

AN ONLINE HOSPITAL MANAGEMENT SYSTEM

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15010301019

**BEING A PROJECT SUBMITTED IN THE DEPARTMENT OF COMPUTER
SCIENCE AND MATHEMATICS, COLLEGE OF BASIC AND
APPLIED SCIENCES IN PARTIAL FUFILLMENT OF
THE REQUIREMENTS FOR THE AWARD OF
DEGREE OF BACHELOR OF SCIENCE
MOUNTAIN TOP UNIVERSITY,
IBAFO, OGUN STATE,
NIGERIA**

2019

CERTIFICATION

This Project titled, **AN ONLINE HOSPITAL MANAGEMENT SYSTEM**, prepared and submitted by **WEKE SAMUEL OLUSEGUN** in partial fulfilment of the requirements for the degree of **BACHELOR OF SCIENCE (Computer Science)**, is hereby accepted.

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DEDICATION

This Project is dedicated to God Almighty

ACKNOWLEDGEMENTS

I owe my profound gratitude to God Almighty who gave the strength, wisdom and courage, divine help and provision to me from the beginning to the completion of this work. I express gratitude to my supervisor, Dr. I.O. Akinyemi, Head of Department, Computer Science and Mathematics, for his teachings, guidance, counsel and fatherly support in ensuring the successful completion of this research. God bless you Sir. My heart-felt gratitude goes to the Dean, College of Basic and Applied Sciences – Prof. Akinwande, A. I., and all other staff members of the department of Computer Science: Prof. Idowu, P. A., Dr. Ojesanmi, O. A., Dr. Adamu, O. B., Dr. Okunoye, O. B., Dr. Oyetunji, M. O., Dr. Alaba, O. B., Dr.(Mrs) Olaniyan, O. O., Dr. Kasali, F. A., and Mr Falana, O. J and other members of staff.

I acknowledge the constant support of my mentors who had contributed to my academic achievement. They include Prof. Okeyinka, A. E., Prof. Atulomah, N. O. S., Dr. Ogbaro, D., Dr. Bolarinwa R. A., and Dr. Olasupo, S. F., Dr. Lala, O. J. I pray God would continue to increase their knowledge. I will forever be grateful to my parents Mr. and Mrs. Taiwo, S. A., who sacrificed wealth and enjoyable moments of their lives for the sake of my success; and my siblings - Oluwasikemi, Adeyemi, Oluwadamilola and Jesusegun for their prayers and support.

I want to thank also the entire Olaniyan, M. A. and family, Rev. Dr. Oladejo, S. O., Pastor Akande, M. O., Pastor Kingsley, O., and Pastor Josh-Adefishan, J., Dr. Omotunde, A., Dr. Ebiesuwa, S., Mr. Okoro, R., Mr. Adekola, O., Kasali, F., and Izang, A., Olagbenro, B., and Babcock University colleague and friends for their prayers and support, and help in one way or the other. God bless them all greatly. Lastly, I specially appreciate my loving, wonderful and glowing fiancé, Mr. Olaniyan, T. S., for his love, patience, support, words and actions taken to ensure I complete this programme in time. I love him and God bless him

I heartily thank my parents and siblings, thank you all for your moral and financial support. I am grateful for all the investments into my education and future. I would not forget to remember

all the students in the Department of Computer Science and Mathematics, for making my stay a worthwhile one, I say God bless you all richly.

I would also like to thank my very good friends who contributed by assisting me in my project.

God bless you all!

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ABSTRACT

This project is based on the Design and Implementation of an Online Hospital Management System for use at the Mountain Top University Health Center. It evolved from the manual file keeping system used to store patients record and other data in the hospital. With the help of the internet, computers and other mobile devices are used to manage hospital records and help the administrator effectively access these records.

This project aims to create an efficient and reliable hospital management system that can do all the manual work with ease. In order to achieve its aim and objectives, a database was created, and design steps were taken using the iterative and incremental model.

This project work was built on Laravel framework with other frontend and backend technologies using Visual Studio Community 2017 as the Integrated Development Environment. The Hospital Management System created is useful in helping patients, doctors, nurses, record officers and administrators monitor and manage their respective operations properly.

The Hospital Management is a faster and more efficient way of keeping hospital records and monitor them.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Hospitals are concerned with human life and health. Good medical care relies on well-trained physicians and nurses and high-quality facilities and equipment. It also depends on good record keeping. Without correct, detailed and up to date and accessible patient records, medical staff may find it hard to give the best treatment, which can have severe implications. Associated records, such as x-rays, specimens, drug records and patient records, also needs to be stored in a database. Good records care also guarantees that the hospital's administration operates smoothly, if unwanted data are removed frequently, storage regions would be clear and accessible, and important records would be discovered quickly, thereby saving time and improving efficiency (Okwor, 2012).

Managing hospital records addresses the specific issues involved in the management of clinical and non-clinical hospital records. A comprehensive records management system in a hospital helps to guarantee that staff have access to both clinical data and administrative documents on a wide range of issues, including policy, precedents, legal rights and responsibilities, employees, finance, buildings, facilities and resources. Record keeping is the systematic method by which an organization's documented are generated, captured, maintained, and disposed of. This system also guarantees their preservation for evidential purposes, accurate and effective updating, timely availability, and control of access to them only by authorized staff (Ahmed & Usman, 2017).

1.2 Statement of the Problem

Many challenges are faced with the manual method of keeping records. The challenges faced with this manual system include time wastage in searching for registers, inadequate use of statistical data, error prone calculations, and redundancy of information. This project is aimed at devising a system that will eradicate these above problems and improve medical services to the users. This computerization process is believed to be capable of not only solving these problems but many more to be encountered.

1.3 Aim and Objectives of the Study

The aim of this study is to create an efficient and reliable hospital management system that can do all the manual work with ease. It is designed to achieve the following objectives:

- i. To ensure that the storage and retrieval of information is fast
- ii. To reduce human errors to the barest minimum
- iii. To help the management plan, monitor and optimize resources

1.4 Scope of the Study

The scope of the project covers the development of a web-based database application for use at the Mountain Top University health center to replace their old paper notebook recording system. The requirements include designing a user interface for the application and providing options for a user to log into the application by supplying the correct username and password combination; register new patient and view a list of already registered patient; to keep records of outpatient and in-patient in the hospital; view patient registered on the database; admitted, discharge, bill patient etc. It also covers writing the background programming to ensure that the interface works with the database through the underlying codes to perform the required actions. It also involves the testing, improvement and optimization of the application.

1.5 Significance of the Study

The researcher during the course of this investigation found out that all the medical keeping record are done manually and having seen the problem associated with the manual system, the researcher calls for a new system in patient related services.

The significance of this study is to improve the health care institution using different web technologies that will help in the medical, financial and administrative needs with the goal of reducing the time and the more complicated paper work. This study will also help to improve most of the operations that take place in the health care institution.

1.6 Definition of Terms

Hospital Management System: A hospital management system (hms) is a software designed to manage all areas of a hospital such as medical, financial, administrative and the corresponding processing of services

Inpatients: A patient staying and receiving treatments in the hospital

Outpatients: Any person who goes to receive treatment in the hospital but does not stay overnight

Record Management: Records Management refers to an on-going process of managing the records in a media neutral basis in accordance with approved policies, procedures and schedules

Repository: A central location in which data is stored and managed

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter provides a review of literature on the factors influencing the successful implementation of HMS. The presentation of this chapter begins with the conceptual review, theoretical review, review of related literature and the summary of the literature reviewed.

Hospital management system (HMS) handles all patient data, doctor and medical staff information, and hospital billing. An HMS system helps manage all sections of hospital: reception, labs, and so on. This improves processing efficiency (Anastasia, 2019). Online Hospital Management Systems are meant to complement current (frequently paper based) medical records that are being used by medical practitioners. According to (Adhithyan, 2018) a number of advantages exist for online hospital management system such as "improving communication of information to physicians, overall cost reduction, improving access to patient medical information, reduction of errors, revenue management, and data security". Rise of health information technology worldwide is increasing the efficiency of health service delivery, reducing medical errors, improving quality of care, and providing better information for patients and physicians (Pollak & Lorch, 2007). Over the last few years, healthcare software has gained great popularity among clinics and healthcare organizations. Medical software is crucial to the healthcare industry since it lets healthcare providers to monitor and manage healthcare organization and patient data. (Anastasia, 2019).

The health care sector is an area of social and economic interest in several countries; therefore, there have been lots of efforts in the use of electronic health records. All things considered, there is prove proposing that these frameworks have not been embraced as anticipated, and although there are some proposals to support their adoption, the proposed support is not by means of information and communication technology which can provide automatic tools of support.

2.1 Conceptual Review

2.1.1 Hospital

The word hospital is derived from the Latin word “hospitalis”, which relates to guests and their treatment. The word reflects the early use of these institutions not merely as places of healing but as havens for the poor or for weary travelers. A hospital is a health care institution with specialized medical and nursing staff and medical equipment to provide treatment for patients (World Health Organization [WHO], 2018). It can also be defined as an institution built, staffed and equipped for disease diagnosis; for the treatment of the sick and the injured, both medical and surgical; and for their housing during this process (Piercey, Fralick & Scarborough, 2019). Hospitals play a vital role in the delivery of health services worldwide.

2.1.2 Hospital Management

Hospital Management is a wide-ranging term that can be defined from various aspects. It is primarily about managing all aspects of a hospital; coordinating all elements of a hospital. This can range from patient care to record keeping to inventory of medicines and cleanliness (RNpedia, 2016). Healthcare managers have a legal and moral duty to ensure a high quality of patient care and to strive for better care. These managers are primarily responsible for entrusting policies, systems, procedures and organisational climates. Therefore, many have argued that it is clear that managers have an important and obvious role in the quality of care and patient safety and that it is one of the highest priorities of healthcare managers. (Parand, Dopson, Renz, & Vincent, 2014).

Hospitals need top-notch management to help them run efficiently, with several departments providing life-saving care, operating complex equipment, and handling business issues such as policy development and compliance. Improving the quality of hospital services has the potential to enhance hospital performance and increase user demand for services, as well as enhance the overall trust patients have in health institutions (WHO, 2018). Good hospital management can often be the difference between a well-maintained hospital and a chaotic environment in which the quality of patient care is affected (Healthcare Business and Technology, 2016). Hospital management plays an important in implementing innovative methodologies, thus having a positive impact on patient experience and ensuring a successful and profitable healthcare institution.

2.1.3 Hospital Management System

According to Agnes (2011), delivery of health care services, particularly in developing countries like Nigeria, is constantly hindered by very weak information infrastructure to support data collection, collection, analysis and interpretation. This has resulted to numerous issues such as poor and inadequate information for clinical care of patients, education, research, and planning, budgeting and report generation amongst others. The burdens of poor information infrastructure include missing and misfiled patients records which are gradually becoming a norm while data reporting is either absent or delayed to the point of uselessness. Hospitals still groan with the burden of manual health records, lack of a good health library, and long waiting time for documentation from patients. The healthcare industry is looking to the IT sector for the best tools and equipment to face and handle several challenges along the way. As demands for better treatment and diagnostic procedures continue to increase, it is best for health care organizations, particularly hospitals, to upgrade their infrastructure and deliver the best results for this purpose, hence the need for a hospital management system (Rupp, 2018).

Hospital management system (HMS) handles all patient data, doctor and medical staff information, and hospital billing. An HMS system helps manage all sections of hospital: reception, labs, pharmacy amongst others (Anastasia, 2019). According to Rupp (2018), a hospital management system has several important advantages that help the day-to-day operations of a hospital or nursing home to function smoothly, such as:

- i) It saves costs
- ii) It makes the workload lighter
- iii) It streamlines medical billing
- iv) It enables accurate capture of information
- v) It allows for better competitiveness

2.2 Theoretical Review

Al-Shayea and Qeethara (2015) focused on the use of online hospital management in the implementation of ehealth in Jordan. The study proposed the implementation of the system using MATLAB server services. Through the system, doctors in Jordan could engage with doctors from the developed nations to analyze a patient and make decisions on the best treatment methods. The system concept used video conferencing such that both groups of physicians can engage on a one to one basis and discuss the patient clinical signs to determine the next course of action. Through the simulation of a practical application of the capabilities of online hospital management, great insights on how powerful and effective online hospital management can be in the health sector was provided.

