Web Based System For Sethro Medical Center

By

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IM/2022/015

A report submitted in partial fulfillment of the requirements for the degree of Bachelor of Science Honors in Management and Information Technology (B. Sc.MIT)

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Sri Lanka 2025/07/07

Declaration

I hereby certify that this project and all the artifacts associated with it is my work and it has not been submitted before nor is currently being submitted for any other degree program.

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Introduction

This chapter provides an overview of the organization, current business processes, and the proposed system. The current problems and weaknesses of the system are discussed, while reviewing its goals and scope. Finally, it provides an outline of the entire report.

Description of the Business

This project focuses on transforming a medical center in Awissawella, which currently operates without any digital system. The key areas of enhancement include:

- Comprehensive medical history tracking for every patient
- Streamlined appointment scheduling and management
- Digital prescription and pharmacy inventory control
- Efficient billing and invoicing processes
- Laboratory report digitization and secure record keeping
- Centralized user and staff management with audit trail
- Improved data security and access controls for sensitive information

By addressing these areas, the project aims to increase clinical efficiency, ensure the continuity and accuracy of patient care, and provide robust support for staff and administrative operations. The overall goal is to enable the medical center to deliver safer, faster, and more reliable healthcare through digital transformation.

Business Processes

- Patient Registration & Appointment Scheduling
- Medical Consultation & Diagnosis
- Laboratory Testing & Reporting
- Medication Dispensing (Pharmacy)
- Billing & Payment Collection
- Medical Records Management

Existing System – Problems and Weaknesses

- **Time-Consuming Operations:** Most processes are slow because they rely on manual records and calculations.
- **High Risk of Human Error:** Manual entry increases the likelihood of mistakes in patient data, inventory, and billing.
- **Difficult Inventory Tracking:** Inventory items cannot be easily monitored or updated, leading to shortages or overstocking.
- **Communication Delays:** There is no efficient method to quickly inform suppliers, staff, or patients about appointments, orders, or results.
- **Limited Accessibility:** Patients and suppliers cannot directly access or update information, causing service delays.
- **Inaccurate Reporting:** Manually generated reports are prone to errors and inconsistencies.

Aims and Objectives

Aim

To implement a comprehensive digital solution that optimizes and modernizes the key operations of the medical center, enabling efficient, accurate, and secure delivery of healthcare services.

Objectives

- Digitize patient registration, appointment scheduling, and medical records management.
- Enable secure and fast access to patient histories, lab results, prescriptions, and billing for authorized users.
- Automate inventory tracking and restocking processes for pharmacy operations.
- Provide digital tools for doctors, pharmacists, lab staff, and receptionists to coordinate care more effectively.
- Facilitate timely communication between staff, patients, and suppliers.

- Reduce manual paperwork, errors, and administrative workload.
- Improve the accuracy, accessibility, and security of data and reports.

1.6 Scope of the Project

The project encompasses the design and implementation of an integrated digital system for the Awissawella medical center, supporting the core functions of all stakeholders. The scope specifically includes:

- **Patient Module:** Secure registration, profile switching, full medical history tracking with search/filter, downloading of reports and prescriptions, digital appointment booking, password recovery, AI chatbot for multilingual queries, notification delivery (lab reports, queue, doctor arrival), and profile management for family members.
- **Doctor Module:** Secure login, daily appointment dashboard, patient search, comprehensive medical record access, prescription creation, lab test ordering, and schedule management.
- **Pharmacist Module:** Secure login, prescription queue dashboard, real-time inventory management with low/out-of-stock indicators, medicine addition and restocking, automated inventory update on dispensing, purchase order creation, and consolidated patient invoicing.
- **Receptionist Module:** Secure login, appointment calendar, patient registration (including simplified registration), appointment scheduling/cancellation with notifications, and manual queue override with audit logging.
- **Lab Assistant Module:** Secure login, pending test request dashboard, lab report upload/linking to patient profiles and requests.
- **Admin Module:** User management (add, modify, deactivate, assign roles), and audit log access for monitoring activity and compliance.

Project Feasibility

Technical Feasibility

The Awissawella medical center currently relies on manual records and minimal digital tools such as basic computers and mobile phones. The proposed digital system is technically feasible as it leverages established web technologies (such as React, Node.js, and MySQL) that run efficiently on widely available hardware. The modular, scalable design supports easy extension as the center's requirements evolve. User interfaces are tailored for each staff role, ensuring accessibility with basic IT training. The system will incorporate secure authentication, role-based access, and regular backups to protect sensitive medical and administrative data.

Economic Feasibility

This project offers a cost-effective solution for a mid-sized medical center. Primary investments involve system development, basic hardware (if needed), and ongoing maintenance. By automating core operations like appointments, records, inventory, and billing, the system reduces manual effort, minimizes errors, and improves operational speed—providing substantial long-term savings and supporting higher quality patient care.

Legal Feasibility

There are no known legal barriers to the planned system. All patient, staff, and operational data will be stored securely, with strict access controls and compliance to applicable health data privacy standards. The system's architecture will support future integrations (e.g., national health networks or payment systems) in accordance with relevant data protection regulations.

1.8 Organization of the Report

Chapter 1:

Introductory chapter to the project, which includes objectives and the scope of project.

Chapter 2:

System Analysis describes the present system, its requirements, and the resulting analysis of those needs.

Chapter 3:

System Design includes proposed system design with full diagrams and database structures in detail.

1.9 Summary

In this chapter, the business context and procedures of the Medical center were discussed, some problems in the existing manual system were shown, and the aims and objectives for this system were outlined. Upcoming chapters will consider the analysis of the current system and the design of the new system.

Chapter 2

Outline of the Chapter

2.1. Introduction

2.2 Use Case Diagram for Existing System

2.3 Use Case Description for Existing System

2.4 Activity Diagrams for Existing System

2.5 Software Requirements Specification

- 2.5.1 Functional Requirements
- 2.5.2 Non-functional Requirements

2.6 Software Requirements Specification (BSO)

2.7 BSO Analysis and Requirements Evaluation

- 2.7.1 BSO vs Functional Requirements
- 2.7.2 BSO vs Non-Functional Requirements

2.8 Summary

2.1 Introduction

This section introduces System Analysis as the essential phase in the development lifecycle, undertaking to gain a comprehensive understanding of the current manual operations at the Sethro medical center. The chapter outlines the requirements for designing a more streamlined and automated solution and serves as a guide for transitioning from legacy practices to a proposed digital system. Through the identification of key features and evaluation of alternative approaches, this section lays the groundwork for developing an efficient, reliable, and scalable healthcare management system.

2.2 Use Case Diagram for Existing System

Figure 1-Use case diagram for existing system

2.3 Use Case Descriptions for Existing System

2.3.1Use Case Description for Booking Appointments

Use Case Id	**UC-01**
Name	Book Appointment
Actors	Patient, Receptionist
Description	The patient or receptionist schedules an appointment with a doctor by physically recording it in a logbook.
Pre-Condition	The patient needs to see a doctor. The clinic's appointment ledger and doctor's schedule are available.
Main Flow	• The patient calls or visits the clinic to request an appointment. • The receptionist checks the doctor's physical appointment ledger for available time slots. • The receptionist and patient agree on a date and time. • The receptionist manually writes the patient's name and contact details into the ledger at the agreed time slot. • The appointment is verbally confirmed to the patient
Post-Condition	• The appointment is recorded in the ledger, and the time slot is no longer available.

2.3.2 Use Case Description for Conducting Consultation

Use Case Id	**UC-02**
Name	Conduct Consultation
Actors	Doctor, Patient
Description	The doctor physically meets with the patient to discuss their health, perform an examination, and decide on a course of action.
Pre-Condition	A scheduled appointment exists. The patient is physically at the medical center. The receptionist has retrieved the patient's physical file/chart.
Main Flow	• The doctor receives the patient's physical file from the receptionist. • The doctor invites the patient into the consultation room. • The doctor discusses the patient's symptoms, reviews their past medical notes in the file, and performs a physical examination • The doctor makes new handwritten notes on a fresh page in the patient's file.
Post-Condition	The patient's physical file is updated with new notes from the consultation.

2.3.3 Use Case Diagram for Request Lab Test

Use Case Id	**UC-03**
Name	Request Lab Test
Actors	Doctor
Description	During a consultation, the doctor manually fills out a paper form to order a laboratory test for the patient.
Pre-Condition	The doctor has determined during a consultation that a lab test is necessary for diagnosis.
Main Flow	• The doctor takes a blank lab request form from a stack of papers • The doctor writes the patient's details and the specific test required on the form. • The doctor signs the form to authorize the test • The doctor hands the physical form to the patient
Post-Condition	The patient holds a signed, physical request form that can be taken to the lab.

2.3.4 Use Case Diagram for Issuing Prescription

Use Case Id	**UC-04**
Name	Issue Prescription
Actors	Doctor
Description	During a consultation, the doctor manually writes a prescription for medication on a prescription pad.
Pre-Condition	The doctor has determined during a consultation that medication is required for treatment.
Main Flow	• The doctor takes a prescription pad. • The doctor writes the patient's name, date, medication name, dosage, and instructions on the slip • The doctor signs the prescription slip • The doctor tears the slip from the pad and gives it to the patient
Post-Condition	The patient holds a valid, signed prescription slip that can be taken to a pharmacy.

2.3.5 Use Case Description for Generating Lab Report

Use Case Id	**UC-05**
Name	Generate Lab Report
Actors	Lab Assistant
Description	The lab assistant performs the requested test and manually records the findings on a physical report document.
Pre-Condition	The lab assistant has received the physical lab request form and the patient's sample for testing.
Main Flow	• The lab assistant conducts the test on the sample • The lab assistant writes the results onto a blank lab report paper • The lab assistant signs or stamps the report to certify it • The physical report is filed and a copy is given to the patient or sent to the doctor to be placed in the patient's main file
Post-Condition	A physical lab report document containing the test results is created.

2.3.6 Use Case Description for Dispensing Medicine

Use Case Id	**UC-06**
Name	Dispense Medicine
Actors	Pharmacist
Description	The pharmacist provides the patient with the correct medication based on a physical prescription slip.
Pre-Condition	The pharmacist has received a valid, physical prescription from the patient.
Main Flow	• The pharmacist reads the handwritten prescription • The pharmacist retrieves the medication from the shelves • The pharmacist packages the medication and provides verbal instructions • The pharmacist gives the medicine to the patient and keeps the prescription slip for record-keeping
Post-Condition	The patient has received their medication. The stock level of the dispensed medicine has decreased.

2.3.7 Use Case Description for Managing Inventory

Use Case Id	**UC-07**
Name	Manage Inventory
Actors	Pharmacist
Description	The pharmacist manually keeps track of medicine stock levels using a physical ledger or stock book.
Pre-Condition	A physical stock book exists for all medicines in the pharmacy.
Main Flow	• After dispensing medicine, the pharmacist finds the item in the stock book and subtracts the quantity • When new medicine stock arrives, the pharmacist finds the item and adds the quantity • The pharmacist periodically reviews the book to identify items that are low in stock and need to be reordered
Post-Condition	The stock book is updated to reflect the current physical inventory.

2.3.8 Use Case Description for Billing and Payment Handling

Use Case Id	**UC-08**
Name	Billing and Payment Handling
Actors	pharmacist
Description	The staff calculates the total cost of services and medication, creates a manual bill, and accepts cash payment.
Pre-Condition	The patient has received all services (consultation, medicine, lab tests) for their visit.
Main Flow	• The receptionist or pharmacist gathers all cost slips (consultation fee, lab fee, medicine cost). They use a calculator to find the total sum and manually write out a bill or invoice • The physical bill is given to the patient • The patient pays with cash • The staff member accepts the cash, provides change, and marks the bill as "Paid" in a cash ledger
Post-Condition	The patient has paid their bill. The clinic's cash ledger is updated with the received payment.

