

UNIVERSITY PARTNER



6CS007

PROJECT AND PROFESSIONALISM

ARTEFACT DESIGN AND TEST PLAN

NYAYAMITRA: RAG based AI for Nepali legal Q&A

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Artefact Design

FDD - Functional Decomposition Diagram



Figure 1: FDD-Functional Decomposition Diagram

Subsystems

1. User Management Module

1.1. SRS Document

Functional Requirement

Table 1: UM-FunctionalRequirement

Requirement Code	Requirement Description
UM-F-1.0	The system must allow the user to register using email and password.
UM-F-1.1	The system will validate email format before submission.
UM-F-1.2	The system must validate password strength (letters, numbers, special characters).
UM-F-1.3	The system must allow the user to log in.
UM-F-1.4	The system must allow users to view and edit their own profile (name, profile picture).
UM-F-1.5	The system must allow users to log out from the web interface.

Non-Functional Requirement

Table 2: UM_Non-FuunctionalRequirement

Requirement Code	Requirement Description
UM-NF-1.0	All data submitted via the browser must be encrypted using HTTPS/TLS.
UM-NF-1.1	Passwords must be stored using a secure hashing algorithm (bcrypt/argon2).
UM-NF-1.2	The login and registration pages must load within 2-3 seconds on standard broadband.
UM-NF-1.3	The session must use secure cookies (HttpOnly, SameSite, Secure flags).

Usability Requirement

Table 3: UM-UsabilityRequirement

Requirement Code	Requirement Description
UM-UR-1.0	The password field must include a show/hide toggle icon.
UM-UR-1.1	Error messages must be clear and displayed directly on the form (e.g., under the input field).
UM-UR-1.2	Forms must provide inline validation (email checking, password strength indicator).
UM-UR-1.3	The profile update page must be easy to navigate and must preview uploaded profile pictures.
UM-UR-1.4	Buttons and forms should follow consistent styling throughout the web interface.

