AN ONLINE DOCTOR APPOINTMENT BOOKING SYSTEM FOR MACHAKOS SUB COUNTY HOSPITALS.

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Research project submitted in partial fulfillment for the Degree in Bachelor of Science in Information Technology of Technical university of Mombasa.

Date:

ii. DECLARATION

This project is my original work and has not been presented for a degree in any other university or for any other award.

Students' name:

Sign:

Date:

I confirm that the work reported in this project was carried out by the candidate under my supervision.

Name:

Sign:

Date:

iii. DEDICATION

I dedicated this project to my family for their tireless support they accorded me since I was a child.

iv. ACKNOLEDGEMENT

It is with great honor that I concede the Almighty God for this far since I began this course. Great thanks also go to my parents for the support they have given me, financially and emotionally. I would like to thank Technical University of Mombasa through the department of ICT for giving me the chance to carry out this research project that might in the long run bring positive impact to the ICT growth in the country. Finally, great thank you go to the lectures who contributed positively towards the success of this research project.

v. ABSTRACT

The purpose of the study is to design and develop an online doctor appointment booking web-based system for patients in Machakos sub county public hospitals. The system will be used by the patient to book their doctor appointment online at their convenience. It will also store patients details and medical records automatically to the system. The doctors will be able to manage their schedules. The current problem with the current manual booking system in Machakos sub county public hospitals, is that patients have to visit the hospitals physically and wait in the bench queueing due to the large population of the patients. Records are written manually and store in files and retrieving the files it's tiresome and time consuming. The study will use waterfall methodology to design the system. Waterfall methodology is easy to manage due to the rigidity of the model, each phase has its own deliverables and a review phase and its product definition is stable. The frontend will use HTML for the web structure and CSS for styling the webpage, and PHP and MySQL for the backend. It is expected once the application is developed and tested with the users in Machakos sub county public hospitals it will help in booking appointments and storing the records.

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ix. LIST OF ACRONYMS AND ABBREVIATIONS

HTML: Hyper Text Markup Language

CSS: Cascading Styling Sheet

PHP: Hypertext Preprocessor

SQL: Structure Query Language

ERD: Entity Relationship Diagram

DBMS: Database Management System

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter introduces the area of study including background study, problem statement, objectives of study, research questions, significance of the study, limitations of the study, scope of the study and organization of the study.

1.2 Background Study

With traditional appointment booking, patients find it time-consuming with the long queues on the bench, difficult to find suitable time slots for appointments, and limited accessibility outside the normal office hours. Healthcare providers also face challenges in managing their schedules.

An effective online doctor appointment booking system will be accessible through various platforms, such as web browsers and mobile devices. It will offer a user-friendly interface where patients can easily search for available doctors, view their profiles, and select preferred time slots. Additionally, the system can provide appointment reminders to prevent patients from missing their appointments. Stokes et al. (2019) For the doctors, the system will allow easy management of their schedules, enabling them to set their availability and define the duration of appointments. The online doctor appointment booking system will offer features such as registration of the users, storing their details in the system automatically, and integrating seamlessly with their existing electronic health record (EHR) systems, ensuring a smooth flow of patient information and reducing the risk of data inconsistency. The system has the facility to give each user a unique ID that can be used by the patient to search for the available time slot and the doctor availability. (Phichitchaisopa et al., 2017).

Security and privacy are important in the design of the online doctor appointment booking system. Patient data, including personal information and health records, must be protected through robust encryption, and compliance with relevant data protection regulations, such as the Health Insurance Portability and Accountability Act (HIPAA), is crucial to maintaining patient trust. (Gao et al., 2019).

Studies suggest that online doctor appointment booking systems can improve hospital access, particularly for underserved populations and those in remote areas. However, it

is important to address disparities in digital literacy and internet access to ensure equitable benefits. (Perrin et al., 2020).

1.3 Problem Statement

Doctor appointment needs booking. However, manual booking is time consuming for the patients and workload to the staff handling it. Public hospitals in Machakos sub county do not have online doctor appointment booking system hence the patients are subjected to spend a lot of time visiting the hospital for bookings. This is due to the poor IT infrastructure in the hospital systems that does not support of the online doctor appointment booking system and poorly integrated IT architecture. Less obvious reasons why facilities are inadequate for such support system has to do with the naturally evolved technology (IT) architecture found in many organizations today (Inmon, 2002; Linthicum, 2000).

A proper online doctor appointment booking system will enable patients to make their doctor appointments from any place and time.

1.4 Purpose

The main objective for this study is to develop an online doctor appointment booking system that will allow patients to book their appointment with their doctors online and reduce congestion in the hospitals.

1.4.1 Specific Objectives

i. Analyze current doctor appointment booking system used in Machakos County public hospitals to obtain requirements.

ii. Design and develop an online doctor appointment booking system using waterfall methodology.

iii. Code and test the online doctor appointment booking system using HTML, CSS, PHP and MySQL.
iv. Test the developed online doctor appointment booking system with the users from Machakos Sub County Hospitals.

1.5 Research Questions

i. What methods and features can be implemented in an online doctor appointment booking system to simplify the appointment booking process and eliminate physical interaction, ensuring user-friendly experience for users?
ii. How can the online doctor appointment booking be developed ensuring convenience and accessibility at any place and time for the users?
iii. What technologies and strategies can be used in an online doctor appointment booking system to accurately determine and display the availability of the doctor?
iv. How can an online doctor appointment booking system be designed and implemented to maintain honesty and trust among the patient and the doctor?

1.6 Justification

This study examines the impact and benefits of the online doctor appointment booking system on patients, doctors and the overall hospital system.

- The online doctor appointment booking system will provide accessibility and convenience to the patients. They can book their appointments at any time and place without having to queue for long.
- The online doctor appointment booking system will significantly simplify the appointment booking system for the doctors. By automating the system administrative staff can allocate their time and resources more efficient leading to increase of productivity.

- By implementing the online appointment booking system it will reduce the waiting time for the patients. It will give the patient a chance to choose suitable time slots and real-time updates on the doctor availability. Reduced waiting time leads to patient satisfaction that promotes better adherence to appointment that contribute to overall well-being of a patient.
- By implementing an online appointment booking system, the overall efficiency of the hospital system will be enhanced. Simplified processes, reduction of waiting time and improved accessibility and convenience contribute to a more efficient hospital experience. This improves the patient satisfaction thus improved health outcomes.

1.7 Limitations of the Study

- User behavior and preference change over time and can be influenced by external factors such as technologies advancement or changes in the hospital policies. Researchers may not have control over the external influences thus making it difficult to capture the full information of user behavior and preferences over a single study.
- Online doctor appointment booking system is subject to upgrades, updates, and evolution over time and it's also dynamic. These changes can affect the user experience, functionality and overall performance of the system. Researcher may not be able to keep up with these changes potentially affecting the relevance and the accuracy of their findings.
- Online doctor appointment system can be affected by regulatory and legal framework established by government bodies. Changes in hospital law policies, regulations, or data protection measures may affect the accessibility and availability of certain data, thereby limiting the scope and depth of the study.

- The online appointment system needs to be integrated often with other hospital information systems such as billing system and electronic health records. However, the interoperability challenges or compatibility issues between different platforms can prevent data sharing limiting the researcher's ability to accessing comprehensive data for analysis.
- The online hospital industry is highly competitive and new people continuously enter into the industry with new innovative solutions. New emergence of an online appointment platforms, changes in the dynamic market, or change in industry trends can influence user adoption patterns and affect the relevance of a study's findings.

1.8 Scope of The Study

- The study focuses on developing and implementing an online doctor appointment booking designed specifically for public hospitals in Machakos County. The system aims to provide convenient, efficient and a user-friendly platform for booking doctor appointment, this will improve the productivity of their services. The study will touch on various aspects of the system concepts, features, functionality, user interface and the impact on medical services delivered in Machakos county.
- The study should also focus on the key areas related to the online doctor appointment booking system. The areas include
    i. User registration and authentication process for the admin, patients and the doctors.
    ii. The doctor profile that includes their specialization, personal details and availability management of the doctors.
    iii. Appointment booking features that allow the patients to view the doctor profile and book the available time slots.
    iv. Secure storage and access to patients' medical history records.

v. Administrative dashboard for hospital administrators to manage the system.

