the system. The requirements are collected in a requirements specification document.

Functional Requirements

The functional requirements highlight the specific functions the system should be able to carry out. Pertaining to the CRMS, the system should:

- i. Add users (police officers and background screening companies) and assign them their different level of privileges
- ii. Validate user login details and ensure user-level privileges to information.
- iii. Store and retrieve information about crime and criminals.
- iv. Perform search functions based on some specified criteria's.
- v. Perform crime analysis and statistics as well as to generate adequate reports.
- vi. Generate criminal's report.

User Requirements

The user requirements describe functions that are performed by the users on the system. The users of the proposed system are categorized into six levels namely levels one to six. The requirements for these users are described in table 1 using use case diagrams:

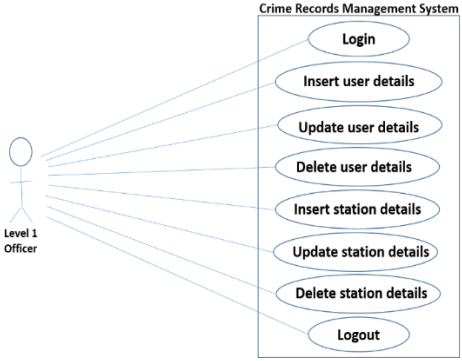
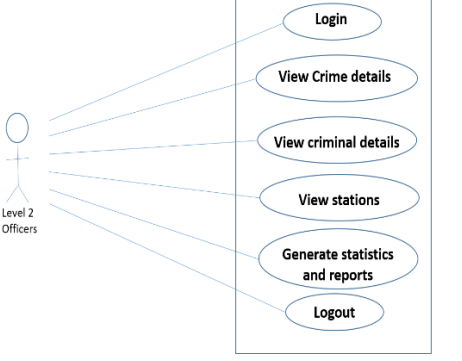
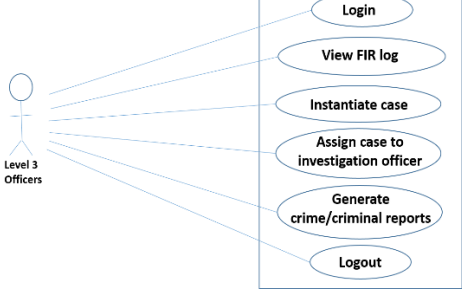
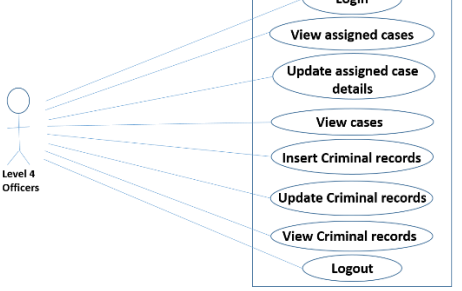
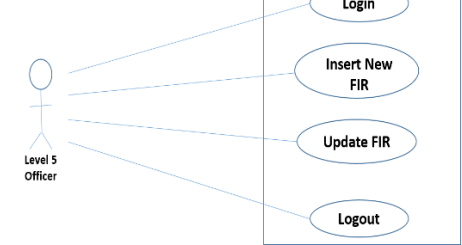
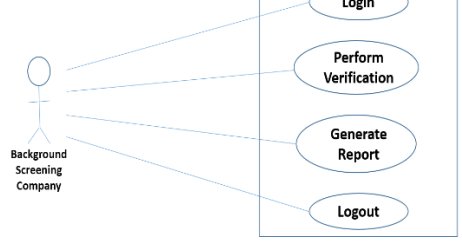
 <p>Use Case Diagram for Level One Officers</p>	 <p>Use Case Diagram for Level Two Officers</p>
 <p>Use Case Diagram for Level Three Officers</p>	 <p>Use Case Diagrams for Level Four Officers</p>
 <p>Use Case Diagrams for Level Five Officers</p>	 <p>Use Case Diagrams for Background Check Companies</p>

Table 1 User requirements represented by use case diagrams

- v. 4GB Hard disk space (recommended)
3. Implementation: the CRMS is implemented using HTML and JavaScript for the graphical user interface. MySQL is used in designing a robust database and PHP is the application logic which enables communication between the front end and backend.
 4. Testing: All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration, the entire system is tested for any faults and failures.
 5. Deployment of system: Once the functional and non-functional testing is done, the product is deployed in the customer environment or released into the market. The proposed system is installed in the new environment and the transition phase from the old environment is monitored. This stage involves training of the officers that will be given the privilege of operating the system, populating the database with existing records, and converting such data.
 6. Maintenance: At this phase, issues arising on deployment the client environment are fixed. To fix these issues, patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment. (Tutorials point, 2014)

SYSTEM IMPLEMENTATION, TESTING AND RESULTS

System implementation uses the structure created during design and the results of system analysis to construct system elements that meet the stakeholder requirements and system requirements developed in the early life cycle phase (sommerville, 2004). It is the realization of an algorithm as a program or software through computer programming. This infers physical development of the system through coding.

