Project Title: Easymed (Remote Healthcare Solution)

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A thesis submitted in partial fulfillment of the requirement for the degree of Bachelor of Science in Software Engineering

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APPROVAL

This project titled on "**Easymed: Remote Healthcare Solution**", submitted by **Md. Saif Islam (ID: 171-35-1926)** to the Department of Software Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science in Software Engineering and approval as to its style and contents.

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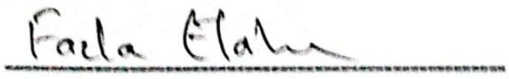

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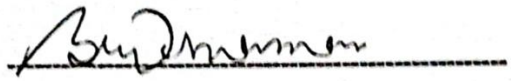

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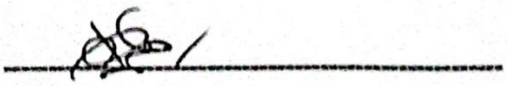

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Declaration

I hereby declare that this project (**Easymed: Remote Healthcare Solution**) has been completed by me, Md. Saif Islam (**ID:171-35-1926**) under the supervision of **Mr. A.H.M Shahariar Parvez, Associate Professor**, Department of Software Engineering, Daffodil International University. I also declare that any part of this project has never been submitted to anywhere else or any other educational institution for the purpose of any academic degree awarded.

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Acknowledgement

First, I want to thank Almighty Allah who gave me the opportunity to live and complete my degree. I would like to express my sincere thanks to my supervisor Mr. A.H.M Shahariar Parvez for his valuable guidance and support throughout the completion of my project. I am also thankful to my department and other teachers for their help to complete the journey successfully. Their support and input have enriched the quality of this work. I would also like to thank my family for always supporting me and being a part of this.

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Chapter 1: Introduction

1.1 Project Overview

According to World Health Organization(WHO) Bangladesh had a density of 9.9 doctors and nurses per 10000 people, a figure much lower than the global median of 48.6. As a result a large number of people are being deprived of proper health care treatment and consultation of experienced doctors in our country. Due to country's communication, transportation and accommodation systems, village peoples are often consulted by rural areas inefficient doctors. We are having insufficient medicine supply, medical equipments compared to town areas on emergency basis. Here our aim is to provide a platform to get easy access to doctors, find medicine from the nearest pharmacy to the village areas and maintain proper treatment of health.

Easymed is a web application that focus to benefit people from all over the country in case of medical treatment and medicines. A lot of people are using smartphone and many of them also familiar with devices like Laptop, Desktop. Besides WIFI is also available from the town areas to rural village now a days. By using the devices and internet, people from anywhere in the country can join Easymed, register themselves and take services from their own place. They can search and see details of any doctors and pay fees online. System will have integrated videocall, messaging and file sharing options. Apart from taking online consultation from the doctors, Easymed will provide online medicine order and delivery services. It is common not to have all the medicine and medical equipment now a days. People need to go town areas and buy them. Using Easymed people can search their medicine online. Pharmacist from the local areas can also be a part of that to ensure faster medicine delivery.

1.2 Project Purpose

The only purpose of Easymed is to establish a connection between doctor and patients in terms of consultation and health guidance. It is not always required to visit to the hospital physically because it takes time to move from rural village to a good quality hospital. Transportation and communication are not appropriate for all the areas. For consultation and health guidance, people can use Easymed easily from their own places.

1.2.1 Proposed System

Easymed will have three type of user registration process including doctors, patients, and pharmacist. Doctor can create different services based on price and availability. Patients can see their services and pay appointment fees online via SSLCommerz (Payment gateway) and receive video call url to join. Patient can upload their previous medical history documents like prescription, test report that is relevant to their services. Video call will be controlled by the doctor and system admin. In case of system failure, admin or doctor can create new video session url and send them to the patient for further activities. Pharmacist can have access to the system and have their own medicine inventory that will be available to the website. Patient can order and get their required medicine from there. Some system generated report will be available like appointment details, fees receipt, and medical transcript that will be provided by the doctor after a successful consultation if necessary. All the data will be secure and electronically recorded for historical data analysis and forecasting.

Chapter 2: System Analysis

2.1 Feasibility analysis

2.1.1 Market Feasibility

As the number of smartphone users and availability of WIFI from town to rural areas fair enough, so the number of users can be extensive. People from any places can be benefited using Easymed. Due to increment of online activities and remote facilities this type of services will be more demandable day by day.

2.1.2 Technical Feasibility

The technical infrastructure will be feasible as it is a web app and compatible for all the devices like smartphone, desktop, and laptops. Integration of videocall, messaging and file sharing options are feasible across the platform using open-source libraries and frameworks. Secure and online payment integration will be feasible using SSLCommerz which a renowned and available payment gateway and will be integrated with the system. Due to the modem and responsive UI, Bangla language option it will be feasible for all kind of users to easily operate.

2.1.3 Operational Feasibility

Collaboration of doctors from different hospitals or retired person will have more impact on this application. Willingness of providing services online and help patient from all over the countries will be a vital role for the success of Easymed implementation. Along with the existing delivery partner, it will be feasible to process easy medicine delivery to the patient location.

2.2 Functional Requirements

Functional requirements mean the functionality and must do things for this web application. These are the following lists of functional requirements for Easymed for different stakeholders and priority. The stakeholder must need to follow these requirements in terms of accessibility of this application.

2.2.1 User registration

FRQ-1	User registration
Description	Both doctors, patients and pharmacist can register through web application
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.2 Login

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.3 Profile update

FRQ-2	Profile update
Description	Both doctors, patients and pharmacist can update their profile after first login from their profile menu
Stakeholder	Doctor, patient, pharmacist
Priority	Medium

2.2.4 Doctor service creation

FRQ-2	Doctor service creation
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.5 Video call creation

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.6 Make e-prescription

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.7 Notify patients

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.8 Password reset

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.9 Search doctors

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.10 Book online appointment

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.11 Pay appointment fees

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.12 Upload medical history

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.13 Leave feedback

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.14 Create medicine inventory

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.15 Order medicine

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.2.16 Process and delivery medicine

FRQ-2	User login
Description	Both doctors, patients and pharmacist can login through web application and find their portal
Stakeholder	Doctor, patient, pharmacist
Priority	High

2.3 Non-Functional Requirements

Non-functional requirements mean the general properties of a system that can also be introduced as quality attributes. Non-functional requirements of Easymed includes,

- **Security:** System will have 2FA authentication system to enhance the security for all the users
- **Availability:** The system should function 24/7 and server response to all the users properly
- **Performance:** System should be operated and execute every process within 5 seconds
- **Accuracy:** Data must be accurate on the terms of video call schedule, payment transaction and all the operational data
- **Maintenance:** It will be easy to maintain with a single point of integration
- **User experience:** System UI, functionality and process will be smooth for the users

2.4 Performance

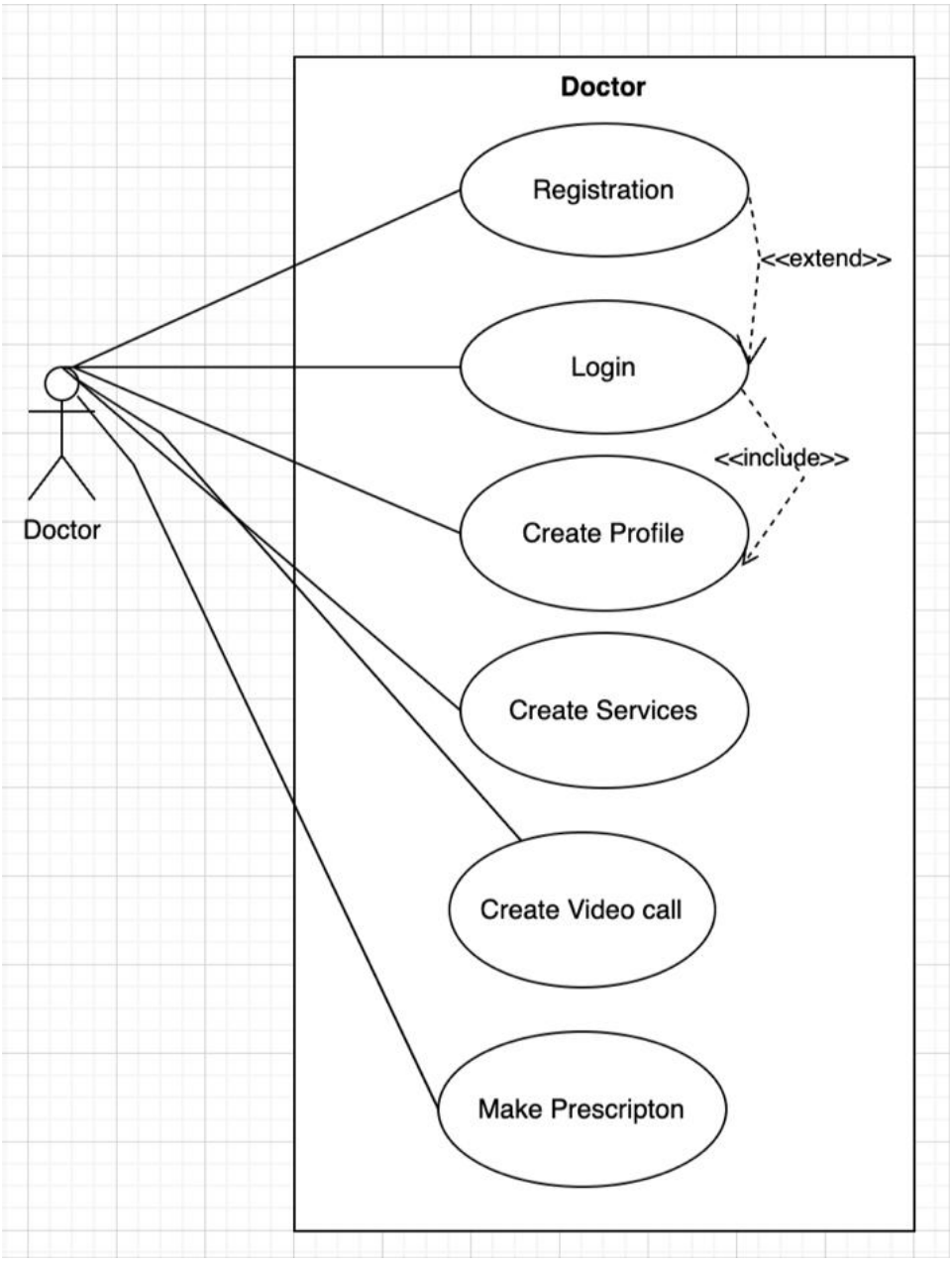
System will have options to track the performance for the following terms,

- Active users: Measure the number of active users based on authentication and access
- Number of registered doctors: Find the number of registered doctors and their services based on uses of the system
- Consultation volume: Monitor the number of consultation and video call session
- Patient engagement: Identify patient registration and consultation booking frequency
- Patient satisfaction: Collect data and insight from patient's feedback based on their services and doctors' consultation
- System availability: System availability will be a key option to find the system performance