Mittal (2013) conducted a study in Guru Gobind Singh Medical College, Faridkot, India on the functioning of health management system services. It was concluded that lack of motivation and low patient education skills are the key elements that have proved to be a major obstacle to the growth of hospital management system services. This data showed the need for improved quality and awareness among rural people of hospital management services.

Renuka and Praveena (2015) analyzed the current position of Foreign Direct Investment (FDI) in Indian health care sector. Various opportunities and challenges regarding such investment were identified. It has been suggested that FDI should create necessary infrastructure as well enhance awareness level to provide qualitative automated health care services. FDI funds can also be utilized to increase the physical capacity and development of specialty and super-specialty centers, up gradation of new technology like ehealth services.

Gautham, Sriram, Craig and Johnson (2014) developed the clinical guidance system with the use of mobile technology to improve the quality of ehealth care. The system developed provides guidance for the management of various diseases.

Udita (2014) identified critical success factors that influenced the success of ehealth services in India. These critical success factors were data warehousing and mining, decision support system, data access control, biomedical engineering technology, telecommunication infrastructure, government policies, consumer mindset, health care providers mind set, literacy level and health insurance. It has been emphasized that the success of ehealth care depends not only on technological factors but also on psychology factors.

Pal (2014) discussed the scenario of providing health care services to rural population and mentioned various funding agencies that sponsored different projects across the country for providing hospital management services.

Kapoor and Singh (2014) discussed the different issues faced during the implementation of an online hospital management system. The study revealed that these issues are not linked with technical problems but are linked with funds, behavior and attitude of doctors, lack of awareness amongst others.

Srivastava (2013) reviewed and analyzed online hospital management position for the provision of health care services. The results of the study concluded that hospital management system may be more beneficial to the elderly, especially those with disabilities and pregnant women who are unable to embark on a long-distance journey for regular hospital check-ups. New platform for disseminating health information on precautions to be taken against life threatening diseases such as HIV/AIDS, cancer amongst others. has emerged with the introduction of social sites. The focused areas for the study were technological development, security and reliability issues, benefits and challenges involved in providing e-health services, satellite use and other technological equipment.

2.3 Review of Related Works

Adebayo, Kanyinsola and David (2014) noticed the problems involved in the manual method of carrying out hospital operations which were unreliable backup of file, difficulty in accessing information which would result in waste of time and inaccuracy of reports. They created a patient record management system capable of improving information integrity, reducing transcription errors, reducing duplication of information entries, optimizing reporting time, reducing pilfering chances and maintaining records of indoor and outdoor patients. The system was built on Java in which a waterfall model was followed for the development of the system. Though the system met the minimum expectations that were initially set for it, but it also had some limitations which were the system could not be used in all areas of the hospital, the system was not user friendly and the system was vulnerable to attacks.

Ahmed and Usman (2017) focused their research on solving the amount of time patients waste before they book their appointments with the doctor. They decided to come up with a system that would manage patients' appointments with the doctor. The system was designed based on the 3-tier architectural pattern, consisting of the presentation tier (user interface or the client application), business logic tier (application server), database/storage tier (for storing patients'

details). The software was developed using the waterfall model and Visual basic.NET as the development tool. With the development of the system, patients can easily book and manage their own appointment. They will also be reminded of their appointments via SMS/email which they will receive promptly before their date of appointment. The system also enabled patients to track and monitor their appointment record. However, due to technical constraints, the display of bio-data such as X-rays and laboratory results were not included in the system.

Ilo, Igbajar and Acholonu (2015) implemented a web-based hospital management system for MOUAC clinic. Their aim was to increase the efficiency and interactivity in any area of specialization in the hospital. The spiral software development model was adopted and used in this system. The system was developed using C# programming language and Visual Studio 2013 as its development environment with MySQL as its database. The system is able to perform the following functions:

- i) The system can authenticate the users of the system.
- ii) Only the administrator can make changes to the database
- iii) The system was able to generate test reports, provide prescription details including various tests, and medicines prescribed to patients by doctors

Due to inadequate facilities used, the system was unable to provide an online payment functionality.

Bayanno Hospital Management System is one of the several products created by the software developers at Codecanyon. It is a complete software for hospital, clinic and medical institutes. It supports laptop, smartphone, desktop and tablet devices. It integrates and facilitates seven types of user area of a hospital, namely Administrator, Patient, Physician, Nurse, Pharmacist, Lab, and Accountant. The software also includes a security feature claimed to be invulnerable to threats such as SQL-injection, XSS attacks and CSRF (Codecanyon, 2014). Improvements made to Bayanno Hospital Management System by the proposed system include reduced data redundancy possibilities and cost efficiency. Due to limited time, the design of the system was not responsive on mobile devices.

Calorisplanitia Hospital Management System has the following features: Registration, Patient Check In / Check Out, Out-Patient, Patient Record Maintenance, and Billing. Registration: users are able to register, add, update and delete the records from the system with username and password protected proper privileges, according to organizational hierarchy; Patient Check In / Check Out: (IPD): new patient gets admitted with unique records, along with room reservation, case papers, check out, billing, and other details, generated for every patient. Out-Patient

(OPD): the system creates a unique record for each outpatient. including case papers, billing and other details. Patient Record Maintenance: the system maintains a detailed record of each patient. Billing: the entire detailed bill for each patient is automatically created (Calorisplanitia, 2014). However, the system had a poor user interface design implemented that needs to be re-designed.

2.4 Summary of the Literatures Reviewed

S/No.	Author(s)	Title of Paper	Problem Statement	Method used	Results	Contribution	Limitation
1.	Adebisi O.A, Oladosu D.A, Busari O.A and Oyewola Y.V.	Design and Implementation of Hospital Management System	a) Eliminating redundancy in terms of data storage. b) Reducing the time wasted in retrieving data especially in finding a past health records.	Waterfall Model	The system solved the problems associated with the existing manual system. Security was also enhanced using authentication.	Providing counter measures for security concerns in HMS	The system could not alert the pharmacy of the drugs expiry date.
2.	Olawale Ayotunde SobogunGod	The Development of Hospital Management Software	Replacing the manual method of keeping files with an automated database system	Iterative and Incremental Model	The system could handle patient registration, patient medical records, doctors and nurse's information, patient test	Developing a system that can manage both medical records and accept	The software could not communicate with other computers from other departments of the hospital

					reports, medication prescription details and a payment system	payment of hospital bills online	
3.	Ilo S.F, Igbajar Abraham, Acholonu Joyce C.	Designing A Web Based Hospital Management System For MOUAU Clinic	Increasing efficiency and interactivity in any area of specialization in the hospital	Spiral Model	The system was able to generate test reports, provide prescription details including various tests, and medicines prescribed to patients by doctors. It also provided injection details on the basis of patient's status for both indoor and outdoor patients.	Developing a computerized system that can reduce some of the manual work done by the hospital staff	The functionality of online credit card payment could not be implemented
4	Okwor Emeka Daniel	Design and Implementation of an Electronic Patient Management System	a) Improper documentation of payment record b) Difficulty in retrieving patient payment record.	Rapid Application Development	The system was able to provide a reliable storage for keeping payment records, reduce the amount of time spent during	Providing a reliable database storage for keeping files in HMS	Due to limited funds, the system was not fully implemented with the features that were dully meant to be.

					payment and also reduce the number of errors made during calculation.		
5	Ahmed Garko and Usman Mahmud	Design and Implementation of Outpatient Management System	Improving the quality of service offered by hospitals through outpatients scheduling	Waterfall Model	Patients could book and manage their own appointments with ease. They could also be reminded of their appointment dates via SMS/Email	Providing a platform in which patients can use to track and monitor their appointment record through SMS/Email	Patients are not able to view x-ray and laboratory result in the system

Table 2.1: Summary of Literatures Reviewed

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter provides a methodology of the HMS to be built. The presentation of this chapter begins with the flowchart, use case diagrams, design details, software development life cycle and the methods of data collection.

Methodology of research is the concept within which research is planned or organized (Okwor 2012). The design of a secured online hospital management system, is to improve the quality of services rendered in the hospital. With the improved changes of information and technology, the process by which automated management systems are made is changing dramatically. Using ICT in health institutions has led to the improvement in quality of hospital services. Coupled with the rapid changes of ICT evolution in the society, the health institution should be along with the changes of modern society too. Organizations have benefitted from the use of Information Technology (I.T).

3.1 Flowchart of the Hospital Management System

The flowchart illustrates the flow of control in program modules. It is a visual or symbolic representation of a process. The flowchart does not mention anything about how data flows through the system.

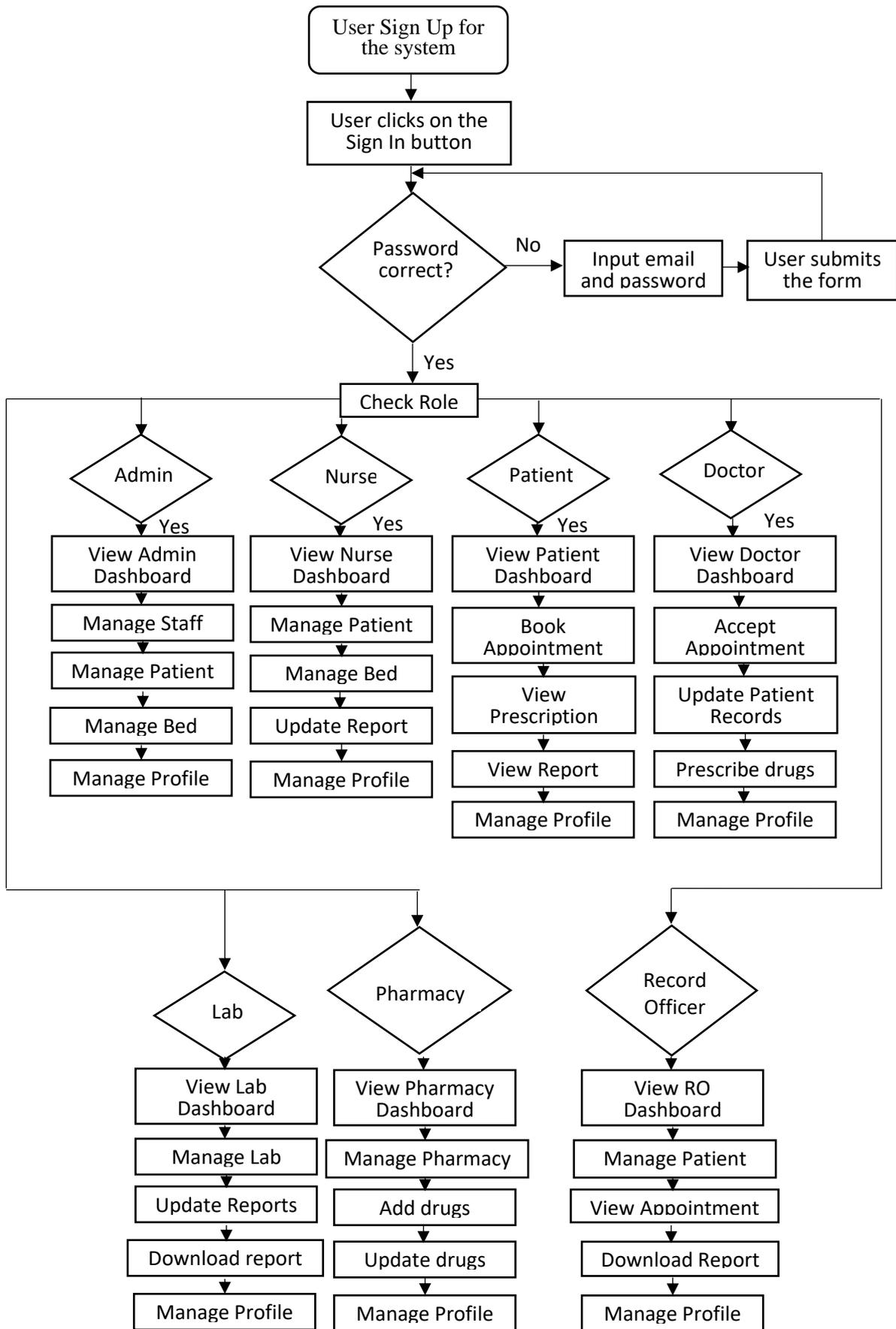


Figure 3.1: Flowchart of the Hospital Management System

3.2 Use Case Diagram

A use case diagram is a graphical representation of the relationship between the elements of a system. A use case is also a methodology used in system analysis to define, clarify, and organize system requirements (WhatIs, 2015). The following are the different use case diagrams for the system:

3.2.1 Record Officer Use Case

The Record Officer shall be able to sign up for the system, then login to the system, interact with the dashboard and view what the system has to offer. Record Officers shall also be able to view patients records in the hospital, check if patient have appointment with the doctor and update profile.

