SOFTWARE REQUIREMENT SPECIFICATION

Telemedicine & Appointment Booking Platform (MedConnect)

Group 1 | SE1961 - NJ

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I. Record of Changes

Date	A* M, D	In charge	Change Description
18/9	A	KhoaNDHE190183	Create context diagram and description
18/9	A	HuongCHTHE180528	Create UC Diagrams and user cases
18/9	M	NguyenPNTHE186168	Modified and adding extra user cases
18/9	A	HungNQHE194267	Create ERD and description
18/9	A	KhoaNDHE190183	Create Business Process Diagrams
18/9	A	HungNQHE194267	Create System Functionalities and description
19/9	M	NhatTTHE191617	Modified System Functionalities
21/9	M	KhoaNDHE190183	Modified Screen Authorization
21/9	A	KhoaNDHE190183	Adding actors table
21/9	A	KhoaNDHE190183	Create Use Case Specifications
21/9	M	NhatTHHE191617	Modified ERD
22/9	A	KhoaNDHE190183	Create Requirement Appendix
22/9	A	KhoaNDHE190183	Create Non-Functional Requirements
22/9	A	NguyenPNTHE186168	Modified Use Case
22/9	M	HuongCHTHE180528	Modified and adding extra Use Case Specifications
23/9	A	HuongCHTHE180528	Adding extra Business Rules and System Messages
23/9	M	KhoaNDHE190183	Adding Business Process Diagrams
24/9	A	HuongCHTHE180528	Create Glossary and Legend for diagrams
24/9	A	HuongCHTHE180528	Add Legend of Context, legend of Use Case
25/9	A	HungNQHE194267	Create Actors Generalization
25/9	A	HungNQHE194267	Create function requirement and description
27/9	M	NhatTHHE191617	Modified ERD
29/9	A	HungNQHE194267	Add legend of ERD, legend of Screen Flow
29/9	M	HuongCHTHE180528	Modified Table List figure, Table Business Rule
2/10	M	KhoaNDHE190183	Modified Business Process Diagrams
2/10	M	KhoaNDHE190183	Modified Legend

*A - Added M - Modified D - Deleted

II. Glossary and Legend

1. Glossary

No	Name	Description
1	Context Diagram	A high-level diagram that presents an overall view of the system, highlighting the external actors and illustrating the primary ways in which they interact with the system.
2	Use Case	A structured description of a situation where a user engages with the system, outlining the sequence of actions taken and the expected results produced.
3	Screen Flow	A diagram that maps out the navigation between screens in the user interface, showing the path a user follows throughout the system's workflow.
4	Doctor	A healthcare professional within the system who is responsible for examining patients, making diagnoses, and providing treatments as part of medical services.
5	Patient	An individual who interacts with the system to register an account, schedule appointments, and access healthcare services provided by the clinic.
6	Administrator	A person who oversees the entire system, including user account management, configuration changes, content updates, and general system maintenance.
7	AI Service	A technology-based service that applies artificial intelligence techniques to support activities such as medical diagnostics, data analysis, and the automation of routine processes.
8	VietQR Service	A payment service that enables quick and secure transactions by generating standardized QR codes for users, simplifying the process of making and receiving payments within the system.
9	Notification Service	A communication feature that automatically sends alerts and reminders to different users (patients, doctors, staff) regarding important updates such as appointments, results, or invoices.
10	Firebase Authentication Service	A cloud-based authentication solution that manages secure user sign-in and identity verification, supporting multiple methods such as email, password, phone, or third-party providers.
11	OpenStreetMap Service	A mapping service that integrates geographic data and visualization, allowing the system to display locations, routes, and spatial information through the OpenStreetMap platform.
12	Speech-to-text Service	An intelligent service that converts spoken language into written text, enabling features such as voice-based input, medical dictation, or accessibility support within the system.
13	Video Call Service	A real-time communication service that allows doctors and patients to connect through secure video conferencing, supporting remote consultations, follow-up sessions, and online medical interactions within the system.
14	Activity Diagram	A diagram that visually represents workflows by breaking down a business process into steps, clarifying the sequence of actions and decision points required to complete a task.

15	Non-UI Functions	Core system features that operate behind the scenes without direct user interface interaction, including business logic, data processing, and database management operations.
16	ERD	A model that graphically depicts the entities in the system along with the relationships between them, helping to structure and organize system data.
17	Conceptual ERD	A high-level version of an ERD that focuses on illustrating entities and their relationships conceptually, without delving into detailed database implementation aspects.
18	Crow's foot ERD	A specific ERD type that uses the Crow's Foot notation to clearly represent one-to-many and many-to-many relationships between entities in the system.
19	Database Schema	The overall blueprint of the database that defines tables, fields, constraints, indexes, and the relationships that structure how data is stored and connected.
20	Package Diagram	A UML diagram that describes the organization of the system into groups of related modules or classes, showing how these components are structured and interact with each other.

2. Legend

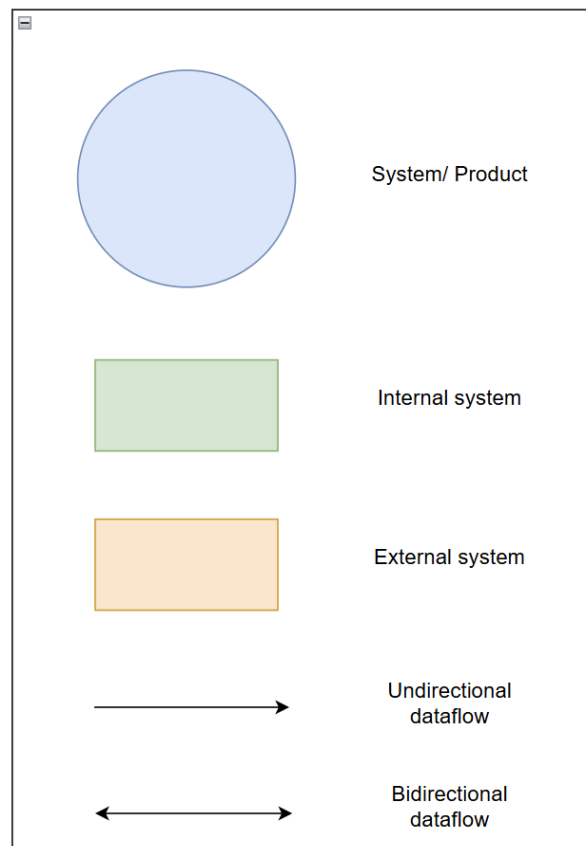### 2.1. Context Diagram

Figure 2.1 - Legend of Context Diagram
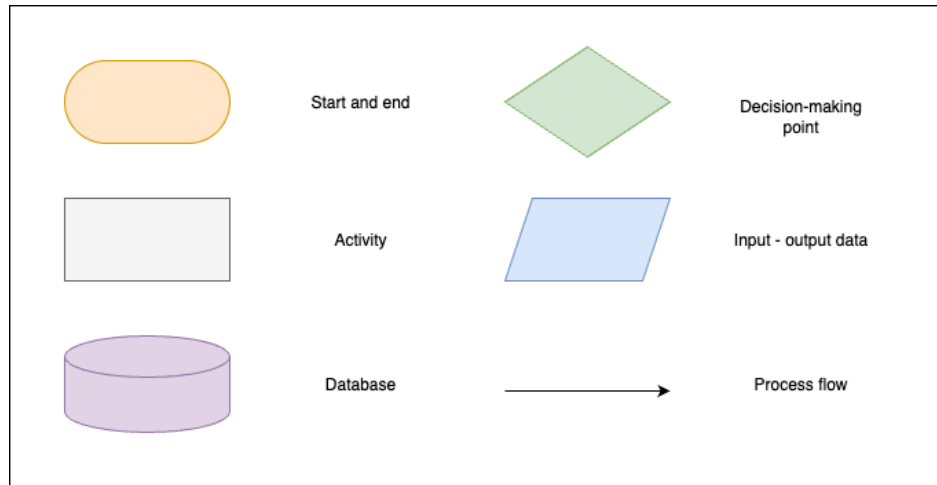
2.2. Business Process Diagram

Figure 2.2 - Legend of Business Process Diagram
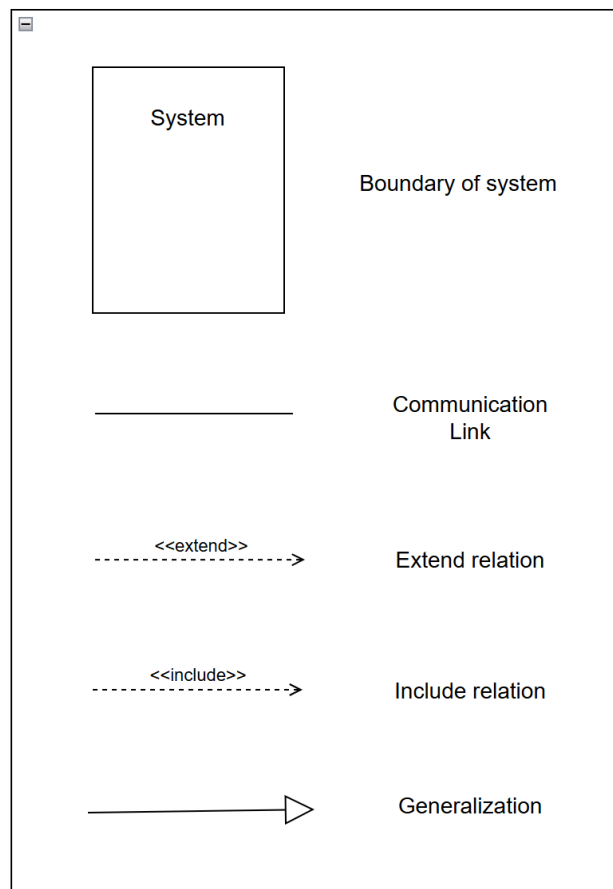
2.3. Use Case Diagram

Figure 2.3 - Legend of Use Case Diagram
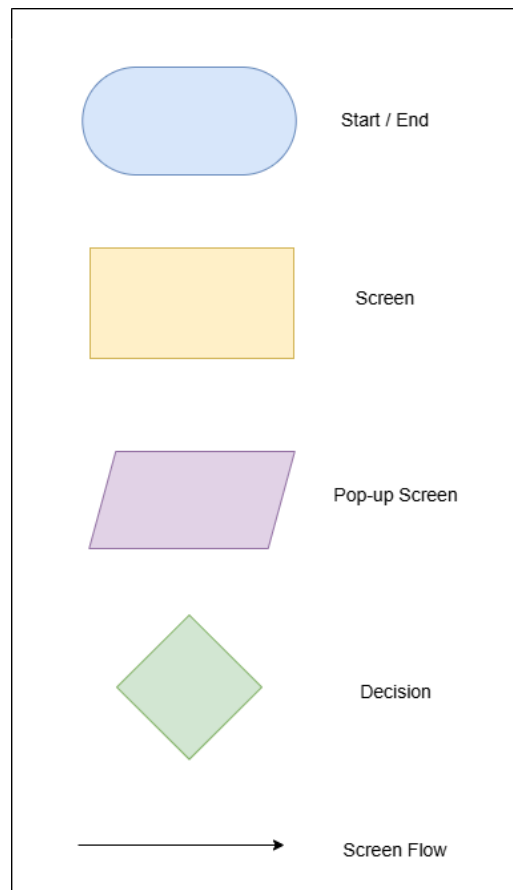
2.4. Screen Flow Diagram
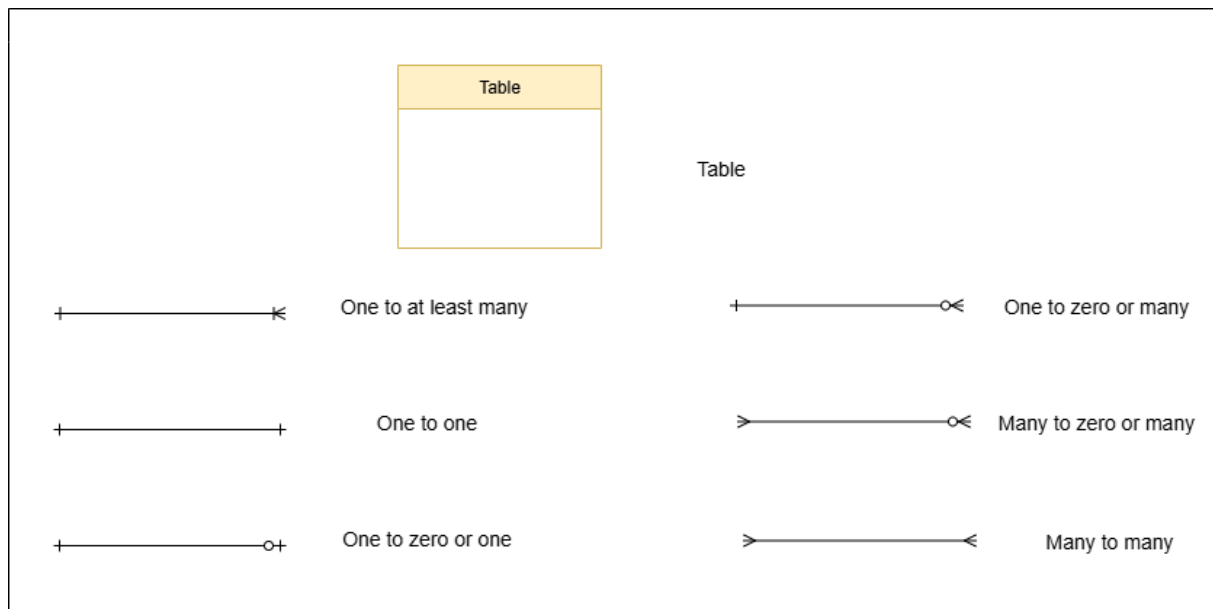

Figure 2.4 - Legend of Screen Flow

2.5. ERD Diagram

Figure 2.5 - Legend of ERD

3. List figure and table

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III. Software Requirement Specification

1. Overall Requirements

1.1 Context Diagram

MedConnect is a new web-based healthcare platform designed to address the common challenges faced by patients and doctors in Vietnam. Many patients currently struggle with long travel distances to reach specialized doctors, extensive waiting times at hospitals and clinics, and inefficient appointment scheduling, which result in delayed care, higher costs, and a poor overall experience. On the other hand, doctors face significant administrative burdens in managing appointments and follow-ups.

The MedConnect system will allow patients to search for and connect with verified doctors, book both in-person and online video consultations, and manage their health appointments seamlessly. For doctors, the platform streamlines scheduling and follow-up management. The context diagram below illustrates the external entities and system interfaces for the initial release. Future releases are expected to expand functionality, potentially integrating with national health databases, insurance providers, and advanced telemedicine services.
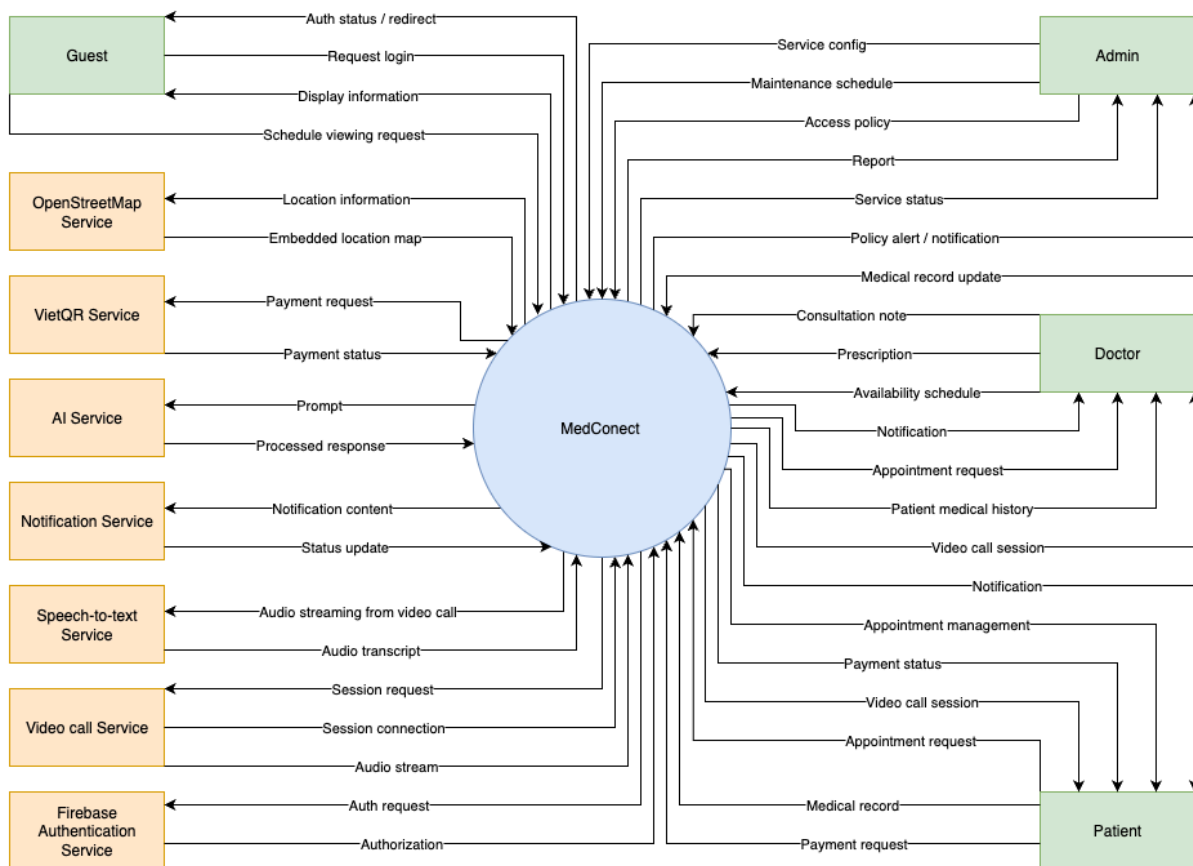

