

Developing a Web-Based Patients' Information Management System for Desire Medical Centre

Nuwamanya David¹, Hussein Kalinaki²

1, 2 Metropolitan International University

Abstract

This project involved the analysis, design, and development of a web-based patients' information management system for Desire Medical Centre, a healthcare facility that had been managing patient information using manual, paper-based methods. Manual records are prone to loss, duplication, delay, and difficulty of retrieval, which undermine the quality and efficiency of care. The project adopted a systems development methodology combining requirements analysis, system design, implementation, and testing. Requirements were gathered from staff through interviews, observation, and review of existing records, and the system was designed using a three-tier architecture, entity-relationship modelling, and use-case modelling, and implemented as a web application using PHP, the Laravel framework, and a MySQL database. The developed system provides modules for patient registration, records management, appointments, prescriptions, billing, reporting, and user access control. Testing confirmed that the system met its functional requirements and was usable by staff. The project concludes that the web-based system offers a substantial improvement over the manual system in the accuracy, security, accessibility, and efficiency of patient information management, and recommends its deployment together with staff training, data backup, and maintenance.

Keywords: patient information management, web-based system, health information system, database, medical centre, Uganda

1.0 Introduction

The effective management of patient information is fundamental to the delivery of quality healthcare, since accurate, accessible, and secure records underpin diagnosis, treatment, continuity of care, and administration (WHO, 2021). Health information management—the systematic capture, storage, retrieval, and use of patient information—has been transformed in many settings by the adoption of computerised information systems, which overcome the limitations of manual, paper-based records (Wager, Lee, & Glaser, 2021). For healthcare facilities still relying on manual methods, the development of a computerised patient information management system offers substantial benefits in accuracy, efficiency, security, and quality of care.

Desire Medical Centre, a healthcare facility in Uganda, had been managing its patient information using manual, paper-based methods, in which patient records were recorded and stored on paper. Such methods are prone to well-documented problems: records can be lost, damaged, or misplaced; information can be duplicated or inconsistent; retrieval is slow, particularly as records accumulate; and paper records are difficult to secure and to analyse for reporting (Wager, Lee, & Glaser, 2021). These problems undermine the efficiency of the facility and the quality and continuity of care it provides. This project was undertaken to address these problems by developing a web-based patients' information management system for the medical centre.

A web-based information system—one accessed through a web browser and running on a server—offers particular advantages: it can be accessed from multiple points within the facility, centralises data in a single secure database, supports concurrent use, and is relatively easy to maintain and update (Connolly & Begg, 2021). The development of such a system requires a systematic process of analysis, design, implementation, and testing to ensure that it meets the needs of its users and functions reliably (Sommerville, 2021).

This article documents the development of the web-based patients' information management system for Desire Medical Centre. Rather than following the empirical survey structure, it follows a systems-development structure appropriate to a design-and-build project: it presents the problem and objectives, reviews related literature and systems, describes the methodology, and then presents the system analysis, design, implementation, and testing, before concluding. The project is significant for the medical centre and offers a model for similar facilities. The article proceeds accordingly.

2.0 Statement of the Problem

The effective management of patient information is essential to quality healthcare, and Desire Medical Centre requires accurate, accessible, and secure patient records to deliver care efficiently (WHO, 2021). Ideally, patient information would be captured, stored, and retrieved reliably and securely. In practice, however, the medical centre's manual, paper-based system suffered from lost and misplaced records, duplication and inconsistency, slow retrieval, difficulty in securing records, and difficulty in generating reports, which undermined the efficiency of the facility and the quality and continuity of care (Wager, Lee, & Glaser, 2021).

These problems were expected to worsen as the volume of records grew, further slowing service and increasing the risk of error. Without a computerized system, the medical centre would continue to experience inefficiency, data loss, and compromised care. This project therefore sought to develop a web-based patients' information management system to overcome the limitations of the manual system and improve the accuracy, security, accessibility, and efficiency of patient information management at the medical centre.

3.0 Objectives

3.1 Main Objective

The main objective of the project was to develop a web-based patients' information management system for Desire Medical Centre to improve the management of patient information.

3.2 Specific Objectives

- i. To analyse the requirements of the medical centre for a patient information management system and the weaknesses of the existing manual system.
- ii. To design a web-based patients' information management system that meets the identified requirements.
- iii. To implement the designed system using appropriate web technologies and a database.
- iv. To test and validate the system to ensure that it meets its functional requirements and is usable by staff.