2.4 Activity Diagrams for Existing System

2.4.1 Activity diagram for Booking

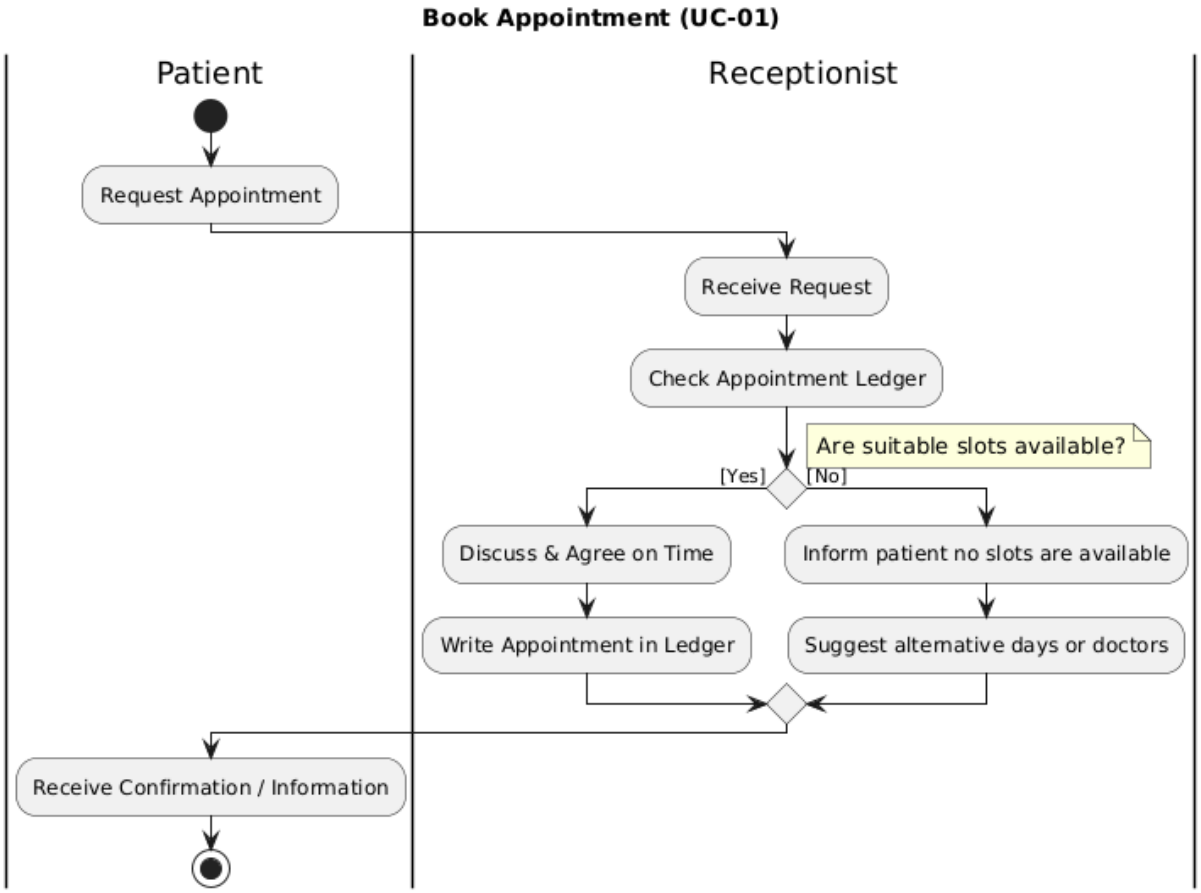


Figure 2 - activity diagram for booking

2.4.2 Activity diagram for conducting consultations

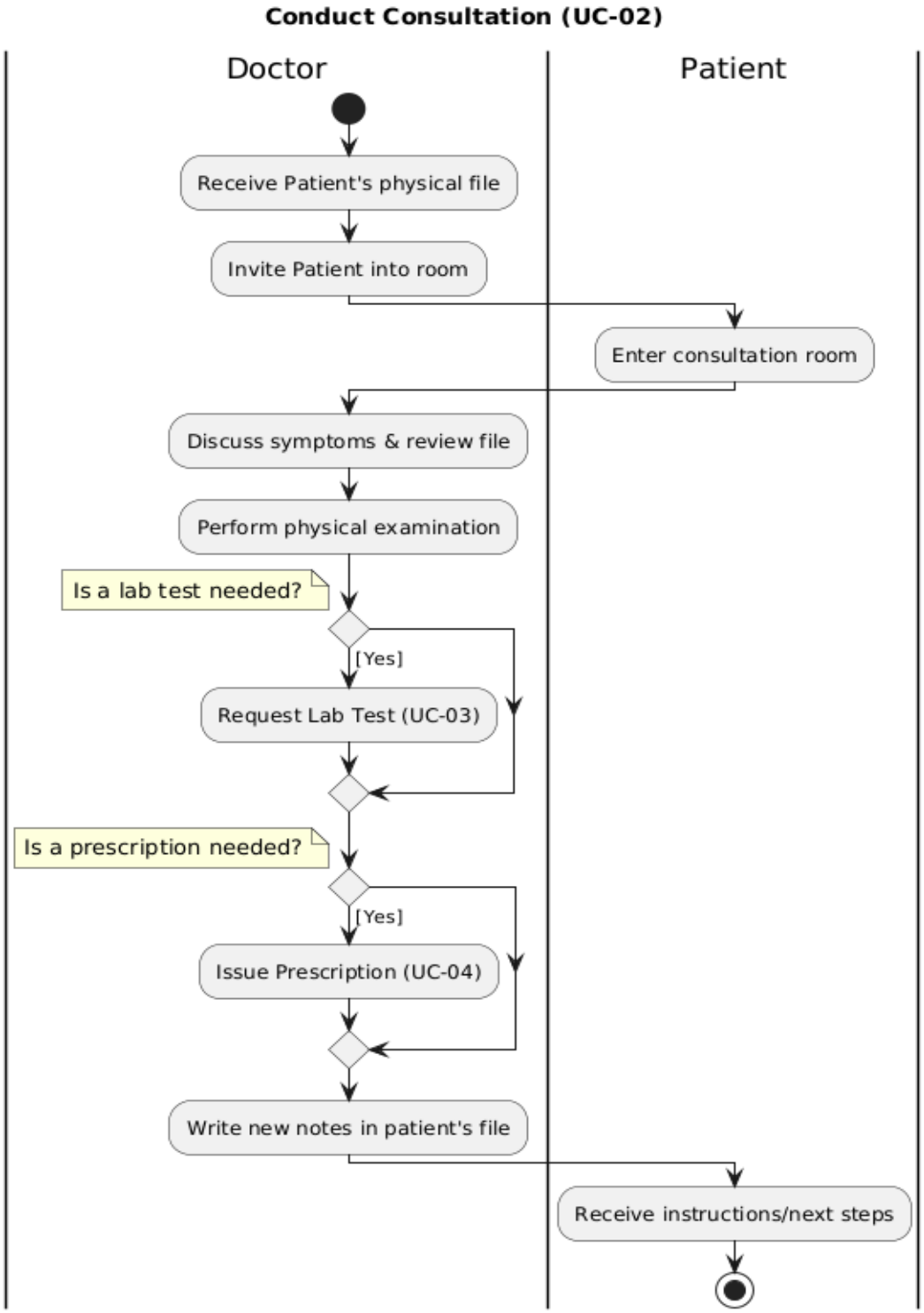


Figure 3 - activity diagram for consultation

2.4.3 Activity diagram for requesting lab reports

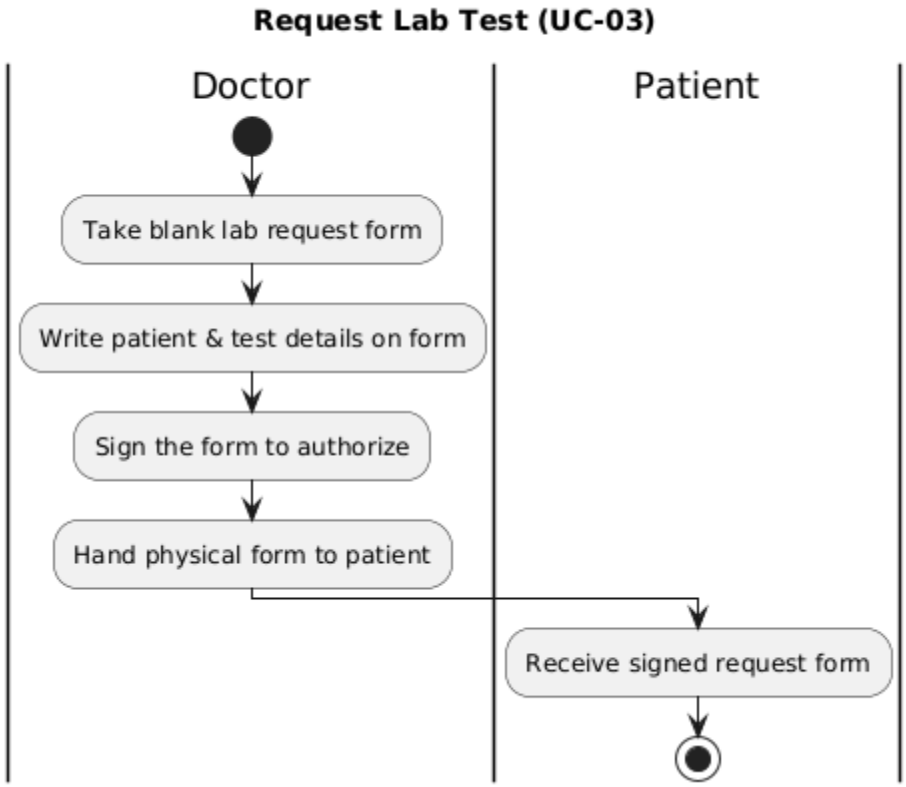


Figure 4 - activity diagram for requesting lab reports

2.4.4 Activity diagram for issuing prescriptions

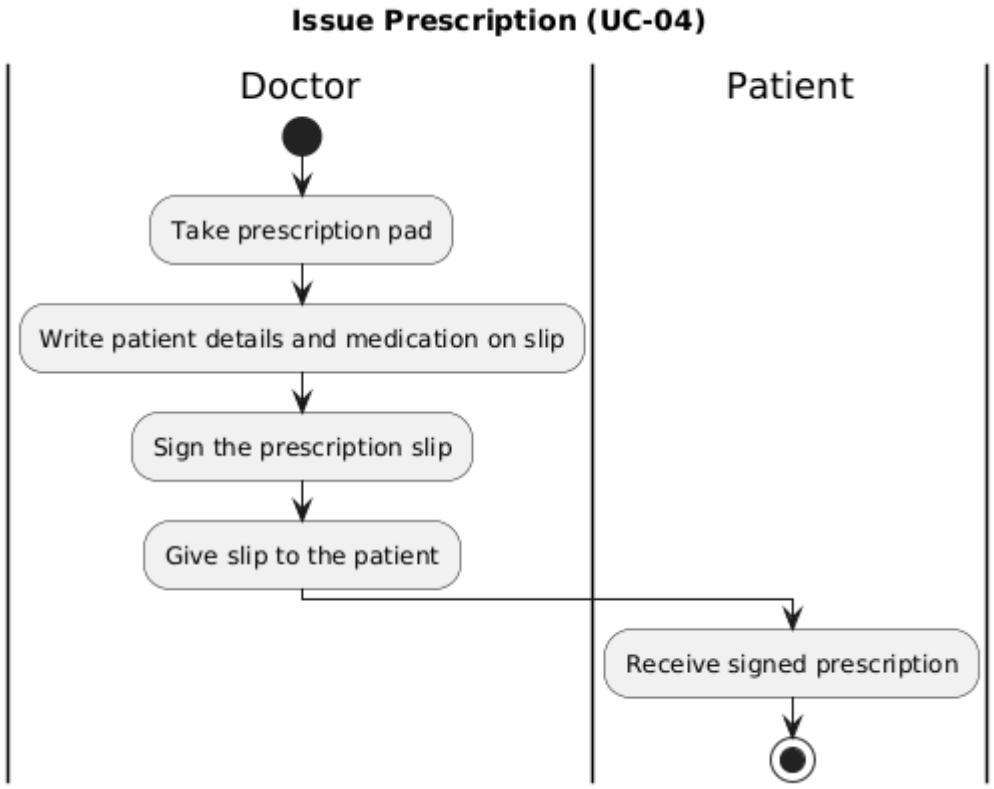


Figure 5 - activity diagram for issuing prescriptions

2.4.5 Activity diagram for generating reports

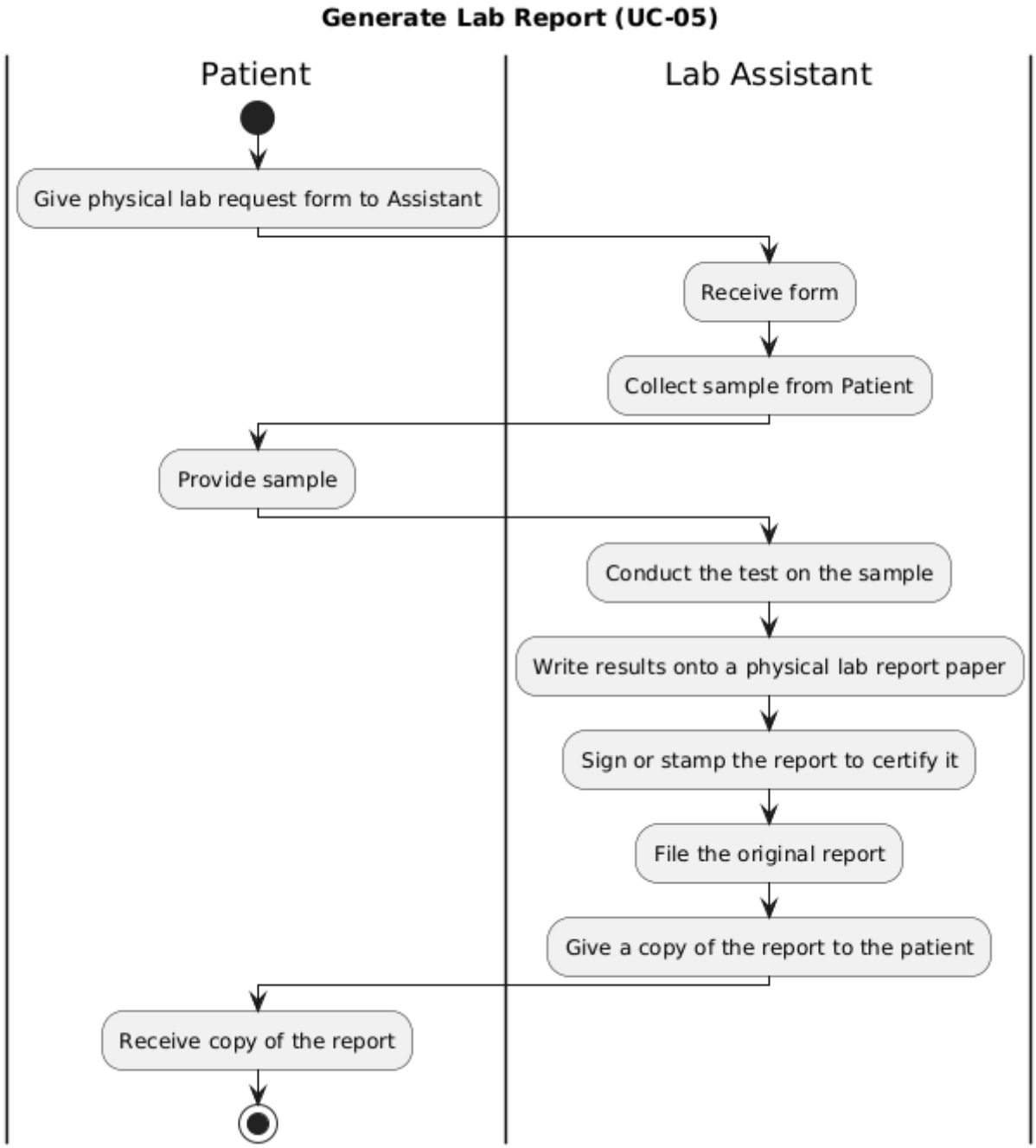


Figure 6 - activity diagram for generating reports

2.4.6 Activity diagram for dispensing medicine

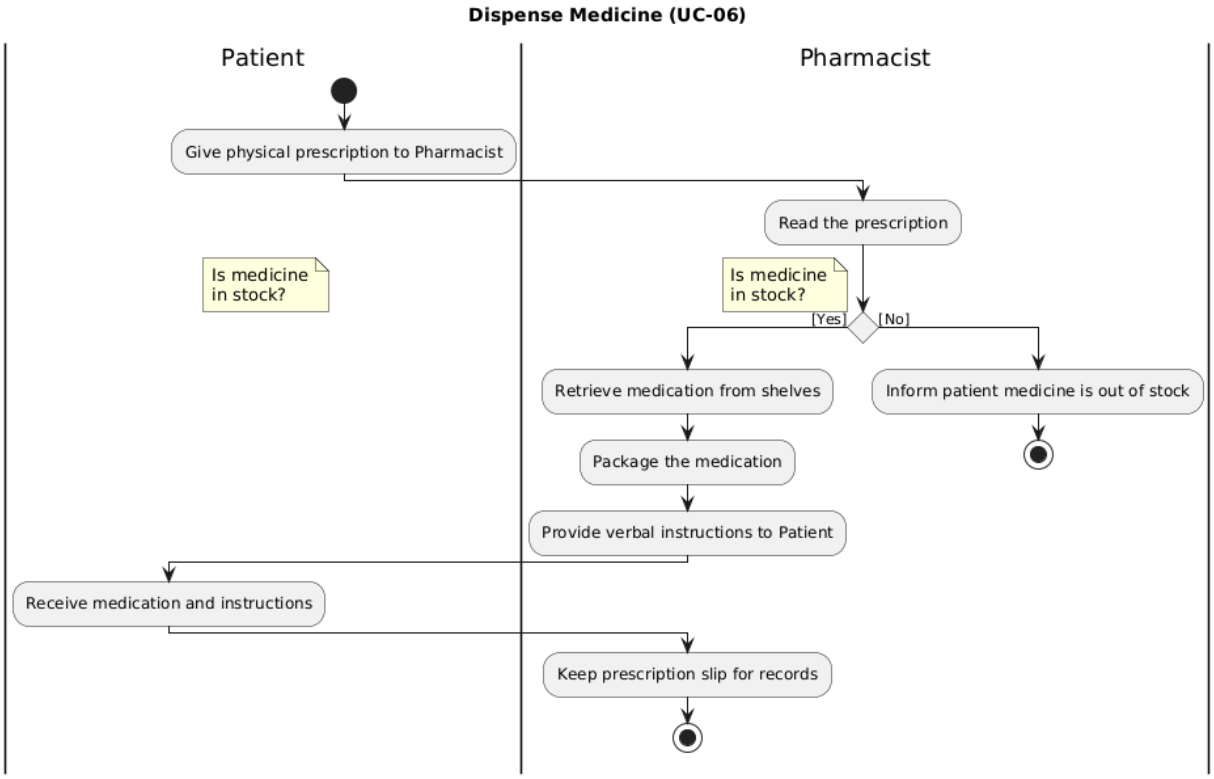


Figure 7 -activity diagram for dispensing medicine

2.4.7 Activity diagram for managing inventory

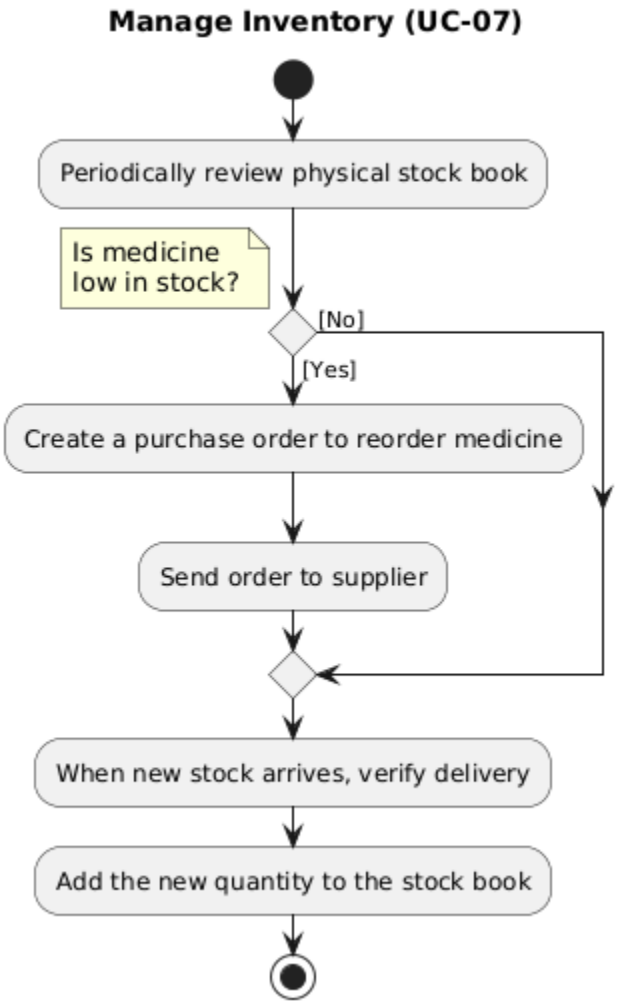


Figure 8 -activity diagram for managing inventory

2.4.8 Activity diagram for billing and payment handling

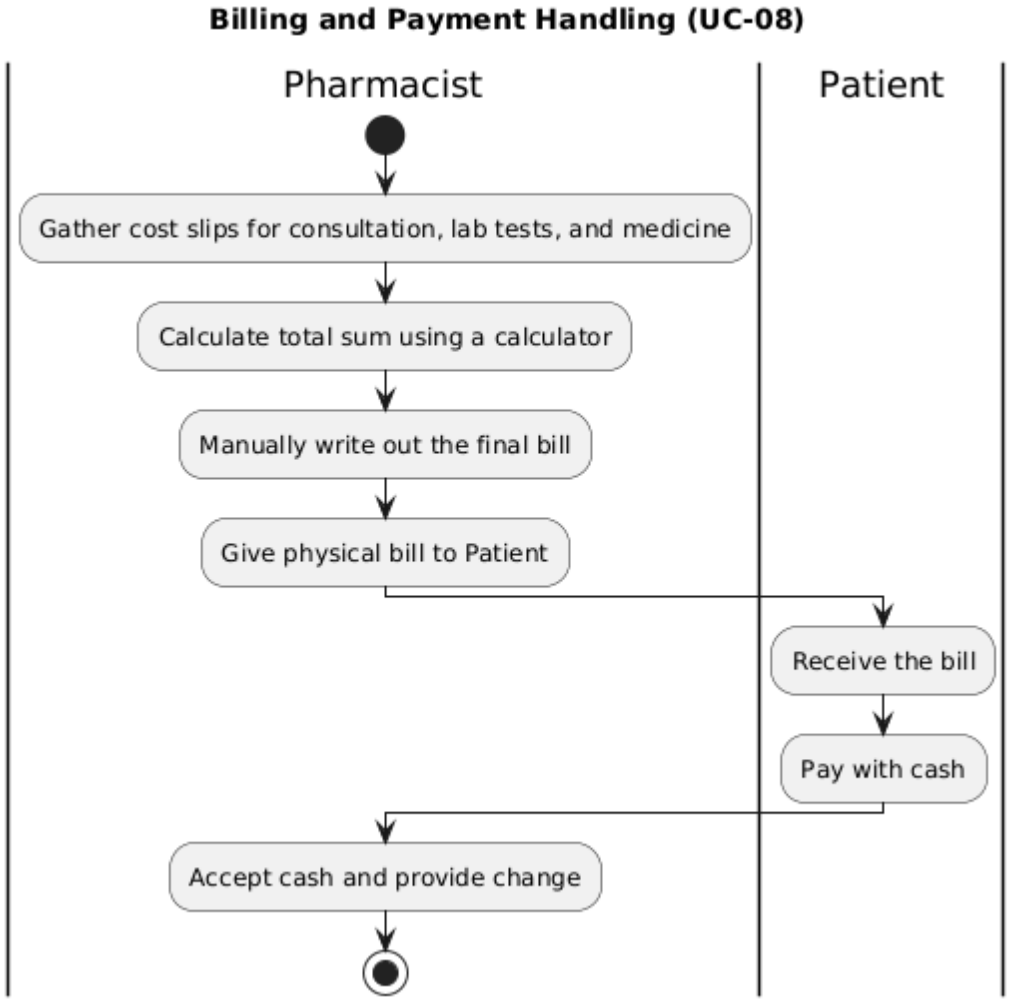


Figure 9 - activity diagram for billing and payment handling

2.5 Software Requirements Specification

This section introduces the Requirements Specification that collates the functional and non functional requirements from the user stories and use cases. The catalogue provides a checklist of the new system's specifications in terms of the basic capabilities the system must deliver, the performance and usability it needs to meet.

2.5.1 Functional Requirements

ID	Requirement
Patient Module	
PAT-FR-01	The system shall support secure registration, login, and logout.
PAT-FR-02	The system shall allow patients to switch between multiple linked patient profiles in one login session.
PAT-FR-03	The system shall display complete medical history with entries tagged by appointment date. It shall support search and filter by date.
PAT-FR-04	The system shall allow patients to download lab reports and prescriptions only in PDF format.
PAT-FR-05	The system shall allow patients to book appointments prior to appointment time.
PAT-FR-06	The system should implement password recovery via email.
PAT-FR-07	The AI chatbot should support appointment queries in Sinhala, Tamil, and English.
PAT-FR-08	The system should deliver notifications for lab reports, doctor

	arrival, and queue status via push, WhatsApp, and SMS.
PAT-FR-09	The system shall allow patients to view past appointment details within medical profiles.
Doctor Module	
DOC-FR-01	The system shall provide secure login and a personalized dashboard with daily appointments in list format.
DOC-FR-02	The system shall allow doctors to search patients by name and mobile number.
DOC-FR-03	The system shall provide access to full medical profiles including tagged entries (diseases, symptoms, prescriptions, lab tests).
DOC-FR-04	The system shall allow doctors to create prescriptions with manually entered medicine text.
DOC-FR-05	The system shall allow doctors to order lab tests linked to patient profiles.
DOC-FR-06	System shall allow the doctors to manage their available time
Pharmacist Module	
PHR-FR-01	The system shall allow secure login and provide a dashboard with a queue of pending prescriptions.
PHR-FR-02	The system shall provide a real-time view of the medicine inventory, with indicators for low-stock and out-of-stock items.

PHR-FR-03	The system shall allow pharmacists to add new medicine types to the database.
PHR-FR-04	The system shall allow pharmacists to update stock quantities to reflect new deliveries (restocking).
PHR-FR-05	The system shall allow pharmacists to process and dispense prescriptions, which shall automatically update inventory levels.
PHR-FR-06	The system should support the creation of purchase orders to reorder medicines.
PHR-FR-07	The system shall calculate a final invoice for patients, consolidating costs for appointments, lab tests, and medicines.
Receptionist Module	
REC-FR-01	The system shall allow secure login and access to a digital appointment calendar.
REC-FR-02	The system shall allow patient registration without mandatory document uploads.
REC-FR-03	The system shall allow scheduling, and cancellation of appointments. Patients shall receive notifications.
REC-FR-04	The system shall allow manual override of patient queue with logging and audit trails.
Lab Assistant Module	
LAB-FR-01	The system shall provide secure login and a dashboard displaying a list of all pending lab test requests.

LAB-FR-02	The system shall allow lab assistants to upload lab reports in PDF format and link them to the correct patient and test request.
Admin Module	
ADMIN-FR-01	The system shall allow admins to add, modify, and deactivate users and assign roles without approval.
ADMIN-FR-02	The system shall provide audit logs restricted to admin users.

2.5.2 Non-Functional Requirements

ID	Requirement
NFR-01	Security: The system shall enforce role-based access, secure password recovery, and encrypted storage/transmission.
NFR-02	Performance: The system shall support ≥20 concurrent users and respond within 4 seconds under normal load.
NFR-03	Usability: The system shall provide bilingual interfaces and responsive design.
NFR-04	Reliability: The system shall maintain ≥99% uptime and routine data integrity checks.
NFR-05	Maintainability: The system should use a modular codebase to support upgrades.
NFR-06	Scalability: The architecture shall support user and feature growth post-MVP.

ID	Requirement
NFR-07	Backup & Recovery: Manual backups shall be performed by IT staff; automated backups should be considered in future.

2.6 Business System Option (BSO)

The options specify a set of alternative solutions to develop the system, with different functional scopes and technological features. Each option is matched against the provision of the functionality looked by the users, meeting the business objectives, and facilitating or enhancing operational efficiency.

2.6.1 BSO 1: Off-the-Shelf Clinic Management Software

Description:
Deploy commercially available clinic management software that provides standard modules for patient management, appointments, billing, inventory tracking, prescription management, reporting, and basic security controls. Limited customization is possible.

Advantages:

- Rapid deployment and proven reliability
- Vendor support, maintenance, and regular feature updates
- Lower technical risk, basic training required for staff

Challenges:

- Feature set and workflows may not fully align with local needs
- Ongoing licensing and support costs
- Limited flexibility for future enhancements or integrations

BSO 01 Cost overview

Item	Cost (LKR)	Notes
License Fee	80,000	Annual recurring
Initial Setup	10,000	One-time
Training	10,000	Vendor training
Total Initial Cost	**100,000**	

2.6.2 BSO 2: Custom-Built Web Application (Recommended)

Description:
Develop a secure, scalable web application customized to the workflows of the Sethro medical center. The system covers patient and staff management, appointments, billing, inventory, lab reports, prescriptions, notifications, advanced reporting, and local language support.

Advantages:

- Tailored functionality to the center's requirements
- Flexible modular design for future expansion
- Integration of AI chatbot and multilingual support

Challenges:

- Longer development lead time
- Requires project management and local IT resources
- Ongoing maintenance to accommodate evolving needs

Cost overview of BSO 02

Item	**Cost (LKR)**	**Notes**
Software Development	100,000	Student developer rate
Hosting Setup	10,000	Annual charges
Domain Registration	5,000	One-time
AI Integration	50,000	One-time setup
Training	15,000	In-house workshops
Total Initial Cost	**180,000**	

2.6.3 BSO 3 Advanced High-Cost Enterprise Solution

Description:
Purchase and implement an enterprise-level hospital/clinic management system (e.g., established medical software suite) with comprehensive modules, analytics, API integrations, cloud hosting, AI-powered workflow and reporting, with dedicated vendor onboarding and premium support.

Advantages:

- Best-in-class security, reliability, and compliance
- Includes advanced analytics and multi-site support
- Professional vendor implementation and support

Challenges:

- High initial and ongoing costs
- May offer more features than required
- Vendor lock-in and complex data migration

Cost overview of BSO 3

Item	**Cost (LKR)**	**Notes**
License & Setup	350,000	One-time setup
Premium Support	100,000	Annual recurring
Training & Migration	30,000	Comprehensive support
Total Initial Cost	**480,000**	
Annual Cost	**100,000**	Continued support

2.7 BSO Analysis and Requirements Evaluation

This section examines the functional and non-functional requirements for their suitableness to meet the needs and objectives of the project. From this review, it can be found out that each requirement is appropriate to satisfy users' expectations, the functionality of the system, and standards of performance for the selected BSO to reach the intended outcomes.

2.7.1 BSO vs Functional Requirements

ID	Requirement	BSO 1	BSO 2	BSO 3
PAT-FR-01	Secure registration, login, logout	✓	✓	✓
PAT-FR-02	Multi-profile handling	Limited	✓	✓
PAT-FR-03	Medical history with search/filter	Limited	✓	✓
PAT-FR-04	Download lab reports/prescriptions in PDF	✓	✓	✓
PAT-FR-05	Book appointments in advance	✓	✓	✓
PAT-FR-06	Password recovery via email	Limited	✓	✓
PAT-FR-07	AI chatbot (Sinhala/Tamil/English)	✗	✓	✓
PAT-FR-08	Notifications (push/WhatsApp/SMS)	Limited	✓	✓
PAT-FR-09	View past appointment details	Limited	✓	✓
DOC-FR-01	Secure login/dashboard for doctors	✓	✓	✓

ID	Requirement	BSO 1	BSO 2	BSO 3
DOC-FR-02	Patient search (name/mobile)	Limited	✓	✓
DOC-FR-03	Access full medical profiles (diseases, symptoms, etc.)	Limited	✓	✓
DOC-FR-04	Create prescription (manual entry)	✓	✓	✓
DOC-FR-05	Order lab tests linked to profiles	Limited	✓	✓
DOC-FR-06	Manage doctor schedule	Limited	✓	✓
PHR-FR-01	Secure login & queue of pending prescriptions	✓	✓	✓
PHR-FR-02	Real-time medicine inventory view	Limited	✓	✓
PHR-FR-03	Add new medicines	Limited	✓	✓
PHR-FR-04	Update stock quantities/restock	Limited	✓	✓
PHR-FR-05	Dispense medicines/update inventory	Limited	✓	✓
PHR-FR-06	Create purchase orders	Limited	✓	✓
PHR-FR-07	Calculate/combine invoices (visit, tests, meds)	Limited	✓	✓
REC-FR-01	Secure login/appointment calendar	✓	✓	✓
REC-FR-02	Patient registration (no docs required)	Limited	✓	✓
REC-FR-03	Appointment scheduling/cancellation w/	Limited	✓	✓

ID	Requirement	BSO 1	BSO 2	BSO 3
	notifications			
REC-FR-04	Manual queue override with audit logs	Limited	✓	✓
LAB-FR-01	Secure login/pending lab test dashboard	✓	✓	✓
LAB-FR-02	Upload PDF reports/link to patient & request	Limited	✓	✓
ADMIN-FR-01	Add, modify, deactivate users/roles	Limited	✓	✓
ADMIN-FR-02	Audit logs restricted to admins	Limited	✓	✓

2.7.2 BSO vs Non-Functional Requirements

ID	Requirement	BSO 1	BSO 2	BSO 3
NFR-01	Security: Role-based access, encryption, password recovery	✓	✓	✓
NFR-02	Performance: ≥20 concurrent users, <4s response	Limited	✓	✓
NFR-03	Usability: Bilingual interfaces, responsive design	Limited	✓	✓
NFR-04	Reliability: ≥99% uptime, data integrity checks	Limited	✓	✓
NFR-05	Maintainability: Modular codebase, upgrade support	✗	✓	✓
NFR-06	Scalability: Growth post-MVP	Limited	✓	✓
NFR-07	Backup & Recovery: Manual or automated backups	Manual	Automated	Automated

2.8 Selected BSO with Justification

We can recommend the Custom-Built Web Application (BSO 2) as the most suitable solution for digitizing the operations of the Sethro medical center. This option achieves the ideal balance between tailored functionality, operational efficiency, and future scalability. BSO 2 is chosen because it adapts to the center's unique workflows—enabling secure patient and staff management, automated appointment scheduling, inventory control, streamlined billing, and integrated lab reporting, all with multilingual support and notification features.

