EYE CARE MANAGEMENT SYSTEM

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A Project Report Submitted to
Faculty of Management, Tribhuvan University
in partial fulfillment of the requirements for the degree of

Bachelor of Information Management (BIM)

Khusibu, Kathmandu
March 21, 2025

STUDENT'S DECLARATION

This is to certify that I have completed Summer Project entitled "Eye Care Management System" under the guidance of "Er. Niraj Khadka" in partial fulfillment of the requirements for the degree of **Bachelor of Information Management** at Faculty of Management, Tribhuvan University. This is my original work and I have not submitted earlier elsewhere.

March 21,2025

Signature:
Pranisha Rajkarnikar

CERTIFICATE FROM THE SUPERVISOR

This is to certify that the summer project entitled “Eye Care Management System ” is an academic work done by “Pranisha Rajkarnikar” submitted in the partial fulfillment of the requirements for the degree of Bachelor of Information Management at Faculty of Management, Tribhuvan University under my guidance and supervision. To the best of my knowledge, the information presented by him/her in the summer project report has not been submitted earlier.

_____

Signature of the Supervisor
Name: Niraj Khadka
Designation: Supervisor
Date:

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to the following individuals who have contributed to the success of the summer project:

First and foremost, I would like to express sincere gratitude to my supervisor, **Er. Niraj Khadka**, for their guidance, support and encouragement throughout the project. I am thankful to him for his continuous reinforcement and motivation for completing the project successfully.

I am grateful to all the authors of the articles, research papers and online resources that I have consulted during this project. Their work has provided a solid foundation for my research and helped me to gain a deeper understanding of the subject matter.

Finally, I would like to thank my family and friends for uplifting my spirit to complete the project in time.

ABSTRACT

The Eye Care Management System (ECMS) is a web application designed to modernize and improve eye care services. The development of the ECMS seeks to digitize patient management, schedule patient appointments, manage inventory, and store patient medical records to improve efficiency, accessibility, and accuracy in eye care facilities.

This project has been developed following an Iterative Model that leverages the principles of incremental improvement via continuous testing and feedback loops. The primary functionalities for the ECMS include registration of patients, scheduling patients for appointments online, storing patient electronic health records (EHRs), and providing doctors with a secure environment to access patient records and prescribe treatments. Additionally, the system provides an inventory management module for optical products, allowing the customer to browse through available products, purchase selected product(s) and track the orders.

The development process included unit testing, functionality testing, and interface testing to ensure optimal performance and usability, while significant developer time was spent ensuring the authentication utilized in the process securely managed data. While developing the project, scalability was a consideration for future use. The project effectively addresses the problems caused by manual record keeping, reduces excess administrative and paperwork burden, and improves customer satisfaction.

The Eye Care Management System provides an advance in the delivery of health care services by specifying the usage of modern-day web technologies and cloud-based computing to make patient, doctor, and staff coordination better facilitated. Future enhancements may include telemedicine features and the means of using artificial intelligence to facilitate diagnostics to improve quality services even further.

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LIST OF ABBREVIATIONS

BIM Bachelor of Information Management
CSS Cascading Style Sheet
DOM Document Object Model
HTML Hypertext Markup Language
HTTP Hypertext Transfer Protocol
IT Information Technology
OOP Object-Oriented Programming
PDO PHP Data Objects
PHP PHP: Hypertext Preprocessor
TU Tribhuvan University
UI User Interface
UML Unified Modeling Language
XAMPP Apache Http Server MySQL Database PHP and Perl v

CHAPTER 1: INTRODUCTION

1.1 Background of the Project

1.1.1 Introduction:

The healthcare industry is undergoing a rapid digital transformation by improving service delivery and patient care, due to the advancement of modern technologies. Similar to other healthcare branches, the eye care sector has also recognized the need for integrated digital solutions that enhance efficiency, accessibility and the overall quality of care. The importance of adopting a digital approach to eye care management has been foreseen by challenge of traditional eye care management systems which often rely on manual processes which can lead to inefficiencies, errors and delays of treatment. The complete eye care system has been designed to bridge the gap by offering a comprehensive, web-based solution that integrates various functions by leveraging the latest advancements in web technologies, cloud computing and secure data management, the system aims to revolutionize eye care services, ensuring streamlined operations and improved patient outcomes.

1.1.2 Introduction of the Organization:

Trinetra Eye Care is a modern state-of-art eye care facility committed to offering patients complete and superior eye care services. To broaden its impact beyond its physical location, Trinetra Eye Care is launching an e-platform that will enable easy online bookings with conventional eye care procedures to enable maximum patient satisfaction as well as the efficiency of work. The facility's infrastructure features several specialized examination rooms fitted with updated diagnostic equipment for evaluating and treating various eye ailments. The organization further boasts a full-fledged optical shop in which patients are able to purchase eyeglasses, contact lenses, prescription frames and other eye sight accessories. Doctors and patients may also have lengthy discussions about diagnosis, treatment and preventative eye care procedures in patient consultation rooms that are both comfortable and private. The administrative offices are responsible to oversee the operations of all facilities, from appointment scheduling, billing and inventories to record-keeping. The organization if committed to building its services in a patient-focused way through the support of cutting-edge technology solutions that make workflow easier and enhance the quality of care.

1.1.3 Current Situation of the Organization:

Before the installation of the complete eye care system, the organization was facing various working issues that affected the working and patient satisfaction. Patient information was recorded on paper-based documents that was a problem for data storage, recovery and updating which led to risk of data loss, misplacement and errors in medical history tracking. The optical shop faced inventory management issues of tracking stock levels and processing sales manually causing delays in restocking essential and demanded products. The administrative processes were time-consuming

and prone to errors. These inefficiencies pointed out that a robust digital solution was essential to improve total service delivery and operating operations.

1.2 Problem Statement

Healthcare industries in Nepal, particularly eye care services face significant challenges due to lack of online platform for patients and doctors interactions which is a huge problem. This problem is further exacerbated by following functions:
Manual Process Inefficiencies: Time-consuming paper-based record keeping and prescriptions.
Appointment Management Challenges: Double bookings and scheduling conflicts.
Inventory Management Issues: Limited visibility of available products.
Data Analytics Limitations: Challenges in performance monitoring.

1.3 Objective of Project

The primary objective of this project is to develop an eye care management system that streamlines healthcare operations and enhance patient management. The specific objectives of the project are:

- To digitize healthcare operations by implementing an electronic health record (EHR) system for secure data storage and retrieval.
- To enhance patient experience by enabling easy online appointment booking.
- To optimize resource management through improved inventory tracking and staff scheduling.
- To ensure regulatory compliance by implementing robust data security measures and maintaining patient privacy.

1.4 Review of Related Works and Literature Review

1.4.1 Background Study

In the past few decades, eye care in Nepal has experienced revolutionary change due to advances in technology and the greater awareness of vision-related health issues among the population. The changes in care have involved a conscious effort to improve quality and access to eye care, given the alarming statistics indicating unnecessarily high levels of preventable blindness. More than 90% of blindness in Nepal is either preventable or treatable (Thapa, 2020), which speaks to the clear demand for effective interventions. Even with the advances in technology and the general awareness of eye care, access to eye care continues to be a major challenge, especially in rural and remote areas with limited access to specialized care.
Several factors contribute to the challenges faced in the management of eye care services in Nepal.
Lack of Accessibility: The most significant concern, arguably, comes from insufficient access to specialized eye care in much of the non-metropolitan regions. Patients travel long distances coming from such areas to access health care services capable of providing the specialized care they need in which expenses incurred are burdensome,

both in time and finances. Such geographic barriers severely limit individual capacity to access timely and appropriate care creates risk of avoidable blindness as a real threat.
Dependence on Paper-Based Systems: Another significant challenge is the reliance on paper-based systems for maintaining healthcare records. Many hospitals and clinics continue to use traditional methods for record-keeping, which can lead to inefficiencies and errors. The manual handling of patient data not only increases the likelihood of miscommunication and data loss but also complicates the process of tracking patient histories and treatment outcomes. This outdated approach can hinder the overall quality of care provided to patients.
Limited Digital Infrastructure: The implementation of electronic health records (EHR) and telemedicine is still in its early stages in Nepal, which poses a barrier to the modernization of eye care services. While there is a growing recognition of the benefits of digital health solutions, the lack of robust digital infrastructure means that many healthcare providers are unable to fully leverage these technologies. This limitation restricts the ability to streamline operations, improve patient management, and enhance communication between healthcare providers and patients.
Financial Constraints: Financial constraints also play a critical role in the challenges faced by healthcare institutions in Nepal. Many hospitals and clinics struggle to afford the costs associated with implementing and maintaining digital eye care management systems. The initial investment required for technology adoption, coupled with ongoing expenses for training staff and maintaining systems, can be prohibitive for many institutions, particularly those in rural areas with limited funding. As a result, the potential benefits of digital transformation in eye care remain largely untapped.