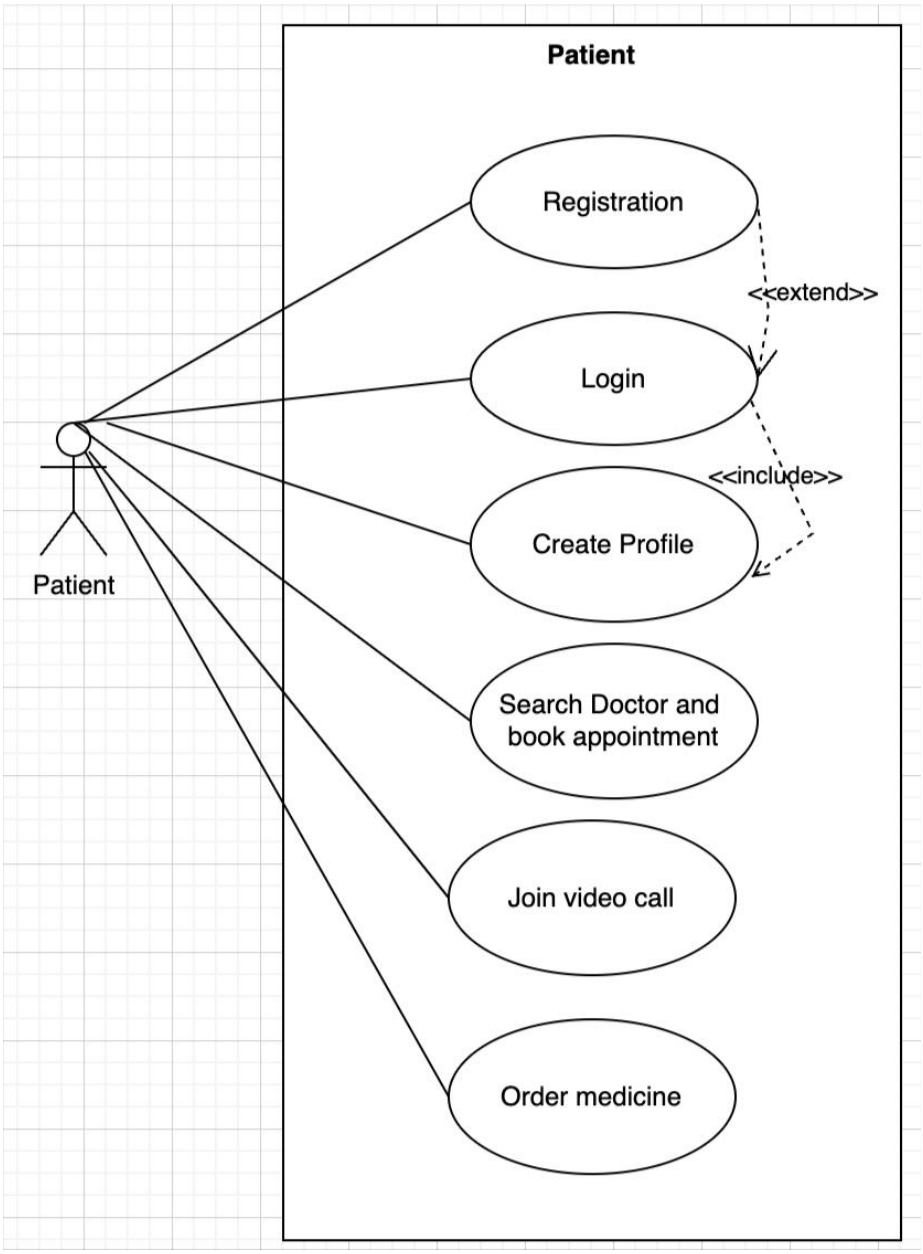
Chapter 3: System Design

3.1 Use case diagram for Easymed

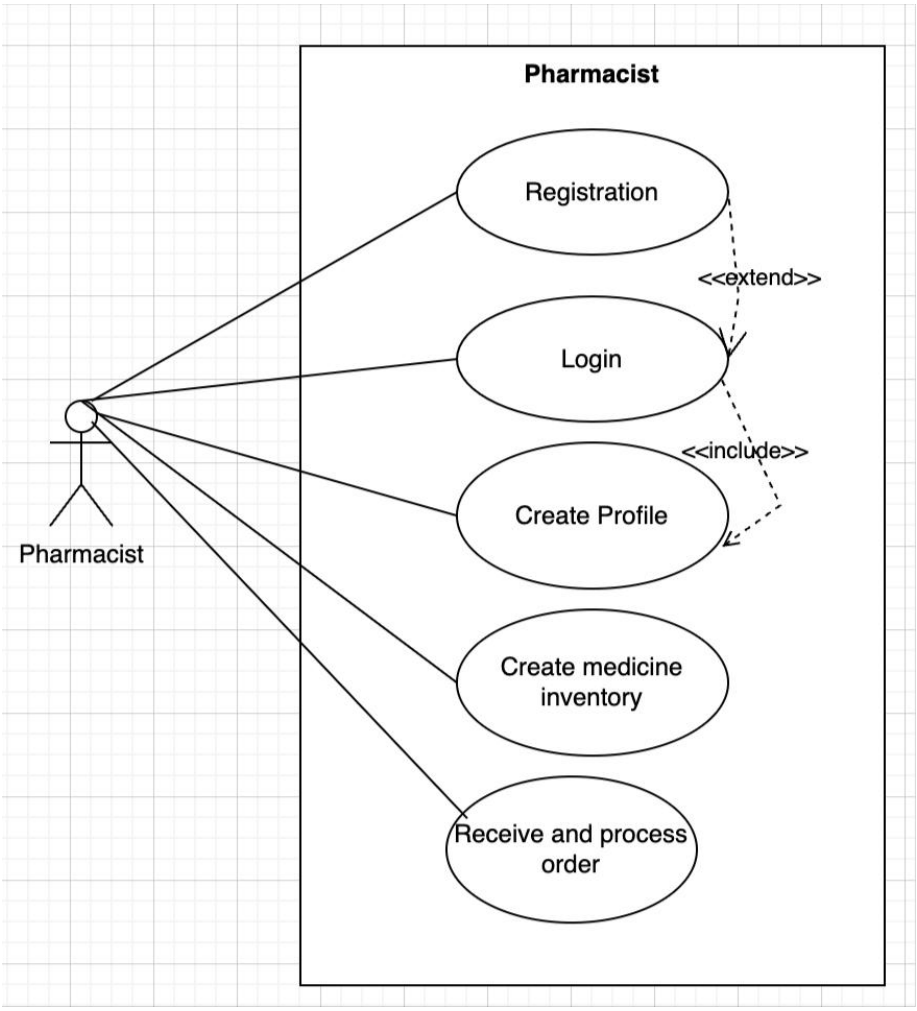
3.1.1 Use case diagram for doctor



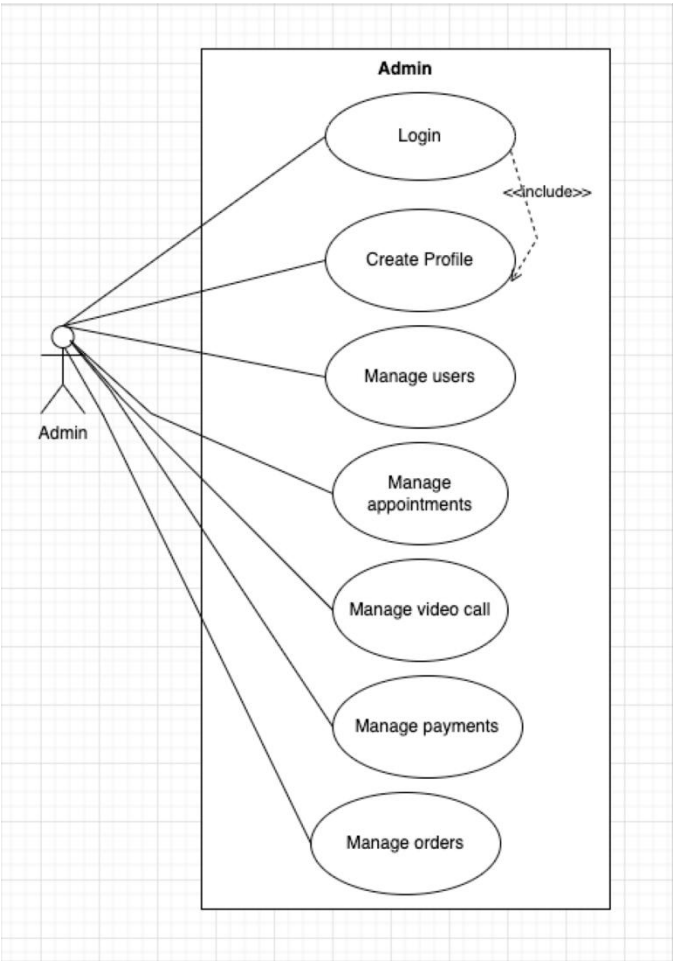
3.1.2 Use case diagram for patients



3.1.3 Use case diagram for pharmacist



3.1.4 Use case diagram for admin



3.2 Use case description

3.2.1 Registration

Use case	Registration
Use case no.	01
Goal	Create the user account into the system
Pre-condition	User must have to fill-up the basic information
Primary actor Secondary Actor	Doctor, Pharmacist, Patient No
Description	User will navigate to the signup page and fill up all the information to do a successful registration
Expectation	If everything is correct, the user account will be created
Priority	High

3.2.2 Login

Use case	Login
Use case no.	02
Goal	Login to the system
Pre-condition	User must have to be registered
Primary actor Secondary Actor	Doctor, Pharmacist, Patient, Admin No
Description	User will navigate to the login page and fill up all the information to do a successful login
Expectation	If everything is correct, the user be logged in successfully
Priority	High

3.2.3 Create and update profile

Use case	Create profile
Use case no.	03
Goal	Create and update users' profile by their own permission
Pre-condition	User must have to login first
Primary actor Secondary Actor	Doctor, Pharmacist, Patient, Admin No
Description	After login, user will find see profile option to update data
Expectation	If everything is correct, the user profile will be updated
Priority	Medium

3.2.4 Create services

Use case	Create services
Use case no.	04
Goal	Doctor can create services with price and details
Pre-condition	User profile must have to create for that
Primary actor Secondary Actor	Doctor Admin
Description	Doctor will find their own profile and create services from their
Expectation	If services are created and published, then it will visible to website
Priority	High

3.2.5 Create video call

Use case	Create video call
Use case no.	05
Goal	Create video call session using jitsi and share
Pre-condition	Doctor must have permission or should have an online payment first
Primary actor Secondary Actor	Doctor, Patient Admin
Description	Doctor will fill up all the information and create the video call from system tray
Expectation	If everything is correct, a video call url will be generated
Priority	High

3.2.6 Make e-prescription

Use case	Make e-prescription
Use case no.	06
Goal	Create an e-prescription for the patients
Pre-condition	Doctor should have created an e-prescription for a booked appointment
Primary actor Secondary Actor	Doctor, Patient Admin
Description	Doctor will write the medicine info and dose details for the patient
Expectation	After all the information is provided, patient will receive an e-prescription
Priority	High

3.2.7 Search doctor

Use case	Search doctor
Use case no.	07
Goal	Patient will search doctor and see details
Pre-condition	User must have to visit the website first
Primary actor Secondary Actor	Patient No
Description	User will go to the landing page and search doctor details
Expectation	Patient will find a doctor for online consultation
Priority	High

3.2.8 Pay fees online

Use case	Pay fees
Use case no.	08
Goal	Patient will make online payment for consultation
Pre-condition	Patient must have to visit a doctor profile first
Primary actor Secondary Actor	Patient No
Description	Patient will select a doctor and proceed to pay the consultation fees
Expectation	If everything is correct, the payment will be processed, and patient will receive a video call url
Priority	High

3.2.9 Join video call

Use case	Join video call
Use case no.	09
Goal	Patient will join the video call using the video call url
Pre-condition	Patient must have to pay first before receiving and join to the video call
Primary actor Secondary Actor	Doctor, Patient Admin
Description	Patient will join to the video call with doctor using the provided link during payment
Expectation	If the video call server is okay, patient will be able to join
Priority	High

3.2.10 Upload medical record

Use case	Upload medical record
Use case no.	10
Goal	Patient can upload their previous medical history to the system
Pre-condition	User must have to sign up and logged in to the system
Primary actor Secondary Actor	Doctor, Patient Admin
Description	User will have option to upload data from their profile and doctor can check that

Expectation	If the file type and size is correct, then the data will be uploaded in to the system
Priority	Medium

3.2.11 Create medicine inventory

Use case	Create medicine inventory
Use case no.	11
Goal	Pharmacist will create medicine product from their profile
Pre-condition	Pharmacist must have permission and option to create product
Primary actor Secondary Actor	Pharmacist Admin
Description	Pharmacist will create the medicine with all the details
Expectation	If the medicine is created and published, then it will be visible to the website.
Priority	Medium

3.2.12 Order medicine

Use case	Order medicine
Use case no.	12
Goal	Patient will search and order medicine online
Pre-condition	User must have to fill-up the basic information
Primary actor Secondary Actor	Patient Pharmacist, Admin
Description	User will navigate to the medicine page and add to cart
Expectation	If everything is correct, the order will be placed, and pharmacist can check then
Priority	Medium

3.2.13 Receive and process order

Use case	Receive and process order
Use case no.	13
Goal	Pharmacist will create delivery and process the order
Pre-condition	Pharmacist must have to confirm and check stock
Primary actor Secondary Actor	Pharmacist, Patient Admin
Description	Pharmacist will go to patient order and create delivery based on patient address.
Expectation	After confirmation, a delivery will be created for the medicine.
Priority	Medium

3.2.14 Manage users

Use case	Manage users
Use case no.	14
Goal	Admin will manage all type users
Pre-condition	Admin must have to login into the system first
Primary actor Secondary Actor	Admin No
Description	Admin will manage all the user's information, and take steps if necessary
Expectation	Admin can save and update any data if necessary
Priority	Low

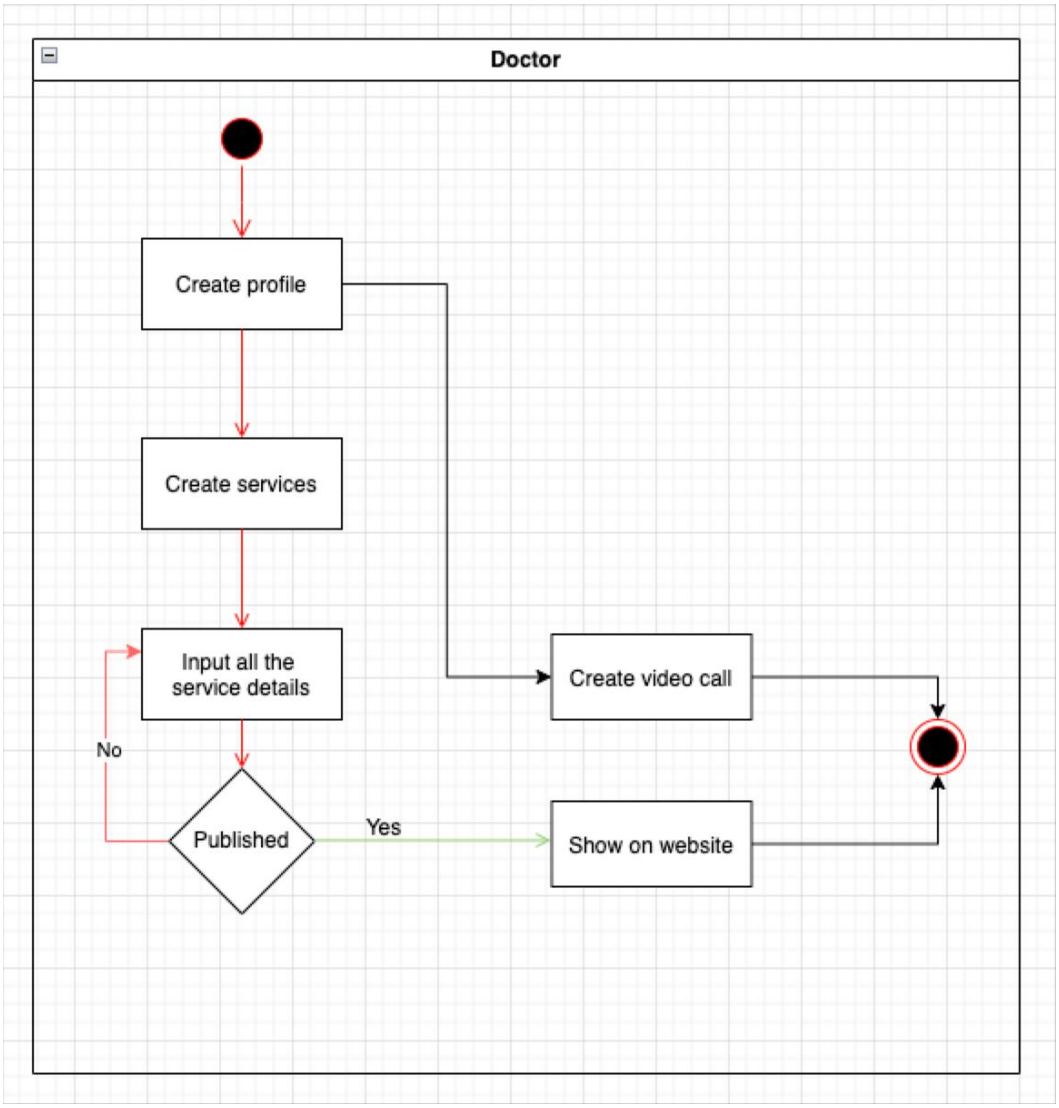
3.2.15 Manage video call

Use case	Manage video call
Use case no.	15
Goal	Admin can manage video call
Pre-condition	Admin must have to login to the system
Primary actor Secondary Actor	Admin No
Description	Admin can go the video call module and monitor all the system
Expectation	If necessary admi can edit the session details

