

An Automated Web-Based Enabled Correctional Centre's Management System

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Abstract

Nigerian correctional facilities rely on inefficient manual record-keeping processes, hindering effective prisoner information management and inter-agency coordination. This study aims to develop a comprehensive, centralized, web-based Prison Management System (PMS) to modernize and streamline operations in Nigerian correctional centers. The research employed a multifaceted data collection approach, including interviews, observations, and form evaluations. System development utilized the Incremental Model, incorporating MySQL, PHP, and JavaWeb technologies. The proposed PMS introduces a unified platform consolidating prisoner profiles, including demographic details, biometric data, parole status, visitor records, and departure logs. The system enables remote access, real-time information exchange, and intelligent administration through cloud computing integration. This digital transformation promises to elevate the Nigerian correctional system's efficiency, accountability, and inter-agency coordination, contributing to a more effective and secure justice framework.

Keywords: Prison Management System, Centralized, Cloud Computing, Information Sharing, Digital Transformation.

1. Introduction

Prisons, also known as correctional facilities or detention centers, are institutions where individuals are physically confined and deprived of personal freedoms as a legal penalty imposed by the state for committing a crime. In addition to housing convicted or suspected criminals, prisons may also detain those not charged with an offense, political prisoners, prisoners of conscience, and prisoners of war during times of conflict (Carson, 1999). As technology evolves, the need for centralized prisoner data management arises to facilitate



information exchange, and data sharing, reduce administrative overheads, improve responsiveness, mitigate risks associated with inmate custody, eliminate obsolete processes, and reap cost-saving benefits.

Prison management systems play a crucial role in ensuring the efficient and effective functioning of correctional facilities. These systems enable the maintenance of inmate records, management of inmate movement and behavior, tracking of prison inventory, and facilitation of communication among prison staff. Recent research has been conducted in this domain. For instance, Wagh *et al.* (2022) developed a comprehensive "Prison Management System" for the Tihar Jail, emphasizing efficiency, security, and prisoner empowerment. Utilizing stakeholder interviews and document analysis, the study highlighted the positive impact of e-governance, with the system leveraging technology for transparency, streamlined record-keeping, and simplified administrative tasks, ultimately showcasing digital solutions' potential to transform prison management and contribute to offender rehabilitation and societal reintegration. However, the study was limited in scope to Tihar Jail.

Moreover, Jiang (2023) presented a "Design and Construction of Smart Prison Management System Based on Cloud Computing Technology," aiming to improve prison management efficiency and intelligence. By integrating cloud, wearable, and RFID technologies, the system addressed challenges such as low integration, weak data analysis, and limited intelligent applications. Methodologically, it involved designing electronic wristbands with sensors and intelligent chips, implementing RFID sensing systems, and developing business modules using Javaweb technology. Implementation on a cloud server allowed remote access, while personnel management features enabled intelligent administration. Results included enhanced data collection, improved personnel monitoring, efficient performance, and the superiority of the decision tree analysis model over others, contributing to digital transformation and laying the groundwork for smart justice.

Furthermore, the Nigerian correctional system faces significant challenges due to outdated manual record-keeping processes. As highlighted by Tochukwu (2018), prison management in Nigeria has been a neglected area, only recently incorporated into the government's e-governance program. The current system, relying on manual files and registers, impedes information flow, complicates retrieval processes, and hinders inter-agency information sharing. These inefficiencies affect daily prison operations and pose potential national security risks due to the lack of a centralized inmate database.



This research aims to develop a comprehensive, centralized Prison Management System (PMS) tailored to the Nigerian context. The study contributes by proposing a unified web-based platform that consolidates prisoner information and creates a centralized, interconnected database accessible to all Nigerian correctional facilities. It enhances security through modern protective measures and improves efficiency by streamlining information relay. The research provides a digital transformation framework for the Nigerian correctional system and integrates contemporary technologies, enabling remote access and intelligent administration.

These contributions align with recent research while addressing the specific needs of Nigerian correctional facilities. The proposed PMS aims to elevate the Nigerian correctional system's efficiency, accountability, and inter-agency coordination, contributing to a more effective and secure justice framework.

