



SCS2202 INTERIM REPORT



CS GROUP 11

Table of Contents

| | | |
|----------|--------------------------------------|-----------|
| 1 | Introduction | 4 |
| 1.1 | Domain description | |
| 1.2 | Current System & Limitations | |
| 1.3 | Goals & Objectives | |
| 1.3.1 | System Goals | |
| 1.3.2 | Objectives | |
| 1.4 | Assumptions | |
| 2 | Feasibility Study | 7 |
| 2.1 | Social Feasibility..... | |
| 2.2 | Technical Feasibility..... | |
| 2.3 | Economic Feasibility..... | |
| 2.4 | Legal Feasibility..... | |
| 2.5 | Operational Feasibility..... | |
| 3 | Requirements | 11 |
| 3.1 | Stakeholders | |
| 3.2 | Functional Requirements | |
| 3.2.1 | Functionalities of the Patient | |
| 3.2.2 | Functionalities of the Doctor | |
| 3.2.3 | Functionalities of the Clerk | |
| 3.3 | Quality Attributes | |
| 3.3.1 | Security | |
| 3.3.2 | Legal Compliance | |
| 3.3.3 | Usability | |
| 3.3.4 | Reliability | |
| 3.3.5 | Scalability and Performance | |
| 3.4 | In-scope | |
| 3.5 | Out-scope | |
| 3.6 | Constraints and Limitations | |

| | |
|---|-----------|
| 4 Proposed System's Architecture | 16 |
| 4.1 Component Interactions (Component diagram) | |
| 4.2 Components & Functionalities | |
| 5 System Design Diagrams | 24 |
| 5.1 Use case diagrams | |
| 5.1.1 Guest/Registered User | |
| 5.1.2 Patient | |
| 5.1.3 Hospital User | |
| 5.1.4 Insurance Agent | |
| 5.1.5 Doctor | |
| 5.2 Class diagram | |
| 5.3 ER diagrams | |
| 5.4 Activity diagrams | |
| 6 Current progress | 66 |
| 6.1 Progress Analysis against System Requirements | |
| 6.2 Current System Completion Percentage | |
| 6.3 Remaining Tasks & Work Items | |
| 6.4 Team Member Contributions & Responsibilities | |

1 Introduction

1.1 Domain description

Introducing E-care Digital Health Management system, a revolutionary web application to manage all your healthcare needs. Appointment handling, Medical document managing, and Health insurance are now all in one platform.

In the rapidly evolving landscape of healthcare, efficiency, accuracy, and accessibility are paramount. To address these needs, we are developing a comprehensive healthcare management system designed to optimize and virtualize, and integrate diverse functionalities into a unified, scalable, and secure platform.

The system will be used to integrate the above-mentioned processes of a hospital chain/network regarding patients, doctors, etc. The hospital network may have its own laboratories, surgical hospitals, and other medical centers.

1.2 Current System & Limitations

- Current digital health management systems often lack integration between different functionalities, requiring separate platforms for appointment scheduling, medical record management, and insurance handling.
- Many existing systems are not accessible across devices or rely on on-premises software, making it difficult for users to access information remotely.
- Most systems focus on administrative efficiency rather than patient-centric features like easy access to medical documents, personalized appointment management, or streamlined communication with doctors.
- Despite being digital, several systems still rely on manual processes for tasks like claim verification and file uploads, leading to delays and errors.
- Many systems fail to integrate seamlessly with external systems, such as insurance providers or payment gateways.
- Existing solutions often struggle to adapt to the growing needs of larger hospital networks or multi-location facilities.
- Insufficient focus on data protection leads to vulnerabilities, risking sensitive medical and personal information.
- Complex and non-intuitive interfaces make it challenging for patients and medical staff to use the system efficiently.
- Critical updates, such as test results or schedule changes, are often not delivered in real time, impacting decision-making and user experience.

1.3 Goals & Objectives

The goal of this Health Management System project is to streamline hospital operations such as appointment scheduling and health insurance claims to improve the overall efficiency of healthcare delivery through a user friendly, integrated platform.

1.3.1 System Goals

The goal of this Health Management System project is to streamline hospital operations such as appointment scheduling and health insurance claims to improve the overall efficiency of healthcare delivery through a user friendly, integrated platform.

The web application will allow patients to interact with any branch of the corresponding hospital network, doctors to manage their past(since the implementation of the system) and current patients through the system and patients to file their insurance claims with the insurance companies registered with the hospital network(if applicable).

Below are some generalized points regarding the project;

- Optimize and virtualize consultation processes.
- Improve patient experience.
- Ensure secure and seamless access to medical information for both patients and other concerned healthcare providers.
- Allow patients to handle their medical processes in a centralized environment.

1.3.2 Objectives

- Provide an interface for patients to channel doctors who are employed within the corresponding hospital network.
- Allow Doctors to manage their patients, appointments and schedules.
- Provide a facility for patients to view their medical documents(lab reports, scans, medical reports, bills) and manage them accordingly.
- Provide a facility for patients to file insurance claims through the system making the process more convenient for patients.
- Provide the ability for patients to interact with any branch belonging to the hospital network.

1.4 Assumptions

- Cashless Insurance Claims
 - Cashless-type insurance claims are out of scope for the system and will be handled externally by hospitals and insurance companies, following current industry methods.
- Existing Hospital Systems
 - The hospital network already has systems in place for processes outside the scope of this system, such as billing, claim handling, employee management, and revenue management.

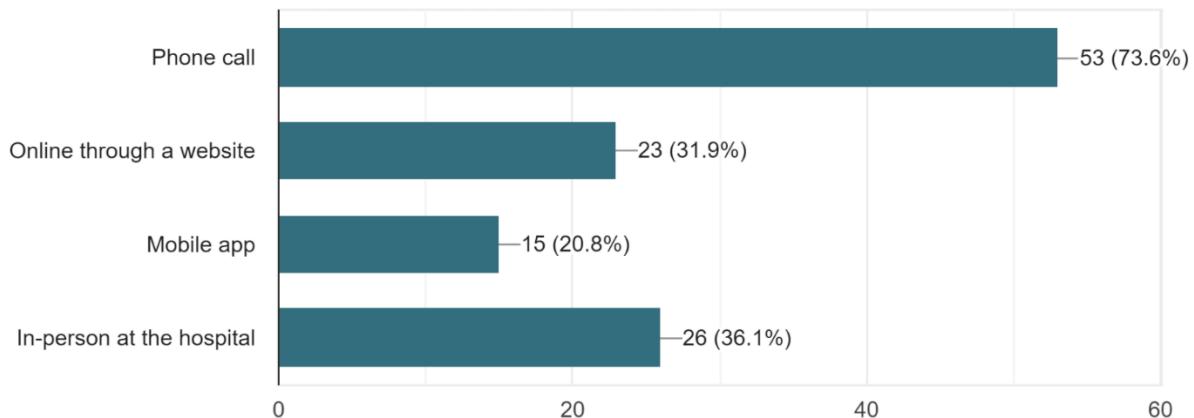
2 Feasibility Study

2.1 Social Feasibility

- The system has a high potential for acceptance among patients and healthcare providers due to the increased convenience and efficiency in accessing and managing healthcare services.
- The system provides enhanced patient engagement and satisfaction due to easier appointment scheduling, better access to medical records, and improved communication with doctors.
- Below shown are some of the information we've collected by conducting a survey of 72 individuals;
 - The following diagrams show methods currently used by potential

How do you currently book, reschedule, or cancel appointments?

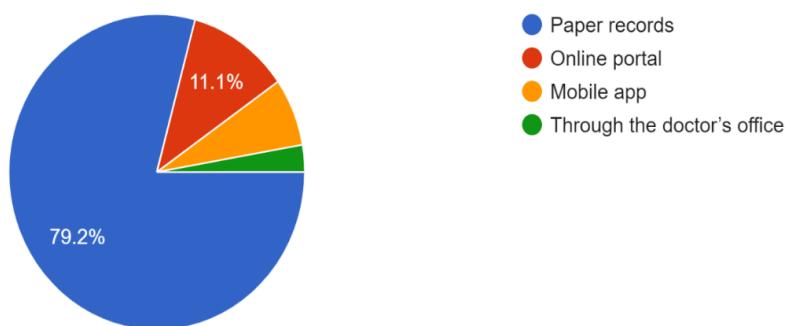
72 responses



users of the system to manage appointments and medical records.

How do you access your medical history and records currently?

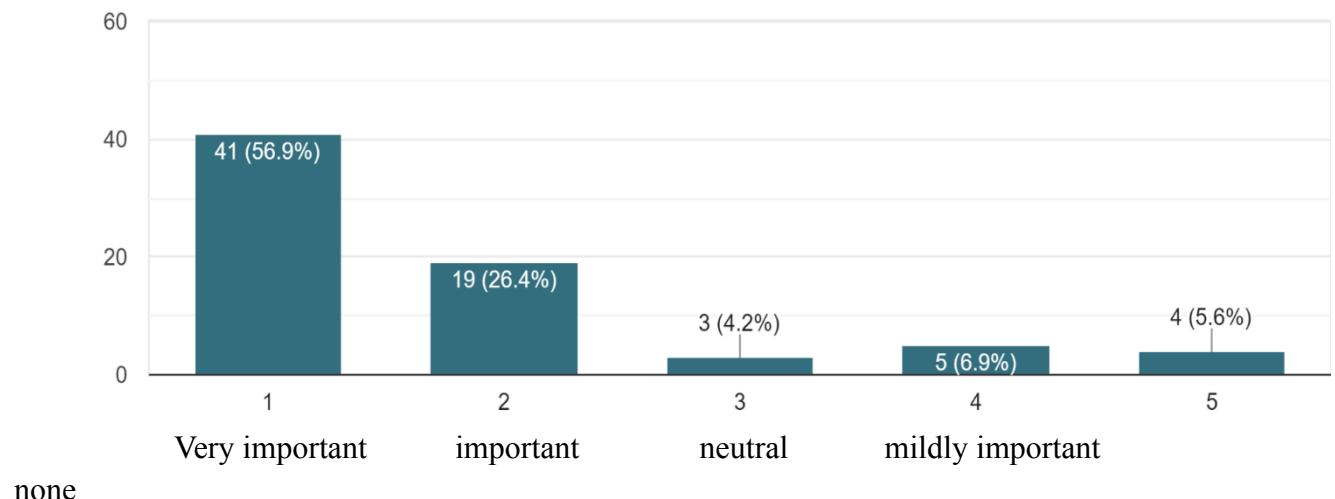
72 responses



- The diagram below shows the importance users depicted regarding making online appointments.

How important is it for you to book medical appointments online?

72 responses



- According to the information gathered through the conducted survey we have found that this system would fulfill the current needs of prospective users while maintaining a user-friendly environment allowing users to seamlessly manage their regular hospital-related proceedings.

[Click here](#) to review responses.

2.2 Technical Feasibility

- The main deliverable of this project is a working web application that allows users to easily fulfill their relevant needs and requirements.
- Utilization of reliable and scalable technologies which will be used for this project will ensure seamless integration and performance corresponding with our system functionalities.
 - Figma/Canva for UI
 - GitHub for collaboration and as a version control tool.
 - Trello as a project management tool to integrate the work done by the development team.
 - PHP for the back end of the web application.
- We have gathered a skilled and reliable development team which has carried out the required research regarding this field to go forward with the development of a reliable system which will fulfill the required needs.

2.3 Economic Feasibility

- For this project, the team will use free and open source software for the development process which in turn is cost effective and since the team will not be making any profits from this, the development of the project is technically cost free.
- There will however be a cost to acquire a web domain to host this web application.
- The system will be free for the users as it will be a service provided by the hospital network.
- The maintenance of the system done by hospital employees will not incur an extra cost because there is no need to hire new employees.

2.4 Legal Feasibility

- Policies and technical safeguards to comply with the Personal Data Protection Act will be followed throughout.
 - Upon sign up, we will inform patients about their rights and how their health information will be used and disclosed.
 - We will allow patients to access and obtain a copy of their health records providing user transparency.
 - Patients also have the right to request restrictions on certain uses and disclosures of their information (Patients can manage their profiles to allow which information can be viewed there by protecting patients' rights and privacy.).
- The documents uploaded to the patients' profiles by the hospital will be used when patients file insurance claims. The authenticity of these documents will be guaranteed by the hospital through a Memorandum of Understanding(MOU) with the corresponding insurance company.
- The employees handling the relevant documents(medical bills and other medical documents) will be under legal obligation with the hospital to uphold the authenticity of said documents.

2.5 Operational Feasibility

- A stable internet connection is required to use the web application without issue.
- A basic understanding of IT and the usage of the internet is required for anyone who uses the system.

3 Requirements

3.1 Stakeholders

3.2 Functional Requirements

- User registration.
 - Records demographic details along with username and password.

- Appointment scheduling.
 - Patients must be able to search for available doctors and hospitals
 - Patients must be able to book doctor appointments
 - The system must provide available time slots for appointments.
 - Patients must be able to pay appointment fees during the booking process.
- Medical record management.
 - Maintains patient's medical history, diagnosis details and prescriptions which were processed and uploaded through the system.
 - Patients must be able to view their medical records/tests/bills and download them at will.
- Filing insurance.
 - Patients must be able to file their insurance claim with their corresponding insurance agent/company and include the relevant documents along with it.
- System management.
 - System admin must be able to manage user accounts and the system as necessary.
- Medical document upload.
 - Relevant clerks must be able to upload patient medical records/bills/tests to patient profiles.

3.2.1 Functionalities of the Patient

- User registration
 - Register with username and password.
 - Provide demographic details during registration.
- Appointment scheduling
 - Search for available doctors and hospitals.
 - Book appointments with doctors.
 - View and select available time slots for appointments.
 - Pay appointment fees during the booking process.

- Medical record management
 - View and download medical records, tests, and bills.
- Filing insurance
 - File insurance claims with the corresponding insurance agent or company.
 - Upload relevant documents to support the claim.

3.2.2 Functionalities of the Doctor

- Appointment management
 - View and manage appointments scheduled by patients.
 - Access patient details related to upcoming appointments.

3.2.3 Functionalities of the Clerk

- Medical document upload
 - Upload patient medical records, bills, and test results to their respective profiles.

3.3 Quality Attributes

3.3.1 Security

- Explanation: Given the sensitivity of healthcare data, the application must incorporate robust security measures to protect patient information from unauthorized access and other security breaches.
- Implementation: Implement strong encryption for data storage and transmission and incorporate password hashing to ensure proper security.

3.3.2 Legal Compliance

- Explanation: Adherence to legal and regulatory standards is essential in healthcare to ensure patient safety and avoid legal repercussions.

- Implementation: Make sure to research and comply with healthcare regulations such as the Personal Data Protection Act (PDPA) which will ensure the privacy of user data including healthcare information.

3.3.3 Usability

- Explanation: The application should be interactive and easy to use for all user types.
- Implementation: Design simple and intuitive UI/UX for the system while providing clear instructions to allow users to easily access system features without confusion.

3.3.4 Reliability

- Explanation: The application must be highly reliable, ensuring that users can consistently access the services without unexpected errors. This is critical in healthcare where timely access to services and information can be vital.
- Implementation: Use redundant servers and databases, regular backups, and thorough testing to handle high availability and quick recovery from failures.

3.3.5 Scalability & Performance

- Explanation: The application should be able to handle a growing number of users and data without performance degradation and while responding interactively to user actions providing real-time updates and smooth navigation which is critical in healthcare services.
- Implementation: Optimize code and employ scalable architecture designs such as microservices, use cloud services that can dynamically adjust resources, and optimize database performance.

3.4 In-scope

- Allow users to register to the system and create profiles.
- Allow patients to channel doctors and make appointments and proceed with the relevant payment.
- Allow users to view past and current medical documents.
- Allow patients to file reimbursement type insurance claims through the system(relevant insurance info of the patient will be provided by the patient upon sign up or later on) Patients can attach the relevant medical documents when filing said claims.
- Allow doctors to manage their appointments and schedules.
- Manage content, and upload articles regarding the hospital.

- Allow patients to review the insurance policies of the affiliated insurance companies.

3.5 Out-scope

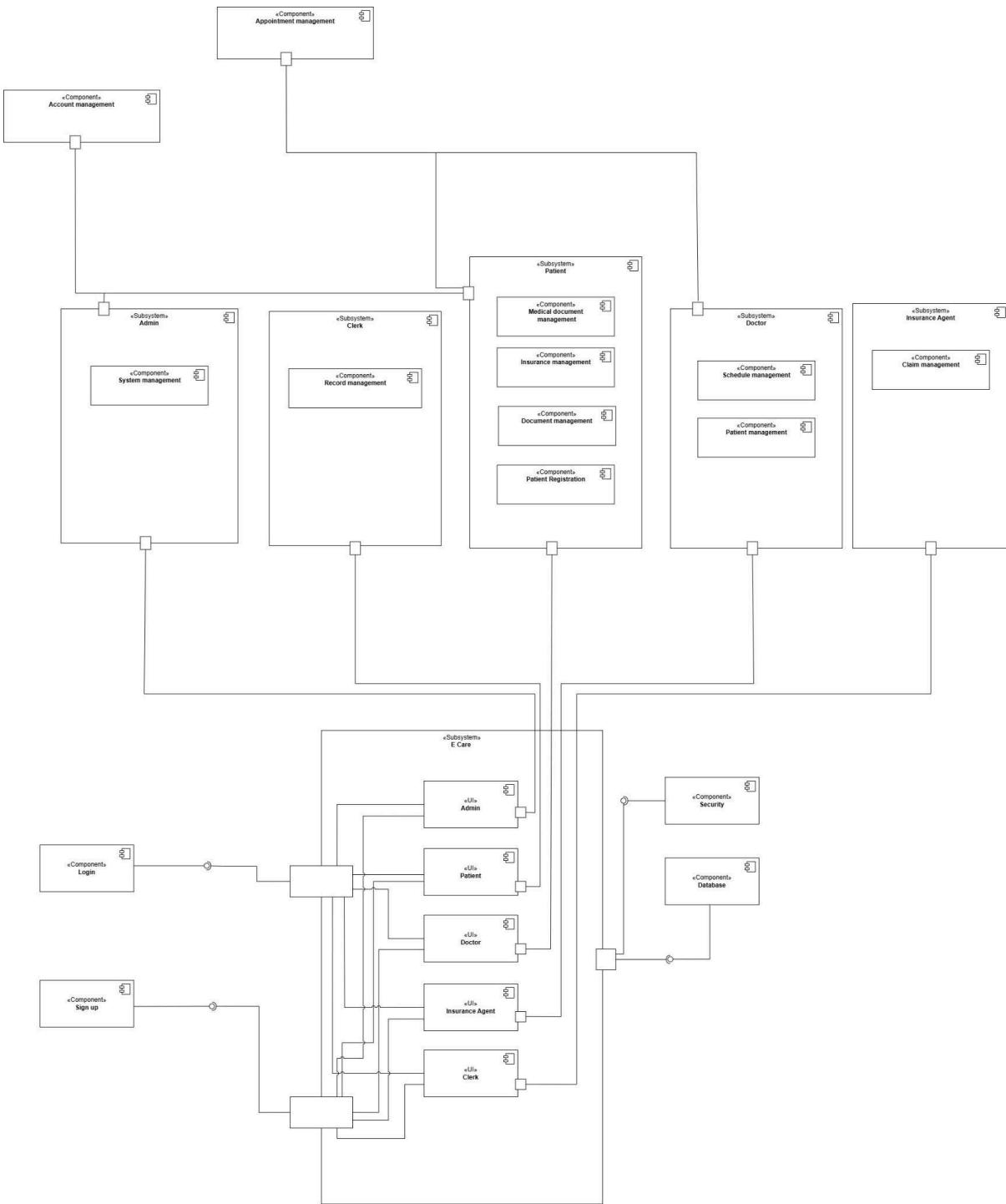
- Medical procedures including surgeries, tests, and scans are done external to the system. Only those relevant documents can be uploaded through the system.
- Bill payments including hospital bills, scans, tests are done physically external to the system.
- Patients signing up for health insurance have to do it on the relevant insurance company's website or any other method.
- Cashless type insurance claims will be handled by the hospital billing department and the insurance sector under a Memorandum of Understanding(MOU).
- The hospital and relevant insurance companies will enter an agreement regarding the processes done within the system. Temporary registration for insurance company profile will be provided by system admin to the agreed upon user on the insurance company's side.

3.6 Constraints & Limitations

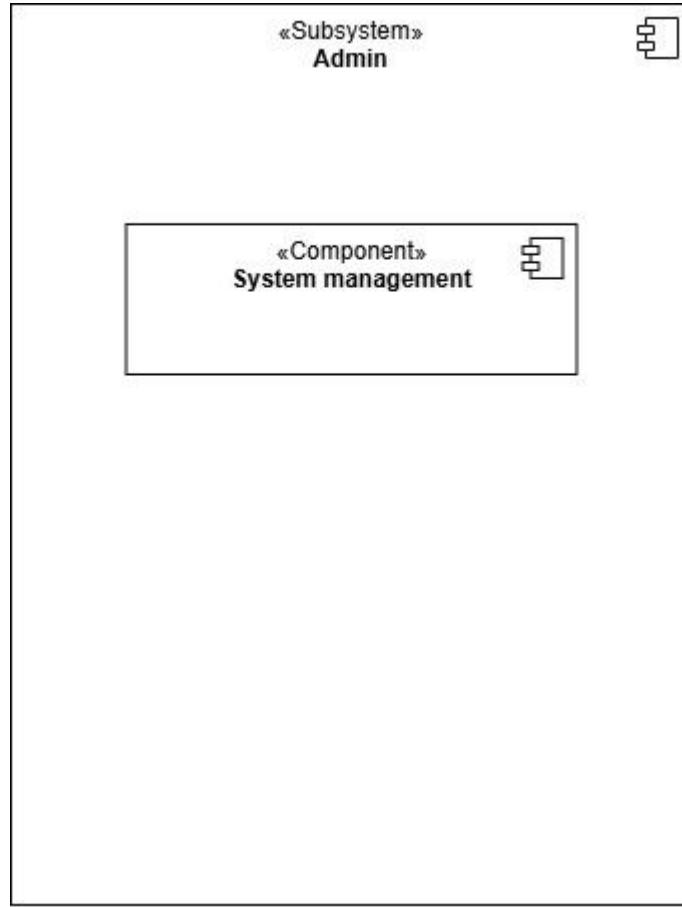
- Appointments
 - Patients can only make appointments with hospitals and doctors within the hospital network.
- Insurance Claims
 - Patients can only deal with insurance companies registered with the system.
 - Only reimbursement-type claims are allowed through the system.
 - Only documents provided by the hospital can be submitted through the insurance claim form.
- Doctor Access
 - Doctors can only view profiles of current patients within the system.