By building the system in-house, the medical center ensures flexibility to meet evolving requirements without the limitations posed by off-the-shelf software or the excessive cost and complexity of enterprise solutions. The modular architecture allows for straightforward upgrades as patient volume and operational demands grow. Built-in automation—such as report generation, inventory alerts, and digital notifications—reduces manual workload and minimizes errors, improving quality and consistency of care. This solution aligns with the center's goals for cost-effective modernization, practical training needs, and long-term sustainability.

2.9 Summary

The system analysis discussion summarizes the major findings, limitations of the present system, definition of requirements, and justification for the selected BSO. It emphasizes the worthiness for moving to the automated system: greater efficiency and accuracy, higher scalability, and sets the stage for the design phase.

Chapter 03

Outline of the Chapter

3.1 Introduction

3.2 User Stories

3.3 Use Case Diagram for Proposed System

3.4 Use Case Description for Proposed System

3.5 Activity Diagrams for Proposed System

3.6 Class Diagram for Proposed System

- 3.6.1 Entity Class Diagram
- 3.6.2 Interface Class Diagram
- 3.6.3 Controller Class Diagram

3.7 Sequence Diagrams for Proposed System

3.8 ER Diagram for Proposed System

3.9 Relational Data Model for Proposed System

3.10 User Interfaces design for Proposed System

3.11 Summary

3.1 Introduction

The chapter will cover the detailed design for the Sethro medical center system based on the selected BSO (BSO 2). All these sections are supported by diagrams and models, which describe the key architecture, procedures, data flows, and user interfaces of the system. The various design elements will coordinate with one another in order to ensure the functioning of the system's stated functional requirements: order management, inventory, and customer interaction; and non-functional requirements such as usability, security, and scalability.

3.2 User Stories

Patient

Id	User Story
US-PAT 01	**As a patient,** I want to book an appointment by selecting a doctor, date, and time **so that** I can get medical care conveniently.
US-PAT 02	**As a patient,** I want to view all my upcoming and past appointments **so that** I can manage my schedule and review my visit history.
US-PAT 03	**As a patient,** I want to check my lab reports **so that** I can understand my health status and review my results.
US-PAT 04	**As a patient,** I want to check my invoices **so that** I can review my billing history and track payments.
US-PAT 05	**As a patient,** I want to see all my prescriptions **so that** I can track my medication and request refills.
US-PAT 06	**As a patient,** I want to access the accounts of my family members **so that** I can manage their healthcare on their behalf.

Doctor

Id	User Story
US-DOC 01	**As a doctor,** I want to check my revenue (daily, monthly, annual) **so that** I can track my financial performance.
US-DOC 02	**As a doctor,** I want to check my average number of appointments (daily, monthly, annual) **so that** I can analyze my workload and patient flow.
US-DOC 03	**As a doctor,** I want to access a patient's complete medical data (prescriptions, lab tests, notes) **so that** I can make informed diagnoses and treatment decisions.
US-DOC 04	**As a doctor,** I want to check a patient's family members' profiles **so that** I can understand potential hereditary conditions or family medical history.
US-DOC 05	**As a doctor,** I want to add clinical notes about a patient **so that** other doctors can have context for continuity of care.
US-DOC 06	**As a doctor,** I want to recommend lab tests for a patient **so that** I can gather diagnostic information.
US-DOC 07	**As a doctor,** I want to issue new prescriptions for a patient **so that** they can receive the necessary medication.

Pharmacist

Id	User Story
US-PHR 01	**As a pharmacist,** I want to see the current inventory of all medicines **so that** I can manage stock and know what is available.
US-PHR 02	**As a pharmacist,** I want to reorder medicines **so that** I can maintain adequate stock levels and prevent shortages.
US-PHR 03	**As a pharmacist,** I want to add new medicines to the system **so that** the inventory database is comprehensive and up-to-date.
US-PHR 04	**As a pharmacist,** I want to update the inventory count when restocking **so that** the system reflects the actual stock on hand.
US-PHR 05	**As a pharmacist,** I want to see all pending prescription requests **so that** I can prepare and dispense them efficiently.
US-PHR 06	**As a pharmacist,** I want to mark a prescription as 'dispensed' **so that** the patient's record is updated and the inventory is reduced.
US-PHR 07	**As a pharmacist,** I want to remove a medicine from a prescription at the patient's request **so that** the order is accurate before dispensing.
US-PHR 08	**As a pharmacist,** I want to easily identify medicines that are out of stock **so that** I can inform the patient and reorder promptly.

US-PHR 09	**As a pharmacist,** I want to see the full price of dispensed medicine **so that** I can process the payment and inform the patient.
US-PHR 10	**As a pharmacist,** I want to see the total cost for a patient's visit (lab test, appointment, medicine) **so that** I can process a consolidated payment.

Receptionist

Id	**User Story**
US-REC 01	**As a receptionist,** I want to view all appointments (today, week, month) **so that** I can manage the schedule and anticipate patient flow.
US-REC 02	**As a receptionist,** I want to register a new patient **so that** their information is in the system for booking and billing.
US-REC 03	**As a receptionist,** I want to book a new appointment for a patient **so that** I can assist them with scheduling over the phone or in person.
US-REC 04	**As a receptionist,** I want to cancel an appointment **so that** the doctor's schedule is updated and the slot becomes available.
US-REC 05	**As a receptionist,** I want to mark a patient as 'arrived' or 'checked-in' **so that** the doctor and medical staff know the patient is ready.

Lab Assistant

Id	User Story
US-LAB 01	**As a lab assistant,** I want to see all pending lab test requests **so that** I can prioritize and process the required tests in an orderly fashion.
US-LAB 02	**As a lab assistant,** I want to upload lab reports to the correct request **so that** the patient and doctor can access the results securely.

Admin

Id	User Story
US-ADM 01	**As an admin,** I want to view all users in the system **so that** I can manage accounts and user permissions.
US-ADM 02	**As an admin,** I want to add new staff members to the system **so that** they can be given access and assigned to their proper roles.
US-ADM 03	**As an admin,** I want to view the system log sheet **so that** I can monitor system activity and troubleshoot issues.

3.3 Use Case Diagram for Proposed System

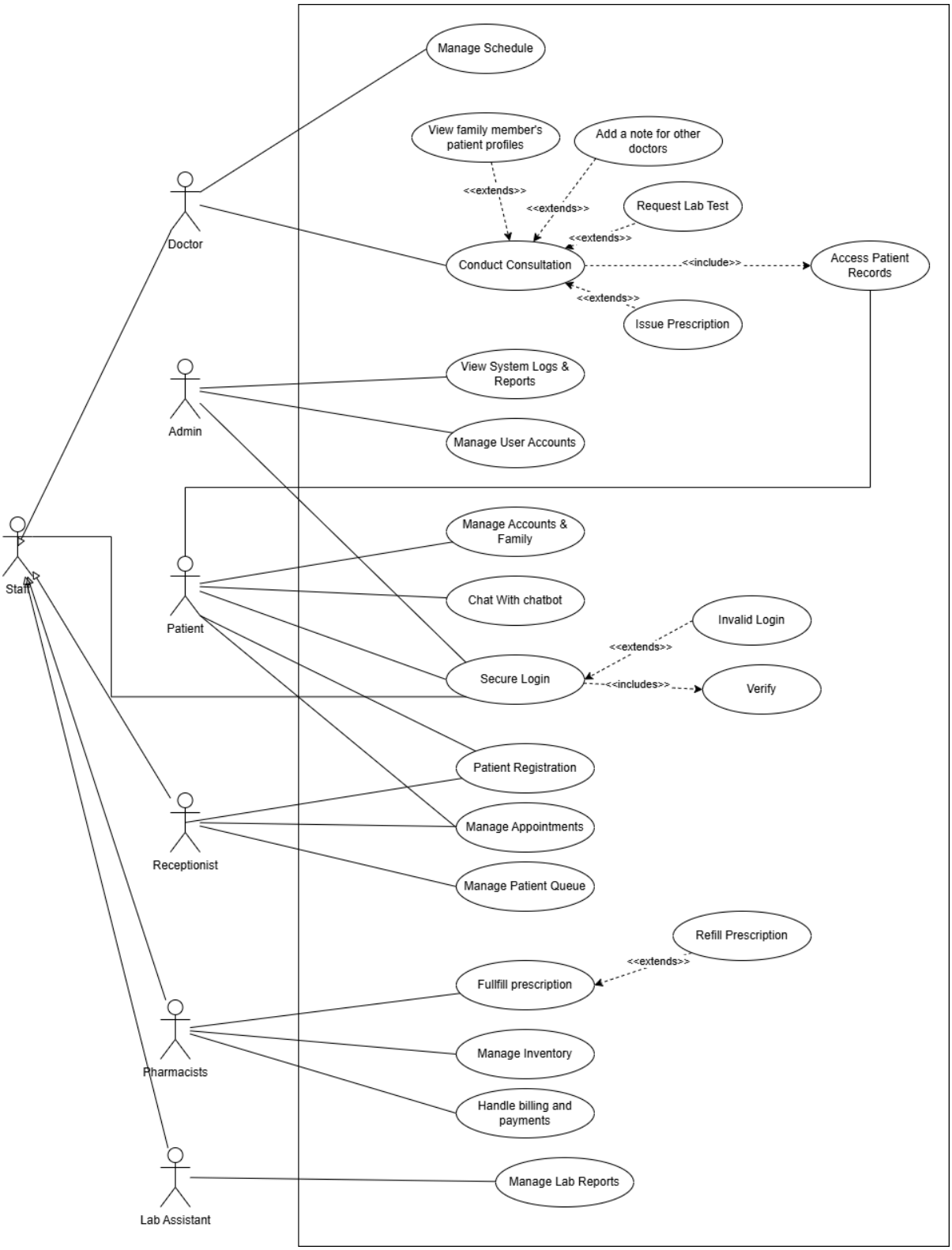


Figure 10 - use case diagram for proposed system

3.4 Use Case Description for Proposed System

3.4.1 Use Case Description for Login

Field	Details
Use Case Id	FND-01
Title	Secure Login
Actors	Patient, Staff (all roles), Admin
Description	Allows a registered user to gain secure access to the system.
Pre-Condition	The user must have a valid, active account.
Main Flow	- The user navigates to the login page. - The user enters their credentials. - The system includes use case FND-03 Verify Credentials. - Upon success, the system grants access and displays the user's role-specific dashboard.
Alternative Flow	- If verification fails, the system extends to use case FND-04 Handle Invalid Login.
Post-Condition	The user has a secure, active session in the system.

Field	Details
Use Case Id	FND-02
Title	Access Patient Records
Actors	Patient, Staff (all medical roles)
Description	Allows an authorized user to view a patient's complete medical history.
Pre-Condition	The user must be logged in and have the necessary permissions.
Main Flow	- The user selects or searches for a patient profile. - The system retrieves and displays the patient's medical history (appointments, prescriptions, labs, notes). - The system provides search and filter capabilities.
Post-Condition	The user has viewed the patient's information. System logs the access for audit.

Field	Details
Use Case Id	FND-03
Title	Verify Credentials
Actors	System
Description	(Included by FND-01) Verifies the user's provided credentials against the system's database.
Pre-Condition	The user has submitted their username and password.
Main Flow	- The system receives the credentials. - The system securely compares the provided credentials with the stored user data. - The system returns a "success" or "failure" status.
Post-Condition	The user's credentials have been validated.

Field	Details
Use Case Id	FND-04
Title	Handle Invalid Login
Actors	System
Description	(Extends FND-01) Manages the scenario where credential verification fails.
Pre-Condition	Use case FND-03 has returned a "failure" status.
Main Flow	- The system displays "Invalid username or password" error message. - The system increments a failed login attempt counter for the user account. - If the counter exceeds a defined threshold, the system temporarily locks the account and provides instructions for recovery.
Post-Condition	The user is notified of the login failure. The account may be locked.

Field	Details
Use Case Id	PP-01
Title	Manage Account & Family
Actors	Patient
Description	Allows a patient to manage their profile and link/manage the profiles of family members.
Pre-Condition	The user (patient) must be logged in.
Main Flow	- The patient navigates to their account settings. - The patient can update their personal information. - The patient selects an option to link a family member's account. - The system allows the patient to switch between their profile and linked family member profiles.
Post-Condition	The patient's profile information is updated, or family member accounts are linked.

Field	Details
Use Case Id	PP-02
Title	Use AI Chatbot
Actors	Patient
Description	Allows a patient to get answers to common queries about appointments using an AI chatbot.
Pre-Condition	The patient is on the clinic's website or application.
Main Flow	- The patient opens the chatbot interface. - The patient types a query in Sinhala, Tamil, or English regarding appointments. - The chatbot processes the query and provides a relevant, pre-programmed answer.
Post-Condition	The patient receives an answer to their query.

Field	Details
Use Case Id	FDS-01
Title	Manage Patient Registration
Actors	Patient, Receptionist
Description	Allows for the creation of a new patient profile in the system.
Pre-Condition	The patient is not already registered in the system.
Main Flow	- The user initiates the registration process. - The system displays a form for personal details. - The user submits the form. - The system creates a new patient record and confirms successful registration.
Post-Condition	A new patient profile is created and stored in the system.

Field	Details
Use Case Id	FDS-02
Title	Manage Appointments
Actors	Patient, Receptionist
Description	Allows patients and receptionists to book, view, cancel, or reschedule appointments.
Pre-Condition	The user must be logged in. For a new patient, the system includes FDS-01 Manage Patient Registration.
Main Flow	- User selects a doctor and views their available schedule. - User selects a desired time slot. - The system confirms the booking, updates the schedule, and sends a notification.
Post-Condition	The doctor's schedule is updated, and the patient's appointment list reflects the changes.

Field	Details
Use Case Id	CW-01
Title	Conduct Consultation
Actors	Doctor
Description	Facilitates the doctor's interaction with a patient during a consultation.
Pre-Condition	The doctor is logged in. The patient has an active appointment.
Main Flow	- Doctor selects the patient from their dashboard. - The system includes FND-02 Access Patient Records. - The doctor consults with the patient while reviewing their digital file.
Optional Flows	- The doctor may extend this use case with CW-03 Add Clinical Note, CW-04 Issue Prescription, CW-05 Request Lab Test, or CW-06 View Family Profile.
Post-Condition	The patient's record is updated with any new information from the consultation.

Field	Details
Use Case Id	CW-02
Title	Manage Schedule
Actors	Doctor
Description	Allows a doctor to manage their availability for patient appointments.
Pre-Condition	The doctor is logged in.
Main Flow	- The doctor navigates to their schedule management page. - The doctor can block out specific time slots or days as unavailable. - The doctor can define or modify their standard working hours.
Post-Condition	The doctor's availability is updated across the system.

Field	Details
Use Case Id	CW-03
Title	Add Clinical Note
Actors	Doctor
Description	(Extends CW-01) Allows a doctor to add new, timestamped clinical notes to a patient's record.
Pre-Condition	The doctor is in an active consultation (CW-01).
Main Flow	- The doctor selects the option to add a new note. - A text editor is displayed. - The doctor types the notes and saves them.
Post-Condition	A new, permanent note is added to the patient's medical history.

Field	Details
Use Case Id	CW-04
Title	Issue Prescription
Actors	Doctor
Description	(Extends CW-01) Allows a doctor to create a new digital prescription.
Pre-Condition	The doctor is in an active consultation (CW-01).
Main Flow	- The doctor selects the option to create a prescription. - The system displays a prescription form. - The doctor enters the medicine details and dosage instructions. - The doctor digitally signs and saves the prescription.
Post-Condition	A new digital prescription is created and sent to the pharmacy queue.

Field	Details
Use Case Id	CW-05
Title	Request Lab Test
Actors	Doctor
Description	(Extends CW-01) Allows a doctor to create a new digital lab test order.
Pre-Condition	The doctor is in an active consultation (CW-01).
Main Flow	- The doctor selects the option to order a lab test. - The system displays a list of available tests. - The doctor selects the required test(s) and saves the order.
Post-Condition	A new lab test request is created and sent to the laboratory queue.

Field	Details
Use Case Id	CW-06
Title	View Family Profile
Actors	Doctor
Description	(Extends CW-01) Allows a doctor to view the profiles of a patient's linked family members.
Pre-Condition	The doctor is in an active consultation (CW-01). The patient has linked family accounts.
Main Flow	- The doctor selects the option to view family members. - The system displays a list of linked profiles. - The doctor can select a profile to view their medical history.
Post-Condition	The doctor has viewed the family member's medical information.

Field	Details
Use Case Id	PM-01
Title	Fulfill Prescription
Actors	Pharmacist
Description	Allows the pharmacist to view and dispense medication against a digital prescription.
Pre-Condition	The pharmacist is logged in. A valid, unfulfilled digital prescription exists.
Main Flow	- The pharmacist views the queue of pending prescriptions. - The pharmacist selects and reviews a prescription. - The pharmacist dispenses the medication and marks the prescription as fulfilled. - This use case includes an automatic update to the inventory.
Post-Condition	The prescription is fulfilled, and the stock count is reduced.

Field	Details
Use Case Id	PM-02
Title	Manage Inventory
Actors	Pharmacist
Description	Allows the pharmacist to manage medicine stock, add new medicines, and reorder supplies.
Pre-Condition	The pharmacist is logged in.
Main Flow	- The pharmacist views the inventory dashboard with stock indicators. - The pharmacist can add a new medicine type. - The pharmacist can update stock quantities to reflect new deliveries. - The pharmacist can generate a purchase order for reordering.
Post-Condition	The medicine database and stock levels are updated.

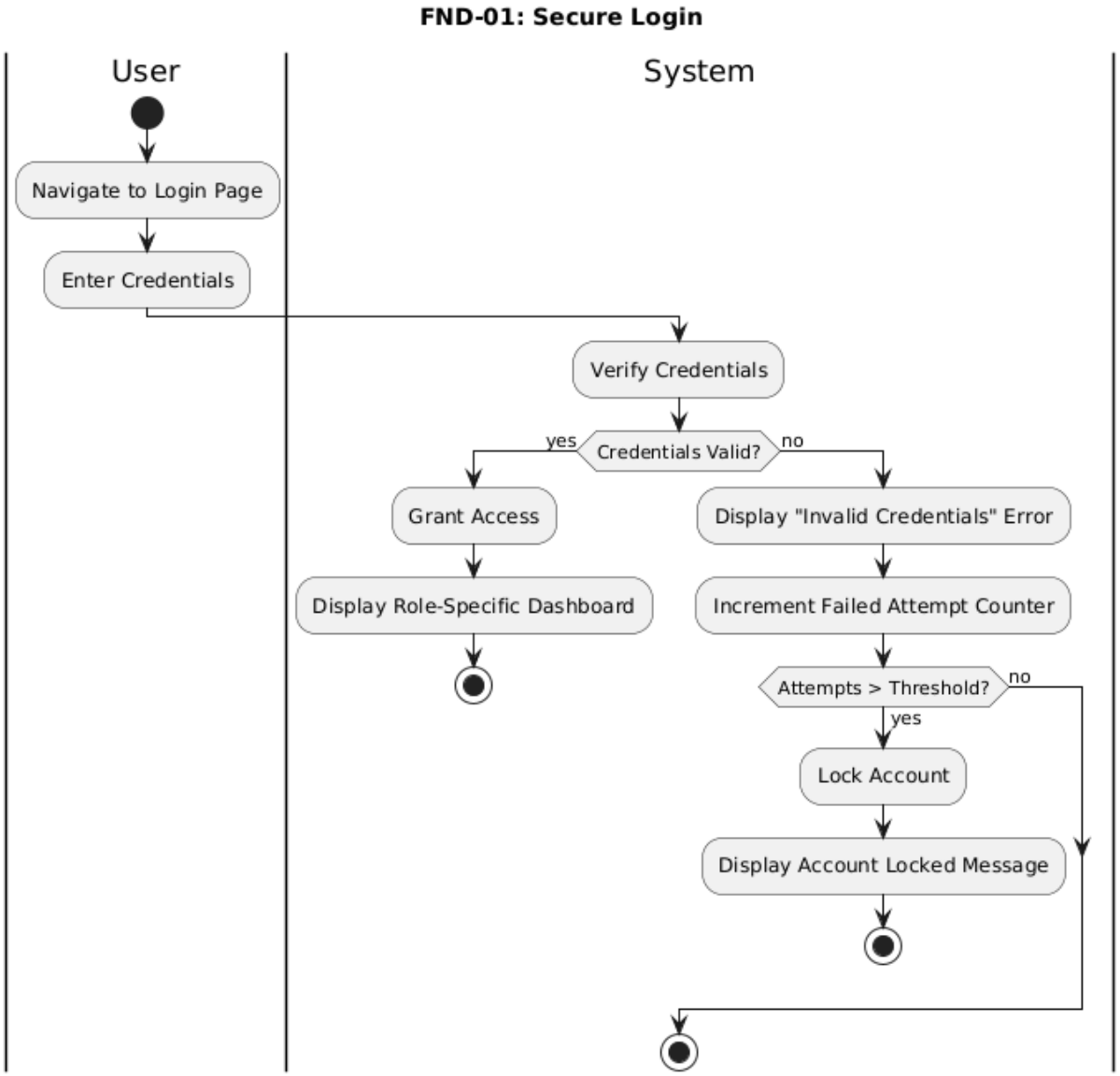
Field	Details
Use Case Id	PM-03
Title	Handle Billing & Invoicing
Actors	Pharmacist
Description	Allows the pharmacist to generate a consolidated invoice for a patient's visit.
Pre-Condition	The patient has completed their visit and is ready for payment.
Main Flow	- The pharmacist selects the patient's profile. - The system retrieves all billable items for the visit. - The system generates a final invoice. - The pharmacist confirms payment and completes the transaction.
Post-Condition	An invoice is generated, and the transaction is recorded as paid.

Field	Details
Use Case Id	LM-01
Title	Manage Lab Reports
Actors	Lab Assistant
Description	Allows the lab assistant to view pending test requests and upload reports.
Pre-Condition	The lab assistant is logged in.
Main Flow	- The lab assistant views a list of pending lab requests. - After performing a test, the assistant selects the corresponding request. - The assistant uploads the digital lab report (PDF). - The system links the report to the patient's file and sends a notification.
Post-Condition	The lab report is securely attached to the patient's medical record.