4.0 Literature Review

Received: 16.08.2026

Accepted: 20.08.2026

Published on: 30.08.2026

The development of health information systems is grounded in the fields of health informatics, information systems, and software engineering. Health informatics concerns the application of information technology to healthcare, and a substantial literature documents the benefits of computerised patient information systems—improved accuracy, accessibility, security, continuity of care, and efficiency—over manual records (Wager, Lee, & Glaser, 2021). Electronic health record and patient information systems are now widely regarded as essential infrastructure for quality healthcare, and their adoption is being promoted in developing countries, including Uganda, as part of the digitisation of health services (WHO, 2021).

The design and development of information systems draws on established software engineering principles and methodologies. The systems development life cycle provides a structured process of analysis, design, implementation, testing, and maintenance, ensuring that systems are built systematically to meet user needs (Sommerville, 2021). Database design, using entity-relationship modelling and normalisation, ensures that data are stored consistently, without redundancy, and can be retrieved efficiently (Connolly & Begg, 2021). Web-based, multi-tier architectures, separating presentation, application logic, and data, are widely used for information systems because they support accessibility, maintainability, and scalability (Sommerville, 2021).

A review of existing patient information systems shows a range from large, commercial electronic health record systems to smaller, custom-built applications suited to individual facilities. Large commercial systems offer extensive functionality but are often costly and complex for small facilities, whereas custom-built web applications, developed with widely available open-source technologies such as PHP and MySQL, can provide the core functionality a small medical centre needs—registration, records, appointments, prescriptions, billing, and reporting—at lower cost and with greater fit to local needs (Wager, Lee, & Glaser, 2021; Connolly & Begg, 2021). This project follows the latter approach, developing a custom web-based system tailored to Desire Medical Centre. The literature emphasises the importance of user involvement, security, and usability in such systems, which this project reflects.

5.0 Methodology

5.1 Development Methodology

The project adopted a systems development methodology based on the systems development life cycle, proceeding through the phases of requirements analysis, system design, implementation, and testing (Sommerville, 2021). An iterative approach was used, in which the design and implementation were refined in response to feedback, ensuring that the system met the needs of its users.

5.2 Requirements Gathering

Requirements were gathered from the staff of the medical centre—including reception, clinical, and administrative staff—using three techniques: interviews, to understand needs and expectations; observation, to understand the existing workflow and the handling of records; and review of the existing paper records and forms, to understand the

data and processes involved. These techniques together produced a comprehensive understanding of the functional and non-functional requirements of the system (Sommerville, 2021).

5.3 System Analysis and Design

The gathered requirements were analysed to specify the functions the system was to perform, and the system was then designed. The design used a three-tier architecture separating the presentation, application, and data tiers; entity-relationship modelling to design the database; and use-case modelling to specify the interactions between users and the system. These design artefacts are presented in the results (Connolly & Begg, 2021; Sommerville, 2021).

5.4 Implementation Tools

The system was implemented as a web application using HTML, CSS, and JavaScript for the presentation tier; the PHP programming language with the Laravel framework for the application tier; and a MySQL database for the data tier. These widely used, open-source technologies were selected for their suitability, reliability, and low cost (Connolly & Begg, 2021).

5.5 Testing

The system was tested using unit testing of individual modules, integration testing of the modules together, and user acceptance testing with staff of the medical centre, to verify that the system met its functional requirements and was usable. Testing was iterative, with issues identified and corrected (Sommerville, 2021).

5.6 Ethical Considerations

The project was conducted with attention to the confidentiality and security of patient information. Permission was obtained from the medical centre, no real patient data were used in development and testing beyond what was necessary and authorised, and the system was designed with access control to protect the confidentiality of patient information (WHO, 2021).

6.0 System Analysis, Design, and Implementation

6.1 Requirements

The analysis identified the functional requirements of the system, which are the functions it must perform. The system must allow the registration of patients and the capture of their details; the recording of visits, diagnoses, and treatment; the management of appointments; the recording of prescriptions; the generation of bills; the searching and retrieval of patient records; the generation of reports; and the management of users and their access rights. The non-functional requirements identified included security (protection of patient information through access control), usability (ease of use by staff), reliability, and performance (fast retrieval of records).

