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Original Article

Design and Implementation of a Court Case Information and Management System

Sulaimon Adebayo

University of Lagos, Akoka. Lagos State, Nigeria.

[1]*Corresponding Author : sadebayo@umass.edu*

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Abstract - *One of the most important issues in various justice structures across the country is the access and processing of an effective and efficient justice system. This can be traced back to the late 1880s when the Supreme Court of Lagos was institutionalized. The main functionalities carried out in court work are registration, routing of court data and information, indexing and follow-up of cases. Case management is a key success factor in judicial systems. An efficient, organized and systematic case management system provides comprehensive information for courts to guarantee unbiased decisions and transparency in the information system, thereby hindering the misuse of power or corruption, as well as case postponement and delays in decision-making. It also reflects the good image of the judiciary. This project illustrates the process of designing and implementing a court case information and management system intended to address the lapses/manual processes in initiating and processing court cases and efficient storage management with timely retrieval of stored information. The main objective of this project is to be geared towards the development of a web-based platform where court case-related information is easily accessible and provides suitable information update procedures in a secure, collaborative, and simple manner.*

Keywords *- Case Management, Integrated Court Management System, Information and Communication Management, Judicial Automation, Court Document Storage, Web Based Application.*

1. Introduction

The Nigerian judiciary and judicial system suffer from systemic inefficiencies ranging from case delays, lack of transparency, and poor document management. According to recent estimates, these issues have cost Nigeria's judiciary an estimated 1.2 billion Nigerian Naira every year as the country continues to rely on paper-based systems, which exacerbates backlogs and corruption and denies timely justice to many litigants, even though technology-driven court systems in Malaysia and the US have significantly improved judicial processing times by 40%.

In recent years, there have been efforts to digitize some components of the judicial system and its limited applications in Nigerian courts. These initiatives continue to be primarily manual, localized, and fragmented.

The general advantages of judicial digitalization have been covered in earlier research (e.g., Haider, 2011), but no scalable, secure, and real-time national case tracking systems have been proposed. The lack of an integrated, web-based, secure infrastructure that permits real-time case monitoring across all judicial levels in Nigeria is a glaring gap in the literature and reality.

This study proposes an innovative web-based case management design to address this gap. The proposed solution enables users to manage and track court cases efficiently, providing case updates and effective access to other cases using a generated case ID. Unlike prior systems, the research presents a solution that integrates real-time case management, SHA-256 encryption and a three-tier architecture to support scalability.

The novelty of this solution resides in its technical architecture and holistic approach. The research integrates several functions, such as case initiation, flow mapping, real-time updates, document storage, secure user registration and authentication into a single platform. To demonstrate the system's adaptability, especially for emerging contexts like Nigeria, it was compared to the existing e-court framework in Malaysia, Kenya and the United States.

2. Literature Review

The literature on digital judiciary applications spans several dimensions. This includes transforming legal processes, security frameworks, technology architecture, and governance adoption. This phase assesses global, African and Nigerian perspectives on technology-based judicial

reform, demonstrating the need for a well-designed, digitally accessible case management solution.

2.1. Global Perspective of e-Court Systems

Many countries have designed integrated digital court solutions to address long-standing issues in their justice delivery. For instance, electronic filing, remote case monitoring, and access to court documents are made possible by the US Public Access to Court Electronic Documents (PACER) system [10].

Faster resolution timelines are facilitated by Malaysia's e-Kehakiman infrastructure, which supports online case filing, cause list publication, and e-payment [3]. Estonia's digital judicial system uses blockchain technology to guarantee data immutability and guard against manipulation. It is, however, important to state that judicial proceedings start long before a case reaches the courtroom.

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2.2. Constraints of Conventional Process of Judicial Delivery

One fact about the conventional process of justice delivery in Nigerian courts is its time-consuming and cumbersome features. This is because all case documents are recorded, filed and distributed on paper [2]. This is explained further by the conventional method, in which a litigant may request a copy of court proceedings, rulings, and judgements; this request must be routed and addressed to the court through the court registrars.

Notwithstanding the purpose for which the request is needed, the litigant will have to await the court's feedback before the document can be prepared (typed, proofread, and retyped).

Finally, the influence of technology changes traditional court case operations, including case filing, case fees and cause lists. Legal information processed through technology tools becomes more and more important in comparison to conventional sources.