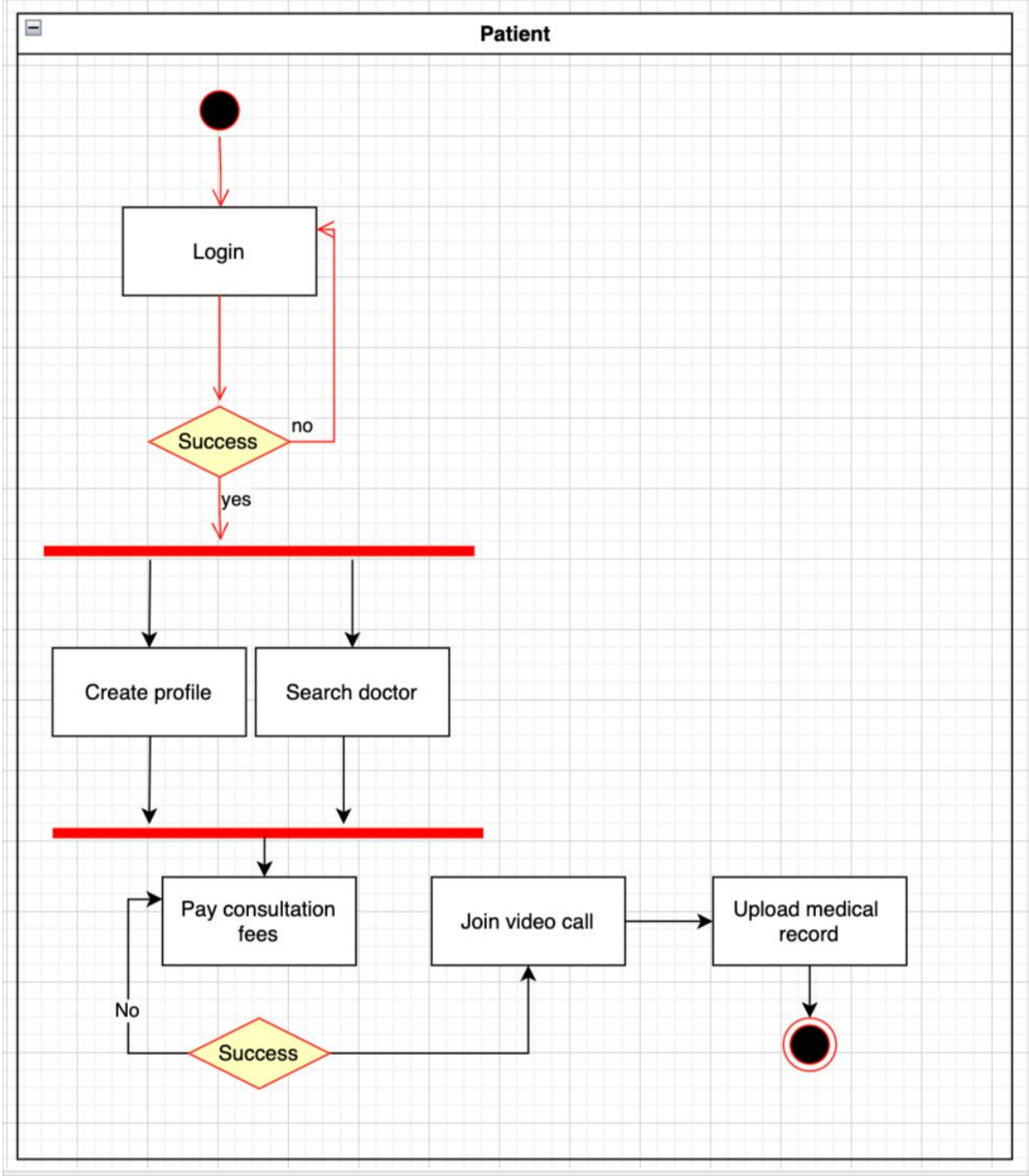
Priority	Low

3.3 Activity diagram

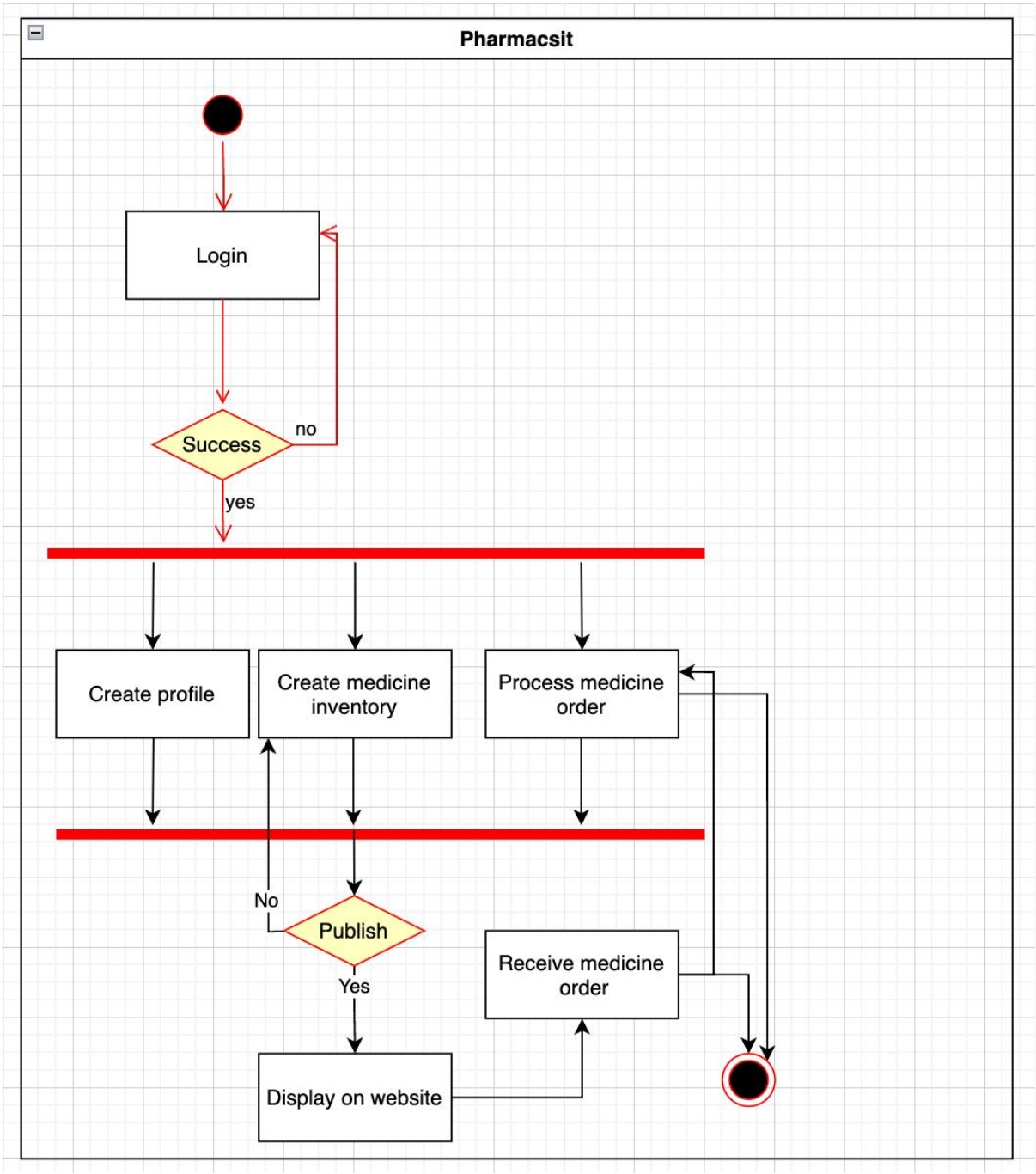
3.3.1 Activity diagram for doctor



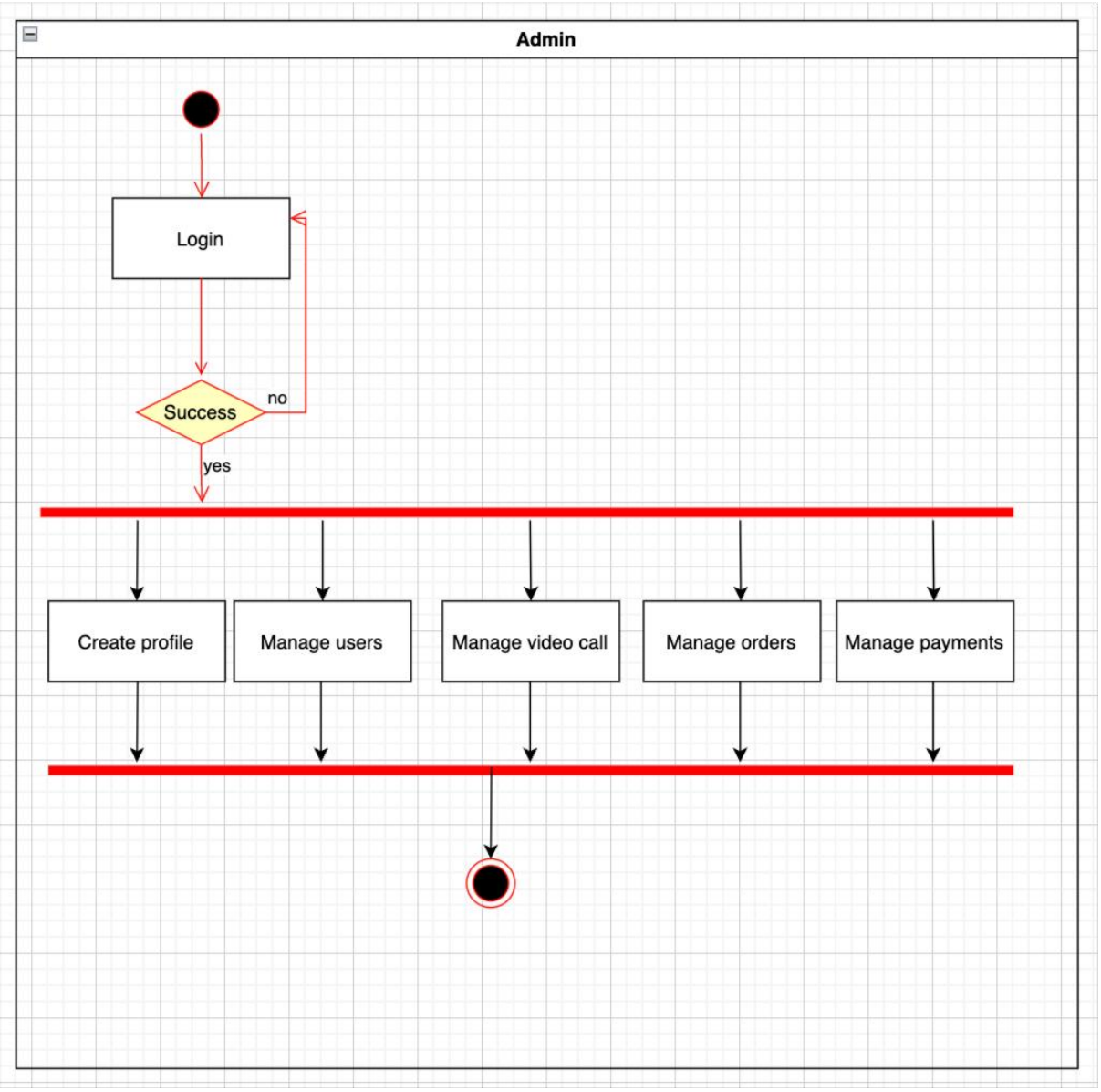
3.3.2 Activity diagram for patient



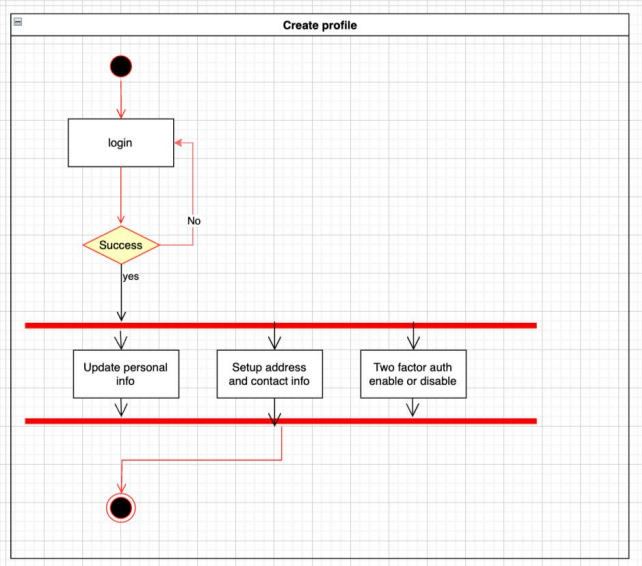
3.3.3 Activity diagram for Pharmacist



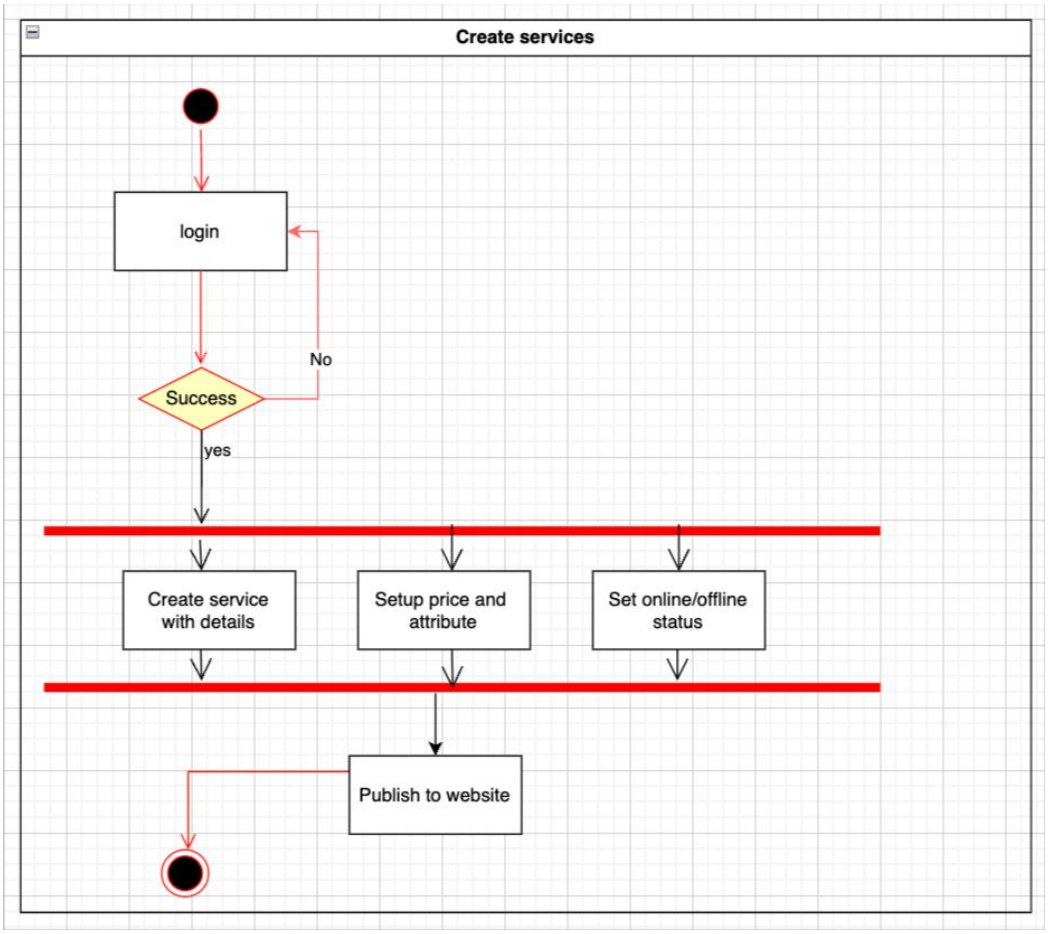
3.3.4 Activity diagram for admin



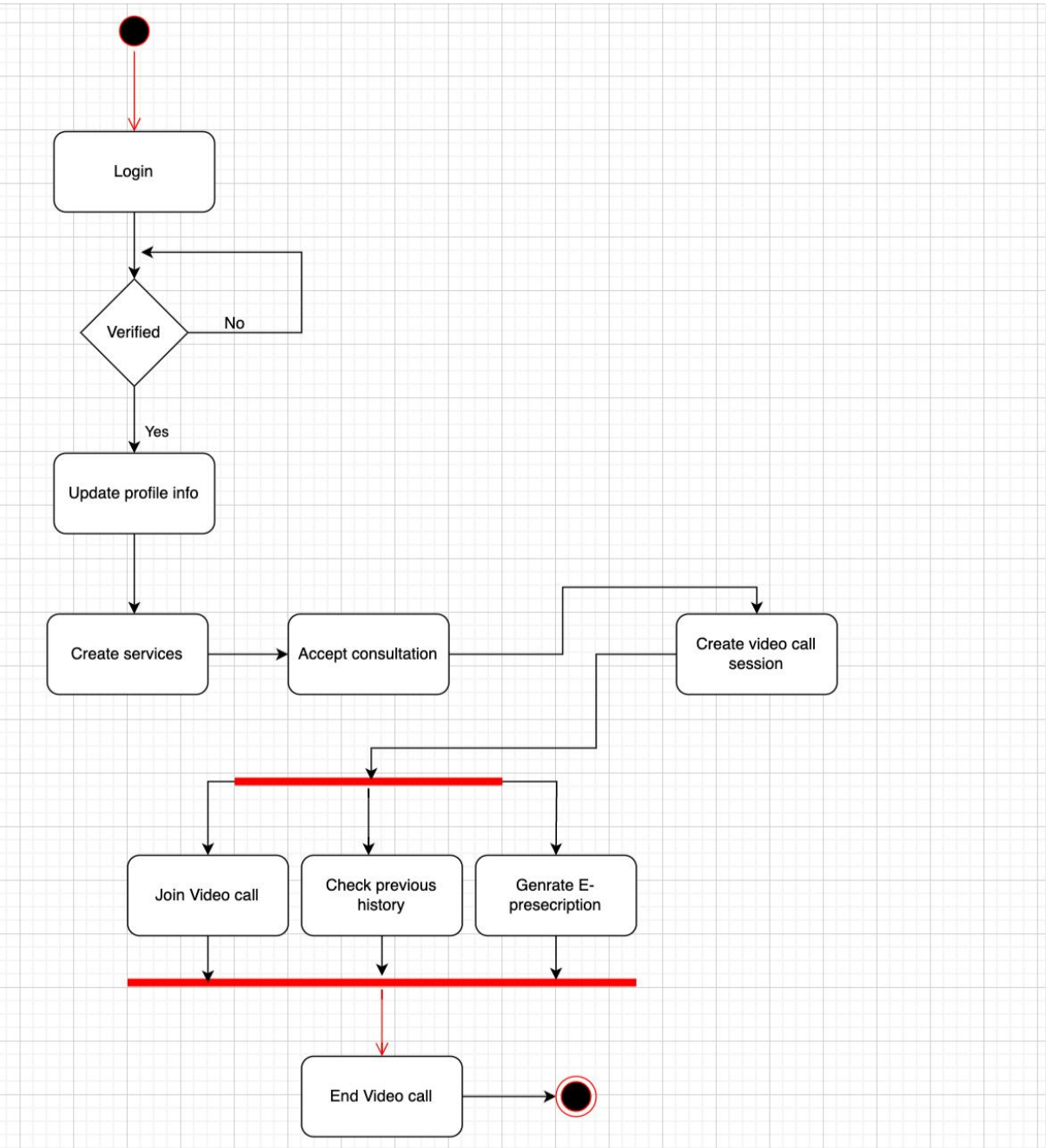
3.3.5 Activity diagram for create profile



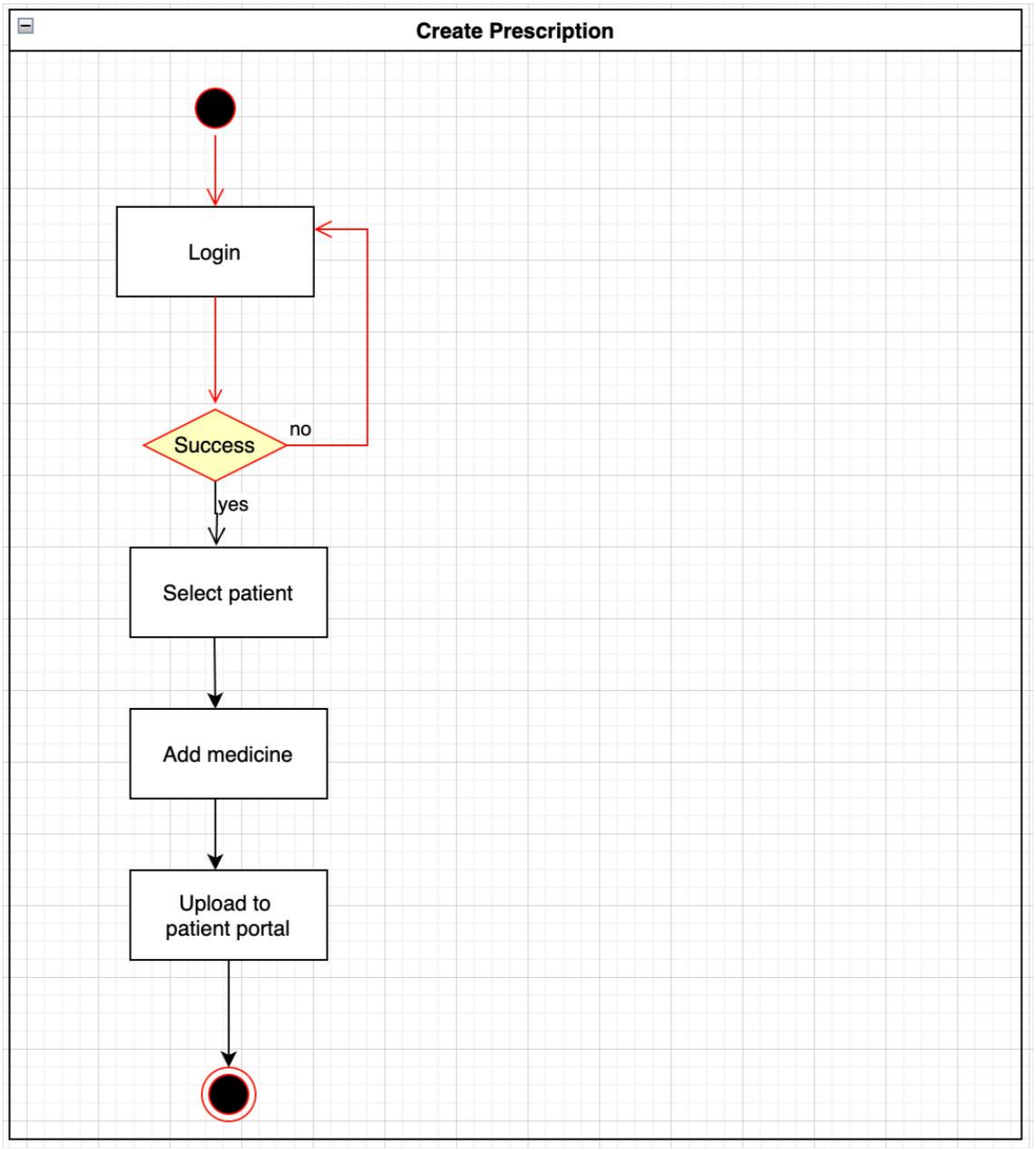
3.3.6 Activity diagram for create services