Figure 1.1 - Context diagram of MedConnect System

Link detail: Context diagram

1.2 Main Business Processes

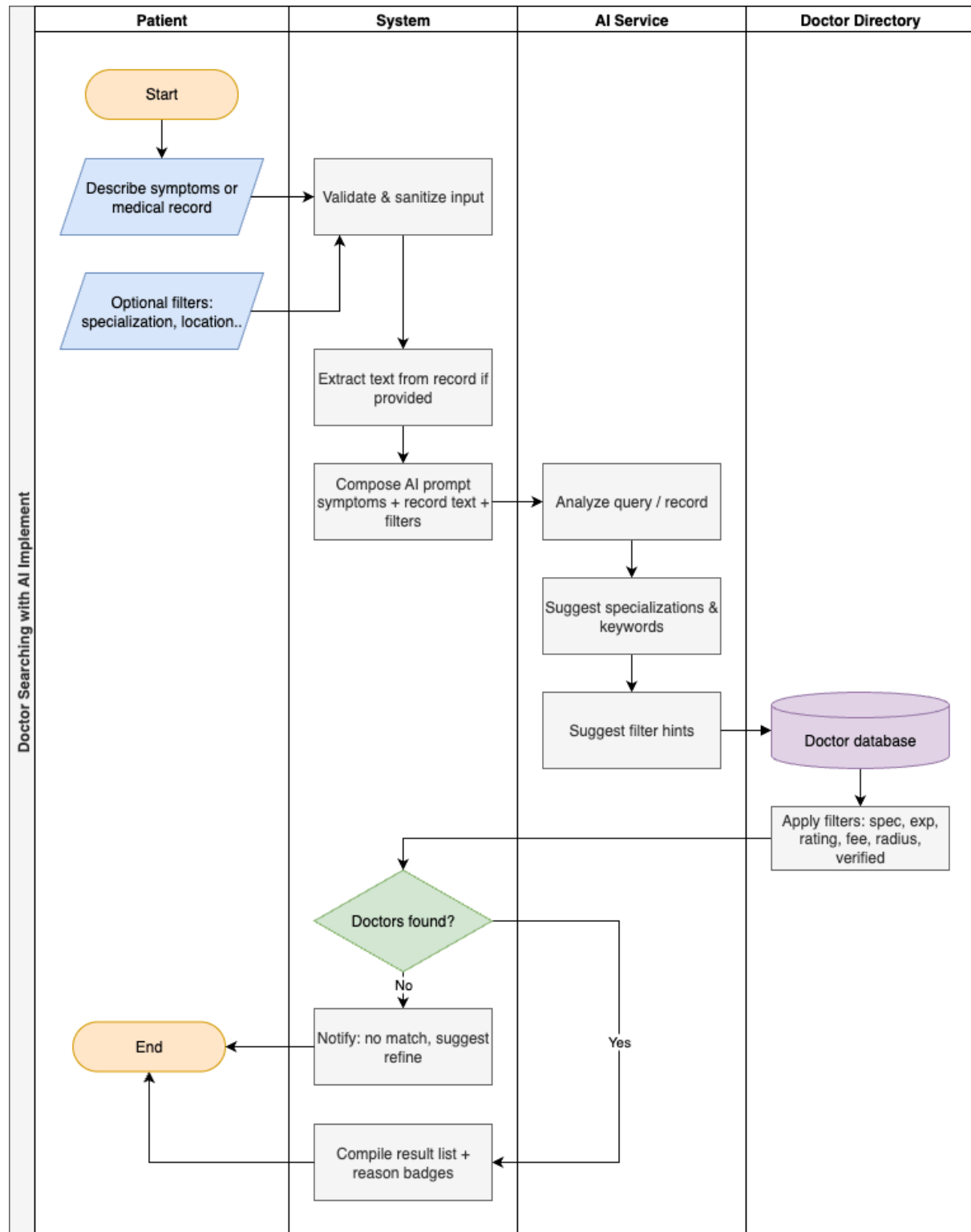### 1.2.1. Doctor searching with AI implement

Figure 1.2.1 - Business process of AI-powered doctor searching

Link detail: Doctor searching with AI implement

Step #	Step name	Step description	Role	Notes
1	Start	Patient initiates doctor search	Patient	Guest and registered users can both search
2	Describe symptoms / Upload record	Patient describes symptoms or uploads a medical record	Patient	Input could be text or file
3	Set optional filters	Patient sets specialization, location, fee, experience, etc.	Patient	Optional
4	Validate input	System validates and sanitizes patient input	System	Prevents invalid or malicious data
5	Extract text from record	System extracts text from uploaded medical record	System	OCR or structured text
6	Compose AI prompt	System composes AI prompt with symptoms, record text, and filters	System	Used for AI service query
7	Analyze query	AI service analyzes symptoms and record	AI Service	Returns specialization and keyword suggestions
8	Suggest filters	AI service generates filter hints (specializations, keywords)	AI Service	E.g. "dermatology, allergy"
9	Query doctor database	Doctor directory applies AI filters with patient filters	Doctor Directory	Filters include spec, exp, rating, fee, radius, verification
10	Doctors found?	System checks if any doctors match criteria	System	Decision point
11a	Compile results	System compiles doctor list with badges (reason why matched)	System	Sent to patient
11b	No match notify	System notifies patient and suggests refining filters	System	Patient can retry search

1.2.2. Appointment booking & payment process
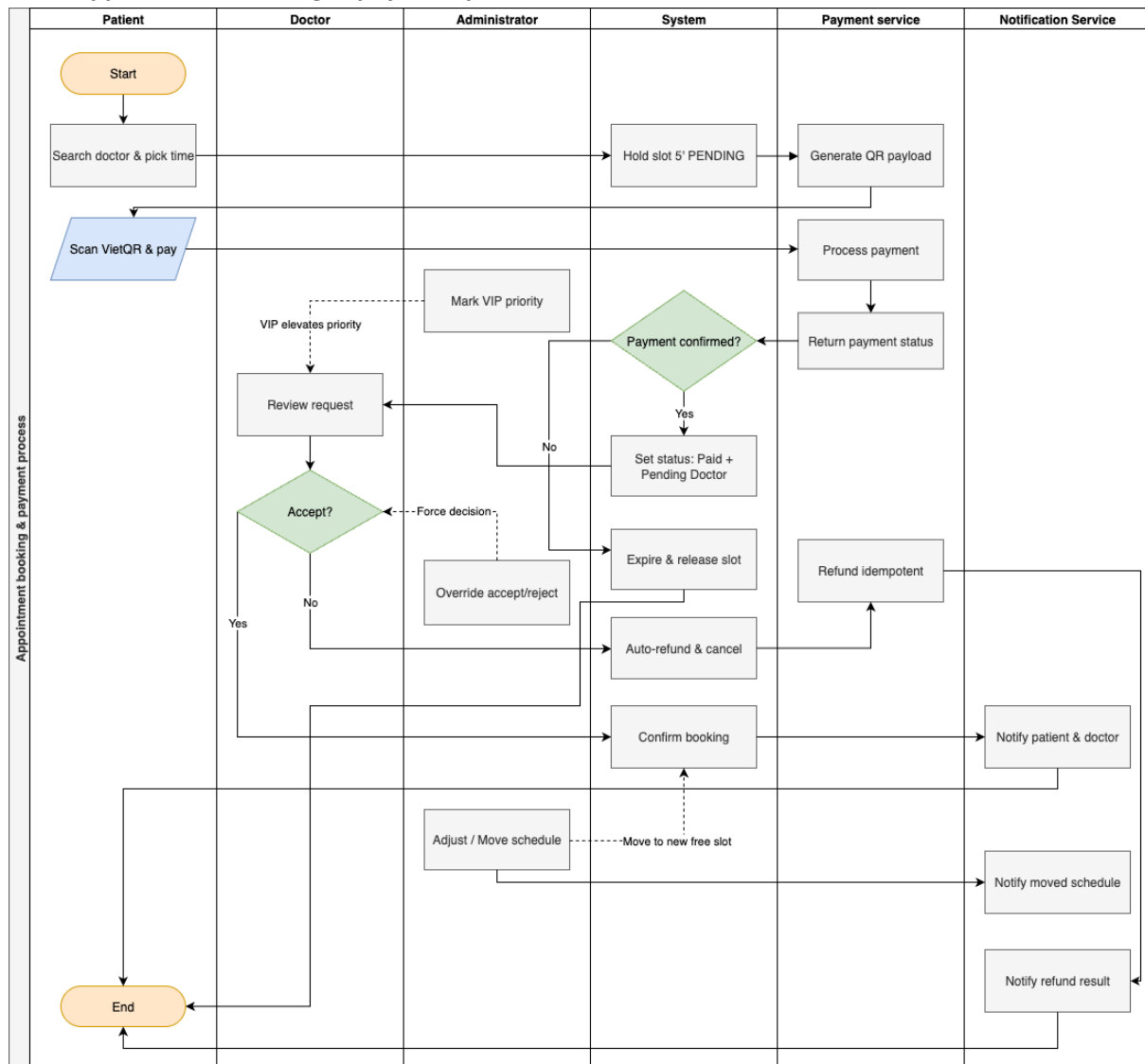
Figure 1.2.2 - Business process of Appointment booking & payment process

Link detail: Appointment booking & payment process

Step #	Step name	Step description	Role	Notes
1	Search doctor & pick time	Patient searches doctor and chooses a time slot.	Patient	Start of flow
2	Hold slot pending	System holds slot for 5 minutes (status = PENDING).	System	Temporary hold (TTL)
3	Generate QR payload	System generates QR payment payload.	Payment service	For VietQR

| 4	Scan QR & pay	Patient scans QR and makes payment.	Patient	Trigger payment
5	Process payment	Payment service processes the transaction.	Payment service	
6	Return payment status	Payment service sends payment status back.	Payment service	Success/Fail
7	Payment confirmed?	System checks if payment is confirmed.	System	Decision point
8	Expire & release slot	If payment fails, slot is released.	System	Timeout handling
9	Refund idempotent	Refund process triggered for failed payment.	Payment service	Safe re-run
10	Review request	Doctor reviews appointment request.	Doctor	After payment success
11	VIP priority	Administrator can elevate VIP patients.	Administrator	Manual override
12	Accept?	Doctor decides to accept or reject.	Doctor	Decision point
13	Override decision	Administrator can override doctor's accept/reject.	Administrator	Force decision
14	Confirm booking	If accepted (or overridden), booking is confirmed.	System	Status updated
15	Auto-refund & cancel	If rejected or expired, refund and cancel booking.	System/Payment	Auto process
16	Adjust / Move schedule	Administrator can move appointment to a new free slot.	Administrator	For VIP/policy
17	Notify patient & doctor	Notification service sends booking result to patient and doctor.	Notification	After confirm
18	Notify moved schedule	If admin reschedules, send notification.	Notification	
19	Notify refund result	Notify patient of refund status.	Notification	End of refund flow
20	End	Process ends.	Patient/System	End of flow

1.2.3. Doctor scheduling
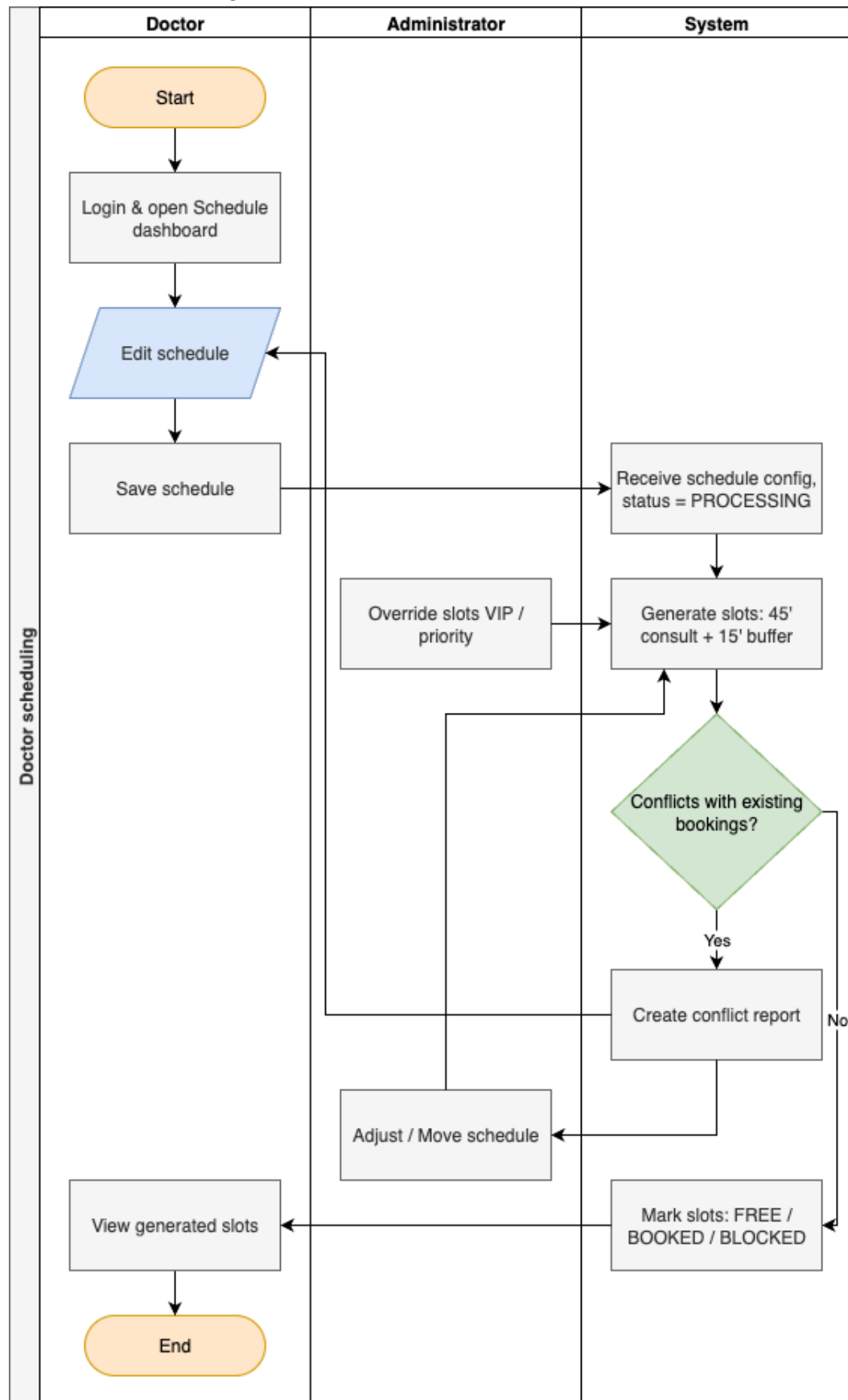
Figure 1.2.3 - Business process of Doctor scheduling

Link detail: Doctor scheduling

Step #	Step name	Step description	Role	Notes
1	Start	Begin scheduling process.	Doctor	Entry point
2	Login & open dashboard	Doctor logs in and opens scheduling dashboard.	Doctor	Requires authentication
3	Edit schedule	Doctor edits weekly working template and sets exceptions (vacation, special days).	Doctor	Can be repeated anytime
4	Save schedule	Doctor saves schedule configuration.	Doctor	Sends data to system
5	Receive config	System receives schedule config, status = PROCESSING.	System	Pre-validation
6	Generate slots	System generates 45' consultation slots with 15' buffer.	System	Automatic slot creation
7	Conflicts check	System checks conflicts with existing bookings.	System	If conflict → report
8	Create conflict report	System creates report for conflicted slots.	System	Forwarded to Admin
9	Override slots	Administrator overrides slots if needed (VIP, priority).	Administrator	Force adjustment
10	Adjust / Move schedule	Administrator or Doctor adjusts or moves schedule.	Admin/Doctor	Manual resolution
11	Mark slots	System marks slots as FREE / BOOKED / BLOCKED.	System	Final status applied
12	View generated slots	Doctor views final generated slots.	Doctor	Available on dashboard
13	End	Scheduling process ends.	Doctor	Exit point

1.2.4. Video consultation and summarise
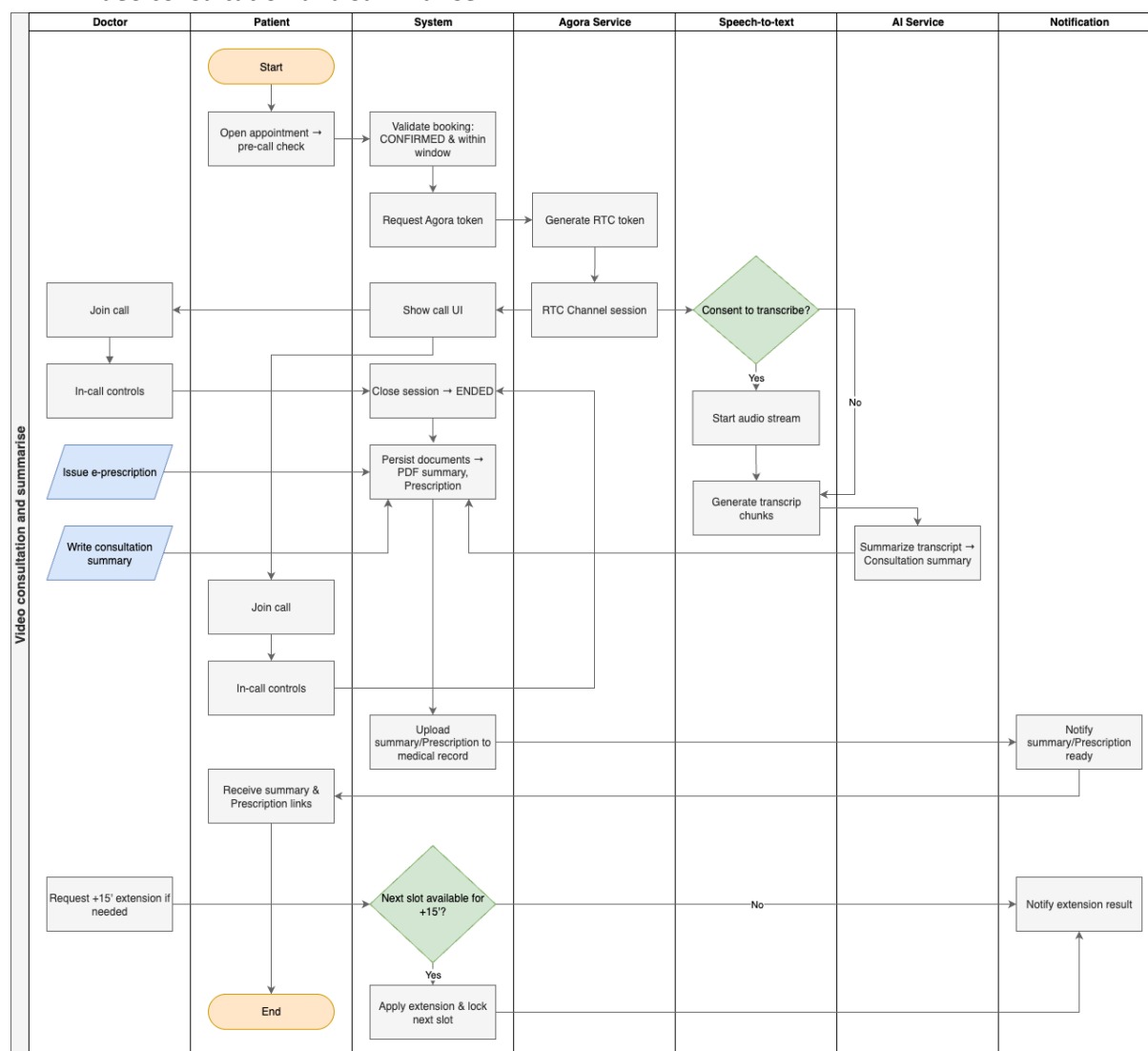
Figure 1.2.4 - Business process of Video consultation and summarise

Link detail: Video consultation and summarise

Step #	Step name	Step description	Role	Notes
1	Start	Flow begins with patient opening appointment (pre-call check).	Patient	Trigger entry point.
2	Validate booking	System checks booking is confirmed and within valid time window.	System	Must be CONFIRMED status.
3	Request Agora token	System requests video session token.	System	Token is generated per session.