2.3. The Case for a Digitally Secured Judicial Platform

A web-based application avails on-demand, adaptive and cross-platform access to judicial data and information. These systems use client-server architecture, in which users submit HTTP queries and browsers provide dynamic answers. Usually, these systems consist of three fundamental layers:

- Presentation Layer: Provides interface control, character translation, and encryption to guarantee consistent presentation and user interaction.
- Logic Layer: Oversees business logic, data processing, and user interface-to-backend database connectivity.
- Data Layer: Manages systematic structuring, retrieval, and storage of lawful data for other applications or systems.

These systems offer strong data safety and integrity when paired with secure hashing methods (SHA-256, for example), which is crucial for sensitive court-related data.

Finally, the influence of technology changes traditional ways of court case operations such as case filing, case fees, cause lists, etc. Legal information processed through technology tools becomes more and more important in comparison to traditional sources.

2.4. Components of Web-Based Application

A web-based solution is an application that its users can access through the internet/intranet or specialized user agents. The developer creates an HTTP request for defined URLs that map to specific resources on the Web Server. The server receives, renders and returns the required HTML page to the CLIENT (i.e. requesting PC, system or agents), which the browser can display. This embodies a client-server application program in which the clients run in the browser [11].

The server-side logic represents the core of the web application. The web application can contain several layers, such as the presentation, logic, and data layers. The presentation layer formats and presents data in an accurate, unique, standardized and well-defined manner. This layer includes character code translation, data conversion, data encryption, decryption, and data translation.

The logic layer manages the interconnection and information transfer between an end-user interface and the system database. This logic regulates how data and information are created, archived and changed. The logic layer separates the presentation from the data layer and regulates the information flow and exchange between the two layers. The data layer is the protocol that manages the information on the web page. This information contains data that might be transmitted to other systems, software or applications.

3. System Analysis and Design Methodology

Several analyses were carried out to highlight the genesis of existing problems. This was achieved when users or administrators started studying the behavioral pattern of the program using the existing system. In the analysis process, key activities were carried out, such as data collection, decisions made on critical problems and processes handled by the existing system.

Several tools were used to conduct the analysis: Entity Relationship Diagram (ERD), unified modeling and analysis, Data Flow Diagram (DFD), flow chart, and problem algorithms. An efficient software development process depends mainly on the quality of the problem analysis applied before development and on properly dealing with the

required stages. The characteristics of software or program development inform the techniques to be deployed for the design and other rules that are required to be followed when designing the required solution.

3.1. Development Methodology

The requirement team expectations and the inherent features determine the relevant software methodology. The waterfall model was considered for its simplicity and understanding in this project. In this approach, the whole process of developing the required software is divided into separate phases. In the waterfall model, the outcome of one phase acts as the input of the next phase sequentially.

The phases of the waterfall model are Requirements, Design, Implementation, Testing, Deployment and Maintenance (as shown in the figure below).

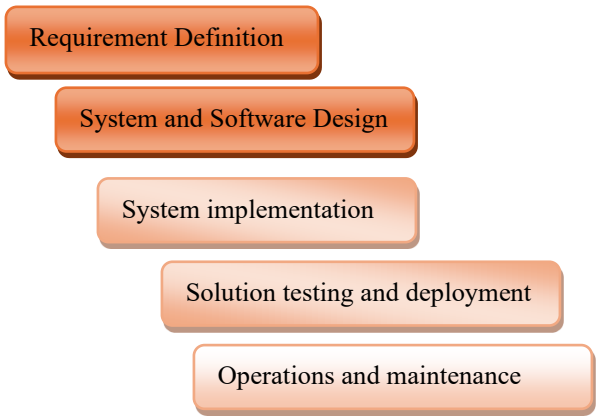

Fig. 1 The waterfall model phases in solution development

3.2. Requirements Definition

The intended solution is a web-based (i.e. online) system that will handle all forms of court case registration, profiling, updates and dissemination of information efficiently and collaboratively.

3.3. Problem Analysis

The identified problem is developing a web application that improves court case processing and management and provides easy access to registered users. To provide an effective solution, the problem has been divided into sub-problems to facilitate easy resolution. This can then be integrated into a complete working application.