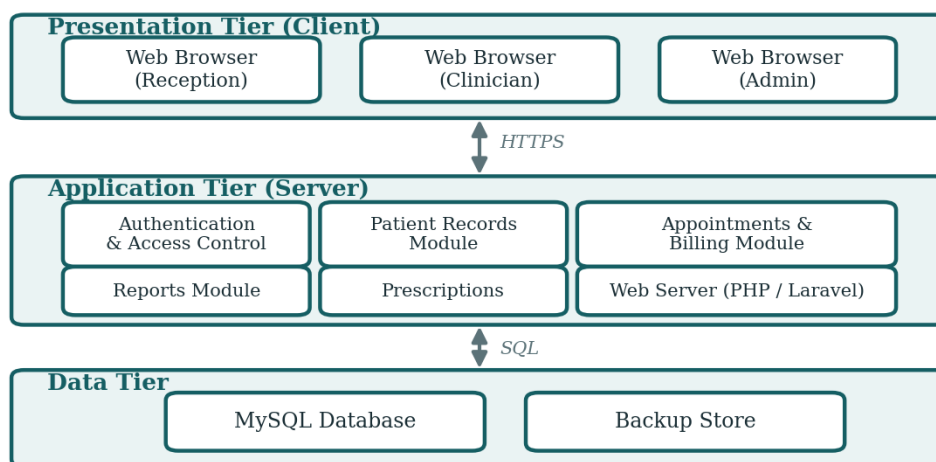
6.2 System Architecture

The system was designed using a three-tier architecture, which separates the system into a presentation tier (the user interface, accessed through a web browser), an application tier (the server, which contains the application logic and modules), and a data tier (the database). This separation, shown in Figure 1, supports accessibility, maintainability, and security, and is a widely adopted design for web-based information systems (Sommerville, 2021).

Received: 16.08.2026

Accepted: 20.08.2026

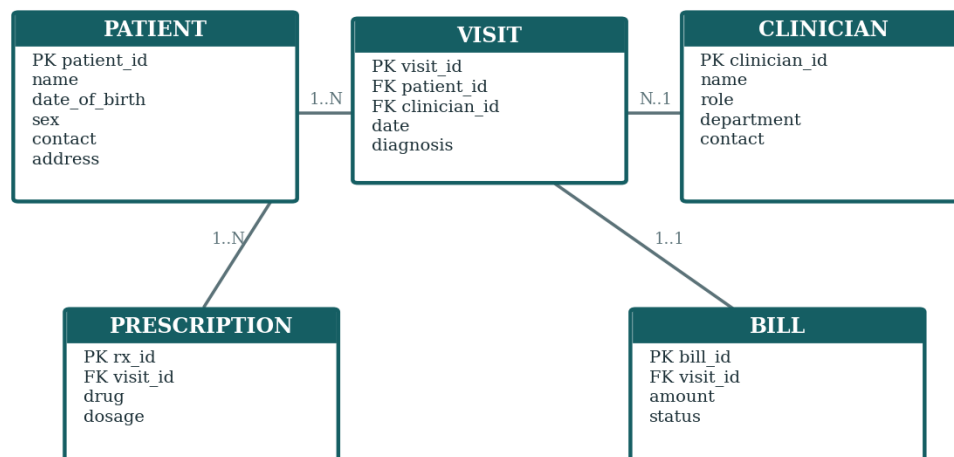
Published on: 30.08.2026

Figure 1: Three-Tier Architecture of the System*Figure 1: Three-tier architecture of the patients' information management system.*

As shown in Figure 1, staff at reception, clinical, and administrative points access the system through web browsers over a secure (HTTPS) connection; the web server hosts the modules for authentication, patient records, appointments and billing, prescriptions, and reports; and the data are stored in a MySQL database with a backup store. This architecture centralises patient data in a single secure database while allowing access from multiple points within the facility.

6.3 Database Design

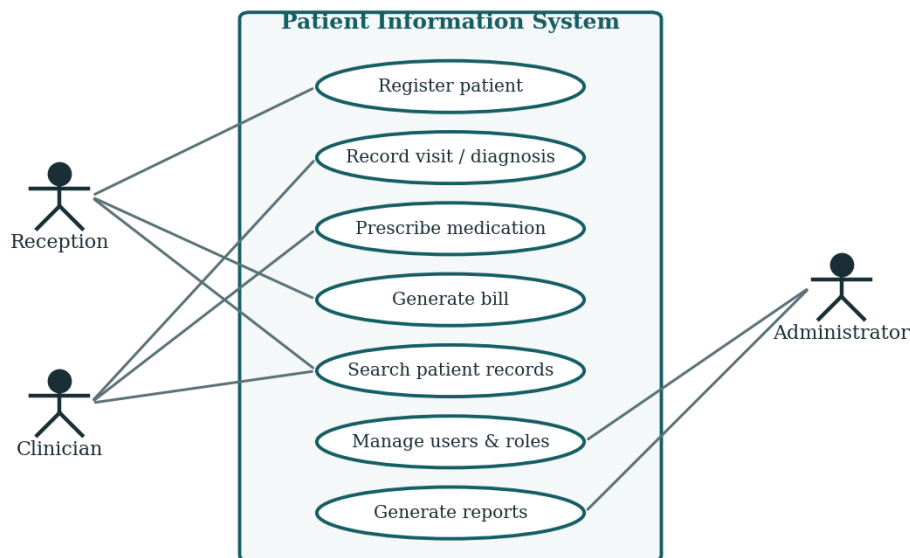
The database was designed using entity-relationship modelling to ensure that data are stored consistently and without redundancy. The core entities and their relationships are shown in the entity-relationship diagram (Figure 2). The principal entities are Patient, Clinician, Visit, Prescription, and Bill, related such that a patient may have many visits, each visit is attended by a clinician and may generate prescriptions and a bill (Connolly & Begg, 2021).