Related works

Jiang (2023) proposed a smart prison management system leveraging cloud computing, wearable, and RFID technologies to enhance intelligence and efficiency. Addressing low business integration, weak data analysis, and insufficient intelligent applications, the methodology involved designing wearable electronic wristbands with sensors for data collection, constructing an RFID sensing system using readers and tags, developing business modules with Javaweb technology, implementing the system on a cloud server for remote access, and enabling personnel management functionalities. Results demonstrated improved data collection through wearable and RFID integration, enhanced personnel monitoring via RFID and smart bracelets, and efficient performance with the decision tree analysis model outperforming others. Ultimately, the system contributed to the digital transformation of prison management, promoting system improvement, and laying the foundation for digital legal systems and smart justice. The study was limited in scope outside Nigeria.

Wagh (2022) developed a comprehensive "Prison Management System" for Tihar Jail, emphasizing efficiency, security, and prisoner empowerment. The system aimed to cover all aspects of prison management from admission to release, leveraging technology for transparency, precise implementation of rules, and accessible data for efficient decision-making. The methodology involved stakeholder interviews and document analysis, highlighting the positive impact of e-governance programs. Results included the development of management software addressing various prison management areas to enhance



administrative efficiency, improve security measures, empower prisoners, and promote transparency in decision-making processes. By implementing efficient record-keeping practices, the system streamlined administrative tasks and ensured accuracy in key operational areas. Ultimately, the project showcased digital solutions' potential to transform prison management, contributing to offender rehabilitation and societal reintegration. However, the study implementation was limited to outside the country.

Mbatha et al. (2020) critically examined the use of information systems within African correctional facilities and the management of resultant records. Utilizing a literature review approach, the study revealed that while information systems have simplified information flow and records management functions in some African countries' prisons, many South African facilities still rely on traditional methods due to financial constraints and lack of government support. The study recommends exploring benchmarking and collaboration with other sectors for the effective implementation of information systems and records management. Furthermore, it suggests future research should focus on how information systems impact records management, policies governing records management in correctional facilities, security and safety of records stored in information systems in South African prisons, and the possibility of benchmarking and collaborating with other sectors to improve tracking systems and accountability in correctional facilities. The study was limited to the evaluation of information systems in South African correctional facilities.

Onyemaobi and Olumeni (2020) aimed to develop a computerized record system for prison inmates in a developing economy to improve the efficiency and effectiveness of managing prison records. Utilizing a constructive research approach focused on studying research methods and benefiting new ideas, the methodology involved critical thinking to provide positive solutions by building artifacts such as models, designs, and software development methods. Following a constructive research procedure of identifying practical problems, gaining topic understanding, innovatively designing new constructs, and demonstrating solution viability, the study employed an iterative software development model to create a functional automated confinement record management system for correctional centers. The research methodology involved analyzing data from correctional service centers and developing modules to maintain prisoner and visitor records using PHP. However, the study was limited to designed and not implemented.



Amadi *et al.* (2017) designed and implemented a management information system for the Nigerian Prisons Service to maintain up-to-date inmate records, provide efficient services to prisoners, and assist the Nigerian Police Force with a database of ex-convict records for investigations. The methodology involved a structured approach, gathering relevant facts through detailed descriptions of planned data collection, analysis, and interpretation procedures. This aimed to understand existing problems with the manual system before designing and implementing an improved web-based solution, ensuring a dependable outcome through systematic data collection and analysis. However, the study did not explicitly mention the achieved results. A limitation was the system's implementation on a locally stored database within different prison workstations, restricting access only within those prisons and preventing remote accessibility, hindering scalability and widespread availability beyond the premises.

Ahishakiye *et al.* (2017) developed a secure web-based records management system for prisons, focusing on Kisoro Prison in Uganda, to address inefficiencies and security risks associated with traditional pen-and-paper systems in developing countries. The system aimed to improve efficiency, data access, security, and record retrieval for instant report production. The methodology involved system study through interactions, interviews, observations, questionnaires, and document reviews to identify requirements, followed by design, implementation using MySQL, PHP, CSS, JavaScript, HTML, testing, validation, and iterative development. The study led to a successful prototype tailored for Kisoro Prison, utilizing a 3-tier approach with a MySQL database, Apache/PHP middle tier, and web browser interface. The developed system provided centralized information access, improved record tracking, enhanced performance, reduced maintenance costs, and facilitated easier prison management. Future recommendations included integration with the criminal justice system and multilingual capabilities. However, the study was limited in scope to Ugandan Prisons.