1.2. Use Case Diagram

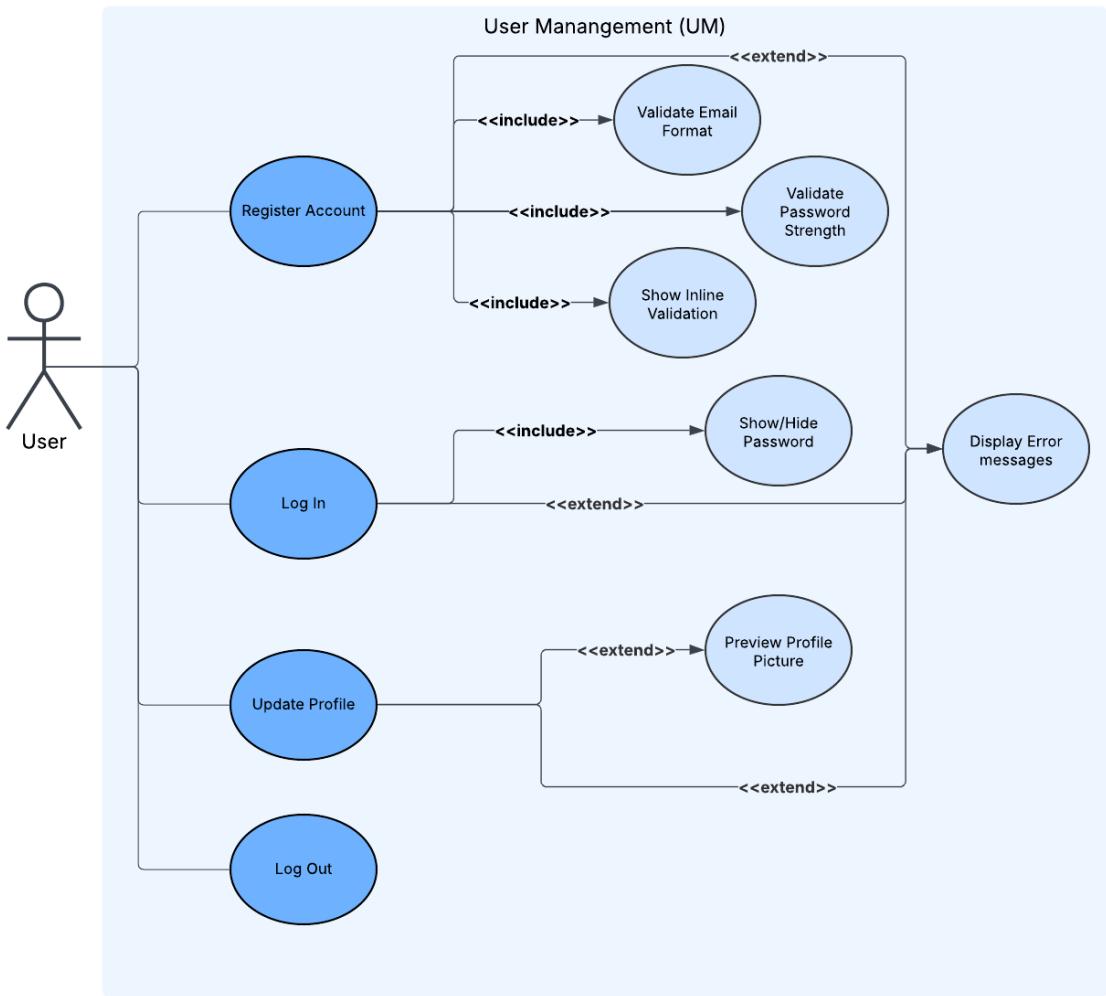


Figure 2: UM-UseCaseDiagram

1.3. Activity Diagram

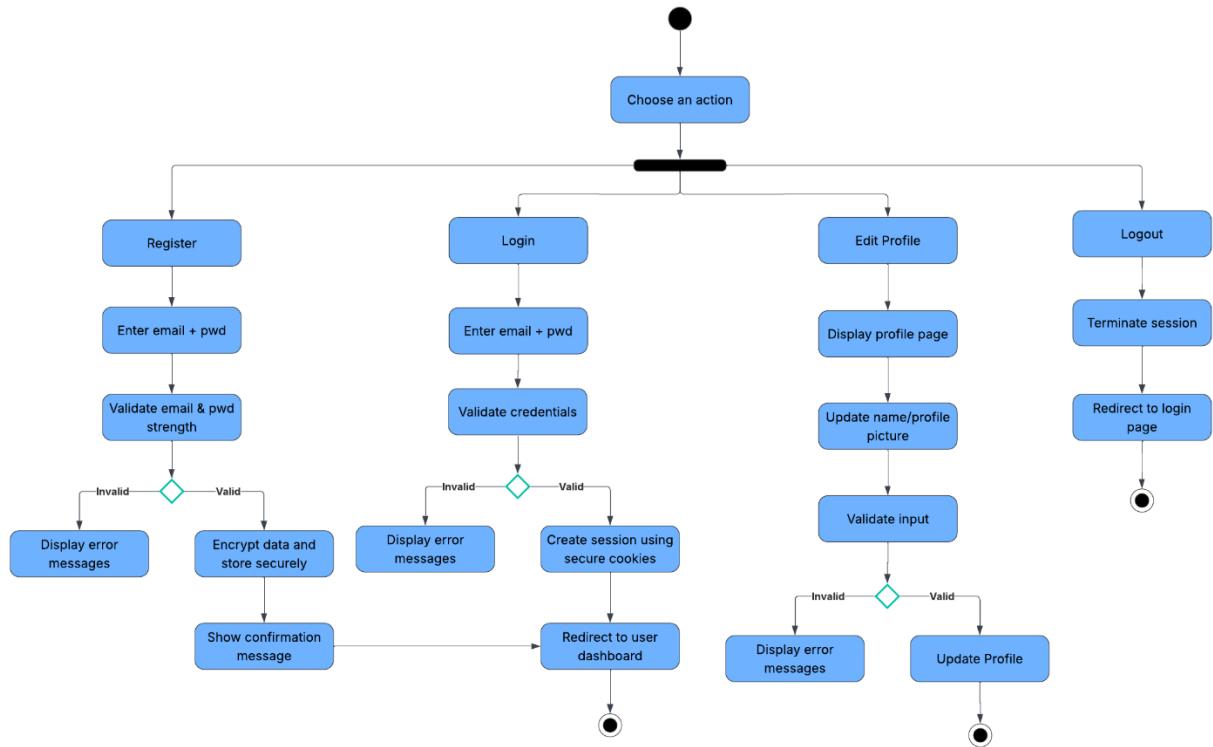


Figure 3: UM-ActivityDiagram

1.4. ERD

users			
PK	user_id	int	
	email	varchar	
	password_hash	varchar	
	name	varchar	
	profile_picture	text	
	created_at	timestamp	
	updated_at	timestamp	