4	Generate RTC token	Agora service generates RTC token.	Agora Service	Auth for video call.
5	Join call	Doctor and patient join RTC channel.	Doctor & Patient	Connects via Agora UI.
6	In-call controls	Doctor and patient interact via call controls.	Doctor, Patient	Includes mute, camera, end-call.
7	Consent to transcribe	Patient gives consent to start transcript.	Patient, STT	Optional step.
8	Start audio stream	If consented, audio stream is sent to STT engine.	STT	Stream real-time audio.
9	Generate transcript chunks	STT processes and outputs transcript.	STT	Intermediate text chunks.
10	Summarize transcript	AI service generates consultation summary from transcript.	AI Service	AI-assisted summarisation.
11	Write consultation summary	Doctor writes their consultation summary manually.	Doctor	Complements AI-generated notes.
12	Issue e-prescription	Doctor issues electronic prescription.	Doctor	Prescription prepared in system.
13	Persist documents	System stores consultation summary & prescription as PDF.	System	Saved to patient record.
14	Upload summary/prescription	System uploads stored docs to patient medical record.	System	Document storage step.
15	Notify results	Notification service alerts patient with summary & prescription links.	Notification	Patient notified after session ends.
16	Request extension	Doctor may request +15' extension.	Doctor	Requires available slot.
17	Check next slot	System checks availability of next 15' slot.	System	Avoid overlap with other bookings.

| 18	Apply extension	If available, system locks next slot and confirms.	System	Noti sent to both doctor & patient.
19	Notify extension result	Notification service sends result of extension request.	Notification	Accepted or rejected.
20	Close session	Session ends, RTC channel closed.	System	Ends active call.
21	End	Patient receives final documents and flow ends.	Patient	End of business process.

1.2.5. Cancel and refund
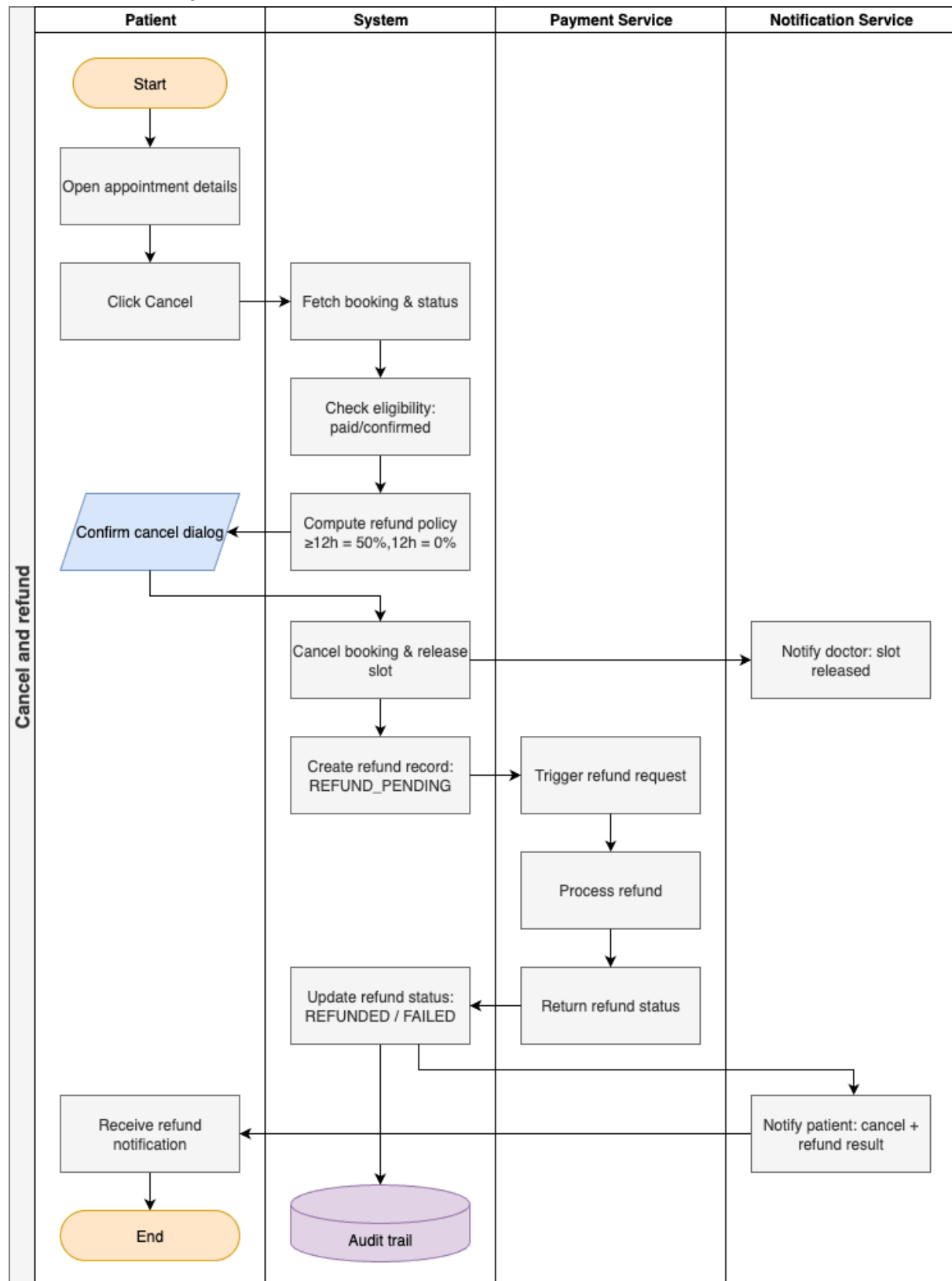
Figure 1.2.5 - Business process of Cancel and refund

Link detail: Cancel and refund

Step #	Step name	Step description	Role	Notes
1	Open appointment details	Patient opens appointment details from system	Patient	Start of flow
2	Click Cancel	Patient clicks cancel on appointment	Patient	
3	Fetch booking & status	System retrieves booking info and current status	System	Must be paid & confirmed
4	Check eligibility	System checks if booking is eligible for cancellation	System	
5	Compute refund policy	System applies refund rule (≥12h = 50%, <12h = 0%)	System	
6	Confirm cancel dialog	Patient confirms cancel request	Patient	
7	Cancel booking & release slot	System cancels booking and releases slot	System	Notify doctor slot released
8	Create refund record	System creates refund record with status = REFUND_PENDING	System	
9	Trigger refund request	System triggers request to Payment Service	System	
10	Process refund	Payment Service processes refund	Payment Service	
11	Return refund status	Payment Service returns status (success/fail)	Payment Service	
12	Update refund status	System updates record: REFUNDED or FAILED	System	
13	Log audit trail	System logs audit trail of cancellation and refund	System	Compliance
14	Notify doctor	Notification service informs doctor that slot was released	Notification	
15	Notify patient result	Notification service informs patient of cancellation & refund result	Notification	

16	Update history UI	Patient sees updated status in history	Patient	
17	Receive refund notification	Patient receives final notification	Patient	End of flow

1.3 User Requirements

1.3.1 Actors Generalization
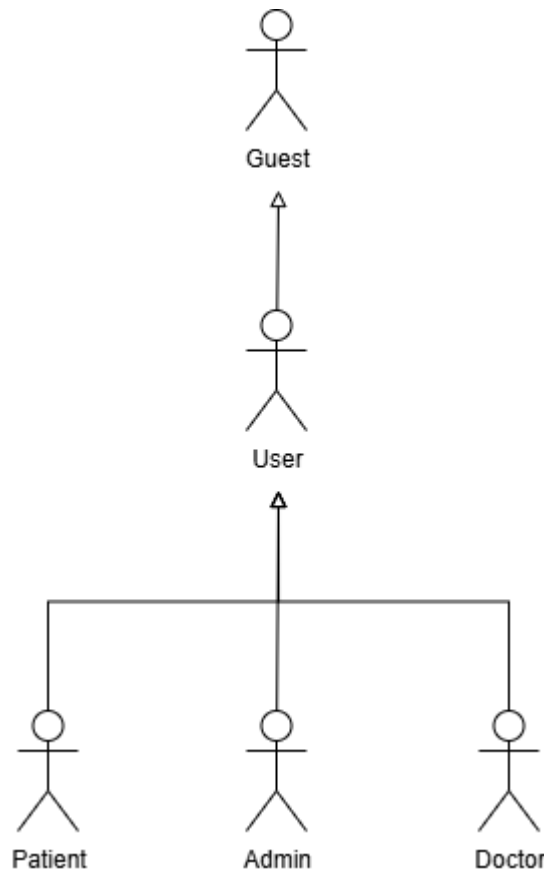
Figure 1.3.1.1 - Actors Generalization

Link detail: Actors Generalization

1.3.2 Actors

#	Actor	Description
1	Administrator	Manages the system: verifies/blocks doctors, manages specialties, handles refund approvals, views reports, and oversees user accounts.
2	Doctor	Licensed provider who completes a profile, declares working schedule, receives/accepts appointments, joins video consultations, writes consultation summaries, and issues e-prescriptions.

3	Patient	End user who searches doctors, views profiles, books appointments, pays via VietQR, joins video calls, cancels under policy, views history, and leaves feedback.
4	Guest	Unauthenticated visitor who can browse the homepage, search doctors at a basic level, and register for an account.
5	User	The User represents any individual who interacts with the MedConnect system through a registered account (Patient, Doctor, Admin) .Each User has a unique login credential (such as email and password) and is associated with a specific role that determines their permissions and available features.

1.3.3 Use Cases (UC)

ID	Use Case	Feature	Use Case Description
1	Login	Admin, Doctor, Patient	Users authenticate to the system with valid credentials and are redirected to their role-specific dashboard. Invalid credentials trigger an error message.
2	Logout	Admin, Doctor, Patient	Allows users to securely log out from the system.
3	Register	Doctor, Patient	Enables Doctors and Patients to create a new account in the MedConnect system.
4	Forgot password	Admin, Doctor, Patient	This use case allows a user to reset their password when they have forgotten it. The system verifies the user's email, sends a reset link, and allows them to set a new password.
5	Change Password	Admin, Doctor, Patient	Users can update their password for account security.
6	View Homepage	Guest	Guests can view the homepage with general information about the system.
7	View Doctors List	Guest	Guests can view a list of available doctors along with their specialties and basic profiles, helping them decide which doctor to consult.

8	View Patient Dashboard	Patient	Patients can access their dashboard displaying appointments, notifications, and personal information.
9	View Profile	Patient	Patients can view their personal profile details.
10	Update Profile	Patient	Patients can update personal information such as name, contact, or address.
11	Search Doctors	Patient	Patients can search for doctors by name, specialization, or location.
12	View Doctor Profile	Patient	Patients can view detailed doctor profiles including specialization, experience.
13	View Feedback	Patient	Patients can view feedback from previous patients for the doctor.
14	View Schedule	Patient	Patients can view their doctor's schedule to choose an appointment.
15	Book Appointment	Patient	Patients can book an appointment with a selected doctor.
16	Pay Consultation Fee	Patient	Patients can make online payments for consultation fees.
17	Cancel Appointment	Patient	Patients can cancel a previously booked appointment.
18	Leave Doctor Feedback	Patient	Patients can leave feedback and ratings for doctors after a consultation.
19	View Appointment History	Patient	Patients can view a history of their past appointments.
20	Receive Appointment Notification	Patient, Doctor	When a new appointment is booked or an existing one is updated, the system notifies the doctor and patient so they can prepare accordingly.

21	Join Video Consultation	Patient, Doctor	The doctor participates in an online consultation via an integrated video call platform, allowing them to assist patients remotely.
22	Medical Record	Patient, Doctor	The system stores and displays medical records, including diagnosis, treatment history, prescriptions, and consultation notes. Patients can review their records, while doctors can update and reference them for better treatment decisions.
23	View Doctor Dashboard	Doctor	Doctors can view their personal dashboard with appointments and patient details.
24	Complete Detailed Profile	Doctor	The doctor provides complete details in their professional profile, including specialization, experience, and qualifications. A complete profile builds trust and helps patients make informed choices.
25	Fill in Personal Information	Doctor	The doctor enters basic personal information such as name, date of birth, gender, and contact details for storage and display in their profile.
26	Enter Credentials	Doctor	The doctor uploads or provides their professional credentials, such as medical degrees, certifications, and licenses. This information is required for verification before being approved to practice on the platform.
27	Select Specialization	Doctor	The doctor selects their medical specialty (e.g., cardiology, pediatrics, endocrinology) so the system can categorize the profile and help patients find the right doctor.
28	Resubmit Profile	Doctor	If the doctor's registration or profile is rejected by the admin, the doctor can update the required information and resubmit the profile for review and approval.
29	Manage Work Schedule	Doctor	The doctor manages their overall work schedule, including adding, editing, or canceling time slots to optimize patient bookings.

30	Update Schedule	Doctor	Allows the doctor to update the existing schedule by adjusting available hours based on real-world needs such as shift changes or availability.
31	Delete Time Slot	Doctor	The doctor can remove a specific time slot that is no longer available, keeping the schedule up to date.
32	Block Off Time	Doctor	The doctor can block off specific time periods (e.g., vacation, conference, personal leave) to prevent patients from booking during those times.
33	View Schedule	Doctor	The doctor views their complete work schedule in daily, weekly, or monthly formats including information of the patient, to stay organized and plan ahead.
34	Set Available Time Slots	Doctor	The doctor defines specific time slots when they are available for consultations, making scheduling easier for patients.
35	Specify Consultation Type	Doctor	The doctor specifies the type of consultation (in-person at the clinic or online), ensuring clarity and flexibility for patients booking appointments.
36	Write Consultation Summary	Doctor	After a consultation, the doctor writes a detailed summary including discussion points, patient condition, and recommendations, which is stored for future reference.
37	Issue E-Prescription	Doctor	The doctor issues an electronic prescription specifying medications, dosage, and usage instructions, making it easier for patients and pharmacies to process.
38	View Feedback	Doctor	Doctors can view feedback and ratings provided by patients after consultations, allowing them to evaluate their performance and improve patient care.
39	Manage Medical Specializations	Admin	Admin manages medical specializations including adding, viewing, updating, and deleting.
40	Create Medical Specialization	Admin	Admin adds a new medical specialization to the system.

41	View Medical Specialization List	Admin	Admin views the list of all available medical specializations.
42	Update Medical Specialization	Admin	Admin updates details of an existing medical specialization.
43	Delete Medical Specializations	Admin	Admin deletes a medical specialization from the system.
44	Manage Doctor Registration	Admin	Admin manages doctor registration requests in the system.
45	Review new Doctor Registrations	Admin	Admin reviews submitted registration details from new doctors.
46	Approve new Doctor Registrations	Admin	Admin approves valid doctor registration requests.
47	Reject new Doctor Registrations	Admin	Admin rejects invalid or incomplete doctor registration requests.