4 Proposed System's Architecture

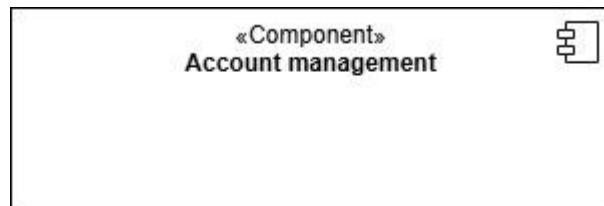
4.1 Component Interactions (Component Diagram)



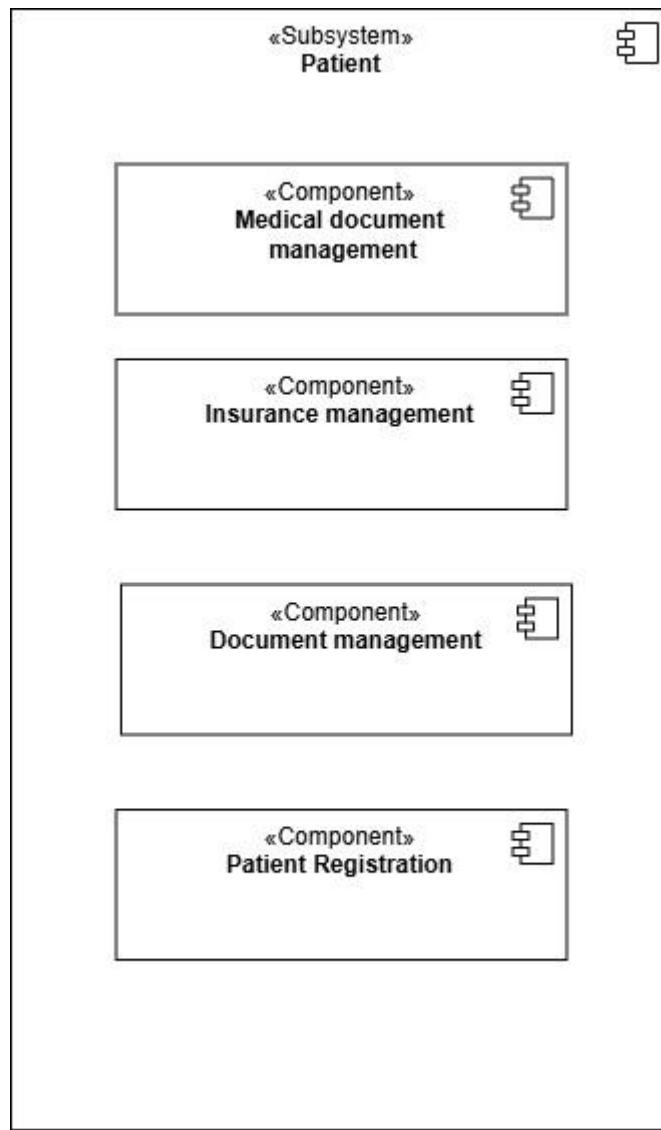
4.2 Components & Functionalities



The System Management component handles the configuration, monitoring, and maintenance of the system, ensuring efficient operations and security. It allows administrators to manage users, enforce policies, and oversee system updates and performance.



The Account Management component is responsible for handling user accounts, including creating, updating, and deleting accounts, managing roles and permissions, and ensuring secure access to the system.



The Patient subsystem focuses on managing patient-related information, services, and interactions within the system.

1. Medical Document Management

This component manages patient medical records, such as diagnosis reports, prescriptions, and treatment histories, ensuring secure storage and easy retrieval.

2. Insurance Management

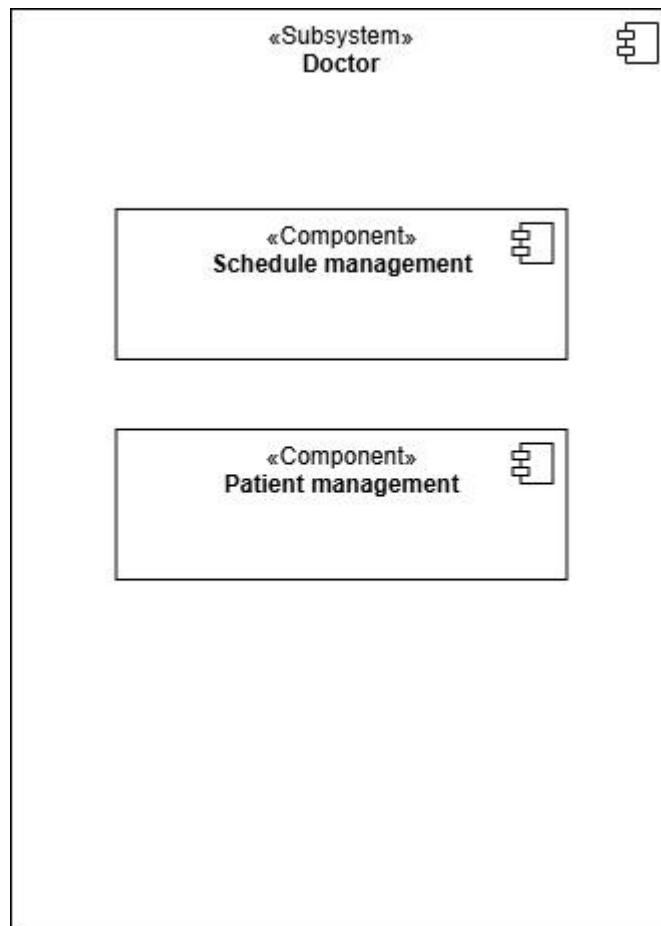
Handles patient insurance details, including policy information, claims processing, and verification of coverage, streamlining insurance-related workflows.

3. Document Management

Manages other non-medical patient documents, such as consent form or identification records, ensuring proper organization and access control.

4. Patient Registration

Facilitates the onboarding process by collecting and storing patient information, such as personal details and contact information, to create or update patient profiles.



The Doctor subsystem focuses on tools and functionalities to assist doctors in managing their schedules, patient interactions, and related tasks efficiently.

1. Schedule Management

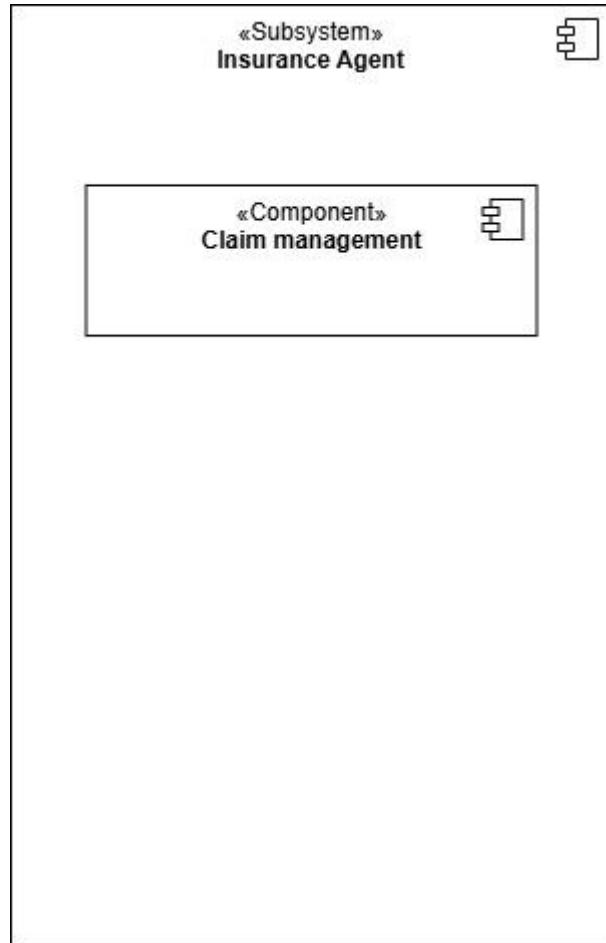
This component allows doctors to manage their appointments, track availability, and organize their daily or weekly schedules, ensuring efficient time management.

2. Patient Management

Handles the management of patient information, enabling doctors to view medical histories, update treatment plans, and track ongoing cases for better patient care.



The Appointment Management component handles the scheduling, rescheduling, and cancellation of appointments between patients and doctors.



This component manages the end-to-end lifecycle of claims, including submission, verification, approval, and tracking. It ensures compliance with policies and streamlines claim resolution for patients and providers.

«Subsystem»
E Care



The E-care subsystem provides the user interface and interaction layer for various stakeholders, enabling seamless access to system functionalities based on their roles.

1. UI - Admin

Allows administrators to manage the system, configure settings, oversee user roles, and monitor overall operations.

2. UI - Patient

Enables patients to view medical records, book appointments, manage insurance details, and access other personal information.

3. UI - Doctor

Provides doctors with tools to manage appointments, view patient medical histories, and update treatment plans.

4. UI - Insurance Agent

Facilitates insurance agents in reviewing claims, verifying policies, and processing reimbursements.

5. UI - Clerk

Supports clerks in handling administrative tasks such as patient registrations, document uploads, and appointment scheduling.



The Login component handles user authentication, allowing secure access to the system by verifying credentials and assigning role-based permissions for various users like Admins, Patients, Doctors, Insurance Agents, and Clerks.



The Sign Up component enables new users to create accounts by providing necessary details and setting up credentials, ensuring secure registration and proper role assignment within the system.



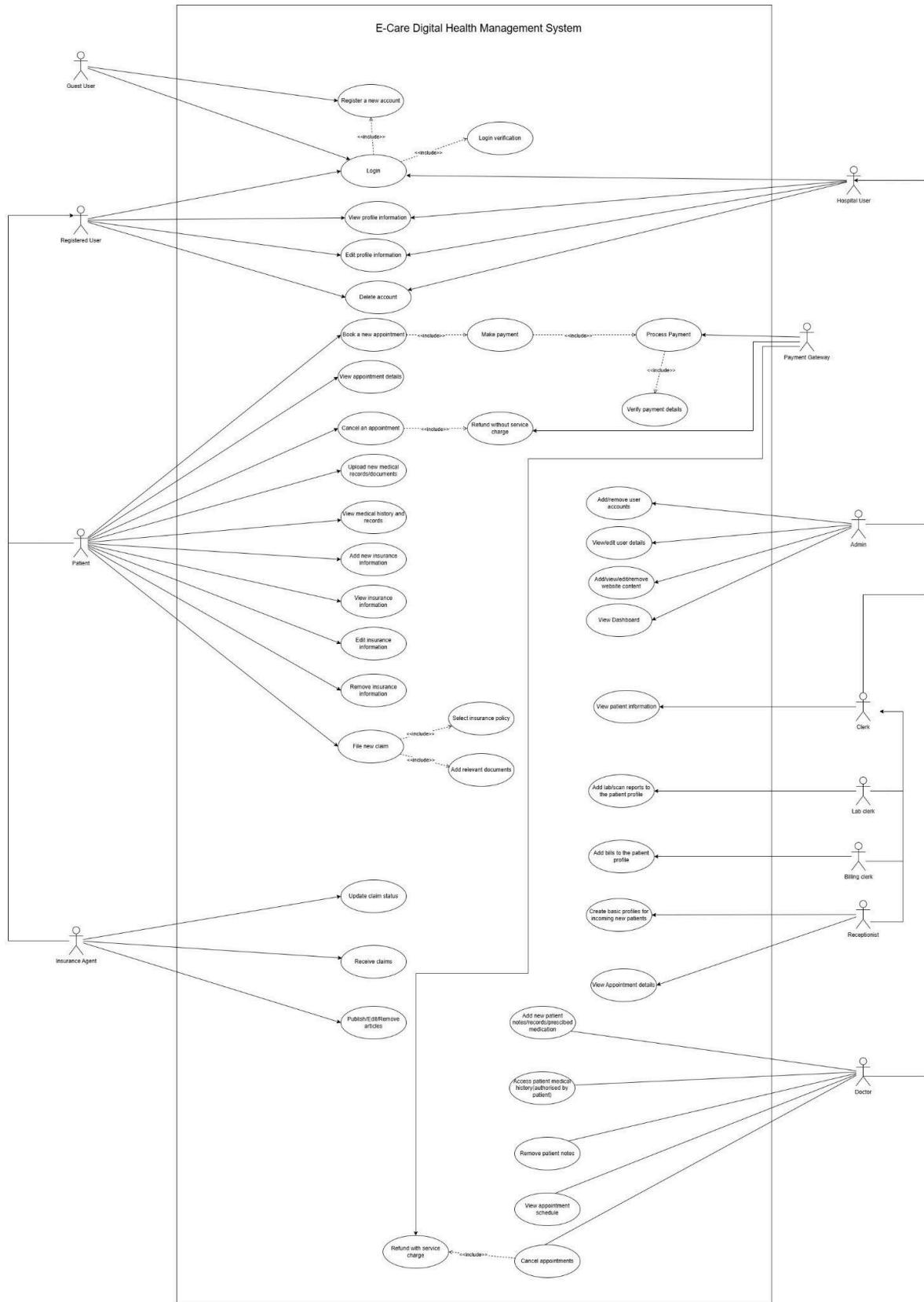
The Security component ensures the protection of system data and user information through features like encryption, authentication, authorization, and activity monitoring, safeguarding against unauthorized access and breaches.



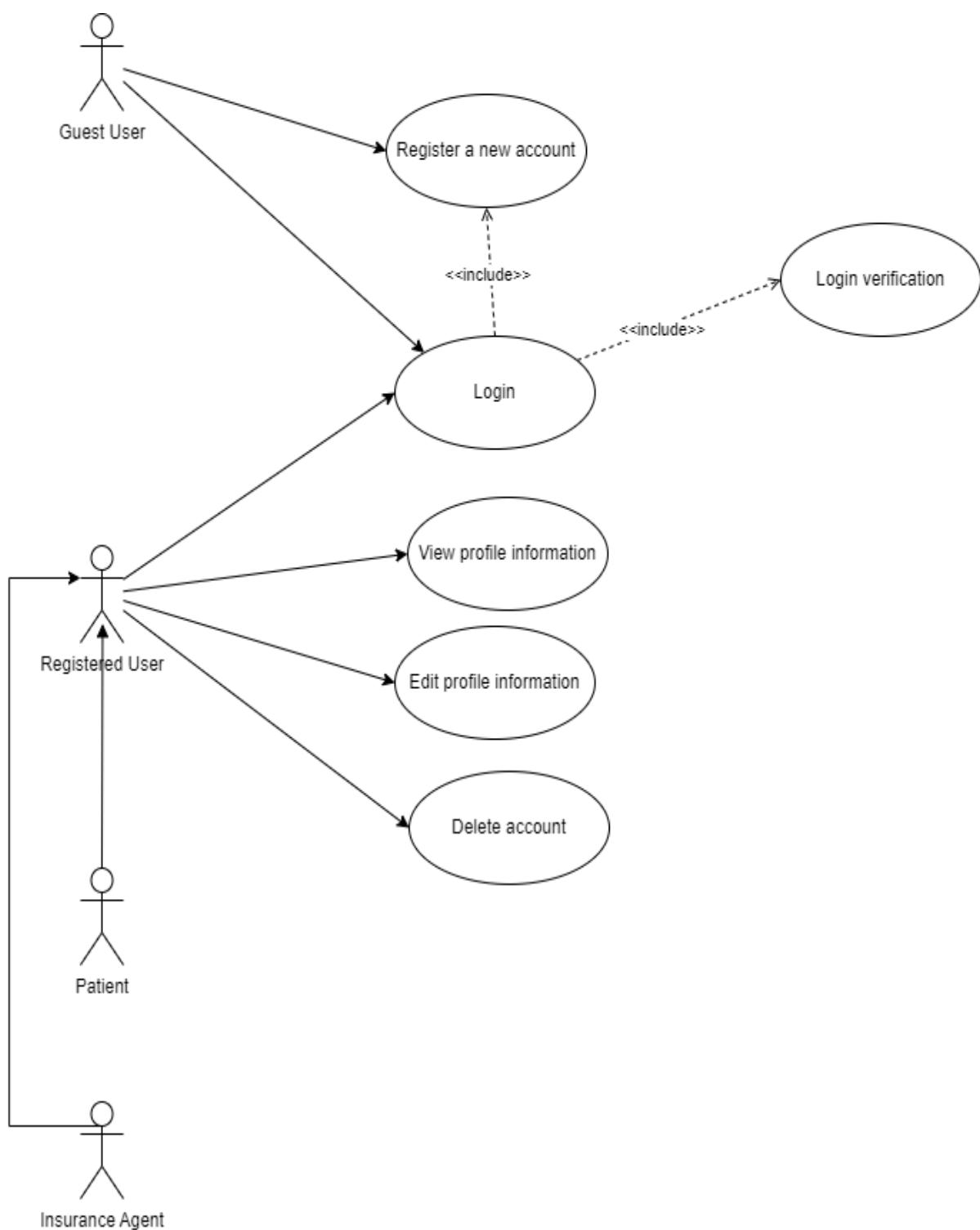
The Database component stores and manages all system data, including user information, medical records, appointments, and claims, ensuring efficient retrieval, scalability, and secure access.