While previous studies have explored digital solutions for prison management systems, enhancing efficiency, security, and data analysis, their implementation has been limited in scope, either confined to specific correctional facilities or countries outside Nigeria. This research aims to bridge the gap by developing a comprehensive, centralized, and interconnected Prison Management System tailored to the Nigerian context, facilitating seamless information sharing and addressing the inefficiencies of the current manual record-keeping process nationwide. By leveraging modern technologies and addressing



infrastructural limitations, this system holds the potential to transform the Nigerian correctional system, fostering transparency, accountability, and improved coordination among relevant agencies.

2. Methodology

The methodology involves a systematic and theoretical examination of techniques applicable to studying methods and principles within a specific domain of knowledge. In analyzing the existing system, this research identifies the primitive state of prison management in Nigeria, characterized by the extensive use of manual files and registers. For instance, facilities like the Nigerian Prison Service in Igbaba Ijebu-Ode primarily depend on these outdated methods, which not only obstruct the efficient flow of vital information but also complicate the retrieval process. This cumbersome approach requires multiple files per prisoner, significantly complicating the profiling process and diminishing operational efficiency.

2.1 Method of Data Collection

This study employed a comprehensive investigation of the existing system to gather precise information on the domain slated for redesign into an online prison management system. The investigation assessed the functionality and efficacy of the current system in meeting its objectives. Data collection involved multiple strategies: interviews with office representatives, evaluation of forms, and direct observation. These methods were specifically chosen to validate the data and ensure the relevance of the results post-analysis, thereby enhancing the reliability of the findings and the subsequent system redesign.

2.1.1 Interviewing

Interviews were conducted with prison management staff as part of the investigation. This technique proved highly effective, providing firsthand insights into the operational processes directly from the users. Interviews facilitated the immediate and direct acquisition of essential information, offering a more efficient approach compared to other methods. The interactive nature of interviews also allowed for the clarification of ambiguous points, thereby securing detailed and relevant responses.

2.1.2 Observation

Observation was employed to directly experience the operations of the existing manual system. This method is invaluable for acquiring an authentic understanding of the system's



functionality. By observing the processes in action, researchers gained a clear and immediate comprehension of the system's dynamics, enhancing the depth and accuracy of the data collected.

2.2 Proposed System

In response to the identified deficiencies, our project introduces a unified, centralized system designed to consolidate all prison and inmate information into a single platform. This integrated system will feature complete profiles for each prisoner, including demographic details, digital photographs, parole status, visitor records, and a log of all instances the prisoner has left the facility, along with the reasons for each departure. This approach not only significantly reduces the time required to relay critical information to relevant agencies but also simplifies and enhances the efficiency of record maintenance compared to traditional manual methods.

2.3 Data Flowchart

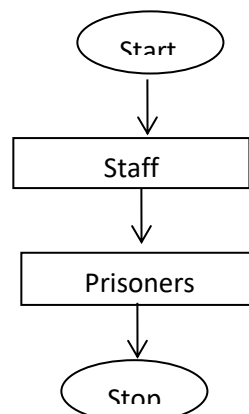


Figure 1: Data Flowchart

- i. **Data Input:** This represents the entry point for prisoner information. Prison staff would input data such as demographic details, case information, and biometric data. This step digitizes the information, replacing manual file creation.
- ii. **Database:** The central repository where all prisoner data is stored. This centralized storage allows for easy retrieval and updates, addressing the inefficiencies of manual file systems.
- iii. **Data Processing:** This step might involve activities such as categorizing prisoners, scheduling, or generating reports. Automated processing reduces human error and increases efficiency.



- iv. **User Interface:** This represents the various screens and forms that staff use to interact with the system. A user-friendly interface ensures ease of use and adoption by prison staff.
- v. **Output:** This includes reports, prisoner profiles, or other information retrieved from the system. Easy access to processed information aids in decision-making and information sharing.
- vi. **Security Layer:** This component ensures data protection and controlled access. Addresses security concerns raised in the literature review.

2.4 Development Methodology Used

The Incremental Model, employed in this project, segments the software development process into distinct, manageable modules, each encompassing a full development cycle—analysis, design, implementation, testing, verification, and maintenance. This method facilitates development in phases, where each iteration progresses through requirements definition, design, coding, and testing. Subsequent releases incrementally add functionality, building upon the previous versions, until the entire system achieves the designed functionality.