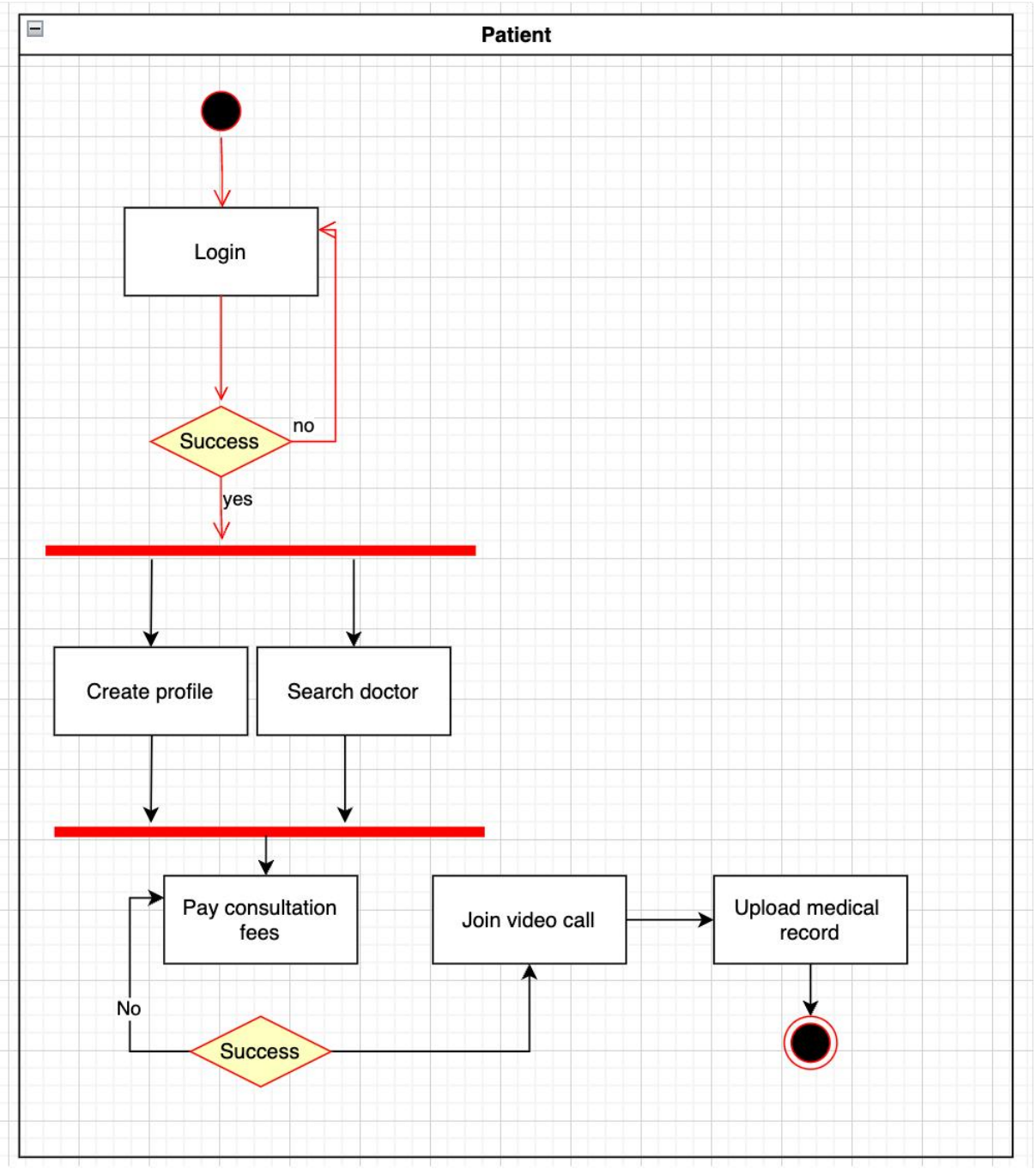
3.3.6 Activity diagram for accepting appointment and create video call



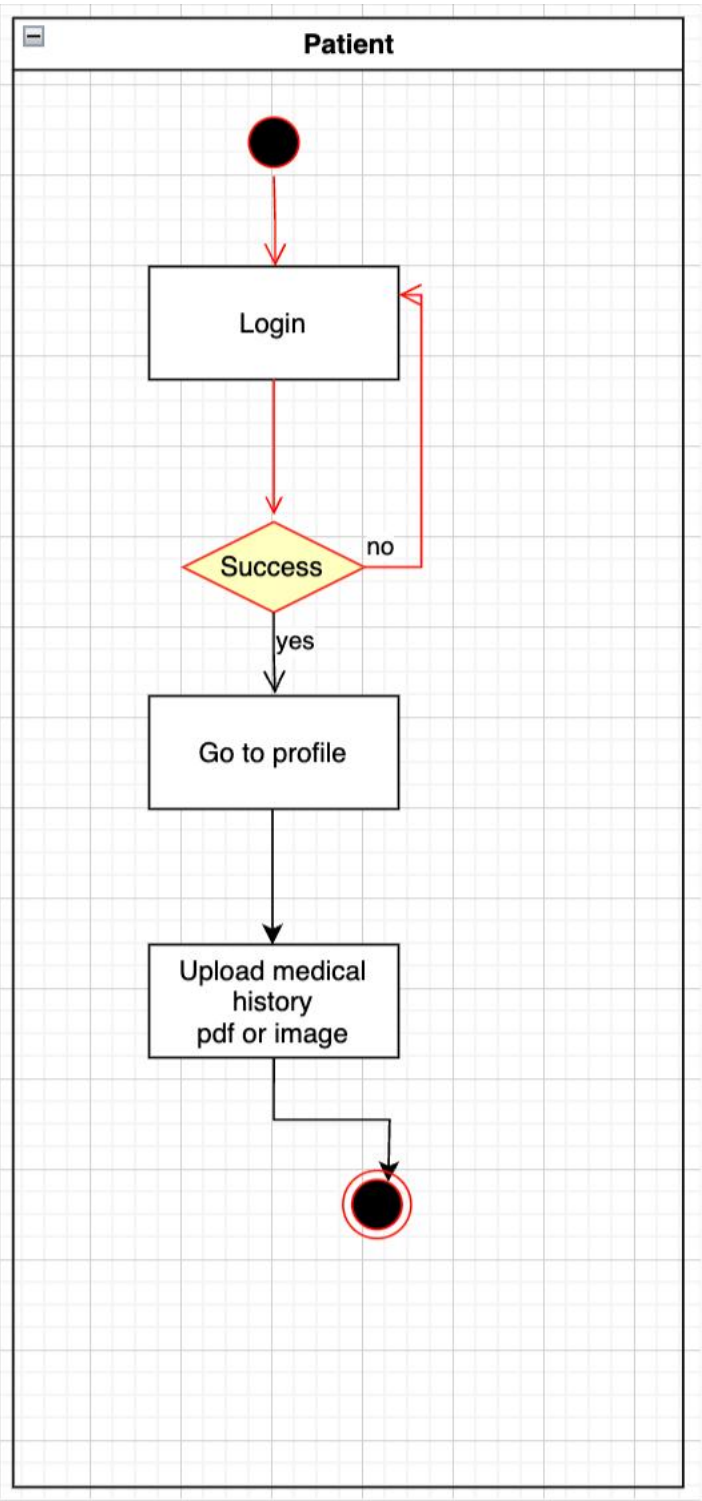
3.3.7 Activity diagram for create prescription



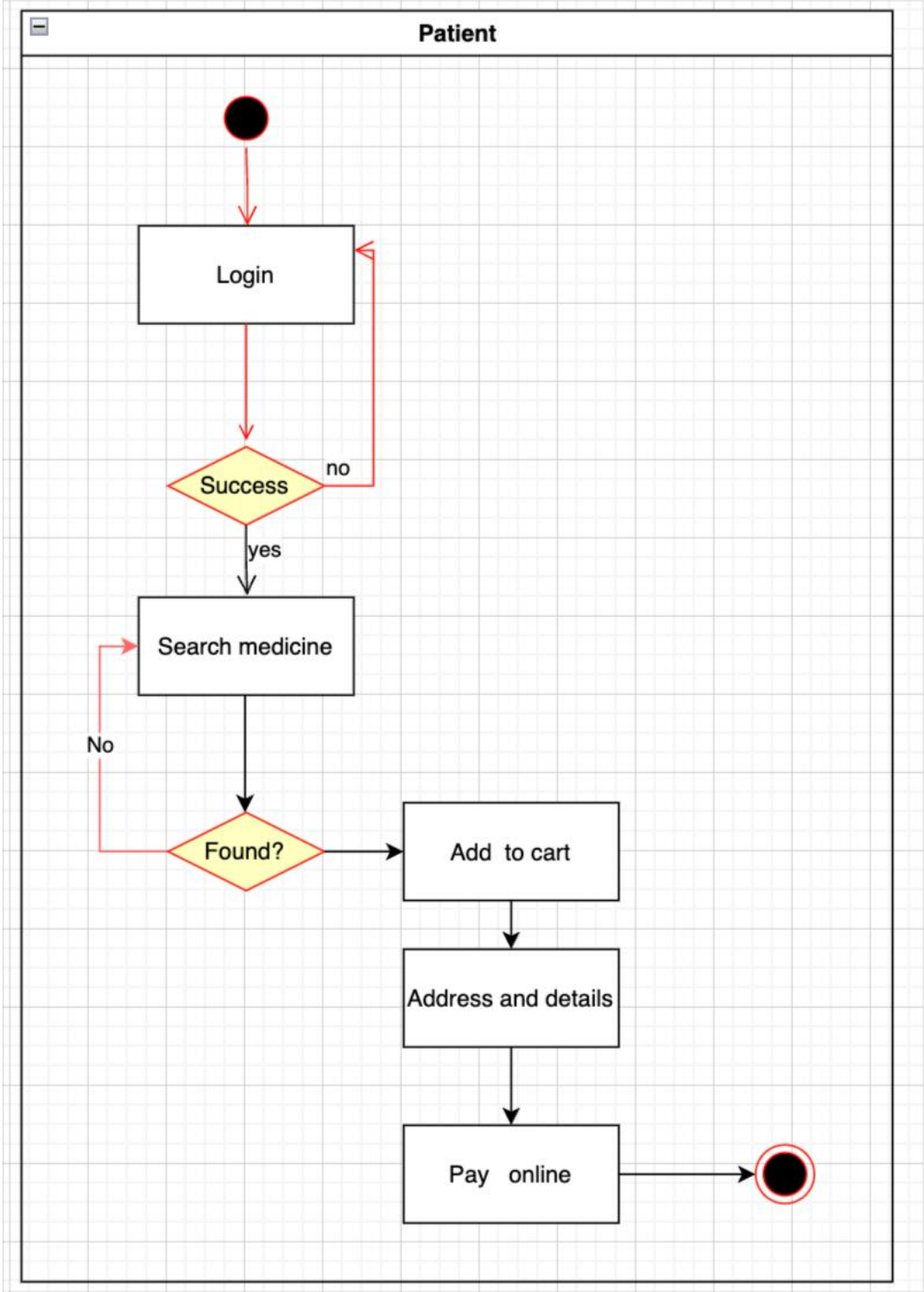
3.3.8 Activity diagram for patient



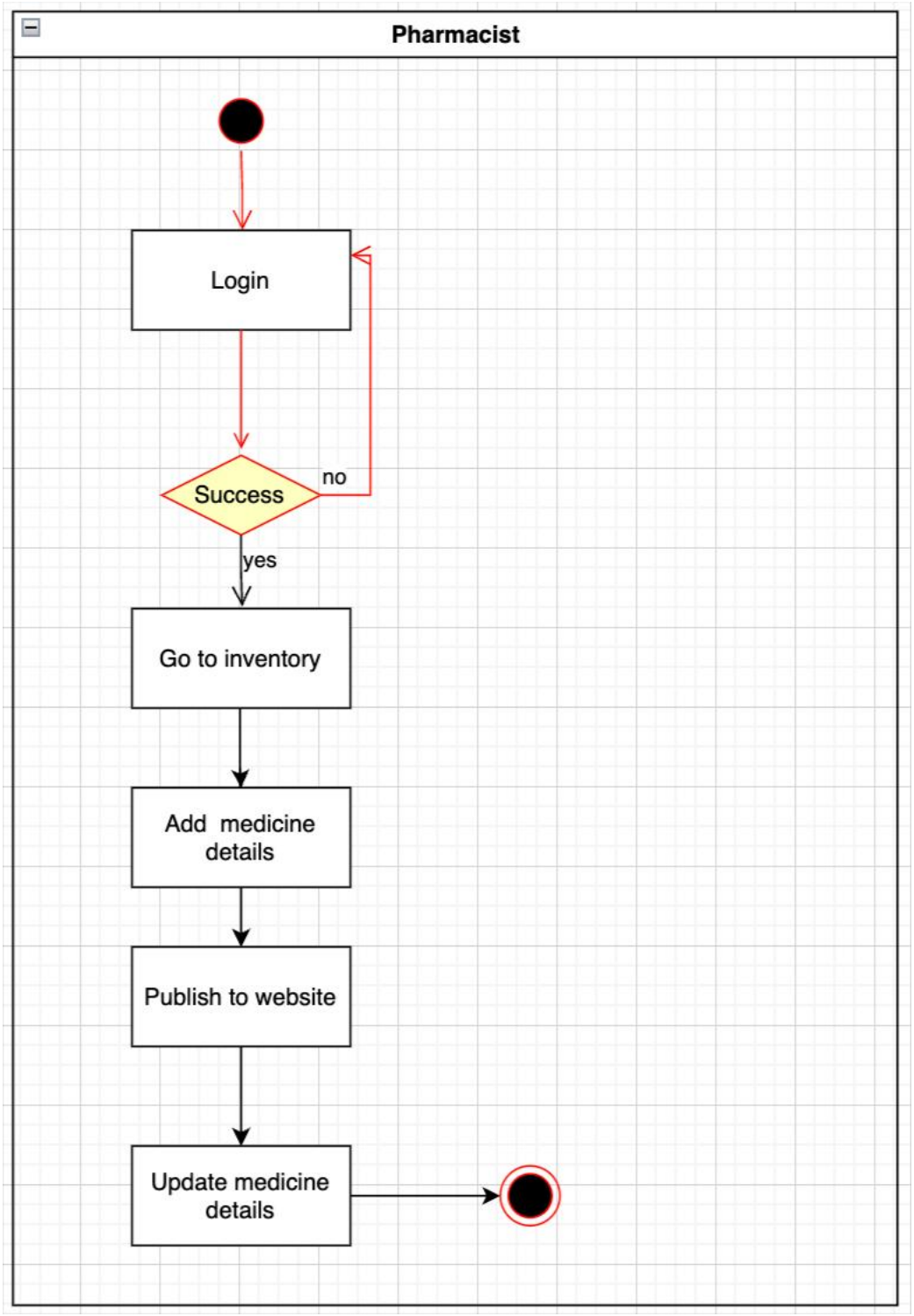
3.3.9 Activity diagram for uploading medical record



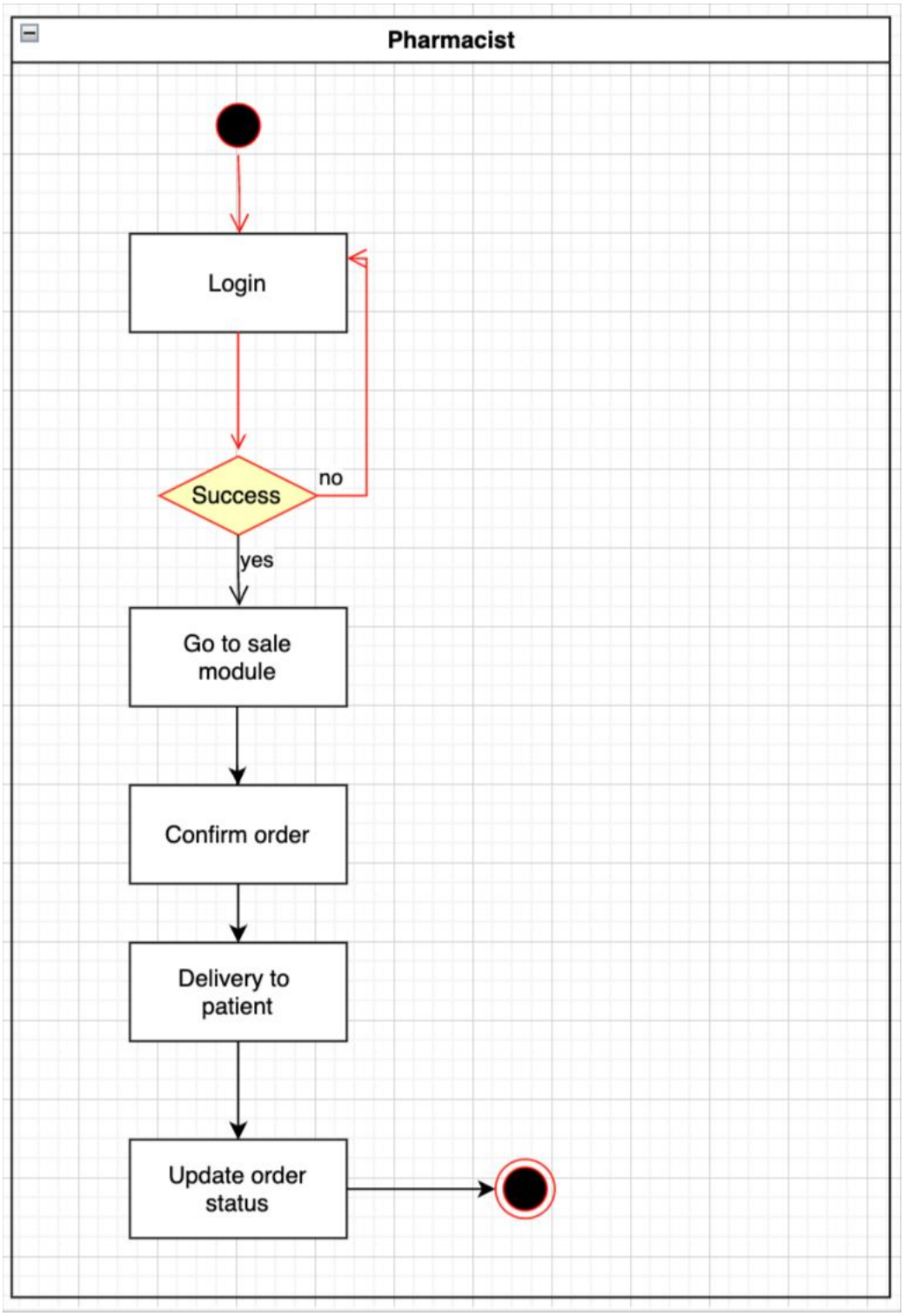
3.3.10 Activity diagram for order medicine