The software testing was categorized in three sections namely database testing, interface testing and system testing.

1. Database Testing: A database is a repository of data of various types. As a result of this, many types of integration and implementation errors may occur in large database systems, which influence the system operation negatively. It is therefore of pivotal importance to test the database in order to achieve a database that satisfies the ACID (atomicity, consistency, Isolation, durability) properties of a database management system. (Korth, 2010). Normalization was carried out to eliminate redundancy. Below are some of the screenshots of some tables in the database of the proposed system.

CRIME TABLE

#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
1	id	tinyint(10)		UNSIGNED	No	None	AUTO_INCREMENT	Change Drop Browse distinct values Primary Unique Index More
2	crime_name	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique Index More
3	sect_of_const	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique Index More

Table 2 shows the crime table which holds information on the crime. It contains the crime id as the primary key and crime specification such as; name and section of constitution.

CRIMINAL TABLE

#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
1	criminal_id	tinyint(10)		UNSIGNED	No	None	AUTO_INCREMENT	Change Drop Browse distinct values Primary Unique More
2	last_name	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
3	first_name	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
4	middle_name	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
5	image	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
6	dob	date			No	None		Change Drop Browse distinct values Primary Unique More
7	gender	char(1)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
8	address	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
9	state_of_origin	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
10	lga	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More

Table 3 shows the criminal table which holds information about the criminal. It contains the criminal id as the primary key, data such as; name, gender, state of origin, image, date of birth, state of origin and local government area.

OFFICER TABLE

#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
1	officer_id	int(10)		UNSIGNED	No	None	AUTO_INCREMENT	Change Drop Browse distinct values Primary Unique Index More
2	station_id	tinyint(10)			No	None		Change Drop Browse distinct values Primary Unique Index More
3	police_id	varchar(15)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique Index More
4	name	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique Index More
5	rank	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique Index More
6	password	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique Index More
7	user_level	int(11)			No	None		Change Drop Browse distinct values Primary Unique Index More

Table 4 shows the officer table which holds information about the incident. It contains the officer id as the primary key. It also contains police id and station id as foreign keys. It contains information such as; rank, user level and password.

BCC TABLE

#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
1	company_id	tinyint(10)		UNSIGNED	No	None	AUTO_INCREMENT	Change Drop Browse distinct values Primary Unique More
2	company_name	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
3	company_address	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
4	company_email	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
5	company_logo	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
6	username	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More
7	password	varchar(255)	latin1_swedish_ci		No	None		Change Drop Browse distinct values Primary Unique More

Table 5 shows the BCC table which holds information on the background check companies. It contains the company id as the primary key and other company information such as; name, email address, logo, username and password.

System testing

This involves testing the various modules of the system individually, integrating the various components into one, and testing the CRMS as a whole. The CRMS consists of various modules. Some of them are:

- i. Login Module: Figure 6 shows the Login page. This is also known as the authentication module. This module is responsible for logging users into the system. This is done by providing a correct and already registered police id and password, without which the user is denied access to the system.

Fig 6 Login page

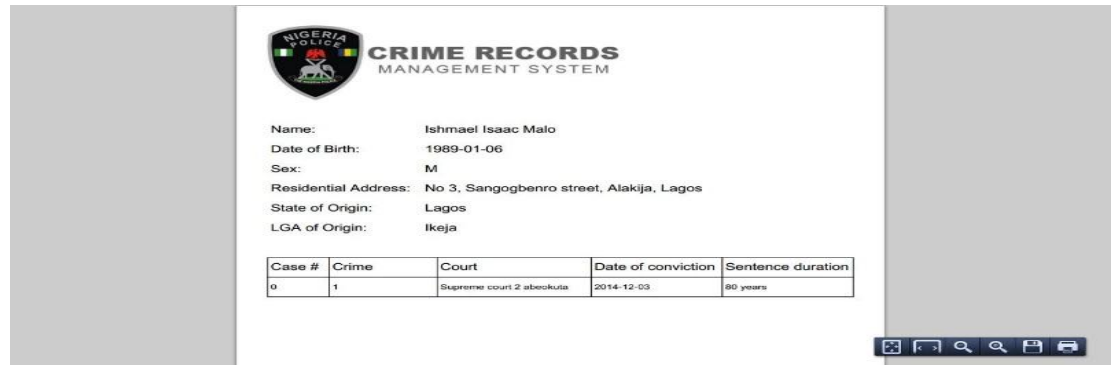
- ii. Add FIR Module: figure 8 shows create new FIR page. This enables the Level Five officers to input new FIR into the system.