2.5 GENERAL OVERVIEW OF INCREMENTAL MODEL

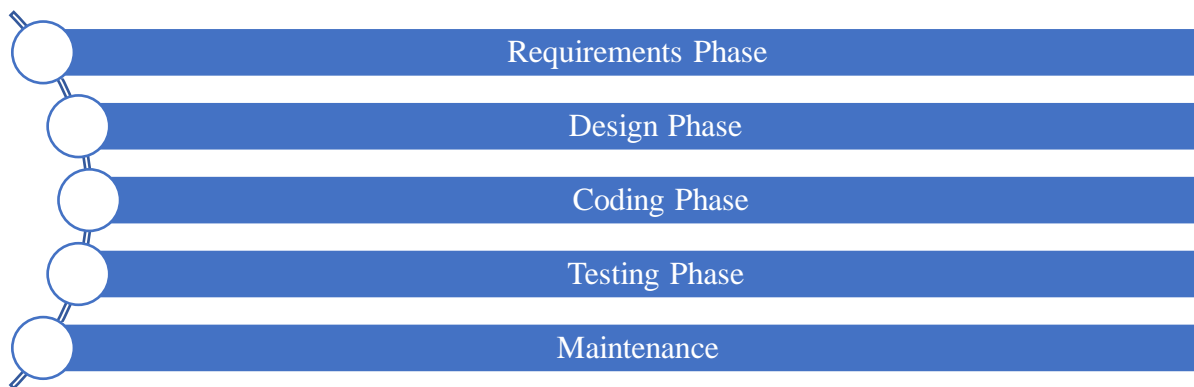


Figure 2: *Overview of Incremental Model*

2.6 Description of Methodology

The Incremental model organizes software development into sequential phases:

1. **Requirement Analysis:** This initial phase involves identifying both functional and non-functional requirements. Therefore, it ensures the system meets the specific needs of Nigerian correctional facilities, addressing the issues identified in the current manual system.



2. **System Design:** This phase finalizes the methods and functional designs of the system. As a results, translates the requirements into a practical design, laying the foundation for a user-friendly and efficient system.
3. **Coding:** In this phase, the actual programming is executed based on the requirements and design. Consequently, transforms the design into a working system, implementing features like centralized data storage and web-based access for the prison management System in Nigeria.
4. **Testing:** This phase assesses the performance of existing and newly added functionalities. Therefore, it ensures the reliability and accuracy of the system, crucial for maintaining the integrity of prisoner records.
5. **Maintenance:** This ongoing phase involves addressing issues and upgrading the system post-deployment. Therefore, it allows for continuous improvement and adaptation of the system to changing needs.

The Incremental Model is particularly beneficial for this project as it allows for the development of the system in manageable phases. Each increment builds upon the previous one, gradually adding functionality. This approach is well-suited to the complex nature of prison management systems, allowing for thorough testing and refinement at each stage.

By using this model, the development team can prioritize critical features (like basic record-keeping) in early increments, while more advanced features (such as data analytics or inter-agency information sharing) can be added in later increments. This aligns to transform the manual system into a comprehensive digital solution gradually and systematically.

3.0 Results and Discussion

3.1 Software Interface Introduction

System implementation involves the integration of interdependent physical devices and their respective software to deliver the intended functionality and performance. This phase encompasses all activities required to transform a thoroughly analyzed and designed system into a fully operational entity, ensuring it performs effectively for its users.

3.2 Interface Overview



Upon launching the software, users' first interface is the startup page, also known as the home page. This default page, located in the application's root directory, features a message box and navigation buttons. These elements facilitate user interaction, allowing for seamless navigation through mouse clicks.