Digital Transformation in Eye Care

Some organizations, including the Nepal Netra Jyoti Sangh (NNJS) and Tilganga Institute of Ophthalmology, have taken advantage of digital platforms to improve and modernize eye care delivery to address critical problems in the eye care system in Nepal. The digital platforms have improved appointment scheduling, follow-ups, and patient management systems to enhance eye care delivery. Health care providers can work more efficiently and provide precise and conveniently accessible patient information with a shift from aging paper-based systems to electronic health records (EHR). This shift reduces administrative burden and errors so that health care providers can focus on providing better quality care to patients.
The expansion of telemedicine care services and cloud-based health management systems has contributed significantly to mitigating the accessibility barrier to care for rural populations as compared to urban populations. These innovations make care coordination more effective and allow for timely treatment of patients with disabilities to occur when patients' medical providers can remotely capture, report, and store patient data. Rather than patients having to travel long distances for specialty care, telemedicine—the use of virtual asynchronous and synchronous consultations involving two or more parties—is now a reality. This is especially beneficial in a developing nation like Nepal where access to even basic healthcare is often situated within geographic distances. In addition to improving access to eye care, these

organizations are leveraging such digital solutions to improve quality of care for residents in rural areas and provide timely treatment to patients to prevent avoidable vision complications.

1.4.2 Literature Review

Implementation of Digital Eye Care Solutions

A study has shown that the implementation of digital eye care management systems yields enhanced efficiency in the provision of healthcare services. According to (WHO, 2022), the merging of electronic medical records (EMR) and telemedicine services has significantly increased patient outcomes among developing countries like Nepal.

(Kandel, 2021) in their study found the benefits of EHR adoption in Nepalese hospitals, where electronic record-keeping had reduced administrative workload and improved patient management. They also, however, found issues such as resistance to change among doctors and inadequate training in computer systems.

(Basnet, 2023) conducted a telemedicine services survey in Nepal and indicated that remote consultations have significantly reduced rural patients' travel time and cost. Nevertheless, data security and maintenance issues still remain key areas for wider use.

Similar Projects:

I. Tilganga Institute of Ophthalmology

The implementation of an electronic medical records (EMR) system at the Tilganga Institute of Ophthalmology is an important step toward the modernization of eye care. This advanced technology, which has made it much easier to manage and access patient information, has enabled healthcare providers to manage and access their patient information more efficiently. Patient wait times are now shorter as a result of improved appointment scheduling. The EMR system has also fostered improved patient experience overall due to enhanced communication among healthcare providers as well as patient communication and treatment coordination as a result of the EMR system.

In addition to the EMR system, the Tilganga Institute has embraced telemedicine services, which have proven invaluable in extending eye care to underserved areas. By enabling remote consultations, telemedicine allows patients who may have difficulty traveling to the clinic to receive expert advice and treatment from specialists. This capability is particularly important in a country like Nepal, where many individuals live in remote regions with limited access to healthcare facilities. The combination of the EMR system and telemedicine services not only enhances the efficiency of care delivery but also ensures that patients receive timely and appropriate treatment, thereby contributing to the reduction of preventable blindness in the community (Tilganga Institute of Ophthalmology, 2020).

II. Nepal Netra Jyoti Sangh (NNJS)

The Nepal Netra Jyoti Sangh (NNJS) is at the forefront of developing solutions for digital eye care across the rural health regions of Nepal, boldly facilitating eye care services. Understanding the unique challenges faced by working-class communities, NNJS has collaborated with many local healthcare facilities to implement mobile screenings. The goal of these screenings is to ensure individuals receive timely

screenings and treatment through access to eye care services that they would have otherwise lacked. The organization has also embraced digital records of care, improved efficiency of overall services, while easing patient information management.

In conjunction with these efforts, NNJS has prioritized the education of healthcare workers in effective digital technology usage. NNJS aims to foster a culture of digital literacy in the healthcare context by providing health professionals with the necessary training and knowledge; this training will increase healthcare providers' ability to deliver quality eye care while ensuring the sustainability of digital initiatives (Sangh, 2021). With these whole-system initiatives underway, NNJS is making significant strides in improving quality and access to eye care for rural communities across Nepal.

III. Bharatpur Eye Hospital

Bharatpur Eye Hospital has made significant advancements in the delivery of eye care services by introducing a cloud-based health management system. This innovative system allows doctors to access patient records remotely, facilitating more efficient and coordinated care. By enabling healthcare providers to retrieve and update patient information from any location, the cloud-based system enhances the overall workflow within the hospital, ensuring that critical patient data is readily available when needed. This capability is particularly beneficial in improving the quality of care and reducing the likelihood of errors associated with traditional record-keeping methods.

In addition to the implementation of the cloud-based system, Bharatpur Eye Hospital has been a pioneer in the field of teleophthalmology. This approach allows patients in remote areas to receive specialist consultations without the need for long-distance travel, which can be a significant barrier to accessing quality eye care. By leveraging telemedicine technologies, the hospital is able to connect patients with ophthalmologists, providing them with expert advice and treatment options from the comfort of their homes. This initiative not only saves time and reduces costs for patients but also ensures that they receive timely care, ultimately contributing to better health outcomes in underserved communities (Sharma, 2020). Through these efforts, Bharatpur Eye Hospital is playing a crucial role in enhancing the accessibility and effectiveness of eye care services in Nepal.

IV. Himalaya Eye Hospital

The Himalaya Eye Hospital in Pokhara has adopted an integrated eye care system that includes computerized patient data management and digital appointment scheduling. Patients' wait times have been decreased as a result of this creative strategy, improving the hospital stay overall. The hospital has established a more patient-centered atmosphere that places a higher priority on prompt access to care by expediting the appointment procedure and making sure that patient data is effectively maintained. Because people can get the treatment they require without needless delays, the use of technology into these procedures not only increases operational efficiency but also promotes higher patient satisfaction. (Himalaya, 2022)

The initiatives undertaken by Himalaya Eye Hospital exemplify the substantial benefits of implementing digital solutions within Nepal's eye care sector. By adopting such technologies, healthcare institutions can enhance service delivery, minimize inefficiencies, and expand access to quality eye care across the country. These projects

serve as valuable models for other healthcare providers, demonstrating that the integration of digital tools can lead to improved patient outcomes and a more effective healthcare system overall. As more institutions follow suit, the potential for transforming eye care services in Nepal becomes increasingly attainable, ultimately contributing to the reduction of preventable blindness and the promotion of better vision health for all.

1.5 Development Methodology

The eye care management system is a user-friendly web application designed to enhance healthcare services through digital solutions.

The Iterative Model is particularly well-suited for projects like the Eye Care Management System, where requirements may evolve based on user feedback and changing needs.

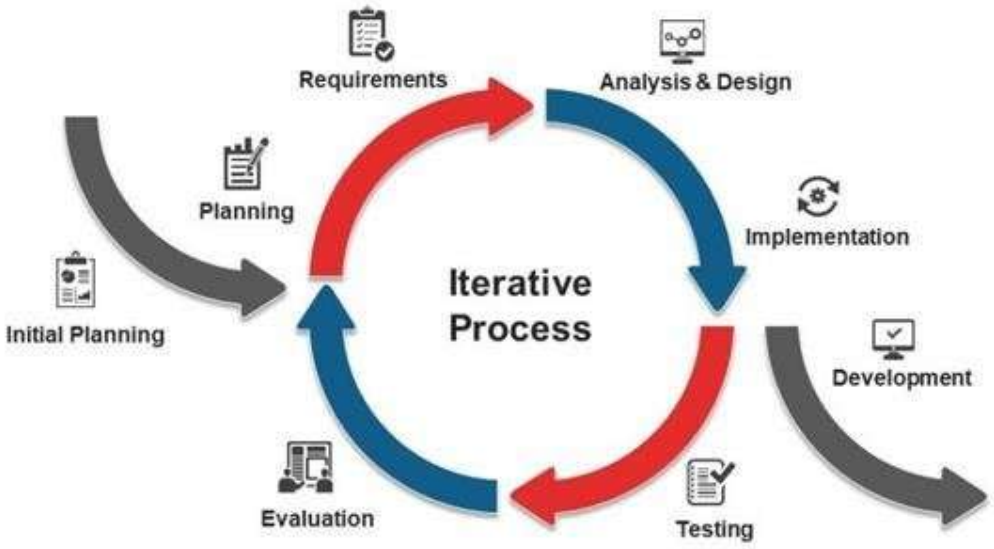

Figure 1.1 Iterative Development Model

Here's a more detailed breakdown of each stage in the context of this project:

1. Planning and Requirement Analysis: In this initial phase, the development team engaged with stakeholders, including eye care professionals, administrative staff, and patients, to gather comprehensive requirements. This involved:

- Workshops and Interviews: Conducting sessions to understand the specific needs and pain points of users.
- Requirement Documentation: Creating a detailed list of features, such as patient management, appointment scheduling, and billing systems.
- Iteration Objectives: Defining clear goals for each iteration, ensuring that each cycle builds upon the last and aligns with user expectations.

2. Design: The design phase focused on creating initial prototypes that would serve as a visual and functional representation of the system. Key activities included:

- Wireframing: Developing wireframes to outline the user interface and user experience.

- Feedback Loops: Presenting prototypes to stakeholders for feedback, which informed design adjustments.
- Architecture Planning: Establishing the system architecture to ensure scalability and maintainability.