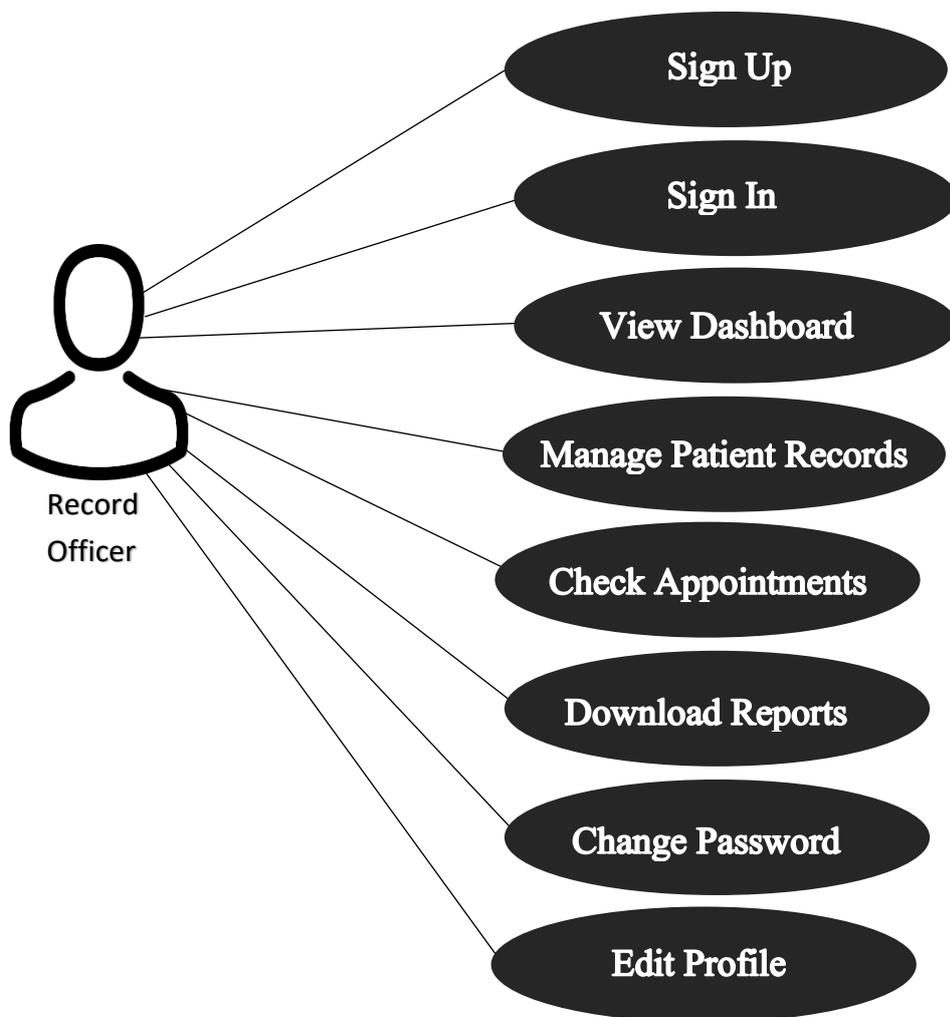


Figure 3.2: Record Officer Use Case

3.2.2 Patient Use Case

The Patient shall be able to sign up for the system, then login to the system, interact with the dashboard and view what the system has to offer. Patients shall also be able to request for an appointment with the doctor, check drug prescription (if there's any), view and download medical reports, and update profile.

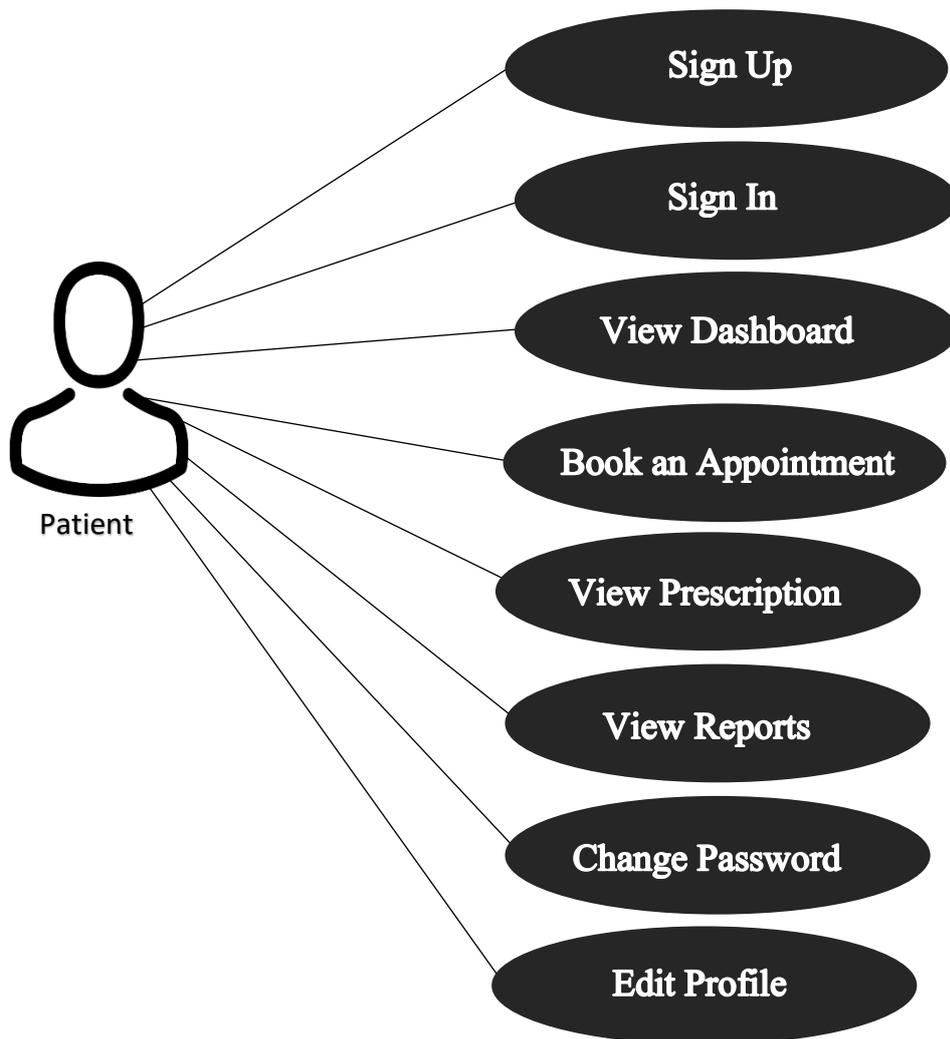


Figure 3.3: Patient Use Case

3.2.3 Nurse Use Case

The Nurse shall be able to sign up for the system, then login to the system, interact with the dashboard and view what the system has to offer. Nurses shall also be able to check patients' previous records and update it, manage bed/ward and allocate bed to the patient (if needed), and update profile.

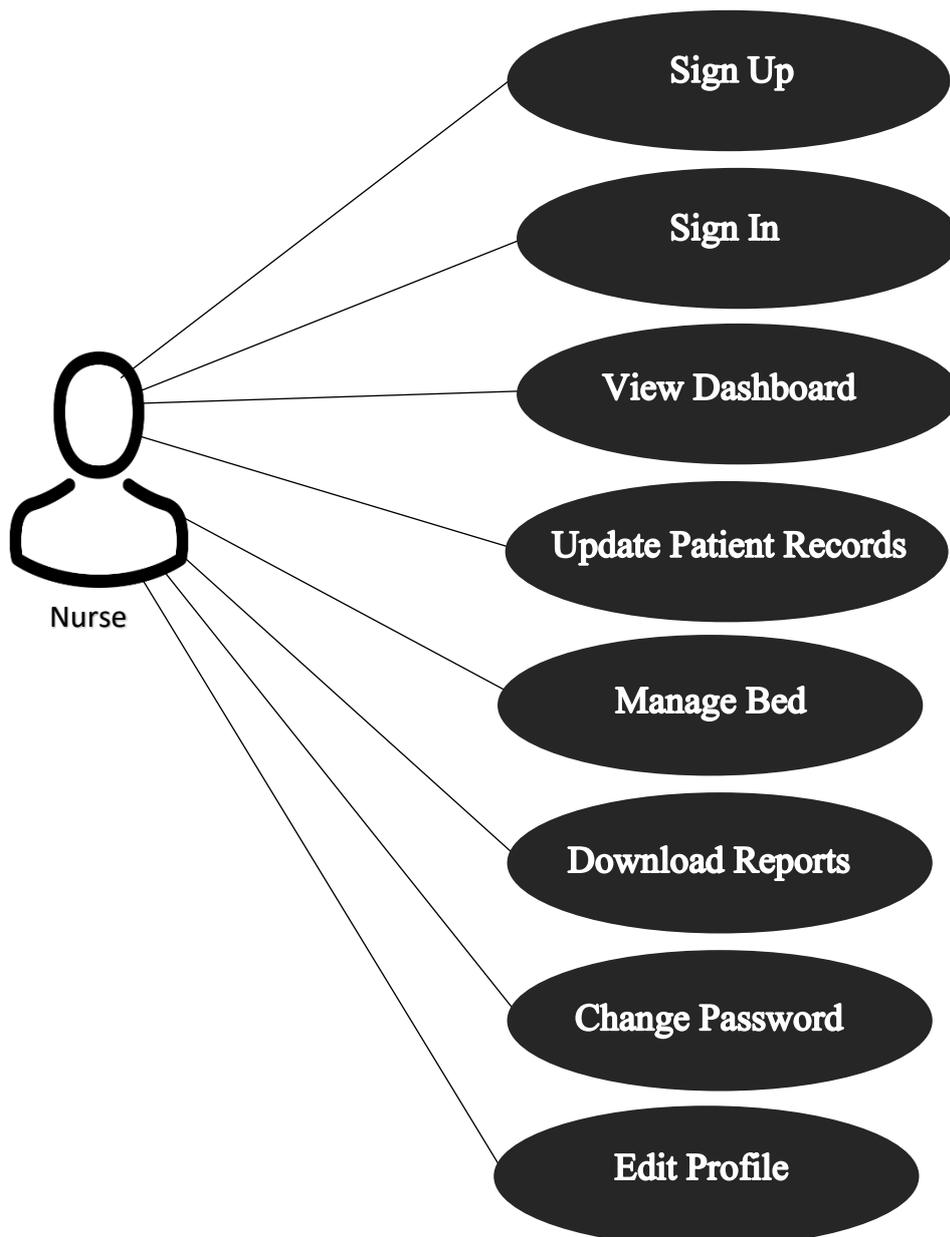


Figure 3.4: Nurse Use Case

3.2.4 Doctor Use Case

The Doctor shall be able to sign up for the system, then login to the system, interact with the dashboard and view what the system has to offer. Doctors shall also be able to check patients' past records and update it, prescribe drugs for the patient, accept or reject patient's appointment, and update profile.