- The study covers the development and the implementation process of the system which includes design, development, testing and deployment of the system.

1.9 Organization of the Study

The study of the online doctor appointment booking system is divided into five chapters.

- Chapter one is the introduction part that includes the background, problem statement, objectives of the study, research questions, significance of the study, limitations of the study, scope of the study and organization of the study.
- Chapter two covers the literature review which includes the work of other researchers on the project, their approach and theoretical framework.
- Chapter three focuses on the methodology of the study, analysis of the data collected interviews and the administration of questionnaires is on the focus of the fourth chapter.
- Chapter five covers the findings, conclusion and recommendation of the study. There are also supplementary pages that include references that were used in the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter explores the existing research and studies done by other researcher related to online doctor appointment booking system. It aims to provide a comprehensive understanding of the concepts, benefits, challenges and user perspectives associated with such system.

2.2 Theoretical Literature

These are some concepts that are used in the theoretical framework to provide a comprehensive understanding of the system.

i. The Technology Acceptance Model (TAM) is a widely used theoretical framework to explain how users accept usefulness and ease of use.
ii. User Experience (UX) is the overall experience a user has while interacting with a system, including their perceptions, satisfaction, and emotions.
iii. Health information privacy and security involve the protection of sensitive patient data and adherence to regulations and ethical standards to ensure confidentiality.

The Technology Acceptance Model (TAM) is the core theoretical framework for this study, focusing on users' acceptance and adoption of the online doctor appointment booking system. It incorporates elements from the Human-Computer Interaction (HCI) Theory, the Technology Readiness and Acceptance Model (TRAM), the Diffusion of Innovation Theory, and the Information Privacy Concerns Theory to provide a comprehensive understanding of user perceptions, privacy concerns, usability, and readiness (Hanson, 2000). By applying TAM, the study examines patients' perceptions of usefulness and ease of use, together with factors influencing system adoption.

Additionally, concepts such as health information privacy and security and user experience are integrated to address user concerns, enhance system design, and ensure compliance with ethical and regulatory standards.

2.3 Similar Systems

Over the years, several online doctor appointments booking systems have been developed to ease the booking process. Some of the systems include:

Practo this is an online platform developed in 2008 by two entrepreneurs from India, Abhivan Lal, who has a degree in business management and Shashank ND, who is a computer engineer. The platform is used by the patients to book an appointment with their doctors through their web or mobile app. It allows the patients to ask medical related questions and get the responses from the specialist which are available. One disadvantage about the system is that it does not display the availability of a particular doctor in a particular hospital.

Health engine is also an online platform developed by Dr Marcus Tan, a general practitioner and Adam Yap, an IT entrepreneur, in Perth, Australia in 2006. It was developed to provide an online solution for patients to find and book appointments with their healthcare providers in their local area. Now health engine has grown since to become one of the Australia's leading online appointments booking platform. Its disadvantage is that it does not allow the users to register so they have to fill their details each time they are booking an appointment.

In the current manual system, the whole process is maintained with hands. The process of keeping, maintaining and retrieving information is very tedious and time consuming. It requires numerous paper forms with data stores spread throughout the hospital management infrastructure. Often information is incomplete or does not follow management standards. Appointment and other forms are often lost in transit between departments requiring comprehensive auditing process to ensure that vital information

is lost. Multiple copies of the same information exist in hospital and may lead to inconsistencies in data in various data stores.

2.4 Critical Review and Research Gap Identification

The online doctor appointment booking system is designed for Machakos sub county public hospitals to replace the existing manual paper-based system. The new system is to control the appointment information of patients. Doctor appointment approval data and availability. The services are to be provides in an efficient and cost-effective manner, with the goal of reducing the time and resources currently required for such tasks.

With computerized doctor appointment booking system, the task of keeping records in organized manner will be solved. The proposed system will help in saving time in different operations and making information flow easily giving valuable reports. The proposed system will also allow the users to register into the platform to eliminate the filling in of the user details each time they want to use the platform. It will also provide a storage space that will store the patient's medical history.

2.5 Chapter Summary

This chapter covers the literature review which includes the work of other researchers on the project, their approach and theoretical framework. It also describes the proposed system and how it can solve the gap weakness of the existing systems.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter focuses on the methods used during data collection and the methodology used in design and developing the system. It also talks about the system requirements both hardware and software required to develop the system, and the database design of the system.

3.2 Research Design

System architecture – It shows a high-level view of the system with the main components and services they provide and how they communicate.

The online doctor appointment booking system for patients in Machakos public hospitals is implemented using three-tier architecture, which includes user interface(frontend), the process management, and the DBMS (backend).

Likewise, the online doctor appointment booking system consists of five main modules. They include:

1. Patient module – used to manage the patient's details.
2. Doctor module – used to manage the doctor profile.
3. Admin module – used to manage the information and details of the users.
4. Login module – used to manage the user's login details.
5. Registration module – used to manage the registration details of the users.

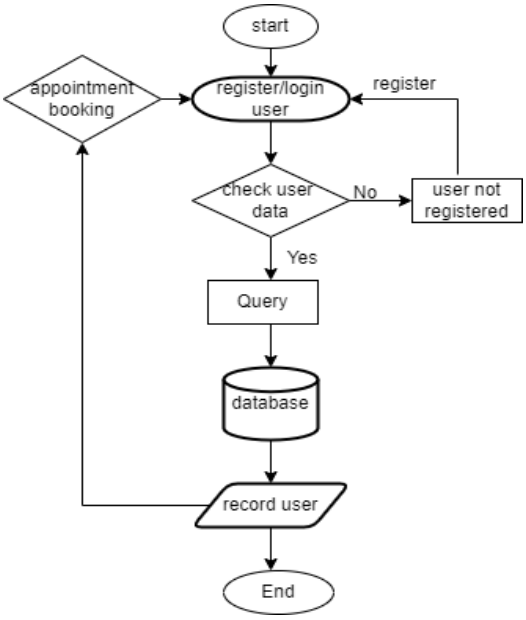

Figure 1 System flowchart

3.2.1 Target Population

A study population is defined as the grand total of all units of research, for which a researcher is interested in conducting a study makes reference to. For this study, the population of the study was the specific senior level managers of Machakos public hospitals since they contain knowledge on the organizational performance. They will include 60 Doctors, nurses, patients, and front office (Receptionist) of the hospitals.

Department	Target population
Doctors	9
Nurses	12
Patients	21
Front office	18
Total	60

Table 1shows the target population

3.2.2 Sample Size

A sample size is a subsection of the population that a researcher intends to use for data collection purposes. (Mugenda and Mugenda, 2003) stated that a 10-30% of the total

research population is considered a good sample size. For this study, the researcher used purposive sampling technique to pick the staff with organizational policies and performance knowledge from the doctors, nurses, lab technicians and front office departments. The sample size of this study was 20 staff members of the Machakos level 5 hospital.

Department	Target population	Sample size	Percentage
Doctors	9	3	30%
Nurses	12	4	30%
Patients	21	7	30%
Front office	18	6	30%
Total	60	20	30%

Table 2 shows the sample size of the study

3.2.3 Data Collection and Procedure

Primary data in this research was collected using questionnaires with both close-ended and open-ended questions. Questionnaires ensure the researcher upholds the confidentiality of the respondents and the data that will be collected. I focused on the current system in place at Machakos public hospitals, in the administrative level that uses the system to keep track of the database records. The questionnaires were distributed to doctors, patient and nurses which allowed collection of data from a large number of people. Questionnaires were used because they give the respondents enough time to answer the questions hence convenient for the busy health providers. The questionnaire was google form based was generated which was shared with the respective personal.