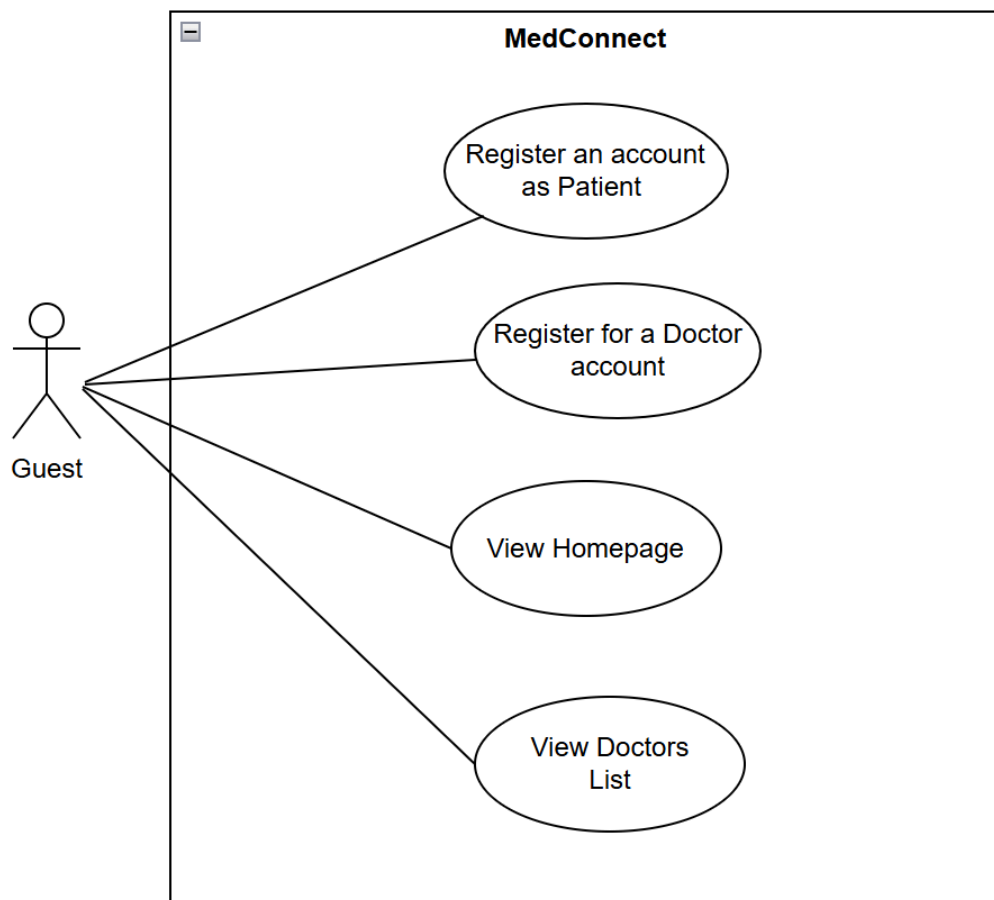### *1.3.4 Use Case Diagrams*

1.3.4.1 UCs for Guest

Figure 1.3.4.1 - Use case diagram for Guest

Link Detail: UCs for Guest

1.3.4.2 UCs for Patient

Figure 1.3.4.2 - Use case diagram for Patient

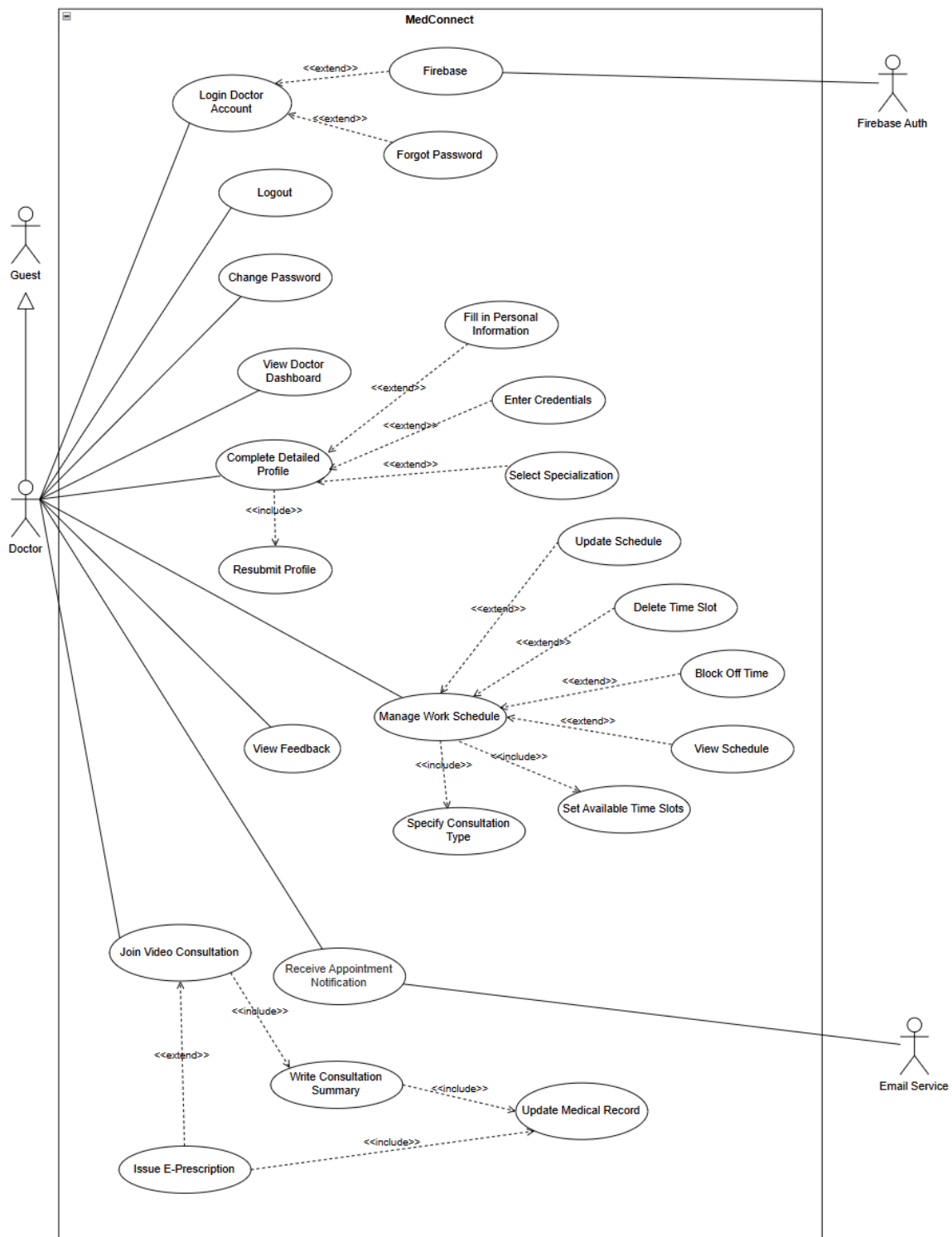Link Detail: UCs for Patient

1.3.4.3 UCs for Doctor

Figure 1.3.4.3 - Use case diagram for Doctor

Link Detail: UCs for Doctor

1.3.4.4 UCs for Admin
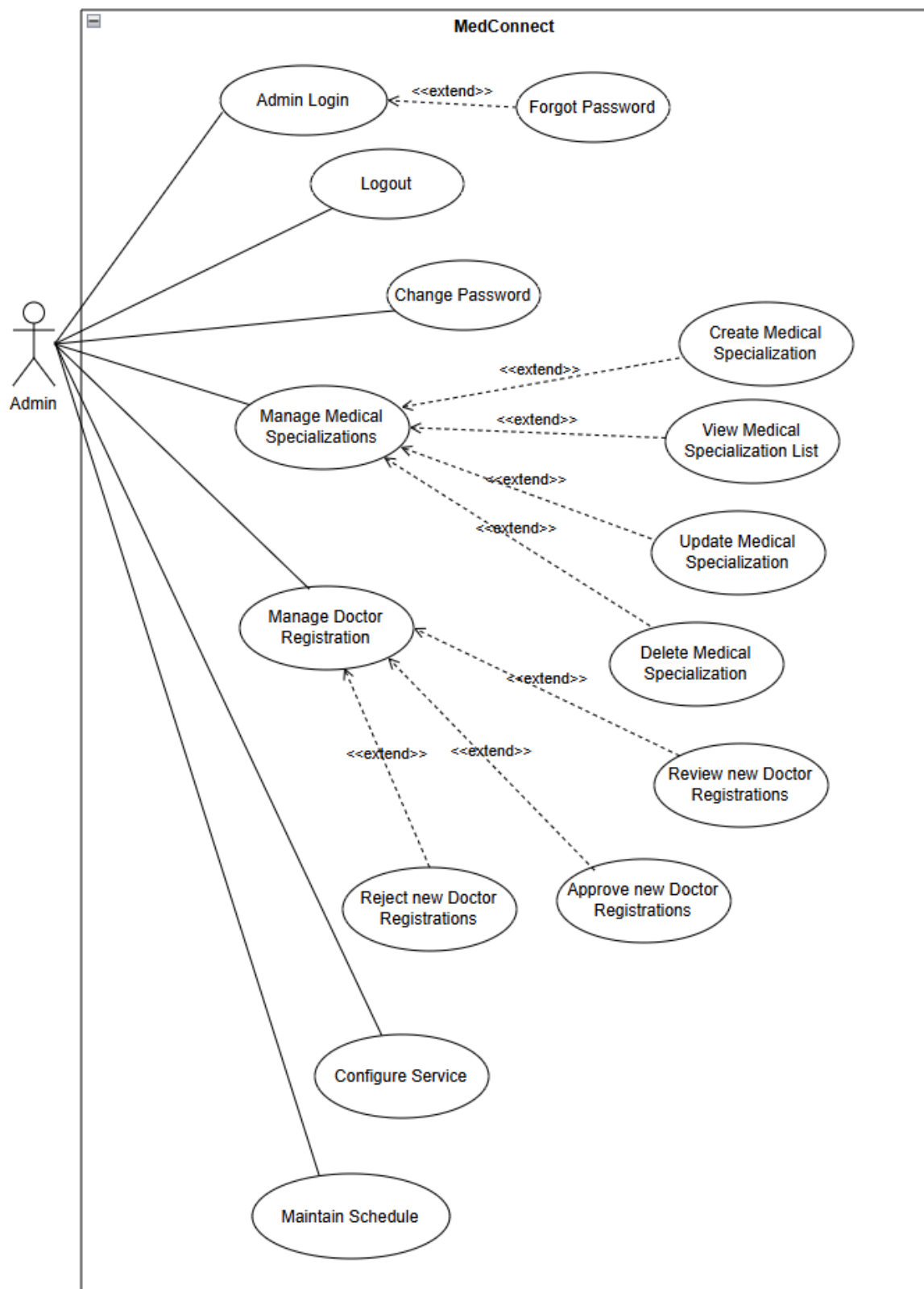

Figure 1.3.4.4 - Use case diagram for Administrator

Link Detail: UCs for Admin

1.4 System Functionalities

1.4.1 Screens Flow

1.4.1.1 Guest Screens Flow

Figure 1.4.1.1 - Guest Screens Flow
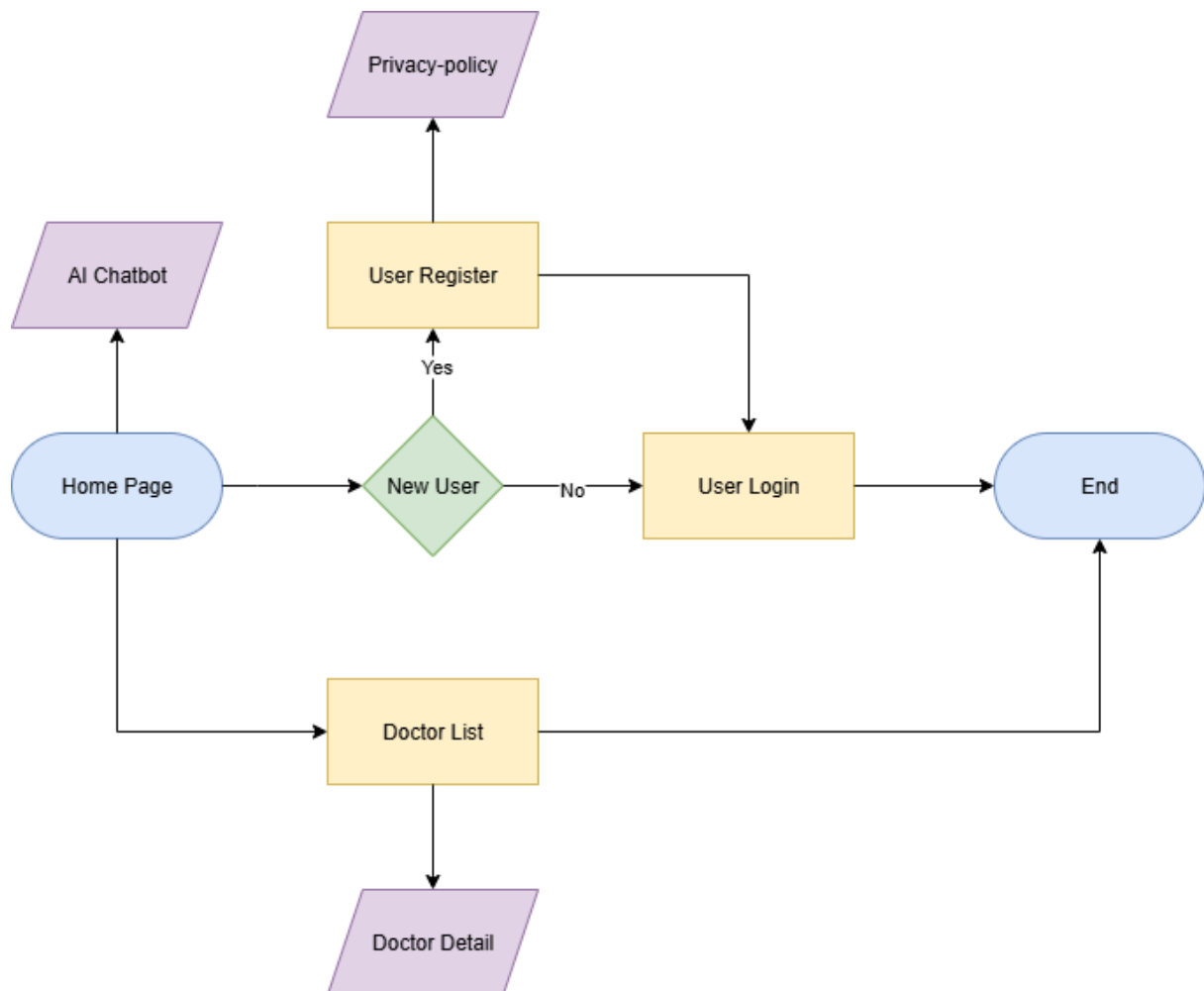
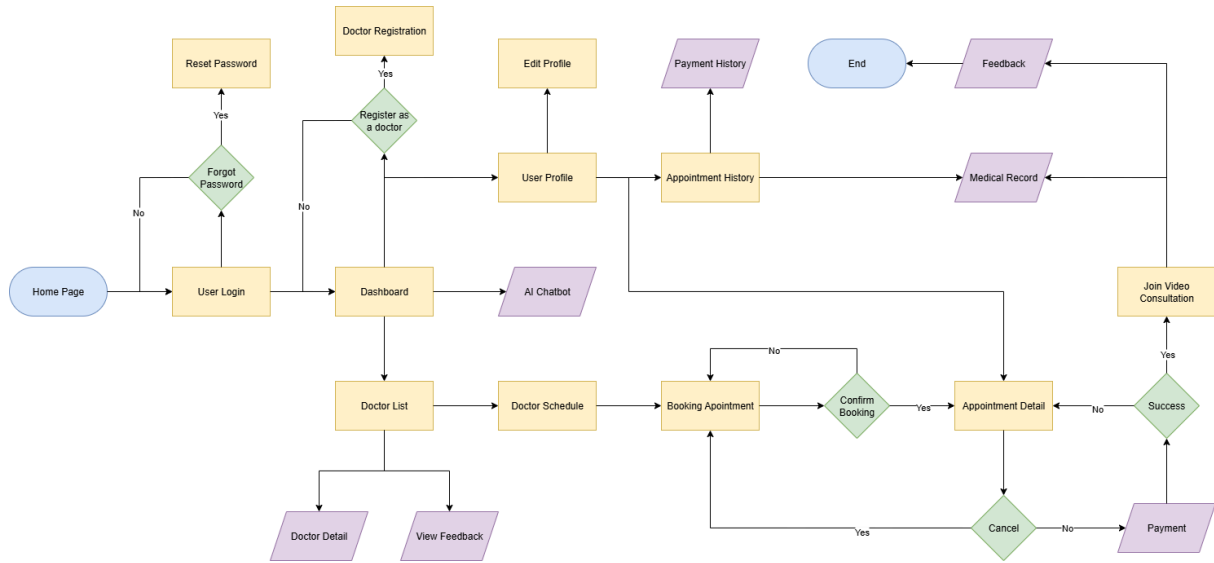Link Detail: Guest Screens Flow