- Landing Page
- Online Login
- Submission of relevant information
- Routing of posted information
- Assignment of relevant privileges
- Management of posted information
- Display of relevant notification to show successful processing or otherwise
- Display of different function classification

In the login module, all users and administrators should validate the username and password credentials accurately at the time of login. User credentials are identified uniquely by the name of the entity using the solution, while the admin account is identified by their unique ID (i.e. ADMIN) and relevant password.

4. Case Management System Implementation

The solution architecture used in this project explicitly described all relevant features and attributes. Considering the scope of the project, a three-tier architecture (i.e. a client-server architecture) was adopted, which enables users to interface the functional logic and data storage and defines the control for accessing relevant data.

These functions or separate architecture tiers are developed and maintained as independent modules built in different platforms. This also facilitates an individual system to undergo specific upgrades without disrupting the activities of other tiers of the system.

4.1. System Architecture

The system-based case management system uses an architecture that compares three independent tiers, as shown in the figure below. It can be noticed that the architecture contains the functional business module, the database module and the data access module.

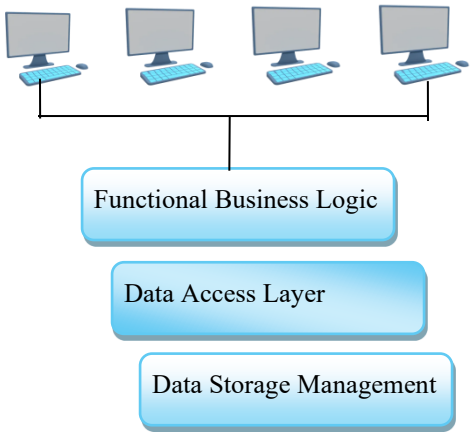

Fig. 2 Framework design for system architecture

The functional business logic can be divided into the presentation and business layers. Each layer performs a unique function and encourages reusable system functionalities. The relationship between each module is mutual. Information is also exchanged between modules when carrying out a specific task.

For a user to initiate a case on the portal, the presentation layer offers a user interface to the user, enabling them to provide relevant information about the case. The

business layer serves as the mechanism responsible for processing the user's request received via the available interface. The data storage and access layer is a repository of all the data and/or information used in the processing using the developed system. It also allows users to add, query, call and update new/existing information and carry out other related processes and/or activities.

4.2. Operating Environment

The software will be a web-powered solution deployed and tested by a web browser. This solution should be able to run on a client-server, a system on an internet connection or locally on a web server. This decision will be based on the location of the web server.

When the data is stored locally, then the solution will run locally. This means that the solution and the data reside on a local system. The external interface will be through the browser with HTML as the markup language, PHP and JavaScript for scripting and CSS for page formatting.

4.3. Case Management Solution Testing

The project was tested to find and correct possible errors. These errors range from operational testing, unit testing, system testing, user acceptance testing, etc. These tests were conducted before the installation and deployment of the new project.

Fig. 3 Landing page for the case management system

Application software was installed and/or loaded on existing or new hardware, while several users were introduced to the new solution. Integration tests assess whether modules or programs must work together without error. The figure above represents the home/index page of the web-based application. This is the default page presented when the application link is first clicked.

This page presents three sub-modules: the case management office, registrar and judge modules. The figure below shows the module for registering new users. This module is designed for administrators, where they can add a new user, provide relevant information and store the details provided in USERS db.

Fig. 4 New user registration page

The system will encrypt the password using HASH data security (SHA-256 algorithm). This enables the data provided for the password to be converted to several string combinations stored in the database. The figure below shows the landing page for the case management officers. The page enables the officers to access the new request form when they have successfully logged on with valid credentials to initiate a new case and assign them to the respective courtroom. The page also allows users to access the register new user page, where new user information can be stored in the relevant database table.

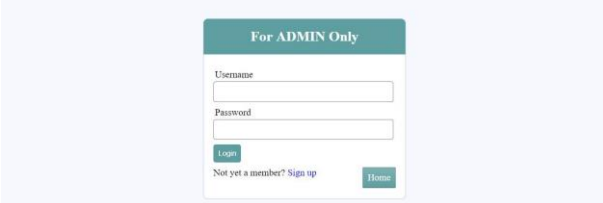

Fig. 5 Administrative access login page

The figure below shows a Register New Case form, where users provide relevant information about the plaintiff, assign the case number, select the court and courtroom and provide the lawyer's information. Users will store the provided information in the designed database by clicking the submit button. Once successful, the page will redirect the user back to the homepage.