3.3 System Development Methodology

Online doctor appointment booking system for Machakos subcounty public hospitals will be designed and developed using waterfall methodology

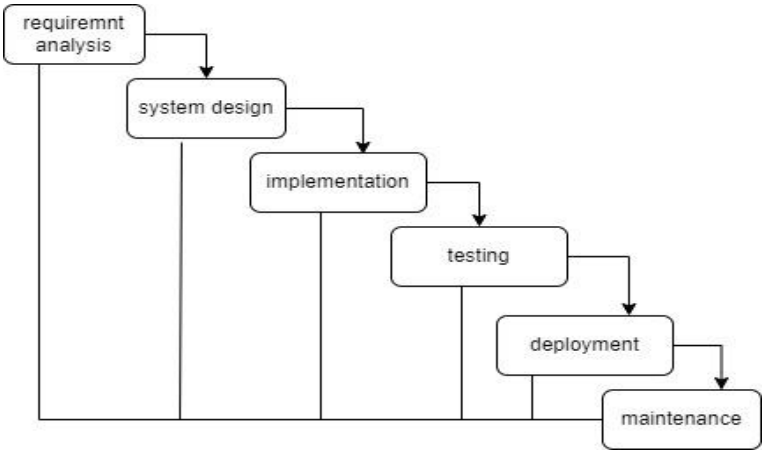

Figure 2 waterfall methodology

3.3.1 Methodology Justification

Every software development requires a suitable SDLC approach to be followed based on both internal and external factors. Machakos county public hospitals' online doctor appointment booking system will be developed using the waterfall methodology.

Waterfall methodology can be used in this project because:

1. It is simple and easy to understand and use.
2. Its requirements are well documented, fixed and clear.
3. Its product definition is stable
4. It's used in short projects
5. Easy to arrange tasks
6. Easy to manage due to the rigidity of the model, each phase has its own deliverables and a review phase
7. Phases are processed and completed one at a time

waterfall methodology phases include:

- **Requirements** - All possible requirements of the system to be developed are captured and documented in a requirement specification document in this phase.
- **System Design** − The requirement specifications from first phase are studied and the system design is prepared in this phase. This system design helps in

specifying hardware and system requirements and defining the overall system architecture.

- **Implementation** − With inputs from the system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality, which is referred to as Unit Testing.
- **Integration and Testing** − All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.
- **Deployment of system** − Once the functional and non-functional testing is done; the product is deployed in the customer environment or released into the market.
- **Maintenance** − There are some issues which come up in the client environment. To fix those issues, patches are released, and to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

3.4 System Requirements and Analysis

In this section the hardware components and software requirements for an efficient working system to be developed.

Table 3 Hardware requirements

SR	Hardware	System minimum requirement
1.	Processor	2.4 GHz processor speed
2.	Memory	2 GB RAM
3.	Disk space	500 GB

Table 4 Software requirements

SR	Software	System minimum requirement
1.	Operating system	Windows sever 2008, windows 7
2.	Database management system	Microsoft SQL server 2014
3.	Runtime environment	Visual studio 2008 Team system

3.4.1 Functional Requirements

The functional requirements desired are:

1. The system should allow the users to log into the system.
2. The system should allow patients to book their appointments.
3. Patients should be able to view the real-time availability of the doctors.
4. The users should be able to add their details.
5. Only the admin should be allowed to delete any information from the database.
6. The system should be able to sent a confirmation message and a reminder once the appointment is confirmed.
7. Doctors should be able to manage their schedule.

3.4.2 Non-functional requirements

The Following are the non-functional requirements for the system:

1. The system must verify and validate all the user inputs.
2. The system must notify the users in case of any error detected in the database.
3. The system should allow room for expansion.

3.4.3 ED Modelling Language

The ED modelling language also known as Unified Modelling Language (UML). It provides a standard notion for many types of diagrams which can divided into 3 main groups: behavioral diagrams, interaction diagrams and structural diagrams.

3.4.3.1 Entity Relationship Diagram

It represents the relationship between entities in a database and attributes of the entities.

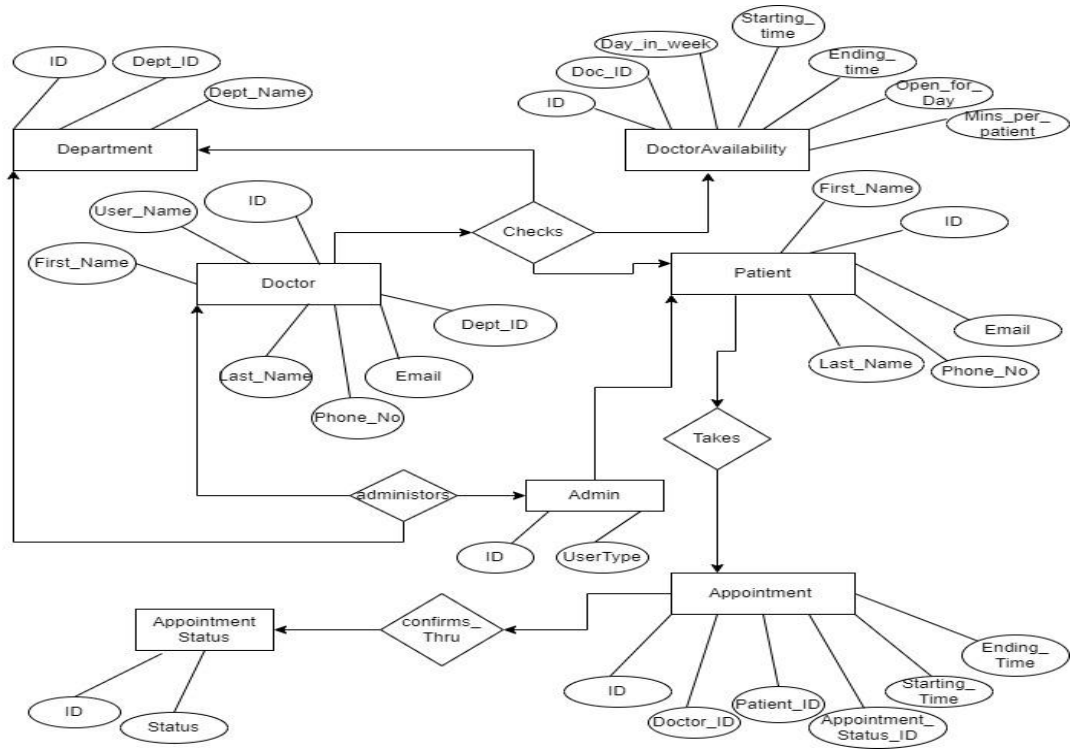

Figure 3 ER diagram

3.4.3.2 Use Case Diagram

It's a behavioral diagram that shows the actors in the system, different functions needed by those actors and how the functions interact.

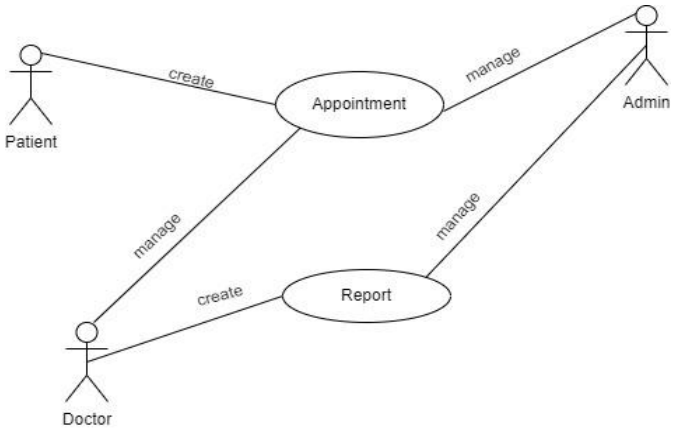

Figure 4 Use Case diagram

3.4.3.3 Activity Diagram

It's a behavioral diagram that represents the work flow of any component in a system. It's like an advanced flowchart that modeling the flow from one activity to another.