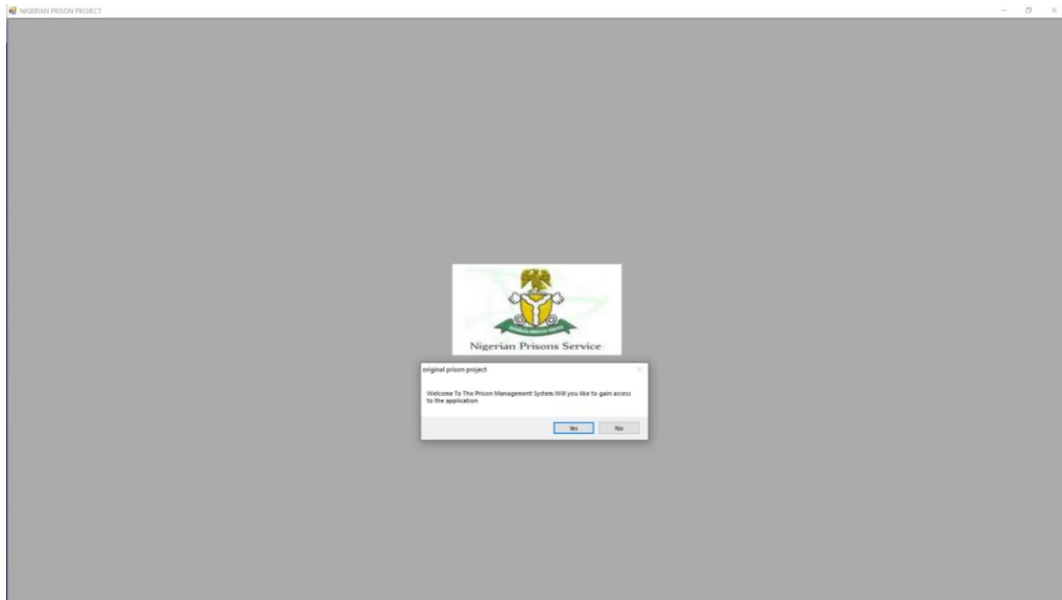


Figure 3: Homepage

Figure 3 presents an overview of the application's interface as experienced by an administrator. It visually summarizes the application's appearance and key properties. The figure includes menus that provide access to various application features, facilitating a comprehensive understanding of its functionality.

3.3 Authentication Page Overview

This page is the authentication gateway for users (administrators) to access the software, requiring credentials such as warder names, passwords, passcodes, and optionally PINs, fingerprints, or retina scans. Common across websites and mobile applications, this security feature is crucial for preventing unauthorized data access. Should authentication fail, user access is promptly denied.

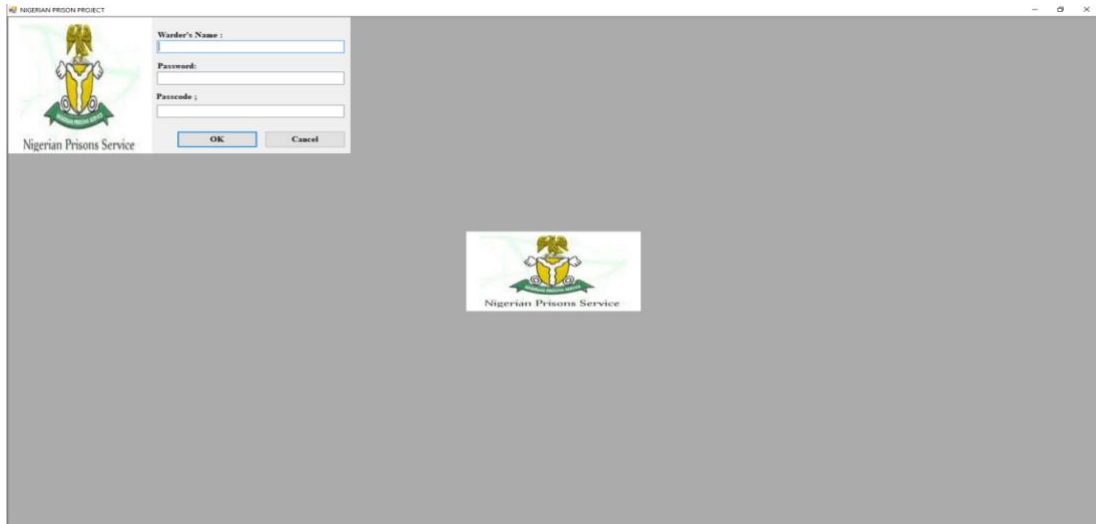


Figure 4: Admin login

Figure 4 illustrates the authentication process for administrators accessing the website. Users must enter specific details including the "warder(s) name," "password," and "passcode," followed by clicking the "sign in" button. Access to the application is contingent upon the provision of the correct passcode; without it, entry is prohibited. Upon verification of the correct credentials, the application grants access to the administrator.

3.4 Main Page Functionality

The main page provides administrators with the capability to manage prisoner data, specifically enabling them to add, edit, or delete entries. In the current version of the application, administrators are limited to adding new applicants to the system, facilitated by the database integration.