5 System Design Diagrams

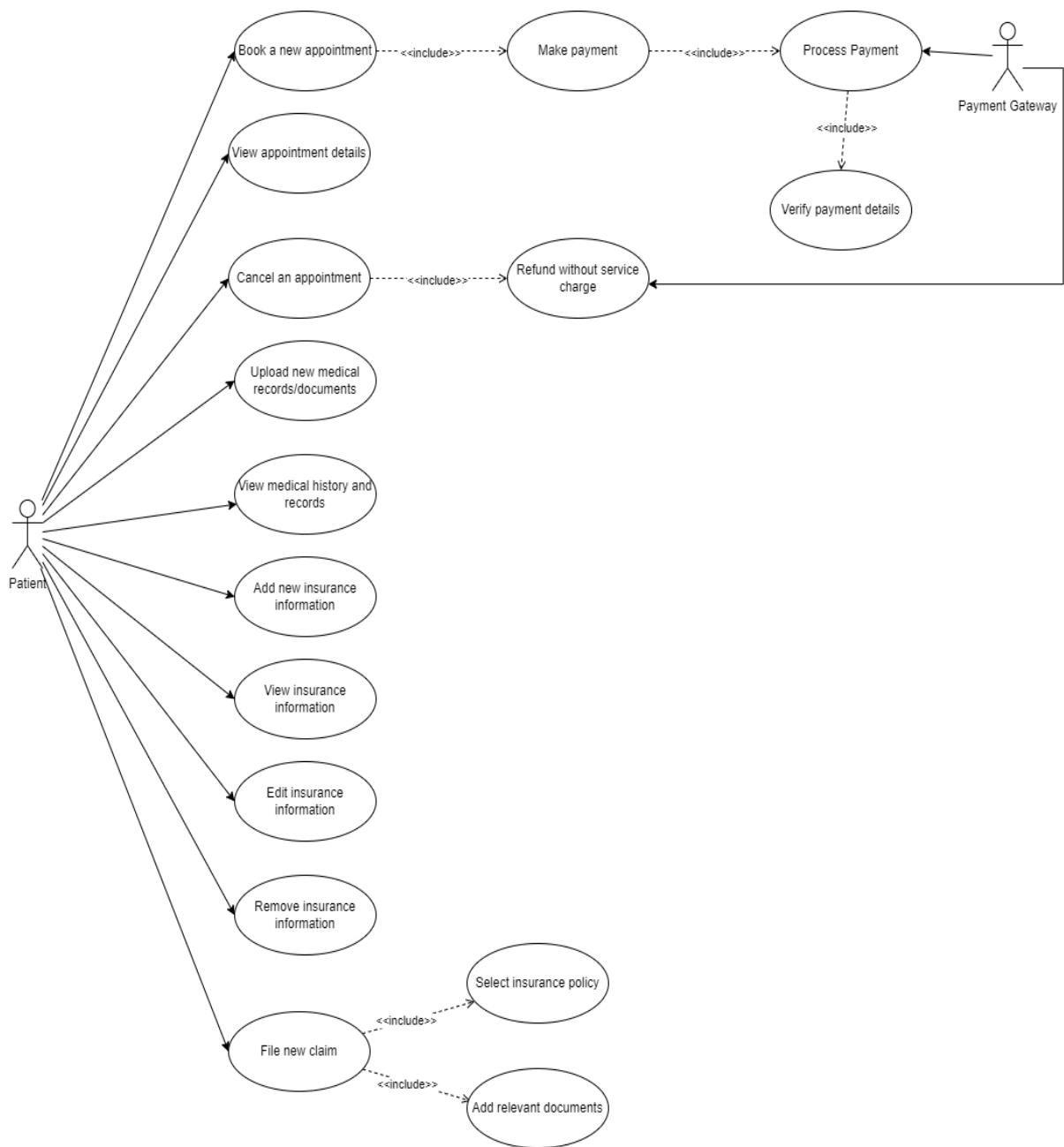
5.1 Use case diagrams



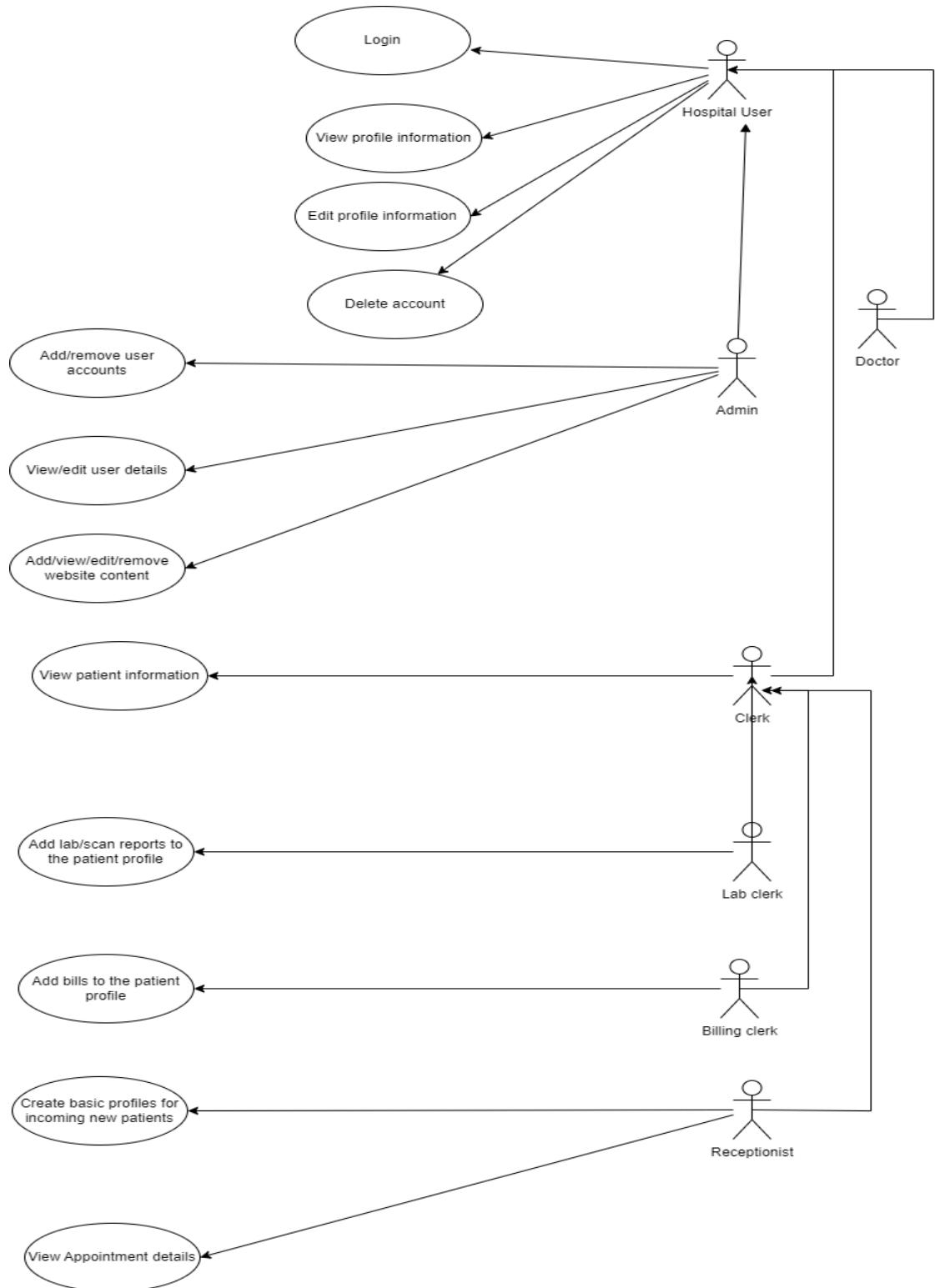
5.1.1 Guest/Registered User



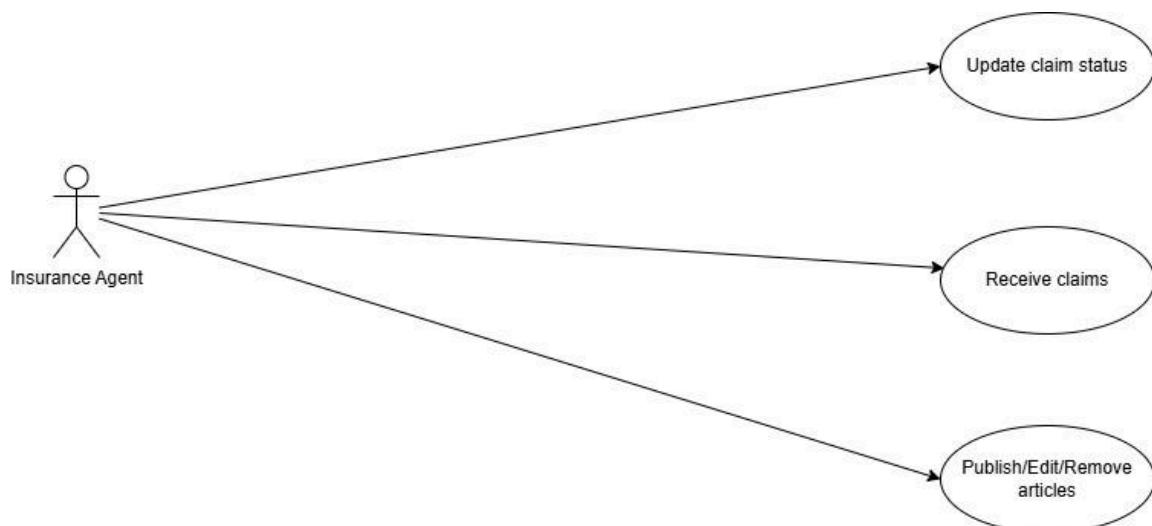
5.1.2 Patient



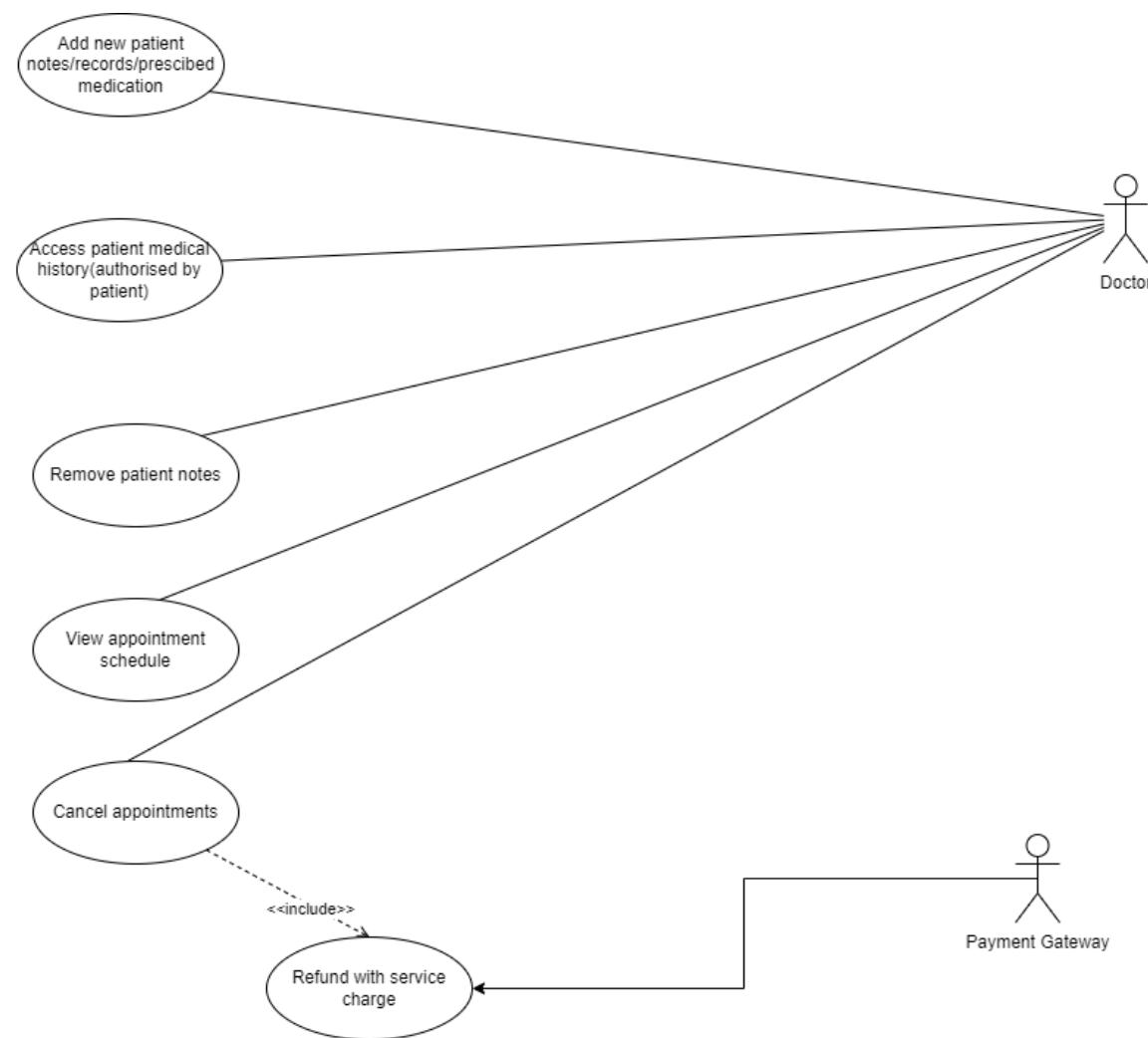
5.1.3 Hospital User



5.1.4 Insurance Agent

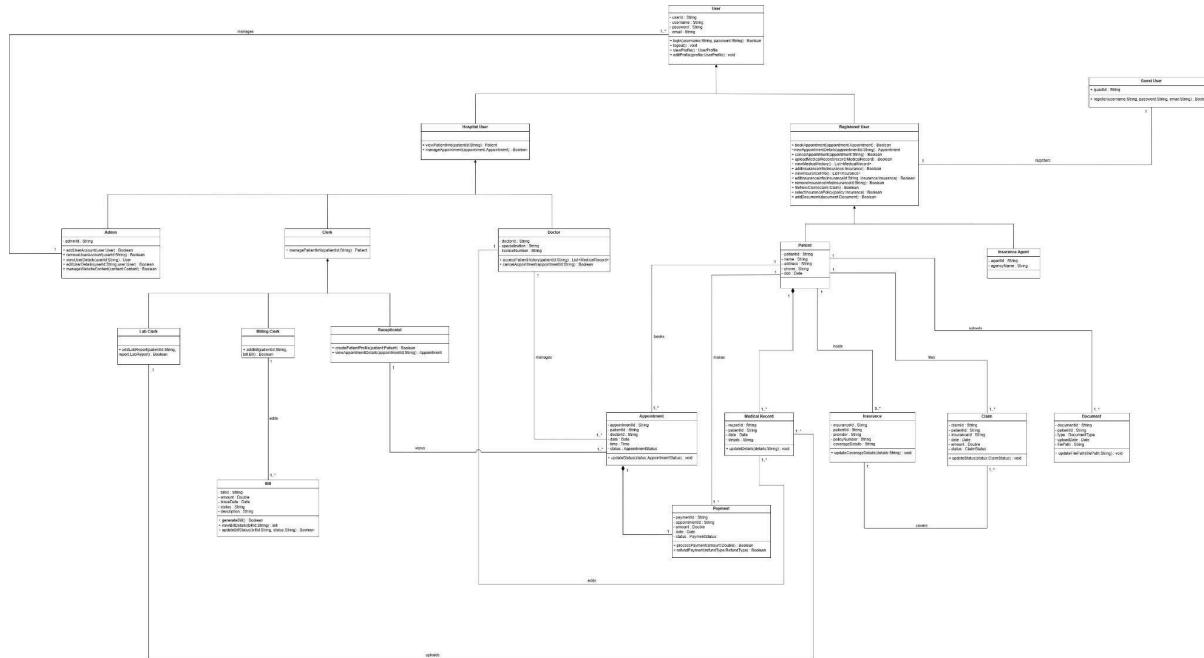


5.1.5 Doctor



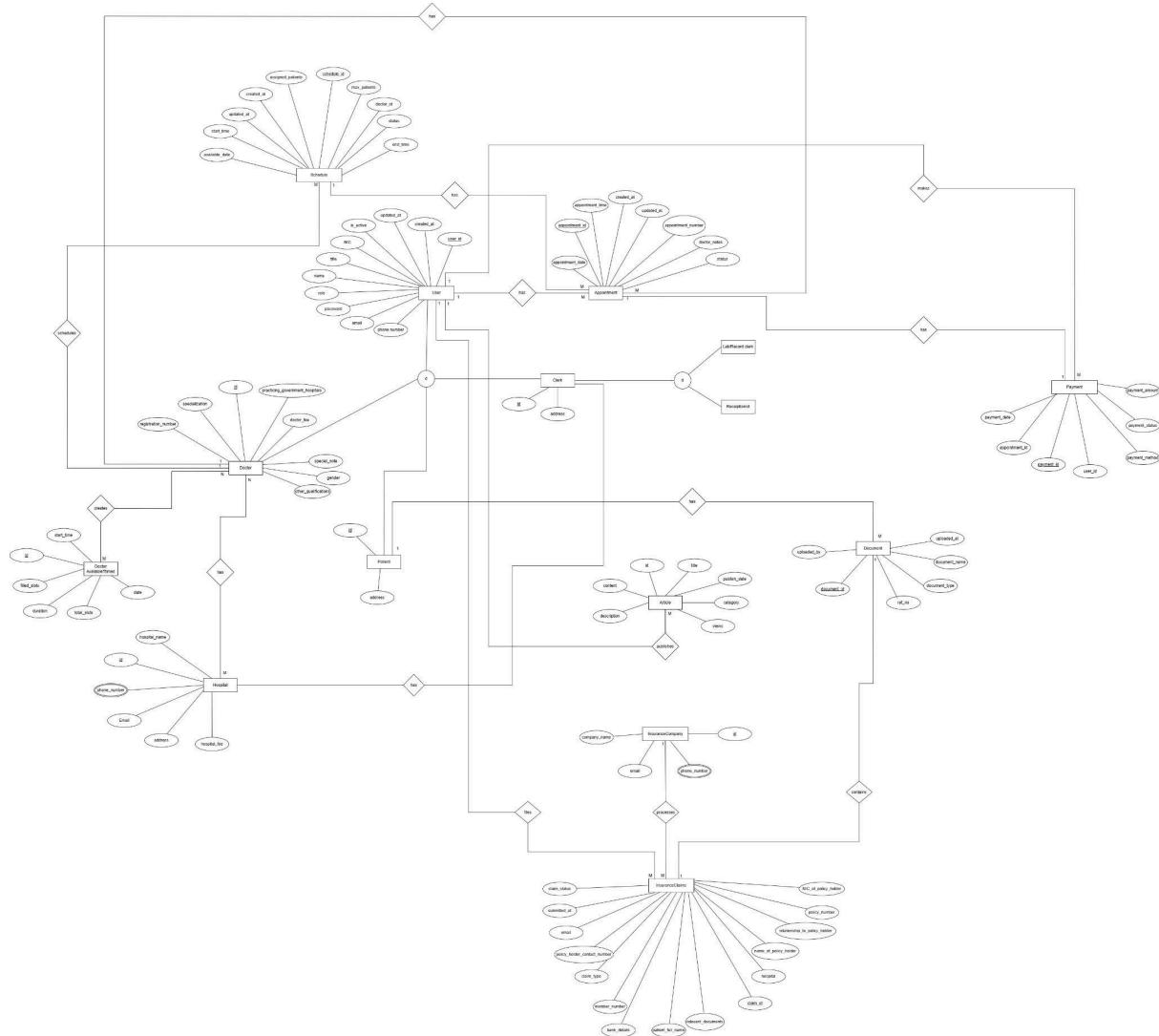
5.2 Class diagram

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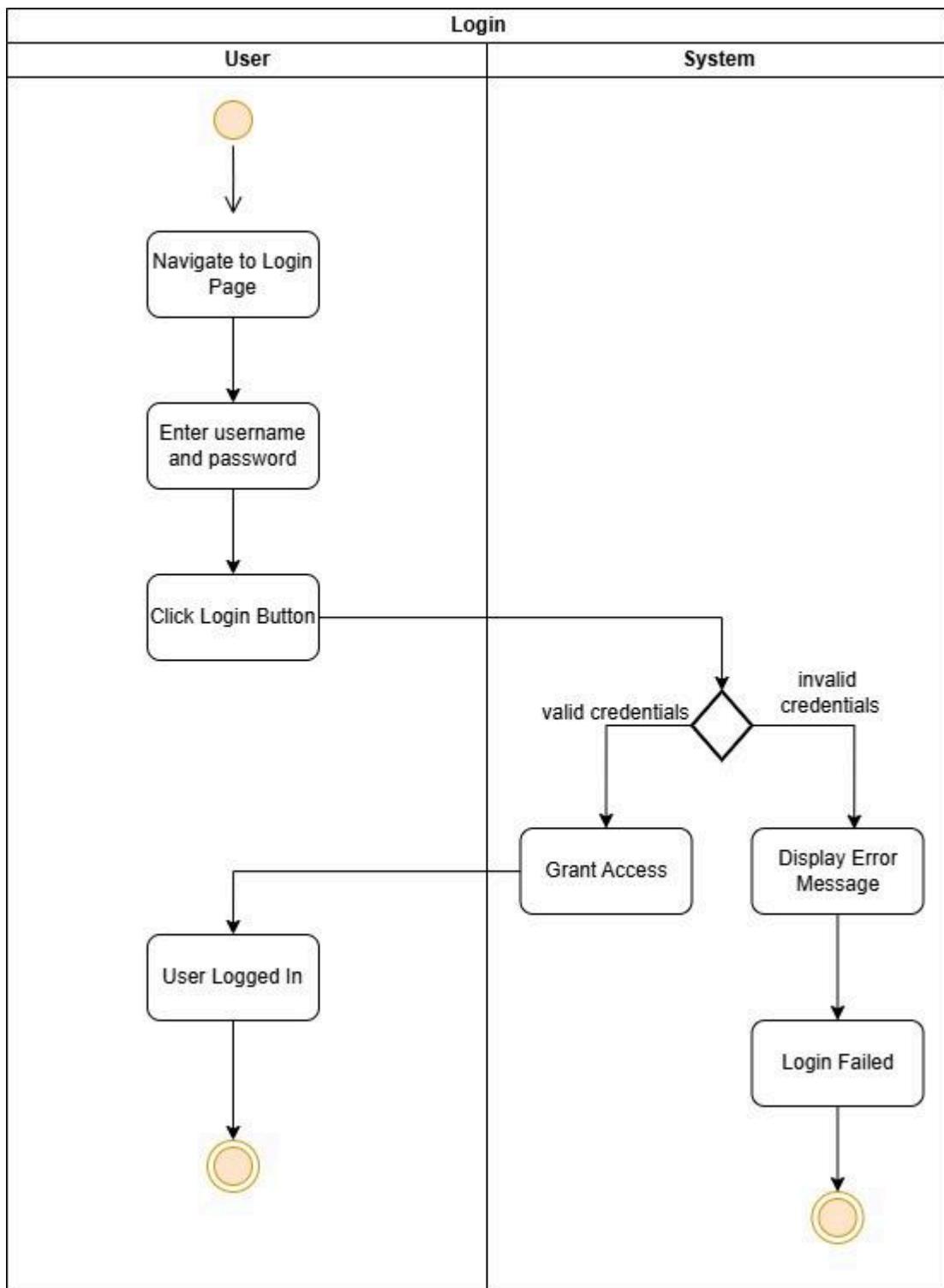


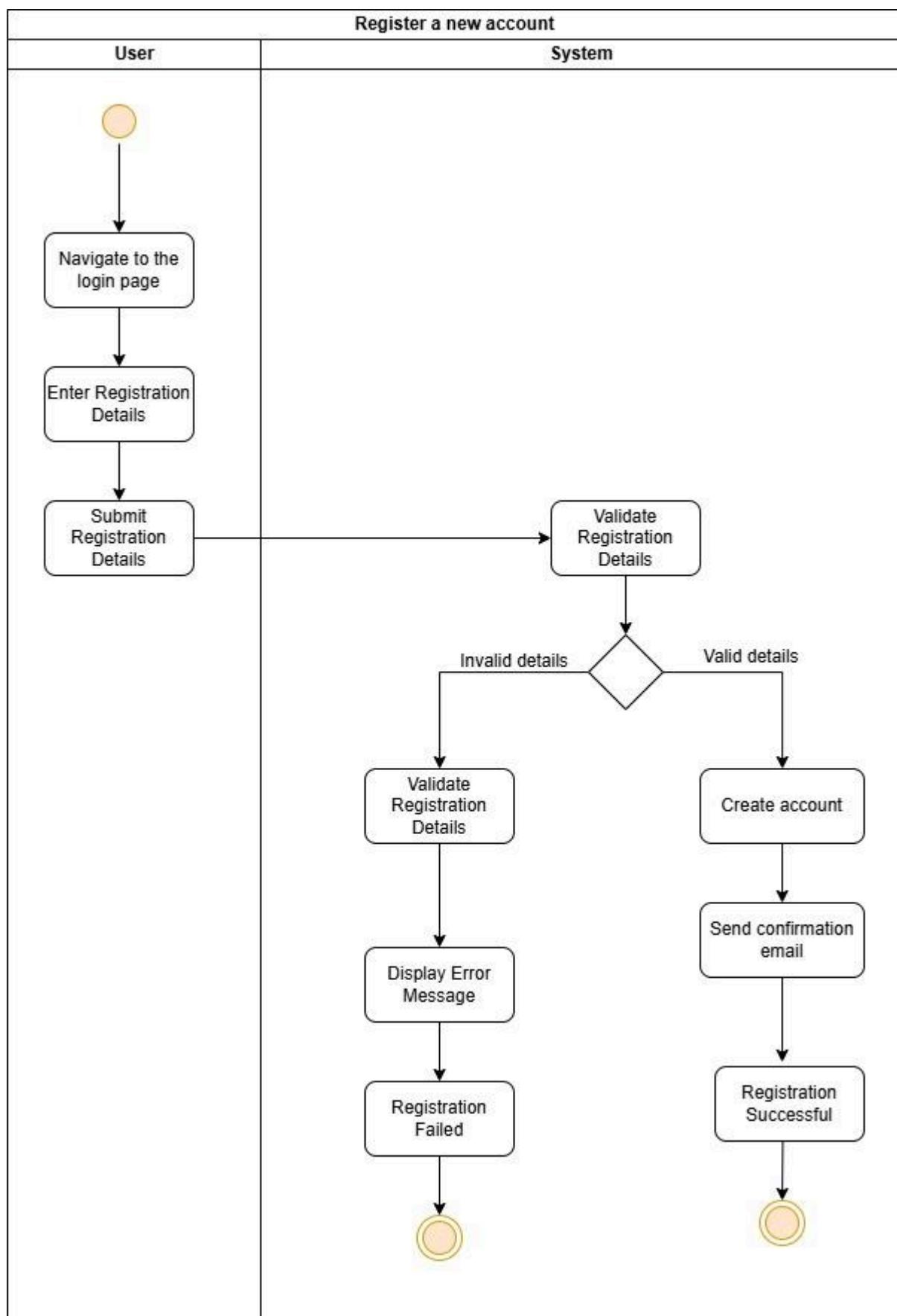
5.3 ER diagram

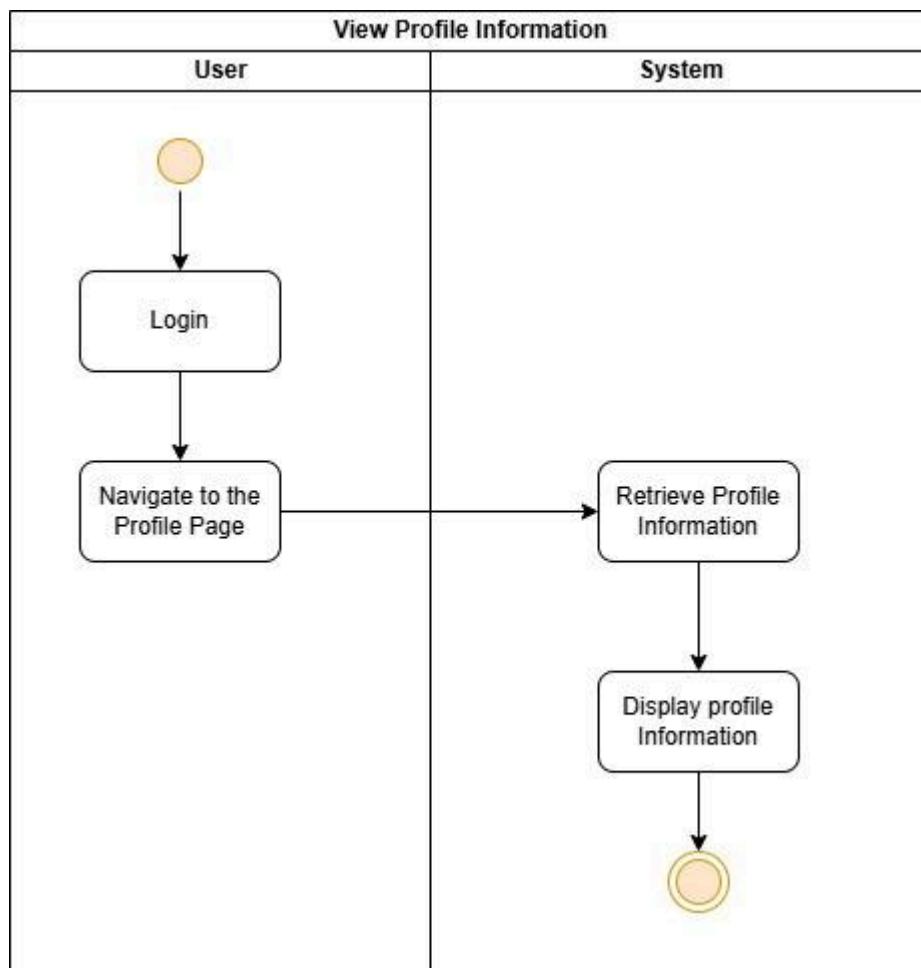
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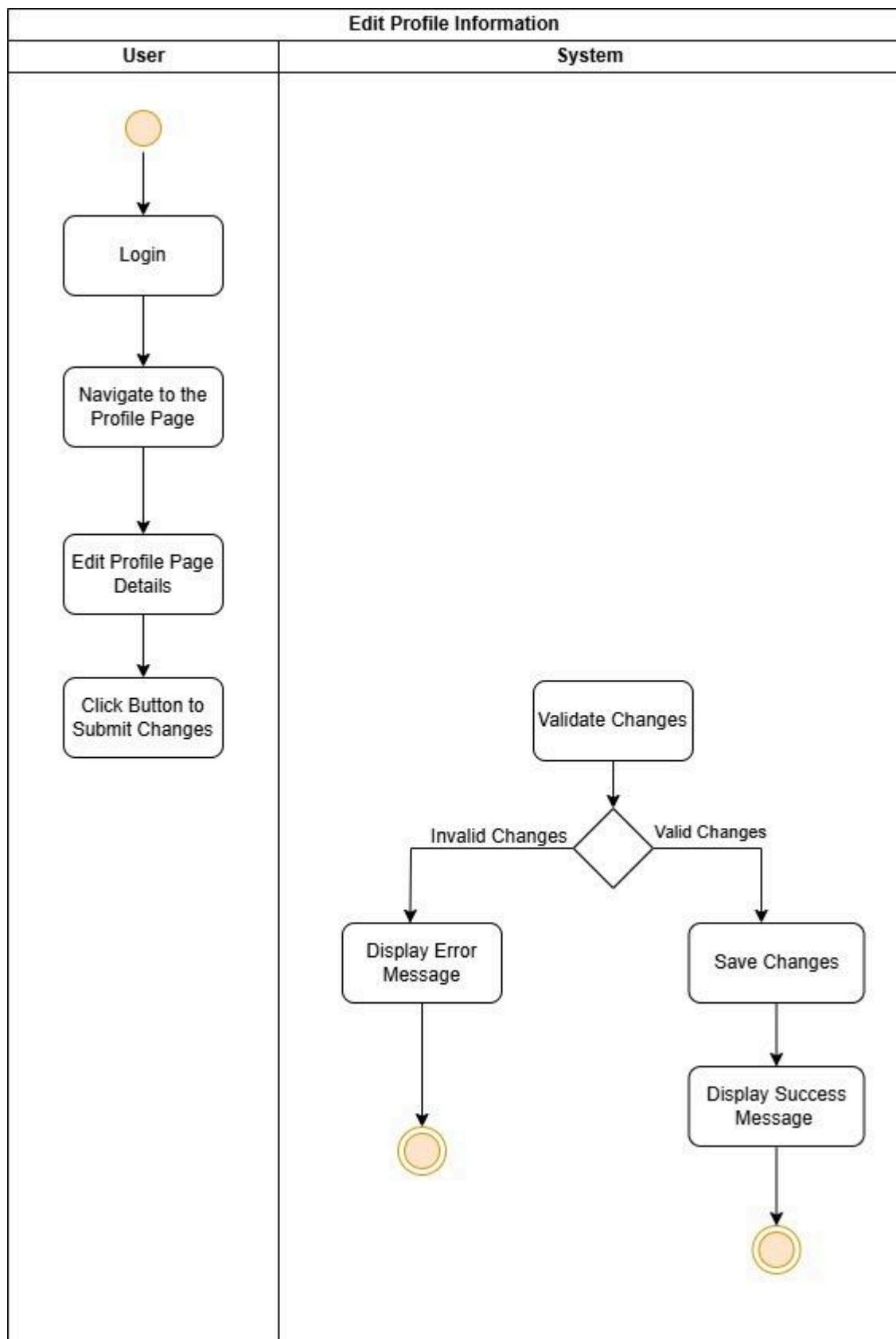