3. Implementation

During the implementation phase, the development team wrote code in small, manageable increments. This included:

- Feature Development: Implementing core functionalities, such as user authentication and data entry forms.
- Incremental Builds: Regularly integrating new code into the existing system to ensure compatibility and functionality.
- Version Control: Utilizing version control systems to track changes and facilitate collaboration among developers.

4. Testing

Testing was a critical component of each iteration, ensuring that new features were stable and met quality standards. This involved:

- Unit Testing: Testing individual components for functionality and performance.
- Integration Testing: Ensuring that new features worked seamlessly with existing components.
- User Acceptance Testing (UAT): Involving stakeholders in testing to validate that the system met their needs and expectations.

5. Evaluation and Refinement: After each iteration, the team conducted a thorough review of the work completed. This phase included:

- Feedback Collection: Gathering insights from users and stakeholders about the system's performance and usability.
- Identifying Improvements: Analyzing feedback to pinpoint areas for enhancement or additional features.
- Planning for Next Iteration: Using insights gained to refine objectives and requirements for the next cycle, ensuring continuous improvement.

1.6 Scope and limitations

1.6.1 Scope:

The scope this project is to design and develop an Eye Care Management System that streamlines healthcare operations. The system will feature a user-friendly interface, secure data handling and automated workflow for appointment scheduling, patient records and inventory management.

- Patients will be able to book appointments online and access their medical history.
- Doctors will have a secure platform to update patient records, track treatment process and manage digital prescriptions.
- The administration panel will allow clinic staff to manage patient data, appointments, inventory and billing records efficiently.

- The system will include a reporting module for tracking patient visits, inventory usage and overall clinic performance.

1.6.2 Limitations:

- The system currently supports only single-location clinics and doesn’t accommodate multi-branch setups.
- The telemedicine feature is limited, offering only basic video consultations without advanced diagnostic integrations.

1.7 Project Structure

The website's project structure is organized into the following folders:

- assets/: contains CSS, JavaScript, and image files for styling and interactivity.
- dc/: contains PHP files, such as config.php for database connections and index.php for the main page logic.
- images:/ contains image files used on the website.
- rootdirectory/:The website's root directory contains HTML files, such as index.php, appointment.php and dashboard.php.
- These technologies were chosen for their scalability, flexibility, and ease of use, ensuring that the system can handle a large volume of users and transactions while providing a seamless user experience.

CHAPTER 2: SYSTEM DEVELOPMENT PROCESS

2.1 System Analysis

Technically, the system will likely be a web-based application built using a suitable programming language (Python, Java), a database (MySQL), and a web server (Apache). Integration with payment gateways and shipping providers is crucial. Challenges include competition, security concerns, scalability, and logistical complexities. Future enhancements may include personalized recommendations, social features and mobile apps. This analysis serves as the basis for the system's design and development, with further detailed requirements gathering anticipated.

2.1.1 Requirement Analysis

The requirement analysis phase is a critical stage in the development of the Eye Care Management System project. This phase involves identifying the functional and non-functional requirements of the project, as well as analyzing the feasibility of the project. In this chapter, we will present the findings of the requirement analysis phase, including the functional and non-functional requirements of the project, and the feasibility analysis of the project.

i. Functional Requirements

The functional requirements of the Eye Care Management System are as follows:

- User Registration and Login: The system should allow users (customers, patients and doctors) to register and login to their accounts securely.
- Appointment Management: Patients should be able to book, reschedule, or cancel appointments with doctors. Doctors should be able to manage their appointment schedules.
- Medical Record Access: Patients should be able to view their medical history, prescriptions, and diagnoses. Doctors should be able to access patient records securely.
- Product Browsing and Purchase: Customers should be able to browse optical products, add them to a shopping cart, and complete purchases with a secure checkout process.
- Feedback and Reviews: Users should be able to submit reviews for products and services, ensuring better quality and user satisfaction.
- Inventory Management: Administrators should manage stock levels, update product availability, and oversee inventory changes.
- User and Appointment Administration: Administrators should be able to manage user accounts, oversee appointment schedules, and modify system access permissions.
- Website Management: The system should allow administrators to update website content, including service descriptions, product listings, and gallery images.

Use-case diagram

Table 2.1 Use Case Diagram Table

Actor	Use Cases
Admin	Manage Doctors, Manage Patients, View Reports, Manage Products, View User Logs, Login
Doctor	Manage Appointments, View Patient History, Write Prescription, Update Profile, Login
Patient	Book Appointment, View Medical History, Update Profile, View Appointments, Browse Products, Add to Cart, Checkout, Make Payment, View Orders, Login, Register
Customer	Browse Products, Add to Cart, Checkout, Make Payment, View Orders, Login, Register

In figure 2.1, the use case diagram illustrates the primary functionalities of eye care system, showing interactions between the Administrator and Doctor with the system.

1. Admin Use Cases

- Manage users – Administrators oversee patient and doctor accounts.
- Manage appointments – Admins can update, confirm, or cancel appointments.
- Manage inventory – Admins handle stock levels and product listings in the optical shop.
- Generate reports – The system allows administrators to analyze user interactions and business metrics.

2. Doctor Use Cases

- Manage profile – Doctors can create and update their professional details.
- Manage appointments – Doctors can approve, reschedule, or cancel patient appointments.
- Access patient records – Doctors can view patient history and medical records.
- Issue prescriptions – Doctors can create and update prescriptions for patients.

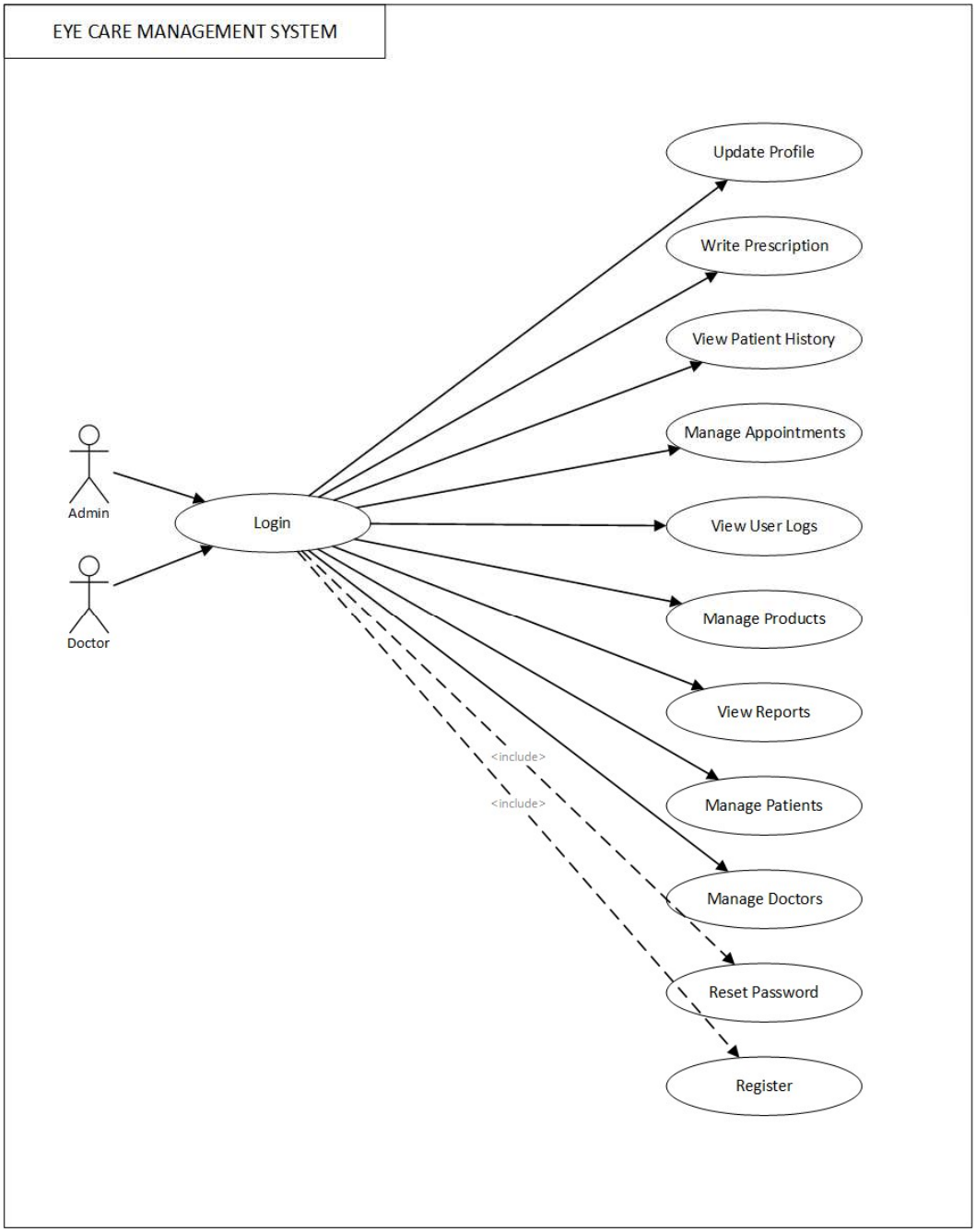

Figure 2.1 Use case diagram of the Administrator and Doctor of Eye Care Management System

In figure 2.2, the use case diagram illustrates the primary functionalities of eye care system, showing interactions between the Patient and Customer with the system.