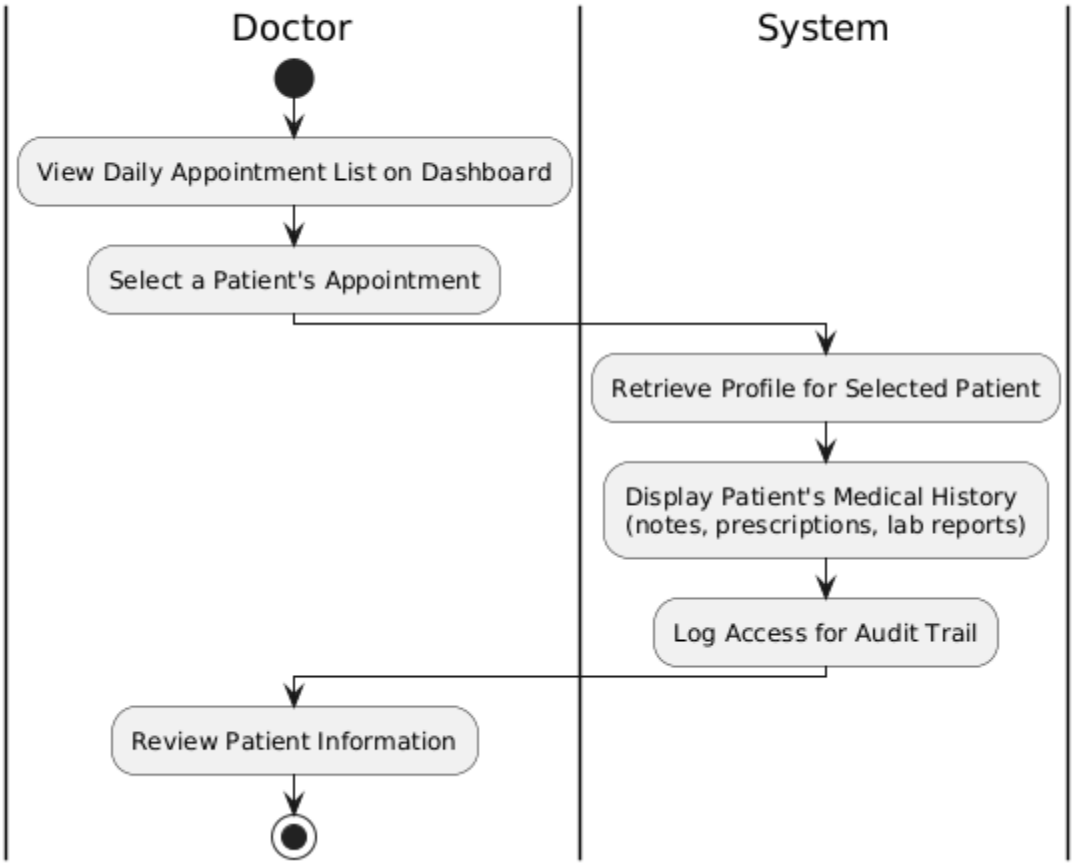
Field	Details
Use Case Id	ADM-01
Title	Manage User Accounts
Actors	Admin
Description	Allows an administrator to manage staff user accounts and assign roles.
Pre-Condition	The administrator is logged in.
Main Flow	- The admin navigates to the user management dashboard. - The admin can add, modify, or deactivate a user account and assign a role.
Post-Condition	The user accounts and roles are updated in the system.

Field	Details
Use Case Id	ADM-02
Title	View System Logs & Reports
Actors	Admin
Description	Allows an administrator to view system audit logs and generate administrative reports.
Pre-Condition	The administrator is logged in.
Main Flow	- The admin navigates to the logging or reporting section. - The admin can view real-time audit logs with search filters. - The admin can generate and export administrative reports.
Post-Condition	The administrator has viewed the requested system data.

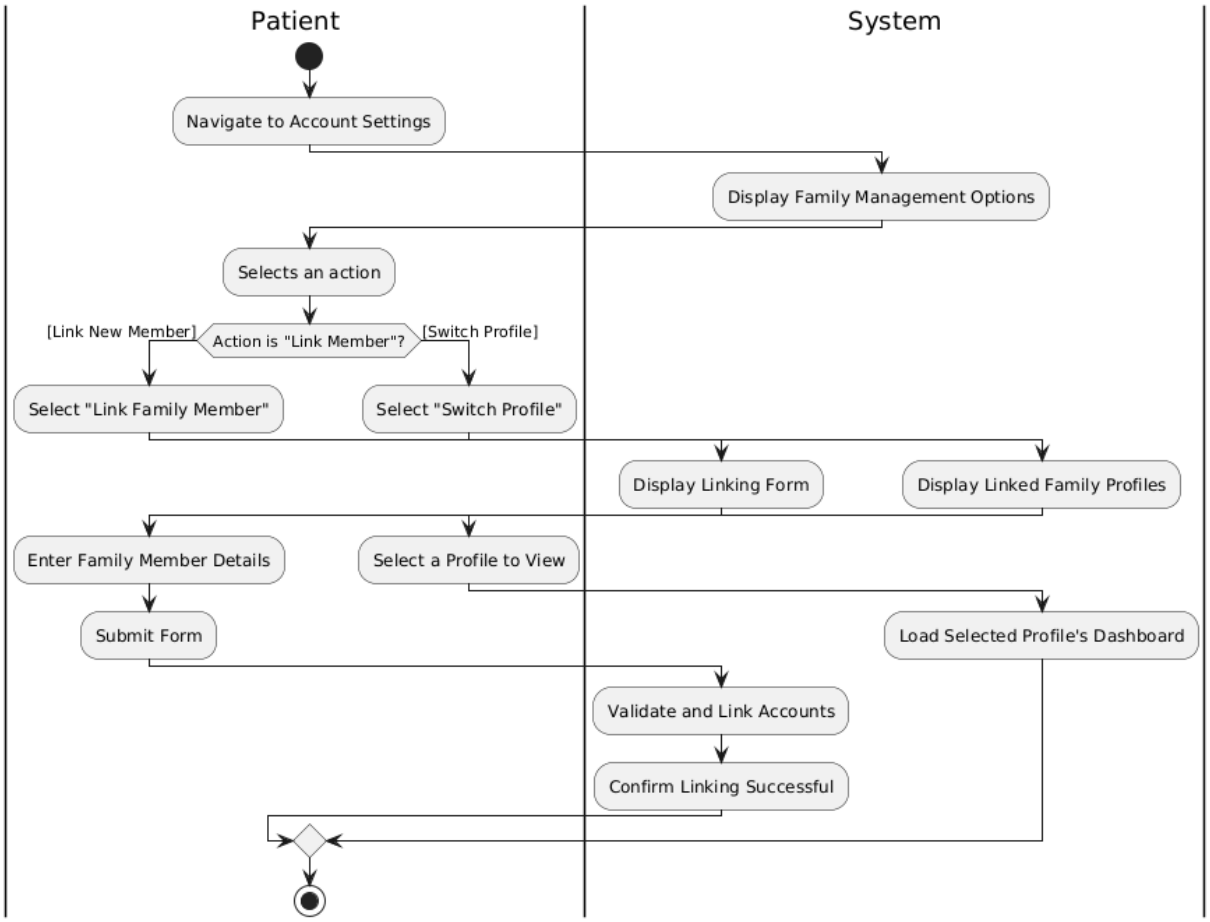
3.5 Activity Diagrams for Proposed System



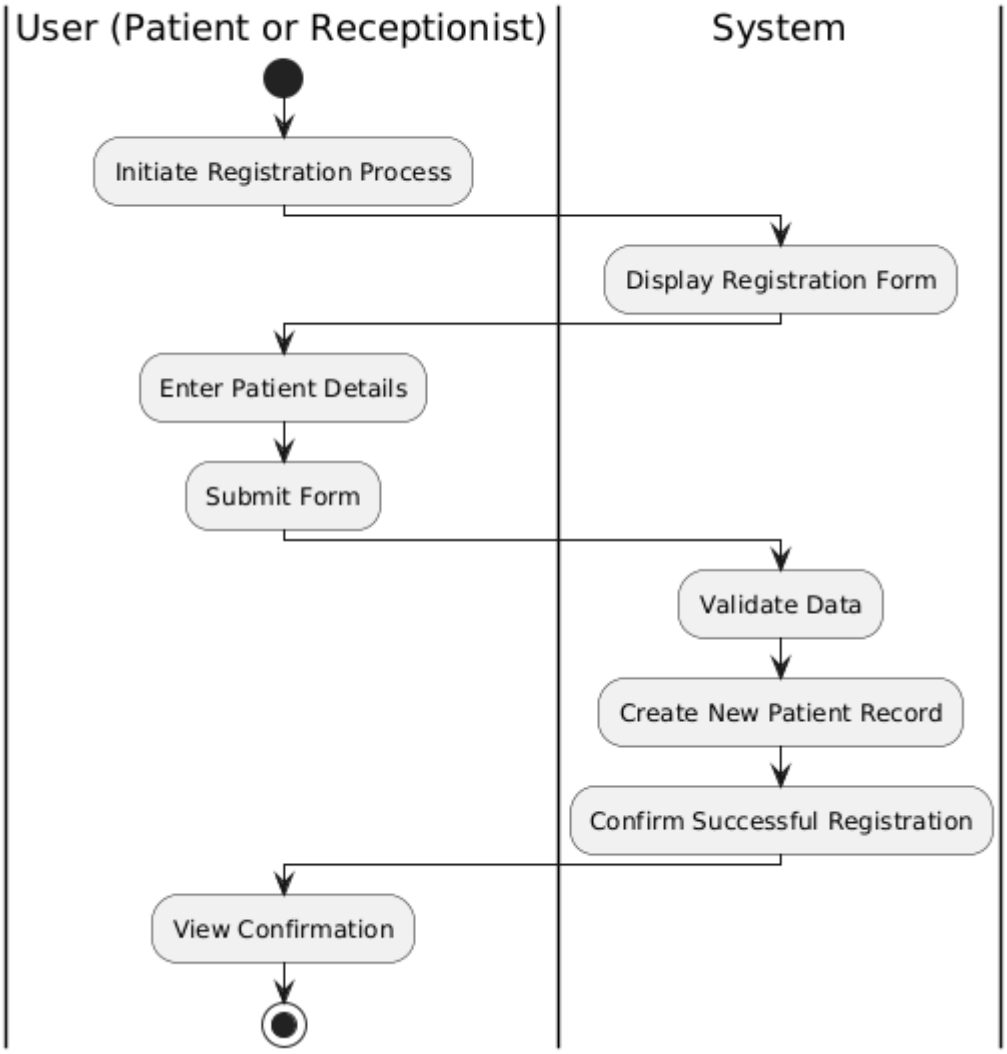
FND-02: Access Patient Records (Doctor's Workflow)