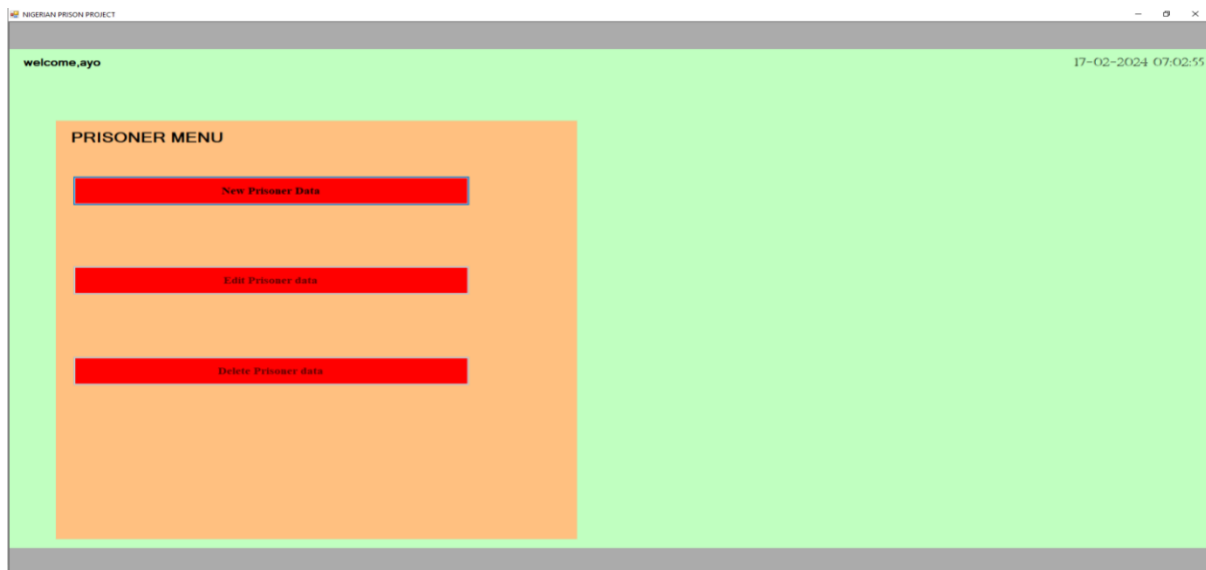


Figure 5: Prisoner login



Figure 5 demonstrates the functionality that allows administrators to input prisoner data into the database.

3.5 Registration Page Overview

The registration page is exclusively designed for administrators to register prisoners by entering their details into the specified fields and submitting this information to the database. The system then either accepts the entry, provided all data are correctly inputted, or issues prompts in case of errors.

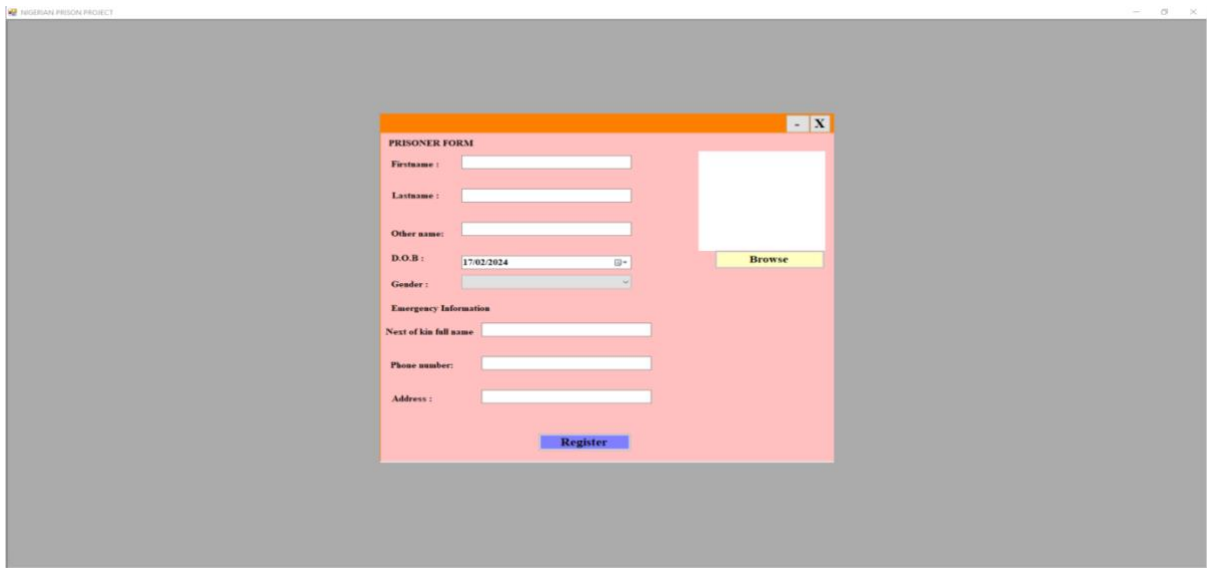


Figure 6: Registration page of prisoner

Figure 6 displays the template of the registration form used in the system.