3. Customer Use Cases

- Create and account- Customers can register their details to access the system.
- View main page- Customers can access the home page for an overview of available services.
- Browse optical products – Customers can view the catalog of available eyewear and accessories.
- Add products to cart – Customers can add desired products to their shopping cart.
- Make a purchase – Customers can proceed to checkout and complete a secure payment.
- Track order status – Customers can monitor the progress of their orders in real time.
- Provide feedback – Customers can submit reviews on products and services.

4. Patient Use Cases

- Register an account – Patients can create an account for accessing medical services.
- Book an appointment – Users can schedule consultations with doctors.
- View medical history – Patients can access past prescriptions and diagnoses.
- Update profile – Users can modify personal details and contact information.
- Purchase optical products – Customers can browse and buy optical products from the online shop.

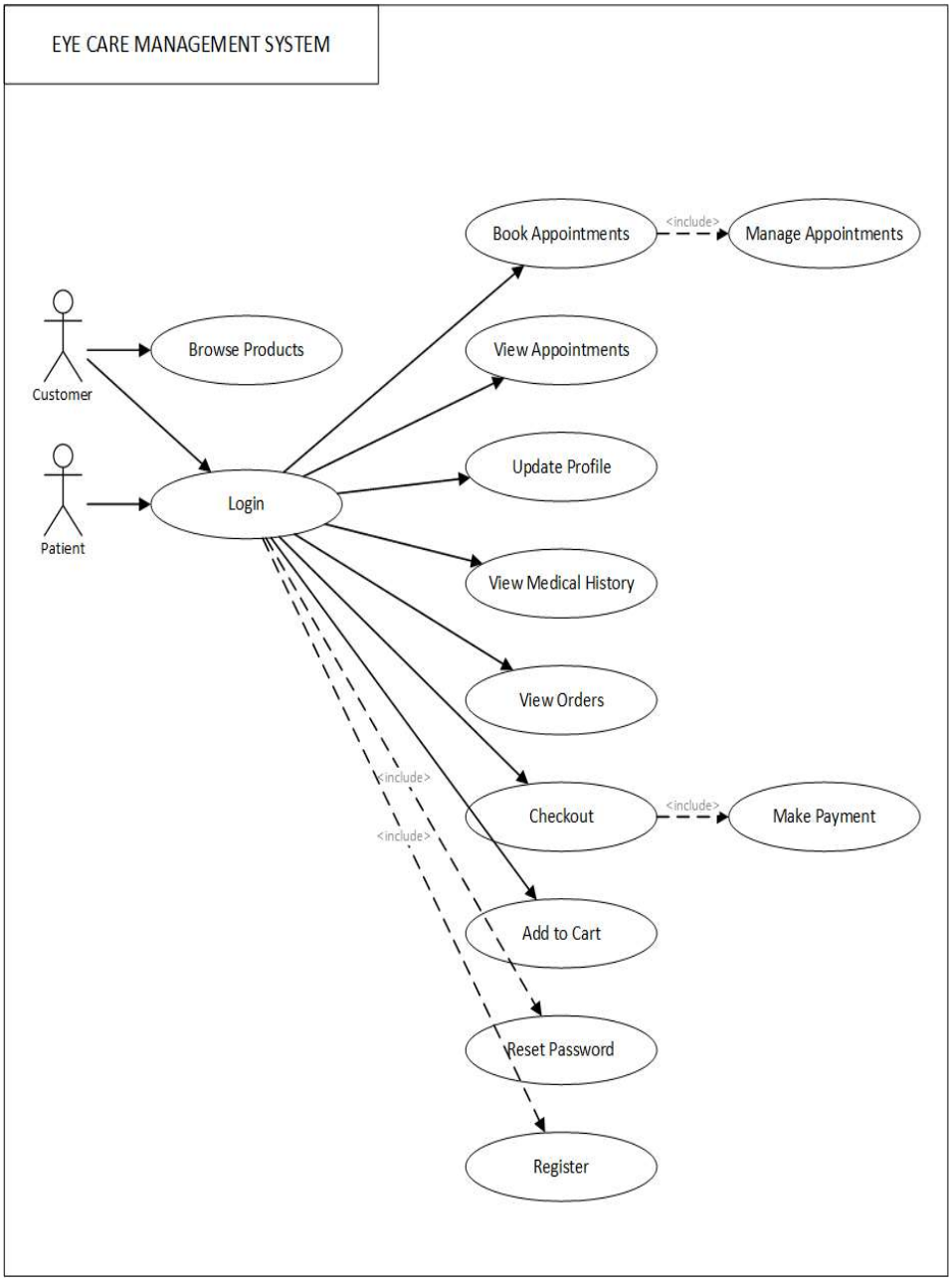

Figure 2.2 Use care diagram of the Administrator and Doctor of Eye Care Management System

Use Case Documentation

Table 2.2 Use case table of Manage Appointments

Aspect	Description
Actor	Doctor, Patient
Description	Allows doctors to manage patient appointments and patients to book appointments
Preconditions	1. User is authenticated 2. Doctor's schedule is configured in the system
Main Success Scenario	1. User accesses appointment management interface 2. System displays available appointment slots 3. User selects desired appointment slot 4. System validates selection 5. System confirms and saves appointment
Alternative Flows	1. Selected slot is no longer available User selects another slot 2. Doctor needs to reschedule Doctor selects new time slot System notifies patient Patient confirms new slot
Postconditions	1. Appointment is scheduled in system 2. Both doctor and patient are notified 3. Appointment appears in respective calendars

Table 2.3 Use case table of Login

Aspect	Description
Actor	Doctor, Patient, Admin, Customer
Description	Authenticates users to access their respective system features
Preconditions	User has registered account in the system
Main Success Scenario	1. User enters credentials 2. System validates credentials 3. System authenticates user 4. System redirects to appropriate dashboard
Alternative Flows	1. Invalid credentials System displays error message User re-enters credentials 2. Forgotten password User requests password reset System sends reset instructions
Postconditions	1. User is authenticated 2. Session is created

Table 2.3 Use case table of Register

Aspect	Description
Actor	Patient, Customer
Description	Allows new users to create an account in the system
Preconditions	User does not have an existing account
Main Success Scenario	1. User provides required information 2. System validates input 3. System creates user account 4. System sends confirmation email
Alternative Flows	1. Email already exists System notifies user User provides different email 2. Invalid information System highlights errors User corrects information
Postconditions	1. New user account is created 2. User can login to the system

Table 2.4 Use case table of Checkout

Aspect	Description
Actor	Patient, Customer
Description	Processes payment and completes product purchase
Preconditions	1. User has items in shopping cart 2. User is authenticated
Main Success Scenario	1. User reviews cart items 2. System calculates total 3. User provides shipping information 4. User selects payment method 5. System processes payment 6. System confirms order
Alternative Flows	1. Payment failure System displays error User tries different payment method 2. Invalid shipping information System highlights errors User corrects information
Postconditions	1. Order is created 2. Payment is processed 3. Inventory is updated 4. Order confirmation is sent

Table 2.5 Use case table of Manage Patients

Aspect	Description
Actor	Doctor
Description	Allows doctors to view patient's medical history and previous visits
Preconditions	1. Doctor is authenticated 2. Patient exists in system
Main Success Scenario	1. Doctor selects patient 2. System retrieves patient history 3. System displays medical records 4. Doctor reviews information
Alternative Flows	1. Patient record not found System displays error Doctor verifies patient information 2. Incomplete records 3. System flags missing information Doctor requests updates
Postconditions	1. Doctor has accessed patient history 2. Access is logged in system

ii. Non-Functional Requirements

The non-functional requirements of the Eye Care Management System are as follows:

- Performance: The system should respond to user requests within 2 seconds, and the search functionality should return results within 1 second.
- Security: The system should ensure the security and integrity of user data, including passwords, credit card information, and personal details.
- Usability: The system should provide an intuitive and user-friendly interface that is easy to navigate and use.
- Scalability: The system should be able to handle a large volume of users and transactions, and should be able to scale up or down as needed.
- Availability: The system should be available 24/7, with a minimum uptime of 99.9%.