Figure 4: UM-ERD

1.5. Wireframe

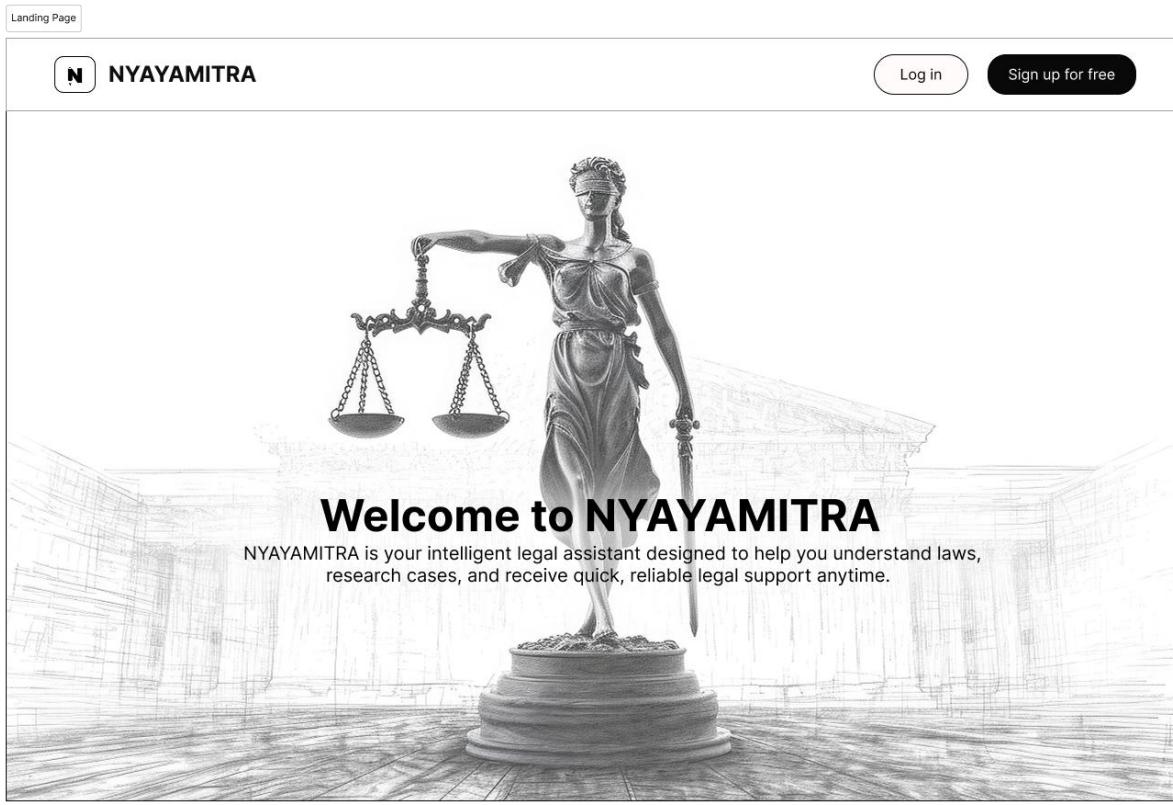


Figure 5: UM-LandingPageWireframe

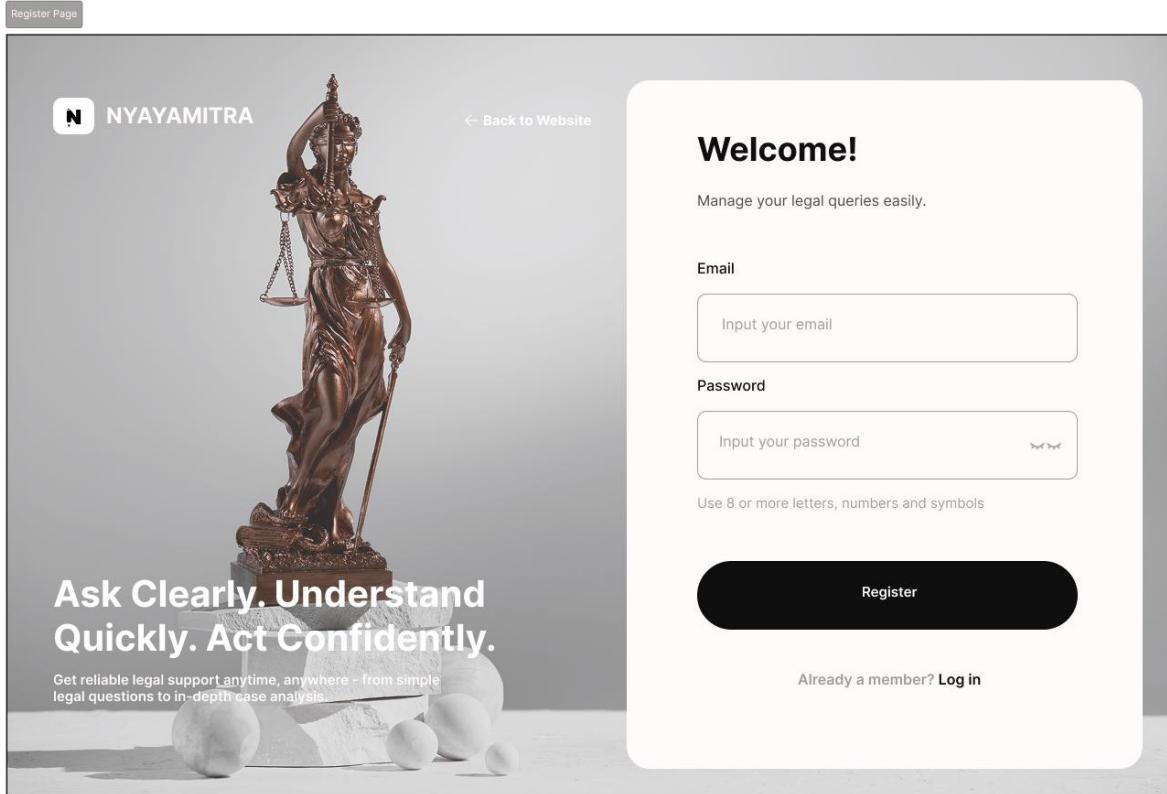


Figure 6: UM-RegisterWireframe

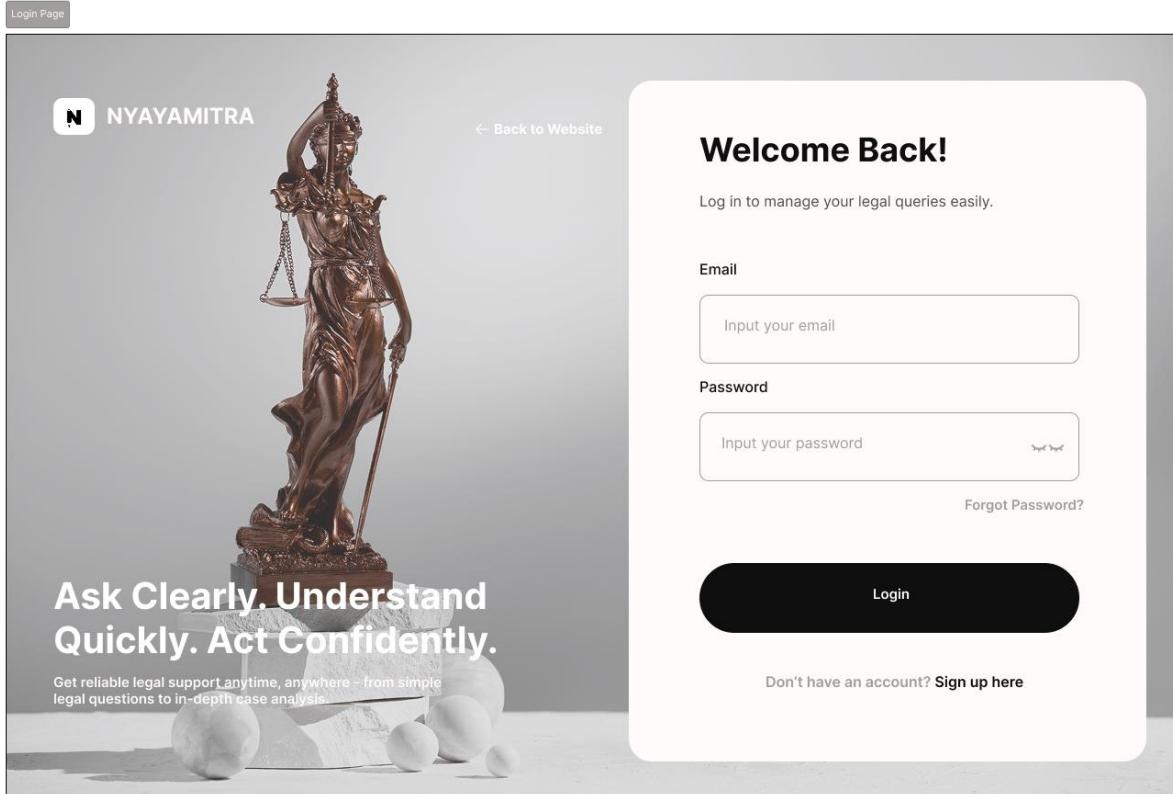


Figure 7: UM-LoginWireframe

Profile Page

The wireframe shows a profile page with a sidebar on the left and a main content area on the right. The main content area has a header with a user icon, a search bar, and a profile picture. Below the header, the title 'Edit profile' is centered. Underneath it, 'Basic Details' is underlined. A section titled 'Lawyer Details' contains fields for 'Photo' (with a placeholder image of a cat), 'Name' (miri), and 'Email' (miritsuki@gmail.com). At the bottom are 'Change Password' and 'Save' buttons.

Ask NyayaMitra

Edit profile

Basic Details

Lawyer Details

Photo

Name
miri

Email
miritsuki@gmail.com

Change

Change Password

Save

Figure 8: UM-EditProfileWireframe

The wireframe shows a user profile editing interface. At the top right are 'Log out' and a user icon. Below is a header bar with 'Ask NyayaMitra'. The main area is titled 'Edit profile' under 'Basic Details' and 'Lawyer Details'. It includes a 'Photo' section with a placeholder image of a cat and a 'Change' button. Below are fields for 'Name' (miri) and 'Email' (miritsuki@gmail.com). At the bottom are 'Change Password' and 'Save' buttons.

Figure 9: UM-LogoutWireframe

2. Document Management Module

2.1. SRS Document

Functional Requirement

Table 4: DM-FunctionalRequirement

Requirement Code	Requirement Description
DM-F-1.0	The system must allow users to upload PDF documents.
DM-F-1.1	Users can upload multiple PDFs simultaneously.
DM-F-1.2	The system must allow users to preview a list of uploaded documents.
DM-F-1.3	Users can perform batch queries across multiple documents.
DM-F-1.4	The system must allow cross-document comparisons (e.g., searching for the same term in multiple PDFs).

DM-F-1.5	Users can delete uploaded documents.
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Non-Functional Requirement

Table 5: DM-Non-FunctionalRequirement

Requirement Code	Requirement Description
DM-NF-1.0	All PDF uploads and downloads must be transmitted over HTTPS/TLS.
DM-NF-1.1	Uploaded PDFs must be stored securely with access control to prevent unauthorized access.
DM-NF-1.2	The system must handle simultaneous uploads of at least 20 PDFs without performance degradation.
DM-NF-1.3	Document processing (search, comparison) must complete within 5 seconds for up to 10 documents of 10 MB each.

Usability Requirement

Table 6: DM-UsabilityRequirement

Requirement Code	Requirement Description
DM-UR-1.0	The upload interface must allow drag-and-drop for multiple PDFs.
DM-UR-1.1	Progress bars should show upload status for each PDF.
DM-UR-1.2	Error messages must be clear and displayed near the document upload area (e.g., file too large, invalid format).