Fig 7 Create New FIR page

- iii. Perform Verification Module: Figure 9 shows the perform verification page. This enables background checks to be performed on individuals. The verification is done by the BCC. The company provides information such as the names of the individual, the date of birth, the gender, the local government area and state of origin.

Fig 8 Perform Verification Page

- iv. Report Sheet Generation Module: Figure 10 shows the report sheet. Here, a report is generated when requested for by the jury during court proceedings as to the details of a particular criminal and the crimes committed. This can be generated by the level two, three and four officers.



The screenshot shows the 'CRIME RECORDS MANAGEMENT SYSTEM' interface. It displays personal details for a user and a table of their criminal records.

CRIME RECORDS MANAGEMENT SYSTEM

Name: Ishmael Isaac Malo
 Date of Birth: 1989-01-06
 Sex: M
 Residential Address: No 3, Sangogbenro street, Alakija, Lagos
 State of Origin: Lagos
 LGA of Origin: Ikeja

Case #	Crime	Court	Date of conviction	Sentence duration
0	1	Supreme court 2 abeokuta	2014-12-03	80 years

Fig 9 Report Sheet Generation

2. Interface Testing: This section shows the various tests that have been carried out in terms of the interface design. It is carried out to ensure that the systems components pass information and control correctly to each other. The various tests that have been performed include:
- i. User Validation: Figure 10 shows user validation page test. When users input incorrect or unregistered details, the page is returned with an error message showing 'Incorrect details'. It gives another opportunity for the user to input correct details, after which the welcome page is displayed.



The screenshot shows the login page of the 'CRIME RECORDS MANAGEMENT SYSTEM'. It features a login form with two input fields: 'Police ID' and 'Password'. A green 'LOG IN' button is positioned below the fields. A red error message, 'Incorrect details', is displayed above the form.

Fig 10 User Validation Page

- ii. Input Verification: Figure 10 shows input verification page test. All fields in all of the forms have a not null key attributed to them. If some of the fields are left null, the system does not register the details and shows a pop-up error message, otherwise, it displays a success message.



Fig 11 Input Verification Page

DISCUSSION OF RESULTS

In the course of developing the CRMS, the major challenge faced was the gathering of requirements from the NPF. Closely related systems helped in eliciting system requirements. The system was measured in terms of authentication, real-time access and centralized storage, and it proved efficient. There also exists inter-station communication and generation of crime and criminal reports.

Furthermore, the system portrays a simple and highly interactive design, accomplishing the set objective of making it user friendly. It also allows enhanced access to comprehensive, reliable and accurate information.

CONCLUSION

The need for a computerized platform for crime record management cannot be overemphasized. The CRMS enhances proper and efficient management of criminal records by the NPF thereby helping in making informed decisions and improving reliability thus improving law enforcement operations. This results in lower crime rate in the country thereby increasing national security.

LIMITATION

Over the course of this research work, the major limitation encountered was; inadequate information as officers were not forthcoming with information thereby making it complex to specify requirements of the system.

FUTURE RESEARCH

After carrying out extensive research on crime record management at home and abroad and on full implementation of the CRMS, some points to consider in improving the efficiency and effectiveness of the crime record management system of the NPF include;

1. A generic platform for keeping human records from birth till death. Deploying this sort of platform will serve as a source of information on persons from various states within

the country and even those outside. The crime record managements system can then be linked to this system and thus provide comprehensive data on persons.

2. The crime record management system should be merged with the criminal justice system to form a mega system that spans over all facets of the justice system. This will enhance synchronization and transfer of information between the court of law and NPF.
3. Verification using Biometric: it is highly recommended that a biometric system be inculcated into the system to enhance security of data stored in the system. This increases the restriction on access to the system thus unauthorized users have no access to the system.

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