1.4.1.2 Patient Screens Flow

Figure 1.4.1.2 - Patient Screens Flow

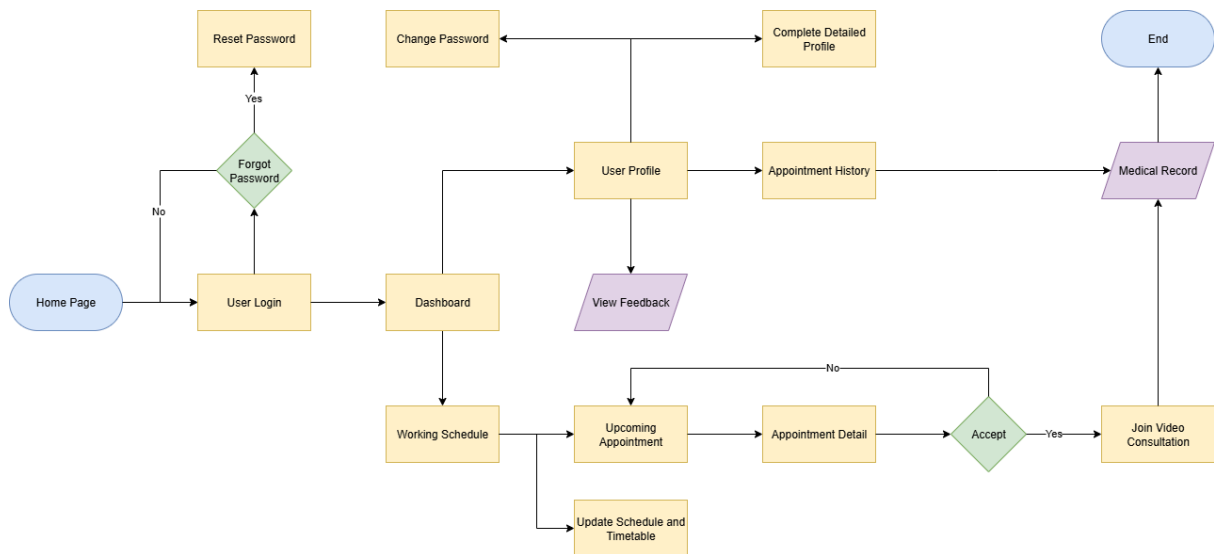Link Detail: Patient Screens Flow

1.4.1.3. Doctor Screens Flow

Figure 1.4.1.3 - Doctor Screens Flow

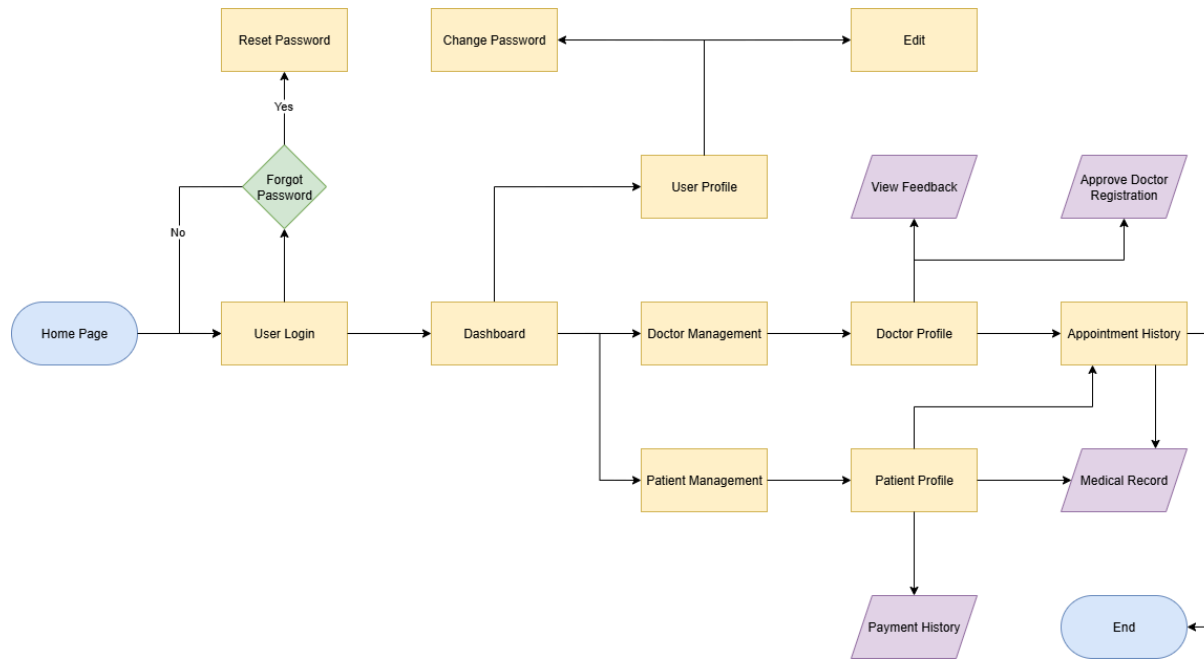Link Detail: Doctor Screens Flow

1.4.1.4 Admin Screens Flow

Figure 1.4.1.4 - Admin Screens Flow

Link Detail: Admin Screens Flow

1.4.1.5 Screen Descriptions

ID	Feature		Description
1	Home Page	Home Page	Main landing page for all users
2	Home Page	Patient Dashboard	Displays patient-specific information as appointments, medical records, and prescriptions
3	Home Page	Doctor Dashboard	Provides doctors with access to schedules, patient details, and consultation tools
4	Home Page	Admin Dashboard	Central hub for administrators to manage users, doctors, patients, and system settings
5	Authentication	Login	Allows users to log into their accounts
6	Authentication	Register	Enables new users to create an account
7	Doctor Management	Doctor List	Display a list of doctor
8	Doctor Management	Doctor Detail	Provides detailed information about doctor
9	Doctor Management	Doctor Management	Allow admin to manage doctor profile
10	Doctor Management	Manage Doctor Registration	Allow admin to approve or reject doctor registration
11	Booking	Booking Appointment	Allow patients to book an appointment
12	Profile Management	User Profile	Display user profile details
13	Profile Management	Edit Profile	Allow users to update their profile information
14	Profile Management	Complete Detailed Profile	Allow doctors to complete their profile
15	Services	Doctor Schedule	Display available timeslot of the doctor
16	Services	Join Video Consultation	Allow user to join online video call
17	Services	Medical Record	Allow user to view the medical record after an appointment
18	Feedback	Feedback	Allow patient to submit feedback after appointment
19	History	Appointment History	Show list of booking history
20	History	Payment History	Show payment history
21	Schedule Management	Upcoming Appointment	Allow doctor to view upcoming appointment
22	Schedule Management	Update Schedule and Time slot	Allow doctor to update their weekly working timetable
23	Patient Management	Patient Management	Allow admin to manage patient profile
24	Payment	Payment	Processes payments for bookings

1.4.2 Screen Authorization

Screen	Guest	Patient	Doctor	Admin
Home Page	x	x	x	x
Patient Profile		x		x
Doctor Dashboard			x	x

Feature				
Admin Dashboard				x
Login	x			
Logout		x	x	x
Register	x			
Doctor List	x	x	x	x
Doctor Detail	x	x	x	x
Doctor Management				x
Manage Doctor Registration				x
Booking Appointment		x		
User Profile		x	x	x
Edit Profile		x	x	x
Complete Detailed Profile			x	
Doctor Schedule		x	x	x
Join Video Consultation		x	x	
Medical Record		x	x	x
Feedback	x	x	x	x
Appointment History		x	x	x
Payment History		x		x
Upcoming Appointment		x	x	x
Update Schedule and Time slot			x	x
Patient Management				x
Payment		x		

1.4.3 Non-UI Functions

ID	Feature	System Function	Description
1	User Authentication	Manage user registration, login, and role-based access	The system verifies accounts, supports roles, and ensures secure session management.
2	Chat AI	User submits questions	To provide automated, real-time conversational assistance to users for common queries, guidance, or support.
3	Feedback	Send feedback after appointment	Allow customers to provide feedback or a review of the service after completing their appointment
4	Payment Processing	Process payments through payment gateways	The system integrates with VietQR to ensure secure transactions.
5	Notification System	Send email notifications	The system automatically sends notification (email and in-app)

6	Speech-to-text	Speech-to-text	Transcript voice to text and display

1.5 Entity Relationship Diagram
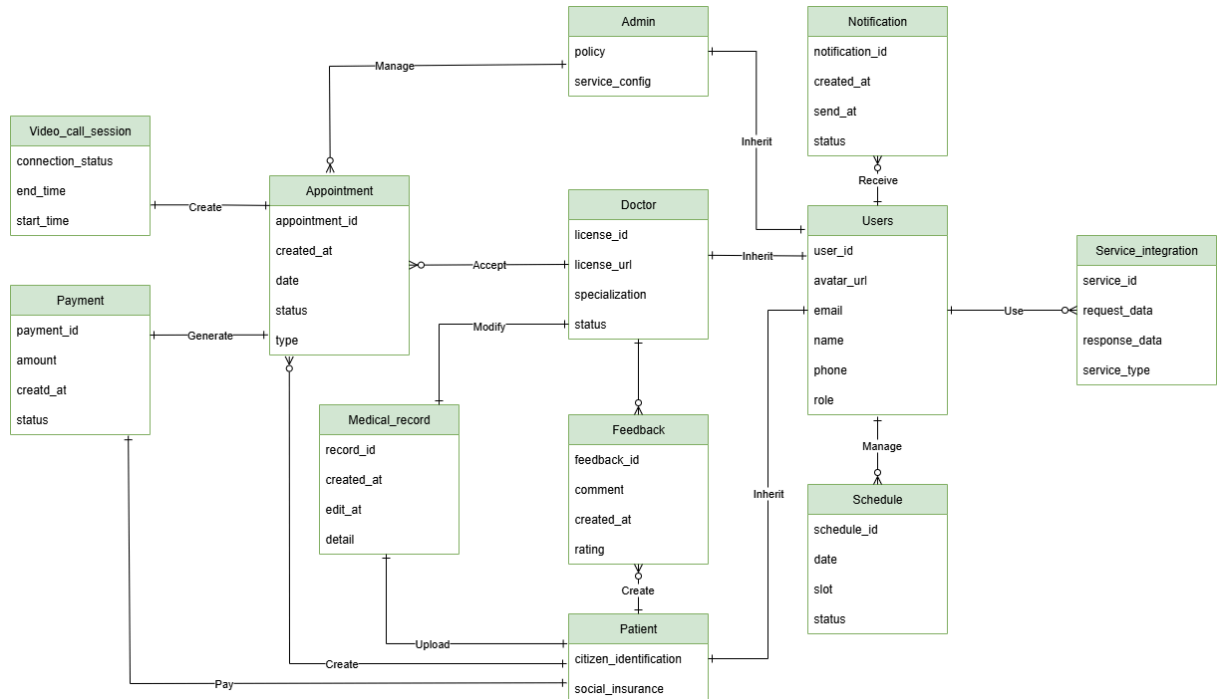
Figure 1.5 - Entity Relationship Diagram

Link Detail: ERD Diagram

Entities Description

#	Entity	Description
1	User	Login identity and role (username, password, email, role) used by all user types.
2	Admin	System administrator; manages access policy, service configurations, verifies doctors, and reviews reports.
3	Doctor	Doctor profile (name, specialization, license, contacts)
4	Patient	Patient profile (name, contact)
5	Schedule	A Doctor/Patient time slot on a given date
6	Appointment	Booking between a patient and a doctor; references Schedule; holds lifecycle status.
7	Payment	VietQR payment record for one appointment (status, amount, date).
8	MedicalRecord	An Electronic Medical Record (EMR) uploaded by a patient during registration. It stores past medical history, existing conditions, or documents. Doctors can view and reference it during appointments.
9	VideoCallSession	Online consultation session tied to an appointment; stores session metadata (start/end time, connection status).

10	Feedback	Patient's rating and comment for a doctor.
11	Notification	Outbound messages/alerts sent to admin, doctor, patient
12	ServiceIntegration	Log of interactions with external services (AI, Map, QR Payment, Speech-to-Text, Notification, Authentication). Stores request and response data.

2. Use Case Specifications

2.1. Authentication & Account Management

2.1.1 UC: Login

ID and Name:	**UC-1 – Login**		
Primary Actor:	Patient / Doctor / Admin	Secondary Actors:	Firebase Auth
Description:	Allows Patient, Doctor, or Admin to authenticate using valid credentials. Firebase Auth validates credentials, issues session tokens, and system redirects to the respective dashboard.		
Trigger:	The user clicks the "Login" button.		
Preconditions:	- The user has a registered and valid account. - Email must be verified. - Doctor accounts must be admin-verified (BR-01).		
Postconditions:	- The user is authenticated. - Firebase issues access/refresh tokens. - User redirected to dashboard (Patient, Doctor, or Admin).		
Normal Flow:	1. The user enters an email and password. 2. System validates required fields → MSG007. 3. System checks credential validity (via Firebase Auth). 4. If valid → Firebase issues token → MSG002 (Signed in successfully). 5. Redirect user to dashboard.		
Alternative Flows:	AF1: Incorrect credentials → MSG001. AF2: Account locked/not verified → MSG040 (Permission denied). AF3: Forgot password → Redirect to reset → MSG006.		
Exceptions:	EX1: Required fields empty → MSG007. EX2: Invalid format (email) → MSG008. EX3: Session expired (when re-login required) → MSG004.		
Priority:	High		
Frequency of Use:	Very frequent – every returning user		
Business Rules:	BR-01, BR-02		

Other Information:	- Tokens are managed by Firebase Auth. - Session expires as per Firebase configuration.
Assumptions:	- Firebase Auth is configured correctly. - Internet connection is available.

2.1.2 UC: Logout

ID and Name:	**UC-2 – Logout**		
Primary Actor:	Patient / Doctor / Admin	**Secondary Actors:**	None
Description:	Allows logged-in users to end the current session and invalidate tokens.		
Trigger:	The user clicks the "Logout" button.		
Preconditions:	- The user has a registered and valid account. - The user is currently logged in.		
Postconditions:	- Session tokens invalidated. - User redirected to login or home page.		
Normal Flow:	1. The user clicks "Logout". 2. System invalidates Firebase tokens (or clears session). 3. System displays toast MSG003 (Signed out successfully). 4. Redirect the user to the login/home page.		
Alternative Flows:	AF1: Session already expired → MSG004 (Your session has expired. Please sign in again.).		
Exceptions:	EX1: Network error during logout → MSG041.		
Priority:	Medium		
Frequency of Use:	Frequent – every user session end		
Business Rules:	BR-02		
Other Information:	- No secondary actors required.		
Assumptions:	- Session management works correctly. - The user has an active session before logout.		

2.1.3 UC: Register (Patient / Doctor)

ID and Name:	**UC-3 – Register**

Primary Actor:	Guest	Secondary Actors:	Firebase Auth
Description:	Allows a guest to create a new user account (as Patient or as Doctor) by filling required information or by using external auth handled by Firebase Auth. After registration the system (via Firebase) sends a verification email. If the account type = Doctor, additional documents (medical license, credentials) must be submitted and reviewed by an administrator before activation.		
Trigger:	The guest clicks the "Sign Up" button on the homepage.		
Preconditions:	- The guest has not registered before. - The guest has access to a valid email. - The guest has not used an email that already exists in the system.		
Postconditions:	- A new inactive user account is created (Patient) OR - A doctor profile is created in pending verification state (Doctor). - A verification email is sent to the user (via Firebase). - Account remains pending activation until email verified (+ admin verification for doctors).		

Normal Flow:	Normal Flow (Patient)
	
	1. Guest opens registration page.
	2. Guest enters: username, email, password, full name, gender, date of birth, address, account type = Patient.
	3. Guest clicks Sign Up.
	4. System validates required fields → MSG007.
	5. System validates formats (email/name length/etc) → MSG008 or MSG009.
	6. System checks password strength → MSG010.
	7. System checks whether email already exists → MSG043.
	8. System encrypts password and stores account (BR-02).
	9. Firebase Auth sends verification email; system displays toast MSG005.
	10. The account remains inactive until email is verified.
	
	Normal Flow (Doctor)
	
	Follow Patient flow (steps 1–7) PLUS:
	  8. Guest uploads medical license/credentials as part of registration.
	  9. The system stores doctor profiles as pending verification and notifies admins. Display toast MSG011. (BR-01)
	  10. After admin review either: MSG012 (Profile approved) or MSG013 (Profile rejected: {reason}).		

Alternative Flows:	AF1 — OAuth via Firebase: Guest chooses external auth handled by Firebase Auth (any provider configured in Firebase) → Firebase authenticates and returns verified email + profile → system auto-registers account (Patient by default). If account type = Doctor then credential upload is still required and profile set as pending verification. Show MSG005 when a verification email is sent. AF2 — Email Verification Not Delivered: If verification mail cannot be sent → show MSG041 (Network error). On retry success show MSG005.
Exceptions:	EX1: Required fields missing → MSG007. EX2: Invalid format or length issues → MSG008 / MSG009. EX3: Password too weak → MSG010. EX4: Email already in use → MSG043. EX5: Firebase/Auth error → MSG041.
Priority:	High
Frequency of Use:	Very frequent – every new patient/doctor user
Business Rules:	BR-01, BR-02
Other Information:	- Email verification required before login. - External auth handled by Firebase Auth. - Doctor accounts require admin verification.
Assumptions:	- Firebase Auth + notification/email configured correctly. - Mail server operational. - Admins review doctor submissions in a timely manner.

2.1.4 UC: Change Password / Forgot Password

ID and Name:	**UC-4 – Forgot Password**		
Primary Actor:	Patient / Doctor / Admin	Secondary Actors:	Firebase Auth
Description:	Allows the user to reset their password when forgotten. The system verifies the registered email, sends a reset link via Firebase Auth, and lets the user set a new password.		
Trigger:	The user clicks the "Forgot Password" option on the login page.		
Preconditions:	- The user must have a registered account with a valid email. (**BR-06**) - Firebase Auth must be able to send emails.		
Postconditions:	- A reset link is sent to the registered email (MSG006). - After clicking the link and setting a new password, the account password is updated. - Old sessions/tokens may be revoked depending on system policy.		

Normal Flow:	1. The user selects "Forgot Password."
	2. The system displays an email input form.
	3. The user enters an email.
	4. System validates required field → MSG007 if empty.
	5. System validates email format → MSG008 if invalid.
	6. System checks if email exists in database (BR-06):
	    a. If not found → MSG045.
	    b. If found → proceed.
	7. Firebase Auth sends reset link → MSG006 displayed.
	8. The user opens the email and clicks the link (valid and not expired).
	9. System shows Reset Password form: user enters new password + confirm password.
	10. System validates:
	● Required field → MSG007.
	● Password format/strength (BR-07) → MSG010 if weak.
	● Min/Max length → MSG009 if exceeded.
	● Confirmation mismatch → MSG008.
	11. If valid, Firebase updates the password → MSG047 (Password updated successfully).
	12. (Optional) All old sessions are revoked and the user is asked to re-login.

Alternative Flows:	AF1: Email not found → MSG045. AF2: Reset link expired/invalid → MSG046. AF3: Network failure while sending mail → MSG041. AF4: Password confirmation mismatch → MSG008.
Exceptions:	EX1: Empty required field → MSG007. EX2: Invalid email format → MSG008. EX3: Network error → MSG041.
Priority:	High
Frequency of Use:	Occasional (only when password is forgotten)
Business Rules:	BR-02, BR-06, BR-07
Other Information:	- Firebase-generated reset links have expiry time. - CAPTCHA or throttling may be applied to avoid abuse.
Assumptions:	- Firebase Auth email service is available. - The user has access to the registered email inbox.

ID and Name:	**UC-5 – Change Password**

Primary Actor:	Patient/ Doctor/ Admin	Secondary Actors:	Firebase Auth
Description:	Allows a logged-in user to change their password for security reasons. The system verifies the current password (reauthentication if needed), validates the new password, and updates it through Firebase Auth.		
Trigger:	The user selects "Change Password" in account/security settings.		
Preconditions:	- The user is logged in with a valid session. - Users must provide the current password for validation (BR-08).		
Postconditions:	- New password is updated in Firebase Auth. - Old sessions may be revoked; users may be required to log in again.		
Normal Flow:	1. The user opens the Change Password form. 2. The user enters the current password, new password, and confirms the new password. 3. System validates required fields → MSG007 if empty. 4. System checks current password (BR-08): ● If incorrect → MSG048. 5. System validates new password: ● Complexity/strength (BR-07) → MSG010 if weak. ● Min/Max length → MSG009 if invalid. ● New password same as old → MSG049. ● Confirmation mismatch → MSG008. 6. If all checks pass, Firebase Auth updates the password. 7. The system shows MSG047 (Password updated successfully). 8. (Optional) Old tokens are revoked; users may need to re-login.		
Alternative Flows:	AF1: AF1: Current password incorrect → MSG048. AF2: New password same as old → MSG049. AF3: Confirmation mismatch → MSG008. AF4: Network or Firebase error → MSG041.		
Exceptions:	EX1: Required field empty → MSG007. EX2: Invalid/weak password → MSG009, MSG010. EX3: Network error → MSG041.		
Priority:	Medium–High		
Frequency of Use:	Infrequent (user-initiated action for security)		
Business Rules:	BR-07, BR-08, BR-02		
Other Information:	- Firebase Auth may require reauthentication before allowing password updates. - Password changes should be logged for auditing.		
Assumptions:	- The user is logged in with a valid session.		

	- Firebase Auth password update service is operational.