Fig. 6 New case information registration page

The figure below shows the login page for REGISTRARS to enable them to access the required information assigned to them. Users provide relevant usernames, passwords and systems that validate the information when the login button clicks. Users also have access to reroute to the register new user landing page. The home button allows the users to redirect the page to the default home page.

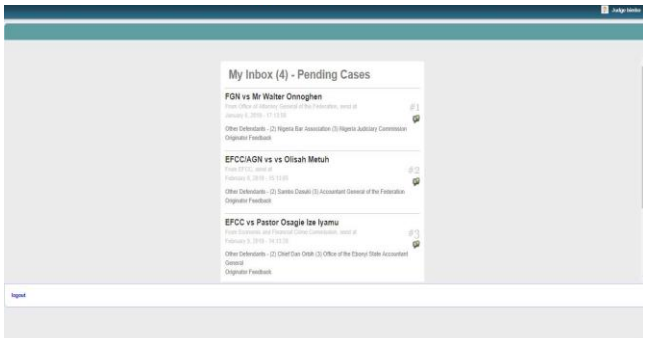

Fig. 7 Image showing pending cases in the user's inbox

The pending cases list highlights relevant information on all registered cases submitted by the Case Management Officer. This can be viewed only by registered REGISTRARS, whose information is stored on the user database (as shown below)

Fig. 8 Image showing database information

5. Achievements, Constraints and Limitations

The project work has outlined how system processes can be adopted to enhance and ensure proper management of court case information systems. This also allows efficient dissemination of information and storage of relevant processing data. The first chapter provides a general overview of the project, which includes the background of the study, aims and objectives, methodology, and significance of the project. It also highlights the statement of the problem and outlines the required solution. The second chapter evaluated relevant literature on project history and court case information management systems and an overview of the proposed project as defined in this document. This chapter also lists the advantages of the previous system and evaluates various components of web-based application technologies, systems and other tools used in development. The third and fourth chapters explain the applicable software development processes used for this project work. This ranges from requirement gathering and analysis, solution design and development, project testing and implementation. The last chapter handles the conclusions and requires recommendations.

5.1. Achievements

The quest to make life easier and enhance the processing of data and information has led to virtually integrating all works of life with information and communication technology. Information technology has transformed various ways of life, especially in the educational sector, through mobile learning, access to timely information and improved virtual learning.

The achievement of this project is that it will improve the management of court cases through all relevant process owners. It will also enhance access to case data/information, facilitate the dissemination of such information, and encourage more users of the project work. This solution will go a long way in addressing the cause of delays in processing court cases and routing such cases to relevant users in a structured and well-managed manner.

5.2. Constraints and Limitations

While working on this project, some constraints ranged from designing the required Database (DB), Tables and Images and other relevant information. Some issues were observed when designing the E-R Diagram, such as the Microsoft Word application used for the project documentation does not have the required shape needed for designing the Entity Relationship diagram. This was eventually designed using another solution, and the information was exported to Microsoft Word.

Also, I encountered some issues when designing the physical DB schema. This is solely because the Microsoft Word used for documentation does not support some technical drawings. Another constraint is limited resources (i.e., available materials) to aid in the prompt development of the required input for the project work. Lastly, time is another important constraint encountered during this project. The time spent carrying out this project work was very limited. Regardless of the limited time, the project was carried out with commitment and precision.

6. Conclusion

The project work has been developed to address some identified key issues; this can be upgraded to include mailing and notification systems. Also, a plaintiff should be able to initiate his/her cases in his/her comfort home or office. A search and indexing function should be added to project work to enable easy lookup of relevant files and information.

In conclusion, from proper assessment and adequate analysis of the proposed system, it can be safely concluded that it is a dependable, usable and efficient Case Management System. It was tested and worked properly, and the design meets the minimum solution requirements. The solution will function as an electronic repository system facilitating engagements and collaboration among the users (i.e. the Admins, Case Management officer, Court Registrar and the Court Judges).

Conflicts of Interest

The authors hereby declare that there exists no conflict of interest whatsoever in relation to this paper's research, authorship, or publication. Neither the principal investigator nor the co-authors have any financial, personal, professional, or other relationships that could be construed as influencing the objectivity, analysis, or conclusions presented in this work. This research was conducted independently without external pressures or competing interests that might affect its integrity.

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