2.1.2 Feasibility Analysis

i. Technical Feasibility Analysis

The Eye Care Management System has been designed using PHP, JavaScript, HTML, CSS, and Bootstrap. These are very popular technologies which provide the surety of the scalability and maintainability of the system. The database management system used is MySQL, which is a very effective and reliable choice for handling huge amounts of data related to user details, doctor appointments and reviews. The system has been deployed within an Apache web server that does support both PHP and MySQL, thus providing a stable platform for the website. A real-time database has been used to create

the system in such a way that the appointment booking information is recent and up to date every second without any delay. This will make sure that neither the customers nor the admins are met with any lags; hence, there are no strong technical limitations in developing and implementing this project.

ii. Operational Feasibility

The system is very simple to operate and does not need technically capable persons. The system reduces administrative workload, improves communication between patients and doctors, and enhances inventory control. No such strong training has been made compulsory admin and doctors to be able to interwork on this system. It is therefore quite operational feasible with most future users.

iii. Economic Feasibility

The system reduces administrative expenses, improves efficiency, enhances inventory management and boosts patient satisfaction. The system was developed totally on open-source software available, hence cutting most costs of licensing for proprietary expensive software. Any future cost that could arise out of the incorporation of advanced payment methods or hosting services can be considered manageable within the project's scope.

iv. Schedule Feasibility

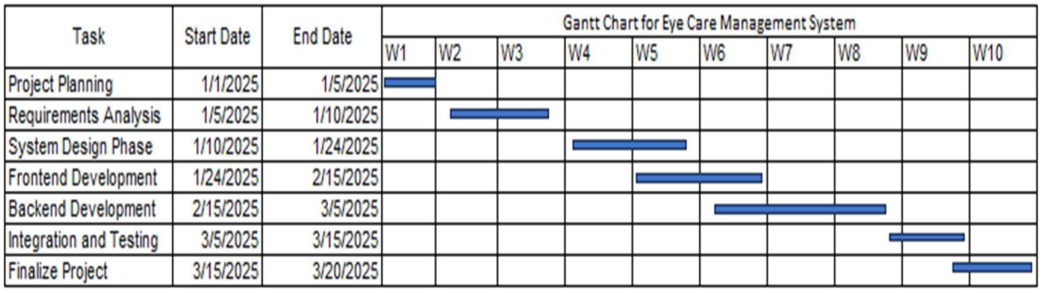

Figure 2.3 Gantt Chart for Eye Care Management System

2.1.3 System Analysis

System design is the process of defining the elements of a system such as the architecture, modules and components, the different interfaces of those components and the data that goes through that system. It is meant to satisfy specific needs and requirements of a business or organization through the engineering of a coherent and well-running system. One of the main components of software design is the software requirement analysis. In this project there is one database used for store the information of customer who have register their account in system.

Class Diagram

A class diagram is an illustration of the relationships and source code dependencies among classes in the Unified Modeling Language (UML). In this context, a class defines the methods and variables in an object, which is a specific entity in a program

or the unit of code representing that entity. Class diagrams are useful in all forms of object-oriented programming (OOP).

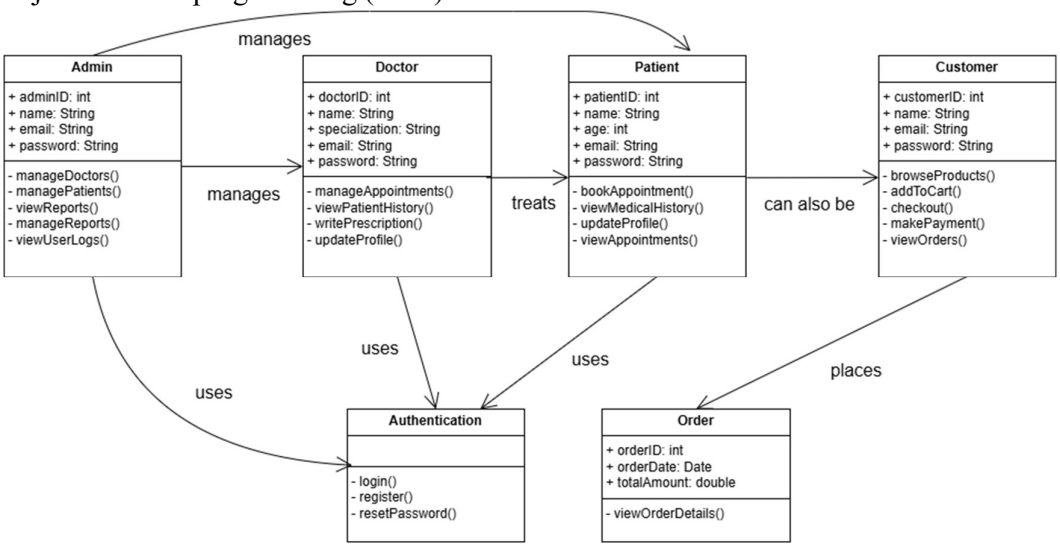

Figure 2.4 Class Diagram of Eye Care Management System

In figure 2.4, class diagram shows relation to eye care management system and how the different elements are combined. There exist controllers of users and those of administrators, models set up in such a way as to define a database structure and relationships. The Admin class is responsible to manage doctors, patients, reports and user logs. It has attributes such as adminID, name, email and password and provides functions like manageDoctors(), managePatients(), viewReports() and viewUserLogs()..

The Admin manages doctors, establishing a hierarchical relationship.The Doctor class includes attributes such as doctorID, name, specialization, email, password. It is responsible to manage appointments, view patient history, write prescriptions update their profile.

The Patient class has attributes like patientID, name, age, email, password. Patients can book appointments, view medical history, update their profile, and view their appointments. Doctors treat patients, forming an essential relationship in the system.

The Customer class represents individuals who can browse products, add items to a cart, checkout,make payments, and view orders. A patient can also be a customer, implying those medical products or services are available for purchase within the system.

The Authentication class is a shared module used by both admins and patients to handle login, registration, and password reset functionalities.

The Order class includes attributes such as orderID, orderDate and totalAmount. Customers place orders, and they can view order details.

Sequence Diagram

UML Sequence Diagrams are interaction diagram that detail how operations are carried out. They capture the interaction between objects in the contest of a collaboration. Sequence diagrams are time focus and they show the order of the interaction visually

by sing the vertical axis of the diagram to represent time what messages are sent and when.