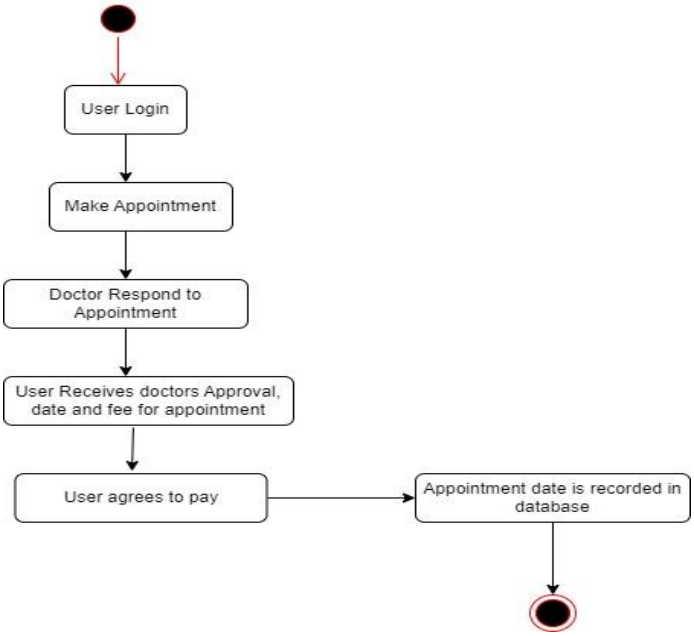

Figure 5 Activity diagram

3.4.3.4 Sequence Diagram

It's a structural diagram that shows how objects interact with each other and the order those interactions occur. The processes are represented vertically and interactions are shown as arrows.

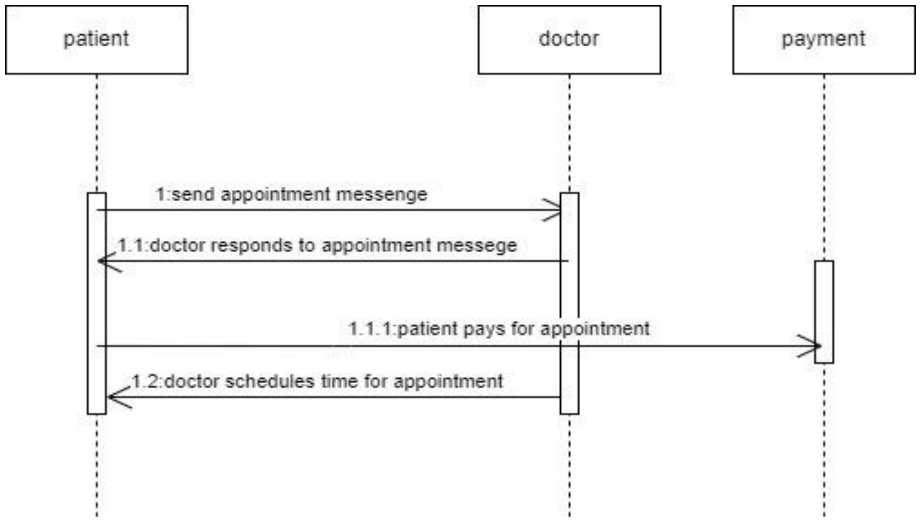

Figure 6 Sequence diagram

3.4.3.5 Class Diagram

It is a structural diagram that shows the classes in a system, attributes, and operations of each class and the relationship between each class.

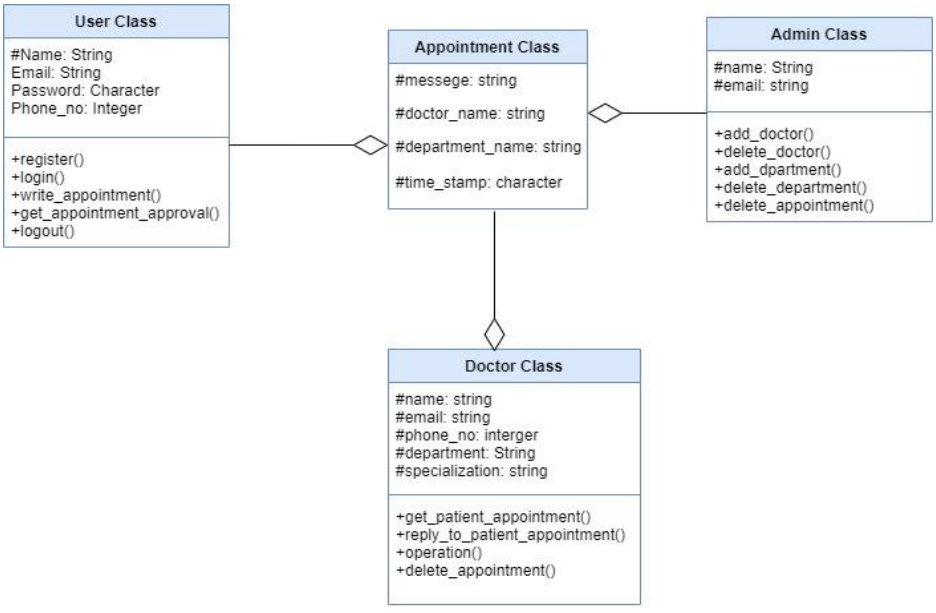

Figure 7 Class diagram

3.4.3.6 Deployment Diagram

It's a structural diagram that show the relationships between the software and hardware components in the system and the configuration of runtime processing nodes.

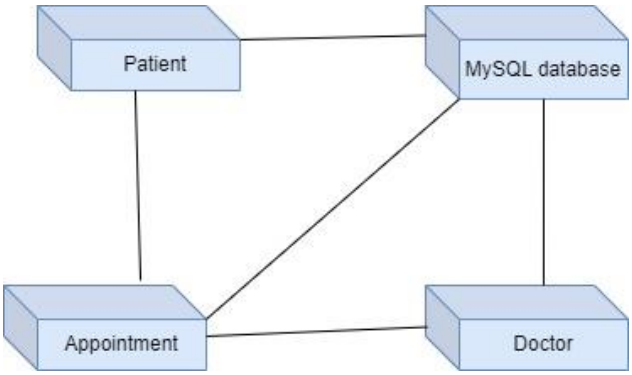

Figure 8 Deployment diagram

3.5 Database Design

Database design is the organization of data according to a database model. The developer determines what data must be stored and how the data elements interrelate. With this information, they can begin to fit the data to the database model.