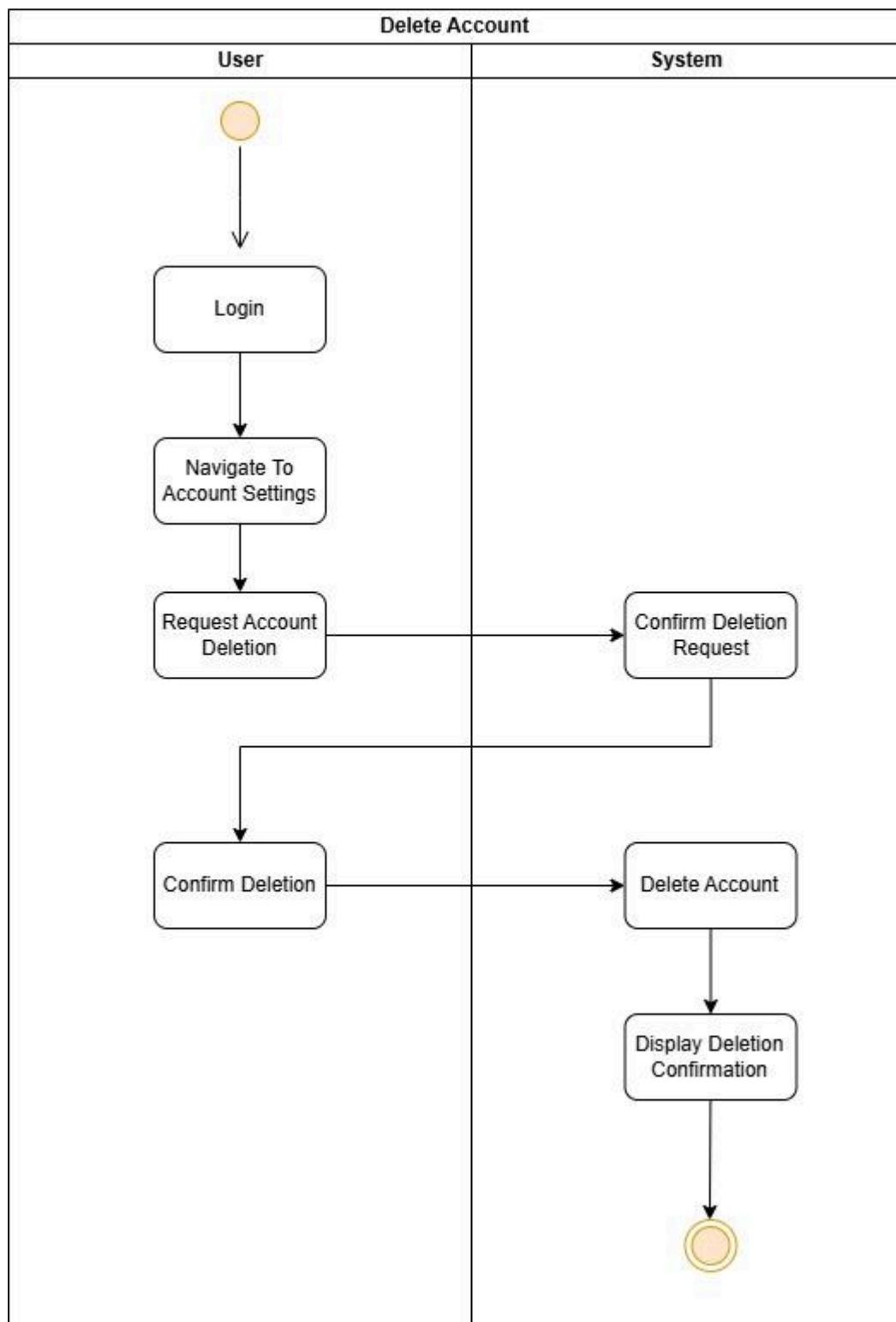
5.4 Activity diagrams

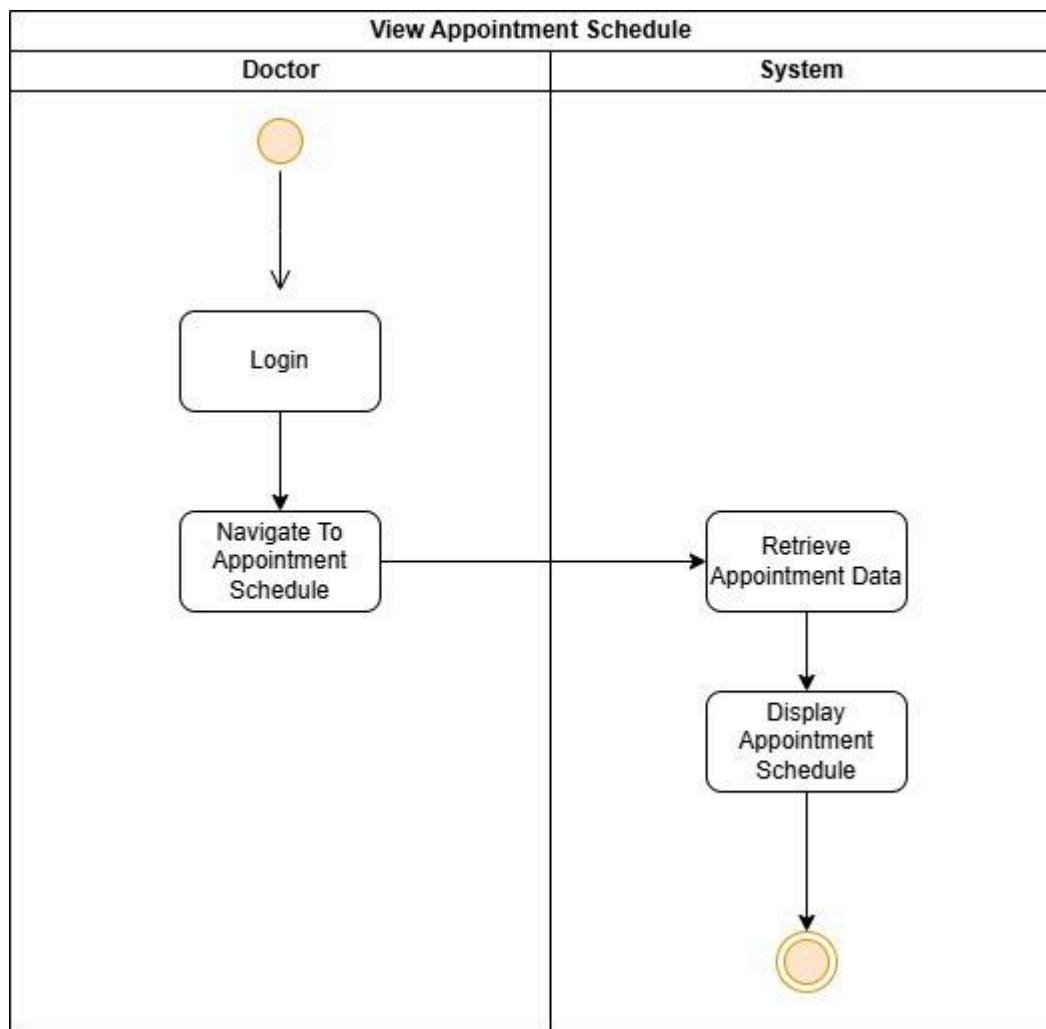


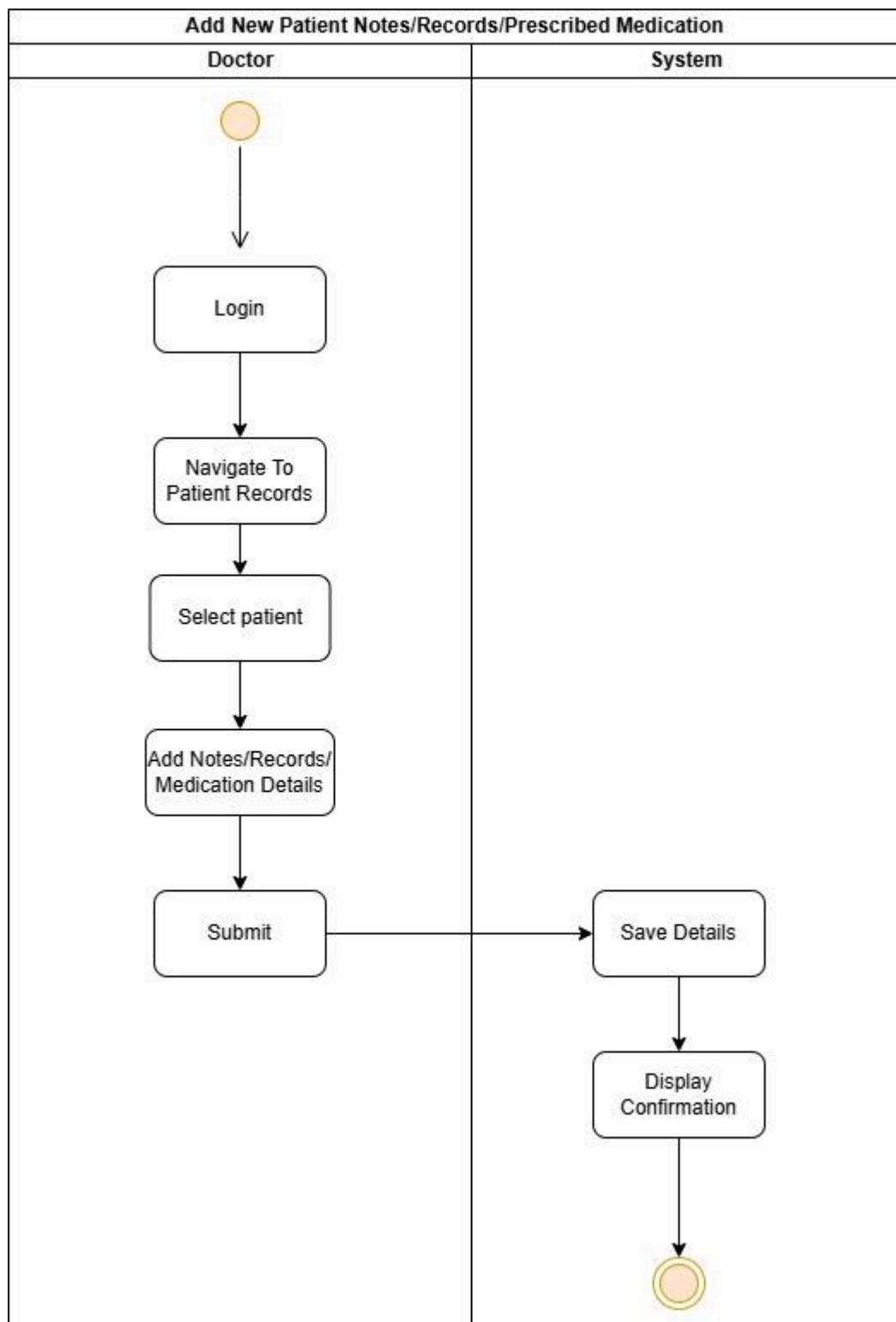


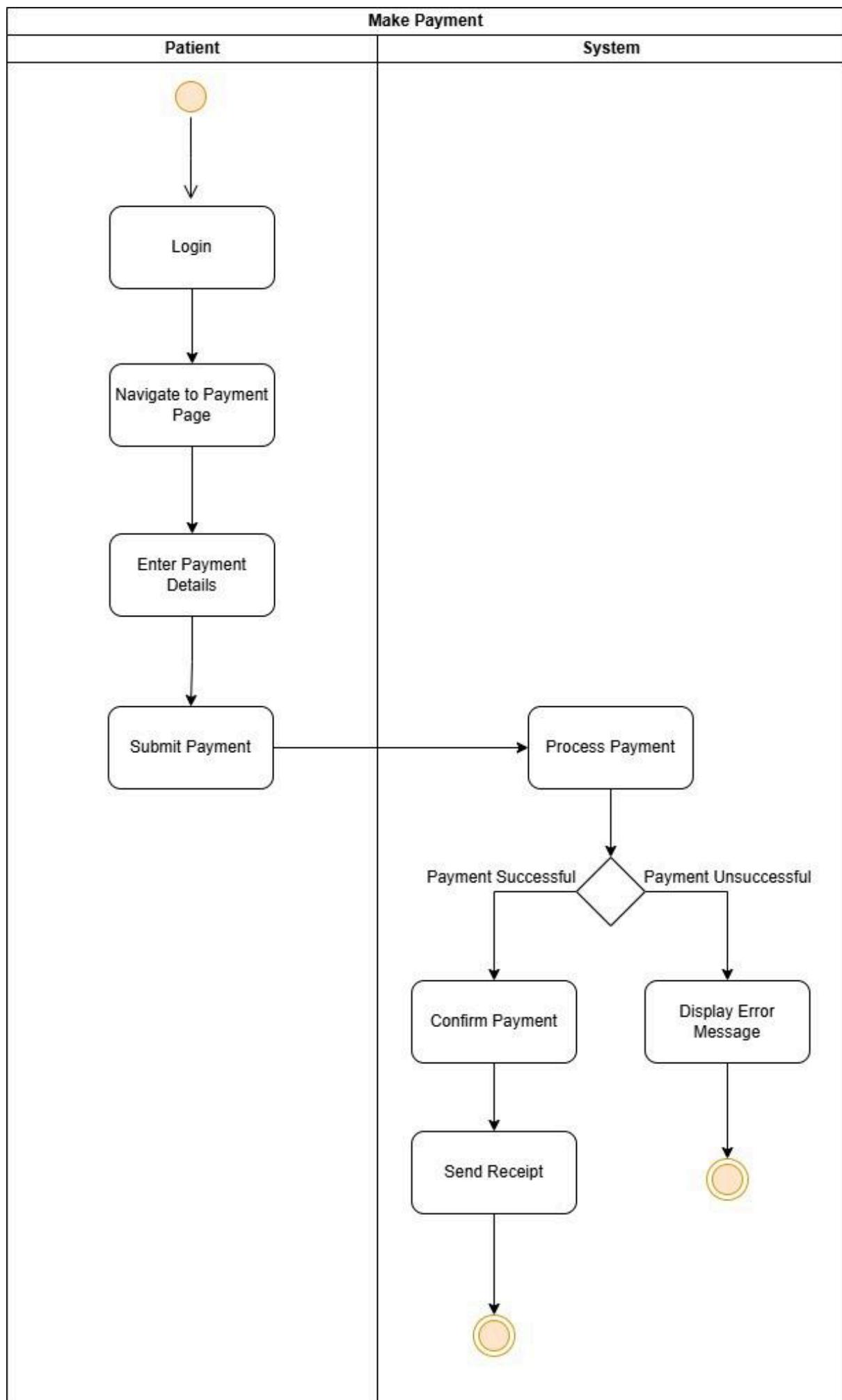


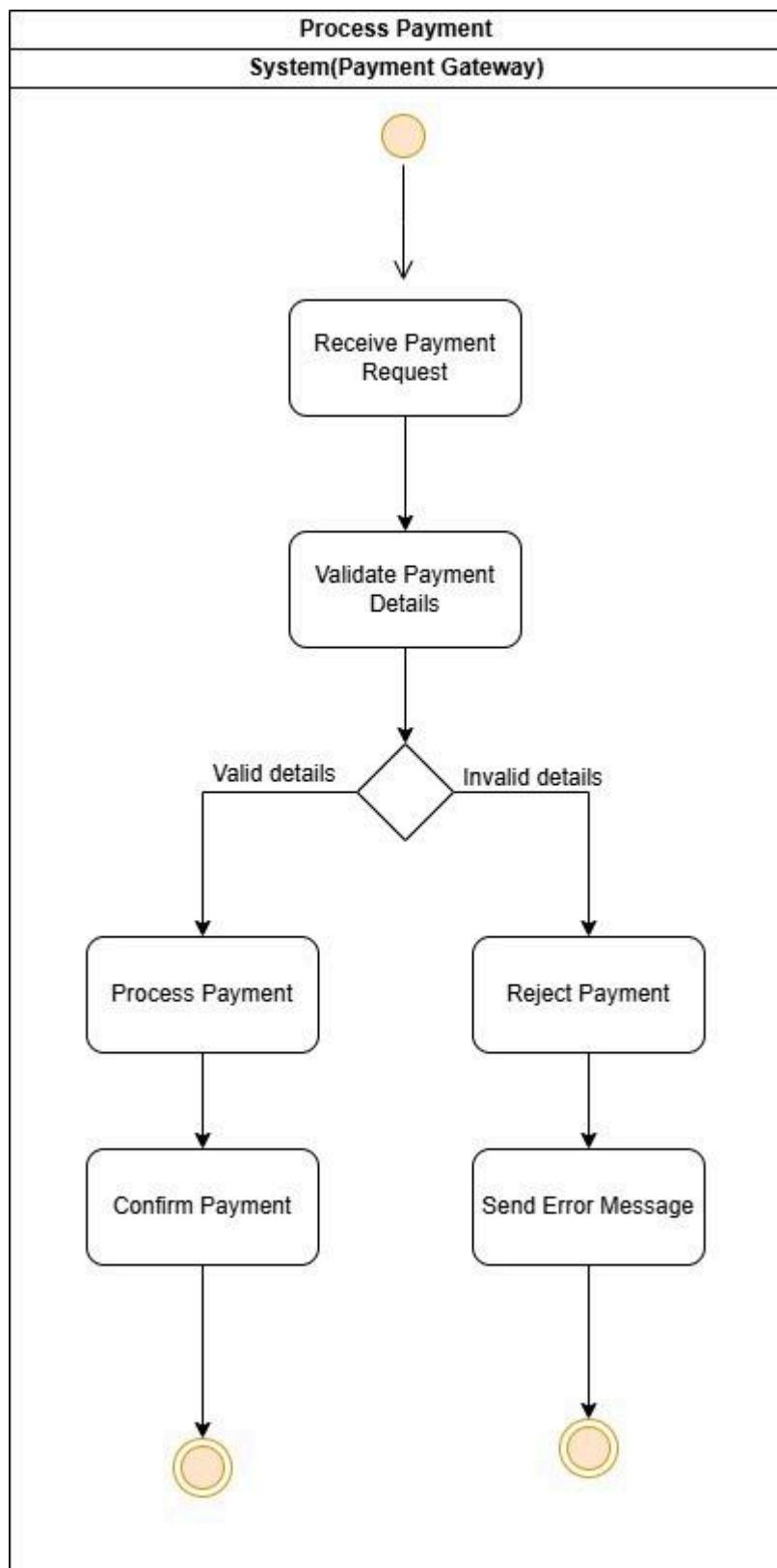


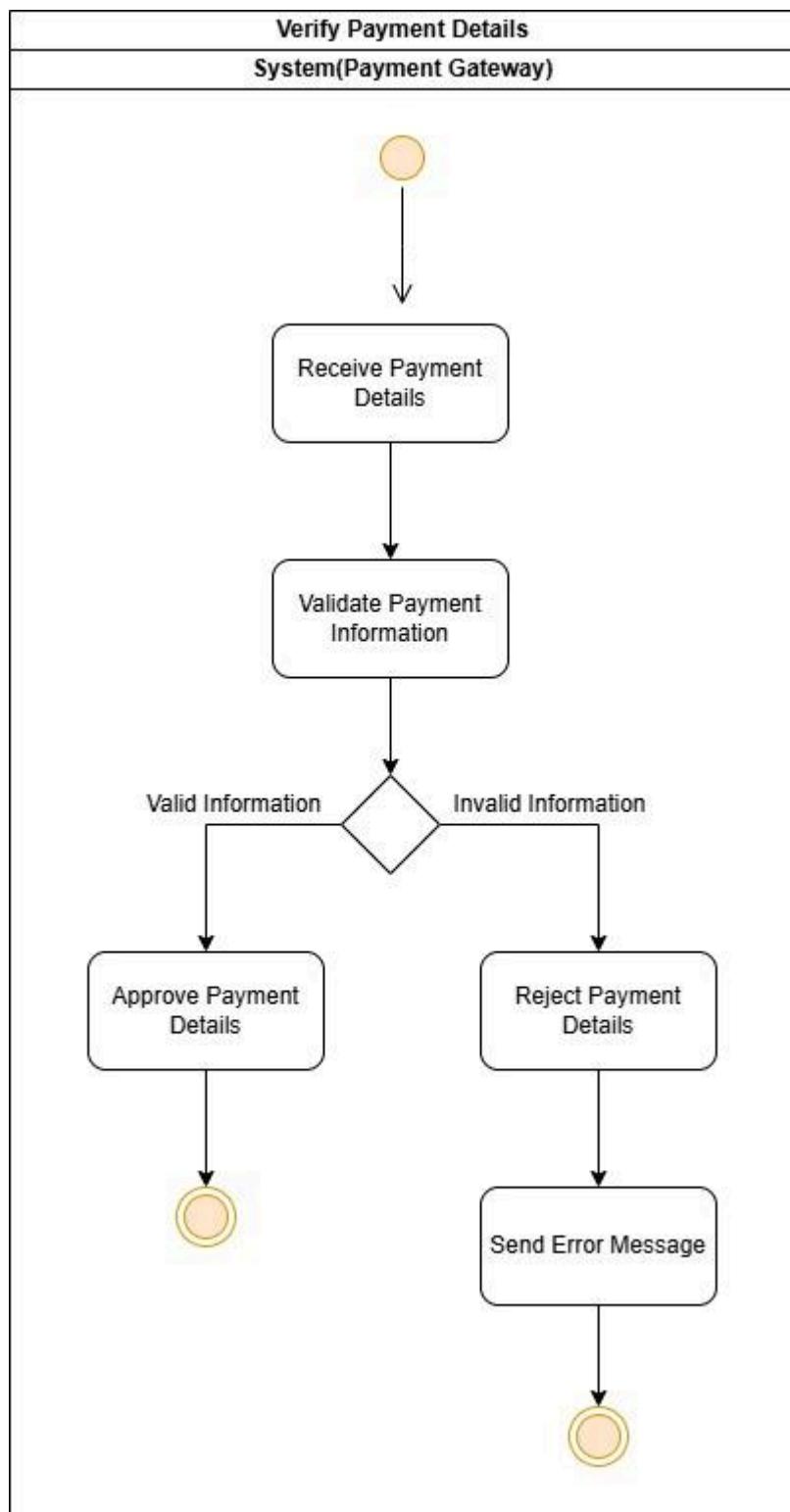


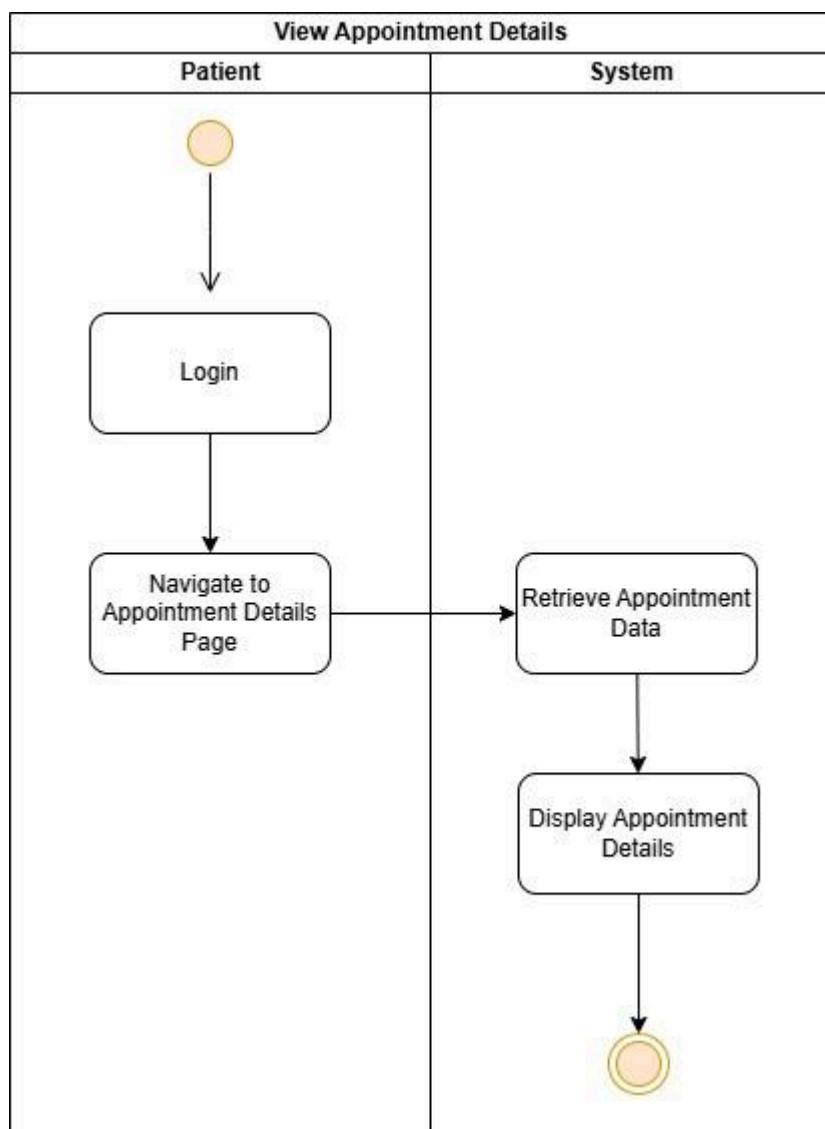


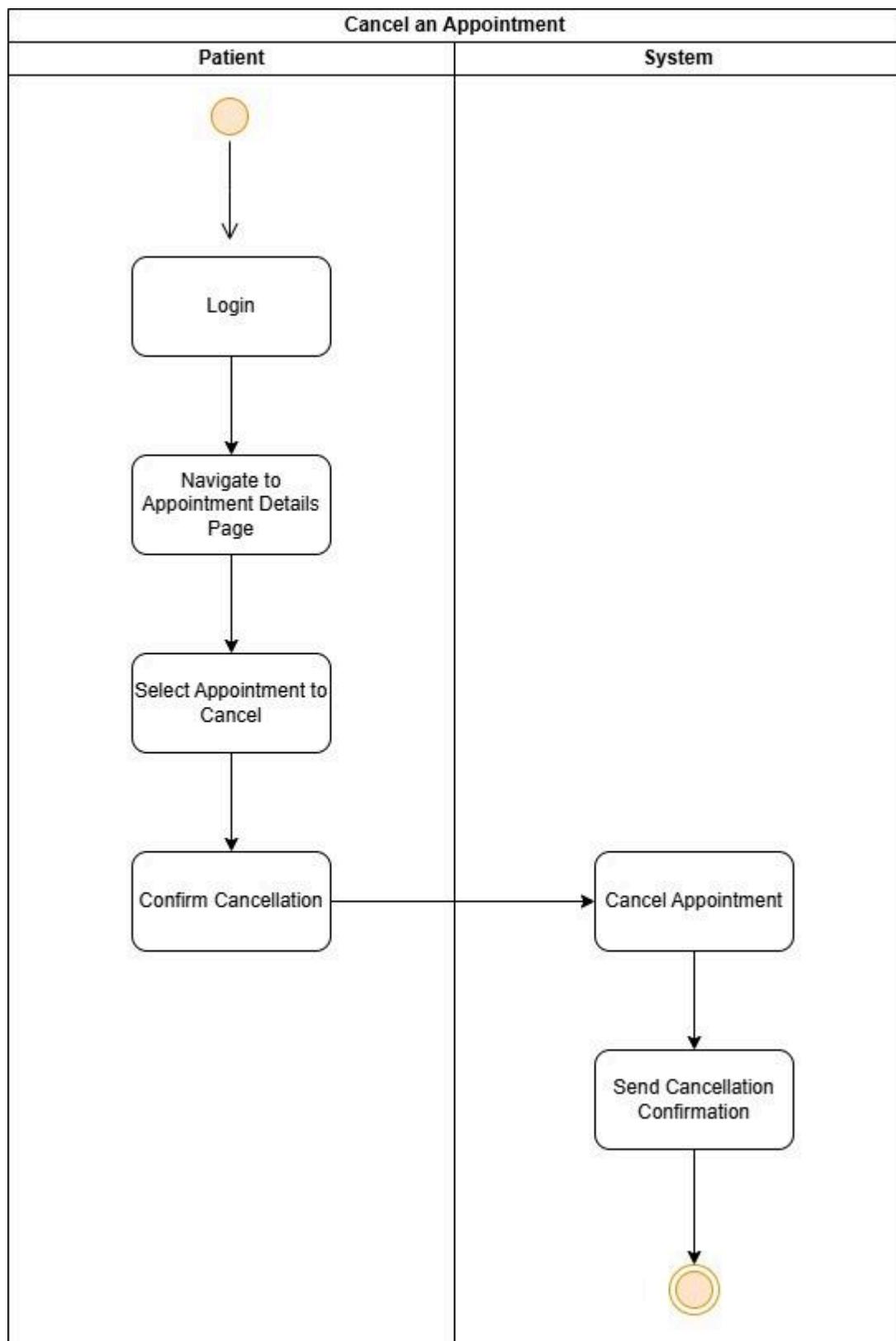


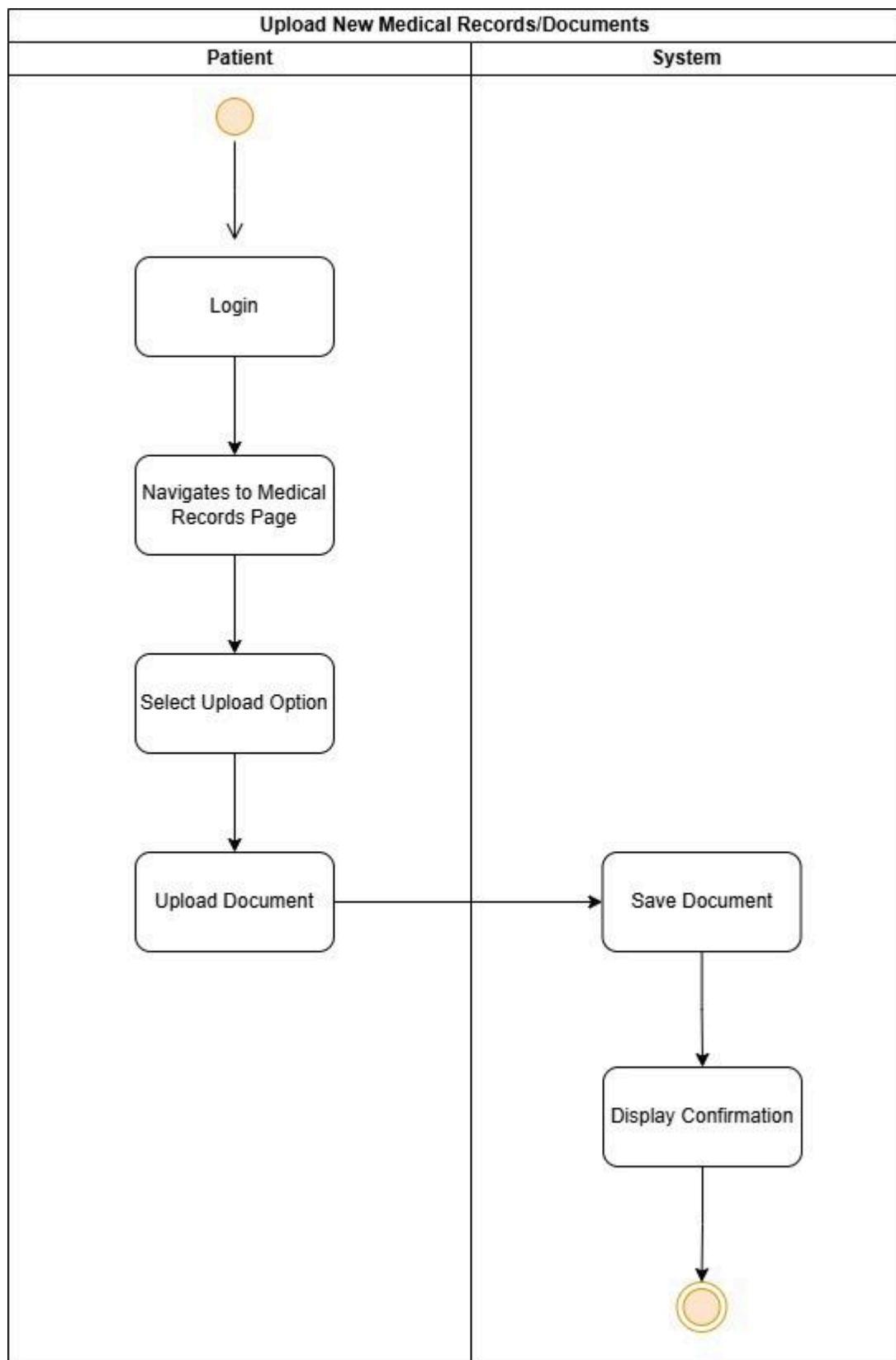


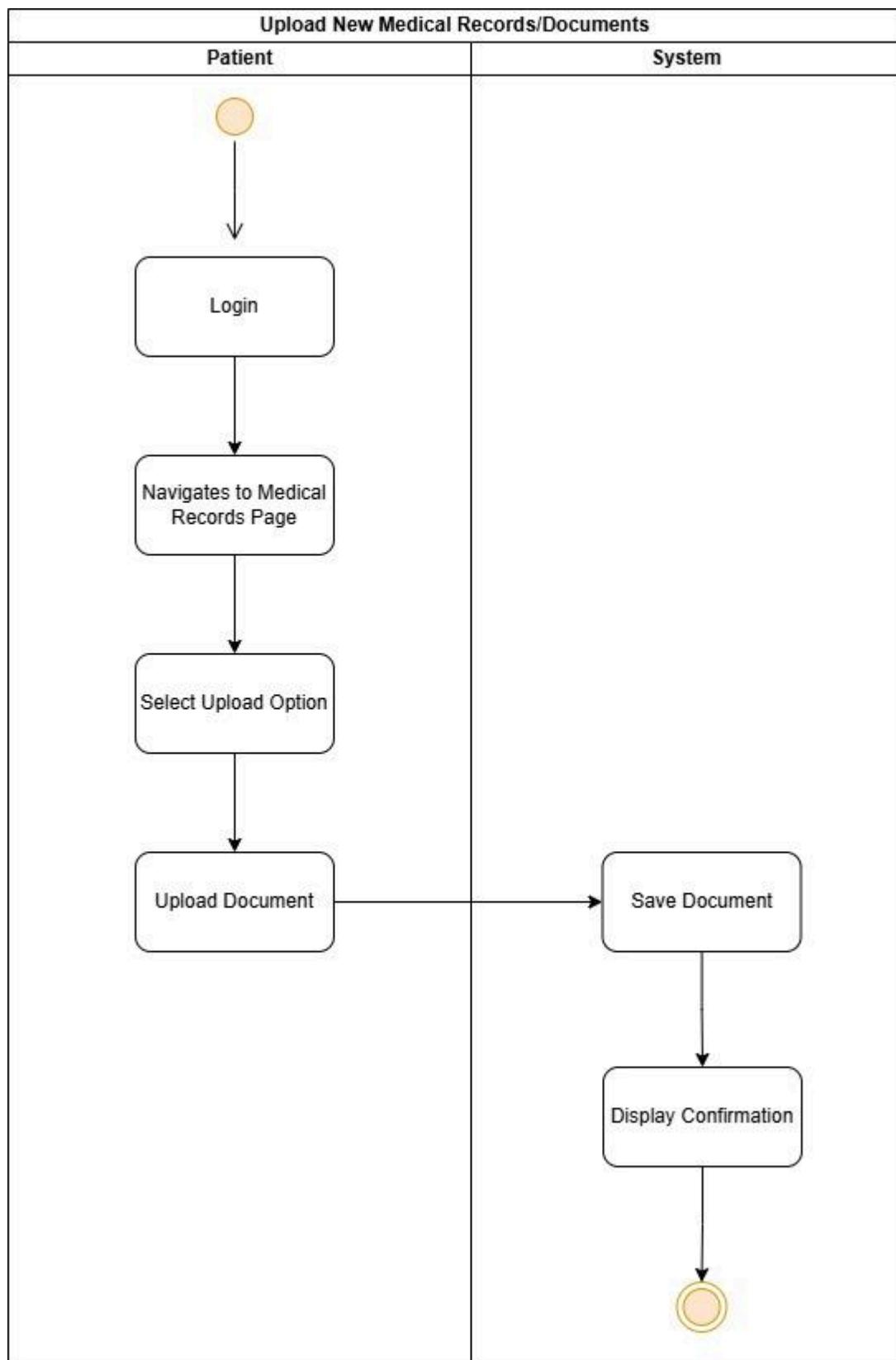


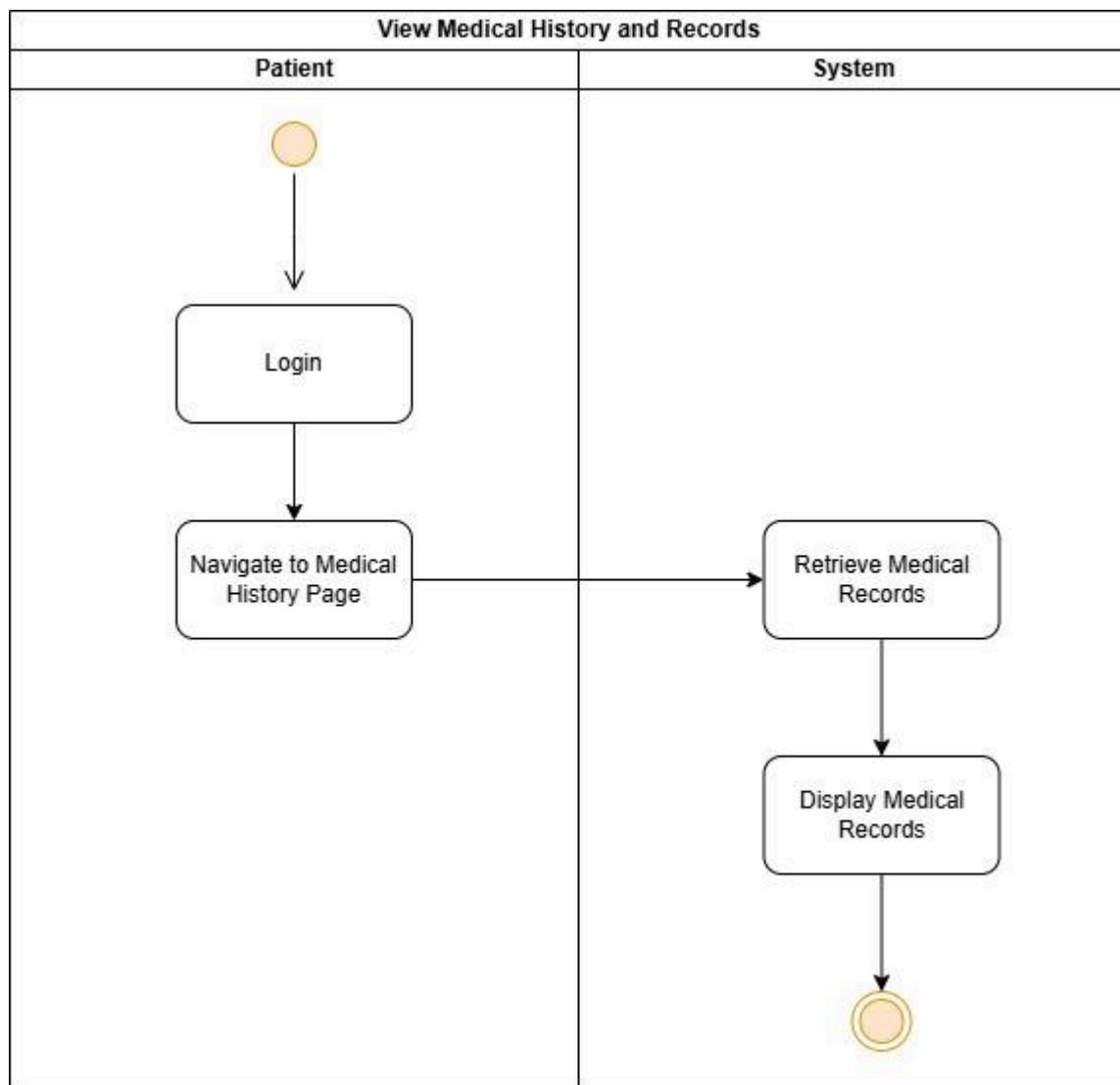


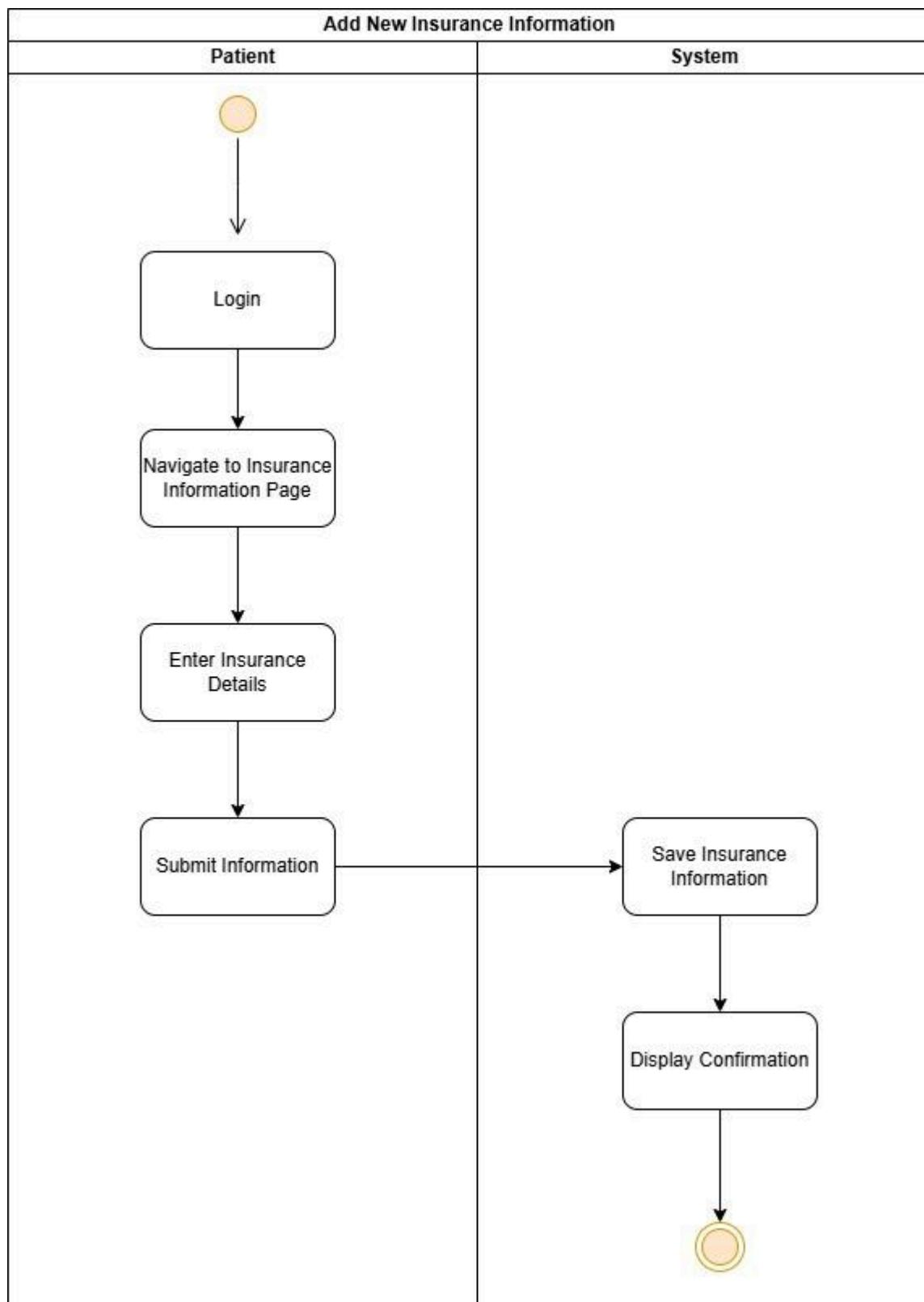


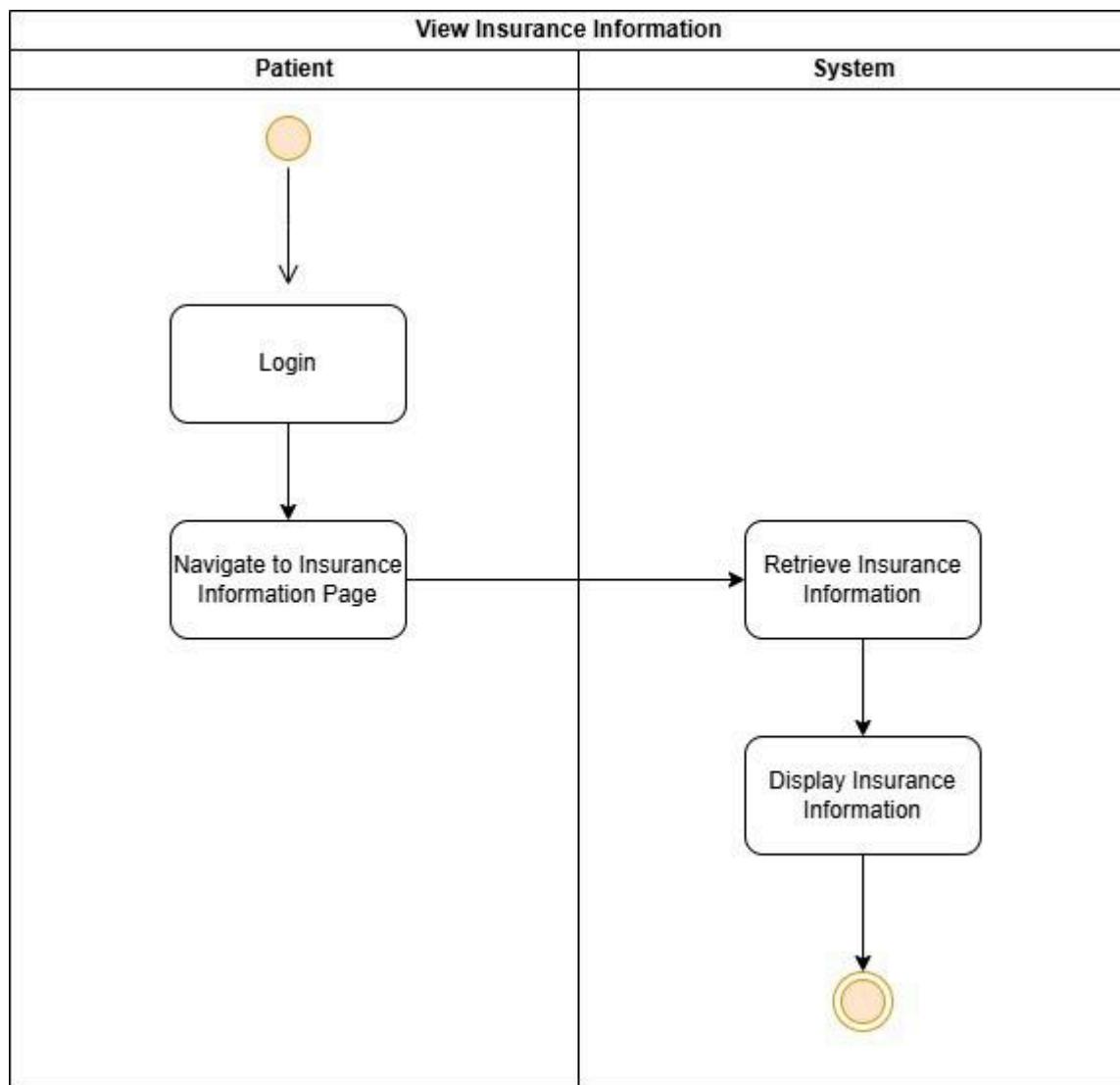


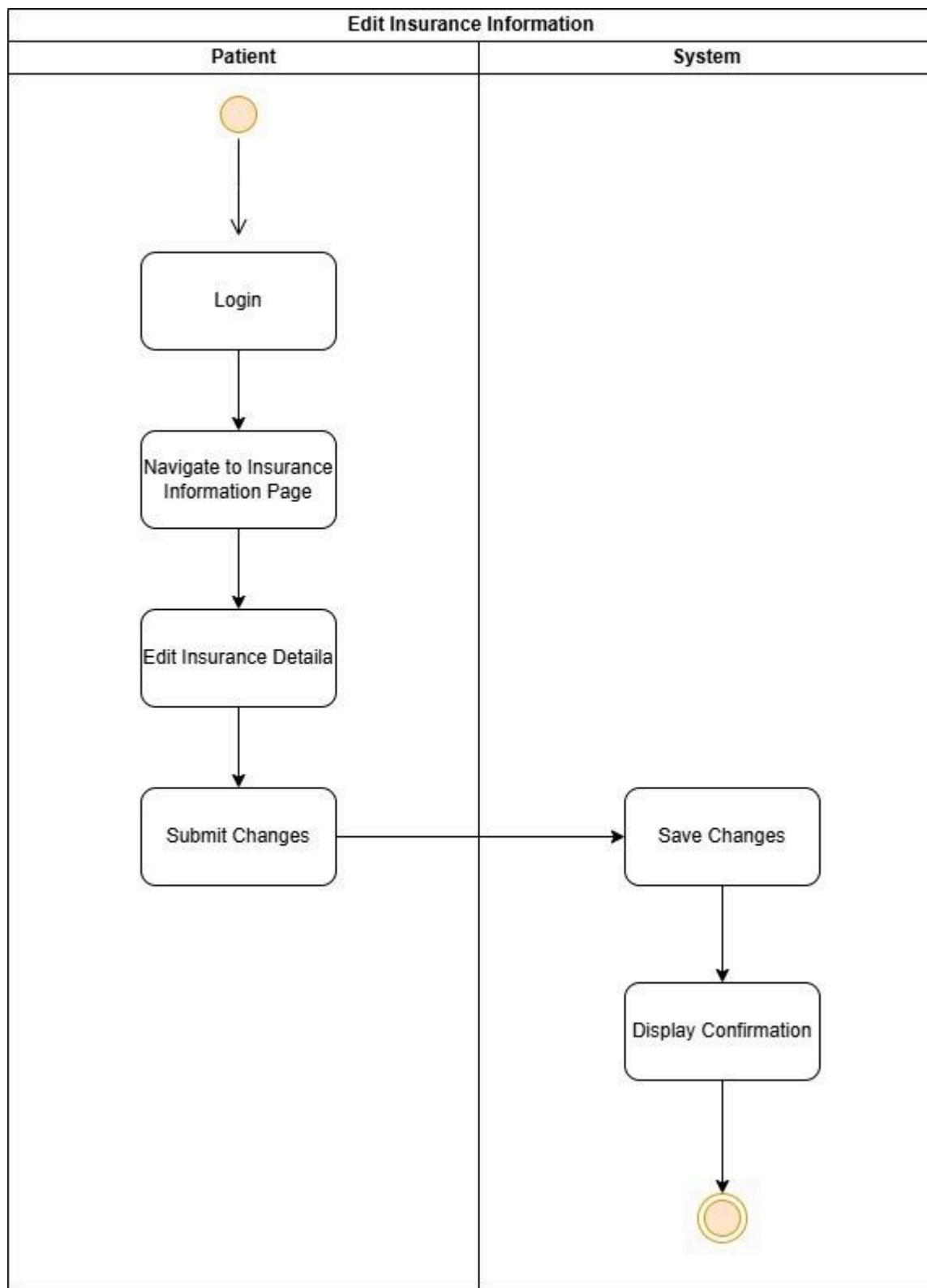


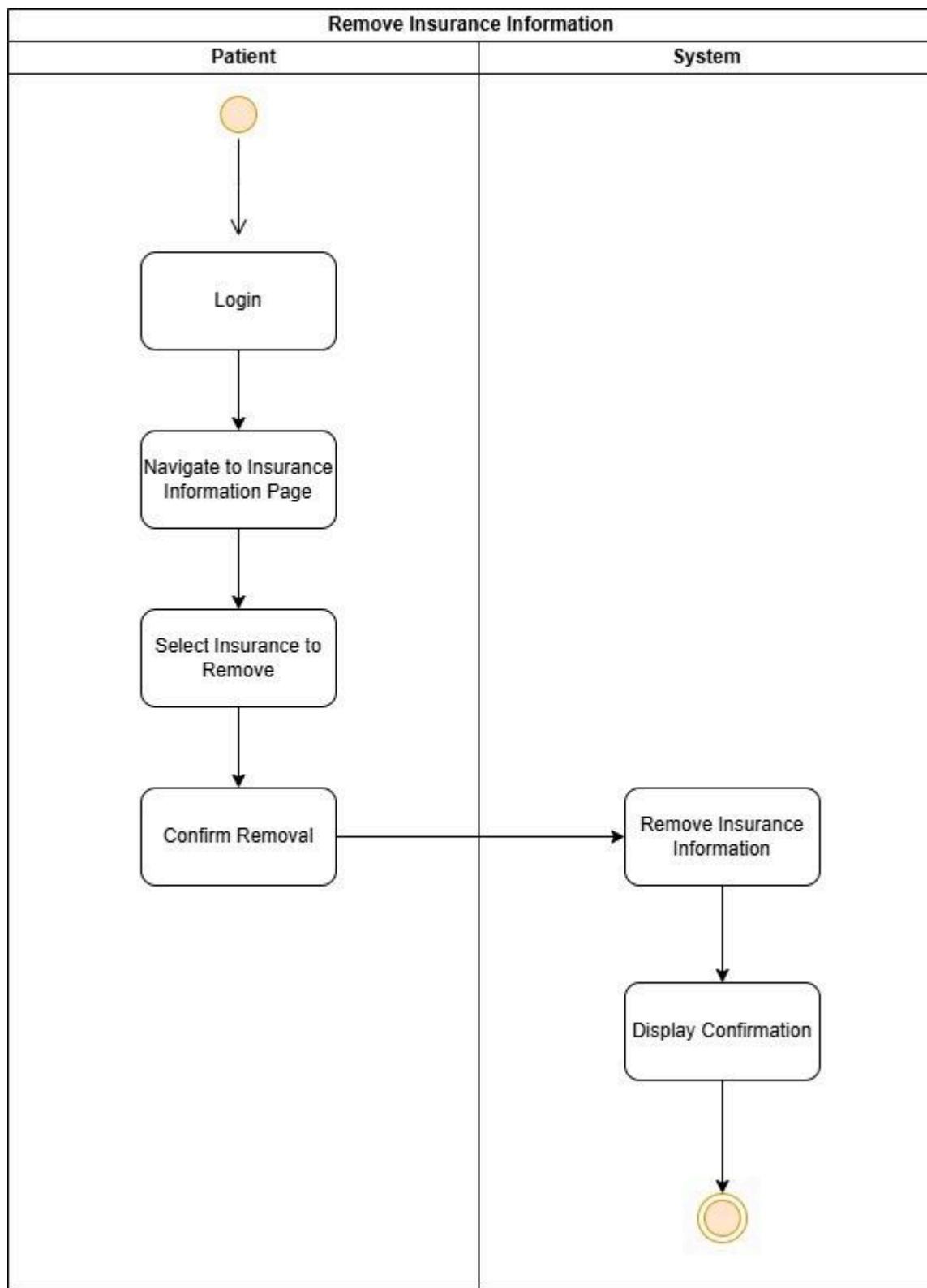


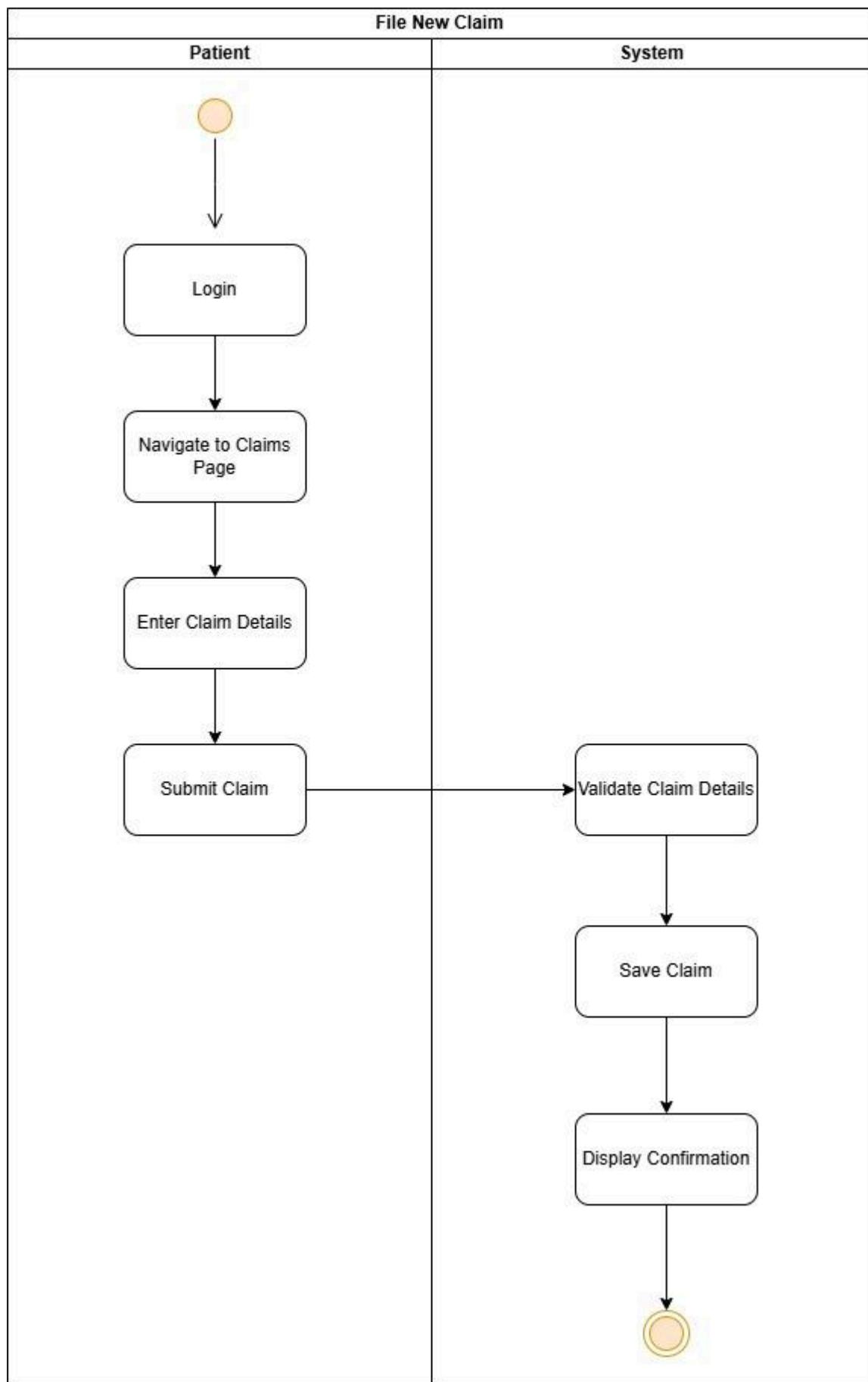


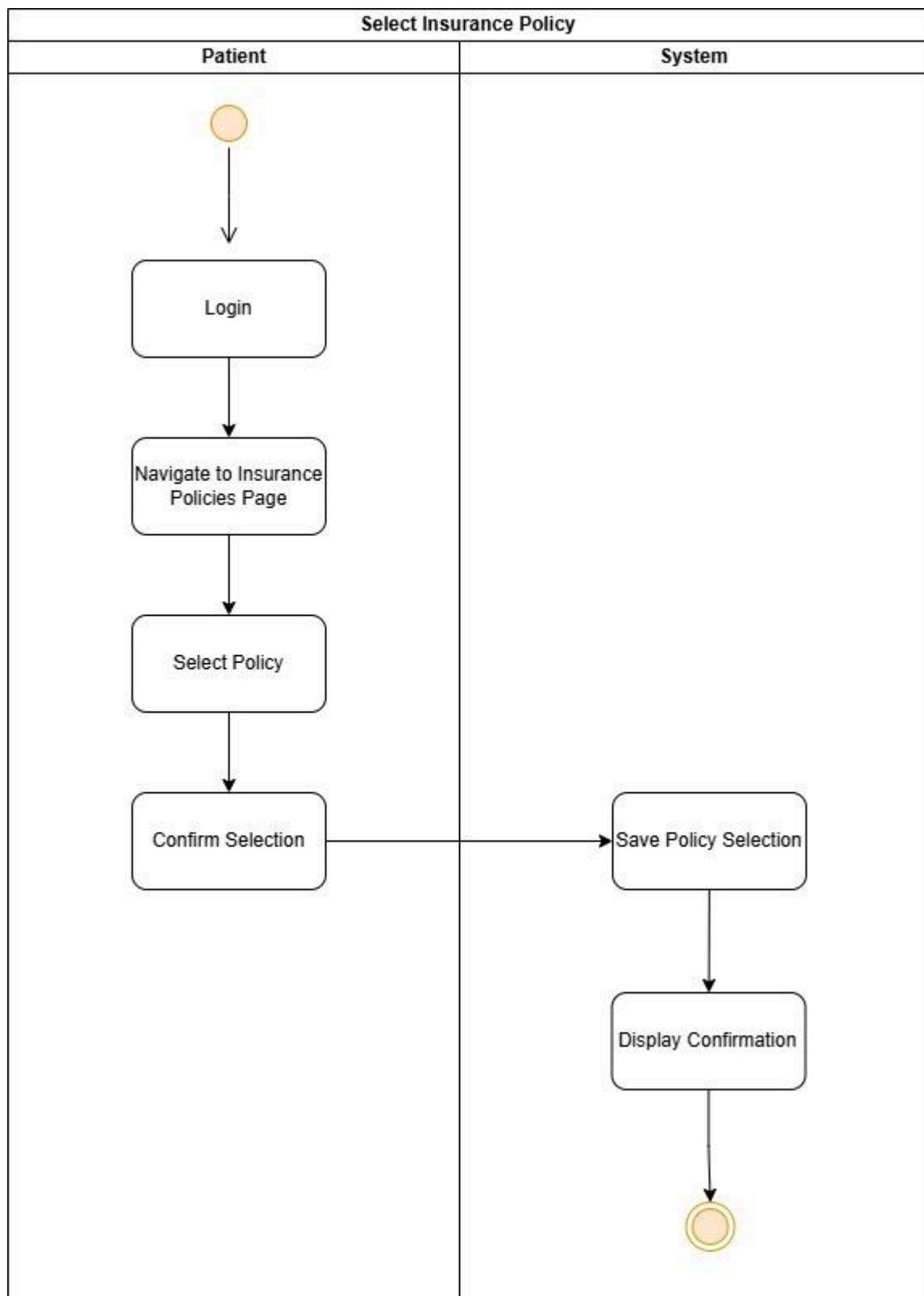


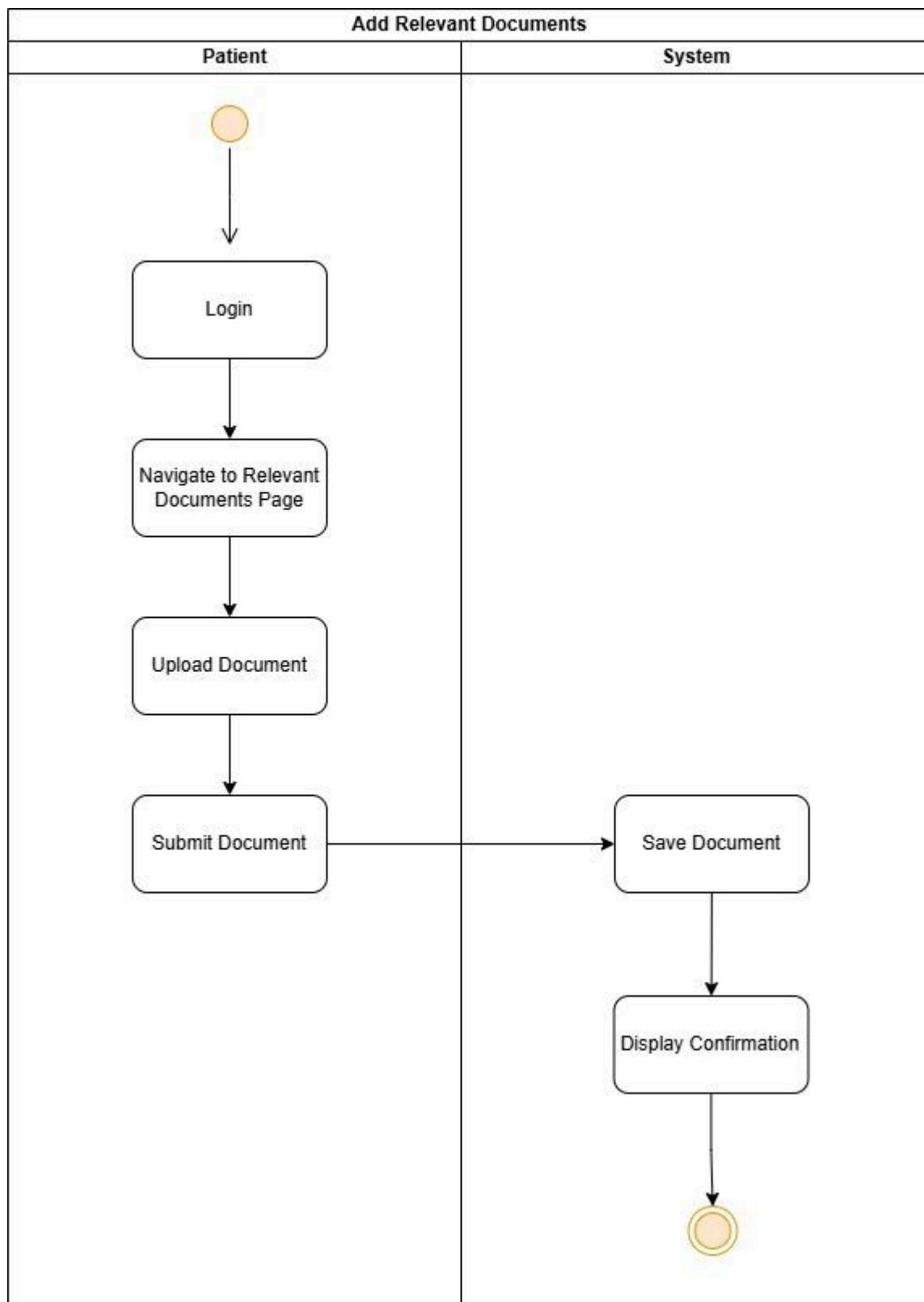


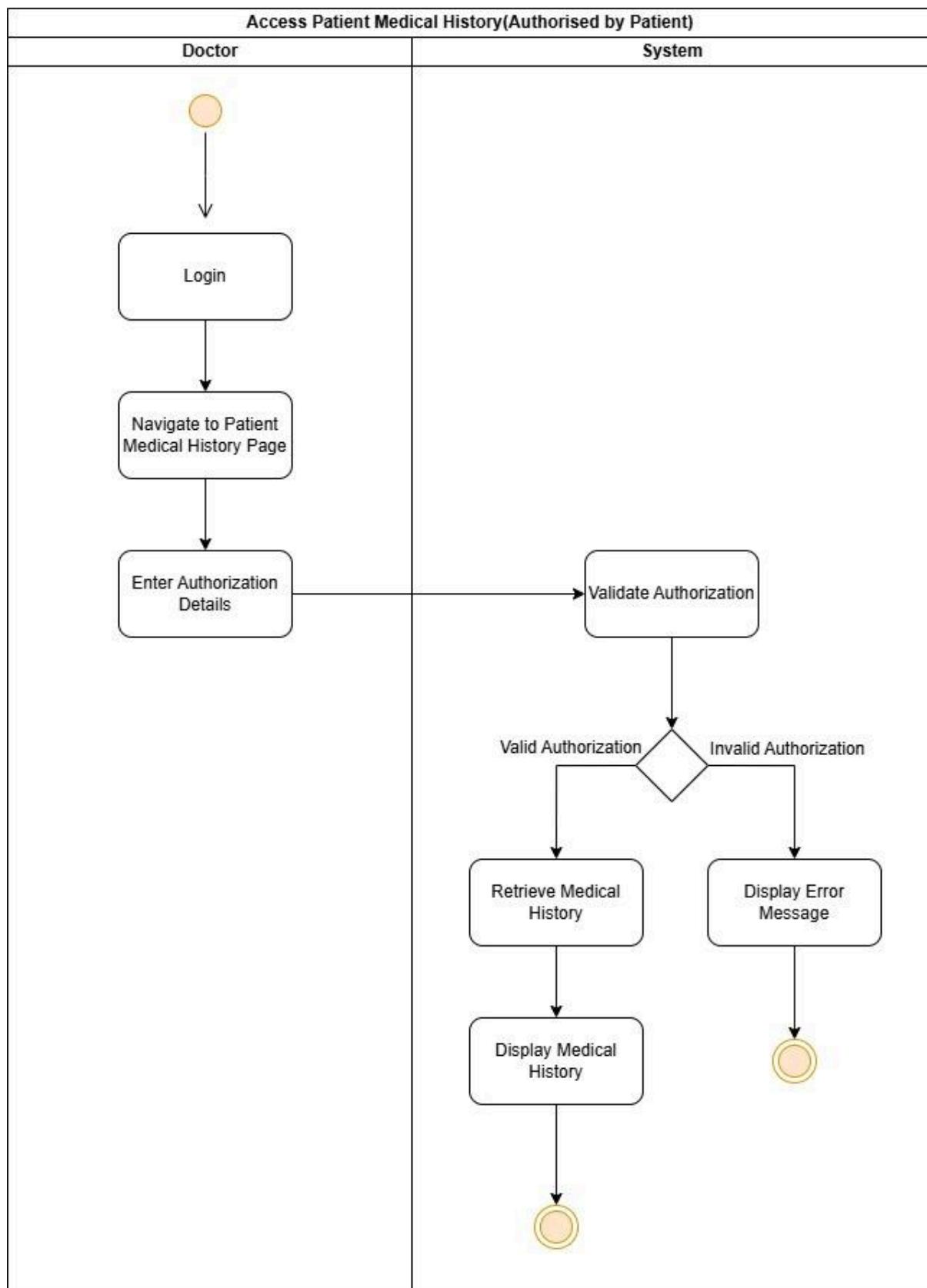


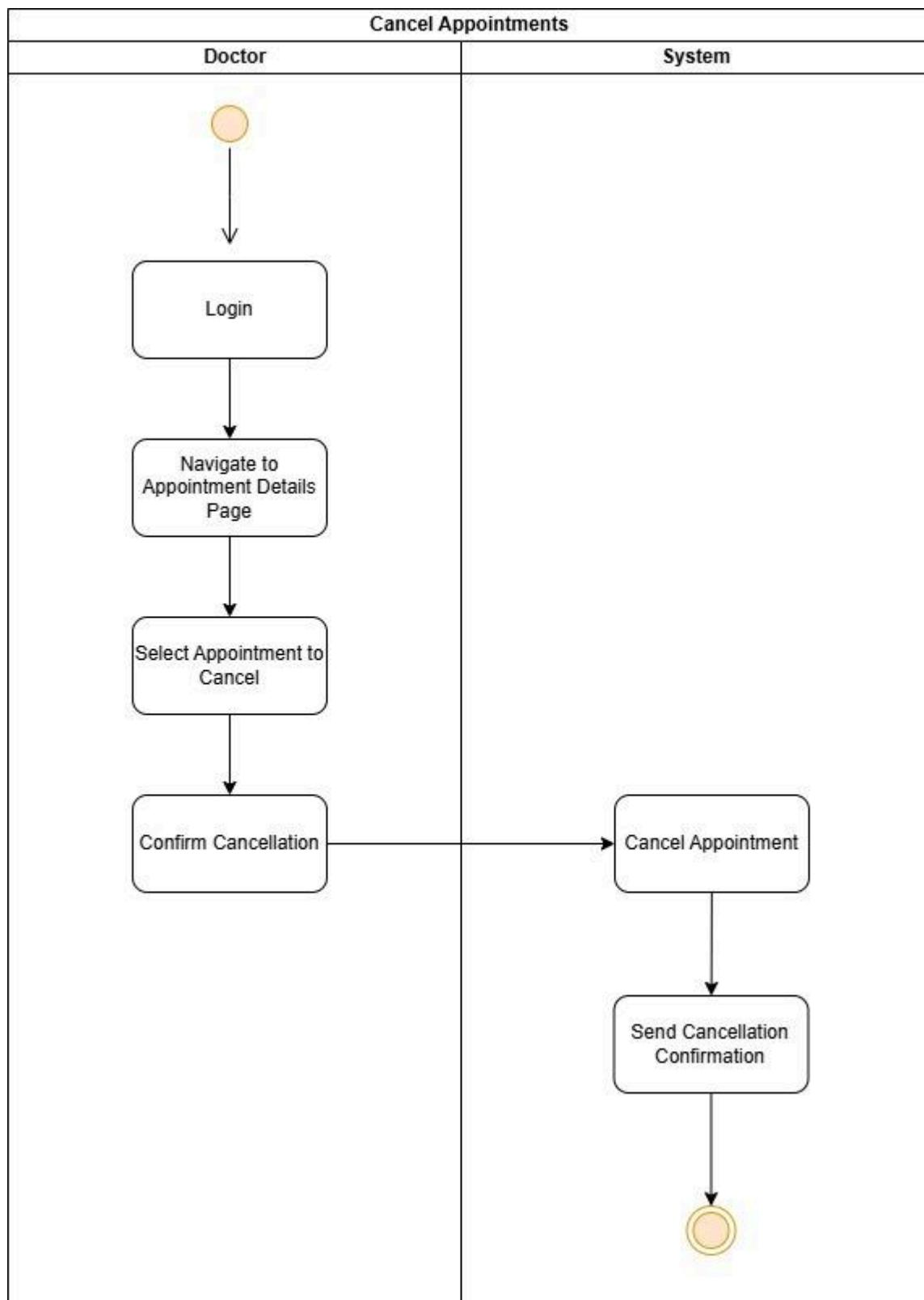


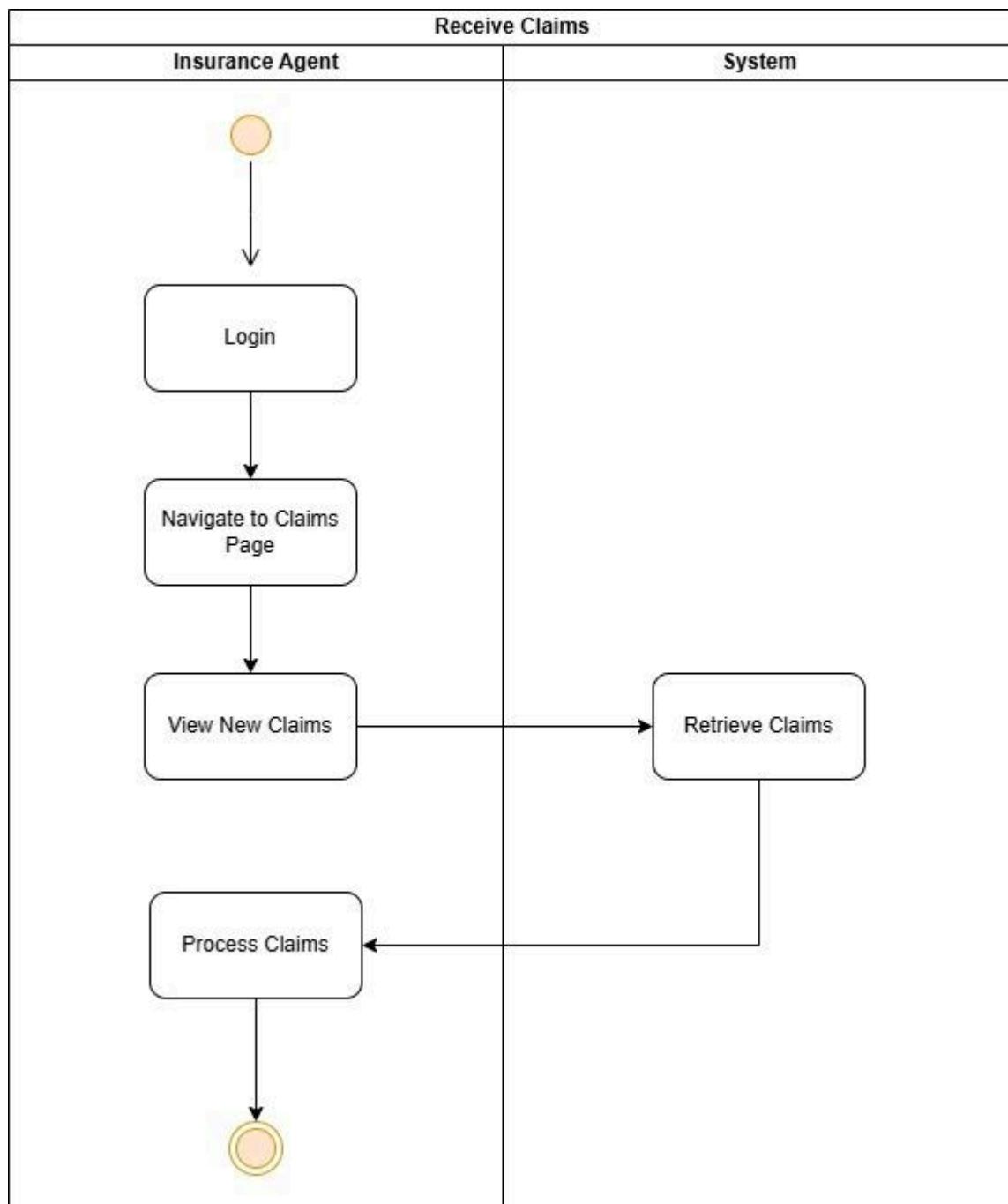


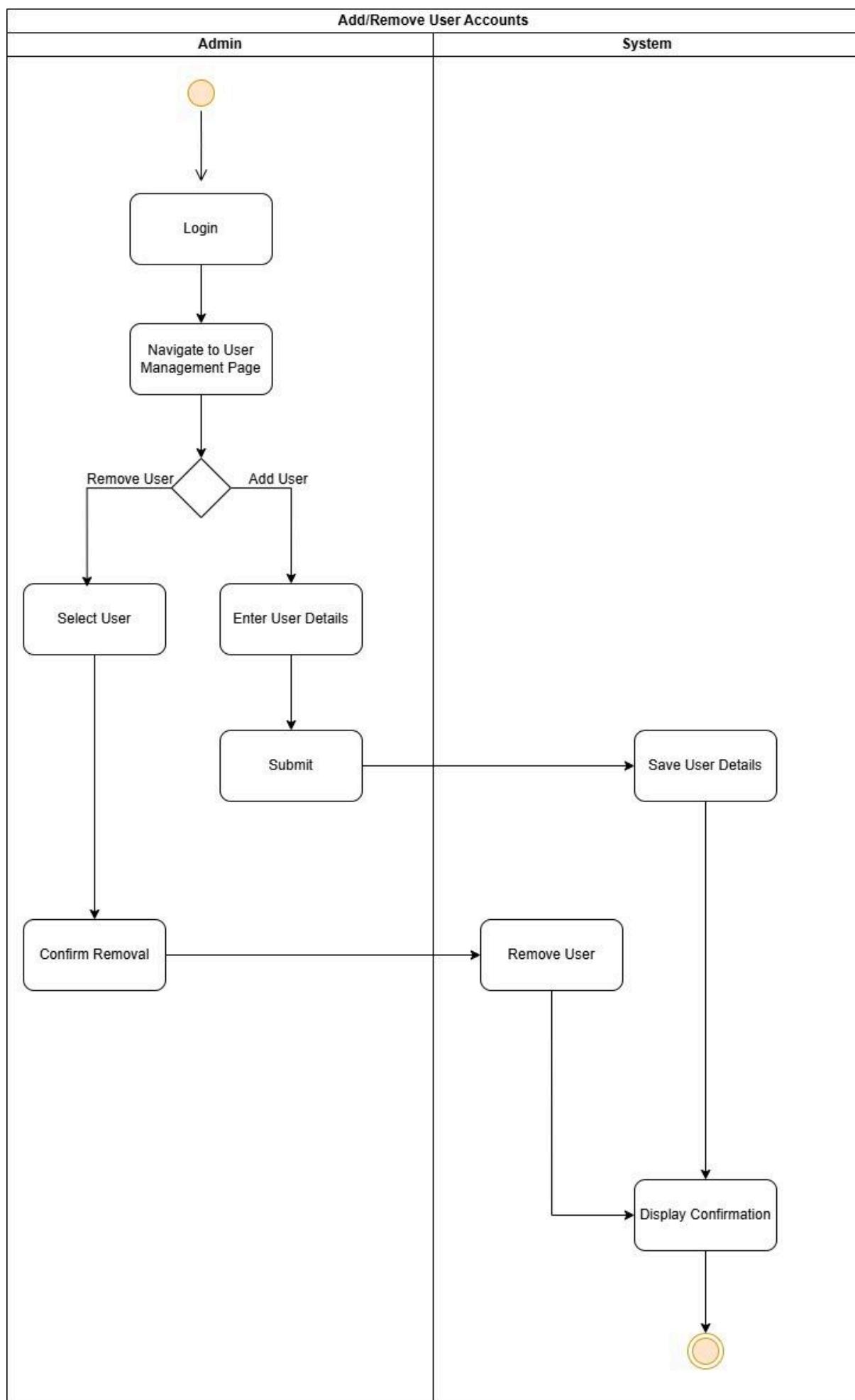


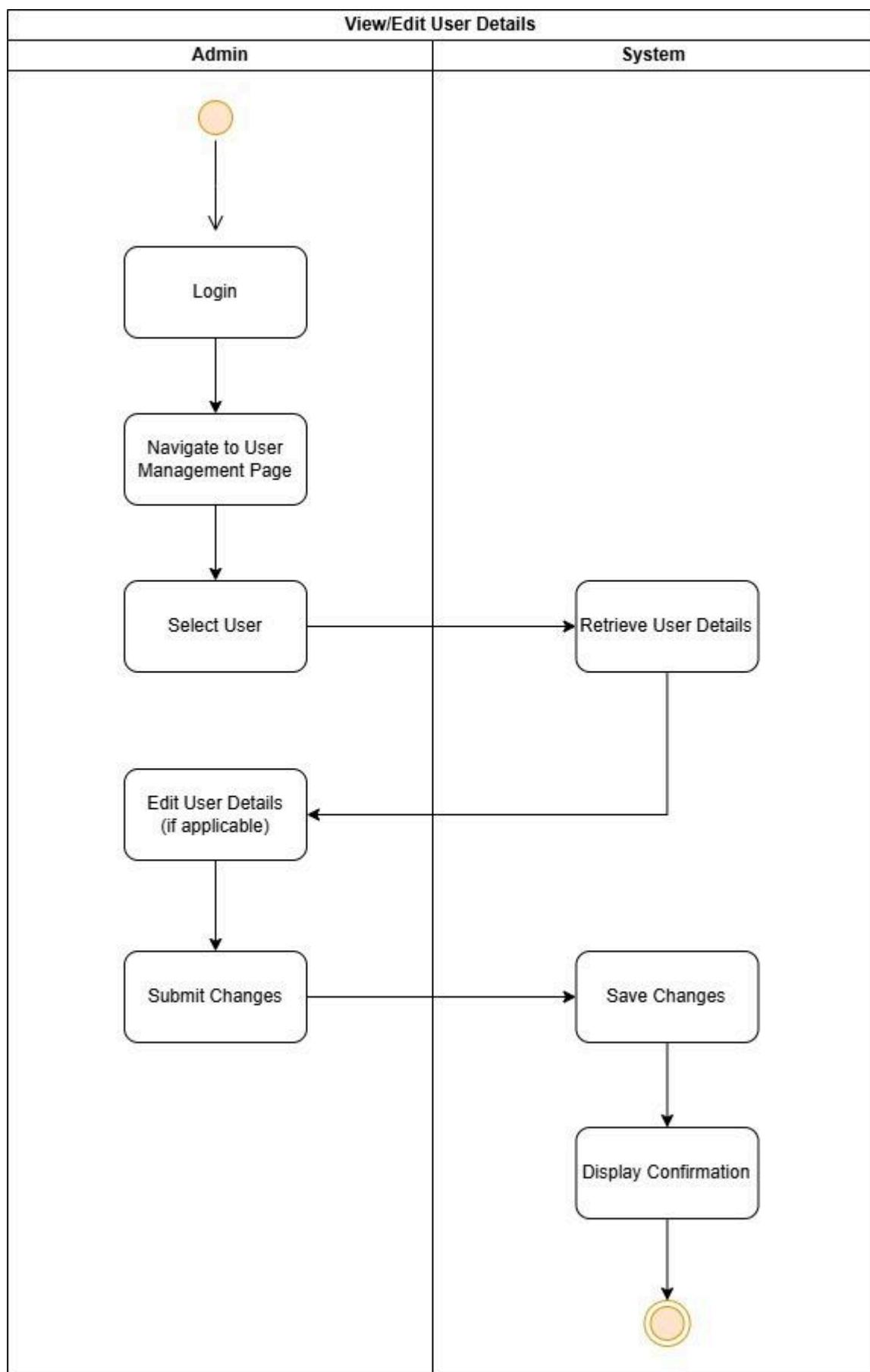


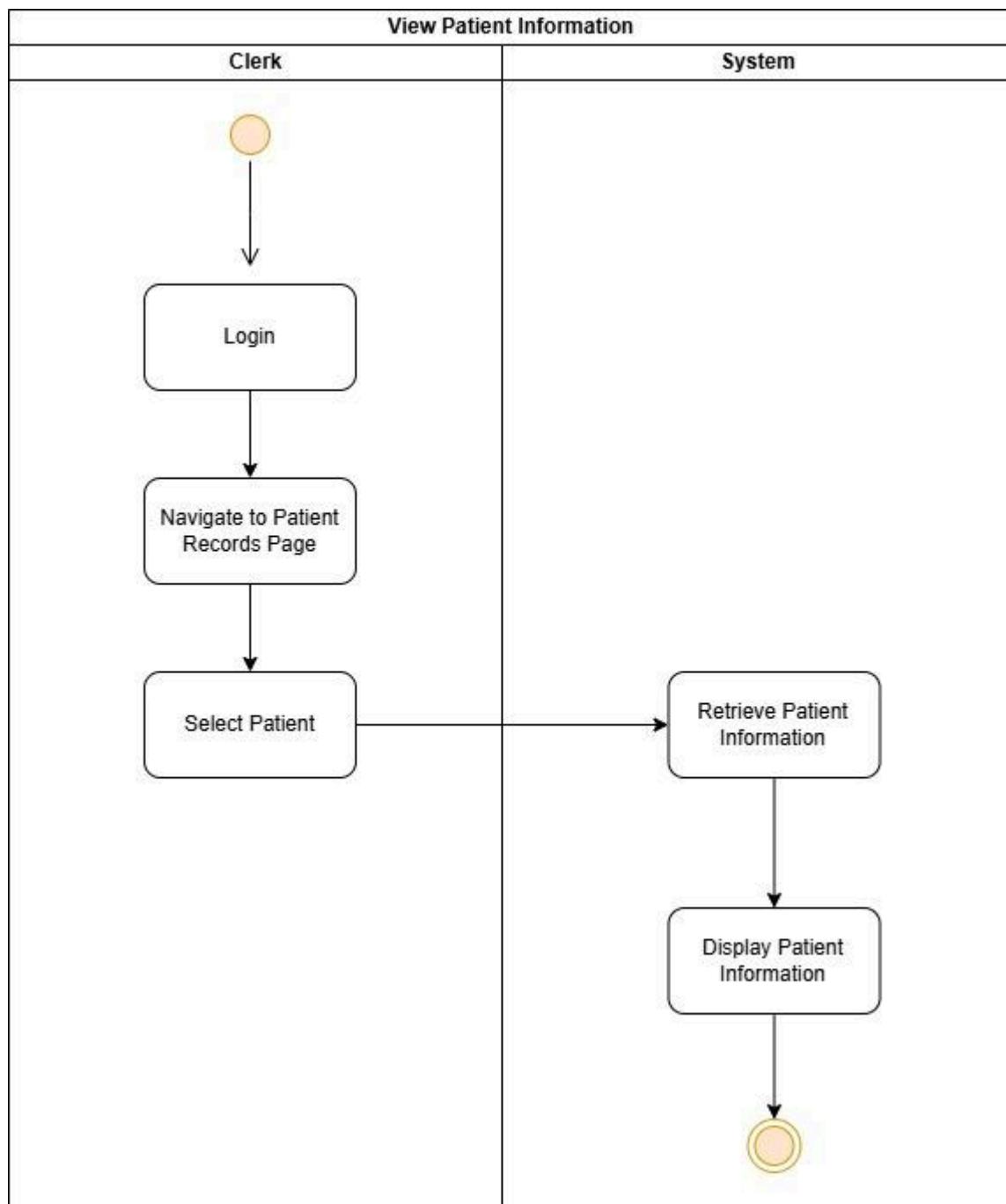


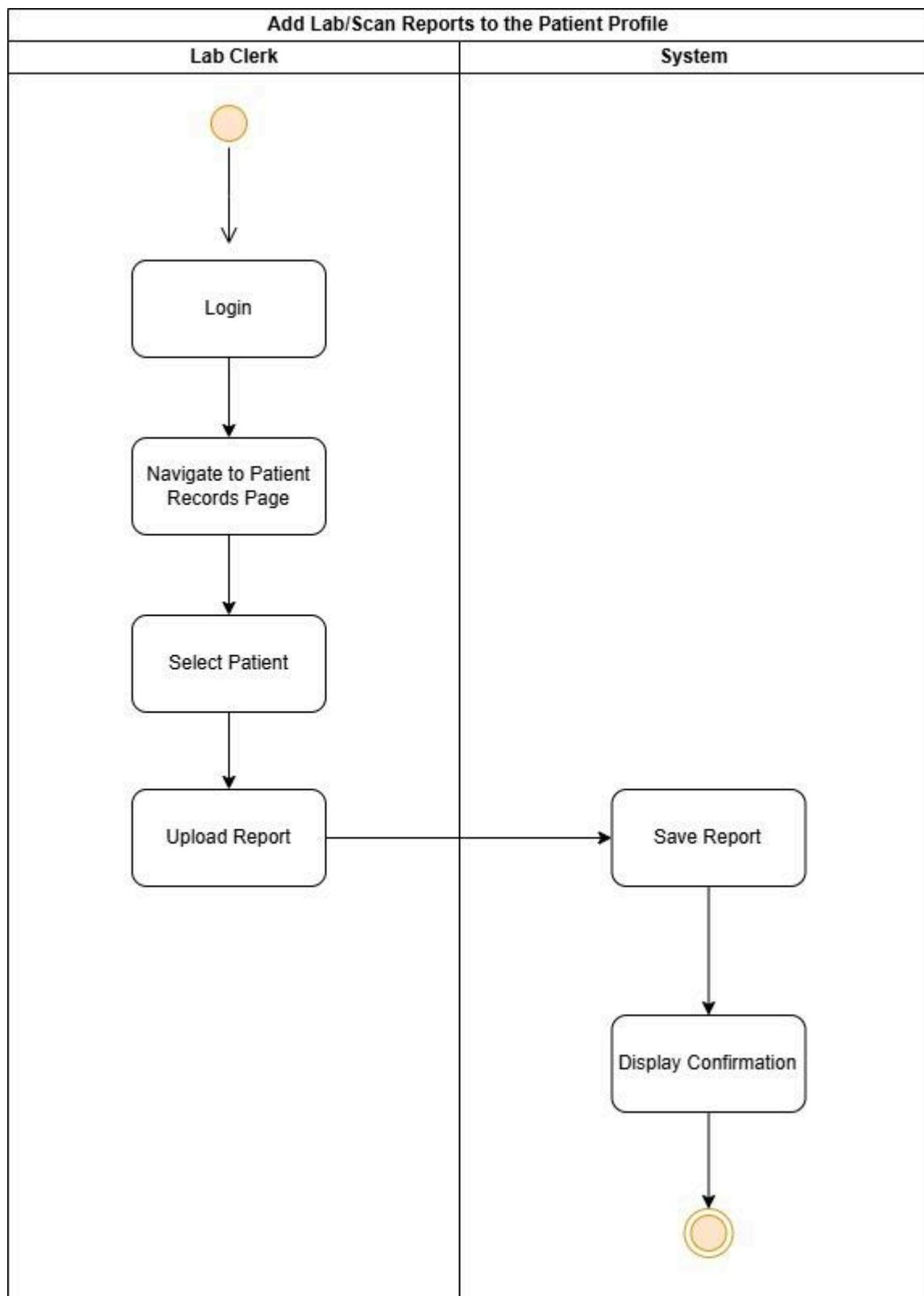


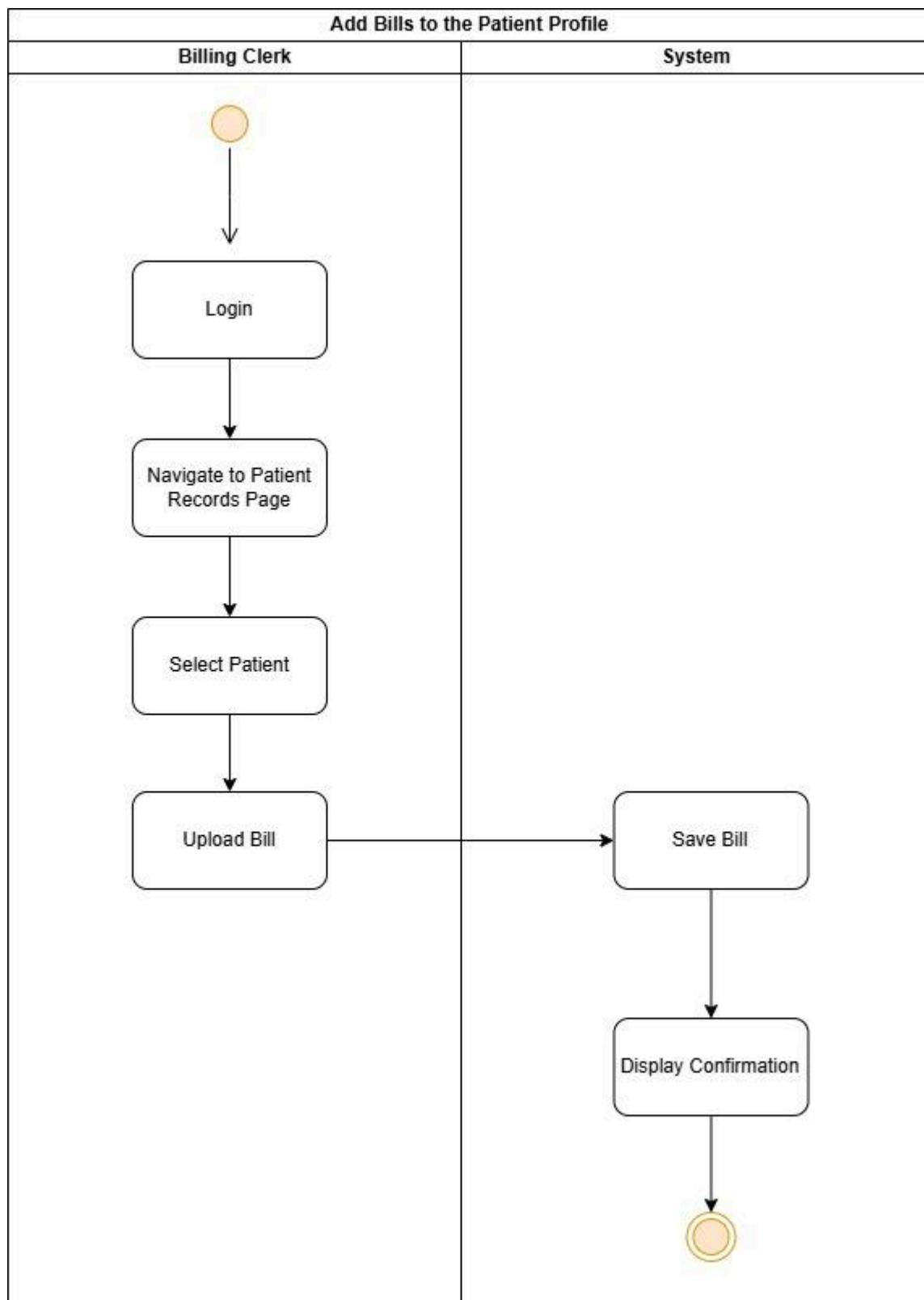


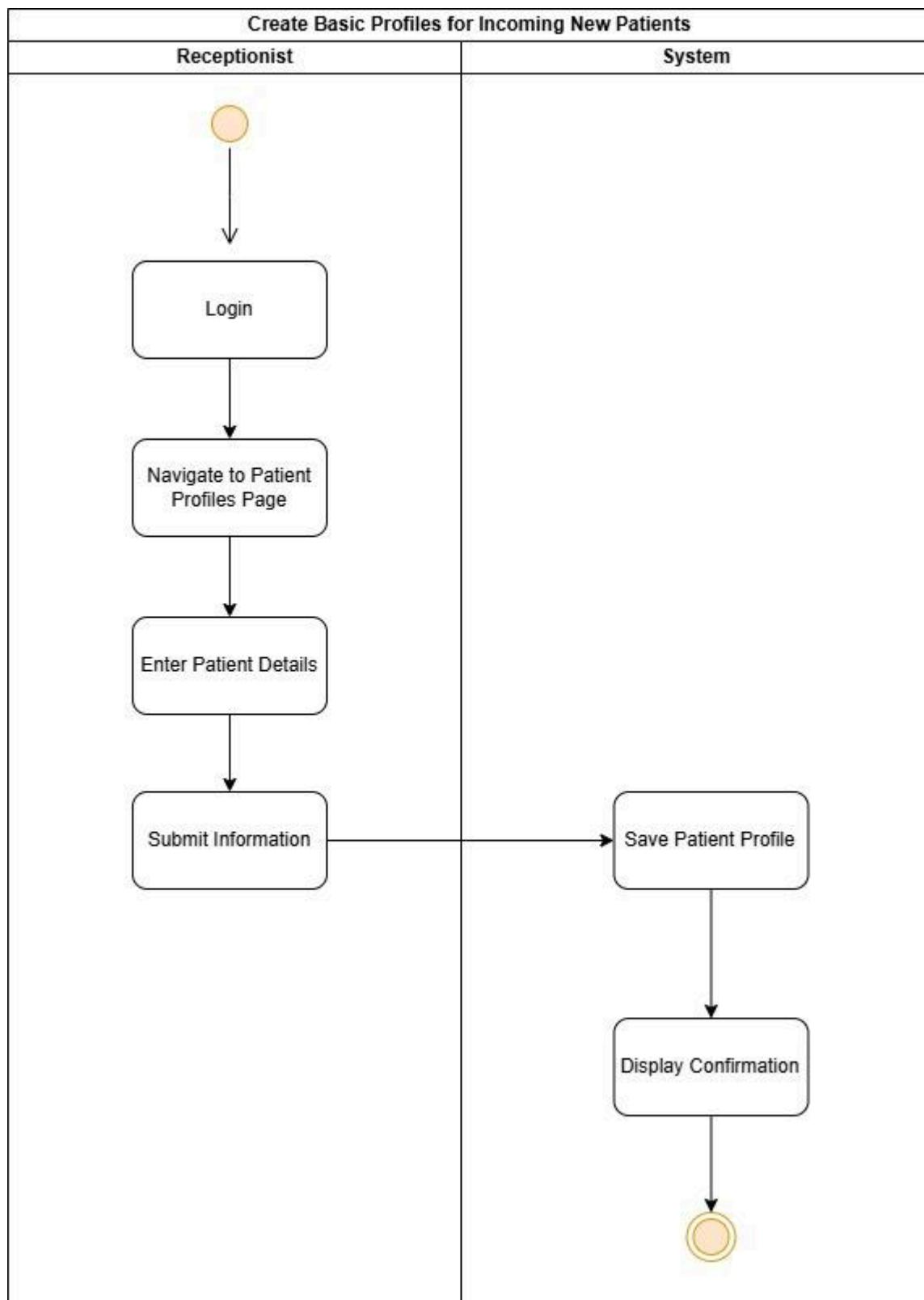


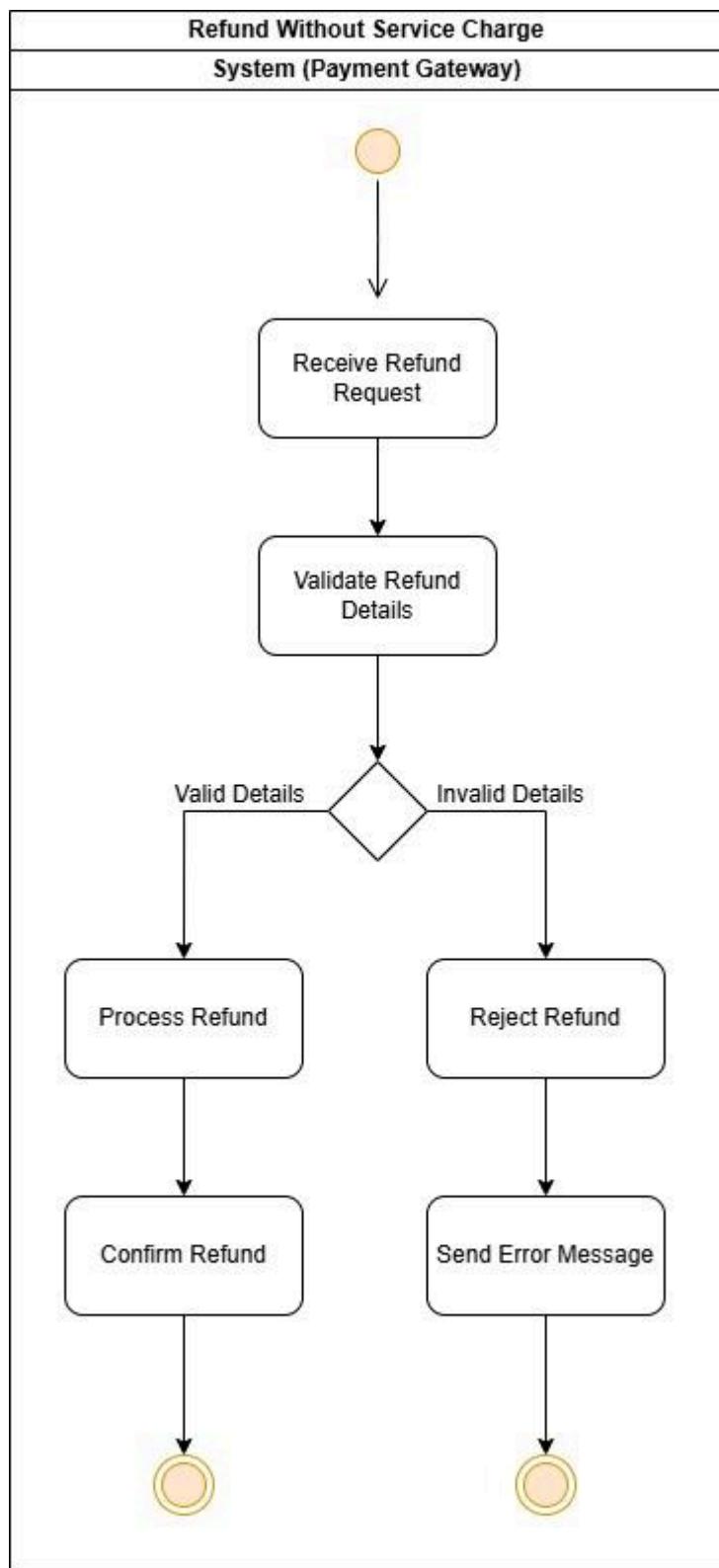