2.2. Doctor Profile & Schedule Management

2.2.1 UC: Complete Detailed Profile

ID and Name:	**UC-6 – Complete Detailed Profile**		
Primary Actor:	Doctor	Secondary Actors:	None
Description:	Allows a doctor to complete their professional profile by providing personal details, credentials, and specialization. A complete and verified profile builds patient trust and enables patients to make informed choices.		
Trigger:	The doctor selects "Complete Profile" from their dashboard.		
Preconditions:	- The doctor has a registered and authenticated account. - Email must be verified. - Doctors must not already have a fully verified profile.		
Postconditions:	- Doctor profile is updated with complete details. - Credentials are submitted for admin verification (BR-01). - Profile status changes to *Pending Verification* until approved.		
Normal Flow:	1. The doctor opens the profile completion form. 2. The doctor enters personal information (name, date of birth, gender, contact details). ● System validates required fields → MSG007 3. Doctor uploads credentials (degrees, certifications, licenses). ● System validates file format/size → MSG008 ● System confirms upload → MSG050 4. Doctor selects specialization (e.g., cardiology, pediatrics). 5. The system saves all details and marks the profile as *Pending Verification*. 6. Admin is notified to verify credentials → BR-01. 7. System confirms → MSG051 (Profile submitted successfully, pending admin verification).		
Alternative Flows:	AF1: Invalid email format when entering contact info → MSG008 (Invalid email format). AF2: Missing credential uploads → MSG052 (Credential required before submission). AF3: Duplicate specialization or invalid selection → MSG053 (Invalid specialization selection).		

Exceptions:	EX1: System error during file upload → MSG054 (System error, please try again later). EX2: Network disconnection before saving profile → MSG055 (Connection lost, please retry).
Priority:	High
Frequency of Use:	One-time per doctor, with occasional updates.
Business Rules:	BR-01, BR-02
Other Information:	- Credential documents stored in secure storage (Firebase / cloud). - Profile remains inactive until admin approval.
Assumptions:	- Doctors have access to required credentials. - Admin is available to review and approve.

2.2.2 UC: Resubmit Profile

ID and Name:	**UC-7 – Resubmit Profile**		
Primary Actor:	Doctor	Secondary Actors:	Admin (for verification)
Description:	If a doctor's registration or professional profile is rejected by the admin, the doctor can update the necessary information and resubmit the profile for review and approval.		
Trigger:	The doctor receives notification that their profile has been rejected and chooses "Resubmit Profile."		
Preconditions:	- The doctor has a registered and authenticated account. - Doctor profile status is *Rejected*. - The system provides feedback/reason for rejection.		
Postconditions:	- Updated profile is submitted. - Profile status changes to *Pending Verification*. - Admin notified for re-verification.		
Normal Flow:	1. Doctor opens rejected profile with admin's feedback. 2. The doctor updates the required information (personal info, credentials, specialization, etc.). ● System validates required fields → MSG007 (Required fields must not be empty). 3. Doctor re-uploads or corrects credentials if needed. ● Invalid file → MSG008. ● Successful upload → MSG050 (Document uploaded successfully). 4. The doctor saves changes and clicks "Resubmit."		

	5. The system saves the updated profile and marks it as *Pending Verification*. 6. Admin receives notification to recheck the profile → BR-01. 7. System confirms submission → MSG056 (Profile resubmitted successfully, pending admin verification).
Alternative Flows:	AF1: Doctor attempts to resubmit without fixing required fields - Missing required fields → MSG007 (Required field empty) - Missing credential → MSG052 (Credential required before submission) AF2: Duplicate or invalid specialization → MSG053 (Invalid specialization selection). AF3: Admin feedback not acknowledged by doctor before resubmission → system prompts confirmation → MSG057 (Please review admin feedback before resubmission).
Exceptions:	EX1: System error during resubmission → MSG054 (System error, please try again later). EX2: Network disconnection before saving → MSG055 (Connection lost, please retry).
Priority:	High
Frequency of Use:	Occasional – only when the initial profile is rejected.
Business Rules:	BR-01, BR-02
Other Information:	- Admin feedback must be stored and visible to the doctor for correction. - The notification system should alert both the doctor (rejection reason) and admin (resubmission).
Assumptions:	- The doctor has corrected issues before resubmission. - Admin is available to review the resubmitted profile.

2.2.4 UC: Manage Work Schedule (Update/Add/Delete/Block slots)

ID and Name:	**UC-8 – Manage Work Schedule**		
Primary Actor:	Doctor	Secondary Actors:	System
Description:	The doctor manages their work schedule by defining a weekly working template, adding exceptions/day-off, generating available slots, updating or deleting slots, blocking off periods, viewing the schedule, and specifying		

	consultation type. This ensures patients can only book valid slots and the doctor maintains control over availability.
Trigger:	Doctor selects "Manage Schedule" from the dashboard.
Preconditions:	- The doctor has a registered and authenticated account. - Doctor's profile is verified (MSG012 – Profile approved). - Templates may already exist if the doctor previously defined one.
Postconditions:	- Schedule template and slots are updated and saved. - Patients only see valid available slots when booking.
Normal Flow:	1. Doctor opens schedule settings. 2. Doctor defines or updates weekly template: ● Add working blocks (e.g., 09:00–12:00, 13:30–17:00). ● Add exceptions or day-off. ● Save template → MSG014 (Schedule saved). 3. Doctor generates slots from template: ● Click "Generate next 30 days." ● The system creates slots with step = 60 minutes (45 minutes bookable + 15 minutes buffer, VN timezone). ● Slots generated → MSG015 (Slot generation success). 4. Doctor may update or delete slots: ● Update slot hours → MSG014 (Schedule saved). ● Delete free slot → MSG014 (Schedule saved). 5. Doctors may block off time (vacation, leave, etc.). ● System updates blocked slots → MSG014 (Schedule saved). 6. Doctors may specify consultation type for a slot (in-person / online). ● System saves update → MSG014 (Schedule saved). 7. Doctor views schedule (daily, weekly, monthly) including patient booking details.
Alternative Flows:	AF1: Overlapping slots or conflicts with existing bookings → MSG016 (Overlap prevented: skipped/adjusted slot). AF2: Doctor tries to edit/delete a booked slot → MSG017 (Cannot edit booked slot). AF3: Slot already taken while editing → MSG019 (Slot taken).
Exceptions:	EX1: Network error → MSG041 (Network error). EX2: Permission denied (doctor profile not yet approved) → MSG040 (Permission denied).
Priority:	High

Frequency of Use:	Daily
Business Rules:	BR-09, BR-10, BR-11, BR-12
Other Information:	- Slots stored in the database with status: Available, Booked, Blocked. - Patients can only book available slots.
Assumptions:	- The doctor uses the system in the correct timezone (VN). - The 45' + 15' buffer rule applies by default. - Only *Available* slots are shown to patients. - Notifications for booking changes are handled outside this UC. - The doctor has a stable internet connection.

2.2.5 UC: View Doctor Dashboard

ID and Name:	**UC-9 – View Doctor Dashboard**		
Primary Actor:	Doctor	Secondary Actors:	None
Description:	The doctor views the dashboard to see today's appointments, pending patient requests, and quick actions (e.g., join call, approve, or manage schedule).		
Trigger:	When doctors want to view their personal dashboard.		
Preconditions:	- The doctor is logged in. - The doctor's profile is approved.		
Postconditions:	- Dashboard is displayed with up-to-date information.		
Normal Flow:	1. The doctor opens the dashboard. 2. System retrieves: ● Today's confirmed appointments. ● Pending booking or resubmission requests. ● Quick action shortcuts (join call, manage schedule, view notifications). 3. System displays dashboard → MSG039 (Notification sent) if updates exist.		
Alternative Flows:	AF1: No confirmed appointments today → system displays an empty state message instead of appointment list.		

	AF2: No pending requests → system hides that section or shows "No pending items."
	AF3: Doctor applies filters (e.g., daily/weekly/monthly view) → system reloads dashboard with selected timeframe.
	AF4: Doctor refreshes dashboard manually → system fetches and displays updated data.
Exceptions:	EX1: Network error → MSG041 (Network error).
	EX2: Permission denied (profile not approved) → MSG040 (Permission denied).
Priority:	High
Frequency of Use:	Multiple times per day.
Business Rules:	BR-13, BR-14
Other Information:	- Dashboard may include charts/statistics (appointments per day/week, patient feedback summary).
Assumptions:	- The doctor has a stable internet connection.
	- Pending items are auto-synced from the backend.
	- Timezone of doctor applied when showing appointment times.

2.2.6 UC: View Patient Dashboard

ID and Name:	**UC-10 – View Patient Dashboard**		
Primary Actor:	Patient	Secondary Actors:	None
Description:	Patients access their personal dashboard to view upcoming appointments, past consultations, notifications, and personal information.		
Trigger:	The patient selects "Dashboard" from the navigation menu.		
Preconditions:	- The patient is authenticated (BR-25).		
Postconditions:	- Dashboard is displayed with up-to-date information.		
Normal Flow:	1. The patient opens the dashboard.		
	2. System retrieves:		
	● Upcoming appointments (with time, doctor name, consultation type).		

	● Past consultations (with status and summary link). ● Notifications (recent updates, booking/payment changes). ● Personal information overview (profile status, account info). 3. The system displays dashboard content.
Alternative Flows:	AF1: No upcoming appointments → system shows empty state message. AF2: No notifications → "No new notifications" placeholder shown. AF3: Patient applies filters (e.g., show only upcoming/past) → system reloads accordingly. AF4: Patient refreshes dashboard manually → system re-fetches and displays updated data.
Exceptions:	EX1: Network error → MSG041 (Network error). EX2: Session expired → redirect to login with MSG004 (Session expired).
Priority:	High
Frequency of Use:	Multiple times per day by patients.
Business Rules:	BR-25, BR-26, BR-27, BR-14
Other Information:	- Dashboards may include quick actions (cancel booking, give feedback). - Notifications are synced with UC: Receive Appointment Notification.
Assumptions:	- The patient has a stable internet connection. - Timezone of patient applied when displaying appointment times.

2.3. Patient Appointment Management

2.3.1 UC: Search Doctor & View Profile

ID and Name:	**UC-11 – Search Doctor & View Profile**		
Primary Actor:	Patient	Secondary Actors:	Map / Geocoding Service
Description:	Patients search for doctors by name, specialization, price, or location, and view detailed profiles. Profile includes specialization, experience, schedule, and feedback from previous patients. Map integration helps locate nearby doctors.		

Trigger:	The patient opens the Search page.
Preconditions:	- Patients are logged in if they intend to book (MSG002 – Login success). - Only verified doctor profiles are searchable (MSG012 – Profile approved).
Postconditions:	- Search results or doctor profile displayed.
Normal Flow:	1. The patient enters search filters (name, specialty, price range, location). 2. System validates input → MSG008 (Invalid format) if invalid. 3. System queries database and returns matching doctors. 4. The patient selects a doctor from the list. 5. System displays: ● Doctor profile (specialization, credentials, experience). ● Feedback/reviews from previous patients. ● Available schedule (from UC-29 Manage Work Schedule). ● Map with location (via geocoding service).
Alternative Flows:	AF1: No results → system suggests broader filters → MSG042 (No search results). AF2: Doctor profile incomplete or under review → system hides profile or shows status → MSG013 (Profile rejected) if applicable.
Exceptions:	EX1: Network error → MSG041 (Network error). EX2: Permission denied (profile not approved) → MSG040 (Permission denied).
Priority:	High
Frequency of Use:	Very frequent (core patient action).
Business Rules:	BR-15, BR-16, BR-17
Other Information:	- Map API used to plot doctor location. - Feedback is read-only, and can not be modified by patients.
Assumptions:	- The patient has internet access.

- Doctor's location is correctly geocoded.	
- Filters (specialty, price, location) are standardized in the database.	

2.3.2 UC: Book Appointment

ID and Name:	**UC-12 – Book Appointment**		
Primary Actor:	Patient	Secondary Actors:	Doctor, Notification Service
Description:	The patient creates a booking for a selected available slot. The system locks the slot and holds it for 5 minutes before payment confirmation.		
Trigger:	The patient selects a free slot from the doctor's schedule.		
Preconditions:	- Patient logged in (MSG002 – Login success). - Doctor has an Available slot.		
Postconditions:	- Booking created with status PENDING (hold 5').		
Normal Flow:	1. The patient selects a time slot. 2. The system validates slot availability. 3. System locks slot and creates booking with status PENDING (hold). ● MSG018 (Booking created – hold {time_left} minutes). 4. Notification sent to patient → MSG039 (Notification sent).		
Alternative Flows:	AF1: Slot already taken → system shows next available slots → MSG019 (Slot taken).		
Exceptions:	EX1: Network error → MSG041 (Network error).		
Priority:	High		
Frequency of Use:	Very frequent.		
Business Rules:	BR-18, BR-19		
Other Information:	- Booking status flow: PENDING → PAID or EXPIRED.		
Assumptions:	- The patient has an internet connection. - Notification delivery is reliable.		

2.3.3 UC: Pay Consultation Fee (VietQR)

ID and Name:	UC-13 – Pay Consultation Fee (VietQR)		
Primary Actor:	Patient	Secondary Actors:	VietQR Service, Notification Service
Description:	Patients pay consultation fees using VietQR. The system reconciles payment status, marks booking as PAID, or issues refunds if necessary.		
Trigger:	The patient chooses "Pay" for a pending booking.		
Preconditions:	- Booking status = PENDING / WAITING_PAYMENT.		
Postconditions:	- Payment confirmed. - Booking marked as PAID.		
Normal Flow:	1. The system displays VietQR code & amount. ● MSG021 (QR generated). 2. The patient scans QR and completes payment. 3. System checks payment status (polling/webhook). 4. On success → booking marked PAID. ● MSG022 (Payment success). 5. Notification sent → MSG039.		
Alternative Flows:	AF1: TTL expires before payment → booking → EXPIRED. ● MSG020 (Booking expired). AF2: Payment arrives after expiry → system auto-refunds. ● MSG024 (Late payment detected → refund initiated).		
Exceptions:	EX1: Payment fails → MSG023 (Payment failed). EX2: Refund failure → MSG027 (Refund failed, manual review). EX3: Network error → MSG041.		
Priority:	High		
Frequency of Use:	Very frequent.		
Business Rules:	BR-20, BR-21		

Other Information:	- Integration with VietQR API for payment reconciliation.
Assumptions:	- The patient has a VietQR-capable banking app. - Payment processing is near real-time.

2.3.4 UC: Cancel Appointment (≥12h refund policy)

ID and Name:	**UC-14 – Cancel Appointment (≥12h Refund Policy)**		
Primary Actor:	Patient	Secondary Actors:	VietQR Service / Admin (for refunds), Notification Service
Description:	Patient cancels a booked appointment. System applies refund policy: if canceled ≥12h before start, 50% refund; otherwise, no refund.		
Trigger:	Patient selects "Cancel appointment."		
Preconditions:	- Appointment exists. - Status = PAID.		
Postconditions:	- Appointment marked Canceled. - Refund applied per policy.		
Normal Flow:	1. The patient requests cancellation. 2. The system checks the time until appointments start. 3. If ≥12h before → issue 50% refund. ● MSG029 (Cancel appointment – eligible). ● Refund initiated → MSG025 (Refund initiated) → MSG026 (Refund completed). 4. If <12h before → no refund (see AF1). 5. Notification sent → MSG039.		
Alternative Flows:	AF1: <12h before start → no refund.		

	● MSG030 (Cancel appointment – not eligible). AF2: Refund failure → system marks for manual review. ● MSG027 (Refund failed).
Exceptions:	EX1: Network error → MSG041.
Priority:	High
Frequency of Use:	Occasional.
Business Rules:	BR-22, BR-23, BR-24
Other Information:	- Refund processing via VietQR / admin backend.
Assumptions:	- The patient bank account supports refunds. - Time calculations use system server time (VN timezone).

2.3.5 UC: View Appointment History

ID and Name:	**UC-15 – View Appointment History**		
Primary Actor:	Patient	Secondary Actors:	None
Description:	Patients view their appointment history, including both upcoming and past consultations, along with related payment status and refund records.		
Trigger:	Patient selects "Appointment History" from the dashboard or navigation menu.		
Preconditions:	- Patient is logged in		
Postconditions:	- Appointment history displayed with filter/sort options.		
Normal Flow:	1. The patient opens the "Appointment History" page. 2. The system retrieves appointment records (past & upcoming) with payment/refund details. 3. The system lists appointments, providing filters (date, doctor, status) and sorting options. 4. Patients can view details of a specific appointment (time, doctor, medical record, payment, feedback).		

Alternative Flows:	— (No specific alternative; system always shows empty list if no records)
Exceptions:	EX1: No history available → system shows message MSG042 (No search results found). EX2: Network error → MSG041 (Network error).
Priority:	Medium
Frequency of Use:	Occasional – patients check history when needed.
Business Rules:	BR-25, BR-26, BR-27
Other Information:	- History can be filtered by date range or status. - Refund details are shown if available.
Assumptions:	- The patient has at least one recorded appointment. - System time is consistent for date calculations.

2.4. Consultation & Medical Records

2.4.1 UC: Join Video Consultation

ID and Name:	**UC-16 – Join Video Consultation**		
Primary Actor:	Patient, Doctor	Secondary Actors:	Agora Service, Notification Service
Description:	The patient and doctor join the scheduled video consultation within the allowed time window. The system issues a secure token to join the video channel. Join/leave events are recorded for auditing and history.		
Trigger:	At appointment start time, the patient/doctor clicks "Join Call" from the dashboard or appointment list.		
Preconditions:	- Booking status = PAID / CONFIRMED. - Current time is within the allowed consultation window.		
Postconditions:	- A video consultation session is established.		

	- Join/leave events are logged.
Normal Flow:	1. The patient/Doctor performs pre-call checks (device, mic, camera, network). 2. The system requests a token from the Agora service. ● MSG032 (Join call token issued). 3. The system grants access and the user joins the video channel. 4. Consultation is conducted in real-time. 5. System records join/leave events.
Alternative Flows:	AF1: Fail to join (invalid token, poor network). ● System guides retry → MSG041 (Network error) with instructions. AF2: Token expired before joining. ● System prompts refresh token → MSG058 (Session expired, please request a new token).
Exceptions:	EX1: Permission denied (doctor not verified, patient not booked) → MSG040 (Permission denied). EX2: Unexpected Agora service error → MSG054 (System error, please try again later).
Priority:	High
Frequency of Use:	Per appointment (daily for active doctors).
Business Rules:	BR-02, BR-04, BR-17, BR-28
Other Information:	- Agora service handles audio/video stream and token issuance. - Notification is sent if the participant joins late or disconnects.
Assumptions:	- Both patient and doctor have devices with camera, mic, and stable internet. - System time (VN timezone) is used to validate consultation windows.