2.2. Use Case Diagram

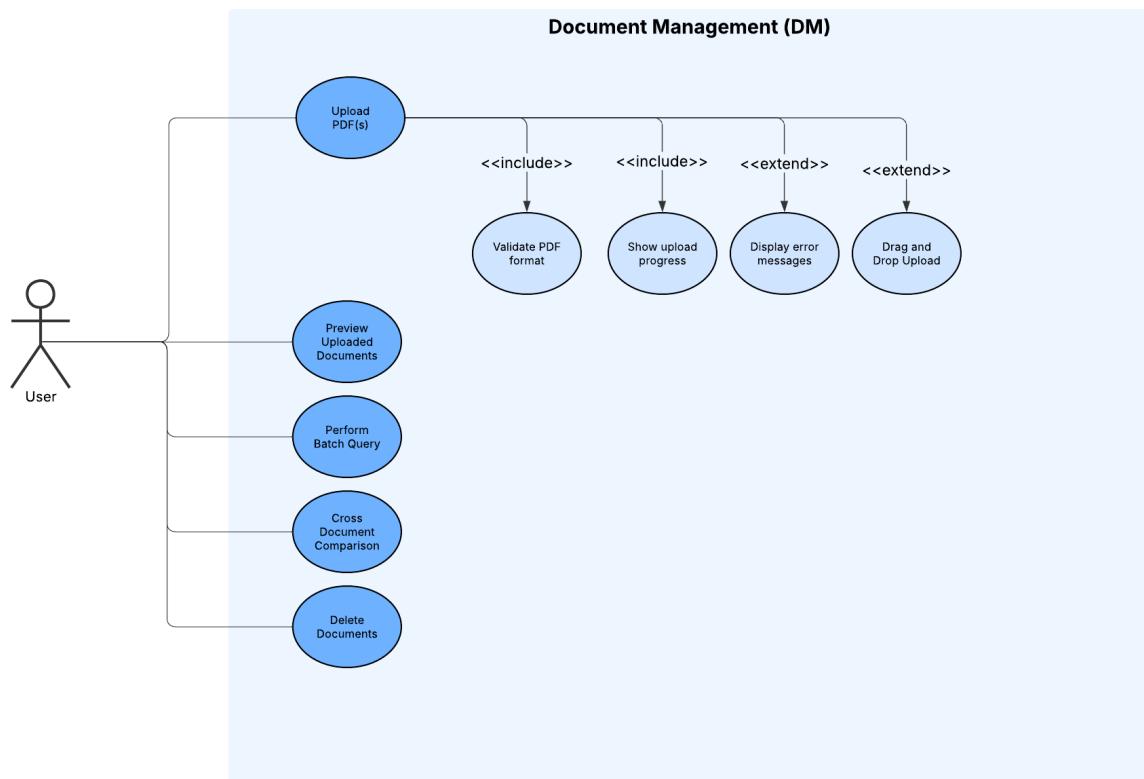


Figure 10: DM-UseCaseDiagram

2.3. Activity Diagram



Figure 11: DM-Activitydiagram

2.4. ERD

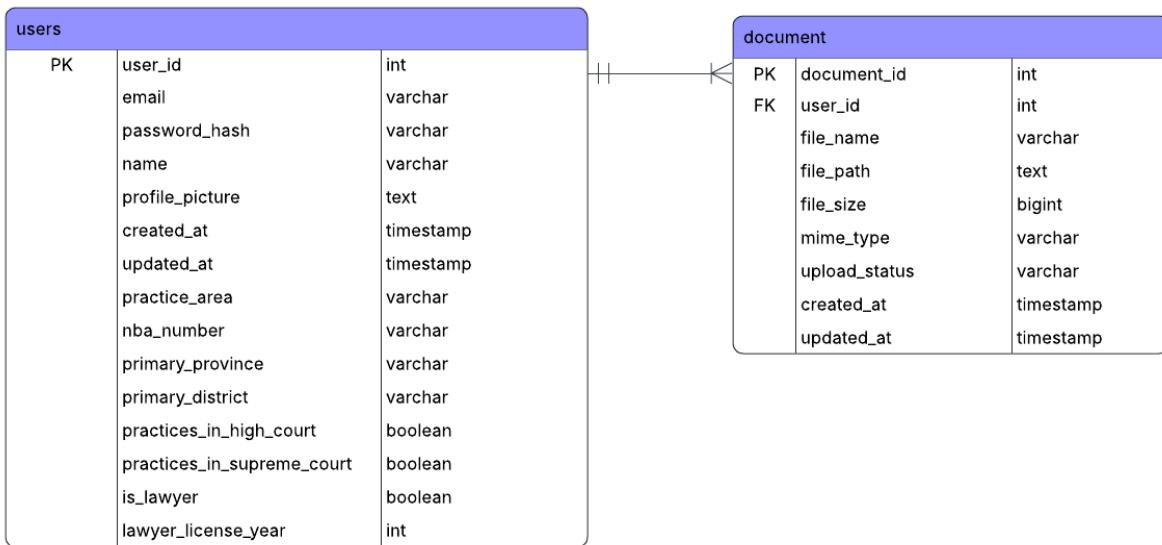


Figure 12: DM-ERD

2.5. Data Dictionary

DM-ChromaDB		
id	String	Unique identifier for each vector record stored in ChromaDB
embedding	Vector<float>	Numerical vector representing the semantic meaning of document content
document_id	Integer (metadata)	References the corresponding document stored in PostgreSQL
user_id	Integer (metadata)	Identifies the owner of the document for access control

Figure 13: DM-DataDictionary

3. Personalization/Onboarding Module

3.1. SRS Document

Functional Requirement

Table 7: PM--FunctionalRequirement

Requirement Code	Requirement Description

PM-F-1.0	The system must display a personalization onboarding flow immediately after successful user signup.
PM-F-1.1	Users can edit their name during onboarding process.
PM-F-1.2	The system must ask the user whether they are a lawyer using a Yes/No pop-up question.
PM-F-1.3	If the user selects “Yes (Lawyer)”, the system must display additional pop-up questions for lawyer-specific details.
PM-F-1.4	For lawyer users, the system must collect the Nepal Bar Association (NBA) number.
PM-F-1.5	For lawyer users, the system must collect the user’s legal practice area.
PM-F-1.6	For lawyer users, the system must collect the court jurisdiction in which the user practices.
PM-F-1.7	If the user selects “No (Non-Lawyer)”, the system must skip lawyer-specific questions.
PM-F-1.8	The system must mark personalization as completed after successful submission of onboarding details.
PM-F-1.9	Users have the option to skip personalization steps.
PM-F-1.10	The system must redirect the user to the dashboard after onboarding is completed.
PM-F-1.11	The system must allow users to update their personal and professional details later through profile management.

Non-Functional Requirement

Table 8: PM--Non-FunctionalRequirement

Requirement Code	Requirement Description
PM-NF-1.0	The onboarding pop-up flow must be responsive and load within acceptable time limits.

PM-NF-1.1	Personal and professional data collected during onboarding must be securely stored.
PM-NF-1.2	The subsystem must ensure data consistency between onboarding inputs and stored user profile information.
PM-NF-1.3	The system must support concurrent onboarding sessions for multiple users without performance degradation.
PM-NF-1.4	Sensitive professional information (e.g., NBA number) must not be exposed to unauthorized users or components.