Figure 2: Entity-Relationship Diagram (Core Entities)*Figure 2: Entity-relationship diagram of the core entities.*

As shown in Figure 2, each entity has a primary key (PK) and attributes, and the entities are linked by foreign keys (FK) representing their relationships. This design, following the principles of normalisation, ensures data integrity and efficient retrieval (Connolly & Begg, 2021).

6.4 Functional Design (Use Cases)

The interactions between users and the system were specified using use-case modelling, which identifies the actors (types of user) and the use cases (functions) they perform. The use-case diagram (Figure 3) shows the three actors—reception, clinician, and administrator—and the use cases they perform.

Figure 3: Use-Case Diagram*Figure 3: Use-case diagram of the system.*

As shown in Figure 3, reception staff register patients, search records, and generate bills; clinicians record visits and diagnoses, prescribe medication, and search records; and the administrator manages users and roles and generates reports. This division of functions by role is enforced through the system's access control, ensuring that each user accesses only the functions appropriate to their role (Sommerville, 2021).

6.5 Implementation

The designed system was implemented as a web application using the selected technologies. The presentation tier was built with HTML, CSS, and JavaScript to provide a clear, usable interface; the application tier was built with PHP and the Laravel framework, implementing the modules for registration, records, appointments, prescriptions, billing, reporting, and access control; and the data tier was implemented as a MySQL database according to the entity-relationship design. The system implements user authentication and role-based access control to protect the confidentiality of patient information. The result is a functioning web-based system that provides the required functionality (Connolly & Begg, 2021).

7.0 Testing and Results

The developed system was tested to verify that it met its functional requirements and was usable. Table 1 summarizes the results of testing the principal functions of the system.

Function tested	Expected result	Outcome
-----------------	-----------------	---------

Received: 16.08.2026

Accepted: 20.08.2026

Published on: 30.08.2026

Patient registration	Patient record created and stored	Passed
Record visit and diagnosis	Visit linked to patient and clinician	Passed
Prescription recording	Prescription linked to visit	Passed
Bill generation	Bill generated for visit	Passed
Search and retrieval	Record retrieved quickly and accurately	Passed
Access control	Users restricted to their role	Passed
Report generation	Reports generated from data	Passed

Source: Primary Data, 2025

As shown in Table 1, the system passed the tests of its principal functions, confirming that it met its functional requirements. Unit testing verified the individual modules, integration testing verified that the modules worked together, and user acceptance testing with staff confirmed that the system was usable and met their needs. Staff feedback, gathered during acceptance testing, indicated that the system was clearer, faster, and easier to use than the manual system, and that the retrieval of records, in particular, was greatly improved. Minor issues identified during testing, such as interface refinements and validation, were corrected iteratively.

The developed system addresses the problems of the manual system directly: it prevents the loss and misplacement of records by storing them securely in a central database; it prevents duplication and inconsistency through the structured database design; it enables fast retrieval through search functions; it secures records through access control; and it enables reporting through its reporting module. The system therefore represents a substantial improvement over the manual system in the accuracy, security, accessibility, and efficiency of patient information management (Wager, Lee, & Glaser, 2021).

8.0 Conclusion and Recommendations

The project successfully analysed the requirements, and designed, implemented, and tested a web-based patients' information management system for Desire Medical Centre. The system meets its functional requirements and offers a substantial improvement over the manual system in the accuracy, security, accessibility, and efficiency of patient information management. It is recommended that the medical centre deploy the system; train staff in its use to ensure effective adoption; institute regular data backup to protect against data loss; maintain and update the system as needs evolve; and ensure the ongoing security and confidentiality of patient information (WHO, 2021; Connolly & Begg, 2021). Future development could extend the system with additional modules, such as pharmacy and laboratory management, and, subject to connectivity and security, integration with national health information systems. The project demonstrates the feasibility and value of custom web-based information systems for small healthcare facilities in Uganda.

References

Received: 16.08.2026

Accepted: 20.08.2026

Published on: 30.08.2026

Connolly, T., & Begg, C. (2021). Database systems: A practical approach to design, implementation, and management (7th ed.). Harlow: Pearson.

Sommerville, I. (2021). Software engineering (10th ed.). Harlow: Pearson.

Wager, K. A., Lee, F. W., & Glaser, J. P. (2021). Health care information systems: A practical approach for health care management (5th ed.). San Francisco: Jossey-Bass.

World Health Organization (WHO). (2021). Digital health and health information systems. Geneva: WHO.