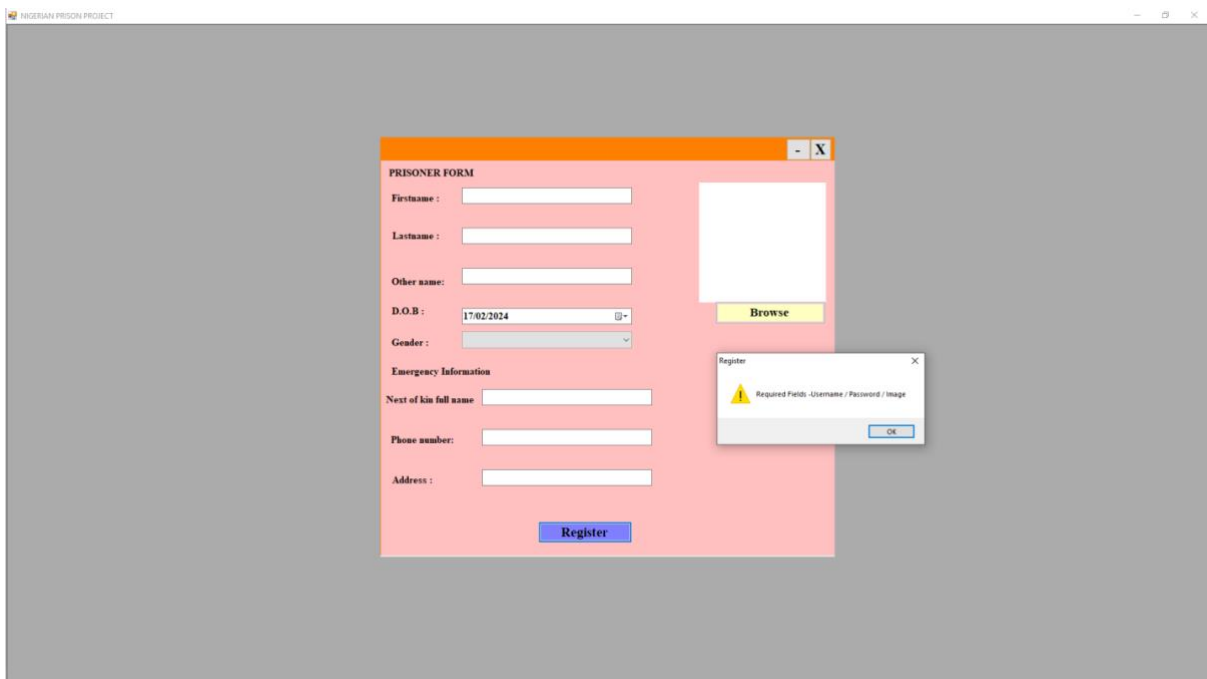


Figure 7: Registration page of prisoner



Figure 7 illustrates that the registration process is incomplete due to errors in the form submission.