Admin Interaction Sequence Diagram

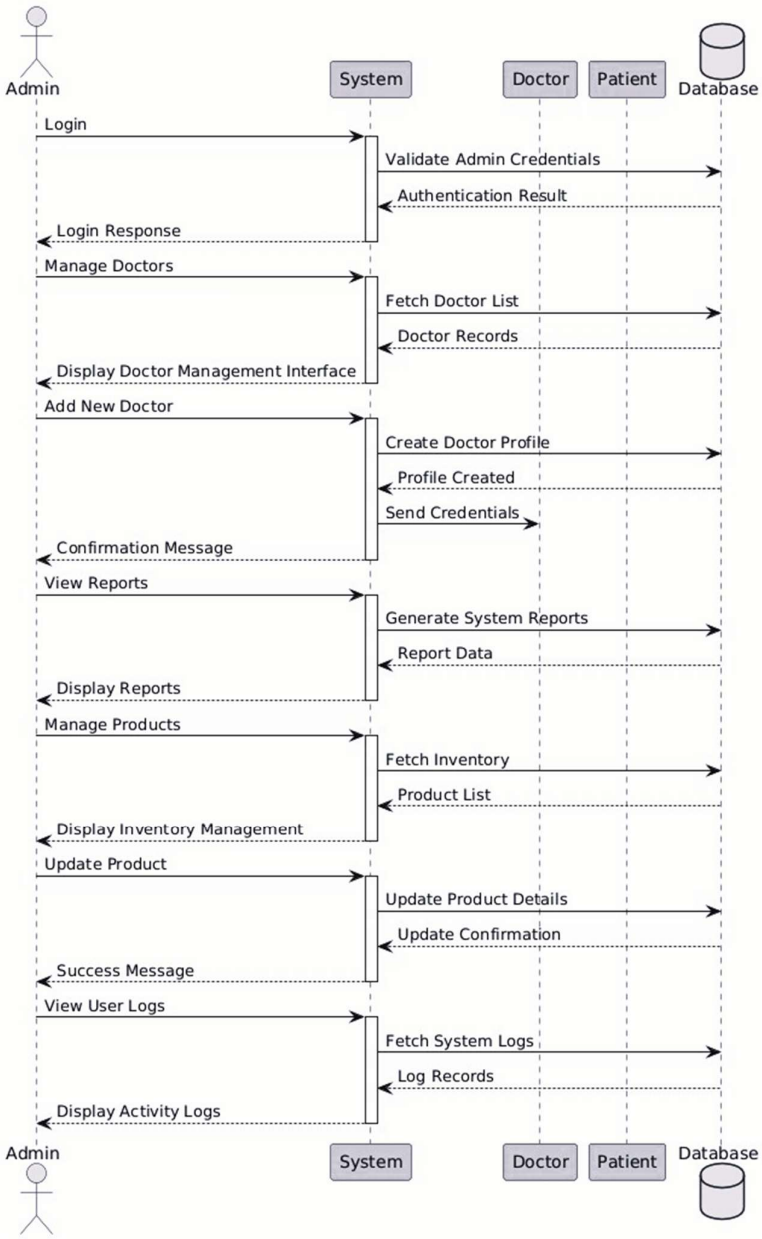

Figure 2.5 Admin Side Sequence Diagram

Patient Interaction Sequence Diagram

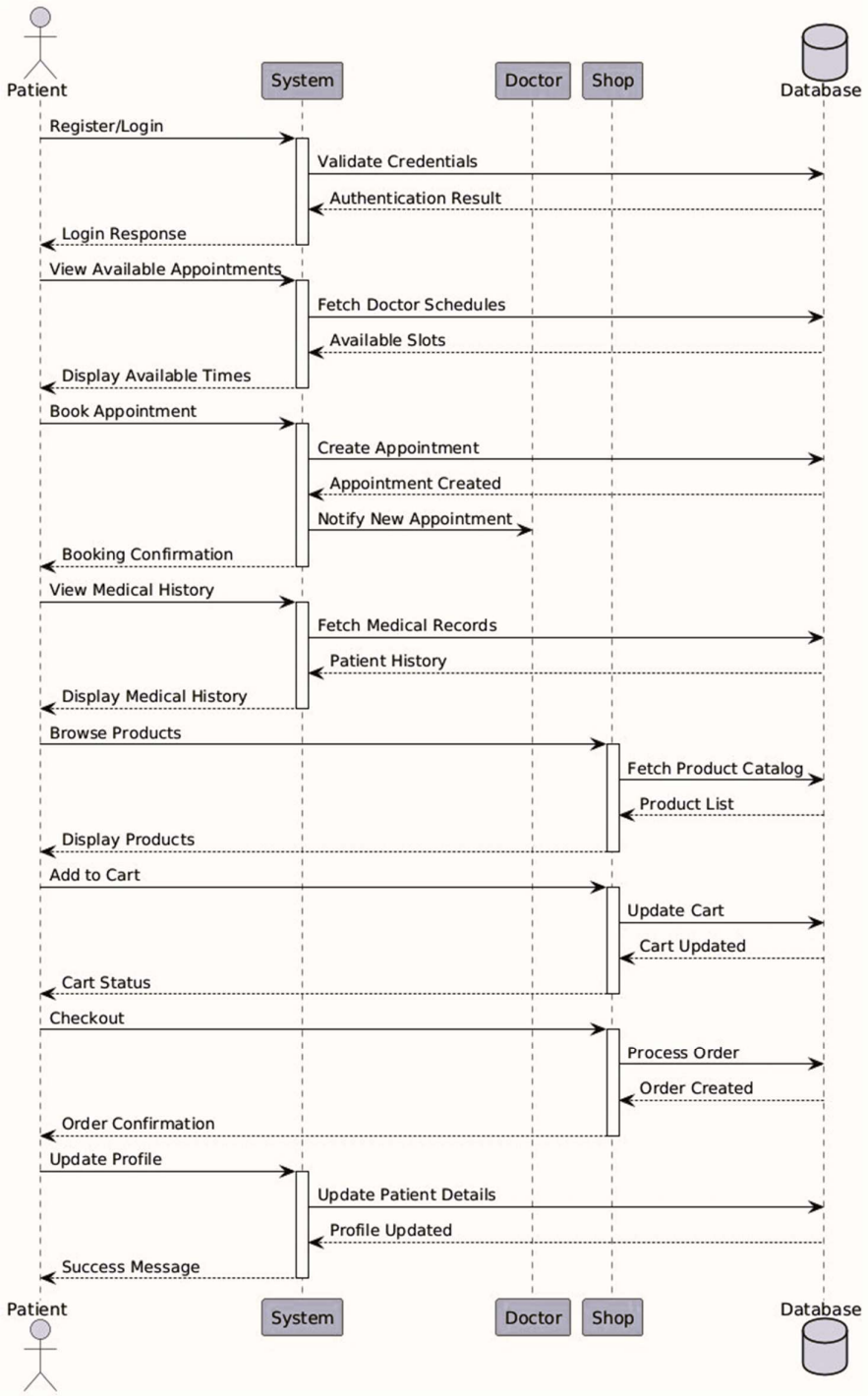

Figure 2.6 Patient side Sequence Diagram

Doctor Interaction Sequence Diagram

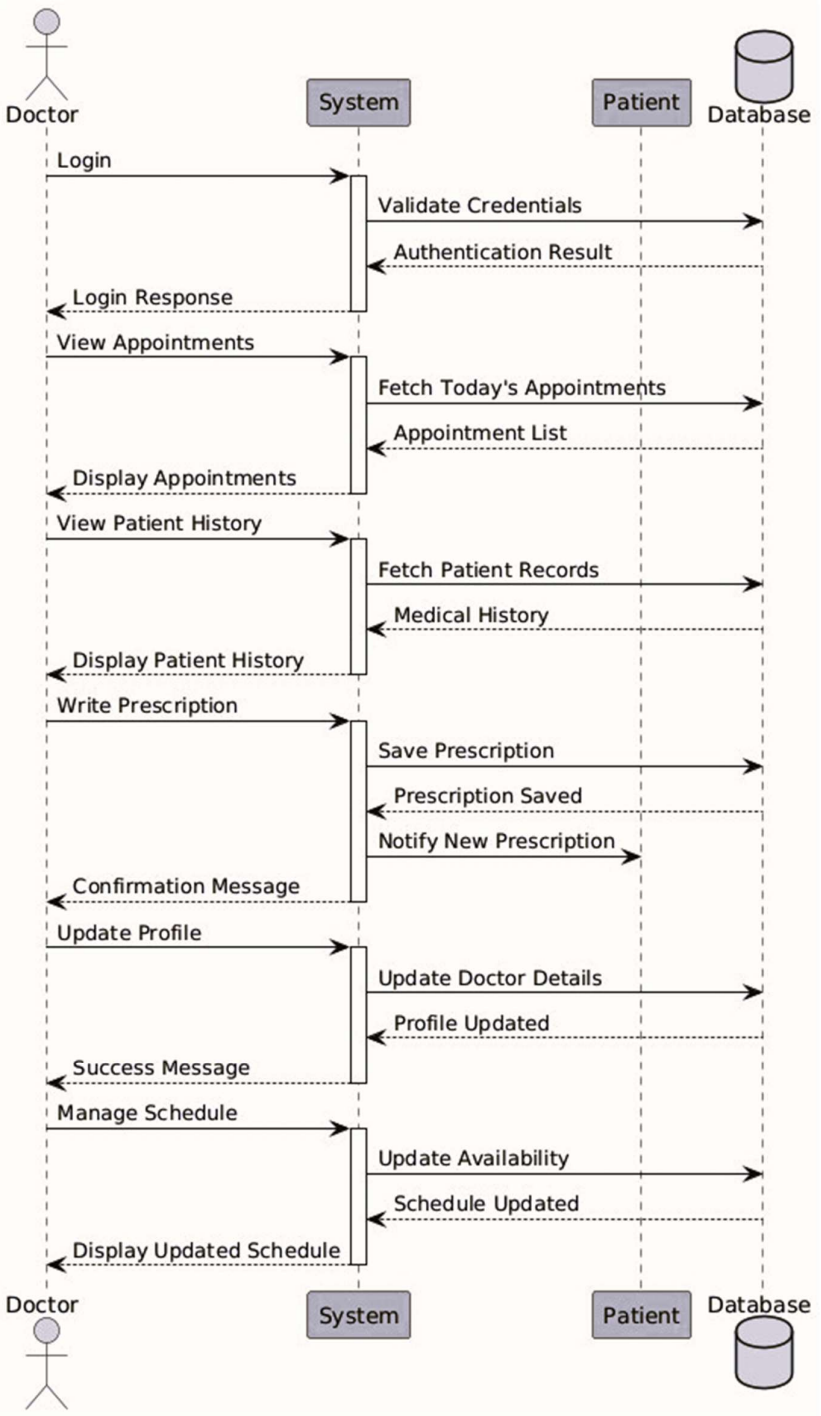

Figure 2.7 Doctor side Sequence Diagram

Activity Diagram

An activity diagram visually presents a series of actions or flow of control in a system similar to a flowchart or a data flow diagram. Activity diagrams are often used in business process modeling. They can also describe the steps in a use case diagram. Activities model can be sequential and concurrent. In both cases an activity diagram will have a beginning and an end.