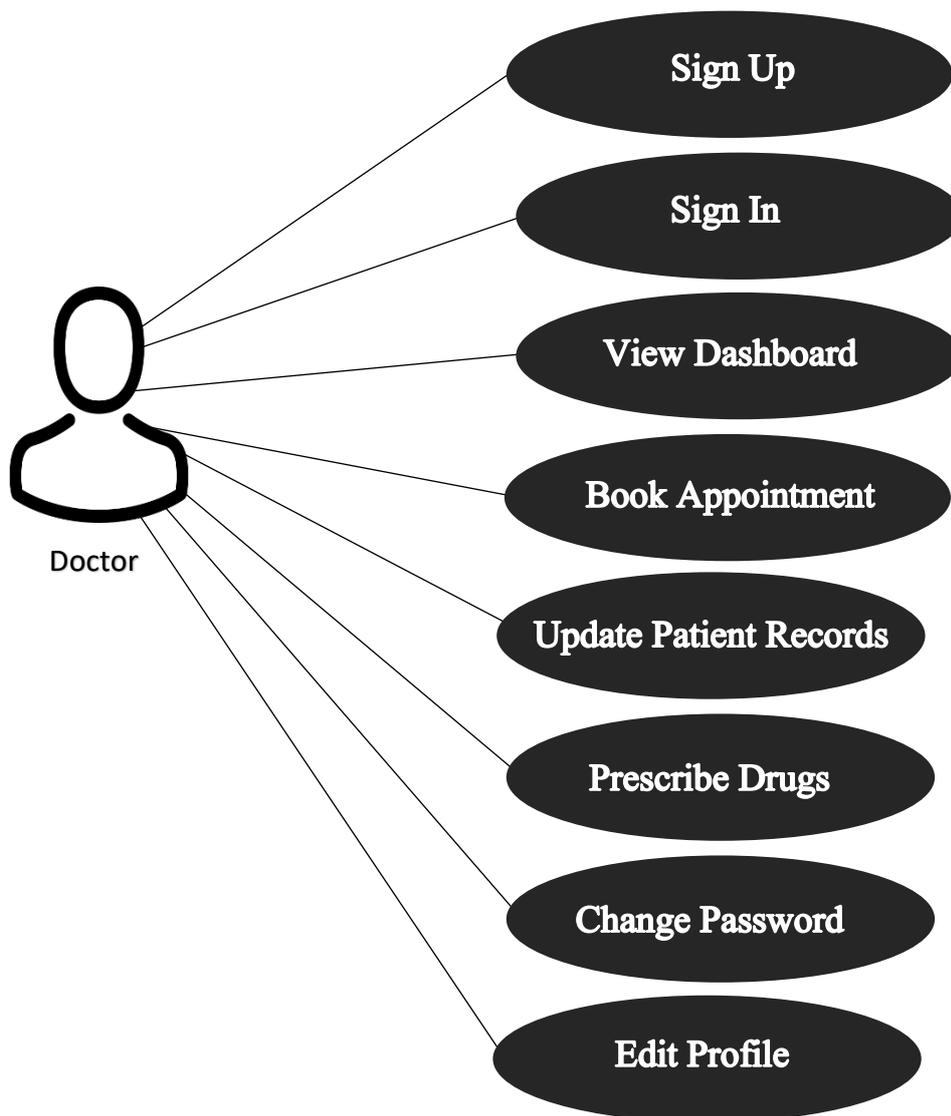


Figure 3.5: Doctor Use Case

3.2.5 Lab Use Case

The Lab Scientist shall be able to sign up for the system, then login to the system, interact with the dashboard and view what the system has to offer. Lab Scientist shall also be able to check patients' previous records and update it with current lab report, and update profile.

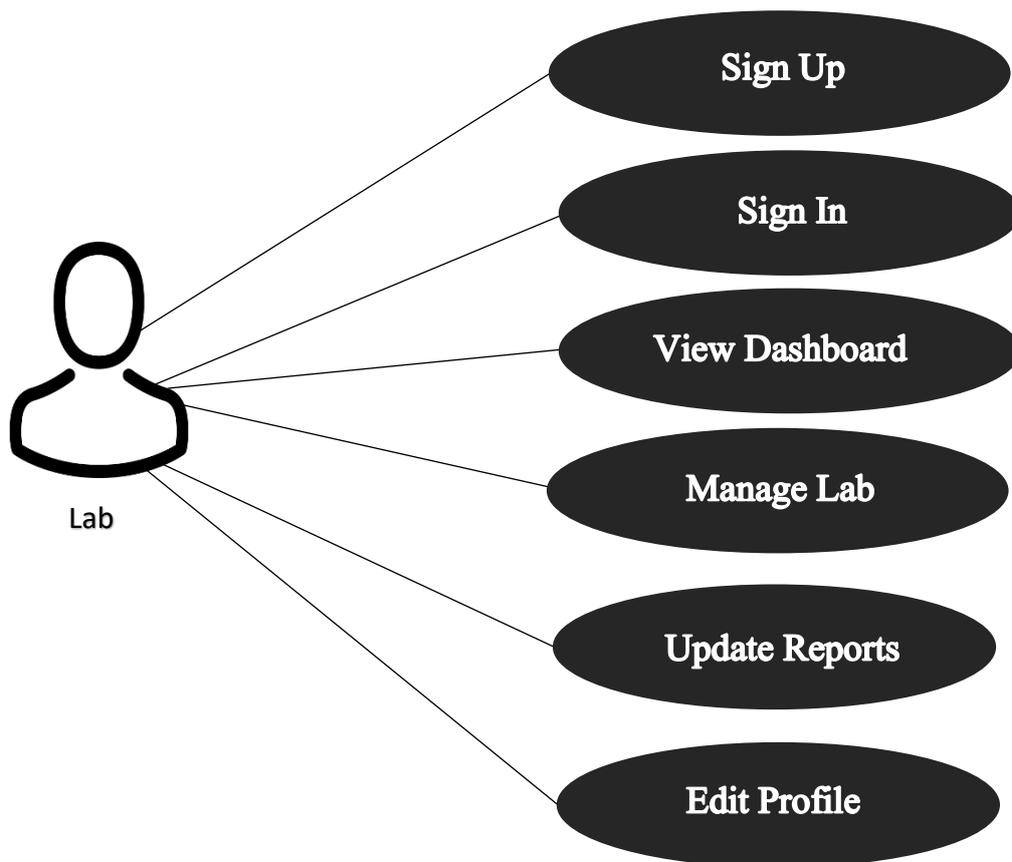


Figure 3.6: Lab Use Case

3.2.6 Pharmacy Use Case

The Pharmacist shall be able to sign up for the system, then login to the system, interact with the dashboard and view what the system has to offer. Pharmacist shall also be able to manage the drugs and edit profile.

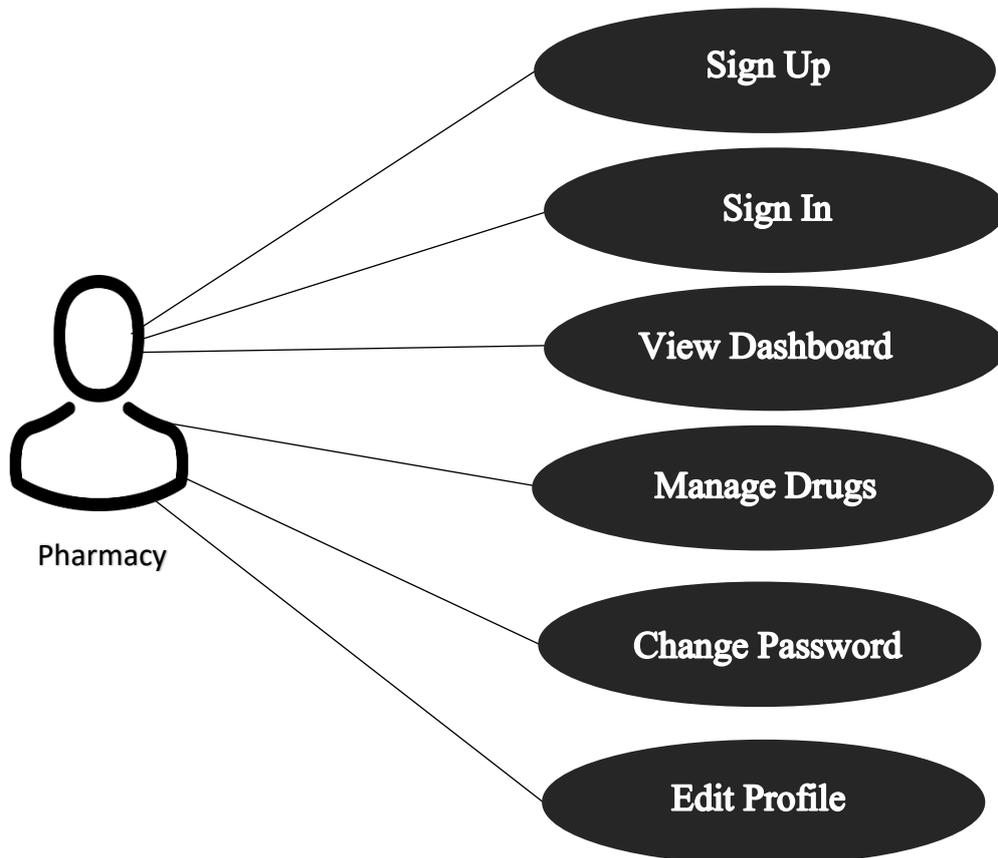


Figure 3.7: Pharmacy Use Case

3.2.7 Admin Use Case

The Admin shall be able to login to the system, interact with the dashboard and view what the system has to offer. Admins shall be able to manage doctors, manage patients, manage nurses, manage lab, manage pharmacy, manage record officer, manage bed/ward and other departments in the hospital.