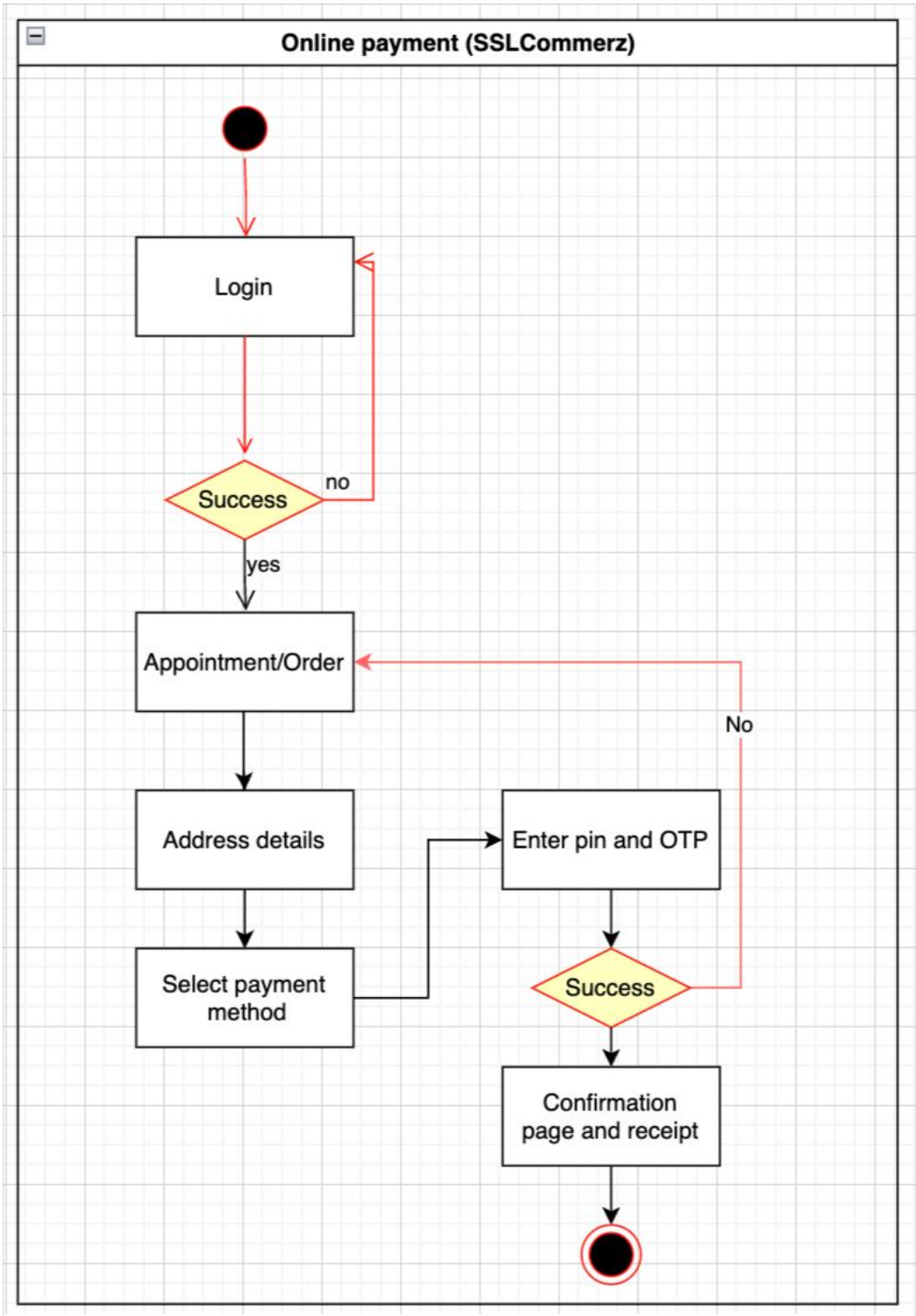
3.3.11 Activity diagram for create medicine



3.3.12 Activity diagram for receive and delivery order



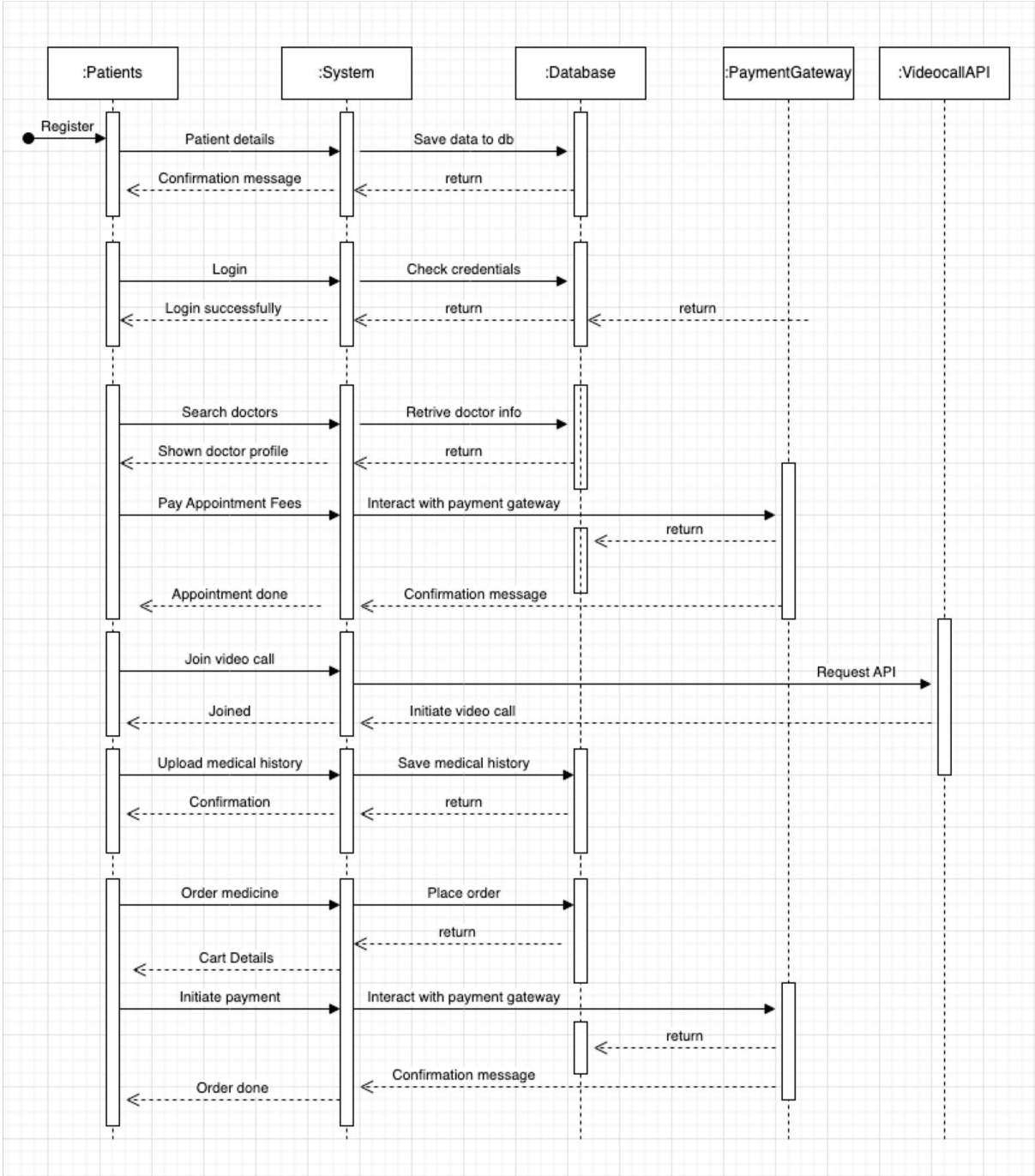
3.3.13 Activity diagram for online payment



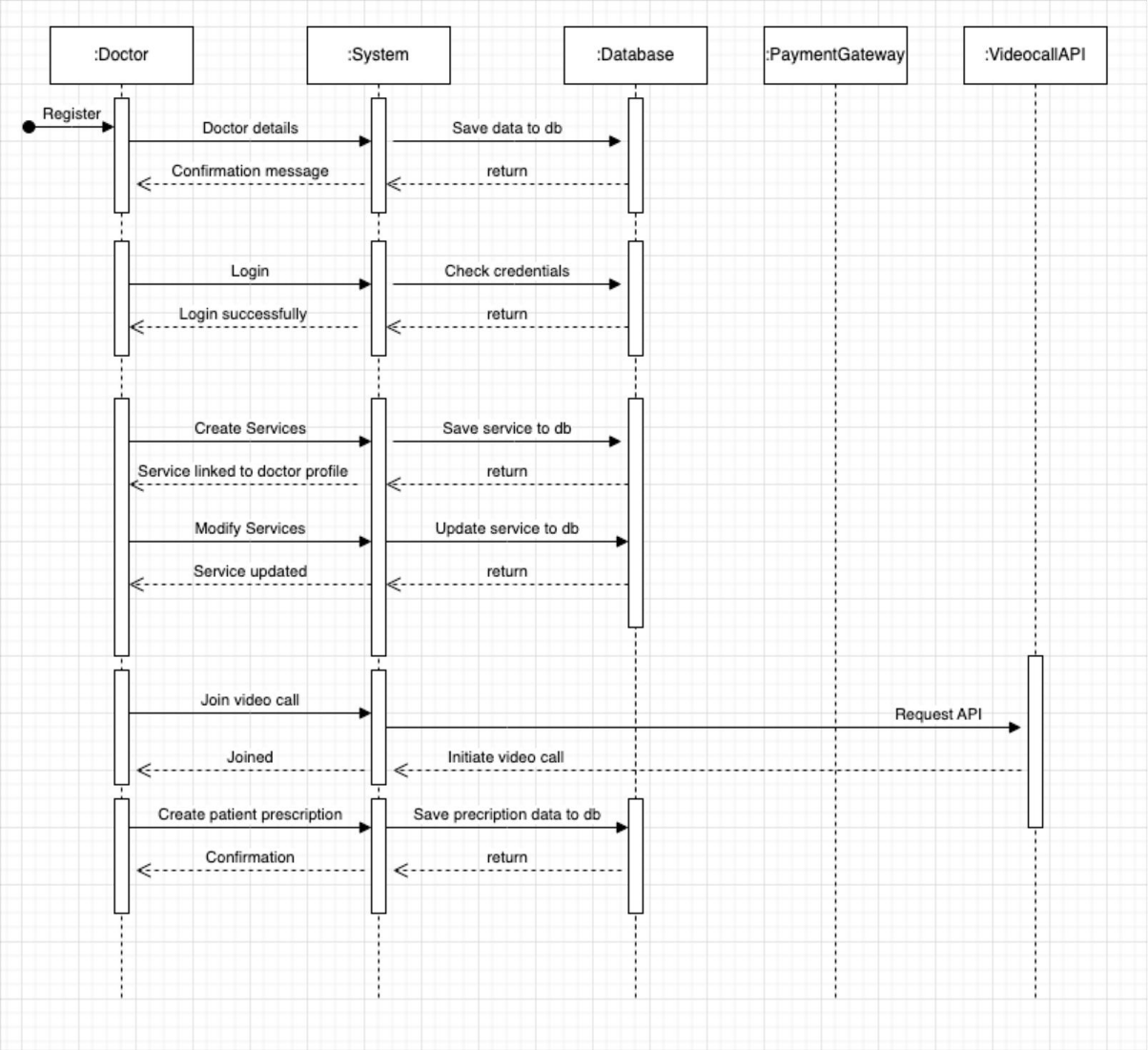
3.4 Sequence diagram

In this phase we will see the sequence diagram for all the stakeholder's journey to the system.