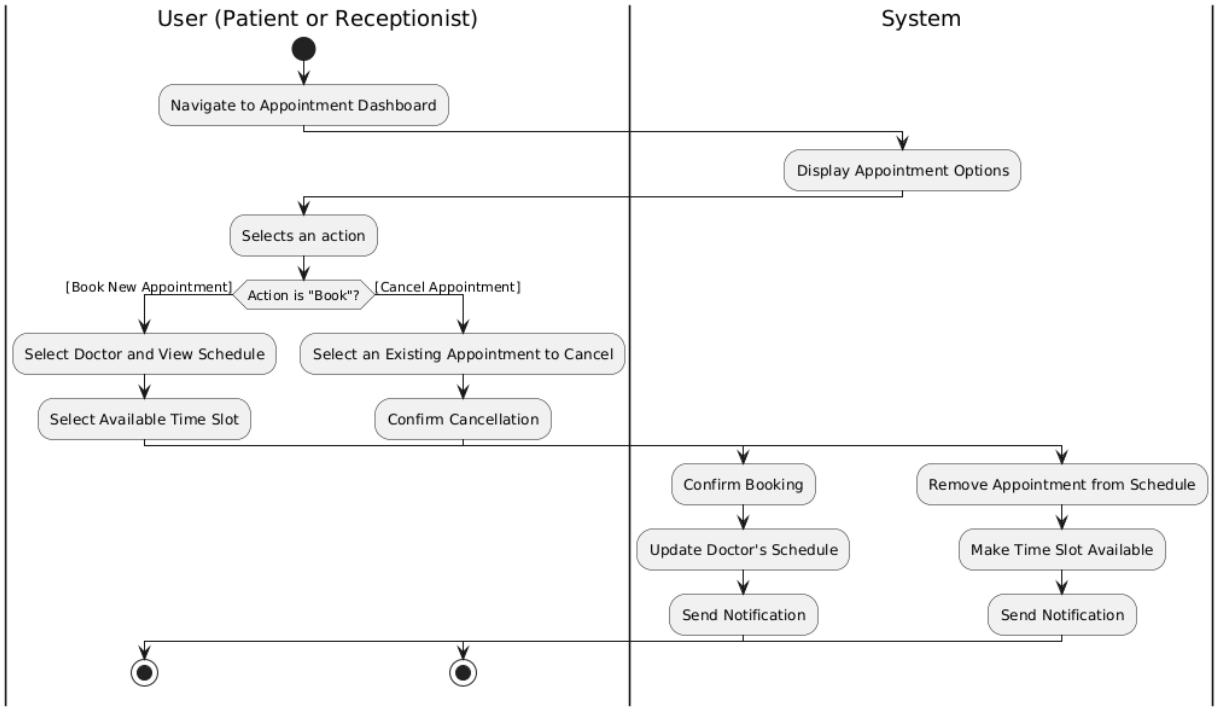
PP-01: Manage Family Members



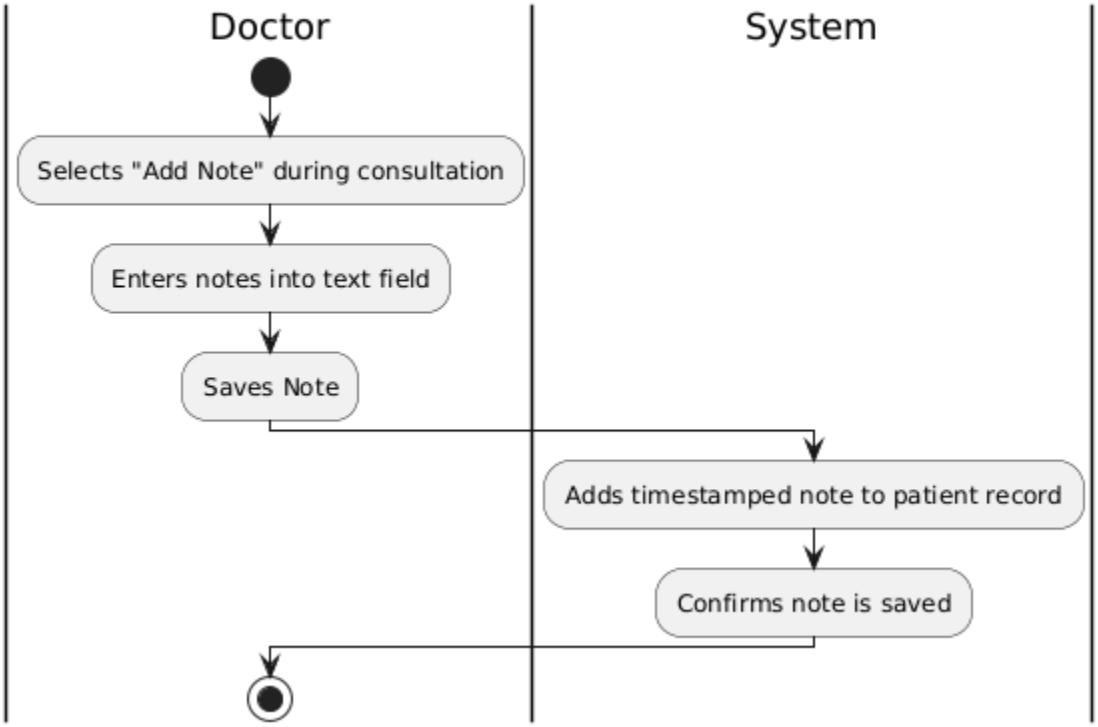
FDS-01: Manage Patient Registration



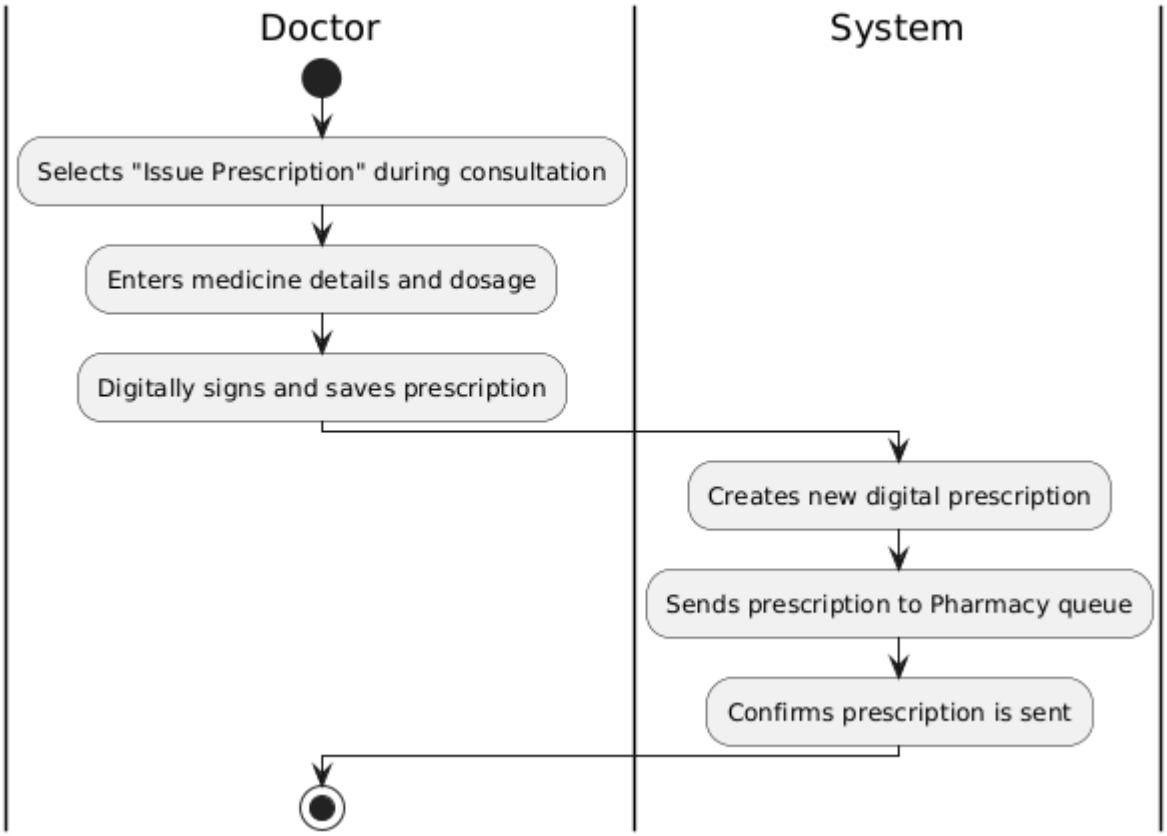
FDS-02: Manage Appointments



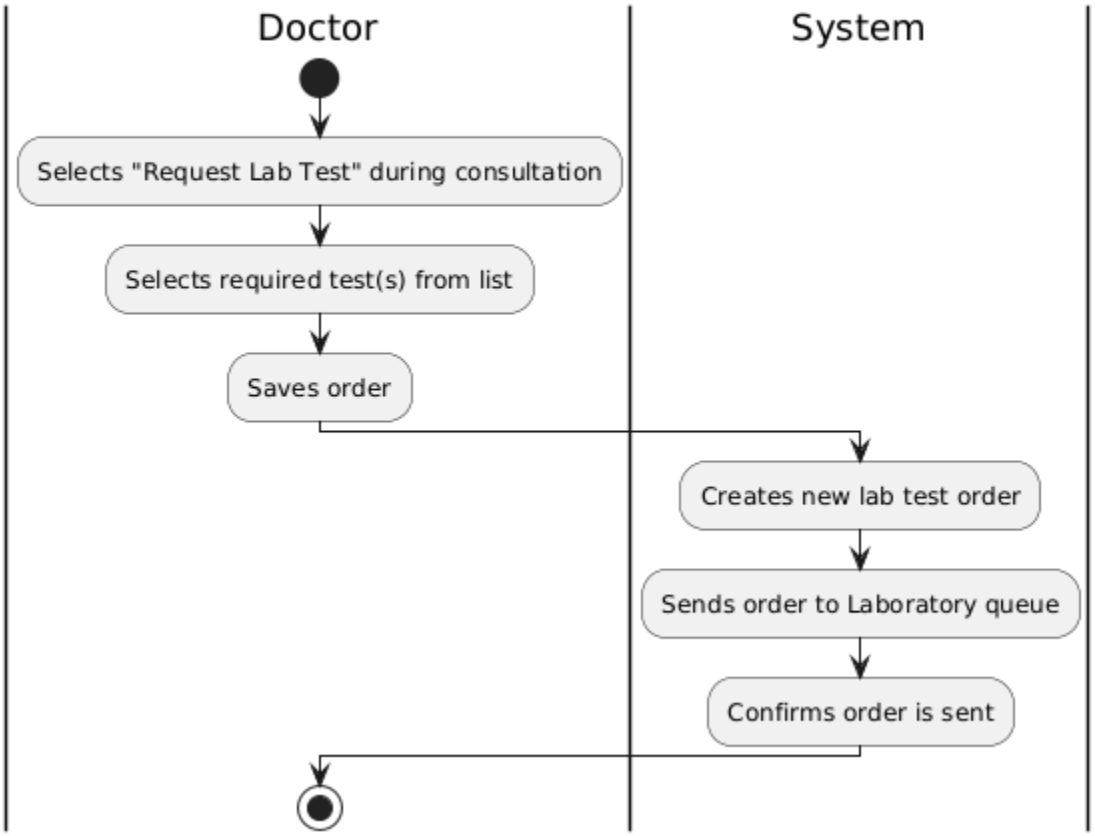
CW-03: Add Clinical Note



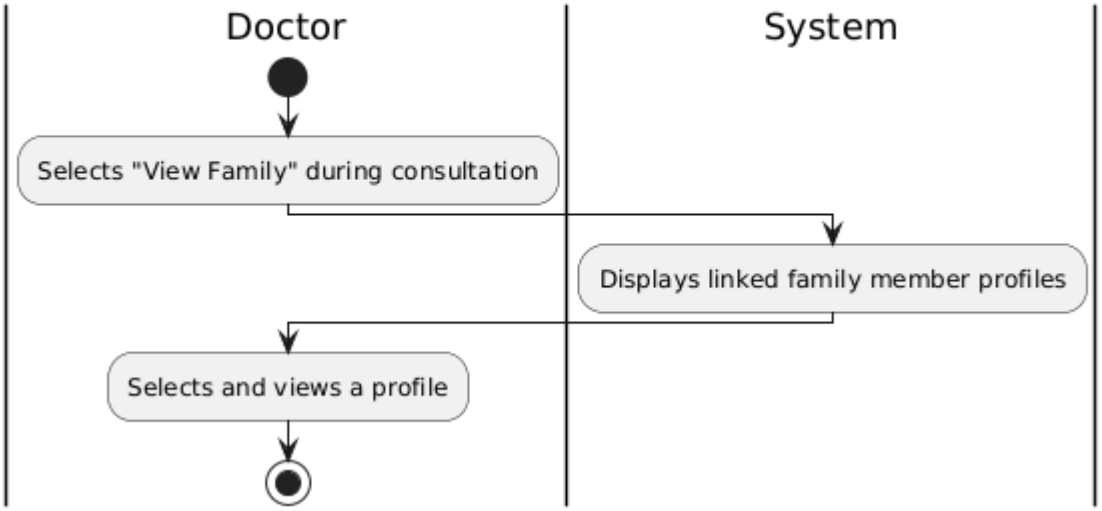
CW-04: Issue Prescription



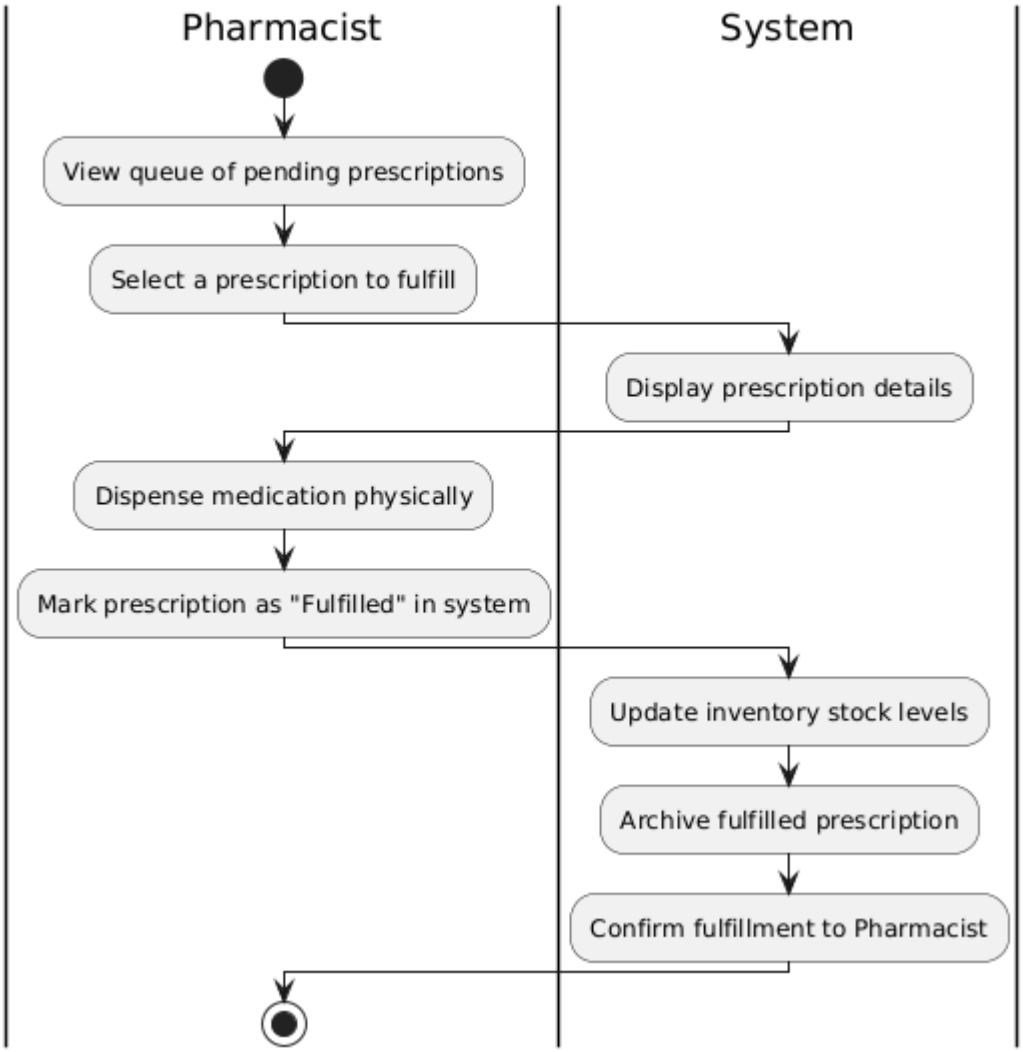
CW-05: Request Lab Test



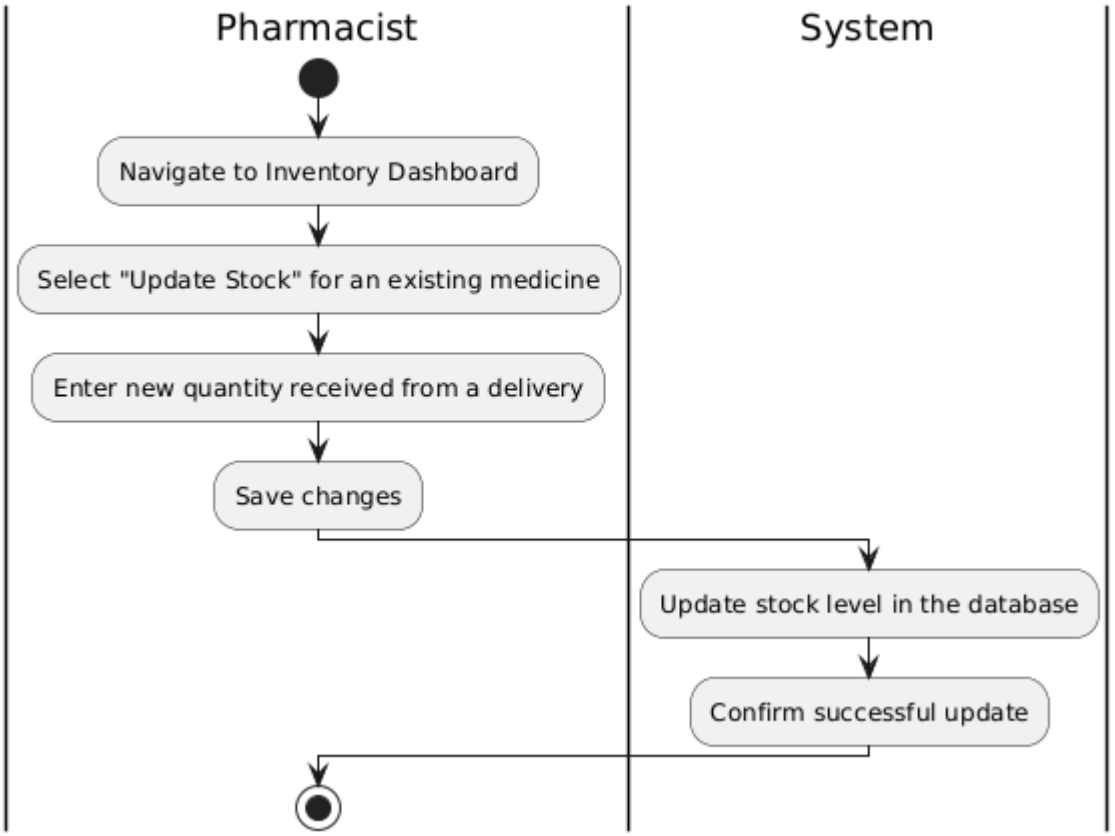
CW-06: View Family Profile



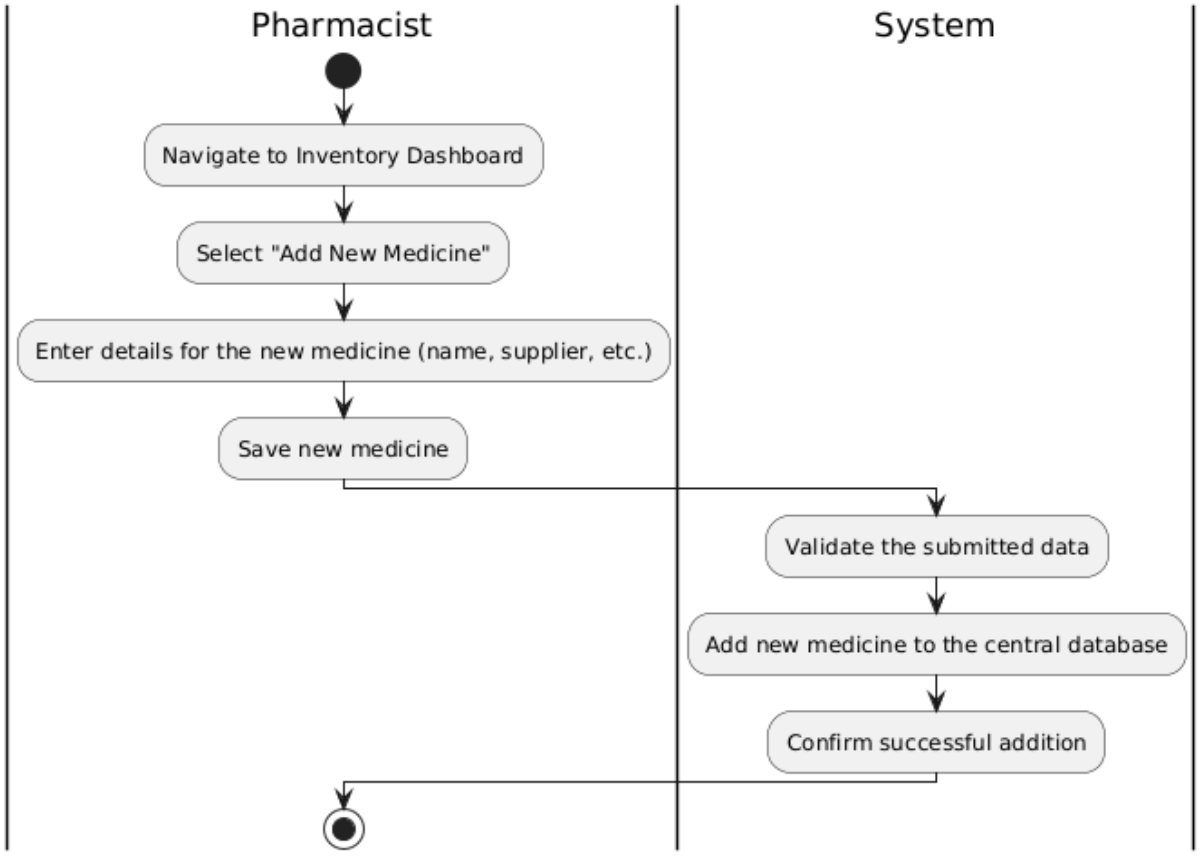
PM-01: Fulfill Prescription



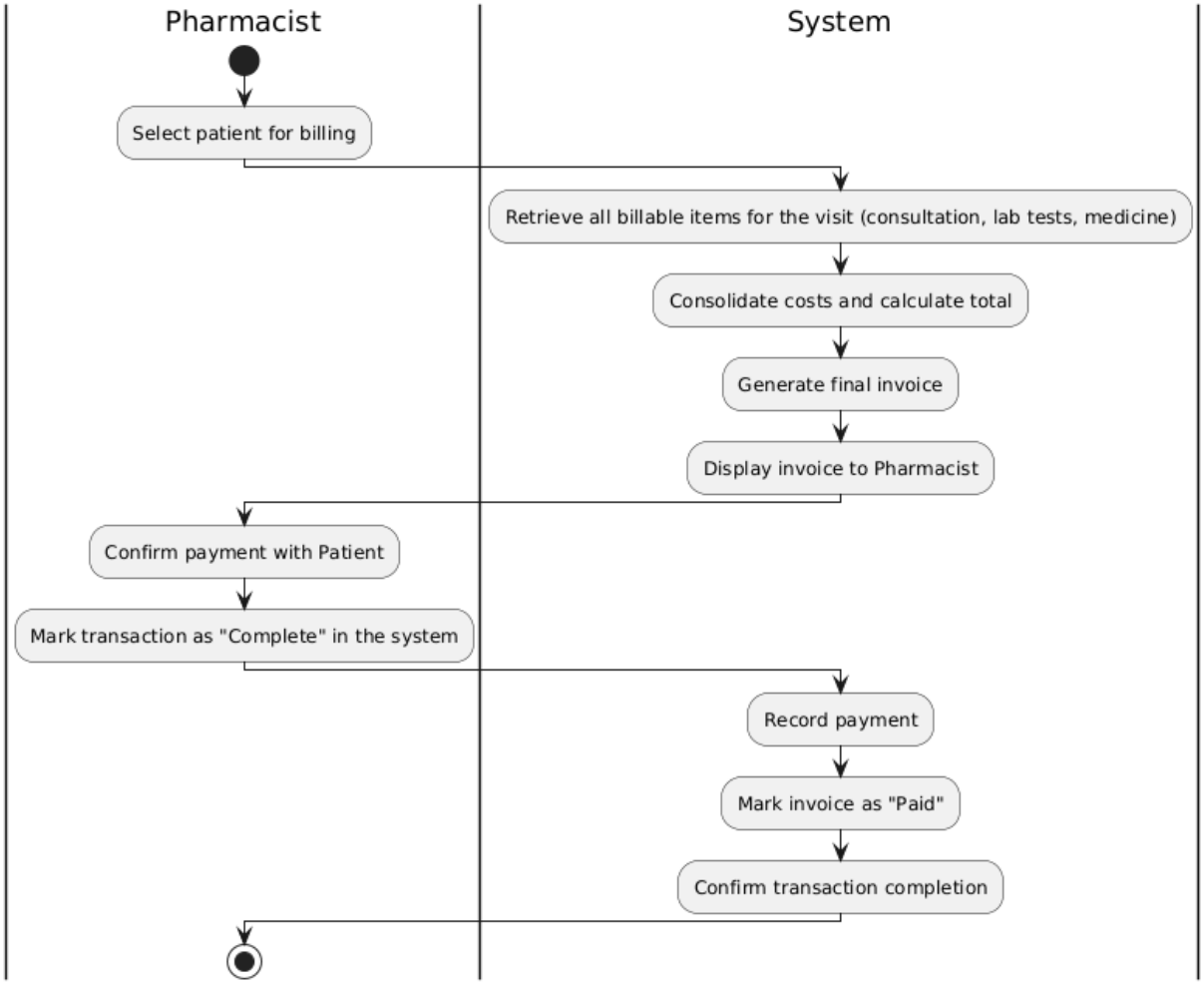
PM-02b: Add New Inventory (Update Stock)