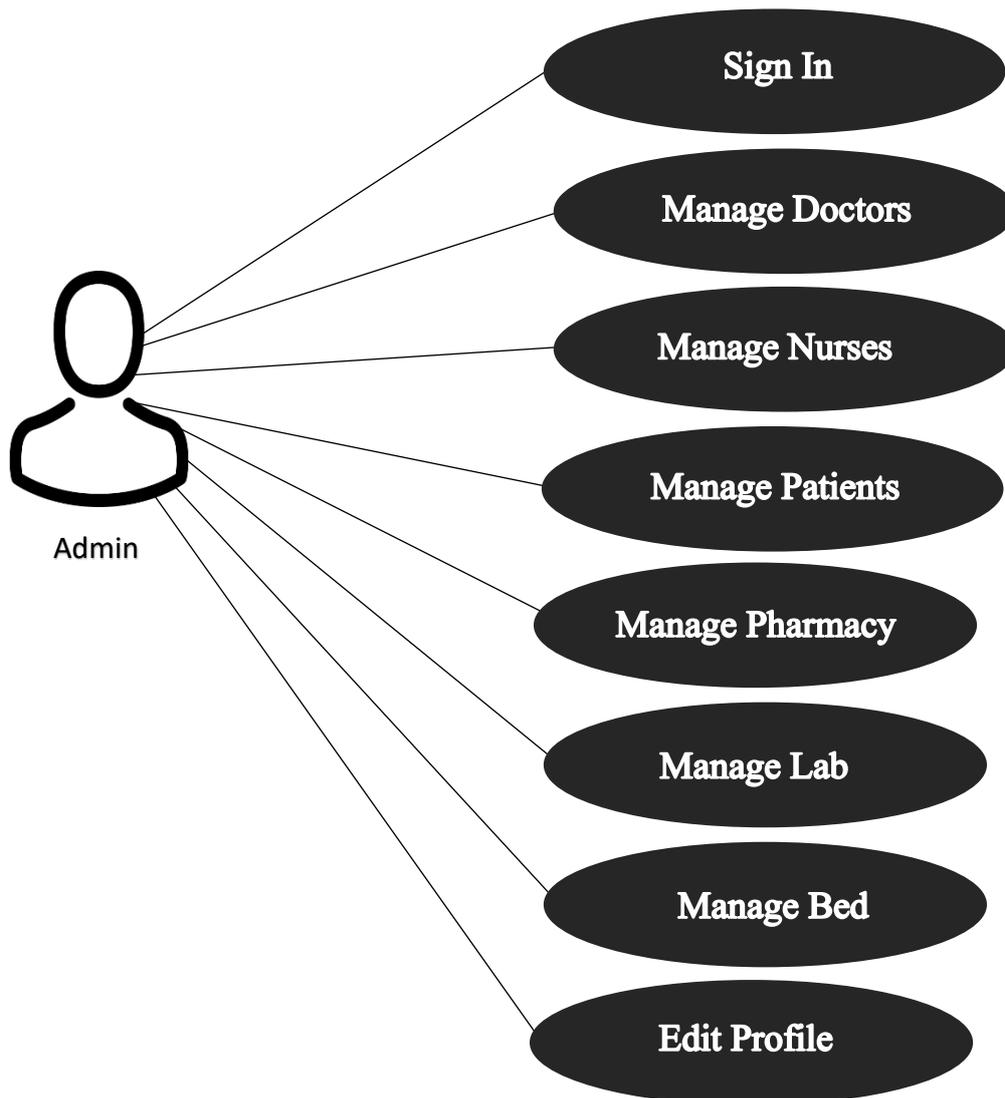


Figure 3.8: Admin Use Case

3.3 Design Details

The hospital management system was developed on Laravel framework. Laravel is a Model-View-Controller (MVC) PHP framework used to develop web applications. The MVC is an architectural pattern that separates an application into three main logical components: The Model (data), the View (user interface), and the Controller (application logic). This pattern helps to achieve separation of concerns. The Model part is responsible for managing the data of the application. The Controller is responsible for controlling the application logic and acts as the coordinator between the View and the Model, and the View is the component involved with the application's user interface. Using the MVC pattern for websites, requests are routed to a Controller which is responsible for working with the Model to perform actions and/or retrieve data. The Controller chooses the View to display, and provides it with the Model. The View renders the final page, based on the data in the Model. Laravel has a very rich set of features which will boost the speed of web development. (Tutorialspoint, 2019).

3.4 Software Development Life Cycle

The iterative and incremental model was adopted and used for the development of the system. In this model, the iterative process begins with a simple implementation of a small set of software requirements and iteratively enhances the evolving versions until the entire system is implemented and ready for deployment. An iterative life cycle model does not attempt to begin with a full requirements specification. Instead, development begins with only part of the software specified and implemented, which is then reviewed to identify additional requirements. This process is then repeated and at the end of each iteration model, a new version of the software is produced. The following diagram is a representation of the iterative and incremental model. (Tutorialspoint, 2019).

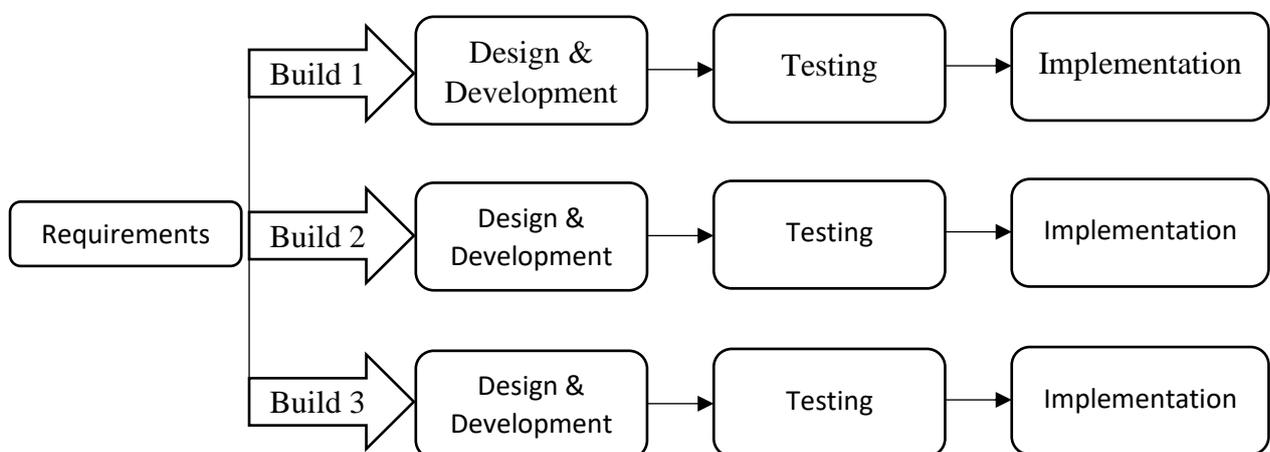


Figure 3.9: Iterative and Incremental Model

The advantages of this model are as follows:

- i. Some working functionality can be developed quickly and early in the life cycle.
- ii. Results are obtained early and periodically.
- iii. Parallel development can be planned.
- iv. Progress can be measured
- v. It is easy to test and debug during smaller iteration
- vi. The operational product is delivered with each increment

This model has the following disadvantages:

- i. It may require more resources.
- ii. It is not suitable for smaller projects.
- iii. Although cost of change is lesser, but it is not very suitable for changing requirements.
- iv. Highly skilled resources are required for risk analysis.
- v. More management attention is required.
- vi. Projects progress is highly dependent upon the risk analysis phase.

3.5 Method of Data Collection

The method of data collection used for this project work are from both primary and secondary sources.

3.5.1 Primary Source

This method of data collection was used to collect data from the doctors and nurses at the MTU Health Center. Some of the staff were interviewed on how operations are being carried out at the health centre.

3.5.2 Secondary Source

This includes the use of journals, internet and books with related articles on hospital management system to enlighten my understanding in developing the system.

CHAPTER FOUR

IMPLEMENTATION AND RESULT

4.0 Introduction and documentation

This chapter demonstrates the information of implementing an online hospital management system. Designing and implementing an online hospital management system considers some aspect which attempt to provide alternatives to the issues recognized and indicated in health-care systems. It describes the tools used in developing and implementing the system. These tools assisted in system design and development of the system's primary idea and functionality to accomplish its defined mission.

It describes a variety of functionalities step beneath every module with their outputs. The entire notion is a system, which are set of things working together as components of a mechanism or an interconnecting system, which are set of matters working collectively as parts of mechanisms or an interconnecting system, it is a set of interacting or interdependent issue forming a set of elements to other elements.

4.1 Implementation

The system was built using Laravel MVC Framework. The implementation was divided into three main parts which are frontend, backend and database. The frontend was built using HTML, CSS, JavaScript and jQuery. The frontend files were stored in the views folder of the MVC framework. The backend was built using Laravel PHP. The backend codes were kept in the Controller folder. The MySQL database was used for the implementation of the system in which the database codes were stored in the Model folder of the framework. Git was used to track changes made to the code.

4.2 How the Online Hospital Management System works

The application works based on the functional and non-functional requirements. This application includes the core phases of software development lifecycle.

4.2.1 Functional Requirements

This section describes the system's anticipated features. To execute a number of high-level tasks. For the planned use of this application, the following specifications are expected.

- i. **Registration:** All users of the system can successfully register on the system by filling in their details.
- ii. **User Management:** Modify rights, creating user ids, adding/deleting existing users.
- iii. **Appointments:** Patients can request for appointment with the doctor and the doctor can chose to accept or reject the appointment
- iv. **Medical Reports:** Doctors and Nurses can file medical reports about the patients. While Patients can also view the reports that was file about them
- v. **Downloading Files:** Admin can download the list of all users in the system. Patients can also download reports file about them.

4.2.2 Non-Functional Requirements

This deals with the characteristics of the system, which cannot be expressed as functions.

- i. **Security:** Access permissions for users are only granted when the email matches with password.
- ii. **Reliability:** The database update process must rollback all related updates when any update process fails.
- iii. **Performance:** The webpage load time is not more than 9 seconds for users that access the system

4.3 System requirements

For the efficient use of the system, certain hardware components and software components must be present on the system. The system requirement is made up of the software and hardware parts that makes the system to be developed effectively.

4.3.1 Software Requirements

One of the key elements in building a system is the section of compatible software. The following software are recommended for the successful implementation of the system.

Front-end technologies:	HTML, CSS, Bootstrap, JavaScript, jQuery,
Backend technologies:	PHP, Laravel Framework
Database Management System:	phpMyAdmin, MySQL
Version Control Tool:	Git
Local Server:	XAMPP
IDE:	Visual Studio Code 2019
Web Browser:	Google Chrome, Mozilla Firefox, Safari, IE

4.3.2 Hardware Requirements

Hardware configuration is an important factor to put in mind when developing a system. Insufficient random-access memory may affect the speed and efficiency of the entire system. The processor should be powerful to handle the entire operations. The hard disk should also have sufficient capacity to store the file and application.

Processor:	Core i3 (Minimum)
Processor speed:	2.5GHz (Minimum)
RAM:	4GB (Minimum)
Hard disk:	500GB (Minimum)
Monitor Display:	LED
Mouse:	Touchpad with multi-touch gesture support, USB or PS/2

4.4 Screenshot of the Pages Implemented

The screenshots of the implemented pages show the different views of the users depending on their roles with a brief description of what it entails. It consists of the Authentication Pages, Admin Dashboard, Patients Dashboard, Doctors Dashboard, Nurse Dashboard and Record Officer Dashboard.

4.4.1 Authentication Pages

The authentication pages consist of both the signup and login page

i) Signup Page

This is the first page that appears when the URL of the HMS is typed in any browser. The signup form is used to register users' credentials before giving them access to their privileges. The signup form contains a field for the name, email, password and role. When the signup form is submitted, the system redirects the users to their respective dashboard based on the roles selected.

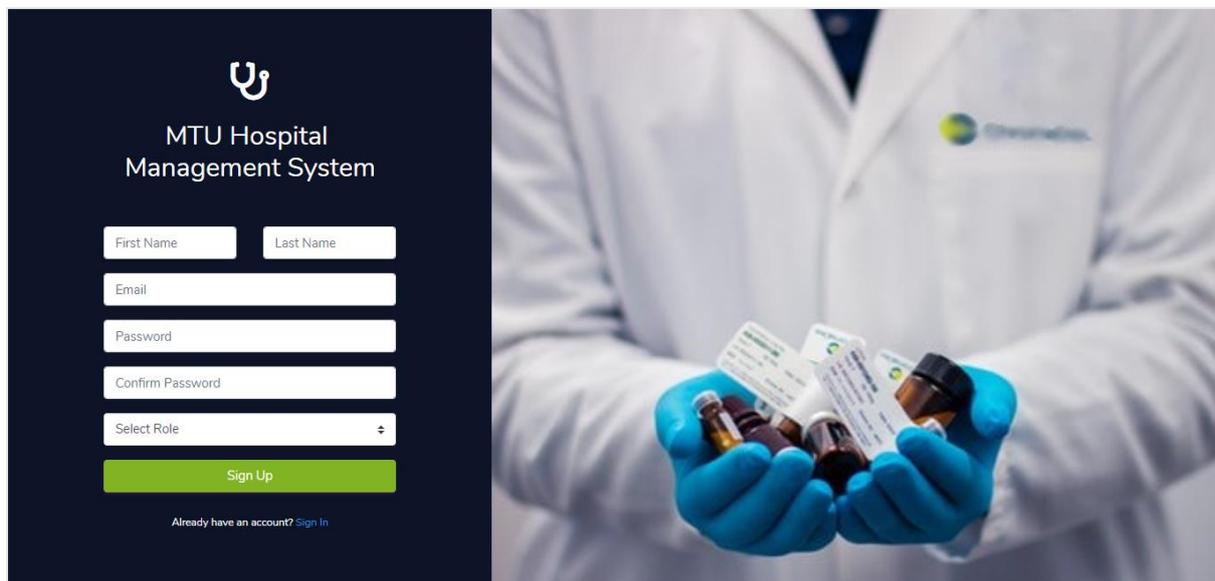


Figure 4.1: Signup Page

ii) Login Page

The login form is used to authenticate users' credentials before giving them access to their privileges. The login form contains a field for the email and another for the password. When the login form is submitted, the code checks that the credentials are authentic, given the user access to the restricted page. If a user is not authenticated correctly, they will not be able to proceed past the login form.