Usability Requirement

Table 9: PM--UsabilityRequirement

Requirement Code	Requirement Description
PM-UR-1.0	The onboarding process must be presented using clear, sequential pop-up questions.
PM-UR-1.1	Validation errors must be clearly displayed within the pop-up interface.
PM-UR-1.2	The onboarding interface must be easy to understand and require minimal user effort.
PM-UR-1.3	Users must receive clear confirmation when personalization is successfully completed.

3.2. Use Case Diagram

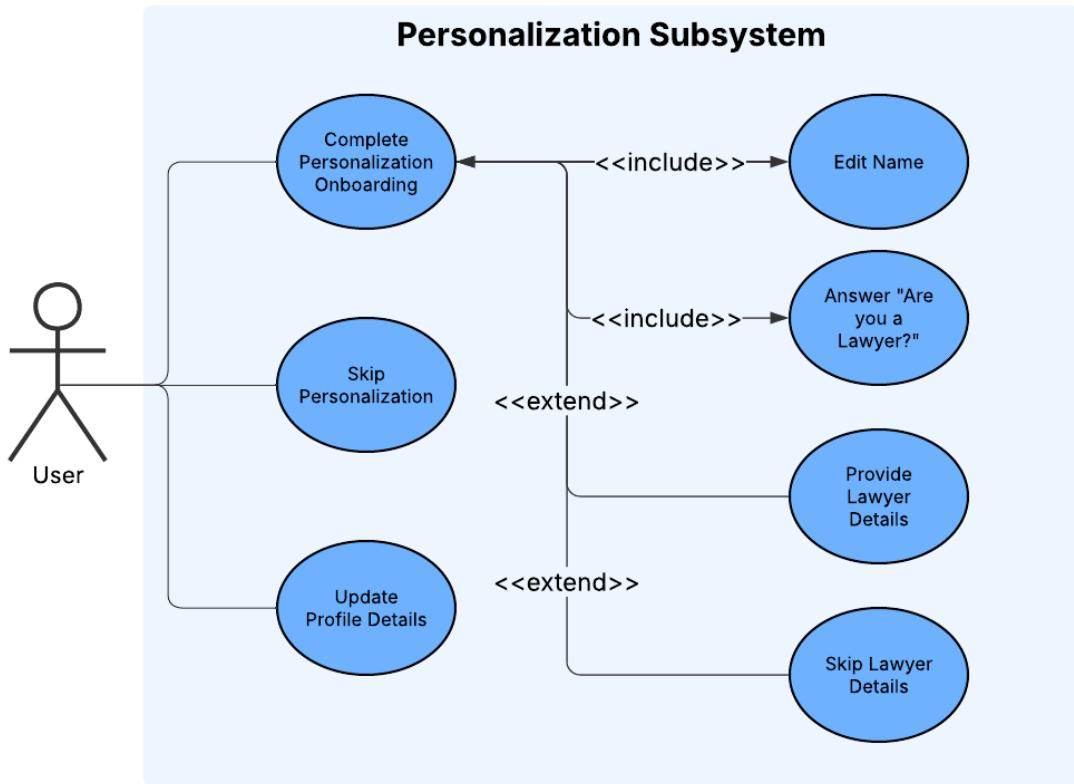


Figure 14: PM-UseCaseDiagram

3.3. Activity Diagram

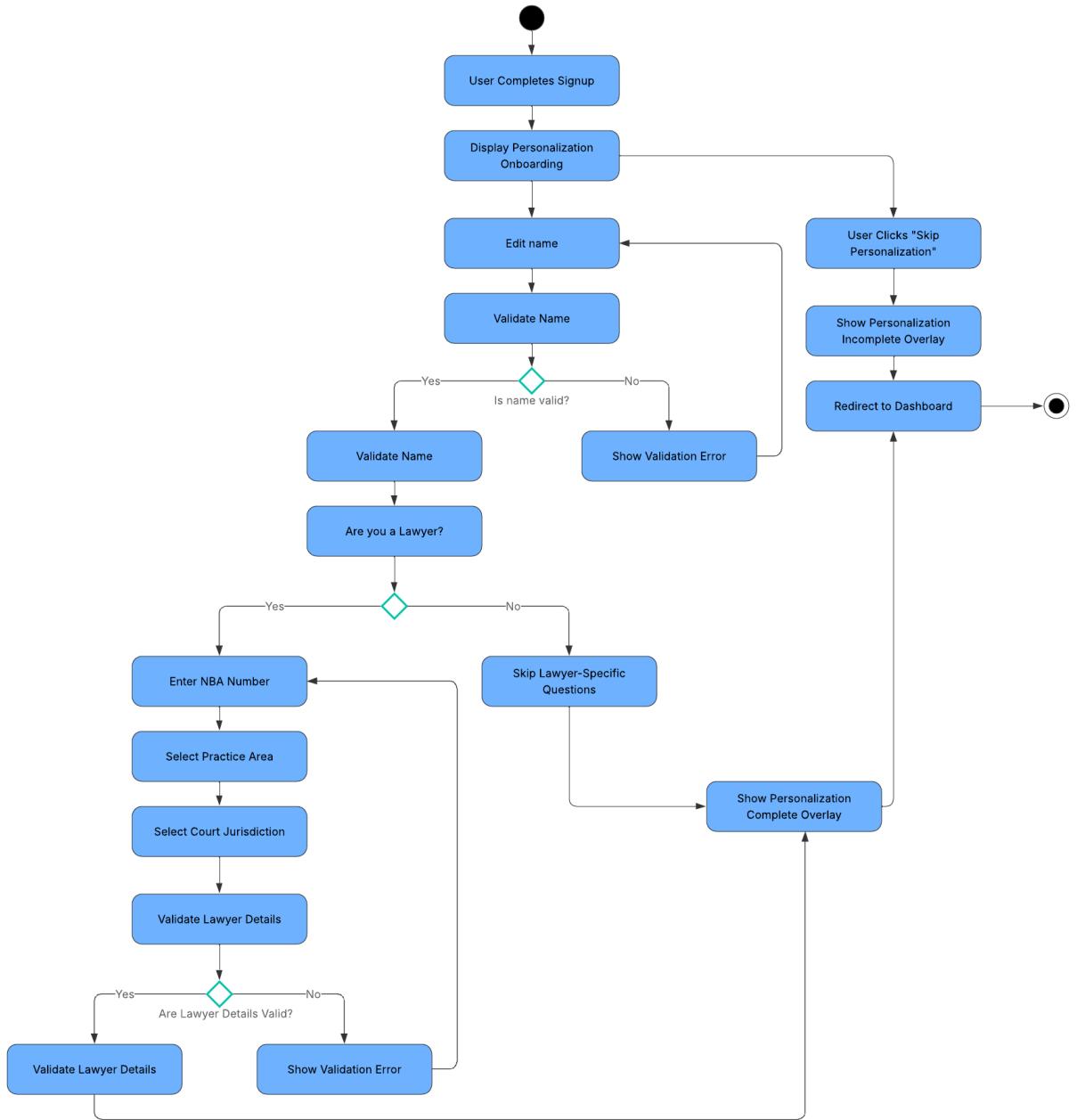