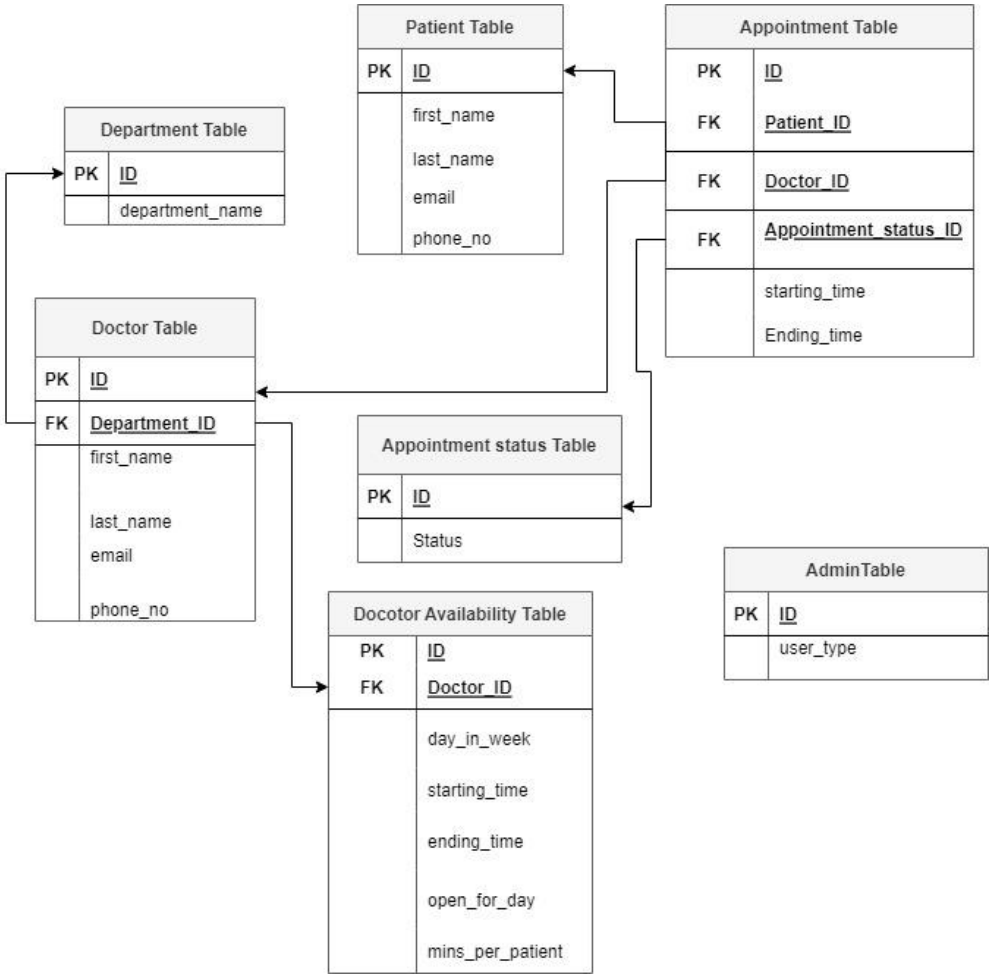

Figure 9 Database Schema

3.5.1 Table Design

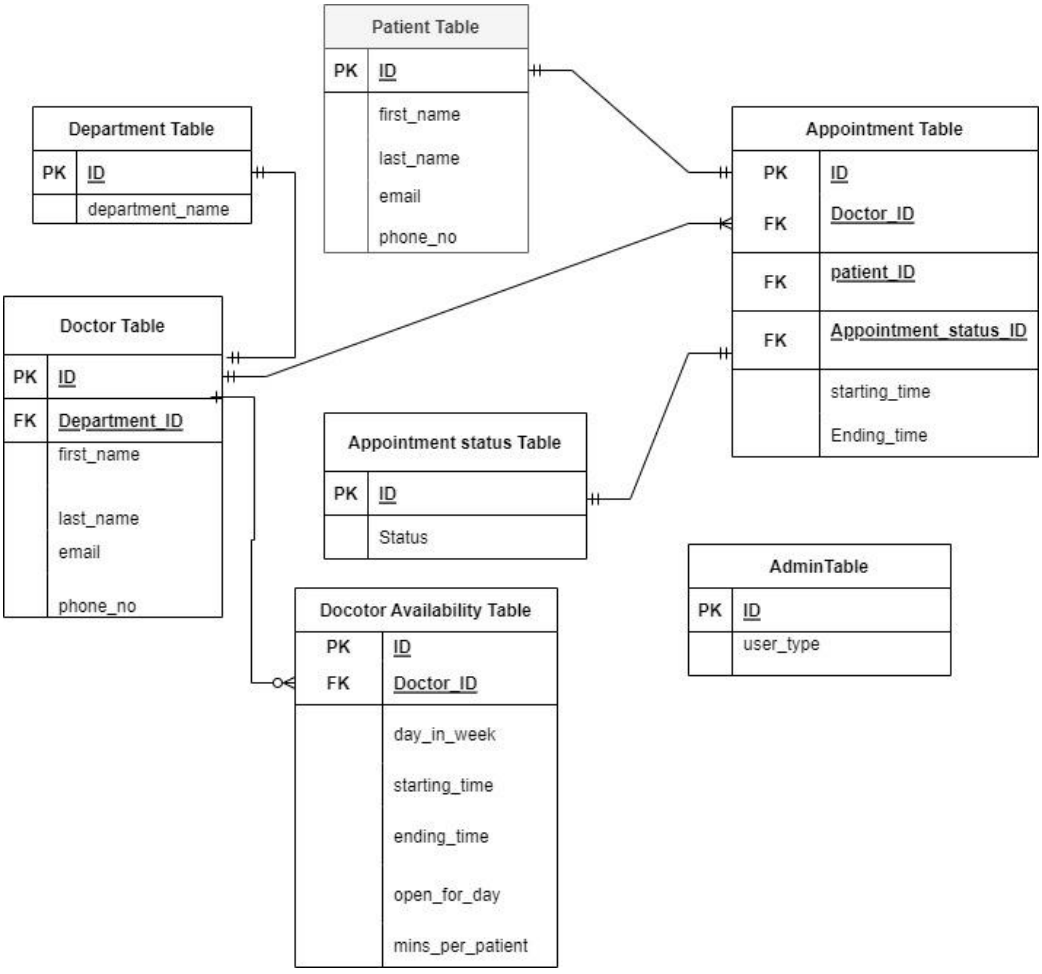

Figure 10 Table design

3.6 Testing Design

Testing is a process, which reveals errors in the program. It is the major quality measure employed during software development. During software development. During testing, the program is executed with a set of test cases and the output of the program for the test cases is evaluated to determine if the program is performing as it is expected to perform. There are several system tests that can be applied to the system.

3.6.1 Test Case

Table 5 below shows an example for preparing various test cases for a login page with a username and password.

Test case	Test condition	Test input	Test expected results	Test Actual results	Remarks
Unit case	Checking if the username field accepts 10 characters	Shilakimeu	Accepts for 10 characters	Pass	None
Functionality case	Checking if with the correct username and password one is able to login	Username: Shilakimeu Password: pmkk@11111	Login successful	Pass	None
	Checking if with incorrect username and password one is not able to	Username: Shilakimeu Password: pmk@21212	Unsuccessful login	Pass	None
User acceptance test case	Check if the loading page is loading effectively for the client	None	Welcome to the login page	Pass	None

3.7 Chapter Summary

The chapter focuses on the research design, data collection, and system methodology that will be used to develop the system. It also talks about the database design.

Appendices

Table 6 Shows the Timeframe

Activity	May	June	July	August	September	October	November	December
Concept development								
Proposal writing								
Data collection								
Proposal presentation								
System implementation								
System testing								

Budget

Table 7 Shows budget

Item	**Description**	**Quantity**	**Estimated cost**	**Actual cost**
Laptop	Dell core i5	1	45,000	
External storage	Flash disk and hard drive	1,1	6000	
Stationary	Books and pens	1,	1000	
Computer utility	Antivirus software	1	1500	
Travel	Transport	1	1500	
Visual studio vb.net	software	1	7000	
TOTAL			**62,000**	

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CHAPTER 4: RESEARCH FINDINGS AND DISCUSSION

DocResrve Doctor Appointment Booking System is an online based website. This system helps hospital clients/patients to request an appointment with a doctor online. This project can also help doctors to manage the schedules of their appointments with their patients. The doctor appointment system organizes the schedules of each patient's appointment, which will be submitted as a request to the doctor they have selected. The system has 3 sides which are the administrator, the doctor, and the patient. The system admin populates the list of the doctors with their specialties and along with the doctor's details and system credentials.

The patients will browse the doctor's appointment system website to find a doctor that has the specialty of their needs.

The patient can check the doctor's weekly schedule to help them to choose the day and time which they can comply for the appointment

and they will submit their request for an appointment. After that, the doctors can view all their appointments and the appointment request of the patients for their availability.

Figure 11 Home page

1.Admin module

- Admin can add doctors, edit doctors, delete and view all doctors with their details and specialties.

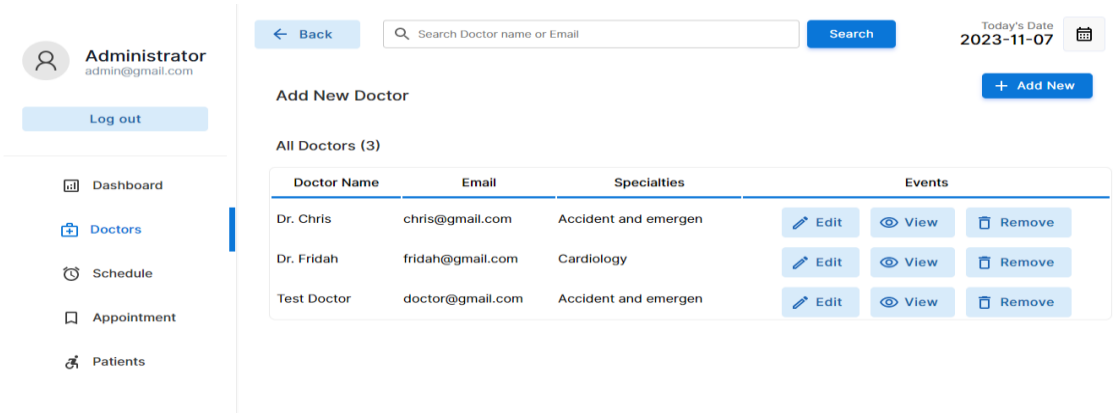

Figure 12 Admin doctors page

- Schedule new doctor's sessions, remove session.