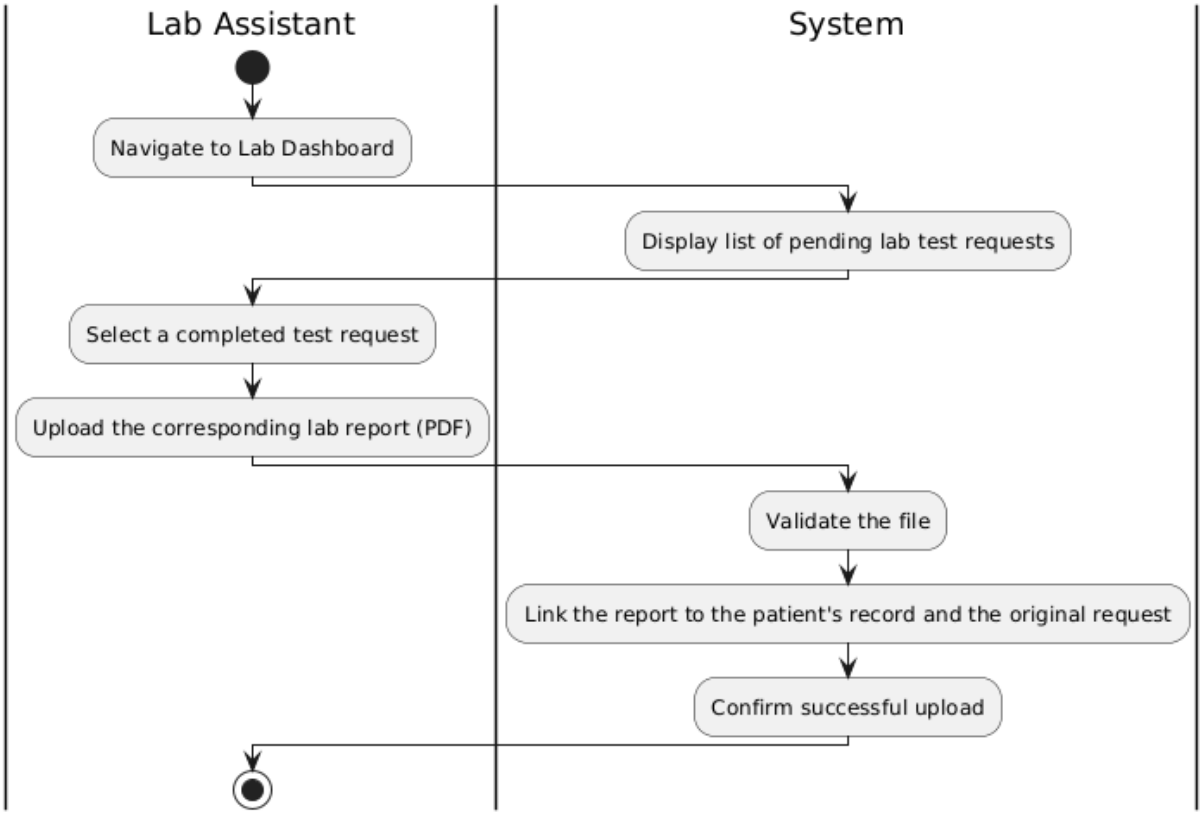
PM-02a: Add New Medicine to Database



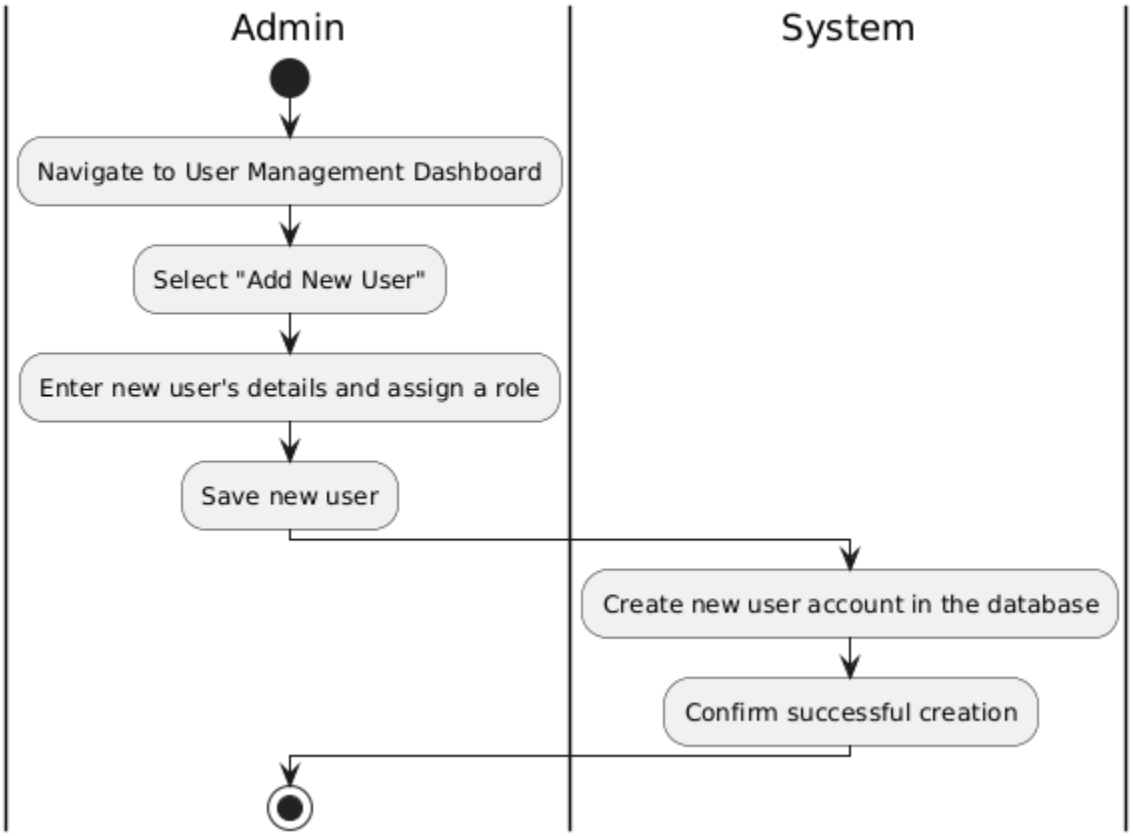
PM-03: Handle Billing & Invoicing



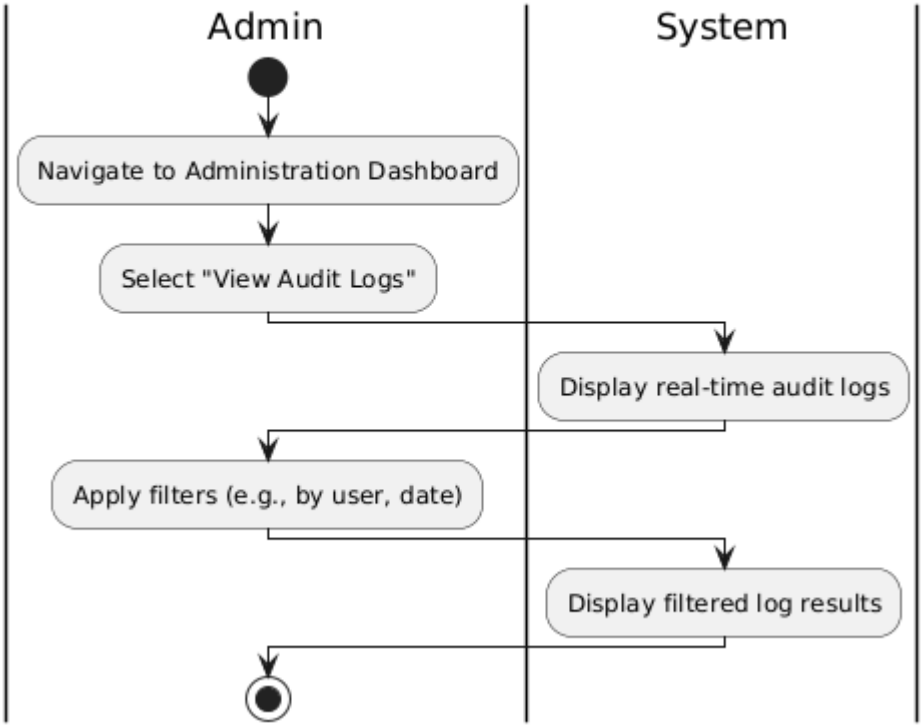
LM-01: Manage Lab Reports



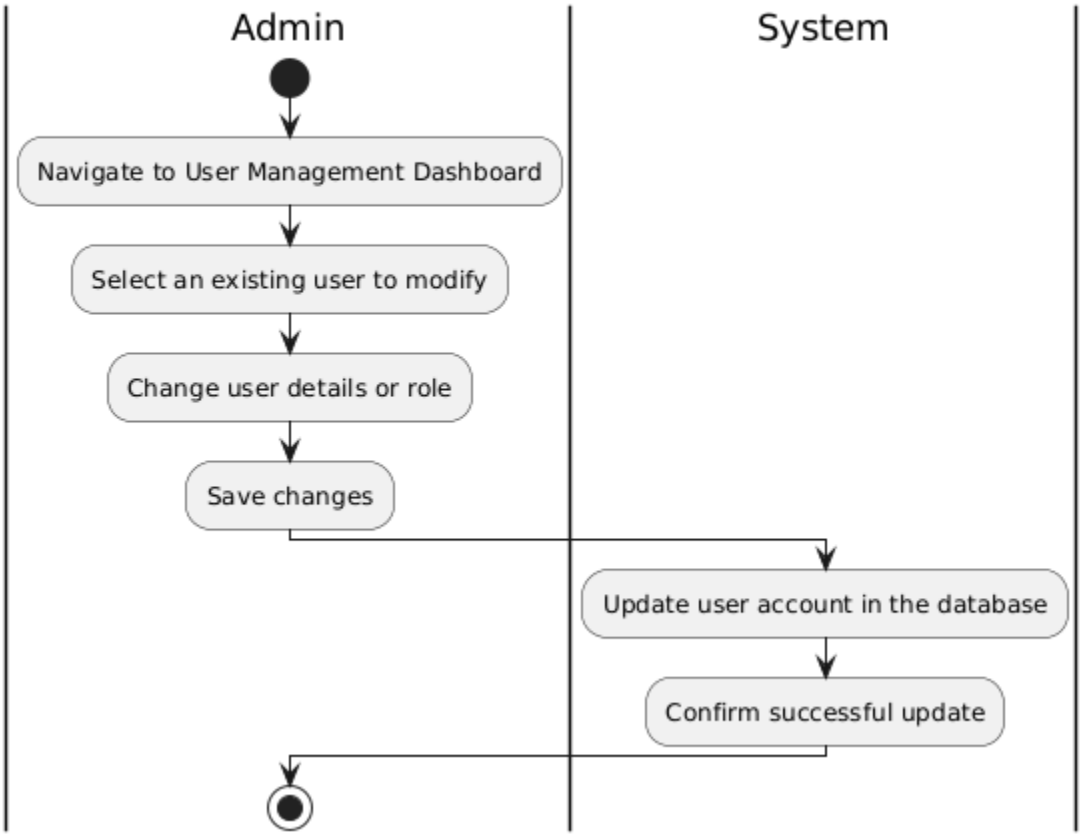
ADM-01a: Add New User



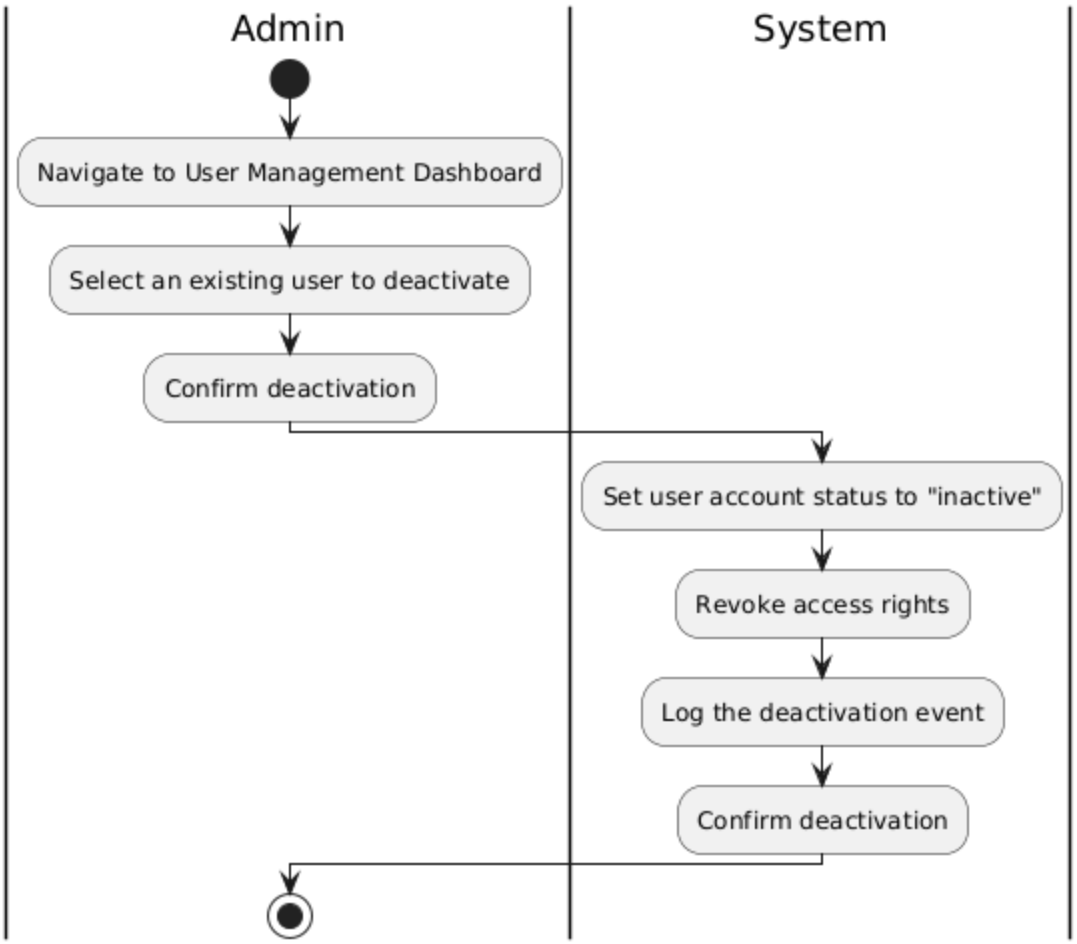
ADM-02: View Audit Logs



ADM-01b: Modify User

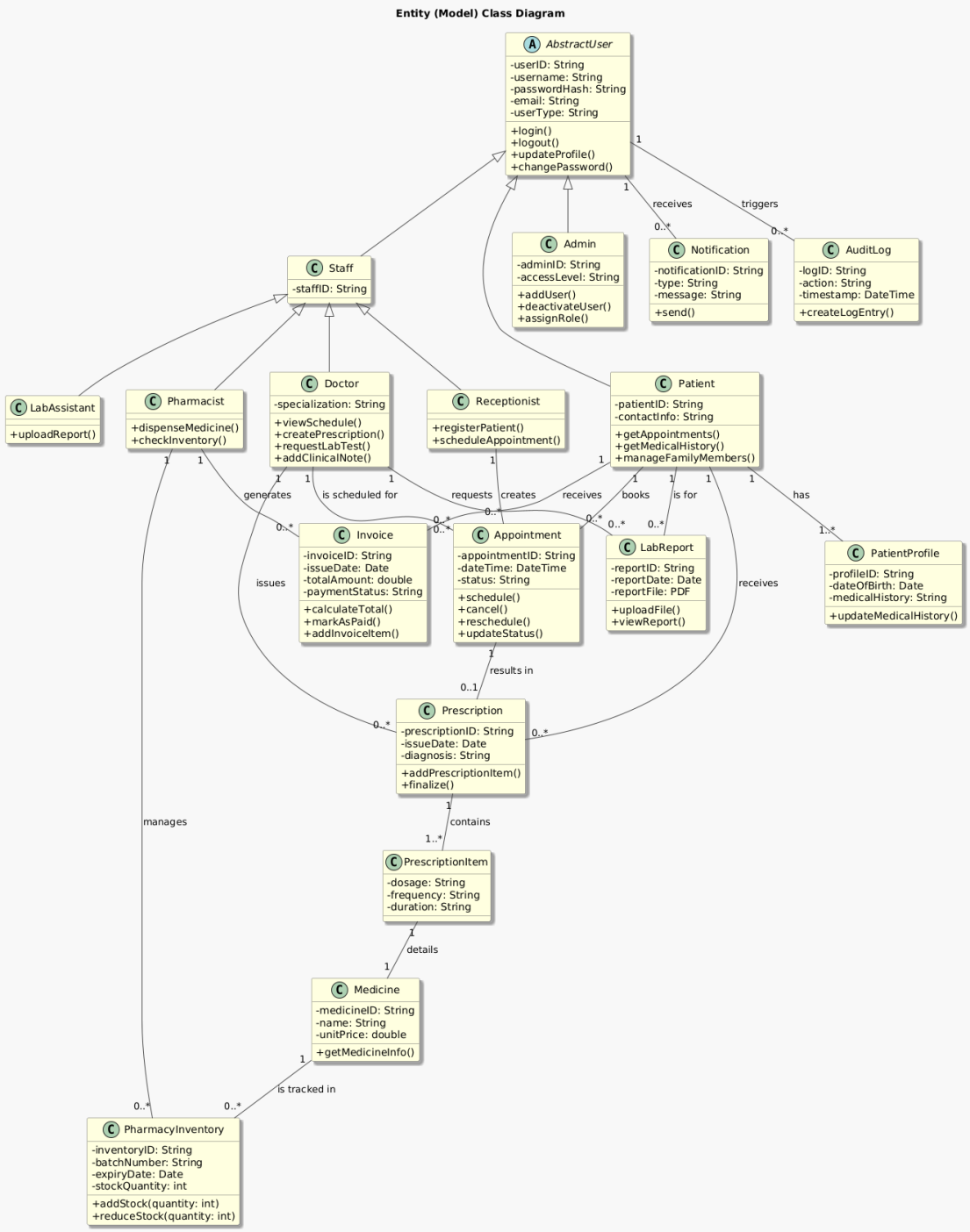


ADM-01c: Deactivate User

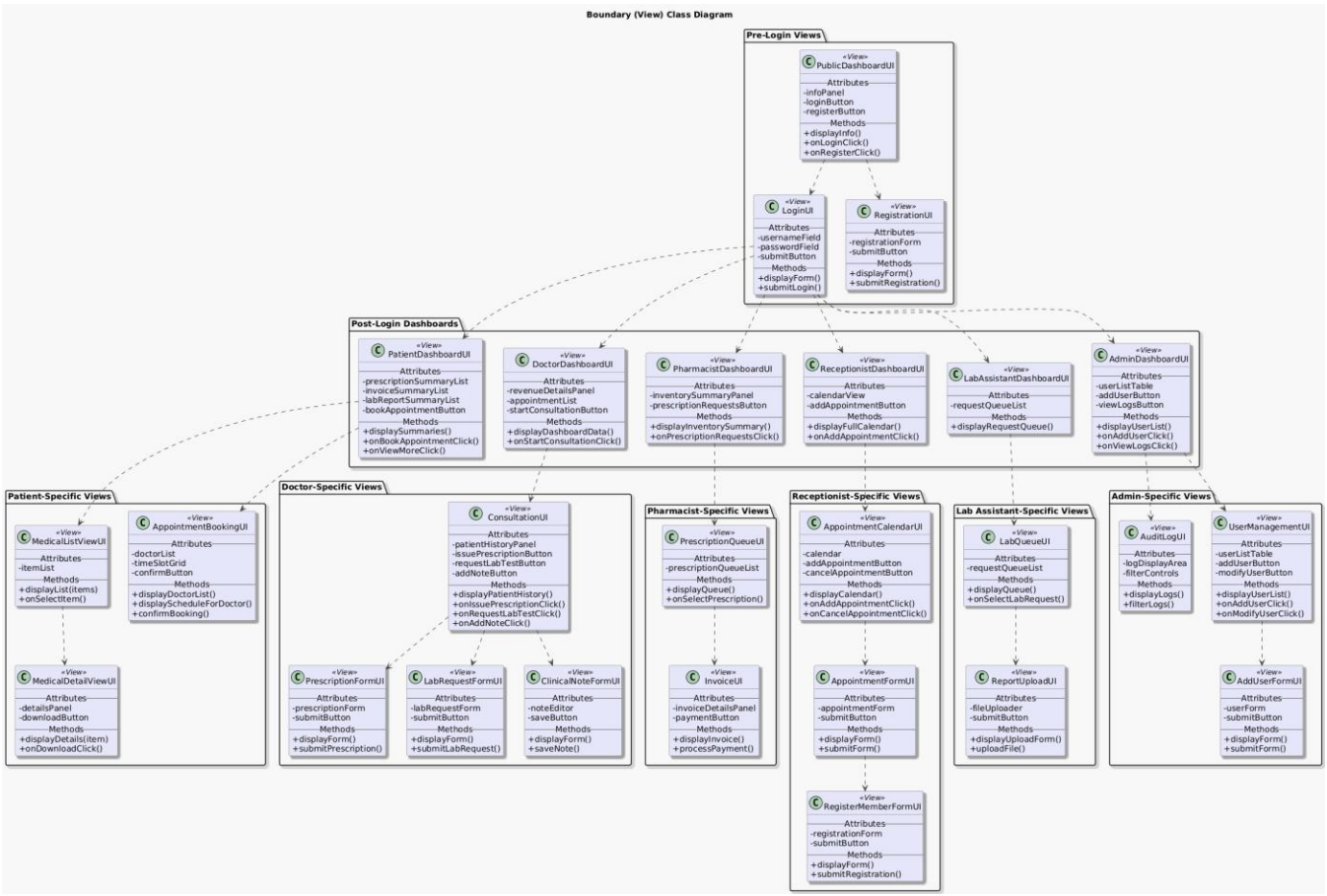


3.6 Class Diagrams for Proposed System

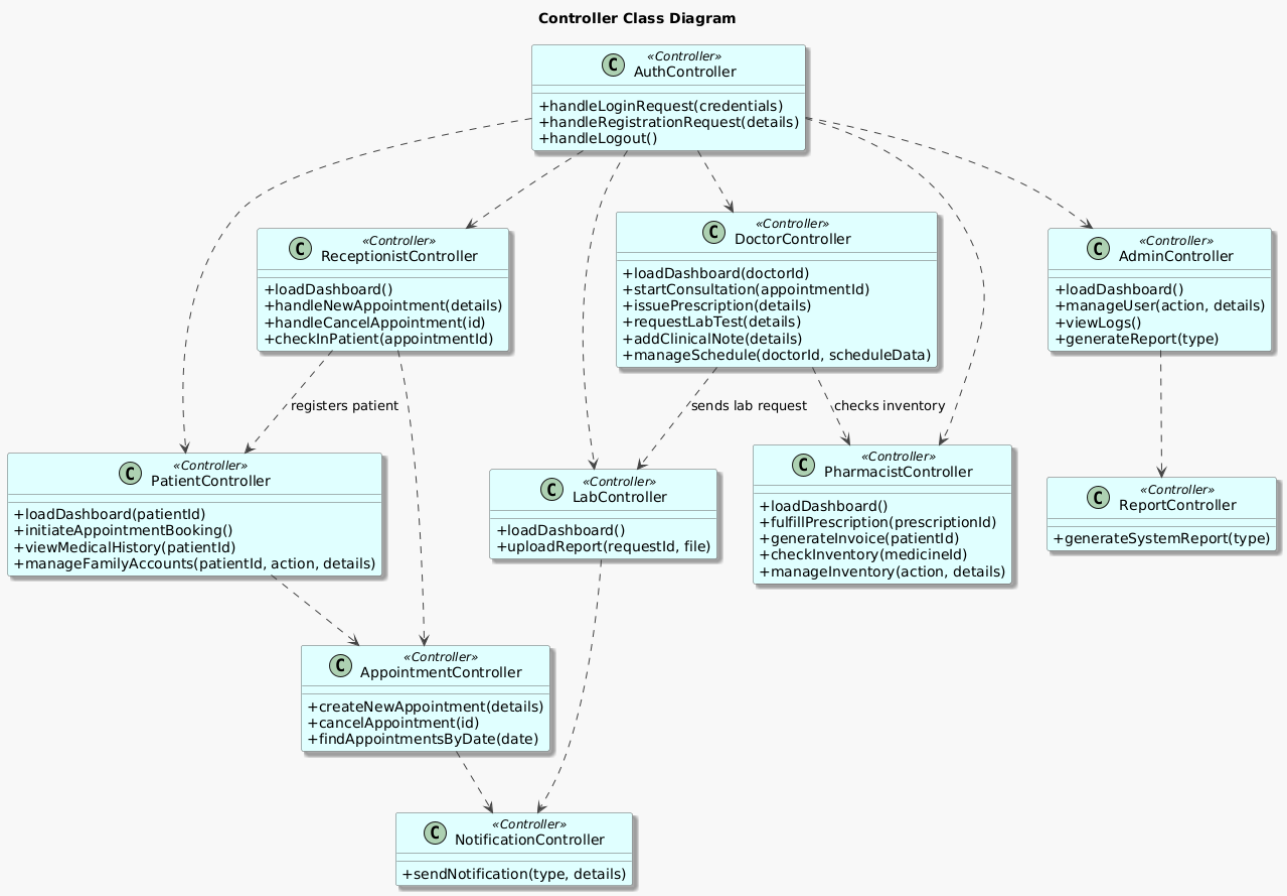
3.6.1 Entity Class Diagram



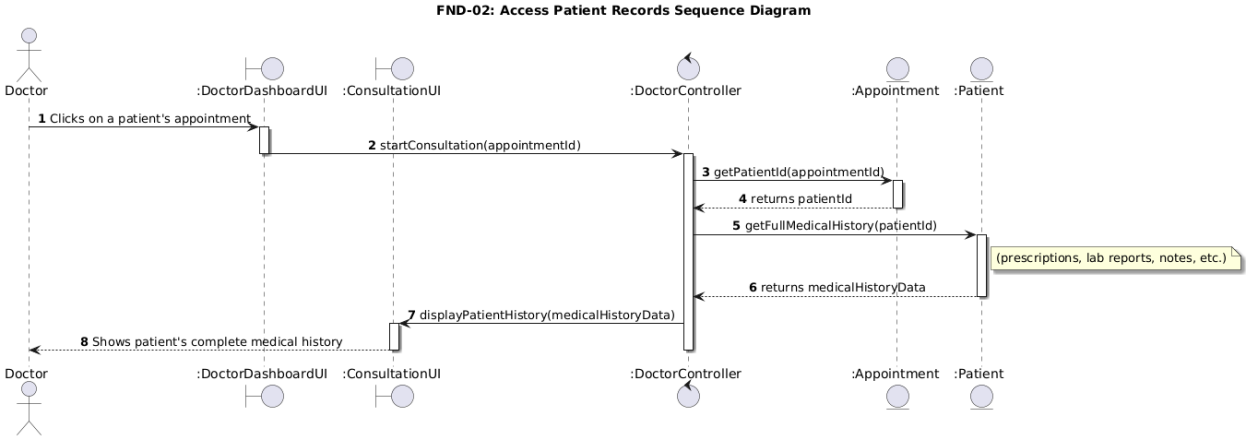
3.6.2 Interface Class Diagram

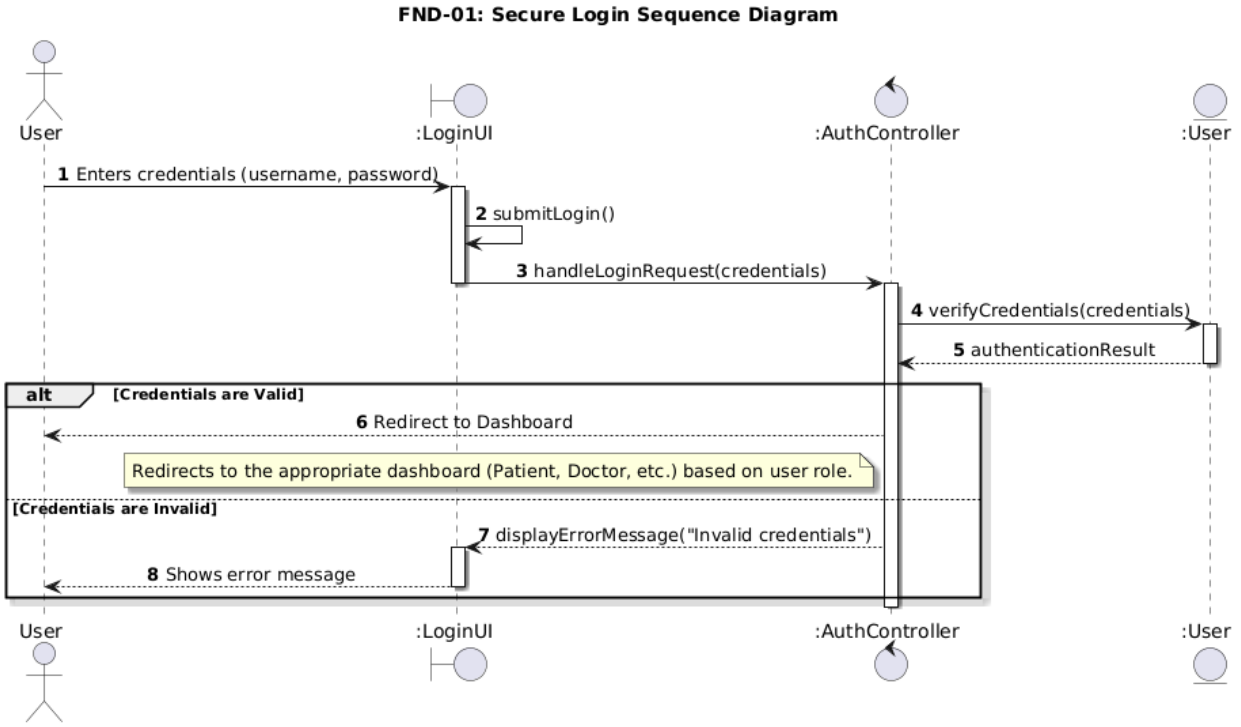


3.6.3 Controller Class Diagram

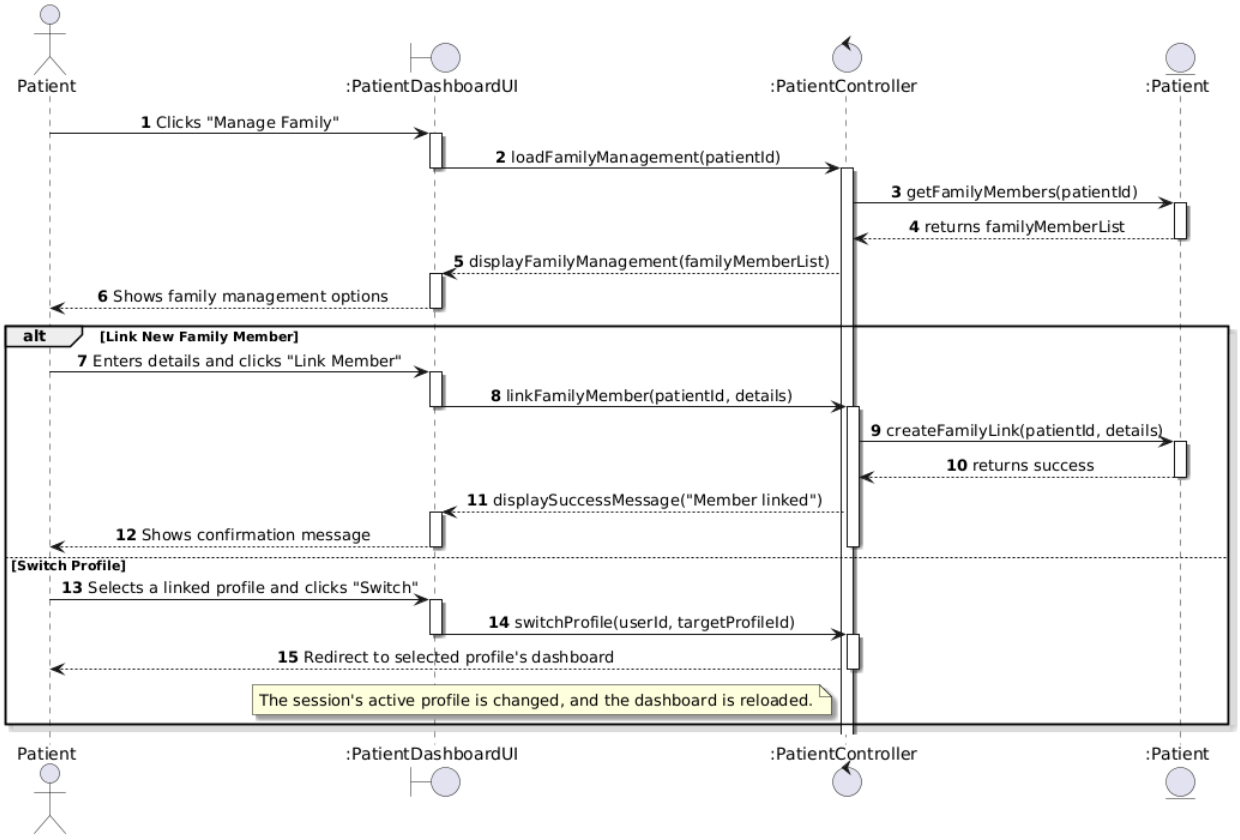