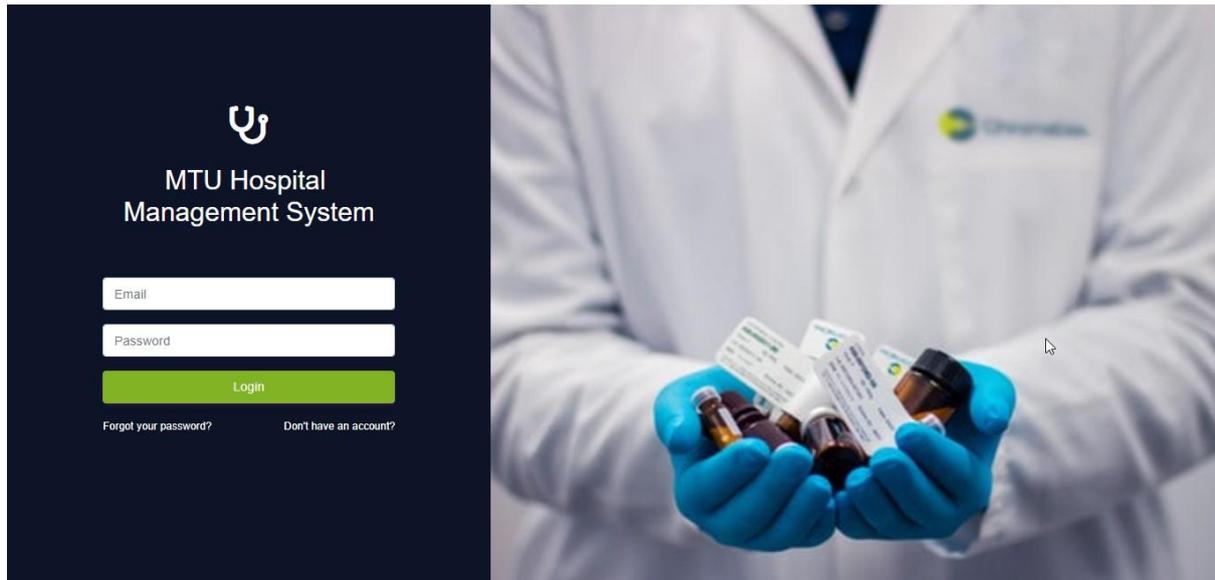


Figure 4.2: Login Page

4.4.2 Admin Dashboard

The admin dashboard is tasked with the management of all users of the system. The Administrator can add users, edit users' profile as well as delete users from the system.

i) Home

In this page, the admin can see the total number of users of the system.

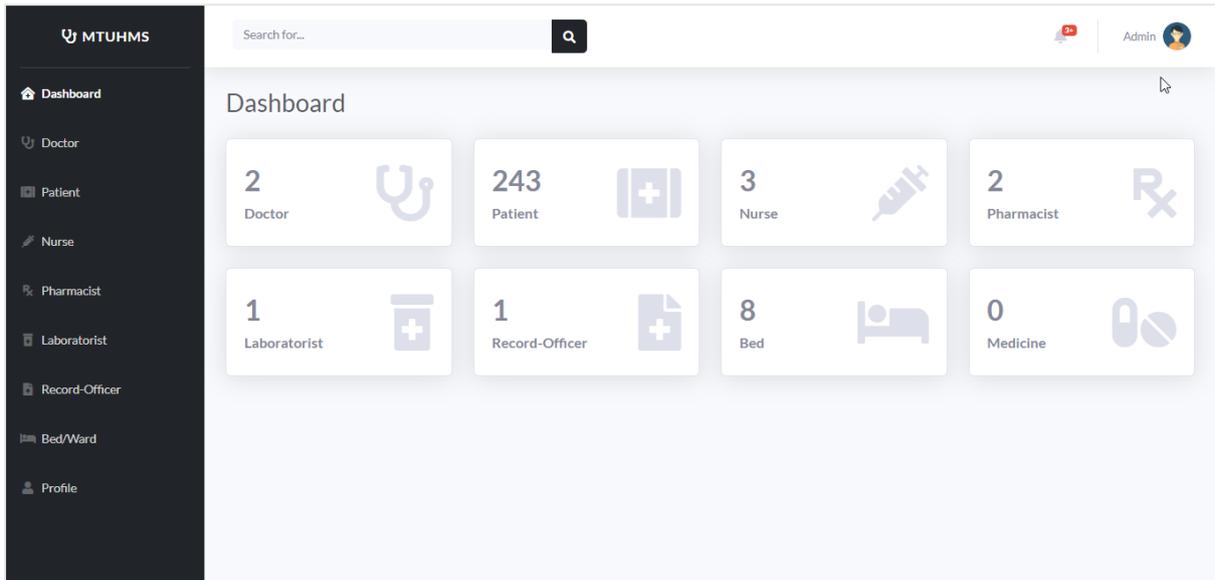


Figure 4.3: Homepage (Admin)

ii) Doctors

In this interface, the admin is tasked with managing the doctors in the hospital. The Administrator can add doctors, edit doctors' profile as well as delete doctors from the system.

The screenshot displays the 'Doctors' management page in the MTUHMS system. The page features a dark sidebar on the left with navigation links: Dashboard, Doctor, Patient, Nurse, Pharmacist, Laboratorist, Record-Officer, Bed/Ward, and Profile. The main content area has a search bar at the top with the text 'Search for...' and a magnifying glass icon. Below the search bar is a green '+ Add Doctor' button. The table below shows a list of doctors with columns for Image, Name, Email, Phone, and Option. The 'Option' column contains 'Edit' buttons and delete icons. The table is currently showing 1 to 3 of 3 entries.

Image	Name	Email	Phone	Option
	Ben Carson	Ben@yahoo.com	08182837564	Edit
	Paul James	pauljames@gmail.com	08023554318	Edit
	Chris Smalling	chrissmalling@yahoo.com	07034345523	Edit

Showing 1 to 3 of 3 entries

Previous 1 Next

Figure 4.4: Doctors Page (Admin)

iii) Patients

In this interface, the admin is tasked with managing the patients in the hospital. The Administrator can add patients, edit patients' profile as well as delete patients from the system.

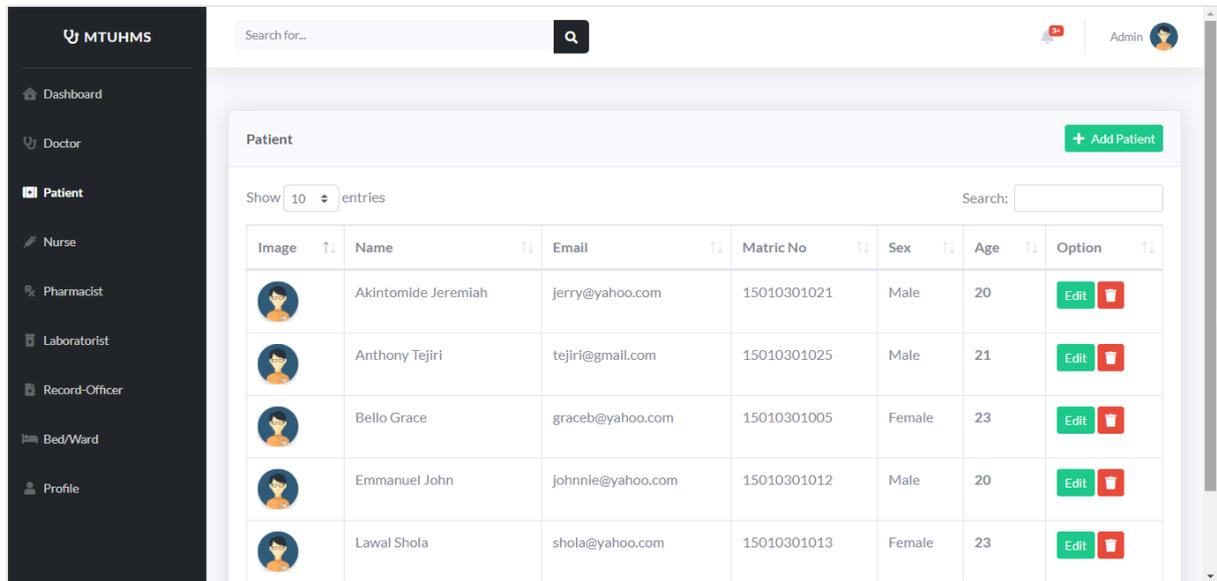


Figure 4.5: Patient Page (Admin)

iv) Nurse

In this interface, the admin is tasked with managing the nurses in the hospital. The Administrator can add nurses, edit nurses' profile as well as delete nurses from the system.

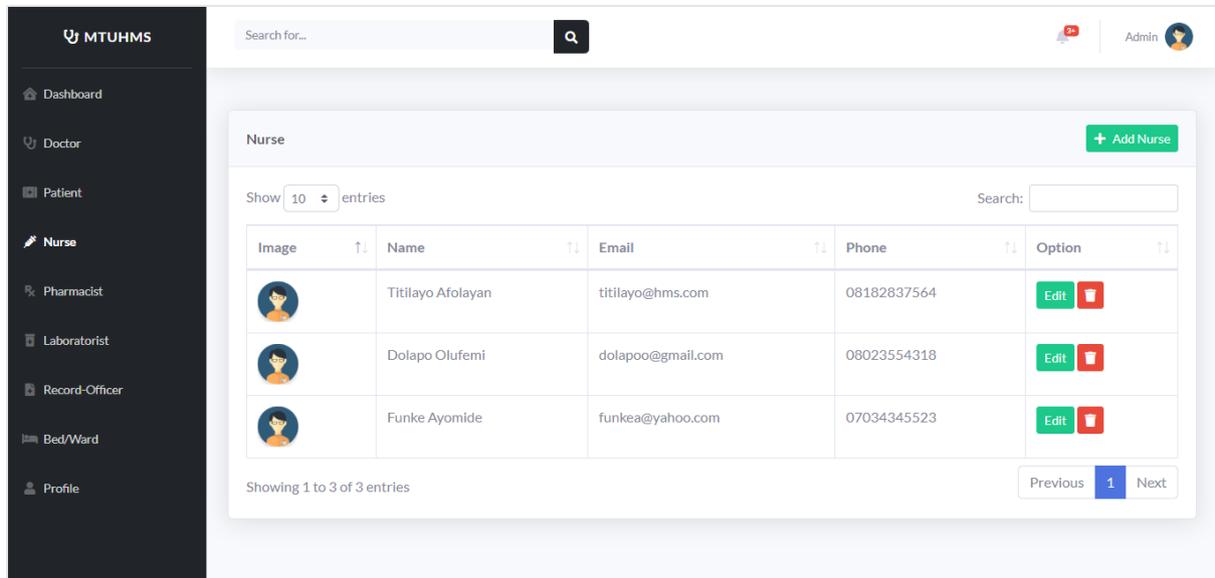
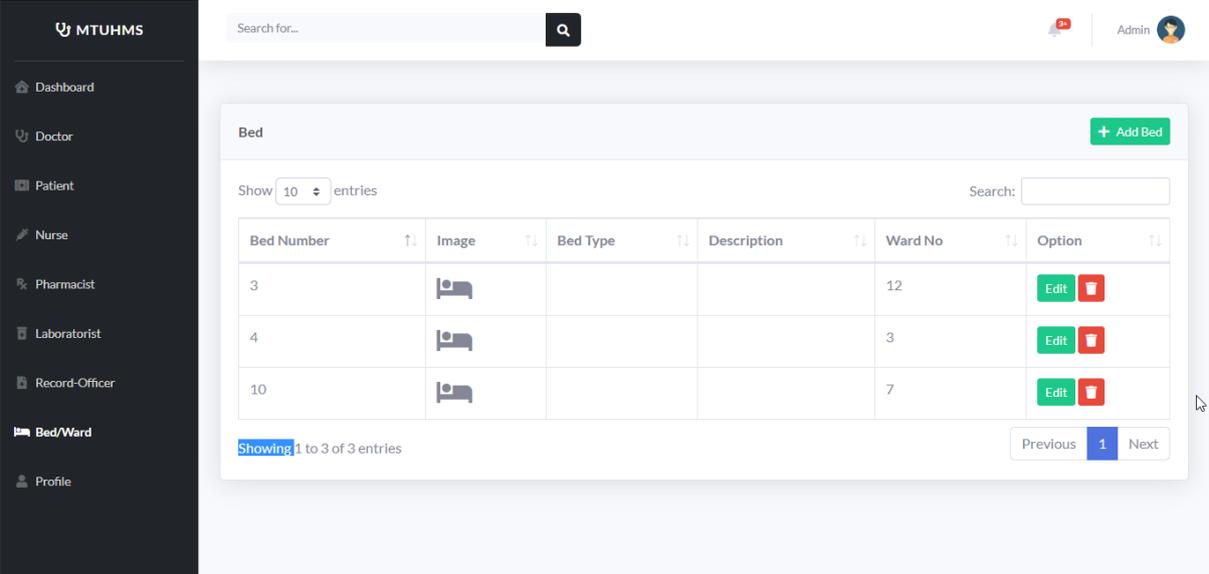