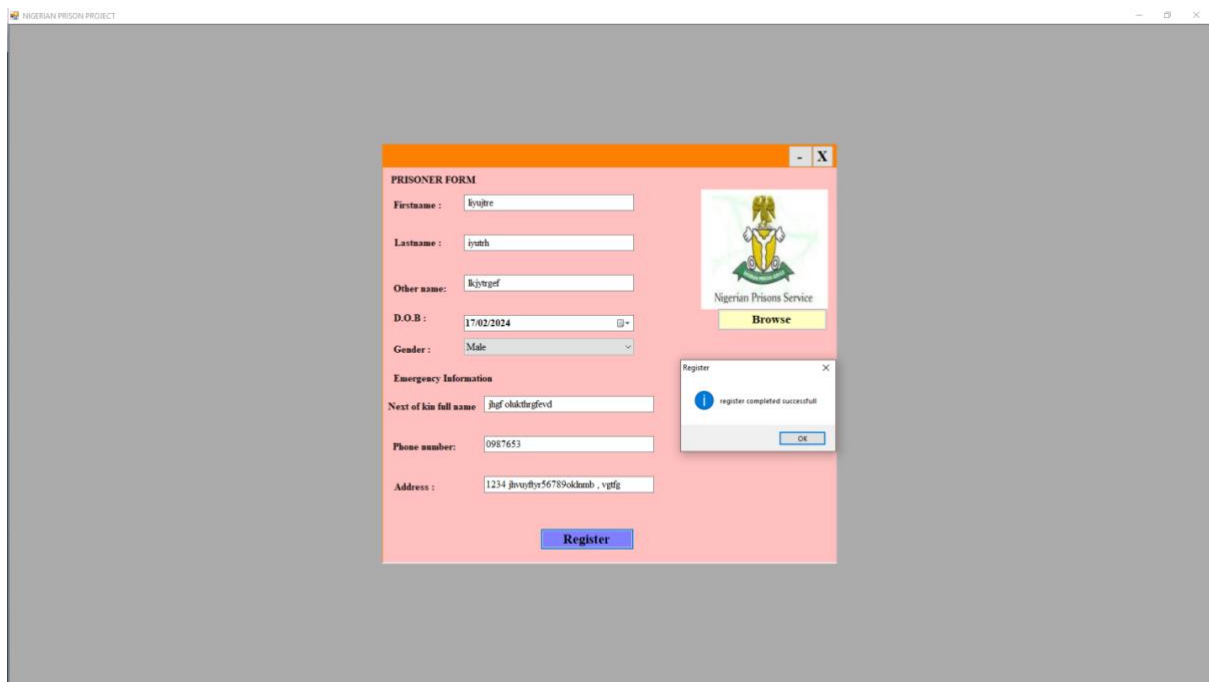


Figure 8: Registration page of prisoner

Figure 8 illustrates successful registration completion with subsequent data storage in the database.

The implementation of a web-based interface addresses the need for modernization identified by Tochukwu (2018). This aligns with the broader trend of e-governance in prison management systems, as highlighted by Wagh *et al.* (2022) in their study of Tihar Jail. The homepage (Figure 3) provides a centralized access point for various system functions. This design choice directly addresses the issue of fragmented information storage identified in the current manual system. It aligns with Jiang's (2023) emphasis on improving business integration in prison management systems. The multi-factor authentication system (Figure 4) significantly enhances security compared to traditional manual systems. This addresses the security concerns raised by Ahishakiye *et al.* (2017) in their study of Ugandan prisons. The use of warder names, passwords, and passcodes creates multiple layers of security, reducing the risk of unauthorized access to sensitive prisoner data. The ability to manage prisoner data from a central interface (Figure 5) directly addresses the inefficiencies of manual file systems described in the methodology section. This functionality aligns with Onyemaobi & Olumeni's (2020) emphasis on improving the efficiency of managing prison records in developing economies.

The digital registration process (Figures 6, 7, and 8) represents a significant improvement over the manual file and register system currently in use. This addresses the need for



streamlined operational processes identified in our methodology section. The error-checking capability (Figure 7) and successful registration confirmation (Figure 8) enhance data accuracy and reliability, addressing issues of data integrity that are common in manual systems. Moreover, the entire system's design as a web-based application aligns with Jiang's (2023) recommendation for leveraging cloud computing in prison management. This allows for remote access and real-time information sharing, addressing the limitations of locally stored databases identified in Amadi *et al.*'s (2017) study. The centralized nature of our system also facilitates the kind of information sharing and records management that Mbatha *et al.* (2020) found lacking in many African correctional facilities. By providing a unified platform for prisoner information, our system addresses the need for improved tracking systems and accountability in correctional facilities in Nigeria.

Each component of our Prison Management System has been designed to address specific issues identified in the literature and our methodology. The web-based nature, centralized database, enhanced security features, and streamlined data entry processes all contribute to a more efficient, secure, and effective prison management system in Nigeria. This aligns with the broader trend toward digital transformation in correctional facilities, as identified in our literature review.

4.0 Conclusion

The study underscores the pressing need to embrace information and communication technology (ICT) advancements for the modernization and development of prison systems in Nigeria. The proposed Prison Management System (PMS) addresses the inefficiencies of the current manual record-keeping process, streamlining the storage, organization, and retrieval of critical prisoner information, including biometric data. However, the system's full potential can only be realized through its implementation as a distributed application, enabling seamless communication and data access among prisons nationwide. In addition, by centralizing and interconnecting prison databases across the country, the PMS facilitates seamless information sharing, enhancing law enforcement capabilities and national security. This comprehensive digital solution holds the promise of transforming prison management in Nigeria, fostering transparency, efficiency, and improved coordination among relevant agencies, ultimately contributing to a more effective and secure correctional system.



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