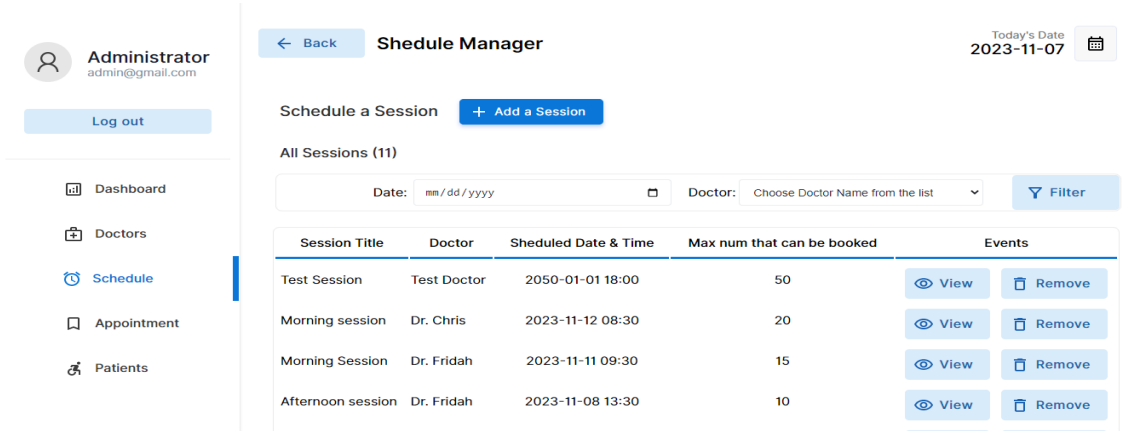

Figure 13 Admin schedule page

- View patient's details.

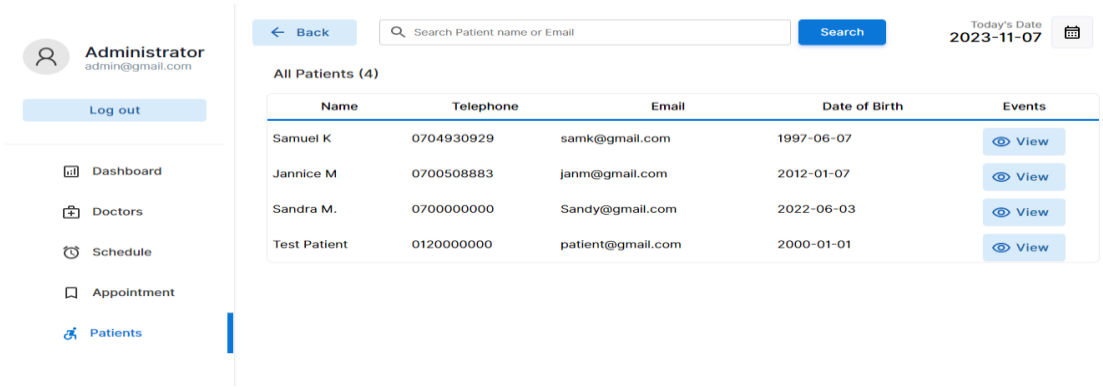

Figure 14 Admin patient page

- View and cancel booking of patients.

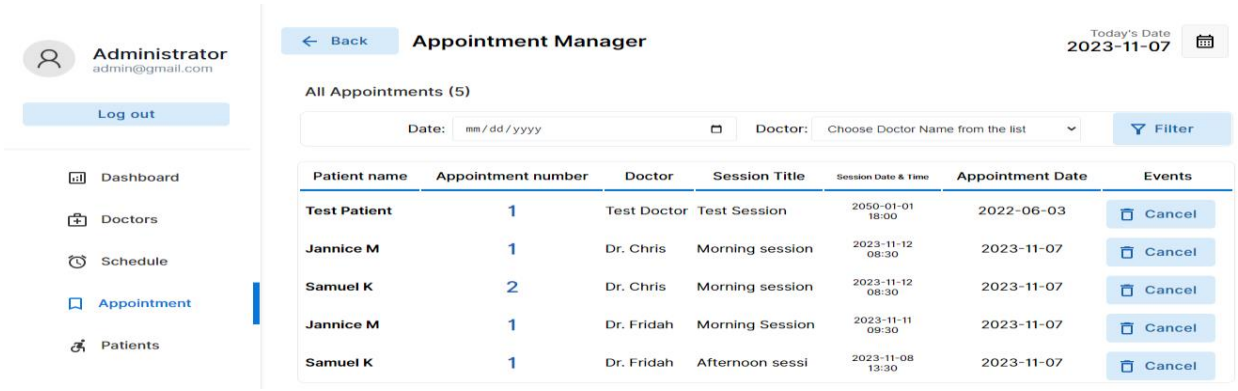

Figure 15 Admin Appointments page

2.Doctors module

The doctor can:

- View their Appointment

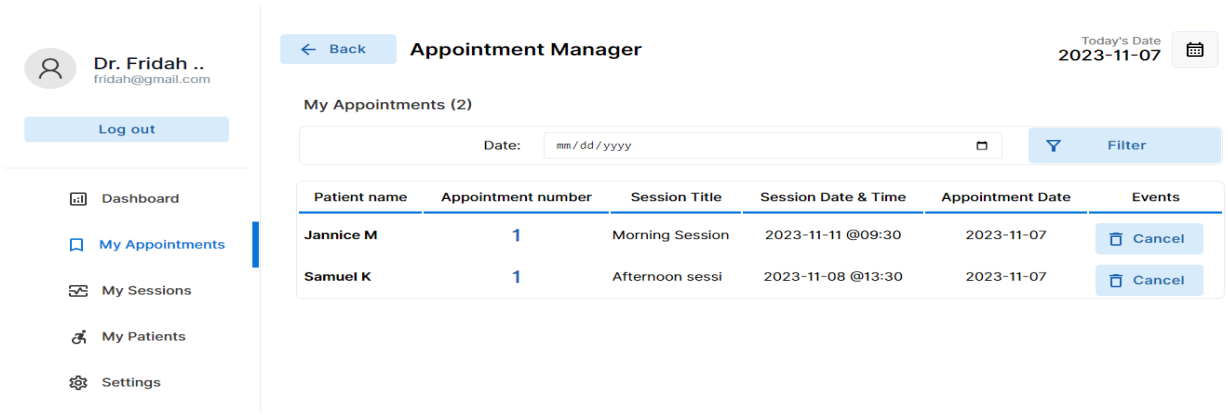

Figure 16 Doctor my appointment page

- View their scheduled sessions

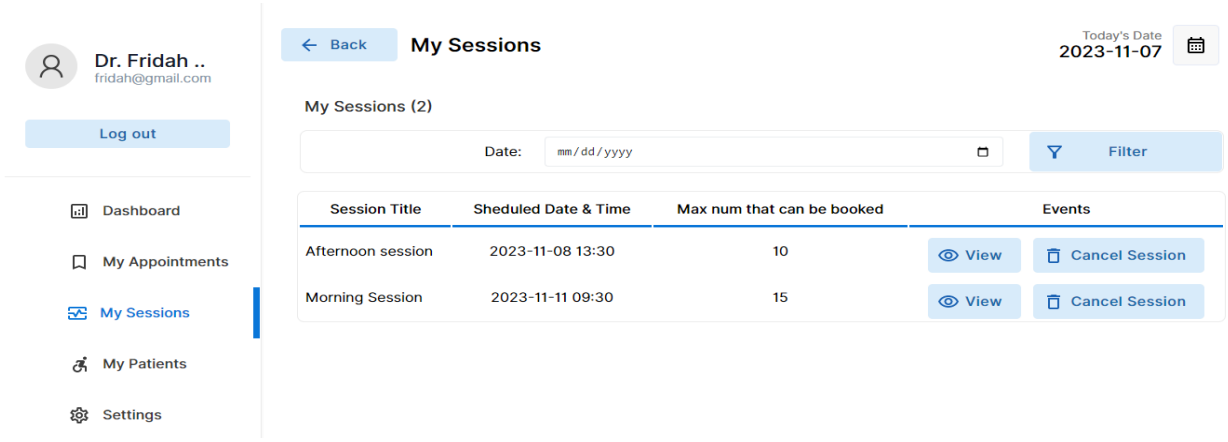

Figure 17 Doctor session page

- View details of patients;