3.7 Sequence Diagrams for Proposed System

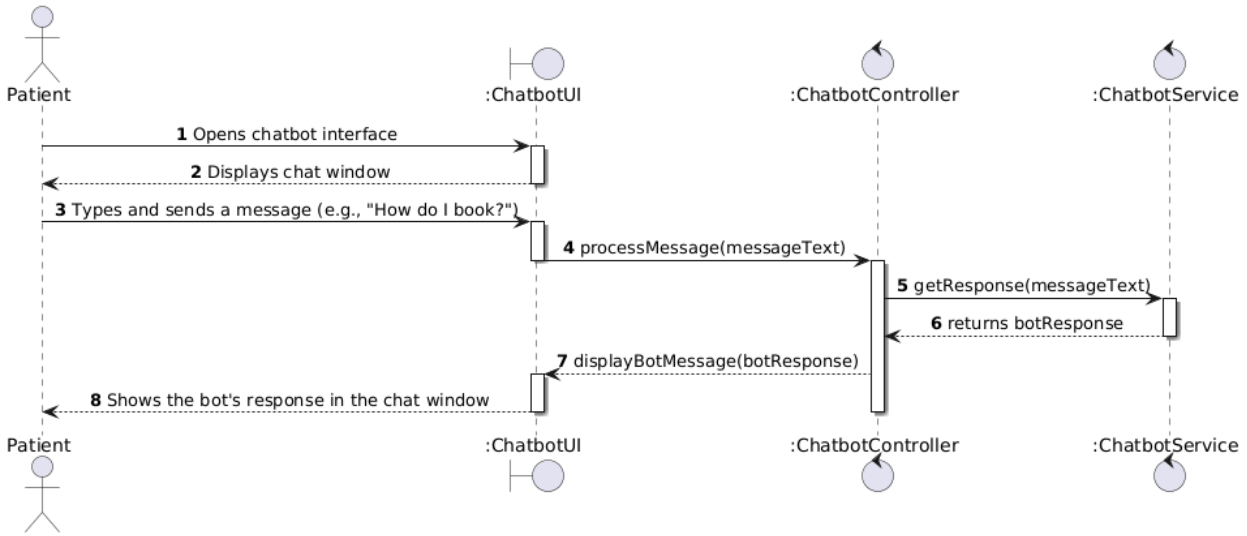




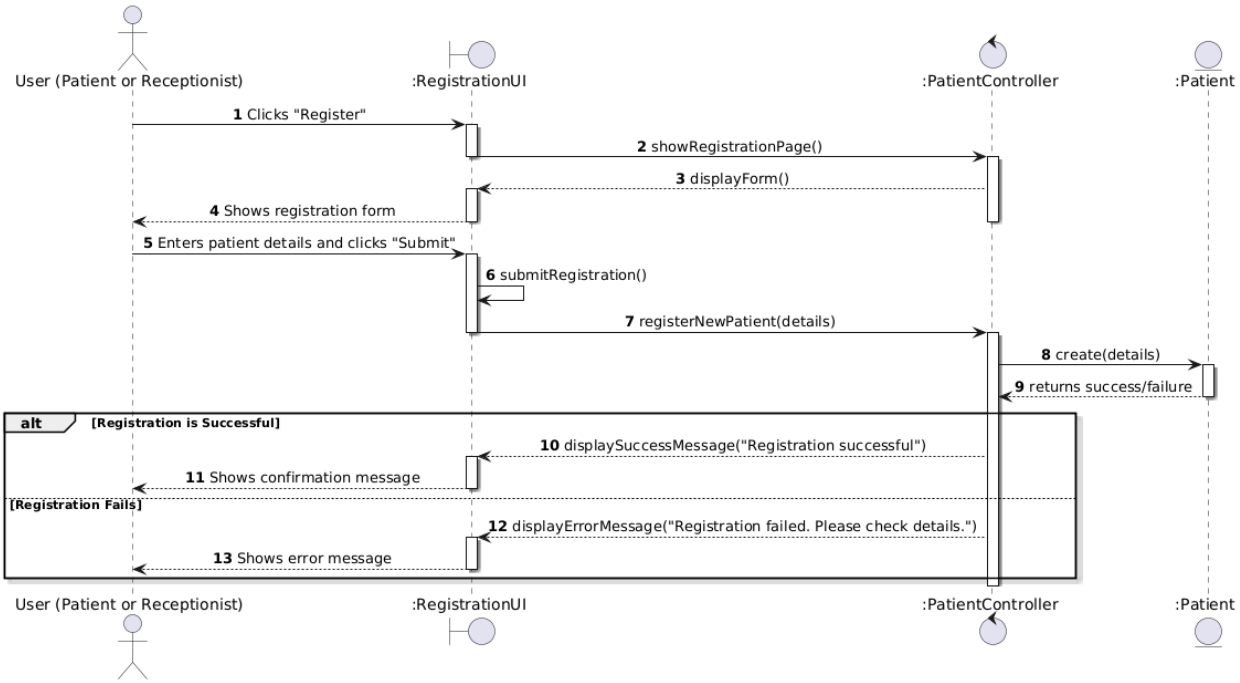
PP-01: Manage Account & Family Sequence Diagram



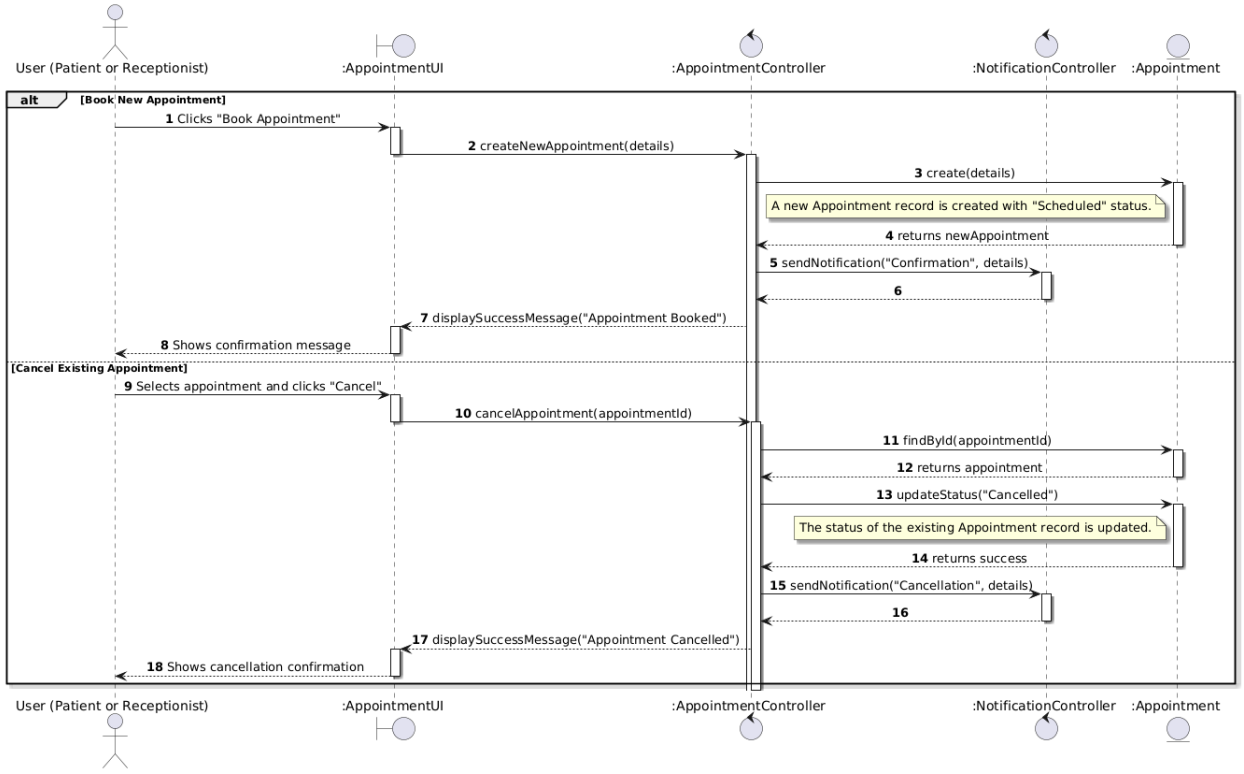
PP-02: Use AI Chatbot Sequence Diagram



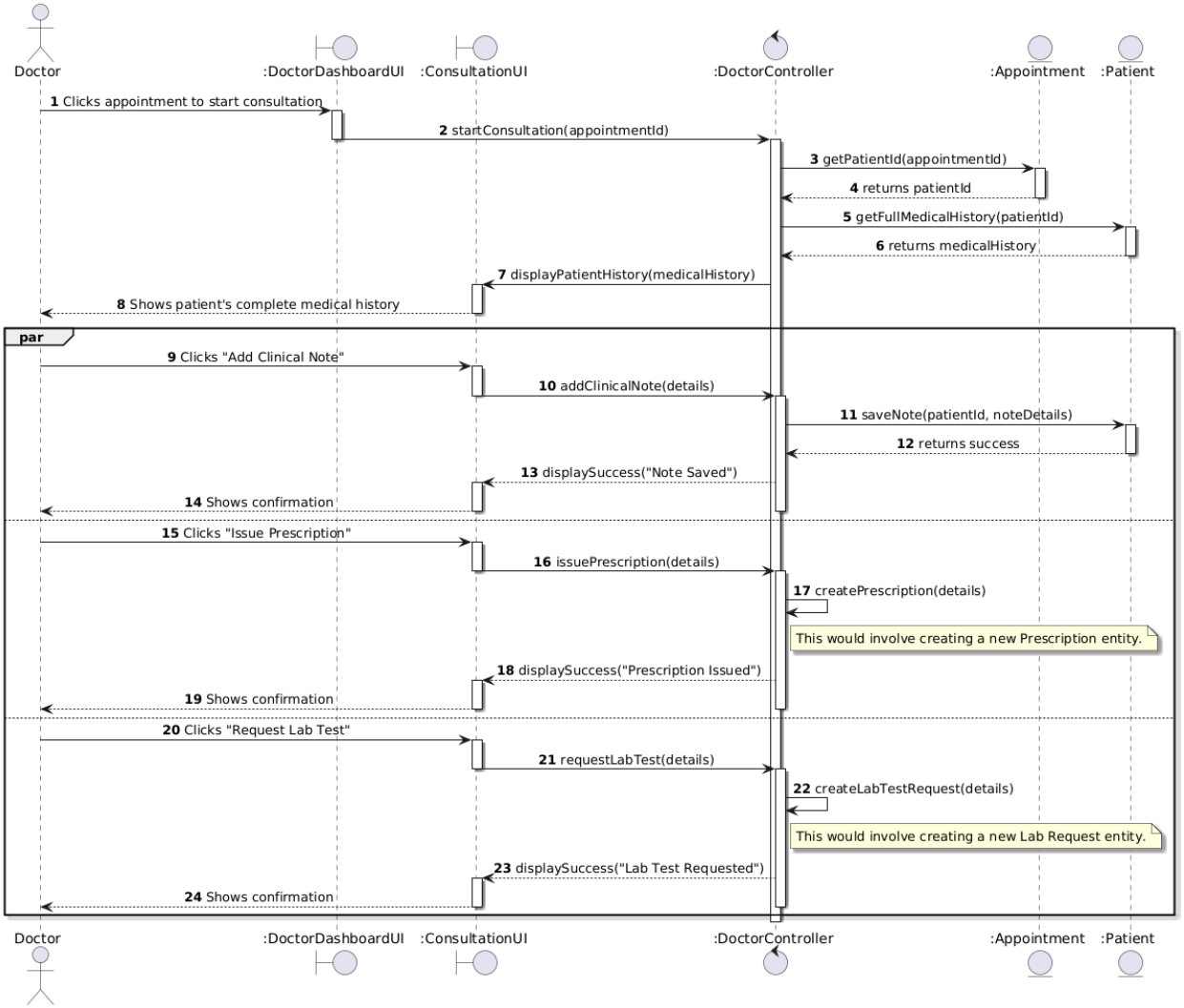
FDS-01: Manage Patient Registration Sequence Diagram



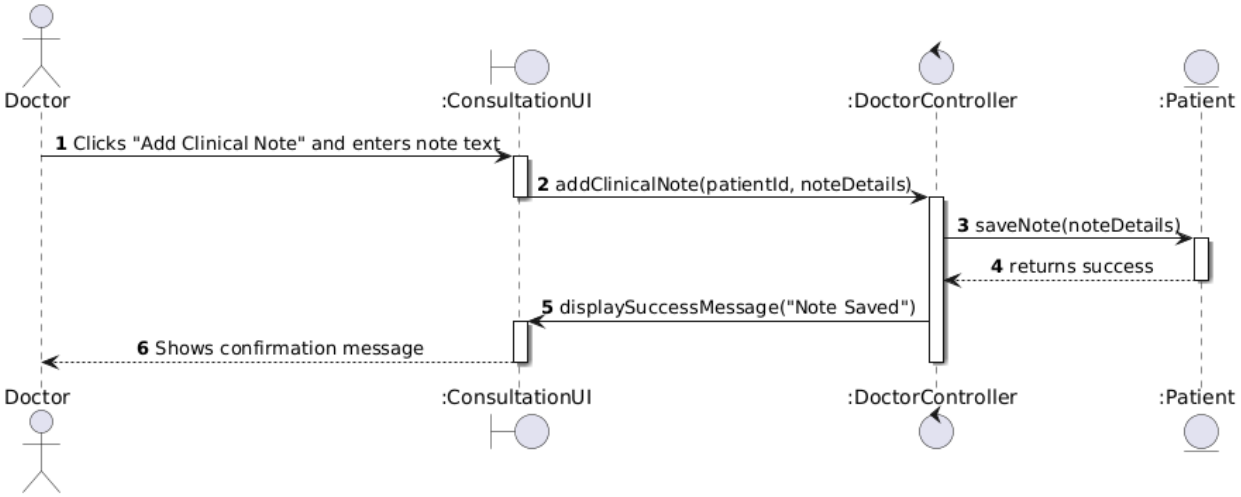
FDS-02: Manage Appointments Sequence Diagram



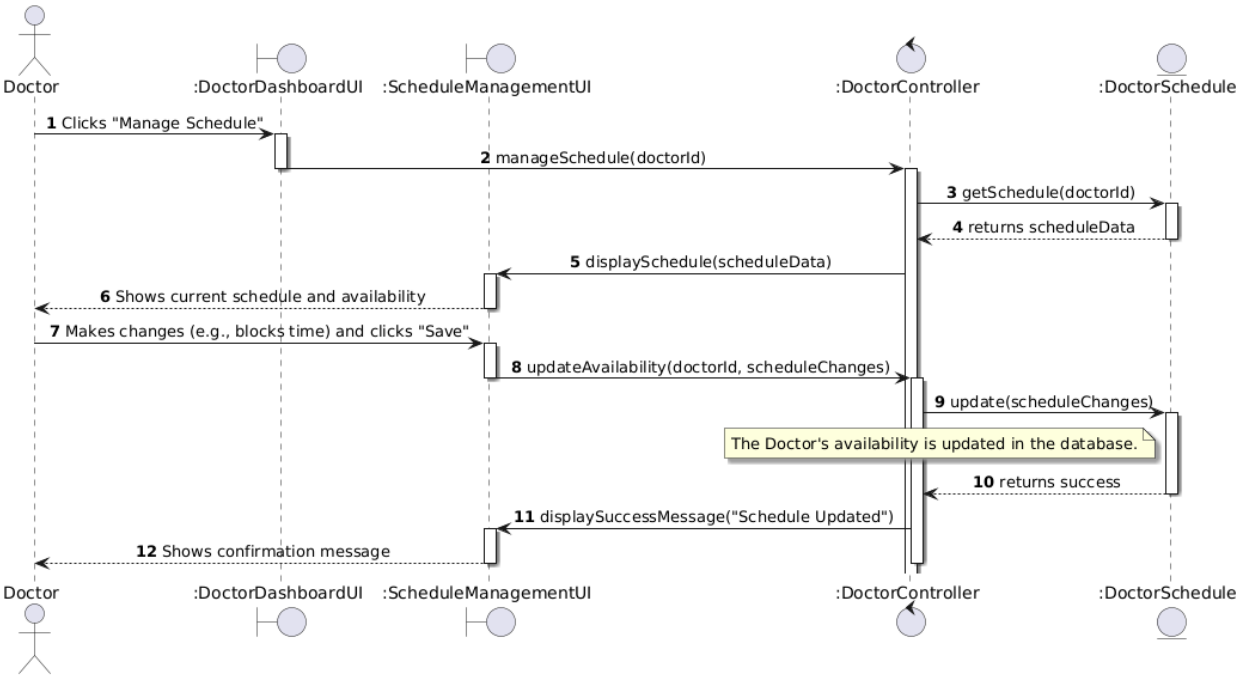
CW-01: Conduct Consultation Sequence Diagram



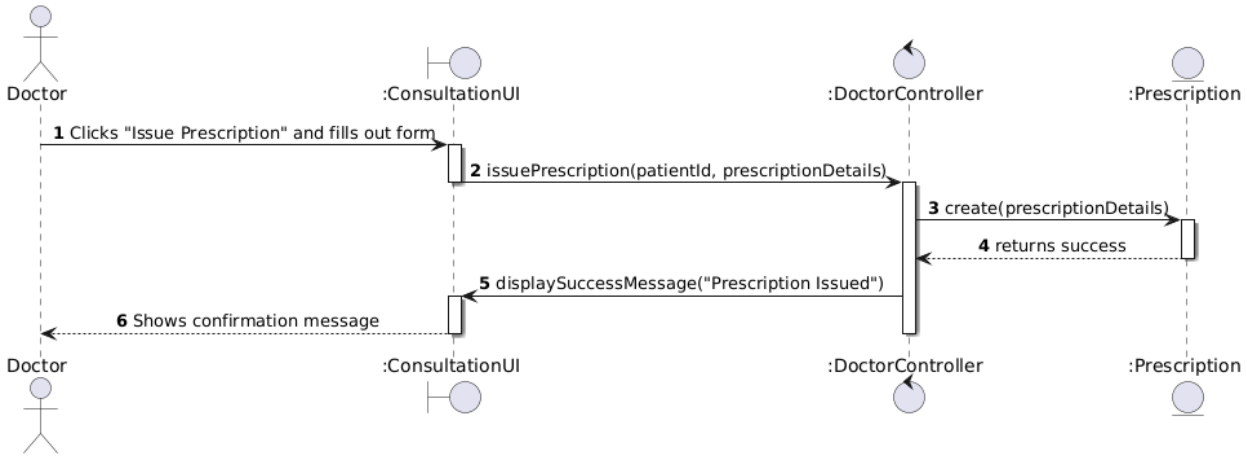
CW-03: Add Clinical Note Sequence Diagram



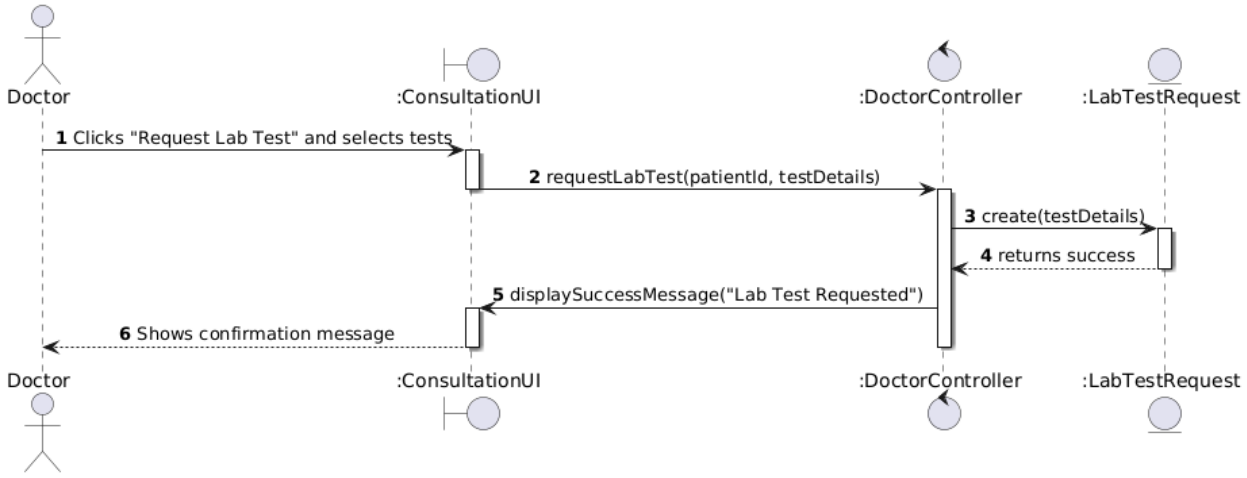
CW-02: Manage Schedule Sequence Diagram



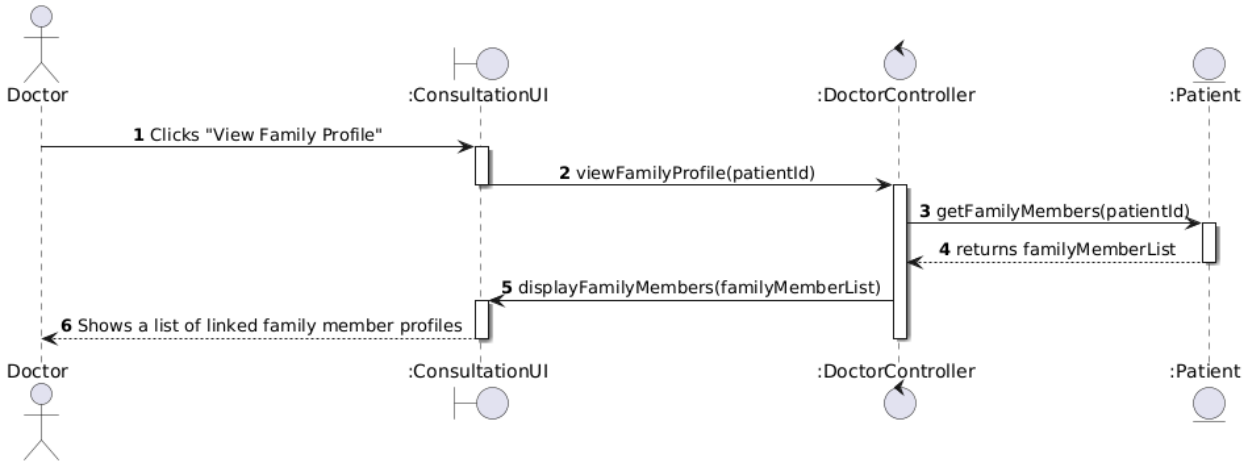
CW-04: Issue Prescription Sequence Diagram