	- Token refresh is possible if the session expires.

2.4.2 UC: Write Consultation Summary

ID and Name:	**UC-17 – Write Consultation Summary**

Primary Actor:	Doctor	Secondary Actors:	None

Description:	The doctor records key notes, findings, and recommendations after finishing a consultation.
Trigger:	After the video consultation ends, the doctor clicks "Write Summary."
Preconditions:	- Completed call session. - Medical record accessible.
Postconditions:	- Summary saved and linked to appointment record
Normal Flow:	1. Doctor opens consultation summary form. 2. The doctor enters notes and recommendations. 3. The doctor clicks "Save." ● System stores summary securely → MSG036 (Summary saved).
Alternative Flows:	AF1: Doctor leaves summary form empty → MSG007 (Required field empty) AF2: Doctor saves partially completed summary
Exceptions:	EX1: Network error → MSG041 (Network error). EX2: Permission denied (doctor not verified / not the assigned doctor) → MSG040 (Permission denied).
Priority:	High
Frequency of Use:	Every consultation.
Business Rules:	BR-02, BR-04
Other Information:	- Summaries may be referenced for feedback, prescriptions, and medical records.

Assumptions:	- Doctor inputs summary immediately after consultation. - Summary length and format flexible but must be text-based.

2.4.3 UC: Issue E-Prescription

ID and Name:	**UC-18 – Issue E-Prescription**		
Primary Actor:	Doctor	Secondary Actors:	PDF Generator Service
Description:	The doctor issues an electronic prescription and exports it as a secure PDF linked to the patient's appointment.		
Trigger:	The doctor selects "Issue Prescription" after writing a summary or during follow-up.		
Preconditions:	- Consultation summary or required prescription fields are filled.		
Postconditions:	- E-prescription generated in PDF. - Patients can download and access the file.		
Normal Flow:	1. The doctor fills a prescription form (medicine, dosage, instructions). 2. The system validates required fields. 3. The doctor clicks "Generate." ● System generates prescription PDF → MSG037 (Prescription generated). 4. The system saves files and shares secure links with patient.		
Alternative Flows:	AF1: Doctor tries to generate prescription without filling mandatory fields → MSG007 (Required field empty) AF2: Doctor edits prescription after generating → The system forces the creation of a new version and the destruction of the old version to ensure legality (BR-05).		
Exceptions:	EX1: Missing mandatory fields → MSG007 (Required field empty). EX2: Network error → MSG041 (Network error). EX3: System/PDF generation error → MSG054 (System error, please try again later).		

Priority:	High
Frequency of Use:	Occasional – depends on consultation type.
Business Rules:	BR-02, BR-04, BR-05
Other Information:	- PDF includes digital signature, timestamp, and doctor info.
Assumptions:	- The doctor provides valid medical details. - The patient has access to view/download PDF. - PDF service available and integrated.

2.4.4 UC: View Medical Record

ID and Name:	**UC-19 – View Medical Record**		
Primary Actor:	Patient	Secondary Actors:	None
Description:	Patients view their own medical records, including consultation summaries and e-prescriptions generated by doctors.		
Trigger:	The patient selects "Medical Record" from the dashboard or menu.		
Preconditions:	- The patient is authenticated (MSG002 – Login success).		
Postconditions:	- Medical records are displayed with summaries and prescriptions.		
Normal Flow:	1. Patient navigates to "Medical Record." 2. The system retrieves patient's consultation summaries and prescriptions. 3. The system displays the list of items with details (date, doctor, type: summary/prescription). 4. Patients may open an item to view content or download PDF (for prescriptions).		
Alternative Flows:	AF1: Patient applies filter (by date/doctor/type) but no match → shows empty list with MSG042 (No search results). AF2: Patient requests prescription download but PDF generator service is unavailable → show warning, allow retry.		

Exceptions:	EX1: No records available → system shows MSG042 (No search results found).
	EX2: Network error → MSG041 (Network error).
	EX3: Permission denied (patient tries to access another's record) → MSG040 (Permission denied).
Priority:	High
Frequency of Use:	Occasional – when a patient needs to review medical history.
Business Rules:	BR-02, BR-25, BR-26
Other Information:	- Records consist of consultation summaries (UC-16) and e-prescriptions (UC-17). - Downloadable prescriptions must preserve PDF integrity and digital signature.
Assumptions:	- The patient has internet access. - Data is synced correctly from completed consultations. - Records are immutable once stored.

2.5. Feedback & Notification

2.5.1 UC: Give Feedback (Patient)

ID and Name:	**UC-20 – Give Feedback**		
Primary Actor:	Patient	Secondary Actors:	None
Description:	Patient rates and comments on the doctor after a completed appointment. Feedback is stored and linked to the specific consultation for transparency.		
Trigger:	The patient selects the "Give Feedback" option from the appointment history.		
Preconditions:	- The patient is authenticated. - Appointment status = COMPLETED.		

Postconditions:	- Feedback (rating + comment) stored in the system. - Feedback is linked to the corresponding appointment and doctor profile.
Normal Flow:	1. Patient opens feedback form from completed appointment. 2. Patient enters rating (e.g., 1–5 stars) and optional comment. 3. The patient submits feedback. 4. System validates required fields → MSG007 (Required field empty) if missing rating. 5. System stores feedback and confirms submission → MSG038 (Feedback submitted).
Alternative Flows:	**AF1:** Patient attempts to submit feedback more than once for the same appointment → system blocks → MSG059
Exceptions:	EX1: Network error → MSG041 (Network error). EX2: System error while saving feedback → MSG003 (System error, please try again later).
Priority:	Medium
Frequency of Use:	Once per completed appointment.
Business Rules:	BR-17, BR-29
Other Information:	- Feedback may be used for doctor ratings and search ranking.
Assumptions:	- Patients provide genuine, non-abusive feedback. - Doctors will see only aggregated results, not editable feedback.

2.5.2 UC: View Feedback (Doctor)

ID and Name:	**UC-21 – View Feedback**		
Primary Actor:	Doctor	Secondary Actors:	None

Description:	Doctor views feedback received from patients, including ratings and comments, with aggregated statistics.
Trigger:	The doctor selects "View Feedback" from their dashboard.
Preconditions:	- The doctor is authenticated and approved (**BR-10**). - At least one feedback entry exists.
Postconditions:	- Feedback list and aggregated rating stats displayed.
Normal Flow:	1. The doctor navigates to the "Feedback" section in the dashboard. 2. The system retrieves feedback data and aggregates statistics. 3. The system displays ratings, comments, and averages.
Alternative Flows:	AF1: No feedback available → system shows message → MSG042 (No search results found).
Exceptions:	EX1: Network error → MSG041 (Network error). EX2: Permission denied (doctor not verified) → MSG040 (Permission denied).
Priority:	Medium
Frequency of Use:	Occasional – when doctor reviews performance.
Business Rules:	BR-17, BR-14
Other Information:	- Feedback may be aggregated into performance reports.
Assumptions:	- Doctors cannot edit or delete patient feedback. - The system automatically anonymizes patient names if needed.

2.5.3 UC: Receive Appointment Notification

ID and Name:	**UC-22 – Receive Appointment Notification**		
Primary Actor:	Doctor/ Patient	Secondary Actors:	Notification Service (email, in-app, push)
Description:	Patients and doctors receive real-time notifications for booking, payment, and consultation events.		

Trigger:	An event occurs in the system (e.g., booking created, payment confirmed, call starting).
Preconditions:	- The user has an active and valid contact channel (email verified or app installed). - Related events (booking/payment/call) exist and are valid.
Postconditions:	- Notification is delivered to the user via a configured channel.
Normal Flow:	1. The system detects an event (e.g., booking confirmation, payment success). 2. The system generates a notification message with event details. 3. Notification service sends message to user's registered channel. 4. The user receives the notification. 5. System confirms delivery → MSG039 (Notification sent successfully).
Alternative Flows:	AF1: Delivery failure → system retries sending up to N times. If still undelivered, mark as failed and log error.
Exceptions:	EX1: Network outage in notification service → retry queued later. EX2: Invalid contact info (wrong email/app uninstalled) → notify user on next login.
Priority:	High
Frequency of Use:	Frequent – triggered by multiple booking/payment/call events daily.
Business Rules:	BR-14, BR-30
Other Information:	- Notification channels: in-app banner, toast, email. - Templates are standardized for clarity and consistency.
Assumptions:	- Users regularly check their registered channel. - Notification service (e.g., Firebase, SMTP) is reliable and monitored.

2.6. Administration

2.6.1 UC: Manage Medical Specializations (Create/Update/Delete/View)

ID and Name:	**UC-23 – Manage Medical Specializations**
Primary Actor:	Admin	Secondary Actors:	None
Description:	Admin manages the list of medical specializations available on the platform. Functions include creating new specializations, viewing existing ones, updating details, and deleting obsolete entries.
Trigger:	Admin selects "Medical Specializations" from the system management menu.
Preconditions:	- Admin is authenticated.
Postconditions:	- Medical specialization list is updated (create, modify, remove, or view successfully).
Normal Flow:	1. Admin navigates to "Manage Medical Specializations." 2. The system displays the list of existing specializations. 3. Admin selects an operation: ● Create: Fill in specialization name/details → system validates required fields (MSG007) → saves new specialization → confirmation (MSG061: Specialization created successfully). ● View: System shows all current specializations with details. ● Update: Select specialization → edit details → system validates (MSG008) → save → confirmation (MSG062: Specialization updated successfully). ● Delete: Select specialization → confirm deletion → system removes entry → confirmation (MSG063: Specialization deleted successfully). 4. The system refreshes the list with changes applied.
Alternative Flows:	AF1: Admin attempts to create specialization with duplicate name → system blocks → MSG016 (Invalid specialization selection) or new MSG064 (Specialization already exists). AF2: Admin cancels delete operation at confirmation → system keeps specialization unchanged.

Exceptions:	EX1: Network error while saving/deleting → MSG041 (Network error). EX2: System error → MSG003 (System error, please try again later).
Priority:	Medium
Frequency of Use:	Occasional – when updating the specialization catalog.
Business Rules:	BR-31, BR-32
Other Information:	- Specializations are critical for search & profile filtering (used in UC: Search Doctor). - Audit log must track all create/update/delete actions by admin.
Assumptions:	- Admin inputs valid names and descriptions. - The system prevents orphan references (doctors already linked to deleted specialization remain unaffected).

2.6.2 UC: Manage Doctor Registration (Approve/Reject/Review)

ID and Name:	**UC-24 – Manage Doctor Registration**		
Primary Actor:	Admin	Secondary Actors:	Notification Service
Description:	Admin manages new doctor registration requests by reviewing submitted details and credentials. Based on verification, the admin can approve or reject the registration, with notifications sent to the doctor.		
Trigger:	Admin selects "Doctor Registration Requests" from the dashboard.		
Preconditions:	- Doctor has submitted a registration/profile with credentials (BR-01, BR-09). - Doctor's profile status = *Pending Verification*.		
Postconditions:	- Doctor profile status is updated to either *Verified* or *Rejected*. - Notification is sent to the doctor about the decision.		
Normal Flow:	1. Admin opens the list of pending doctor registrations.		

	2. The system displays doctor details and uploaded credentials.
	3. Admin reviews the submission.
	4. Admin chooses:
	● Approve: System sets profile → *Verified*, stores record, and sends notification → MSG012 (Profile approved).
	● Reject: Admin enters rejection reason → system sets profile → *Rejected* and notifies doctor → MSG013 (Profile rejected: {reason}).
	5. The system logs the decision for audit purposes.
Alternative Flows:	AF1: Missing or unclear credential → admin requests resubmission instead of reject → system updates profile status to *Resubmission Required* → notify doctor → MSG065 (Resubmission requested: please upload missing documents).
Exceptions:	EX1: Network error while saving/deleting → MSG041 (Network error). EX2: System error → MSG003 (System error, please try again later).
Priority:	High
Frequency of Use:	Frequent – whenever new doctors register on the platform.
Business Rules:	BR-01, BR-09, BR-33
Other Information:	- Approved doctors become visible in UC: Search Doctor & View Profile (BR-15). - Rejected doctors can resubmit using UC-7: Resubmit Profile.
Assumptions:	- Admin makes decisions based on complete and valid evidence. - The notification system is reliable and immediate. - Doctors will correct and resubmit if requested.

2.6.3 UC: Admin Dashboard

ID and Name:	**UC-25 – Admin Dashboard**

Primary Actor:	Admin	Secondary Actors:	None

Description:	Admin views the operational dashboard showing system KPIs, statistics, and recent activities for monitoring purposes.
Trigger:	Admin selects "Dashboard" from the navigation menu after login.
Preconditions:	- Admin is authenticated
Postconditions:	- Dashboard with KPIs and activity lists is displayed.
Normal Flow:	1. Admin opens "Dashboard." 2. The system fetches KPIs (appointments, payments, refunds, doctor/patient counts). 3. The system loads recent activities (new registrations, cancellations, failed payments, etc.). 4. The system displays a dashboard with charts, tables, and notifications.
Alternative Flows:	AF1: Admin applies filters (e.g., date range, doctor specialization) → system reloads KPIs & activities based on filter. AF2: Admin refreshes dashboard manually → system fetches updated data. AF3: No KPI data available for selected filter → system shows empty state with MSG042 (No search results found).
Exceptions:	EX1: Network error → MSG041 (Network error). EX2: Permission denied (session expired / unauthorized user) → MSG040 (Permission denied). EX3: No data available (first-time system run) → show empty state message.

Priority:	High
Frequency of Use:	Daily by admin for system monitoring.
Business Rules:	BR-13, BR-14
Other Information:	- KPIs include both operational (appointments, revenue, refunds) and compliance metrics. - Data refresh intervals can be configured (e.g., every 5 minutes).
Assumptions:	- Admin has a stable internet connection. - Monitoring tools (charts, metrics) are configured correctly. - Logs and activities are stored in the database for retrieval.

2.7. Guest Access

2.7.1 UC: View Homepage

ID and Name:	**UC-26 – View Homepage**		
Primary Actor:	Guest	Secondary Actors:	None
Description:	Guest users can browse the landing page to see general information about the platform, services, and features.		
Trigger:	Guest navigates to the platform URL.		
Preconditions:	- The guest has a working internet connection.		
Postconditions:	- Homepage content is displayed.		
Normal Flow:	1. Guest opens the site homepage. 2. System loads and displays landing content (overview, search bar, CTAs).		
Alternative Flows:	AF1: Homepage content partially fails to load → show fallback text/images. AF2: Guest refreshes page → system reloads content.		
Exceptions:	EX1: Network error → MSG041 (Network error).		

	EX2: Permission denied (rare, misconfigured role) → MSG040 (Permission denied).
Priority:	High
Frequency of Use:	Every time a new or unauthenticated visitor opens the site.
Business Rules:	BR-04, BR-14
Other Information:	- Homepage may include login/register links and doctor search entry point.
Assumptions:	- Guests are not required to log in to view the homepage. - Content is cached/CDN-optimized for performance.

2.7.2 UC: View Doctors List

ID and Name:	**UC-27 – View Doctors List**		
Primary Actor:	Guest	Secondary Actors:	None
Description:	Guests can view the public list of doctors with limited profile information (name, specialization, city). Detailed profiles require login.		
Trigger:	Guest selects "Doctors" or uses homepage search.		
Preconditions:	- At least one approved doctor exists in the system (BR-15).		
Postconditions:	- List of doctors is displayed with limited details.		
Normal Flow:	1. Guest opens the Doctors List page. 2. System fetches list of approved doctors with limited profile info. 3. The system displays doctors in a paginated list.		
Alternative Flows:	AF1: No doctors available (system empty) → system shows MSG042 (No search results found). AF2: Guest applies filters (e.g., specialization, city) → system reloads filtered list.		

Exceptions:	EX1: Network error → MSG041 (Network error). EX2: Guest tries to access full profile without login → system redirects to login/register → MSG040 (Permission denied).
Priority:	High
Frequency of Use:	Frequent – common entry point for new patients browsing doctors.
Business Rules:	BR-15, BR-16
Other Information:	- Only basic details (name, specialization, location) are visible; ratings/feedback may be hidden until login.
Assumptions:	- Guests may later sign up/login to access full profiles. - The system ensures list performance with pagination or infinite scroll.

3. Functional Requirements

3.1.1 Home Page

Logo		Doctor List	Specialization	Login	Register

Slogan

Search

Image

Doctor Detail

Schedule

Booking
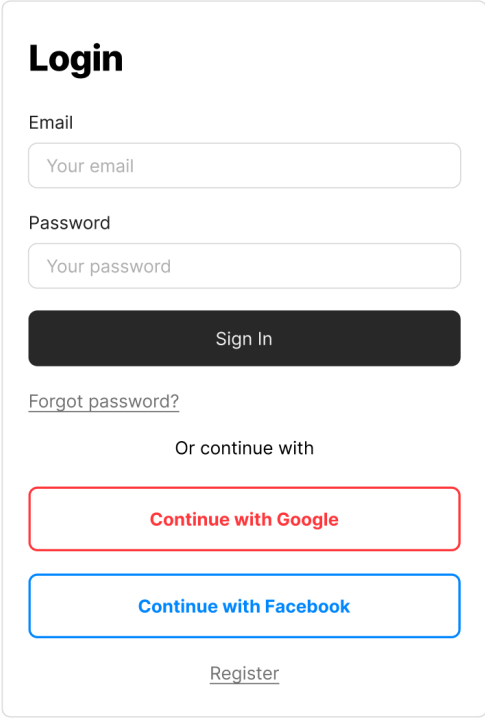
Chat Bot

Footer

#	Field Name	Type	Mandatory	Max Length	Description
1	Logo	Button			
2	Doctor List	Button			
3	Specialization	Button			
4	Login	Button			
5	Register	Button			
6	Image	Image			
7	Doctor Detail				
8	Booking	Button			
9	Chat Bot				
10	Schedule				
11	Slogan				

12	Search				

3.1.2 User Login

Figure 3.1.2 - User Login

#	Field Name	Type	Mandatory	Max Length	Description
1	Email	Email	Yes	100	User's registered email address used for login.
2	Password	Password	Yes	50	User's account password (masked input).
3	Sign in	Button	Yes		Submits the login form with email and password.
4	Forgot Password	Link			Redirects the user to password recovery/reset page.
5	Continue with Google	Button			Allows users to authenticate via Google OAuth.
6	Continue with Facebook	Button			Allows users to authenticate via Facebook OAuth.
7	Register	Link			Redirects users to the registration page for new account creation.