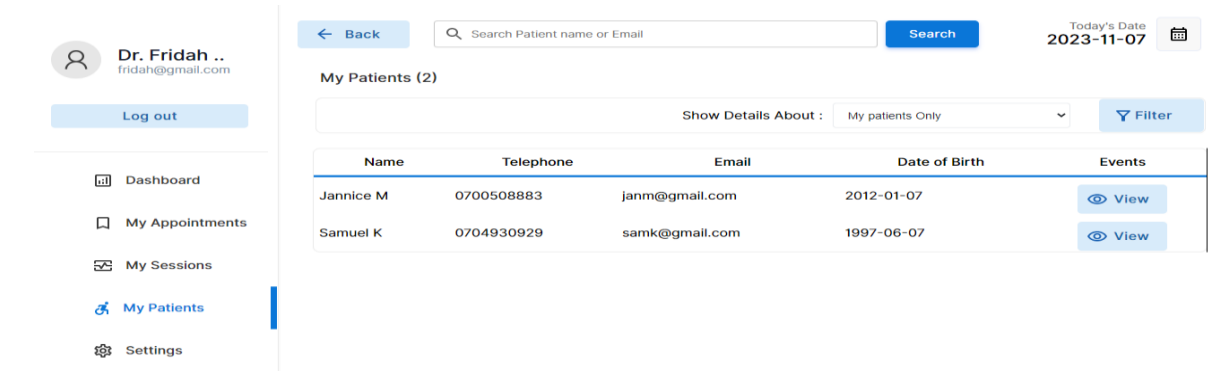

Figure 18 Doctor my patient page

- Edit delete account settings.

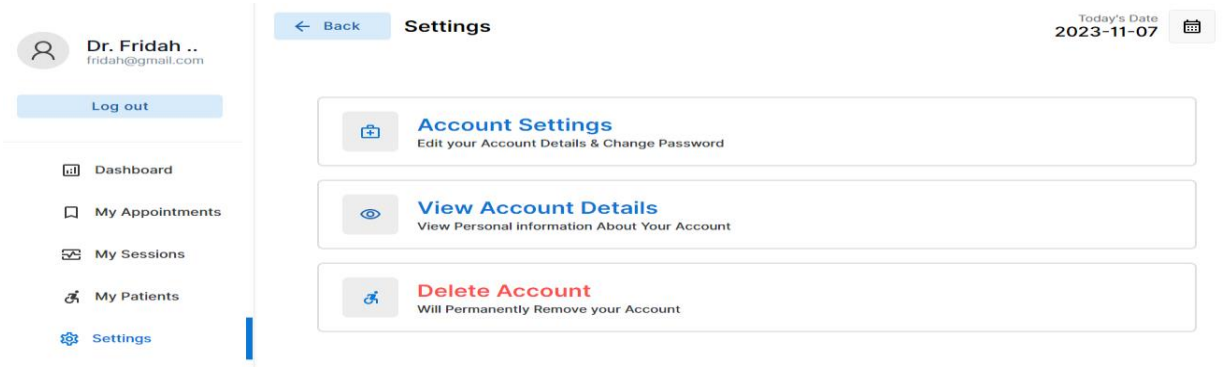

Figure 19 Doctor settings page

3.Patients (Clients).

- Make appointment online.

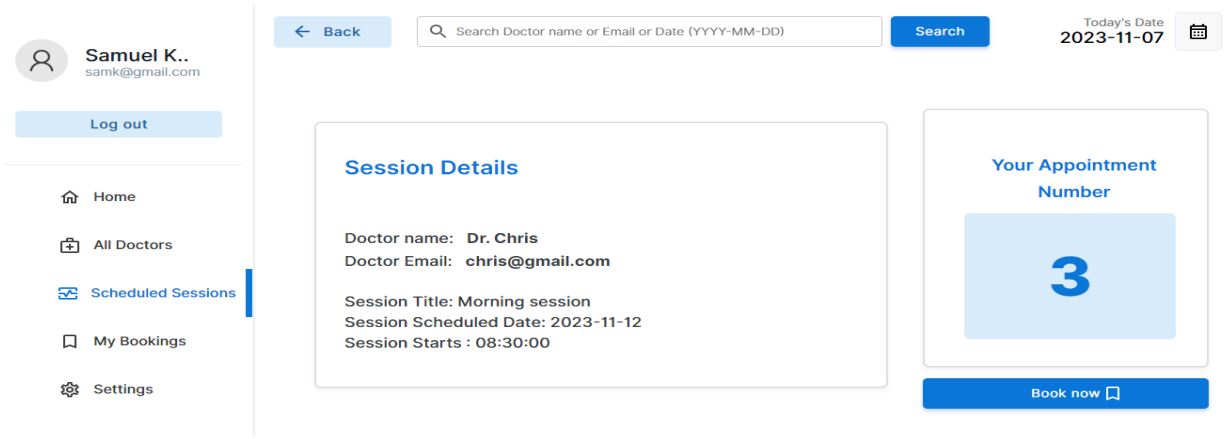

Figure 20 Patient Booking page

- Create accounts themselves.

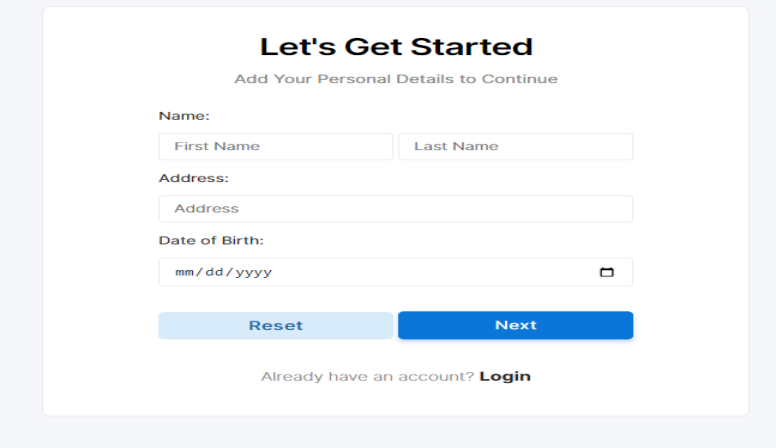

Figure 21 Patient registration page

- View their old booking.

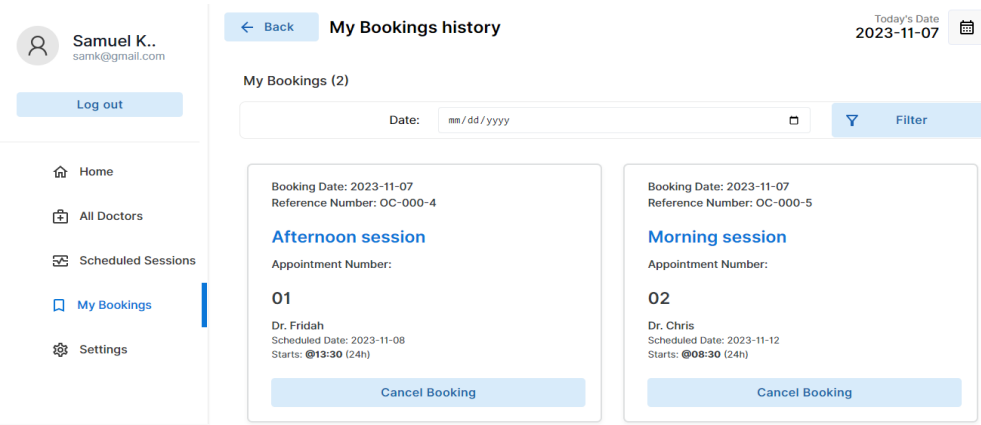

Figure 22 Patient booking history page

- Edit and delete account settings;

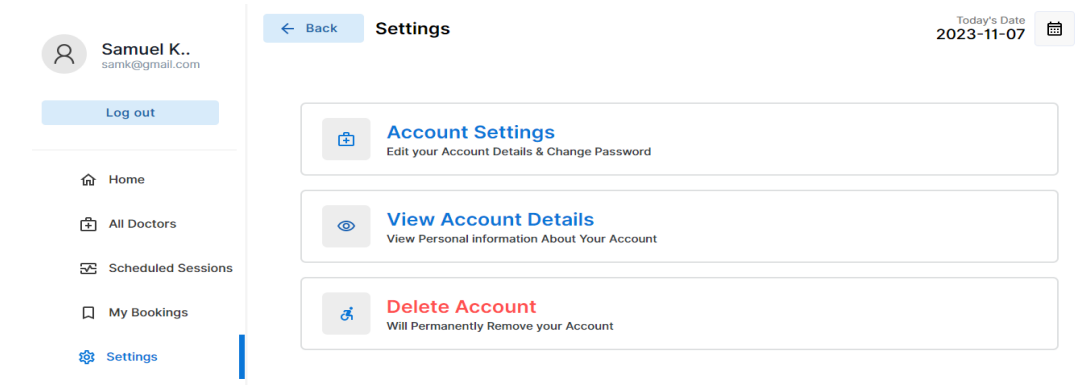

Figure 23 patient settings page

4. Registration module.

- The patient can enter the personal details during registration.