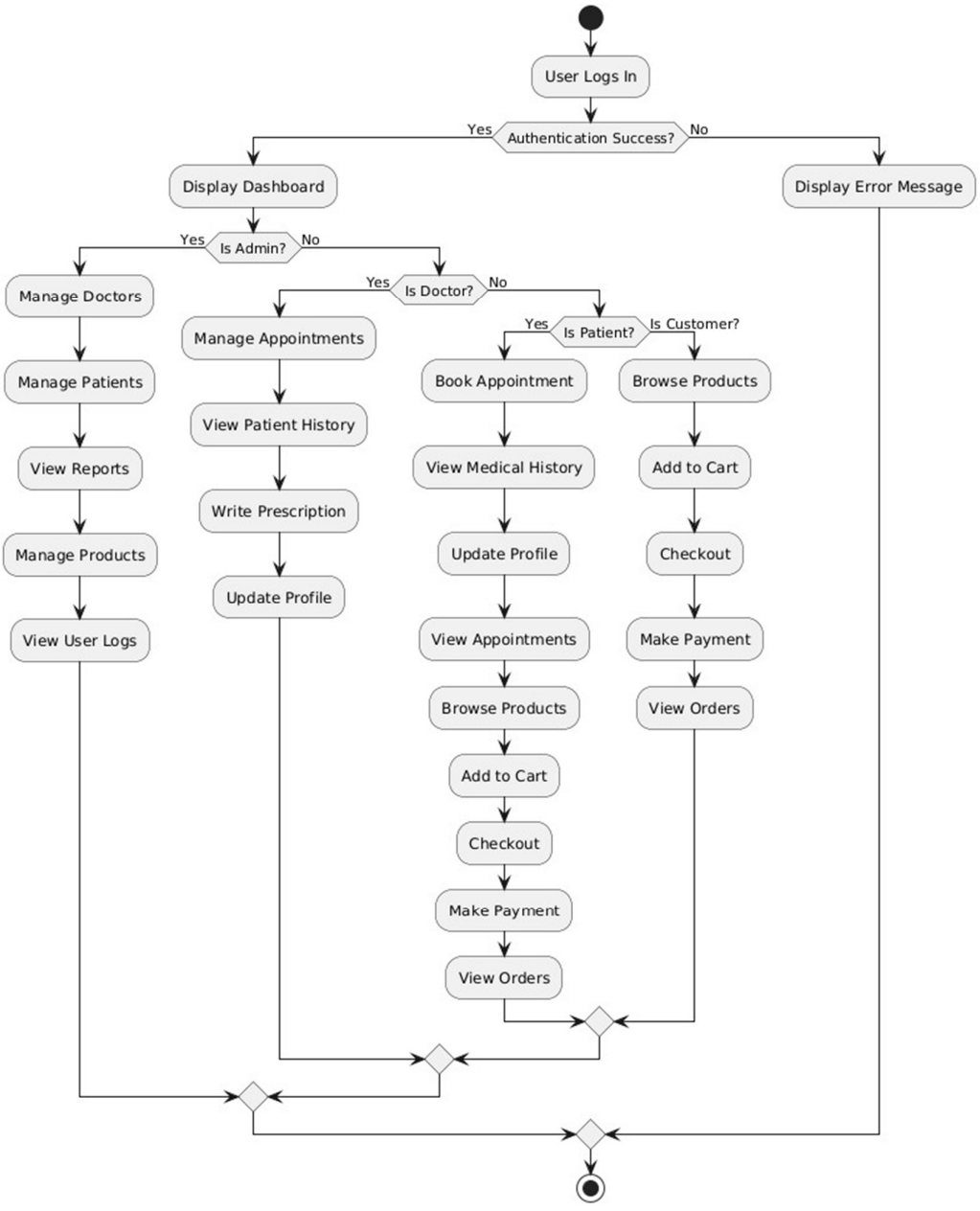

Figure 2.8 Activity Diagram of Eye Care Management System

2.2 System Design

2.2.1 Refinement of class diagram

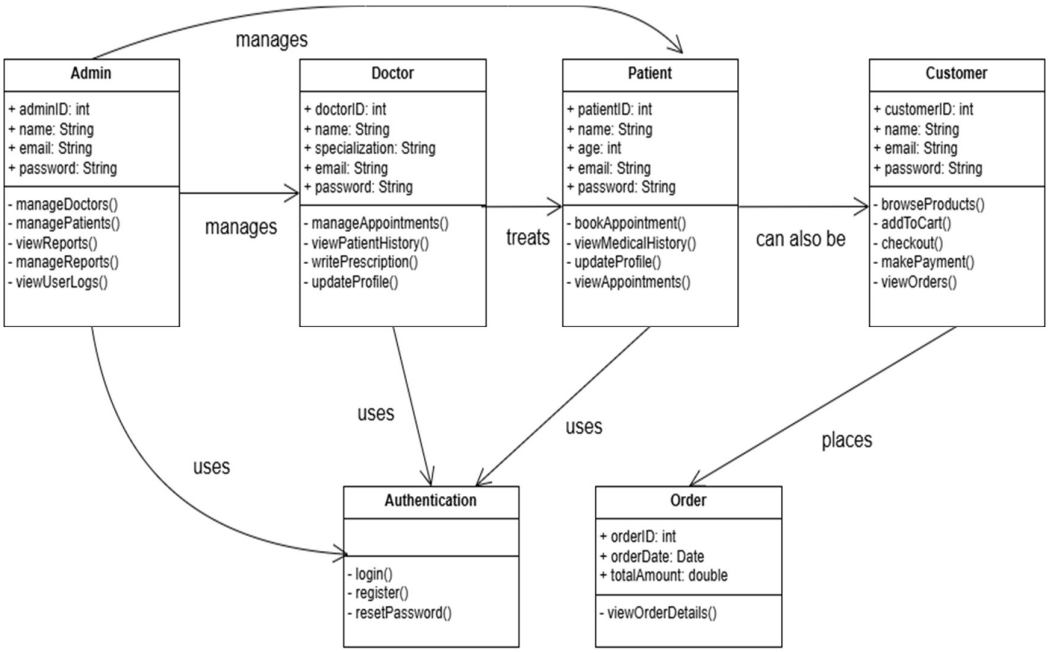

Figure 2.9 Refined class diagram of Eye Care Management System

Figure 2.9 shows the working of Eye Care Management System in following ways:
Admin Class
manageDoctors(): Oversees doctor-related operations.
managePatients(): Handles patient management.
viewReports(): Displays reports.
viewUserLogs(): Monitors system logs.
Doctor Class
manageAppointments(): Schedules and organizes patient visits.
viewPatientHistory(): Reviews past medical records.
writePrescription(): Issues prescriptions.
updateProfile(): Modifies doctor's profile.
Patient Class
bookAppointment(): Schedules a visit.
viewMedicalHistory(): Checks previous medical records.
updateProfile(): Edits user details.
viewAppointments(): Views scheduled visits.
Customer Class
browseProducts(): Views available items.
addToCart(): Adds items to a shopping cart.
checkout(): Proceeds to payment.
makePayment(): Completes the transaction.
viewOrders(): Displays order history.

Authentication Class
login(): Handles user authentication.
register(): Registers a new account.
resetPassword(): Manages password recovery.
Order Class
viewOrderDetails(): Displays order summary.

2.2.2 Algorithm Details

The scheduling mechanism maximizes the use of time slots in which there populates are no competing appointments. It also ensures that the entirety of the physicians' schedules are not disrupted and that patients are offered timely appointments. The system employs a constraint based scheduling system in which rules are used to check for availability, prevent double-booking, and ensure an equitable allocation of time slots.
Slot availability is determined based on existing bookings and the doctor's predefined working hours. The system uses the following SQL query to fetch available slots.

SQL Query:

```
SELECT appointment_date, COUNT(*) AS appointments
FROM appointments
WHERE doctor_id = ? AND appointment_date >= CURDATE()
GROUP BY appointment_date
HAVING appointments < max_appointments_per_day;
```

This query ensures that:
Only appointments in the future are processed.
Each physician does not exceed their maximum appointments per day.
All time slots are organized in groups by date to enable better querying.

Conflicts Prevention Strategies
After conflicts arise, the system performs checks to ensure conflicts do not exist:
Doctor Availability Check will confirm that the doctor is scheduled to work on the date that is selected.
Working hours will ensure that the appointment will be within the shift of the doctor.
Double Booking will stop patients from booking on overlapping time slots.

Advantages of the Scheduling Algorithm
Efficient Slot Delegation – Makes sure that accounts for the best strategic work plan for the doctor while avoiding overload.
Prevention of Conflicting Schedules – Conflicts between scheduling providers cannot occur because strict constraints prevent this.

Scalability – The system will handle multiple doctors and high patient volume with no degradation of performance.

2.3 Implementation

2.3.1 Tools and technologies used

Development Tools

- MySQL: This is a relational database management system which allows for the storage of data about reviews of user information and room booking among other.
- PHP: PHP is used for backend development.
- HTML: It is basically used to format text as titles and headings, to arrange graphics on this system and also used to link different pages within a system.
- CSS: In this system CSS is used for development sites structure by creating design or outline the html element and describing the presentation to different pages, including colors, layout and fonts.
- JavaScript: In this project JavaScript is used for creating some animation in page content.
- Bootstrap: This is a front-end framework that would be very handy in the development of the design having responsiveness and mobile-friendly features. It has pre-designed components that include buttons, navigation bars, forms, etc. that would quicken the development process and leave it polished to most devices.
- JQuery: JQuery is a JavaScript library designed to simplify HTML DOM tree traversal and manipulation, as well as event handling, CSS animations, and Ajax for DOM manipulation

Development Environment

- XAMPP: It is used for creating and configuring with database which is written in MySQL without internet. In this project XAMPP version 3.2.4 is used.
- Apache: The web server serves the purpose of handling HTTP requests and serving the application to the users. It is very reliable, efficient, and most widely used in web-hosting environments.
- MySQL: This is a relational database management system which allows for the storage of data about reviews of user information and room booking among other.
- PDO: The PDO (PHP Data Objects) extension is used for database interactions, enhancing security by preventing SQL injection and allowing prepared statements.
- VS Code: Visual Studio Code is used to write down all the HTML, CSS and PHP code in this project.
- Postman for API Testing

Others

- Microsoft Office: The Microsoft office word document is used for softcopy documentation of the project. All the document design and numeration are done by using Microsoft Office Word 2016.
- Web Browser: Microsoft Edge browser is used to the run the localhost system of a project.
- PHPMailer for email notifications
- Khalti payment gateway integration

2.3.2 Module Description

1. Admin Dashboard Module
    - Administrative control panel for managing the system
    - Monitoring of patient and doctor interactions
    - Real-time statistics on appointments, prescriptions, and optical shop sales
    - Visual data representation using Chart.js
2. Patient Management Module
    - Patient registration and profile management
    - Appointment booking and cancellation system
    - Medical history tracking and digital prescriptions
    - Secure communication with doctors
3. Doctor Management Module
    - Doctor profile and schedule management
    - Patient consultation and prescription handling
    - Review of patient history and medical records
    - Appointment status updates
4. Optical Shop Module
    - Product catalog with filtering and sorting options
    - Shopping cart and secure checkout process
    - Order management and inventory tracking
    - Payment gateway integration for online transactions
5. Authentication and Authorization Module
    - User authentication with encrypted password storage
    - Role-based access control (Admin, Doctor, Patient)
    - Secure session management
    - Multi-factor authentication (optional feature for security enhancement)

2.3.3 Testing

The Eye Care Management System was tested using a combination of manual and automated testing techniques. The testing strategy included unit testing, integration testing, and system testing.