3.1.2.2 Register Screen

Figure 3.1.3 - Register Screen

#	Field Name	Type	Mandatory	Max Length	Description
1	Email	Email	Yes		
2	Password	Password	Yes	50	
3	Confirm Password	Password	Yes	50	
4	Create Account	Button			

3.1.2.3 Forgot Password

#	Field Name	Type	Mandatory	Max Length	Description
1	Email	Email	Yes		
2	Send	Button			

3.2 User Authentication

Screen	Guest	Patient	Doctor	Admin
Role-based Dashboard		X	X	X
Login	X	X	X	X
Register	X	X	X	X
Forgot Password		X	X	X
Change Password		X	X	X
Update Profile		X	X	X
View Profile		X	X	X
Verify Email		X	X	X
Account Activation		X	X (Pending Admin)	X
Logout		X	X	X
Manage User Accounts				X

3.3 System Administration

ID	Name	Description	Input	Output	Business Rules	Priority
FR-3.3.1	Manage User Accounts	Allows Admin to view, block, delete, or reassign roles for Patient/Doctor accounts.	User ID, Action (block/unblock, delete, assign role)	- Success message after update - Blocked users cannot log in	- Only Admin has permission - Doctor must be verified before being activated	High
FR-3.3.2	Doctor Verification	Admin manages verification of doctor profiles (approve/reject).	Doctor profile info, license, certifications	- Doctor account marked as Verified/Rejected - Notification sent to Doctor	- Doctor account becomes active only after Admin approval - Reason must	High

				be logged if rejected		
FR-3.3.3	Manage Specializations	Admin can add, edit, or delete medical specializations.	Specialization Name, Description	- Specialization list updated successfully - Error if duplicate or invalid	- Specialization name must be unique - Cannot delete specialization if linked to existing doctors	Medium
FR-3.3.4	Manage System Settings	Allows Admin to configure system settings (appointment slot time, security policies, etc.).	Config Key, Value	- Settings updated successfully - Applied immediately to the whole system	- All changes must be logged - Only Super Admin can change critical configs	Medium
FR-3.3.5	View Audit Logs	Admin can monitor activity logs (logins, data changes, profile updates).	Filter by User ID, Date, Action	- Display audit log table - Export logs to CSV/PDF	- Logs must be stored for at least 6 months - Audit logs cannot be modified or deleted	Medium
FR-3.3.6	Backup & Restore	Admin manages database backup and restore operations.	Backup/Restore Action, File path	- Backup file created successfully - System restored from backup	- Backup performed daily - Only Super Admin can restore data	Medium
FR-3.3.7	Manage Notifications	Admin manages system notifications (email templates, in-app messages).	Notification Template, Message Content	- Notification/email template saved successfully - Applied to the system	- Notifications must follow standard template - Sent notification logs cannot be modified/deleted	Low–Medium

4. Non-Functional Requirements

4.1 External Interfaces

Interface	Direction	Protocol/Data	Auth	Purpose	Timeout /Retry	Degrade/Fallback
Firebase Authentication	FE → Firebase; BE verifies token	OIDC / Firebase ID Token	Firebase SDK	Sign up, sign in, token issue/verify	5s, retry 1	On verify fail → 401; no auto re-login
VietQR	FE/BE → VietQR	REST, JSON	API key	Create QR & reconcile payment status	5s, retry 2 (expo backoff)	If error: keep **PENDING**, show receipt-upload option (if enabled)
Agora RTC	FE/BE → Agora	REST (token), WebRTC	App ID/Secret	Issue RTC token & join video calls	3s, no retry for token	If token fail → show Retry + network tips
OpenStreetMap / Nominatim	FE/BE → OSM	REST, JSON	—	Geocoding & map embed	3s, retry 1, cache 24h	If rate-limited → use cached result / hide map
Notification Service	BE → SMTP/API	SMTP or REST	API key	Send email & in-app/SSE notifications	5s, retry 2	Queue and retry later; don't block user flow
Speech-to-Text	FE/BE → STT	REST/WebSocket	API key	Transcripts with consent	5s	If fail → disable STT; call continues

4.2 Quality Attributes

4.2.1 Usability

1. Onboarding: Patient signs up and books first appointment in ≤ 3 min; Doctor sets weekly template and generates slots in ≤ 5 min.

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2. Responsive: Supports screens ≥ 360×640; desktop optimized for ≥ 1366×768.
3. Accessibility: Basic WCAG 2.1 AA (focus order, labels, contrast ≥ 4.5:1).
4. Locale: Default Vietnamese; time format DD/MM/YYYY, HH:mm (TZ: Asia/Ho_Chi_Minh).

4.2.2 Performance
1. API latency (p95): common endpoints ≤ 600 ms; doctor search/filter ≤ 800 ms (with cache); issue video token ≤ 1.5 s.
2. Throughput (course target): ~50 concurrent users; 10 simultaneous video calls.
3. Slot generation: 30-day slots (≈2 blocks/day) ≤ 2 s.
4. Payment polling: every 5 s, up to 5 min (booking TTL).
5. FE TTI: landing/home ≤ 3 s on typical 4G.

4.2.3 Reliability & Availability
1. Service availability (staging/demo): 99% during class/demo time.
2. RTO/RPO: recover in 10 min; data loss ≤ 15 min (daily DB backup + pre-demo dump).
3. Atomicity/Consistency: booking/payment flows must be idempotent; no double booking.

4.2.4 Security & Privacy
1. RBAC / Least privilege: Guest / Patient / Doctor / Admin.
2. Privacy (VN Decree 13/2023/NĐ-CP): HTTPS in transit; AES-256 at rest for sensitive data; explicit consent for sharing/recording/STT.
3. Tokens: BE verifies Firebase ID Token; CORS allow-list for staging domain(s).
4. Logs: no medical details/PII; include correlation-id.
5. Rate limits: auth & payment ≤ 10 req/min/IP; excess → temporary block.

4.2.5 Scalability
1. BE stateless; horizontal scale; app-level cache (search/slots).
2. Redis locks for slot generation & booking holds (TTL 5 min).
3. DB indexes: (doctor_id, slot_start), (booking_id), (specialization, city).

4.2.6 Maintainability
1. Stack: Java 21 + Spring Boot, React + TypeScript; lint/format enforced.
2. Tests: ≥ 60% coverage on core (booking, payment, schedule).
3. CI: build + unit tests + linters; PR review before merge to main.

4.2.7 Compatibility & Portability
1. Browsers: Chrome/Edge/Firefox (last 2 versions), Safari (last 1).
2. Devices: desktop/laptop + mobile browsers; no native app requirement.

4.2.8 Observability
1. Structured JSON logs; metrics (req/sec, p95, error rate); health at /actuator/health.
2. Alerts: 5xx error rate > 2% for 5 min; video token issuance failures > 5 in a row.

4.2.9 Compliance & Legal

1. Disclaimer: the platform is a technology intermediary, not responsible for diagnosis/treatment.
2. E-prescription: follows Ministry of Health rules; sign/seal if applicable.
3. Data retention: appointment summaries & prescriptions (PDF) kept ≥ 12 months for coursework; deletable on user request.

5. Requirement Appendix

5.1 Business Rules

ID	Rule Definition
BR-01	Doctor Verification: All doctors must submit valid medical licenses and credentials, which must be verified by an administrator before their profile is activated on the platform.
BR-02	Data Privacy: All patient data, especially medical records and consultation details, must be encrypted and handled in strict compliance with Decree 13/2023/NĐ-CP. Patient consent is required before any data is shared.
BR-03	Appointment & Cancellation: Patients must pay in advance to confirm a booking. A cancellation policy must be in place (e.g., full refund if cancelled 24 hours in advance, no refund otherwise).
BR-04	Medical Liability: The platform must have a clear disclaimer stating that it is a technology provider connecting patients and doctors, and is not responsible for medical diagnoses or treatments. The responsibility lies with the consulting doctor.
BR-05	Prescription Validity: E-prescriptions issued through the platform must comply with the Ministry of Health's regulations on electronic prescriptions.
BR-06	Password Reset Eligibility: Password reset can only be initiated using a registered email address.
BR-07	Password Security: New password must meet complexity requirements (e.g., minimum 8 characters, contain uppercase, lowercase, digit, and special character).
BR-08	Password Validation: Current password must be verified before allowing a password change.
BR-09	An administrator must manually review and verify all submitted doctor profiles, including licenses, certifications, and other credentials. A profile will only be activated after this verification process is successfully completed.
BR-10	Only doctors who have been authenticated and approved by the administrator are permitted to access and manage their appointment schedules. Unverified or pending doctors cannot create, update, or publish available time slots.
BR-11	Once a patient has booked a slot and the booking is confirmed, the doctor is not allowed to edit, reschedule, or delete that time slot. This ensures appointment integrity and prevents unexpected cancellations from the doctor's side.
BR-12	All appointment slots must be generated with at least a 15-minute buffer before the next available slot. This prevents back-to-back bookings and provides doctors with sufficient preparation and transition time between consultations.
BR-13	Access to the doctor's dashboard is restricted to only those doctors who have been authenticated and approved by the administrator. Pending or rejected profiles are not permitted to view or interact with dashboard functionalities.

BR-14	All data displayed on dashboards, booking pages, and patient profiles must be updated in real-time or near real-time. Any changes in booking status, payment confirmation, or consultation updates should be immediately reflected in the system.
BR-15	Only doctors who have successfully completed the verification and approval process will appear in patient search results. Unverified or rejected doctor profiles must remain hidden to maintain patient trust and compliance with regulations.
BR-16	Patients are required to log into their registered accounts before they can proceed with booking an appointment after viewing a doctor's profile. Anonymous users may view doctor profiles but cannot initiate bookings.
BR-17	Patient feedback and ratings shown on doctor profiles must only come from verified consultations conducted through the platform. The system must link feedback to actual completed appointments to prevent fraudulent or misleading reviews.
BR-18	An appointment slot can only be held by one patient at a time. The system must enforce exclusivity to prevent multiple patients from attempting to book the same slot concurrently.
BR-19	When a patient selects a slot, it will be held for a maximum of 5 minutes. If payment is not completed within this time-to-live (TTL) period, the slot will automatically be released and made available to other patients.
BR-20	Patients must confirm and complete payment within the slot's 5-minute TTL. If payment is not received in this window, the booking is automatically cancelled and the slot is returned to availability.
BR-21	If a payment is processed after the TTL has expired and the slot has already been released, the system must automatically refund the transaction to the patient to prevent double-booking or invalid reservations.
BR-22	Patients are eligible for a refund only if the cancellation occurs at least 12 hours before the scheduled appointment time. Any cancellations made later than this threshold will not be eligible for a refund.
BR-23	For cancellations that qualify for a refund, the refunded amount will be 50% of the original payment. The remaining 50% will be retained by the platform or doctor as a cancellation fee.
BR-24	If an attempted refund fails due to technical or banking issues, the case must be automatically escalated to an administrator for manual resolution. The system must keep a log of all failed refund attempts for auditing purposes.
BR-25	Only the logged-in patient can view their personal booking and consultation history. No other patient, doctor, or admin should have unauthorized access to another patient's private history.
BR-26	The appointment history displayed to patients must include detailed payment information, including statuses such as *Paid, Refunded, or Failed*. This ensures transparency and allows patients to track their financial transactions.
BR-27	The system must clearly separate upcoming appointments from past appointments in the patient's history view. This distinction improves usability and helps patients quickly identify pending consultations.
BR-28	Video consultation tokens must be generated as single-use credentials that are valid only within the scheduled appointment time window. Once the consultation ends or the token expires, it must become invalid and cannot be reused.
BR-29	Each patient is allowed to leave feedback only once per completed appointment. Multiple feedback entries for the same consultation are not permitted to prevent manipulation of ratings.

BR-30	All critical system events—including booking confirmations, payments, cancellations, and video call sessions—must trigger a corresponding notification to the relevant parties (patient, doctor, or admin).
BR-31	Each specialization name in the system must be unique. Duplicate specialization entries are not permitted to avoid confusion in search and filtering functions.
BR-32	When a specialization is deleted, it must no longer be available for linking to new doctor profiles. However, it must remain associated with historical records of doctors who had previously been linked to it, ensuring data consistency.
BR-33	All records that are deleted or rejected (including doctor profiles, specializations, appointments, or payments) must be logged in the system. These logs must be traceable by administrators for auditing, compliance, and troubleshooting purposes.

5.2 System Messages

#	Message code	Message Type	Context	Content
1	MSG001	In line	Incorrect credentials on sign-in	*Incorrect email or password. Please try again.*
2	MSG002	Toast message	Login success	*Signed in successfully.*
3	MSG003	Toast message	Logout	Signed out successfully.
4	MSG004	In line	Session expired	*Your session has expired. Please sign in again.*
5	MSG005	Toast message	Email verification	*A verification email has been sent to {email}.*
6	MSG006	Toast message	Password reset	*Password reset link has been sent to {email}.*
7	MSG007	In red, under the text box	Required field empty	*The {field} field is required.*
8	MSG008	In red, under the text box	Invalid format	*Invalid {field}. Please check and try again.*
9	MSG009	In red, under the text box	Min/Max length	*Exceeds max length of {max_length} characters.*
10	MSG010	In red, under the text box	Password strength	*Passwords must meet the required complexity.*
11	MSG011	Toast message	Profile submitted	*Profile submitted for verification.*
12	MSG012	Toast message	Profile approved	*Your doctor profile has been verified.*

13	MSG013	Toast message	Profile rejected	*Profile review failed: {reason}. Please update and resubmit.*
14	MSG014	Toast message	Schedule saved	*Schedule updated successfully.*
15	MSG015	Toast message	Slot generation	*Time slots generated successfully.*
16	MSG016	Toast message	Overlap prevented	*Overlapping time slots were skipped.*
17	MSG017	Toast message	Cannot edit booked slot	*This slot cannot be edited because it has a confirmed booking.*
18	MSG018	Toast message	Booking created (hold)	*Booking created and held for {time_left} minutes. Please complete payment.*
19	MSG019	Toast message	Slot taken	*Sorry, this slot was taken. Please choose another.*
20	MSG020	Toast message	Booking expired	*Your booking has expired and the slot was released.*
21	MSG021	Toast message	QR generated	*VietQR generated. Complete the payment to proceed.*
22	MSG022	Toast message	Payment success	*Payment of {amount}đ received. Booking marked as PAID.*
23	MSG023	Toast message	Payment failed	*Payment failed. Please try again or use another method.*
24	MSG024	Toast message	Late payment detected	*Payment received after expiry. Auto-refund has been initiated.*
25	MSG025	Toast message	Refund initiated	*Refund of {amount}đ has been initiated.*
26	MSG026	Toast message	Refund completed	*Refund completed successfully.*
27	MSG027	Toast message	Refund failed	*Refunds failed. Our team has been notified for manual review.*
28	MSG028	Toast message	Appointment confirmed	*Appointment confirmed for {start_time}.*
29	MSG029	Dialog	Cancel appointment (eligible)	*Cancel this appointment? A 50% refund will be issued.*

30	MSG030	Dialog	Cancel appointment (not eligible)	*This appointment starts in less than 12 hours. No refund will be issued. Do you still want to cancel?*
31	MSG031	Banner	Call starting soon	*Your video call starts in {minutes} minutes. Prepare your device and network.*
32	MSG032	Toast message	Join call token	*Video token issued. Joining now…*
33	MSG033	Toast message	Extend approved	*The session extended by 15 minutes.*
34	MSG034	Toast message	Extend denied	*Cannot extend: the next slot is not available.*
35	MSG035	Toast message	Call ended	*The call ended. Please write the consultation summary.*
36	MSG036	Toast message	Summary saved	*Consultation summary saved.*
37	MSG037	Toast message	Prescription generated	*E-prescription generated and available for download.*
38	MSG038	Toast message	Feedback submitted	*Thank you! Your feedback has been submitted.*
39	MSG039	Toast message	Notification sent	*Notification sent successfully.*
40	MSG040	Banner	Permission denied	*You do not have permission to access this page.*
41	MSG041	Banner	Network error	*Network error. Please check your connection and try again.*
42	MSG042	In line	No search results	*No search results found.*
43	MSG043	In red, under the text box	Email already in use	*The email {email} is already associated with another account.*
44	MSG044	Toast message	Forgot password (success)	*Password reset link sent to {email}.*
45	MSG045	In red, under the text box	Forgot password (email not found)	*Email not found in the system.*

46	MSG046	In line	Forgot password (reset link invalid/expired)	*Reset link expired or invalid. Please request a new one.*
47	MSG047	Toast message	Change password (success)	*Password updated successfully.*
48	MSG048	In red, under the text box	Change password (wrong current password)	*Incorrect current password.*
49	MSG049	In red, under the text box	Change password (same as old)	*The new password cannot be the same as the old password.*
50	MSG050	Toast message	File upload	*Document uploaded successfully.*
51	MSG051	Toast message	Profile submission	*Profile submitted successfully, pending admin verification.*
52	MSG052	In red, under text box	Credential required	*Credential required before submission.*
53	MSG053	In red, under text box	Invalid specialization	*Invalid specialization selection.*
54	MSG054	Toast message	System error	*System error, please try again later.*
55	MSG055	Toast message	Connection lost	*Connection lost, please retry.*
56	MSG056	Toast message	Profile resubmission	*Profile resubmitted successfully, pending admin verification.*
57	MSG057	Toast message	Feedback confirmation	*Please review admin feedback before resubmission.*
58	MSG058	Toast message	Session expired	*Session expired, please request a new token*
59	MSG059	Toast message	Duplicate feedback	*Duplicate feedback not allowed*
60	MSG060	Toast message	Specialization created	*Specialization created successfully*
61	MSG061	Toast message	Specialization updated	*Specialization updated successfully*
62	MSG062	Toast message	Specialization deleted	*Specialization deleted successfully*
63	MSG063	Toast message	Resubmission requested	*Resubmission requested: please upload missing documents*