Figure 15: PM-ActivityDiagram

3.4. ERD

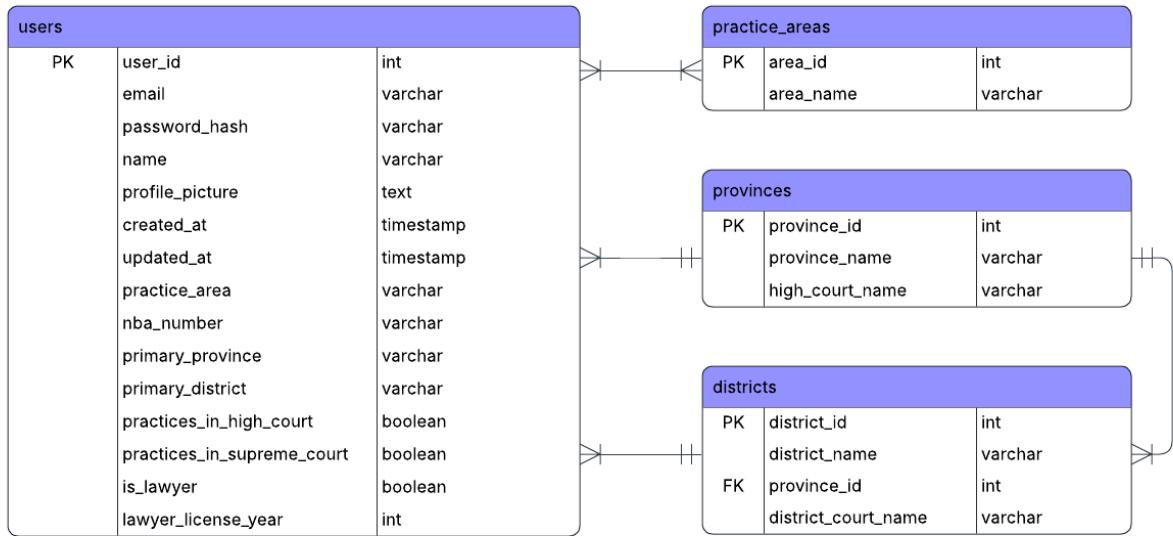


Figure 16: PM-ERD

3.5. Wireframe

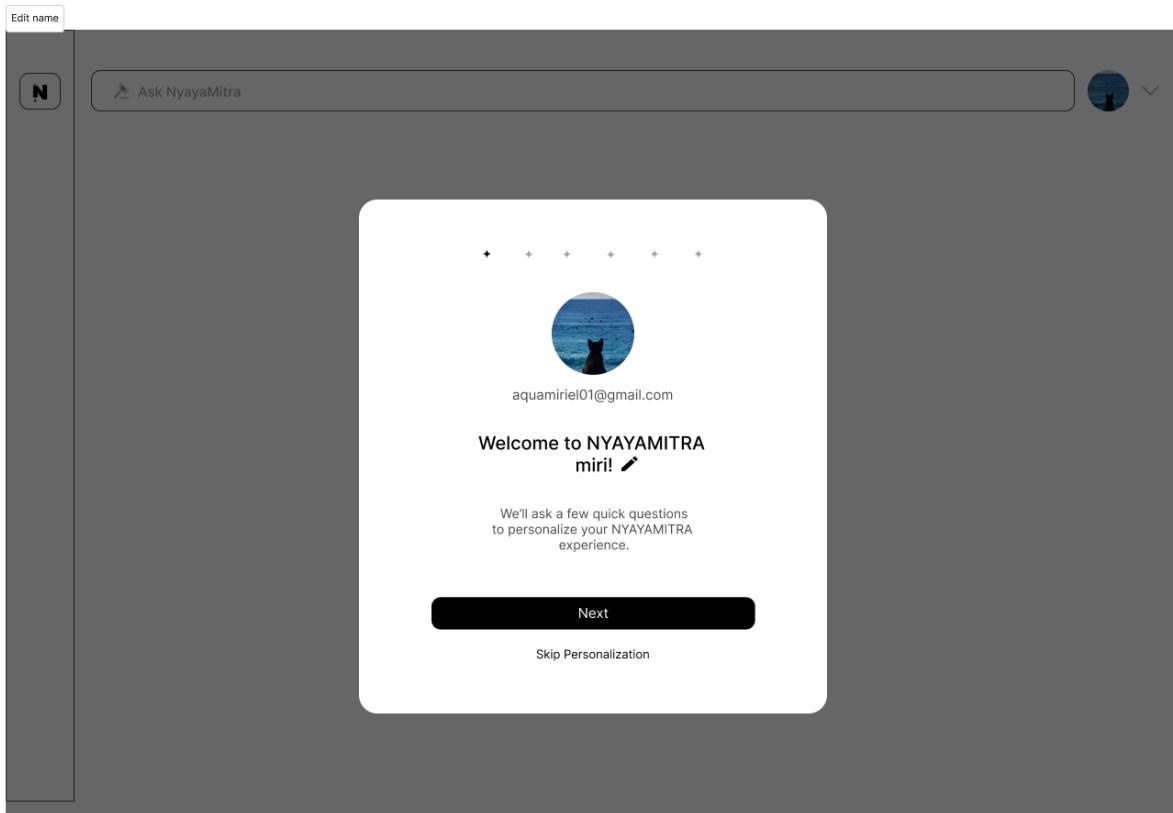


Figure 17: PM-EditNameWireframe

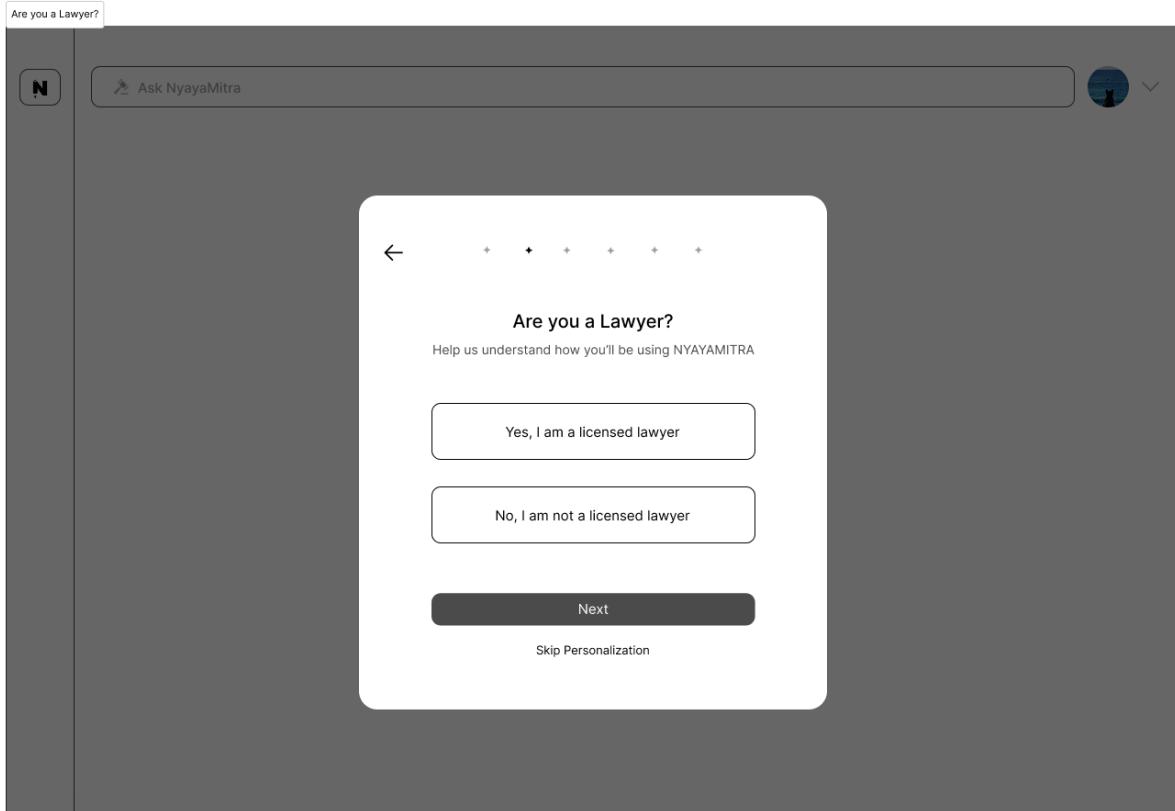


Figure 18: PM-AreYouALawyerWireframe

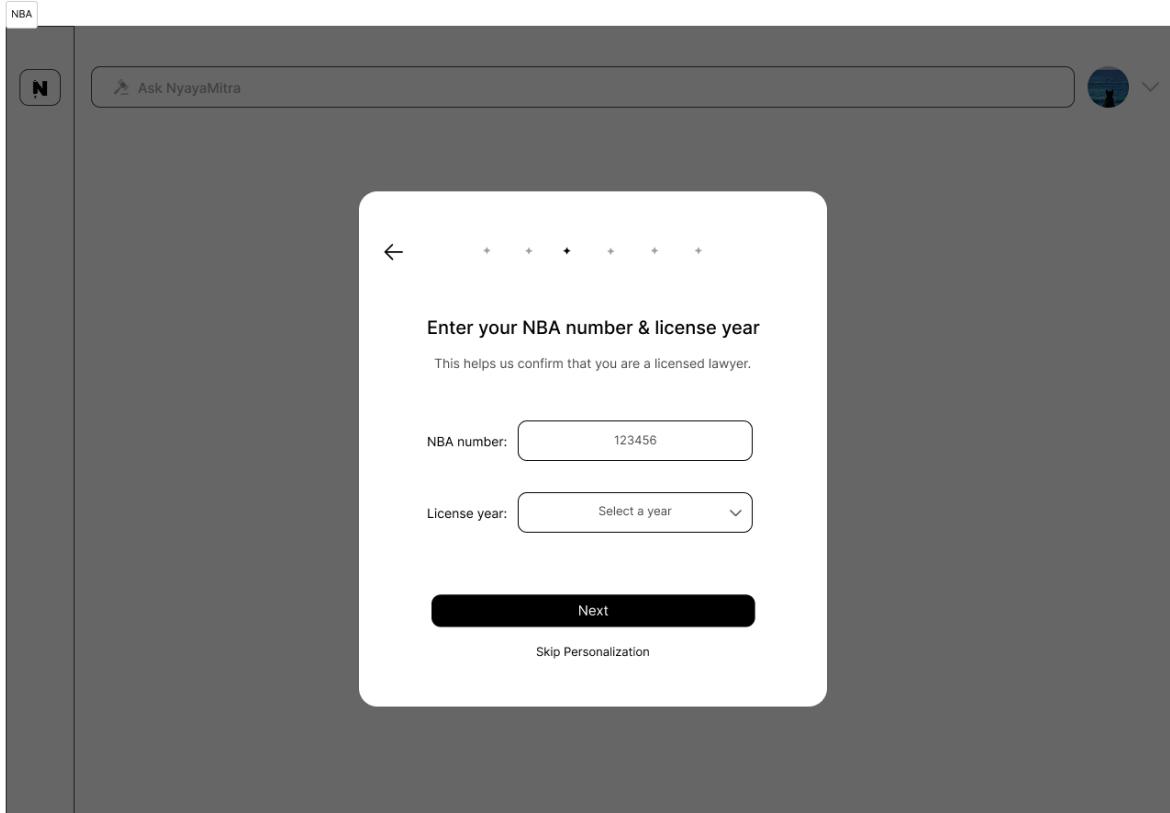