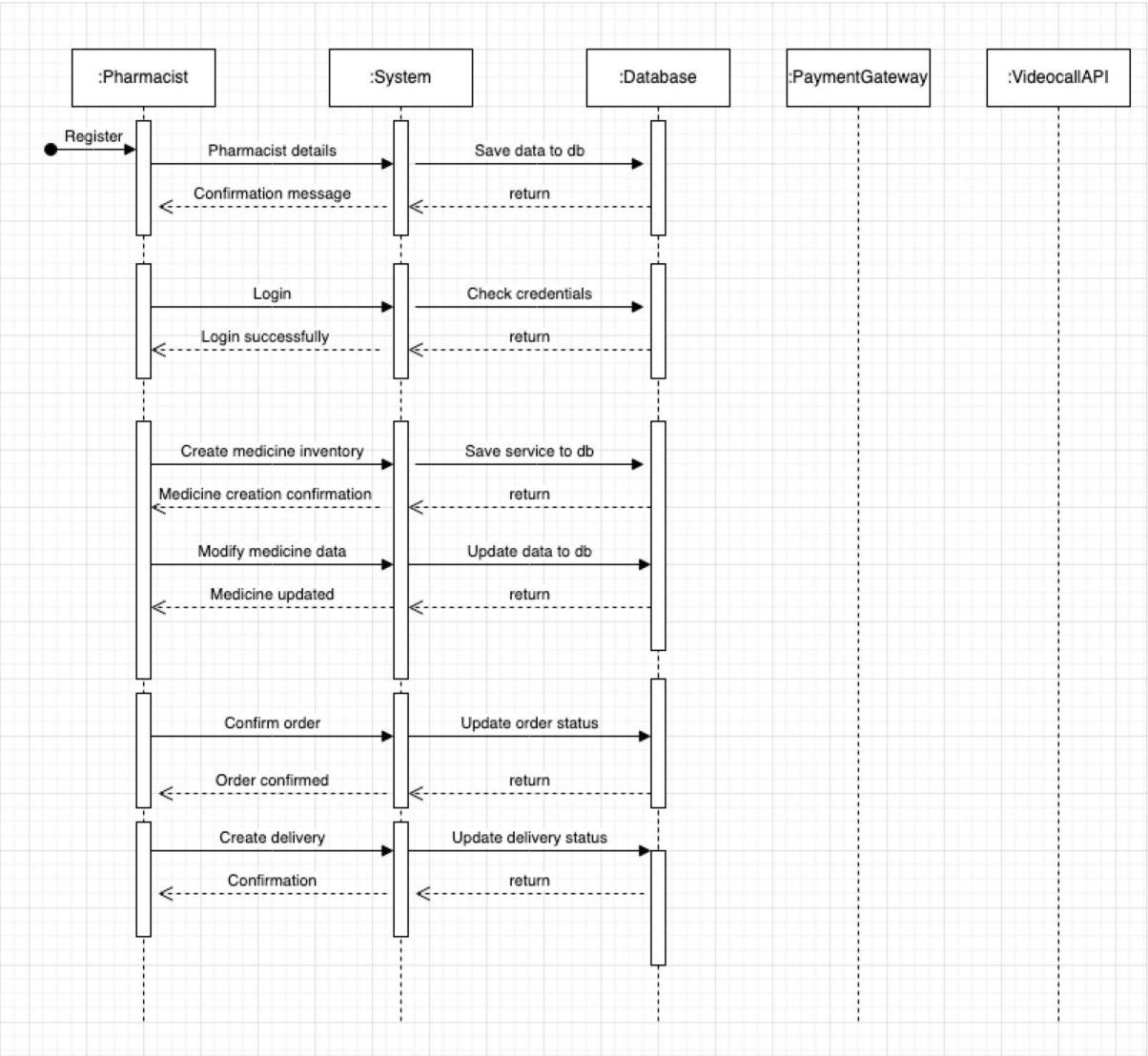
3.4.1 Sequence diagram for patient



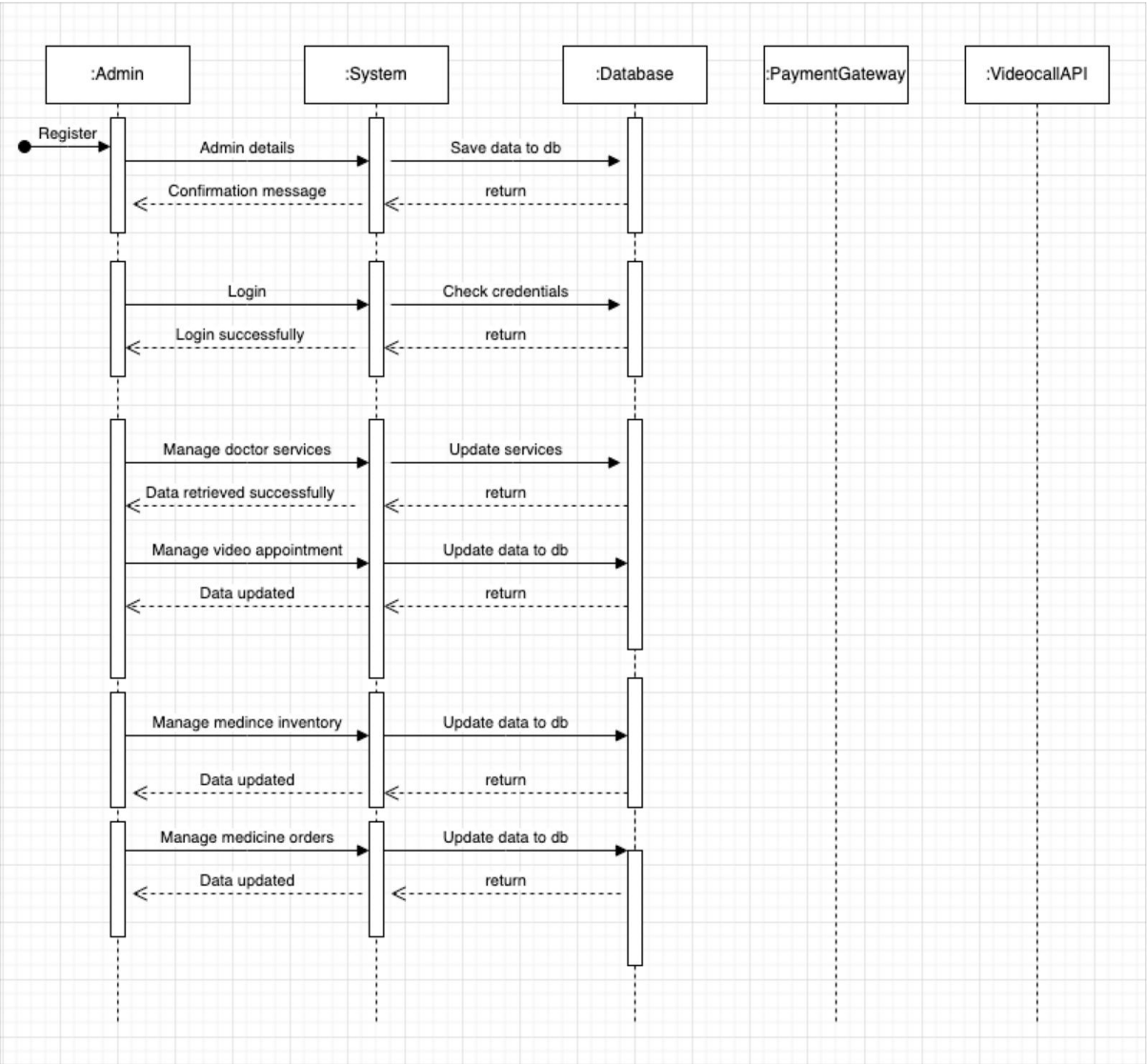
3.4.2 Sequence diagram for doctors



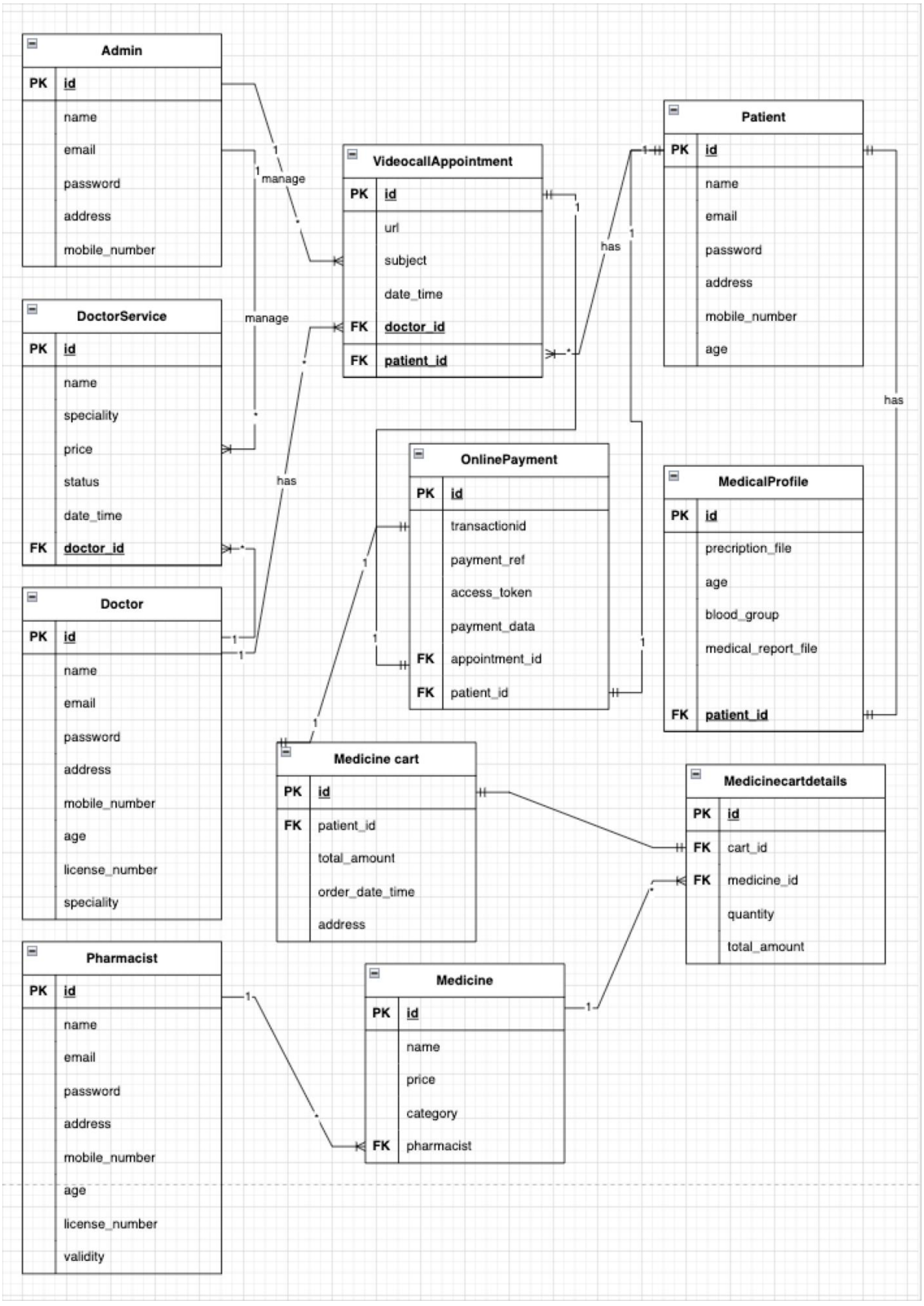
3.4.3 Sequence diagram for pharmacist



3.4.3 Sequence diagram for admin



3.5 ERD Diagram



Chapter 4: Development tool & Technology

To develop Easymed, we need to use different tools and technologies for front end, backend, and database development.

4.1 Integrated Development Environment (IDE)

- Frontend & Backend development: PyCharm, Visual Studio Code
- Database: Pgadmin4

4.2 Technologies

- Backend: Python, Odoo
- Frontend: Xml, CSS, JS
- Database: PostgreSQL
- Video call api integration: Jitsi Meet (Opensource)
- Deployment and hosting: Cloud based vps and ubuntu os preferable

Chapter 5: System Testing

5.1 Testing Features

5.1.1 System Features to be tested

Features	Priority	Descriptions
Registration and authentication	High	Ensure that all the users can register and access to their account securely
Login	High	Ensure that all the existing registered users can login to their account securely
Password Reset	Medium	Ensure that users can reset their password from system properly
Doctor Services Creation	High	Ensure that doctor can different services from their profile
Doctor and medicine list show on website	High	Ensure that all the doctor services and medicine are listed properly for patients
Patient online payment	High	Ensure that the online payment of patient process securely in the system
Video call generation	High	Ensure that system can generate video call session uniquely for patients based on payment status
Stream video call	High	Ensure that the video call URL works both for patient and doctors, also they can join
Upload Medical Report	High	Ensure patient can upload their medical record using the system properly
Leave feedback on doctor	Medium	If a patient wants to leave feedback, then ensure that the patient can record the feedback successfully
Create medicine inventory	High	Pharmacist must have the options to create their own medicine inventory
Process order delivery	High	If patient order medicine, then system must have the capacity to process for delivery

5.1.2 Technical features to be tested

Features	Priority	Descriptions
Database server integration	High	Ensure that the database server is functional 24/7, along with the application server
Video call API integration	High	Ensure that the video call API sever is reachable and ready to connect
Application server	High	Ensure that all the packages are up to date and compatible with application server for smooth operations

5.2 Testing Strategies

Testing strategies are one of the most important things to do for a web application development. System testing gives us feedback if the system will be good or bad for different stakeholders. Based on the stake holders there will be various test strategies for the entire system

5.2.1 Test Approaches

- **Unit testing:** Test individual components and functions of the system in isolation to ensure they work as expected.
- **Integration testing:** Verify the integration between interface such as user interface, database, video call API integration is integrated and work as expected.
- **Automation testing:** Automation test help to find out the preliminary bugs and redundant issues of the application that can be removed based on the test results.
- **Manual testing:** Manual test indicated a natural process of testing for that application where the stakeholders or tester can test each feature individually and find the test outcomes.
- **Performance testing:** Analyze the system response time, stability, and scalability under different level of user's activity.
- **Security testing:** Identify and rectify vulnerabilities of the system, ensure the confidentiality and integrity of user's data.
- **User acceptance testing (UAT):** Engage actual users to validate the overall feature and ensure the system is properly working.

5.2.2 Pass/Fail criteria

Features	**Descriptions**	**Status**
User registration and authentication	Users can register and authenticate successfully	Pass
	Errors on registration or authentication	Fail
Online video call consultations	Smooth online video call initiate, stream, and finish	Pass
	Video call URL broken, server is unreachable	Fail
Online payment options	Payment is done successfully and status update on patient's service	Pass
	Error during online payment	Fail
Online medicine ordering	Patient can order, pay and get medicine delivery successfully	Pass
	Error during order processing	Fail

5.2.3 Testing Schedule

Features	Schedule	Resources
User registration and authentication	7 Days	• Testers • Patients • Doctors • Pharmacist
Online Consultation	14 Days	• Testers • Patients • Doctors
Online medicine ordering	7 Days	• Testers • Patients • Pharmacist

5.3 Test Cases

According to the test features and users level here I have written all the possible test cases that can be done,

5.3.1 Users registration and authentication

Feature	Test Case ID	Scenario	Test Steps	Expected Result	Pass/Fail
User registration and authentication	TC001	User will register to the site	1. Navigate to the signup page. 2. Fill up required informatio n 3. Verify and signup	User successfully registered	Pass
	TC002	User registered with wrong OTP	1. User will enter wrong opt during verification	User will get wrong opt message	Pass
	TC003	User login with correct credentials	1. User will enter their mobile/em ail during login 2. User will enter their password	User will be logged in successfully	Pass
	TC004	User login with incorrect information	1. User will enter wrong email/pass word	User will get wrong login data message	Pass
	TC005	User login with incorrect information	1. User will wrong email/pass word	User will not get any error message	Fail

5.3.2 Online consultation and payment

Feature	Test Case ID	Scenario	Test Steps	Expected Result	Pass/Fail
Online consultation fees payment	TC006	User will search doctor and pay the fees	1. User will search doctor and pay fees for consultation	User will receive payment successful message and video call URL	Pass
	TC007	User will pay the fees	1. User will receive payment confirmation	Payment error occurred but no message	Fail
	TC008	User will join the video call	1. User will try to join the video call with the provided URL	User will enter to the video call room	Pass
	TC009	User will try to join the	1. Video call is	User will see broken url	Pass

		video call	not working with the provided link	message	
	TC010	Doctor closes the appointment and video call link will be finished	1. Doctor will mark the video call option as finished	Patient can't join the video call url further	Pass

5.3.3 Order medicine and get delivery

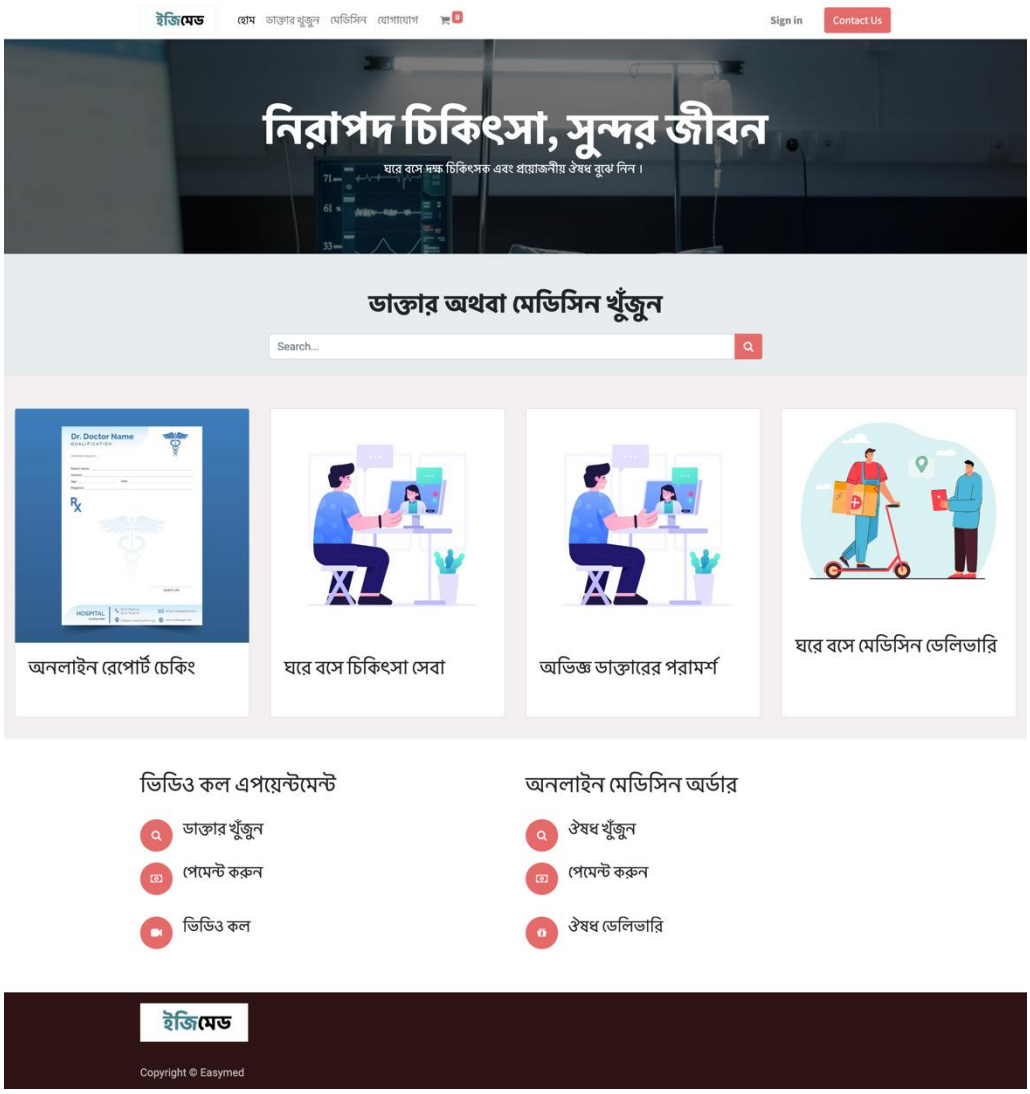
Feature	Test Case ID	Scenario	Test Steps	Expected Result	Pass/Fail
Online consultation fees payment	TC011	Patient will search medicine and order online	1. Patient will search medicine and add to cart 2. Checkout and pay online	Patient will receive a payment confirmation message and receive order details	Pass
	TC012	Patient will update cart with an existing order	1. Patients add extra medicine with an existing cart 2. Checkout	Patient will receive a payment confirmation and place order successfully	Pass