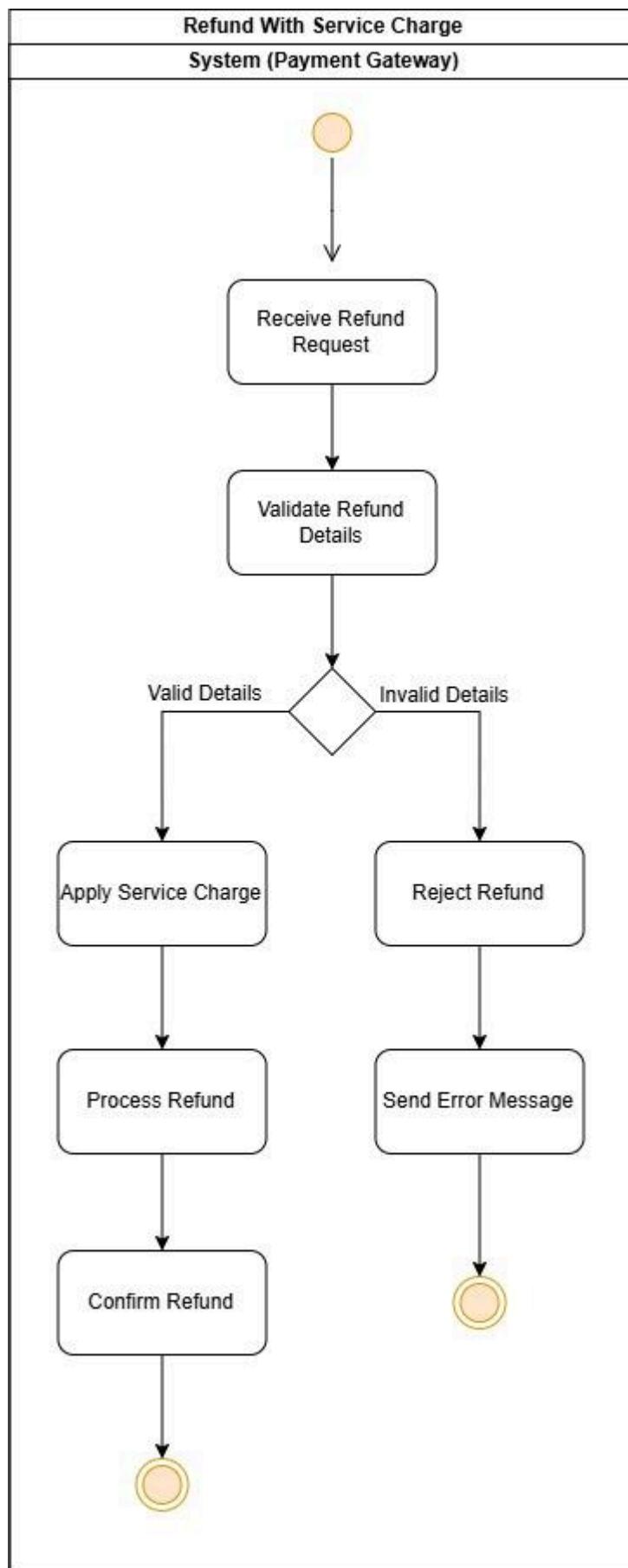


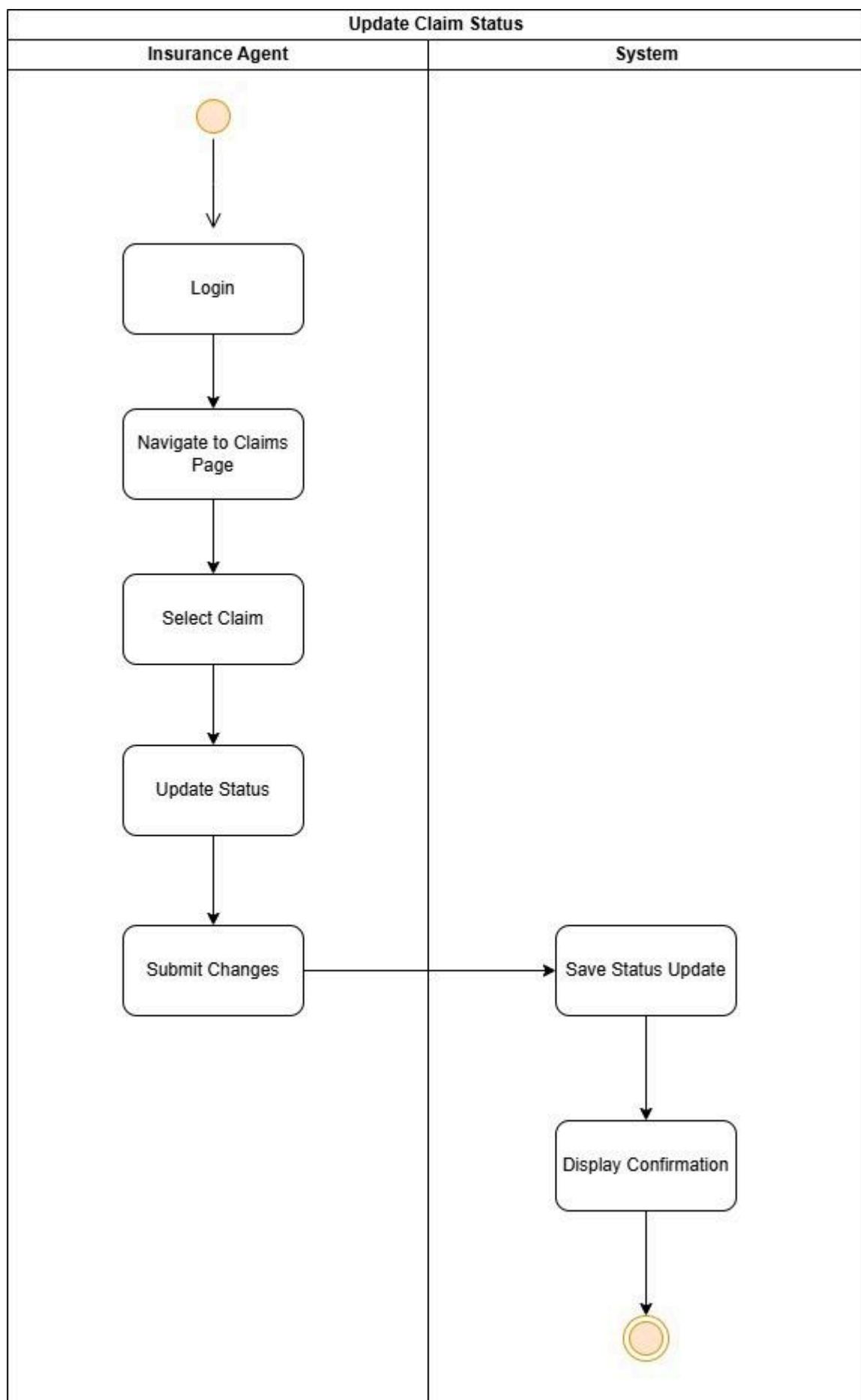


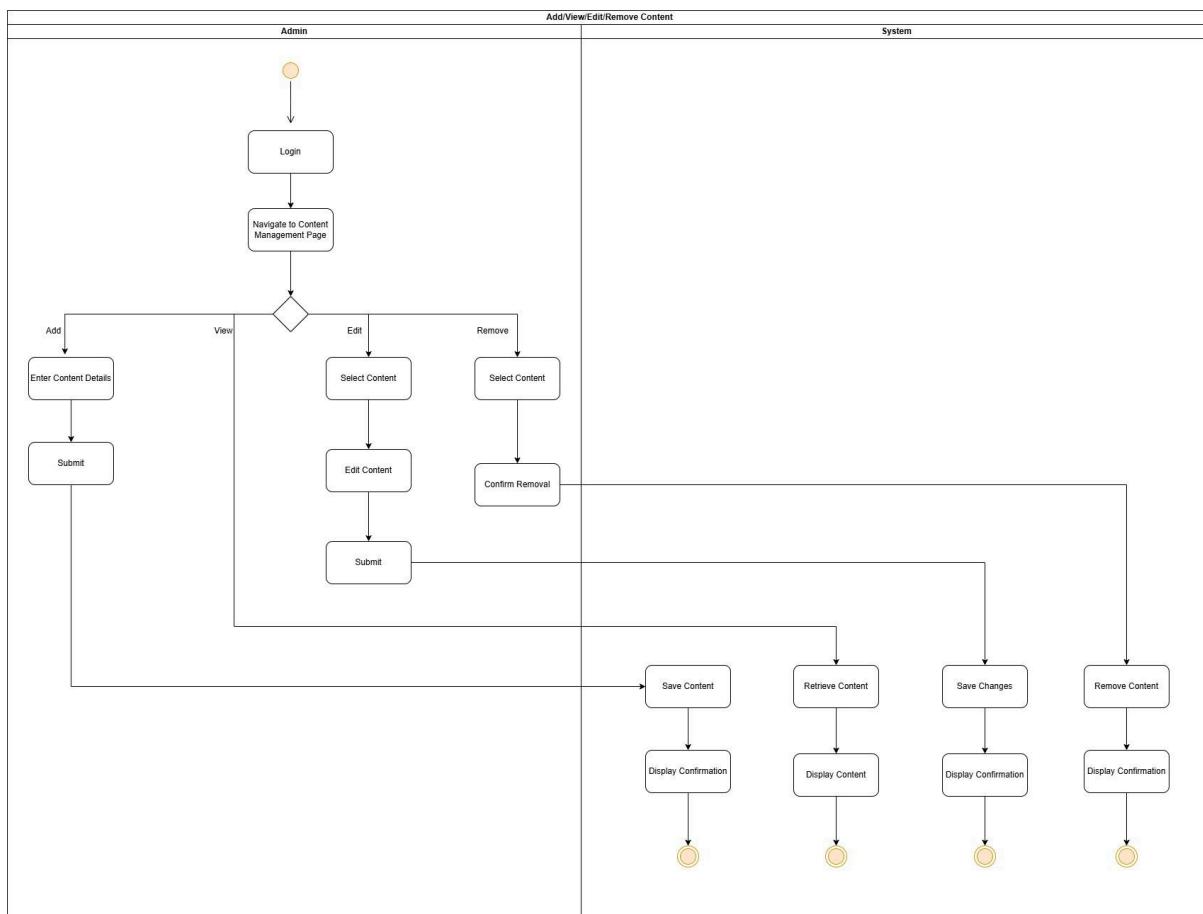












6 Current Progress

6.1 Progress Analysis against System Requirements

Significant progress has been made in implementing the system's core functionalities, catering to the needs of different user roles. The following functional requirements have been completed thus far:

1. User Registration and Authentication
 - The system allows users to register based on their roles (e.g., Patient, Doctor, Admin)
 - Functionality for user registration, sign-in, and sign-out has been fully implemented.
2. Appointment Management and Payments
 - Both guest users and registered users can book appointments.
 - Payment functionality has been partially implemented, with the front-end completed, while the integration of the payment gateway back-end is still in progress.
3. Patient Features
 - Registered users with a patient role can:
 - View their medical records and lab reports.
 - Upload, view, edit, and delete private files.
4. Admin Features
 - Administrators can create, edit, and delete articles.
 - Users can view articles published by administrators.
 - Admins can also manage users by adding, editing, or removing them.