Figure 4.6: Nurse Page (Admin)

v) Bed/Ward

In this interface, the admin is tasked with the management of all beds and wards in the hospital.

The Administrator can add bed, edit bed as well as delete beds from the system.



The screenshot displays the 'Bed/Ward' management page for an administrator. The page features a dark sidebar on the left with navigation options: Dashboard, Doctor, Patient, Nurse, Pharmacist, Laboratorist, Record-Officer, Bed/Ward (selected), and Profile. The main content area has a search bar at the top and a '+ Add Bed' button. Below this is a table with 3 entries, each with a bed number, image, bed type, description, ward number, and edit/delete options. The table is titled 'Bed' and has a 'Show 10 entries' dropdown and a search field. The table data is as follows:

Bed Number	Image	Bed Type	Description	Ward No	Option
3				12	Edit Delete
4				3	Edit Delete
10				7	Edit Delete

At the bottom of the table, there is a pagination control showing 'Showing 1 to 3 of 3 entries' and 'Previous 1 Next'.

Figure 4.7: Bed/Ward Page (Admin)

4.4.3 Patient Dashboard

The patient dashboard shows the user interface which the patient sees. The patients can book appointments with the doctor, view doctor's report about them and view available drug prescriptions.

i) Homepage

This interface shows the patients homepage, where the patients can view appointment dates with the doctor.

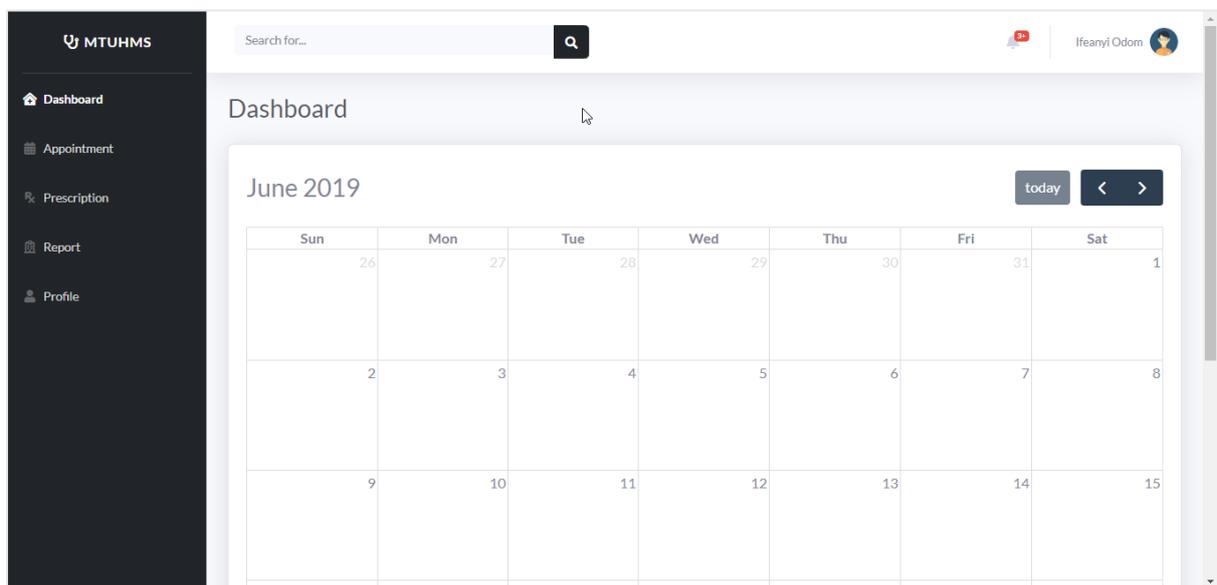
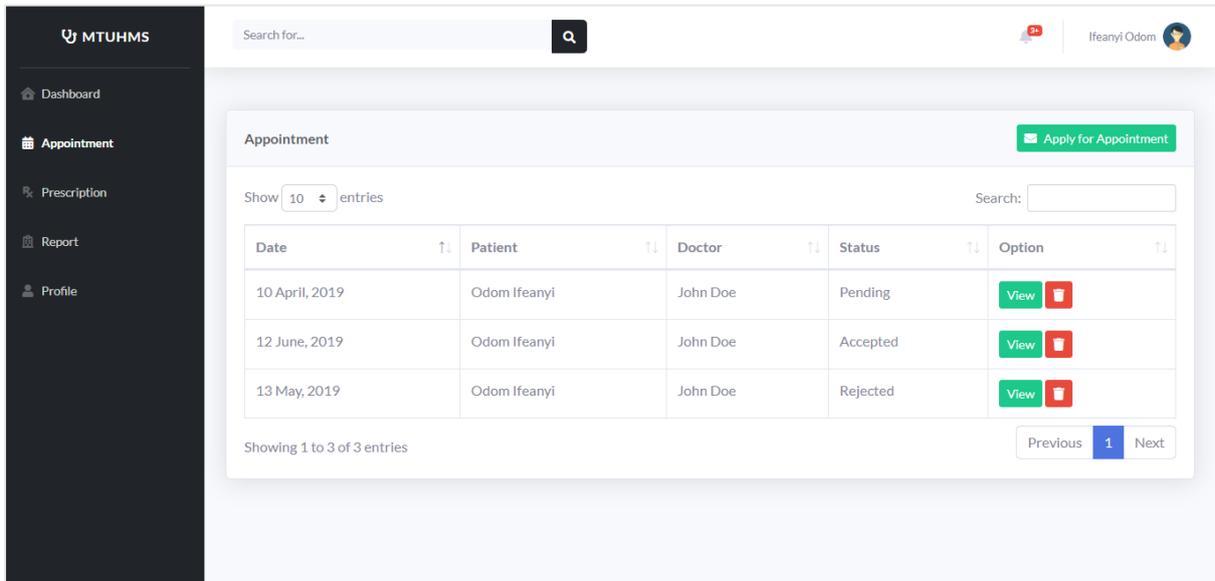


Figure 4.8: Homepage (Patient)

ii) Appointment Page

This interface shows the patients appointment page. In this interface patients can apply for appointment with the doctor, edit previous appointment and also cancel appointment with the doctor.



The screenshot displays the MTUHMS Appointment Page for a patient. The page features a dark sidebar with navigation options: Dashboard, Appointment (selected), Prescription, Report, and Profile. The main content area includes a search bar, a user profile for 'Ifeanyi Odom', and an 'Apply for Appointment' button. Below this is a table of appointments with the following data:

Date	Patient	Doctor	Status	Option
10 April, 2019	Odom Ifeanyi	John Doe	Pending	View Cancel
12 June, 2019	Odom Ifeanyi	John Doe	Accepted	View Cancel
13 May, 2019	Odom Ifeanyi	John Doe	Rejected	View Cancel

At the bottom of the table, it indicates 'Showing 1 to 3 of 3 entries' and includes 'Previous' and 'Next' navigation buttons.

Figure 4.9: Appointment Page (Patient)

iii) Prescription Page

This interface shows the patients prescription page. In this interface patients can view the drugs prescribed for them and also the dosage to be used.

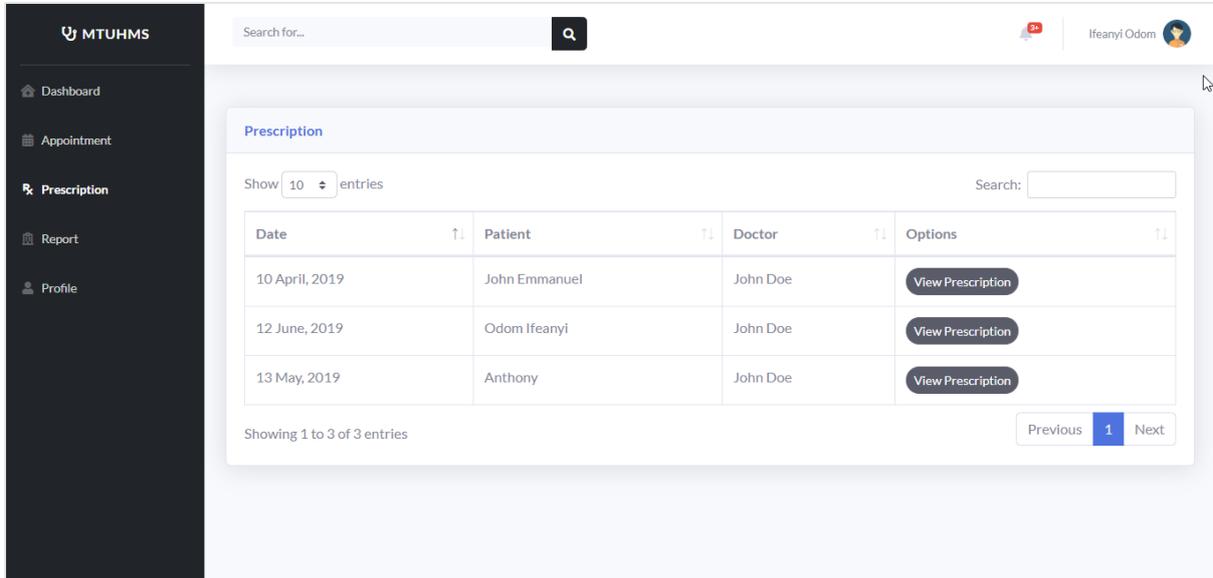


Figure 4.10: Prescription Page (Patient)

iv) Profile Page

This interface shows the patients profile page. In this interface patients can update their biodata.

Patients can also change their password to a new one.