			and pay online		

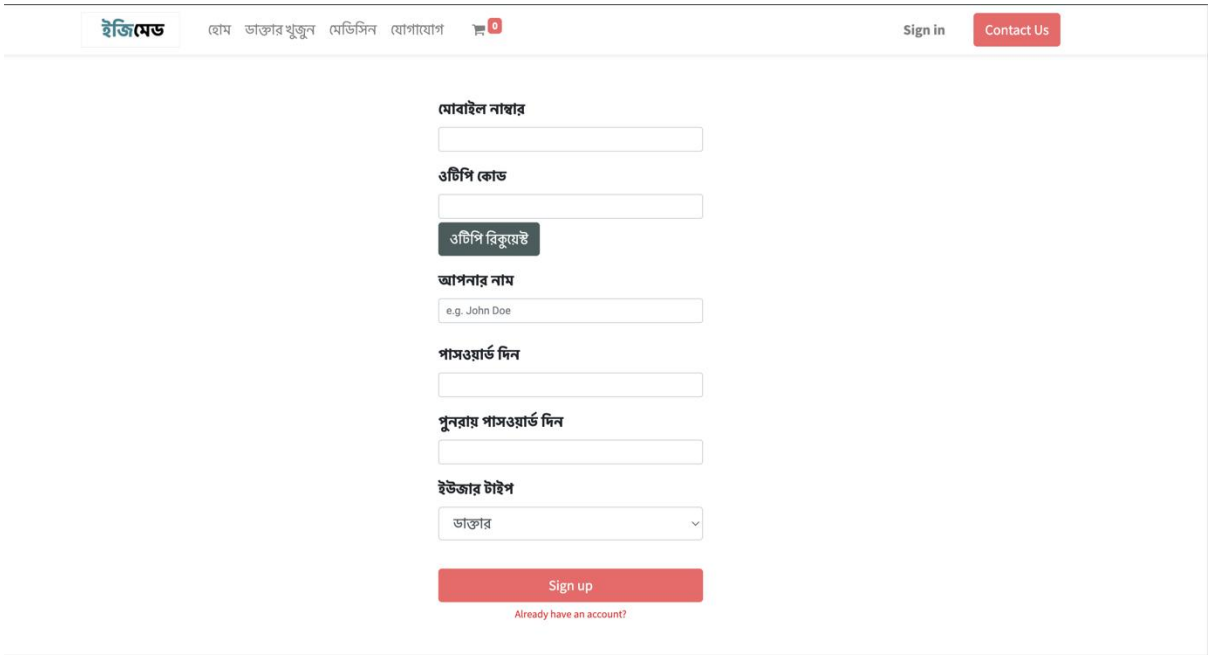
Chapter 6: User manual

6.1 Landing page

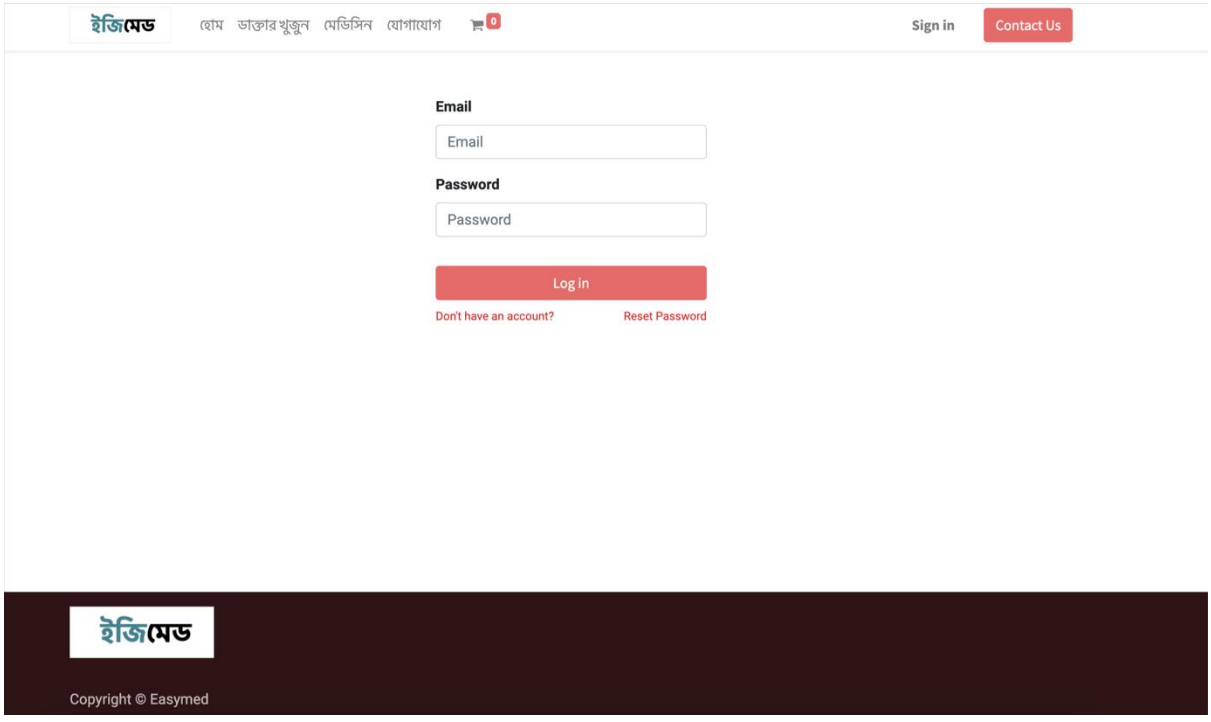
After visiting Easymed, the users will find a landing page for the introduction and features of the website.