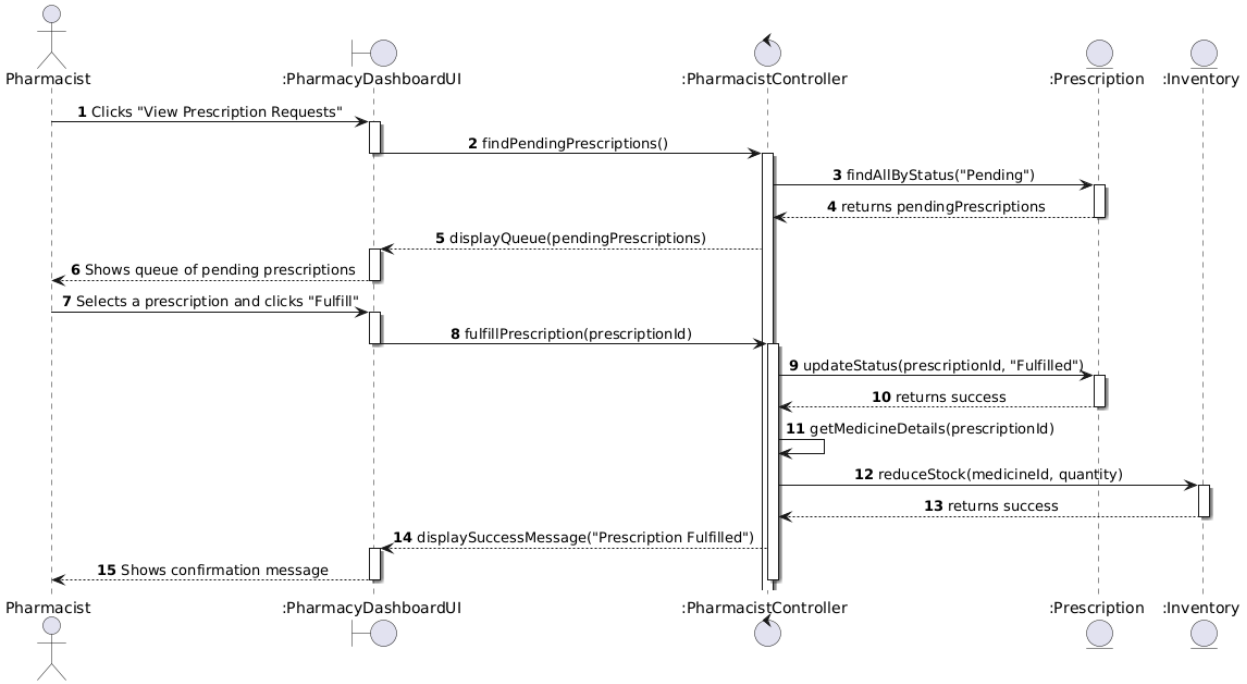
CW-05: Request Lab Test Sequence Diagram



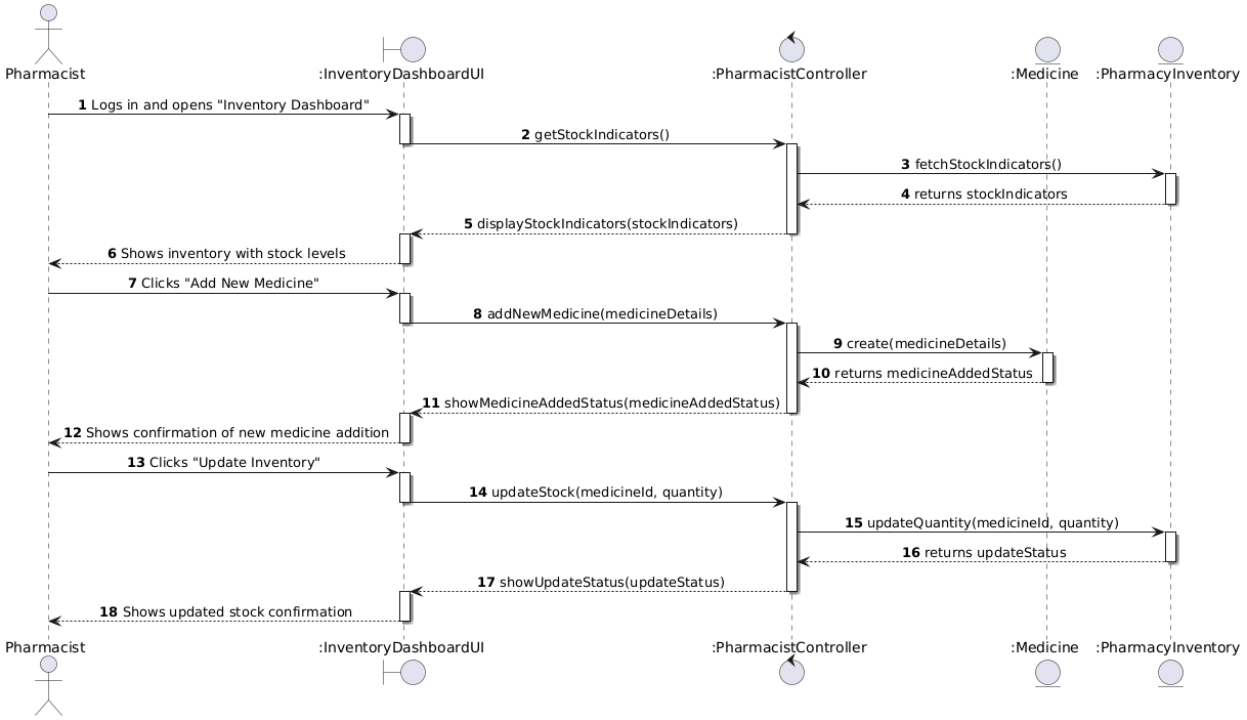
CW-06: View Family Profile Sequence Diagram



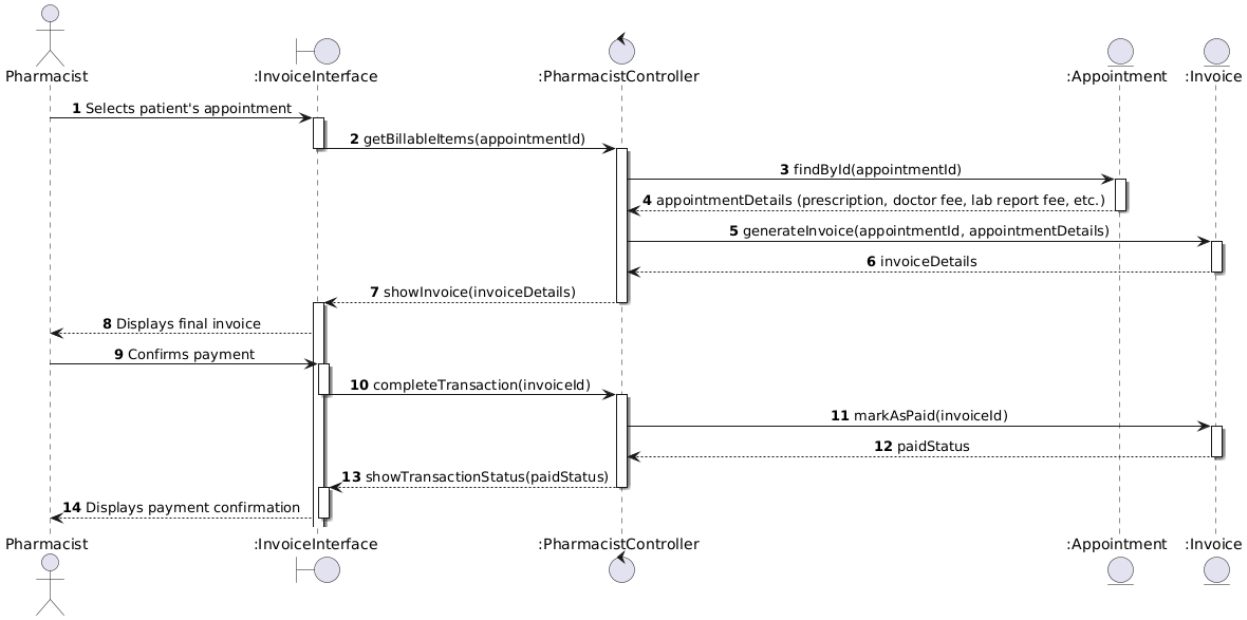
PM-01: Fulfill Prescription Sequence Diagram



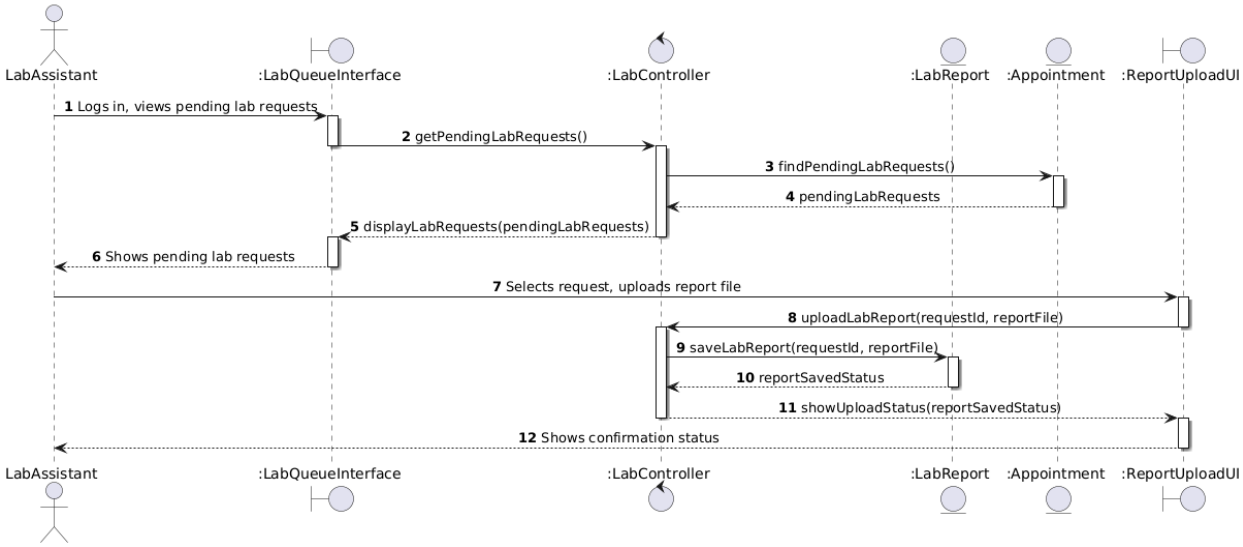
PM-02: Manage Inventory Sequence Diagram



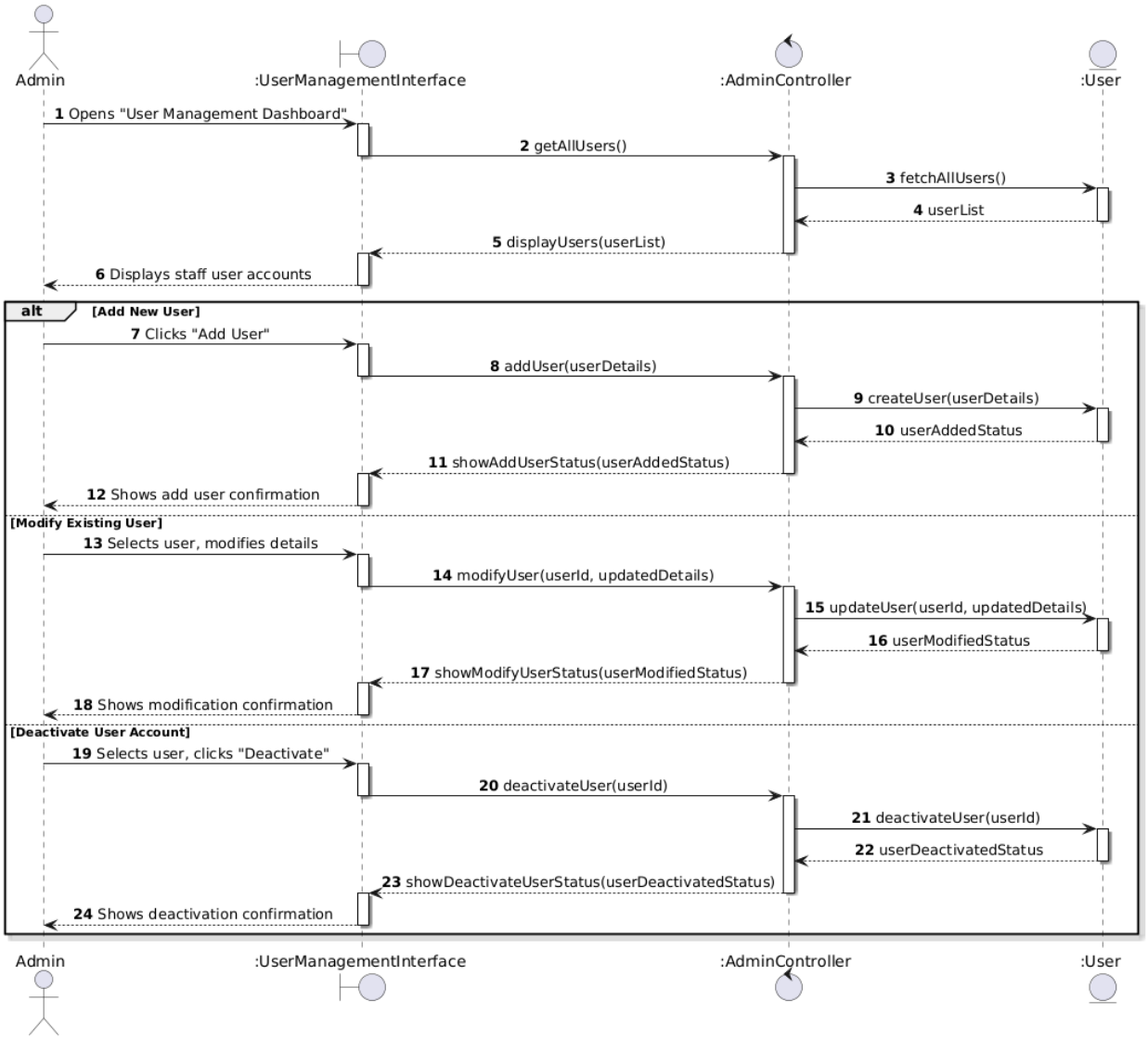
PM-03: Handle Billing & Invoicing (Via Appointment) Sequence Diagram



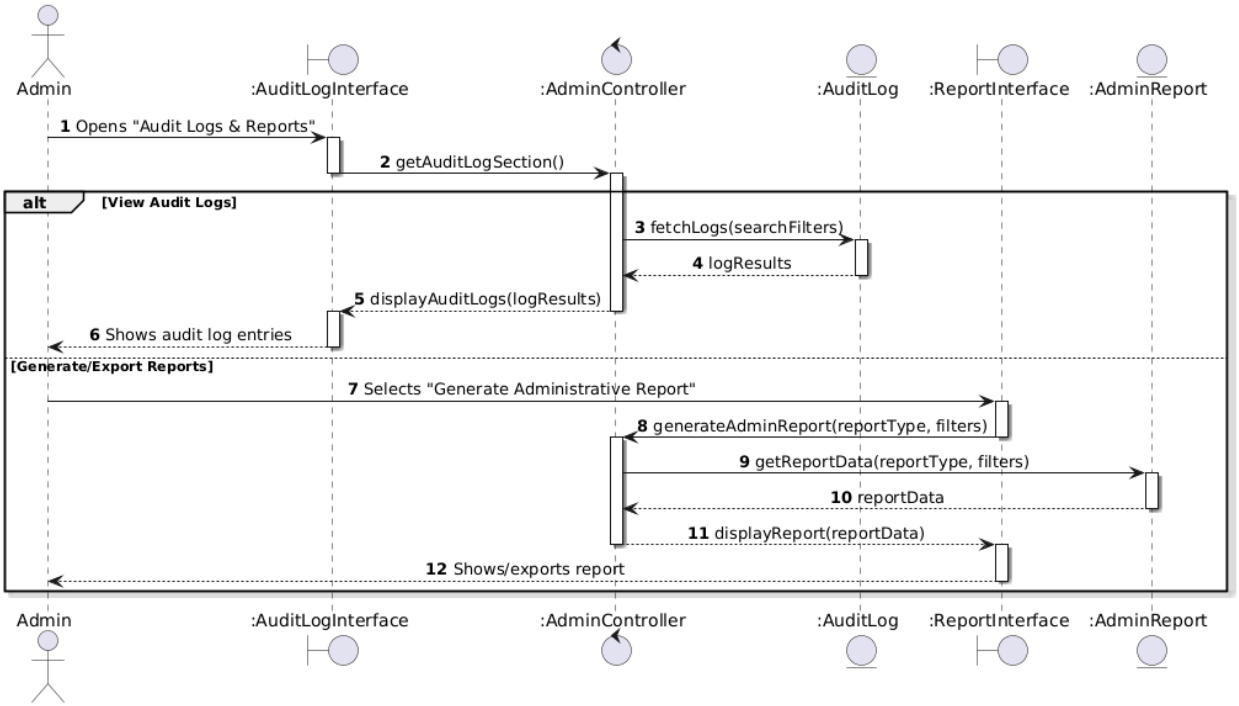
LM-01: Manage Lab Reports Sequence Diagram (Simplified)



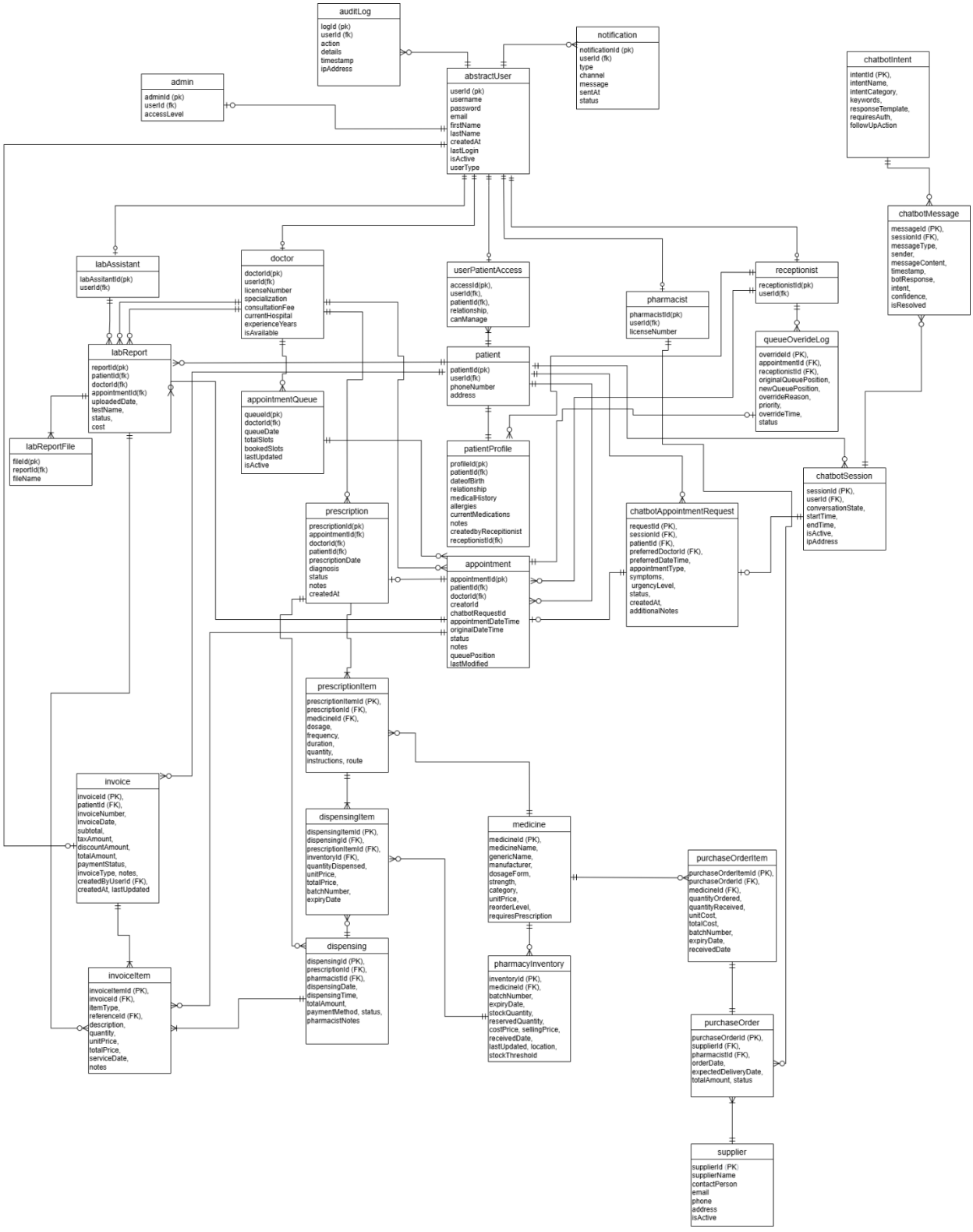
ADM-01: Manage User Accounts Sequence Diagram



ADM-02: View System Logs & Reports Sequence Diagram



3.8 Relational Data Model for Proposed System



3.9 User Interface Design for Proposed System

https://www.figma.com/design/elMiXaFCXda7RNJlCKjqU5/Healthcare-appointment-booking-app-ui-kit--Community-?node-id=0-1&t=VR1Ylxch0TS795Gt-1

https://www.figma.com/proto/elMiXaFCXda7RNJlCKjqU5/Healthcare-appointment-booking-app-ui-kit--Community-?node-id=2071-487&p=f&t=bxjEJmXtmKbUSNJZ-1&scaling=scale-down&content-scaling=fixed&page-id=0%3A1&starting-point-node-id=2186%3A514