The screenshot shows the 'Profile' page of the MTUHMS system. The page is divided into two main sections: 'Update Profile' and 'Change Password'. The 'Update Profile' section contains the following fields: Surname, First Name, Other Name, Gender (a dropdown menu), Age, Matric No, Email, and Address. The 'Change Password' section contains the following fields: Old Password, New Password, and Confirm New Password, along with a 'Change Password' button. The left sidebar shows navigation options: Dashboard, Appointment, Prescription, Report, and Profile. The top right corner displays the user's name 'Ifeanyi Odom' and a profile icon.

Figure 4.11: Profile Page (Patient)

4.4.4 Doctor Dashboard

The doctor dashboard is the user interface the doctor sees. The doctor can manage patients' appointments, view patient's data and update their reports as well as edit their profile. The doctor dashboard consists of the home, appointment, patient, report and profile page.

i) Homepage

This interface shows the doctors homepage, where the doctors can view appointment dates with the doctor.

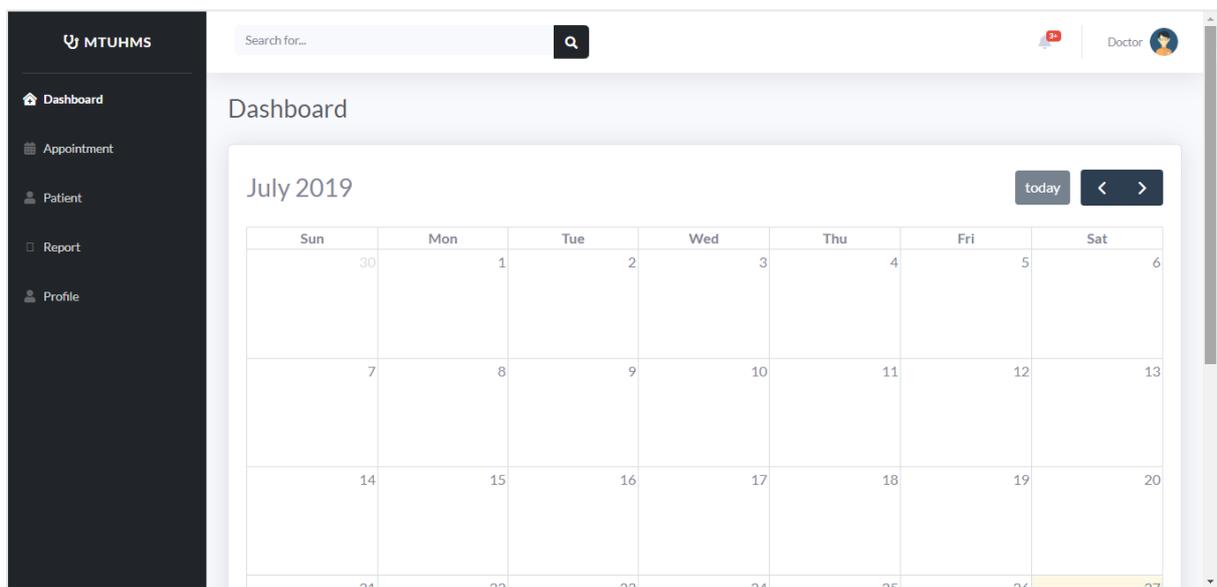


Figure 4.12: Homepage (Doctor)

ii) Appointment Page

In this page, doctors can view all requested appointment from patients and either accept or reject the appointment. They can also reschedule appointment.

The screenshot displays the 'Requested Appointment' section of the MTUHMS system. It features a table with the following data:

Date	Patient	Doctor	Option
10 April, 2019	Odom Ifeanyi	Pending	Approve
12 June, 2019	Weke Samuel	Accepted	Approve
13 May, 2019	Akintomide Jeremiah	Rejected	Approve

Additional interface elements include a search bar at the top, a sidebar with navigation links (Dashboard, Appointment, Patient, Report, Profile), and a footer indicating 'Showing 1 to 3 of 3 entries' with 'Previous' and 'Next' navigation buttons.

Figure 4.13: Appointment Page (Doctor)

iii) Patient Page

In this page, doctors can view patients in the hospital and check their profile and status

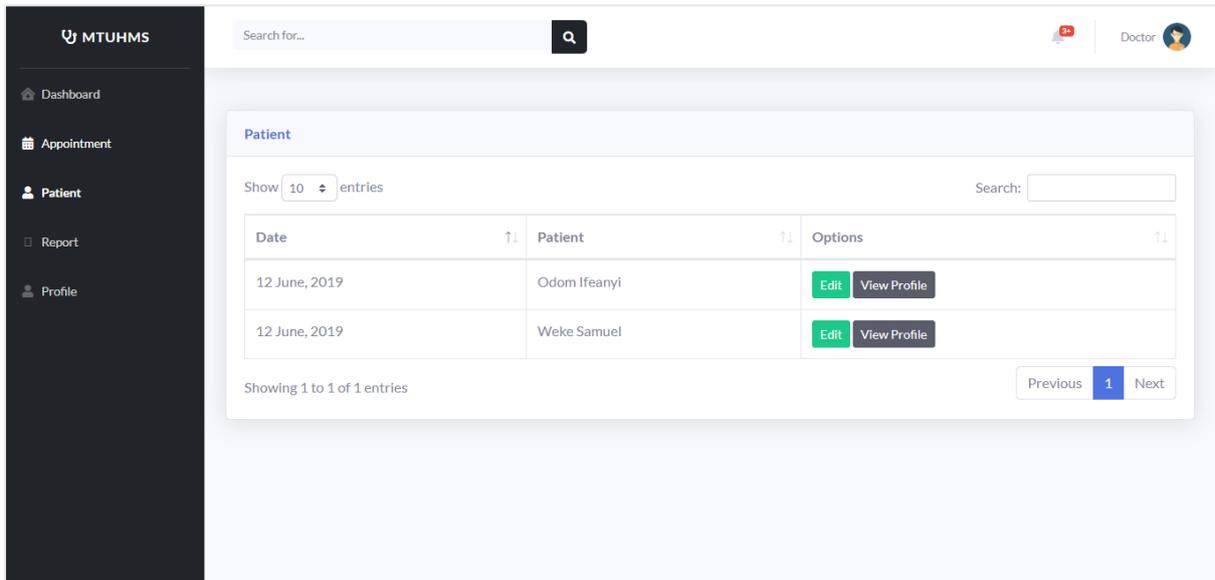


Figure 4.14: Patient Page (Doctor)

iv) Profile Page

In this interface patients can update their biodata. Patients can also change their password to a new one.

The screenshot displays the MTUHMS Profile Page for a Doctor. On the left is a dark sidebar with navigation links: Dashboard, Appointment, Patient, Report, and Profile. The main content area is titled "Profile" and is divided into two sections:

- Update Profile:** A form with input fields for Surname, First Name, Middle Name, Phone No, Email, and Address. It also includes dropdown menus for Gender (with "Select Gender" as the current selection) and Relationship (with "Single" as the current selection).
- Change Password:** A form with input fields for Current Password, New Password, and Confirm New Password. A blue "Change Password" button is located at the bottom right of this section.

Figure 4.15: Profile Page (Doctor)

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Summary

Having reviewed the challenges encountered through the manual use of files in keeping records in the hospital, this proposed system is believed to help eradicate the problems associated with the manual method by the introduction of an online management system which will make documentation more efficient and effective for serving the patients better and to have a more developed way of carrying out hospital operations. The hospital management system adds amazing values to the lives of both staff and patients as it aids in reduction of workload and reduction of data error. It can capture data, store, and view, add and delete records into the database when required. On the long run during the development of this system, some challenges were encountered, some of them includes it not being responsive on mobile and tablet devices, and the laboratory and pharmacy features were not implemented.

5.1 Contribution to Knowledge

The main contribution of knowledge was the ability to implement an online hospital management system using the Laravel Framework. With the help of Laravel, the system is protected from serious security risks like cross site request forgery, SQL injection, and cross site scripting. Patients can also be reminded of their appointment schedule with a doctor through their mails.

5.2 Limitations

- i. The system is not user friendly on tablet and mobile devices
- ii. Due to limited data, the laboratory and pharmacy features of the system could not be implemented

5.3 Recommendation for Further Study

It is recommended that hospitals currently practicing the manual system should switch to the electronic system because it is more efficient and easier to use. Also, since the use of computers

is growing fast globally, introducing the electronic system will enable hospitals fit into the current global trend. The following are also recommended.

- i. Other types of authentication methods (Single-factor, Two-factor, Multi-factor authentication) can be used for securing hospital management systems.
- ii. Other types of frameworks (AngularJS, Symfony, ASP.NET) can be used in building online hospital management systems.
- iii. Other types of database management systems can be used by hospital management systems.

5.4 Conclusion

This project takes a look at the various problems associated with the existing system which are improper documentation, loss and mismatch of patient's data, time wastage amongst others. With all these problems being critically analyzed, a solution was embarked on, to eliminate these problems. With the design of an online hospital management system such problems are considered to be eradicated. In conclusion an online hospital management system not only provides an opportunity to the hospital to enhance their patient care, but also can increase the profitability of the organization. Hospital administrators would be able to significantly improve the operational control and thus streamline operations. This would improve the response time to the demands of patient care because it automates the process of collecting, collating and retrieving patient information.

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APPENDIX SOURCE CODE

```
<?php

namespace App\Http\Controllers\Auth;

use App\User;

use App\Http\Controllers\Controller;

use Illuminate\Support\Facades\Hash;

use Illuminate\Support\Facades\Validator;

use Illuminate\Foundation\Auth\RegistersUsers;

class RegisterController extends Controller
{
    use RegistersUsers;

    protected $redirectTo = '/patient';

    public function __construct()
    {
        $this->middleware('guest');
    }

    protected function validator(array $data)
    {
        return Validator::make($data, [

            'firstname' => 'required|string|max:255',

            'email' => 'required|string|email|max:255|unique:users',

            'password' => 'required|string|min:6|confirmed',

        ]);
    }
}
```

```

protected function create(array $data)
{
    return User::create([
        'firstname' => $data['firstname'],
        'lastname' => $data['lastname'],
        'email' => $data['email'],
        'password' => Hash::make($data['password']),
    ]);
}
}

```

```
<?php
```

```
//Admin Routes
```

```
Route::get('/admin','AdminController@dashboard');
```

```
Route::get('/admin/doctor','AdminController@doctor');
```

```
Route::get('/admin/patient','AdminController@patient');
```

```
Route::get('/admin/nurse','AdminController@nurse');
```

```
Route::get('/admin/pharmacist','AdminController@pharmacist');
```

```
Route::get('/admin/laboratorist','AdminController@lab');
```

```
Route::get('/admin/record-officer','AdminController@recordOfficer');
```

```
Route::get('/admin/bed','AdminController@bed');
```

```
Route::get('/admin/profile','AdminController@profile');
```

```
//Doctor Routes
```

```
Route::get('/doctor','DoctorController@dashboard');
```

```

Route::get('/doctor/appointment','DoctorController@appointment');

Route::get('/doctor/patient','DoctorController@patient');

Route::get('/doctor/report','DoctorController@report');

Route::get('/doctor/profile','DoctorController@profile');

// Patient Routes

Route::get('/patient', 'PatientController@dashboard');

Route::get('/patient/prescription', 'PatientController@prescription');

Route::get('/patient/appointment', 'PatientController@appointment');

Route::get('/patient/report', 'PatientController@report');

Route::get('/patient/profile', 'PatientController@profile');

Route::view('/', 'auth/login');

Route::view('/signup', 'auth/signup');

Route::view('/create-profile', 'create-profile');s

Auth::routes();

```

```
<?php
```

```

class DoctorController extends Controller
{
    //Dashboard

    public function dashboard(){
        return view('doctor.dashboard');
    }

    //Appointment

    public function appointment(){
        return view('doctor.appointment');
    }
}

```

```
}  
  
//Patient  
  
public function patient(){  
    return view('doctor.patient');  
}  
  
//Report  
  
public function report(){  
    return view('doctor.report');  
}  
  
//Profile  
  
public function profile(){  
    return view('doctor.profile');  
}  
}
```