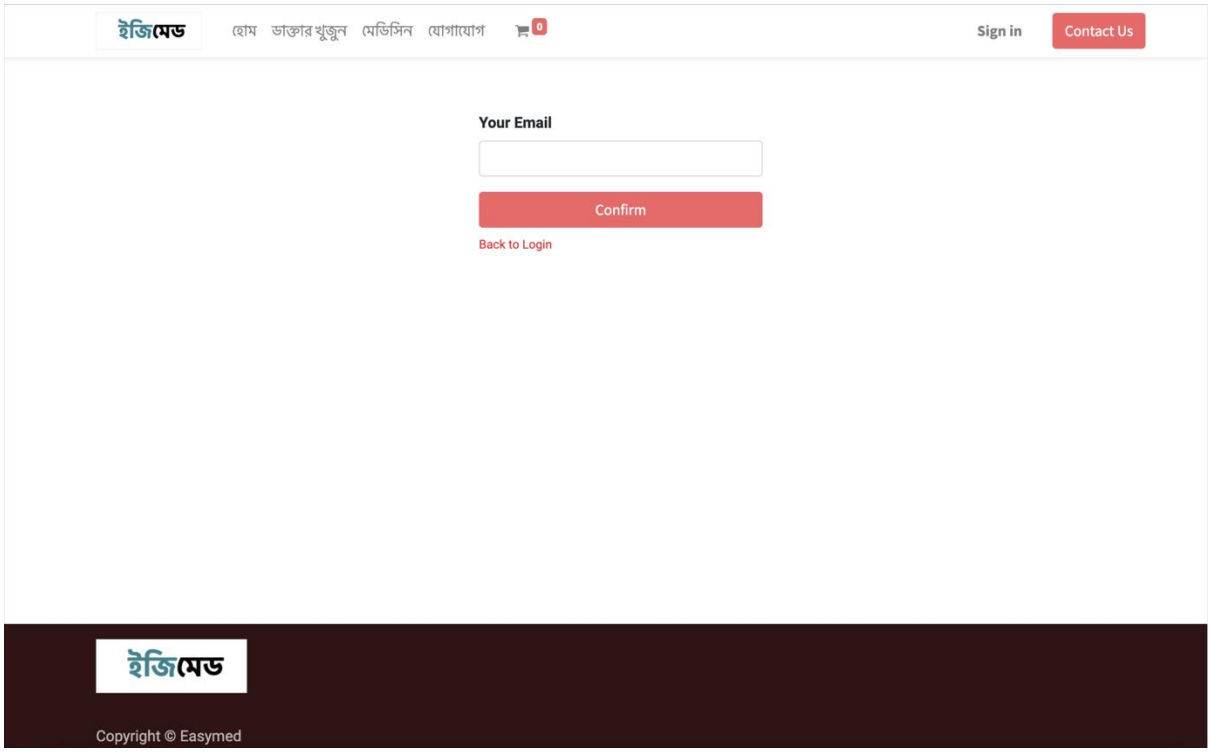
6.2 Registration page



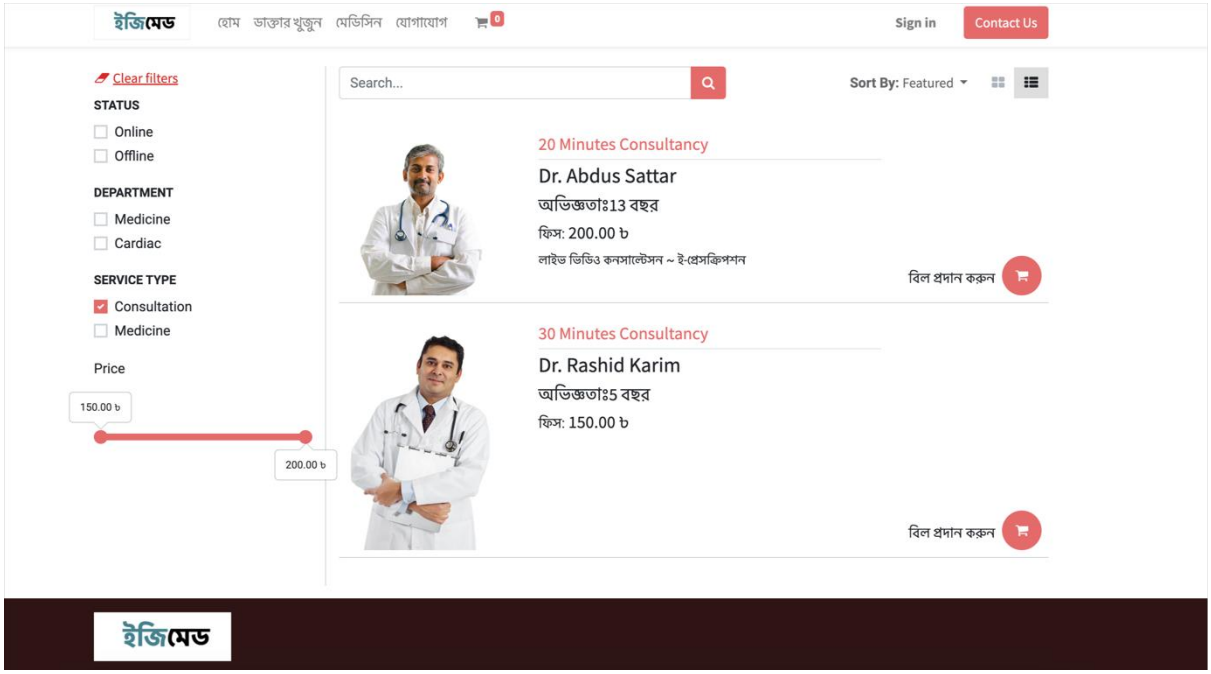
6.3 Login Page



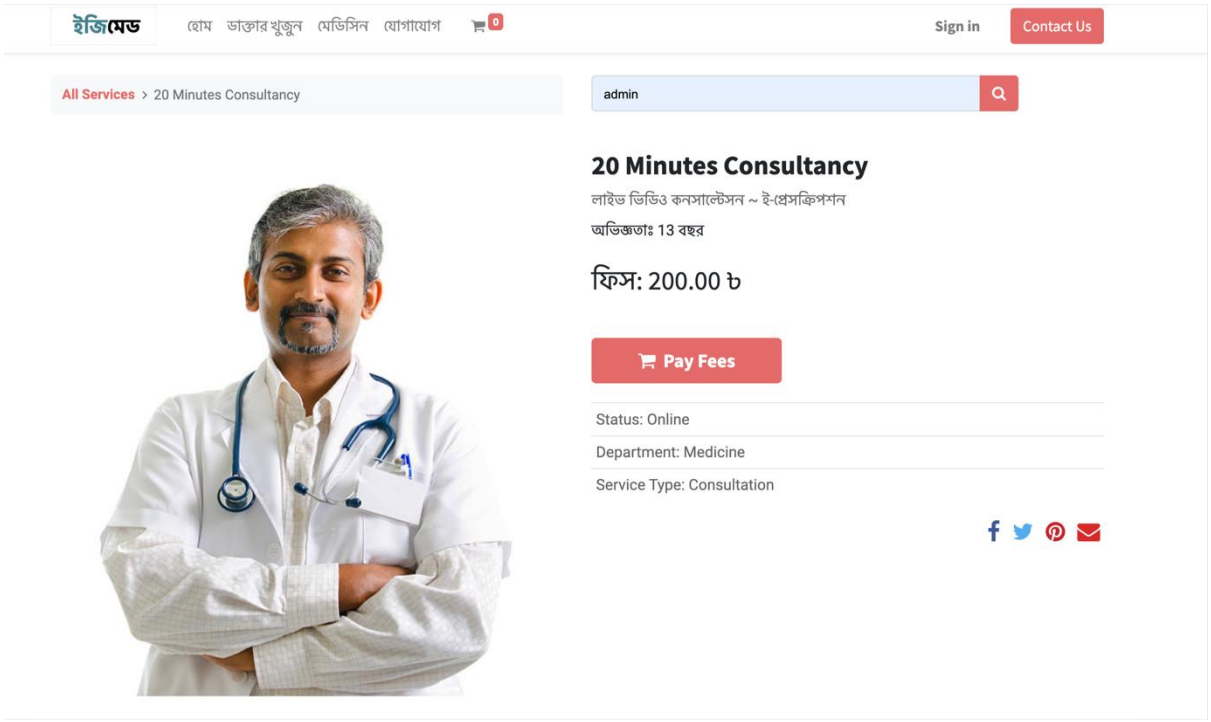
6.4 Password reset



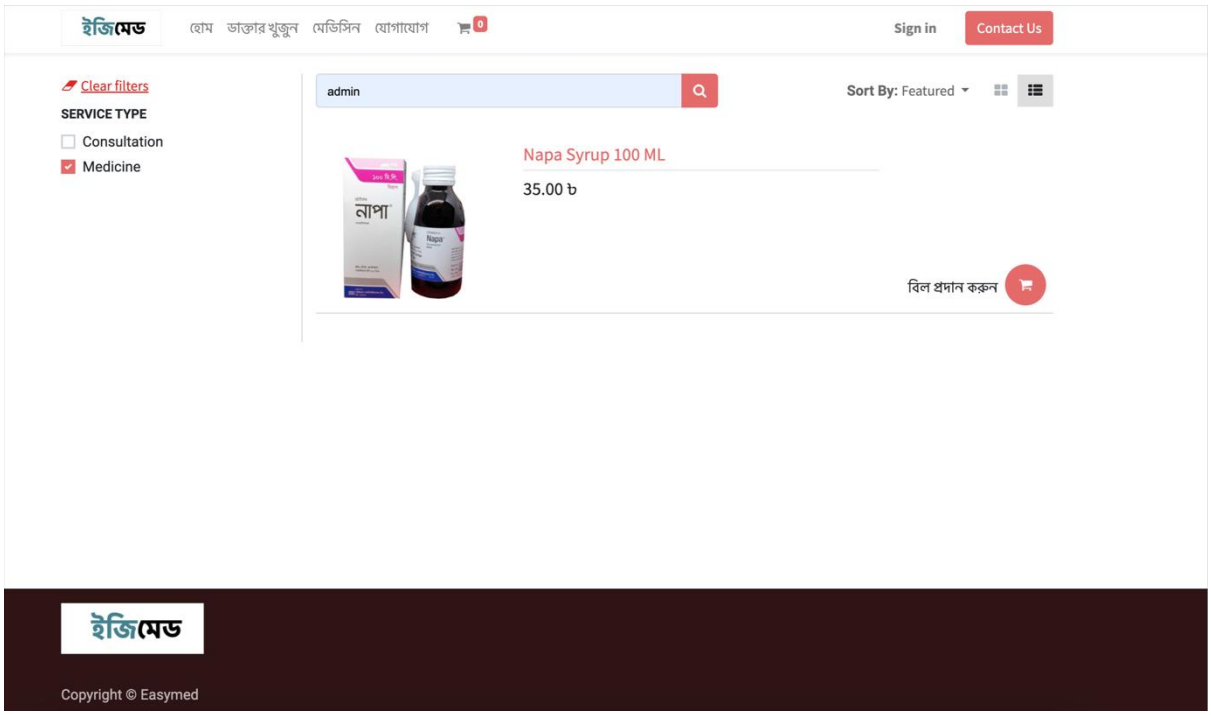
6.5 Search doctor



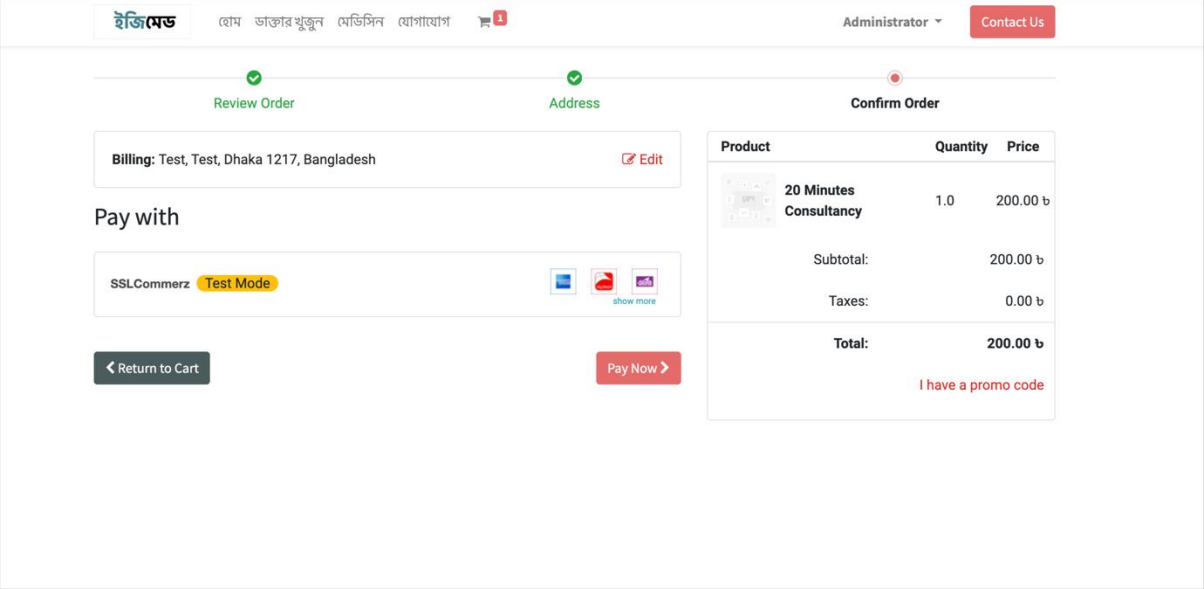
6.6 Doctor profile details



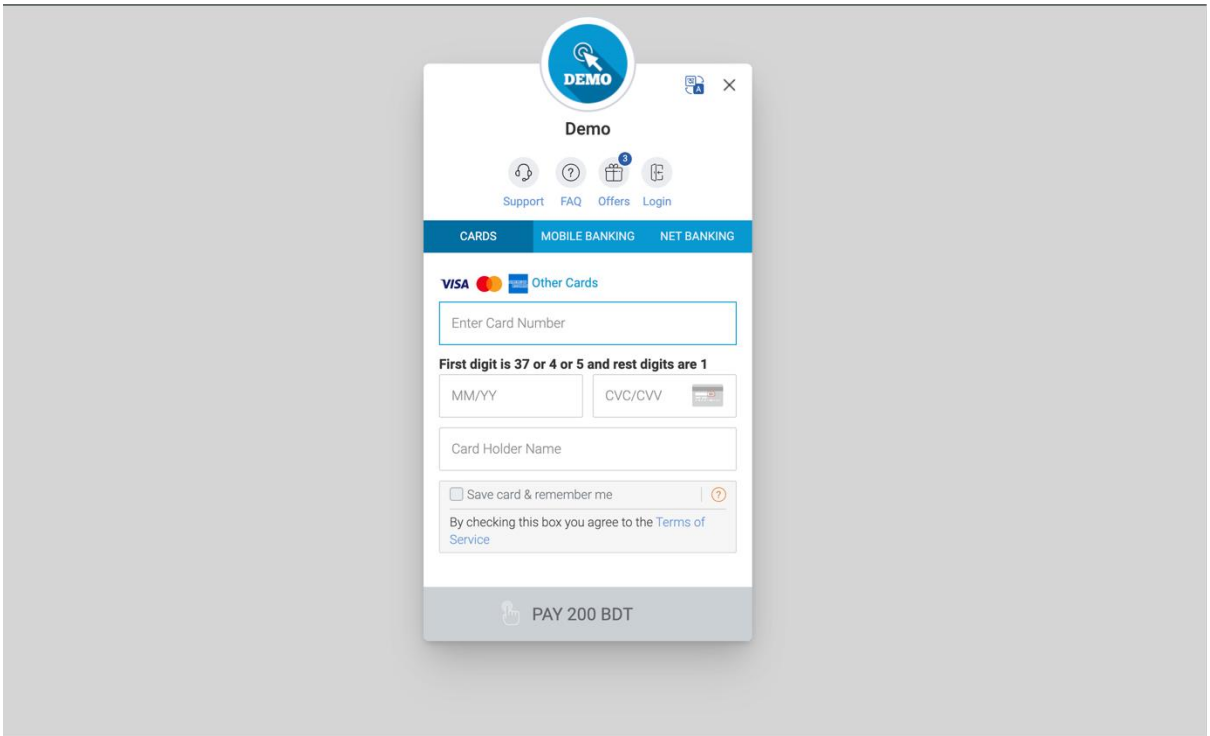
6.7 Medicine search



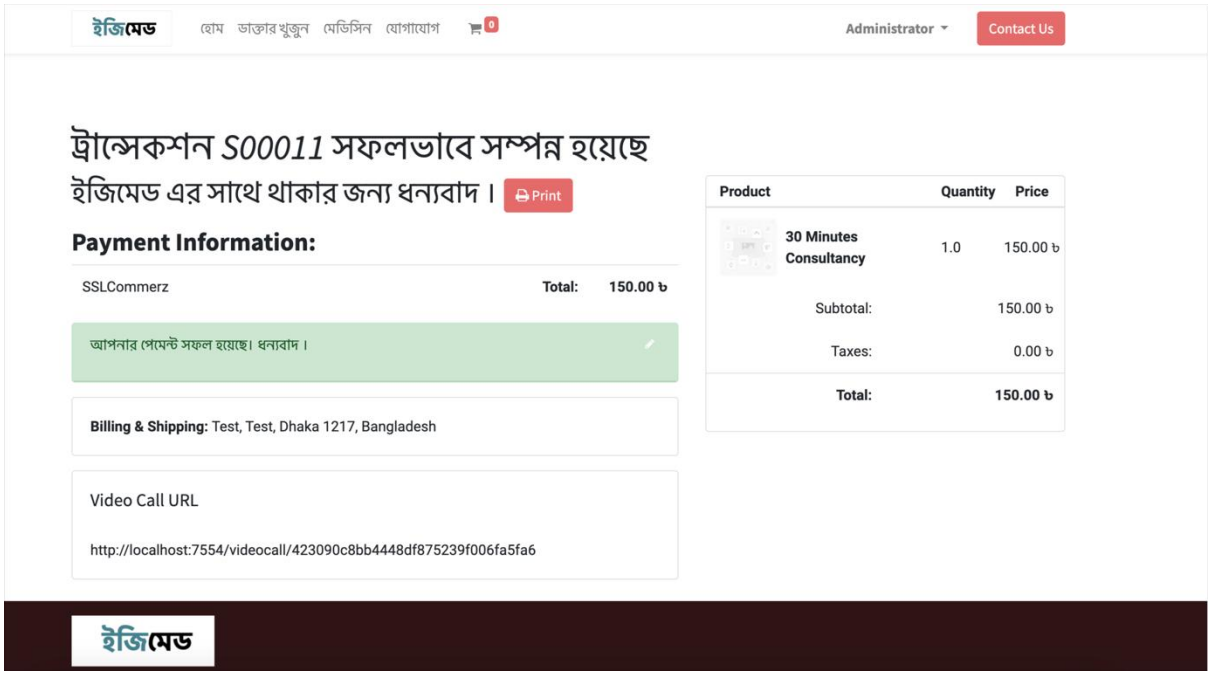
6.8 Checkout and payment page



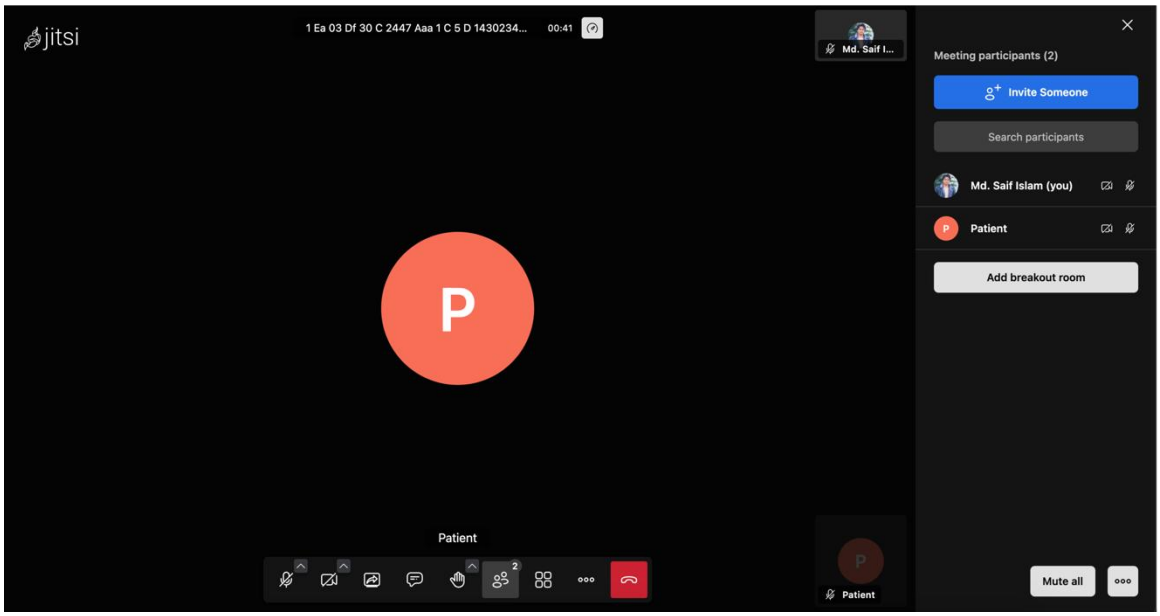
6.9 Online payment gateway



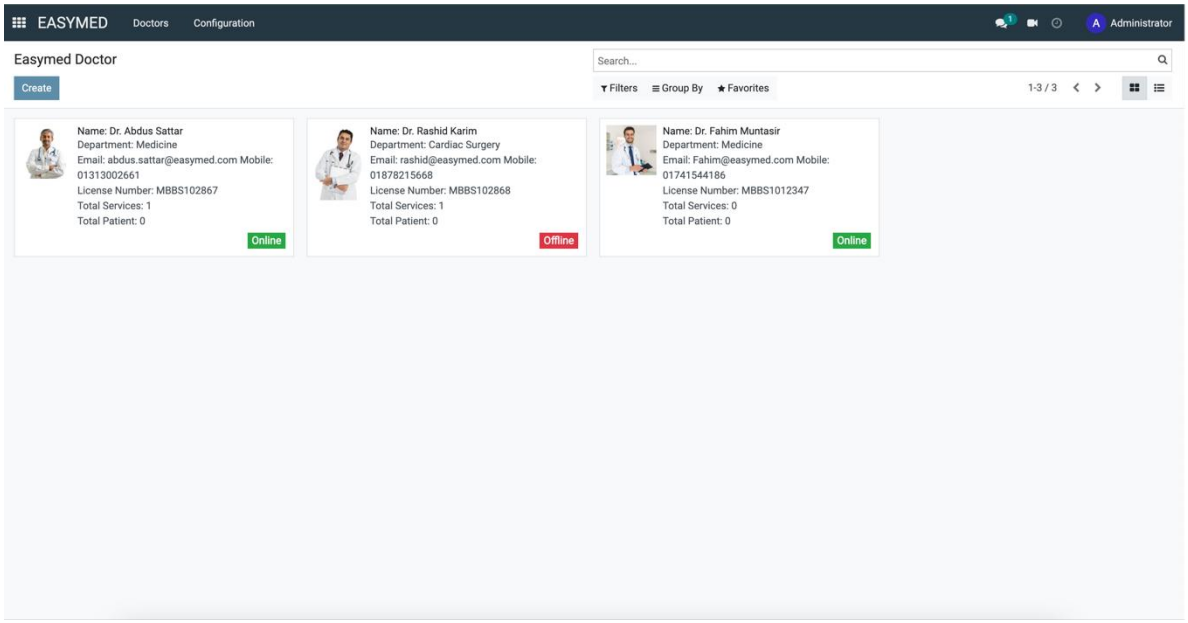
6.10 Payment confirmation and video call url



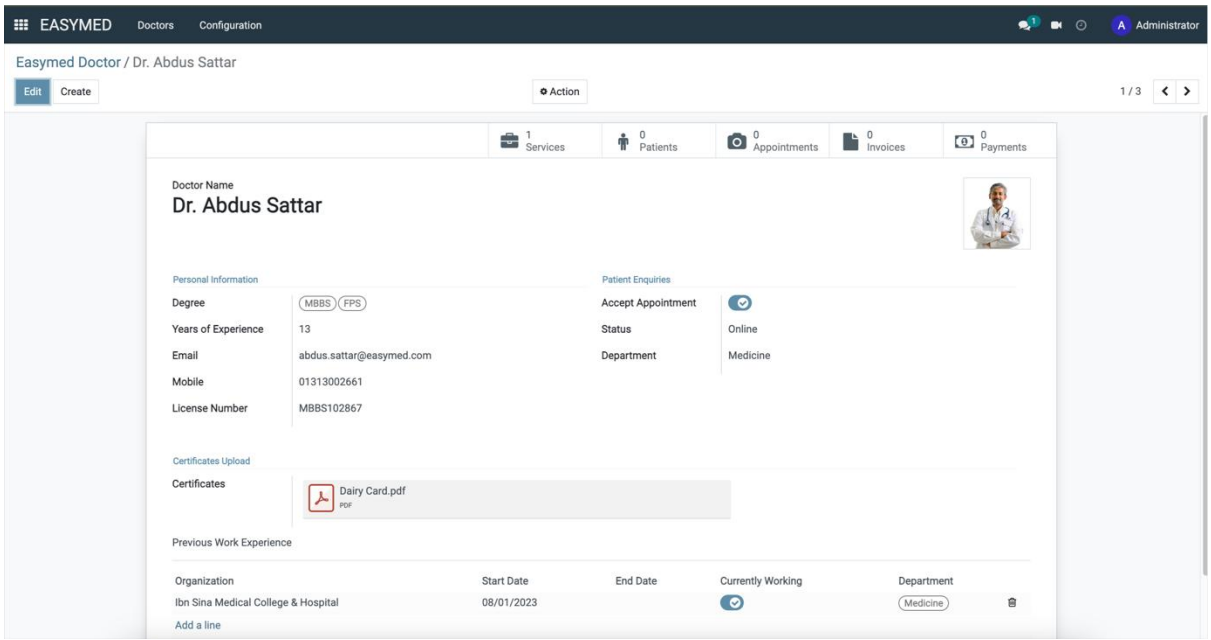
6.11 Video call session with doctor and patients



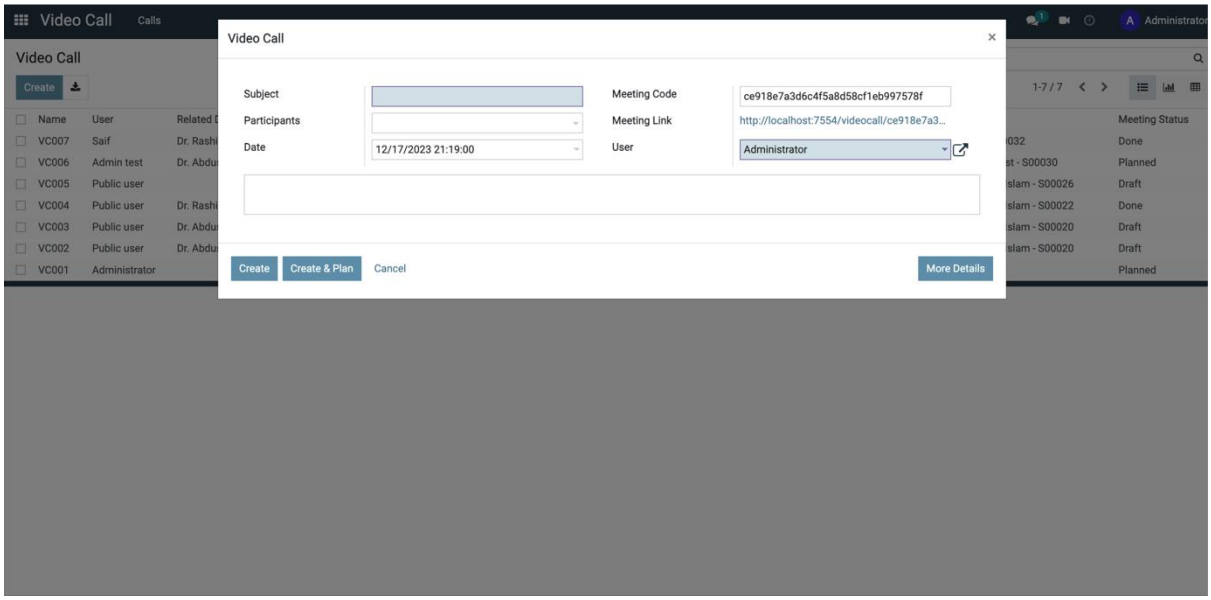
6.12 Doctors panel back admin view



6.13 Doctor profile details



6.14 Doctor on demand video call creation



6.15 Initial video call joining screen

অনুগ্রহ করে ডাক্তার এর জন্য কিছুক্ষণ অপেক্ষা করুন .....

6.16 Video call finish screen

ডাক্তারের সাথে মিটিং সম্পন্ন হয়েছে ।

Chapter 7: Project summary

7.1 Summary

I have been started to develop my project “Easymed” from July. Before starting the project, I sat and discuss with my supervisor about the features and functionalities of my application. After having positive reviews from my supervisor, I have been started to develop. Mainly, the focus of this application is very clear. We will deploy this to any local rural hospital areas. Connect between doctor and patient will be established across the platform. People will start using the system once they will get some benefit and get used to it.

7.2 Limitations

Due to time shortage and some technical aspects, features like IOT integration and automated document scanning can be done. Another limitation can be a mobile app of this web application version that can be featured later.

7.3 References

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