5. Doctor Features
 - Doctors can view and update their profiles.
 - They can access and manage their appointment schedules, including details such as the number of appointments and the date and time for each.

6.2 Current System Completion Percentage



As for now, approximately 60% of the system has been successfully completed. The implemented features address a majority of the functional requirements, including user registration and authentication, appointment management, patient file management, and administrative functionalities. Key system functionalities are operational, with only a few advanced features remaining to be developed to achieve full completion.

6.3 Remaining Tasks & Work Items

The following tasks and functionalities are yet to be completed to achieve the full implementation of the system:

1. Admin Functionalities:
 - Completion of all remaining features for the Admin role, excluding article management (add, remove, delete or view articles).
2. Insurance Claim Management:
 - Implementation of all functionalities related to insurance claims, including claim submission, processing, and status tracking.
3. Validation:
 - Development and integration of input validation mechanisms to ensure data accuracy and prevent errors during user interactions.

4. Security Features:
 - Implementation of advanced security measures such as data encryption and activity monitoring.
5. Payment Gateway Integration:
 - Completion of back-end functionality for the payment gateway to enable seamless payment processing.

6.4 Team Member Contribution & Responsibilities

Front-End Contributions:

1. Nuran:
 - **Doctor Features:** Profile, pending appointments, view pending appointments, past appointments, view past appointments, manage schedule.
 - **Clerk Features:** Profile, workstation (work log, upload documents), appointments (pending appointments, create appointments).
 - Pages : *Our Hospitals* and *Our Laboratories*.
2. Athhar:
 - **Admin Features:** Profile, dashboard, manage users (patients), manage doctors (add new, edit), manage insurance partners (add), articles (add, delete, edit), manage clerks (add, delete, edit).
 - Landing Page
3. Okadini:
 - **Patient Features:** Profile, pending appointments, view pending appointments, past appointments, view past appointments, medical records, lab reports, private files, insurance claim form.
 - User Authentication: Sign-up and Sign-in functionalities
4. Manusha:
 - **Appointment Flow:** Booking appointments, payment processing and integration with the payment gateway.

Back-End Contributions:

1. Nuran
 - Doctor profile management
 - Appointment schedule management for doctors
2. Athhar
 - Article management functionalities for the Admin

3. Okadini
 - Management of medical records, lab reports and private files of the patient.

4. Manusha
 - Implementation of the appointment flow, including appointment management and integration with back-end processes.

Database Contribution:

- **Athhar** led the development of the database and the MVC framework, with support from the other team members during the ER diagram design.

Upcoming Tasks:

1. Admin Functionalities:
 - Assign to **Athhar** and **Okadini** for complementary expertise in admin-related work.

2. Insurance Claim Management:
 - Assign to **Nuran**, leveraging expertise in insurance-related tasks.

3. Validation:
 - Assign to **Athhar**, who has demonstrated expertise in validation and security, ensuring robust data entry mechanisms.

4. Security Features:
 - Assign **Athhar** and **Manusha** leveraging their strength in developing security protocols.

5. Payment Gateway Integration:
 - Assign to **Manusha**, as they are already handling payment flow tasks.