Unit Testing:

- Jest was used to write unit tests for individual components and modules.

Integration Testing:

- Integration tests were written to test the interactions between services.

i. System Testing

The Eye Care Management system was tested as a whole to ensure that it met the functional and non-functional requirements. The testing strategy included testing the system as a whole, as well as individual modules and services.

The system testing included testing the following scenarios:

User Registration and Login:

- Testing user registration and login functionality.
- Testing user profile management and preferences.

Book Appointments:

- Testing booking appointments.

Shopping Cart Management:

- Testing shopping cart management functionality.
- Testing order creation and editing.

Payment Processing:

- Testing payment processing and transactions.
- Testing payment gateways and payment methods.

Table 2.6 System testing

S.N.	Test Case ID	Test Description	Test Data	Steps Executed	Expected Results	Actual Results	Status
i	TC-01	User login and registration	Email: user@gmail.com Password: 123	User signup with username, email, and password, it gets saved to database, the user now signs in with the same credential.	User can fill form to signup, fill sign in form and sign in to dashboard.	User is success fully Login.	Pass

ii	TC-02	Book Appointment		Click on Book Appointment on main page.	Patient can book appointment for their desired doctors.	User successfully books appointment after logging in	Pass

ii. User Application Testing

Table 2.7 User application testing

S.N.	Test Case ID	Test Description	Test Data	Steps Executed	Expected Results	Actual Results	Pass/Fail
i)	TC-01	User registration	Email: user@gmail.com Password: 123	1. Click on the registration button. 2. Enter valid user details and required information	Registration form is displayed. User is successfully registered	The user can register for a new account.	Pass
ii)	TC-02	User login	Email: user@gmail.com Password: 123	1. Click on the login button 2. Enter the valid login credentials	Login form is displayed. User is logged in successfully.	The user can login to the system	Pass
iii)	TC-03	Product browsing and selection	Browsing products.	1. Navigate the Products page. 2. Browse through the product options.	Products are displayed with a list of available products. Product details are displayed	The user can view products and product details.	Pass

iv)	TC-04	Product addition to cart	Adding product to cart	1. Select a product. 2. Click on the "Add to Cart" button.	Product is added to the cart successfully.	The user can add products to the cart.	Pass
v)	TC-05	Cart management	Add, update and delete from cart.	1. View the cart. 2. Update the quantity of a product. 3. Remove a product from the cart.	Cart is updated successfully. Product is removed from the cart successfully.	The user can manage their cart.	Pass
vi)	TC-06	Checkout	Enter credentials, date and click on checkout	1. Proceed to checkout. 2. Enter valid payment details.	Order is placed successfully. Payment is processed successfully.	The user can place an order and make a payment.	Pass
vii)	TC-07	Order tracking	Order viewing	1. View the order history. 2. Track the order status.	Order history is displayed. Order status is updated.	The user can track their order.	Pass

iii. Admin Application Testing:

Table 11: Admin Application testing:

S.N.	Test Case ID	Test Description	Test Data	Steps Executed	Expected Results	Actual Results	Pass/ Fail
i)	TC-01	Admin login	Email: admin@admin.com Password: admin	1. Click on the admin login button. 2. Enter valid admin login credentials	Admin is logged in successfully.	The admin can login to the system.	Pass
ii)	TC-02	Product management	Add, update and delete product.	1. Add a new product. 2. Edit an existing product. 3. Delete a product.	Product is added, edited, and deleted successfully.	The admin can manage products.	Pass
iii)	TC-03	Order management	Viewing, updating or canceling the order.	1. View order details. 2. Update order status. 3. Cancel an order.	Order details are displayed, order status is updated, and order is cancelled successfully.	The admin can manage orders.	Pass
iv)	TC-04	User management	View and delete users.	1. View user details. 2. Edit user details. 3. Delete a user.	User details are displayed, edited, and deleted successfully.	The admin can manage users.	Pass
vi)	TC-06	Settings management	Updating site	1. Update site settings. 2. Update payment settings.	Site and payment settings are updated successfully.	The admin can manage settings.	Pass

iv. Unit Testing

Unit testing was undertaken during the actual implementation of the system. Each time some code was written it was run and monitored for the bug. As bugs were discovered they were corrected by adding code or modifying the existing code. Several bugs were corrected by analyzing the error messages and correcting them by chaining in code. After development of the system has been completed testing was also performed. Functionality testing and interface testing combined to ensure the system functionality as requirement.

Test Case

Title: Eye Care Management System

Description: The system should be able to have the characteristics of Login functionality.

Precondition: The system's database has email= "admin@admin.com" and password= "admin"

Assumption: The login U/I has text field to enter email and password.

Test Steps: a) Open login file

b) Enter email and password

c) Press Login button

Expected Result: The entered email and password must validate with database's username and password and after validation success, it is expected to locate for homepage.

Post Condition: System should able to store the activity done by the admin after successfully login into the system.

Table 2.8 Test Case

Test Case	Test Scenario	Test Data	Expected Result	Status
1	Check response when invalid email and password is entered.	Email= email Password= password	Message Display "Either email or password is incorrect"	Pass
2	Check response with blank email and blank password is submitted	Email= Password=	Message display "Email and Password cannot be blank"	Pass
3	Check response when correct email and incorrect	Email= admin@admin .com Password= Pranisha	Message Display "Either email or password is incorrect"	Pass

	password is entered			
4	Check Response when incorrect email and correct password is entered	Email= user@user.com Password= admin	Message Display "Either email or password is incorrect"	Pass
5	Check response when valid email and password is entered.	Username = admin@admin.com Password = admin	Redirect to Admin Panel	Pass

CHAPTER 3: CONCLUSION AND RECOMMENDATIONS

2.4 Conclusion

The Eye Care Management System has successfully computerized stock tracking, patient record management and appointment scheduling, thus revolutionizing the foundational healthcare process. Not only has it driven down the amount of paperwork and improved collaboration between patients, physicians and administrative staff, but it has also significantly increased operational efficiency. By providing a web-based system, they also have ensured seamless access from multiple devices where users records and their clinicians can communicate more efficiently. The Iterative Model has been particular in this process because it allows for continual testing and adjustments to ensure that the system meets all requirements, whether functional or non-functional.

Extensive testing throughout the development process has validated the reliability, security, and user-friendliness of the system so that it presents an excellent solution for present day eye care facilities. The Eye Care Management System effectively meets many of the difficulties that arise from conventional eye care management but there are opportunities for future improvement. Incorporation of telemedicine capabilities, AI-based diagnostic tools and support for multi-branch and multi-user healthcare could increase the usability and effectiveness of the ECLMS and ultimately improve patient outcomes and delivery capabilities within healthcare.

2.5 Recommendations

1. Integrate Telemedicine Services: Integrating remote consultation capabilities can significantly improve access for patients who cannot attend the clinic in-person.AI-Assisted Diagnosing: Incorporating an AI photo image assessment of eye health will improve the accuracy and timeliness that doctors have for diagnosing eye pathologies.
2. Multiple Clinic Branches: A scalable system that can support multiple clinics is necessary if your organization will grow or operate multiple locations.
3. Mobile Application: A mobile system would allow for greater access and engagement of patients to both book appointments and access their data from their mobile devices.
4. Enhanced Security Measures: Regular monitoring and security enhancements should be made to secure sensitivity data from unapproved use.

Future Enhancements

1. Blockchain for Patient Medical Records: Using blockchain could improve data management and provide better security for patient records.
2. Voice Command for Patients who are Blind: Having voice command will increase accessibility for visually impaired patients and improve usability.
3. Predictive Analytics using AI to Predict Eye Diseases: AI-Predictive analytics will harness data from the patient's history to understand potential risks to their overall

eye health and quickly suggest actions that could improve their current well-being (such as acting on their prior history).

4. Integration with Smart Devices and Wearable Eye Monitoring Devices: Sync with smart glasses and wearable devices that monitor the eye health could allow continued monitoring of conditions.

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