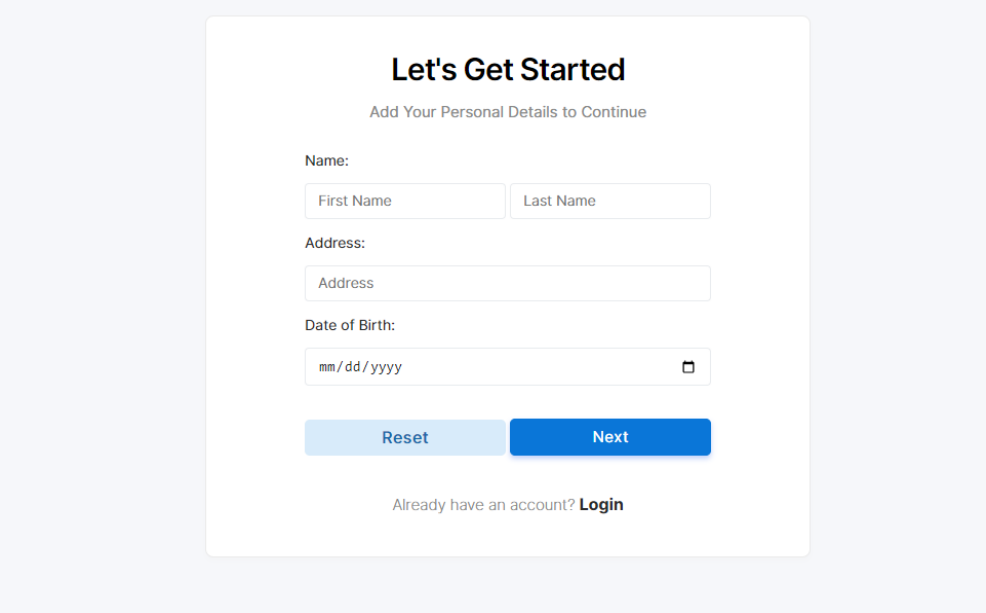

Figure 24 Registration personal details page

- Then proceed to creating the account.

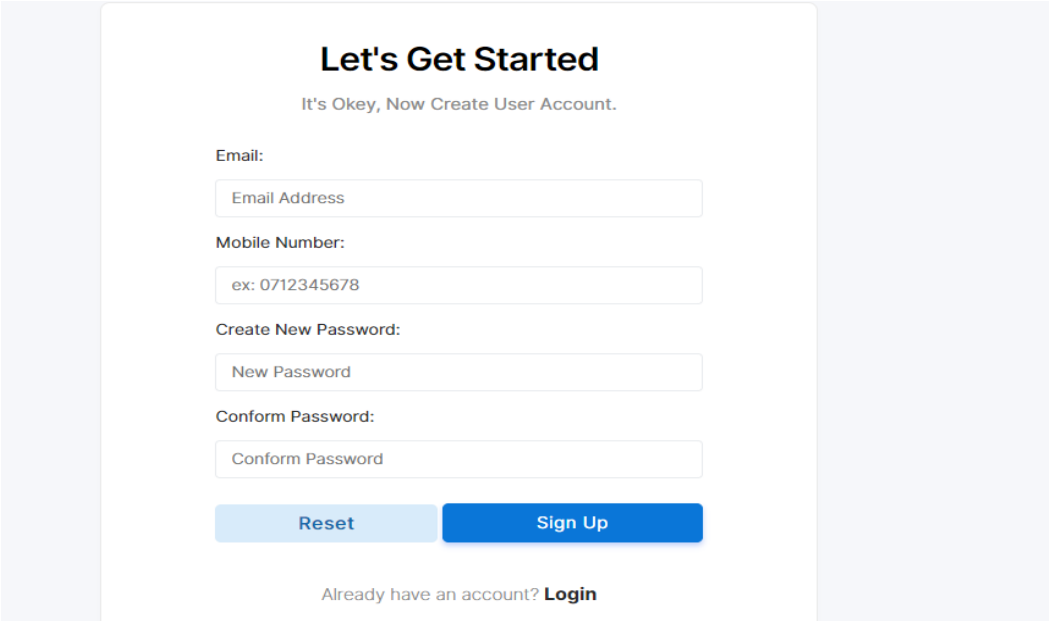

Figure 25 Account creation page

5. Login Module

The user should enter their registered email and password to log in.

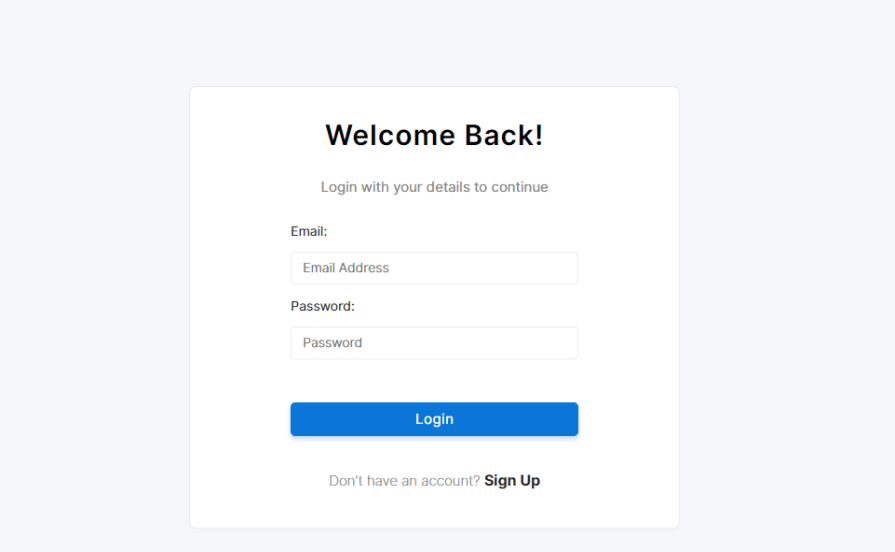

Figure 26 login page

CHAPTER 5: CONCLUSION AND RECOMMENDATION

DocResrve appointment System is a valuable online platform designed to simplify the doctor appointment process for patients and healthcare providers.

This project addresses the growing need for more efficient and user-friendly healthcare appointment management, and is expected to bring several benefits to the healthcare ecosystem for convenience, accessibility and improved patient care.

RECOMMENDATIONS

1. User-centric approach: To ensure the success of the DocResrve system, it is essential to maintain a strong user-centric approach. Continuously collect feedback from patients, doctors, and administrators to continuously improve the platform. This will help refine user experience and improve system functionality.
2. Scalability: Since the system will likely be used more over time, planning for scalability is important. Ensure the system can handle increasing numbers of users and appointments without affecting performance. Regularly evaluate and upgrade system infrastructure when necessary.
3. Data security and privacy: Because the system handles sensitive medical information, it is imperative that the highest standards of data security and privacy are maintained. Continue to update and enhance security measures to protect patient information and ensure ongoing compliance with current regulations.
4. Integration with existing systems: Consider integrating the DocResrve system with existing hospital information systems such as electronic health records (EHR) and billing systems. This integration can streamline data flow and improve the overall efficiency of healthcare services.

5. Registration and login improvements: Continuously improve registration and login processes to make them as simple and secure as possible. Implement additional security measures such as multi-factor authentication to protect user accounts.