Figure 19: PM-NBA&License Year Wireframe

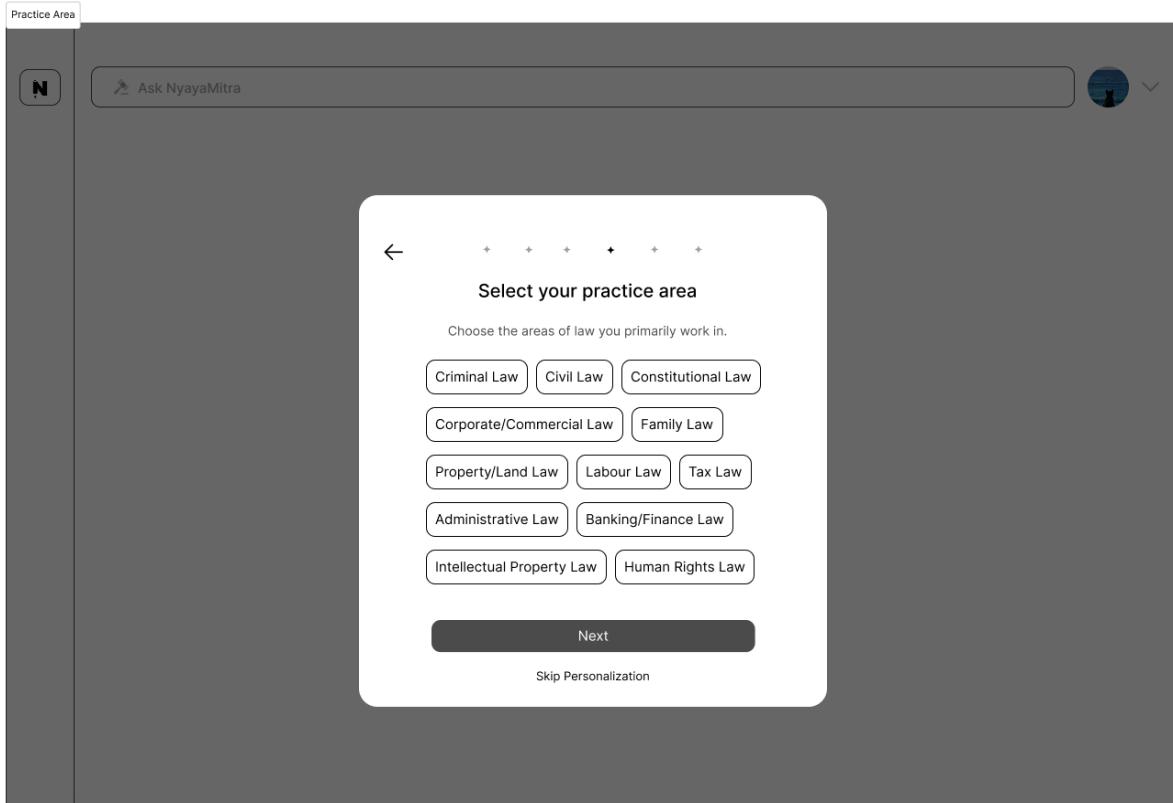


Figure 20: PM-PracticeAreaWireframe

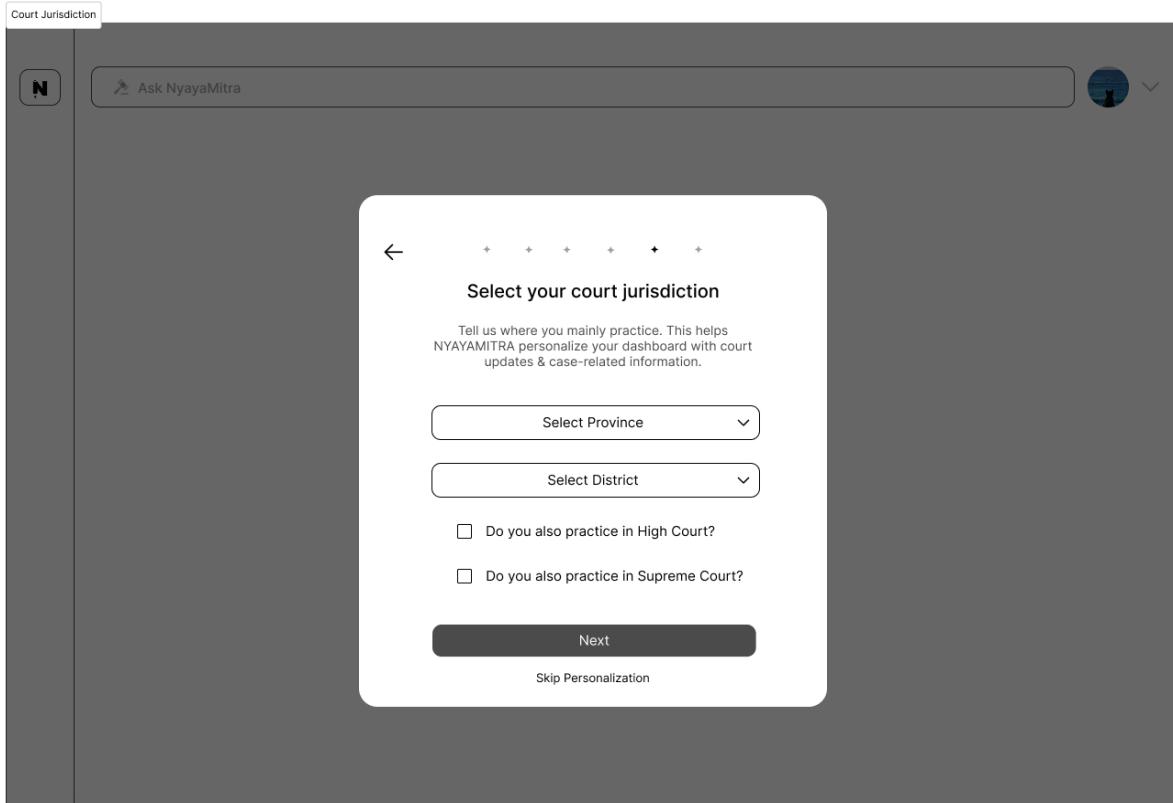


Figure 21: PM-CourtJurisdictionWireframe

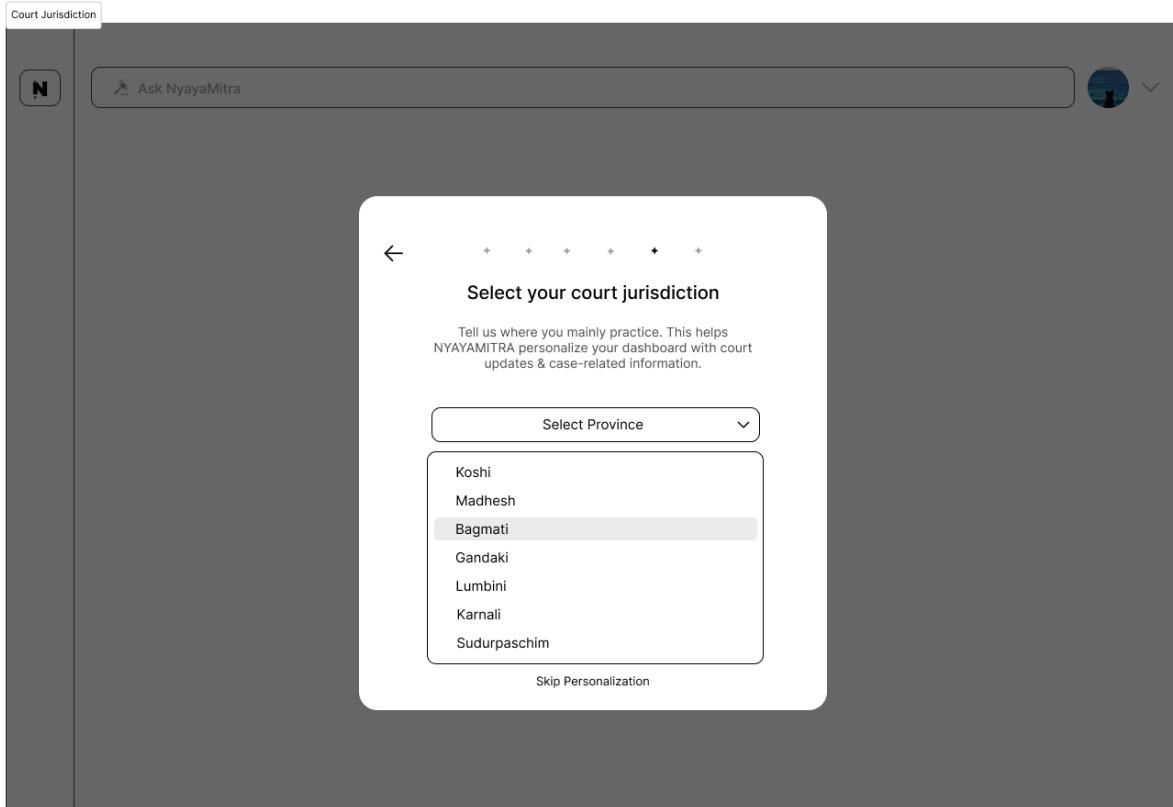


Figure 22: PM-SelectProvinceWireframe

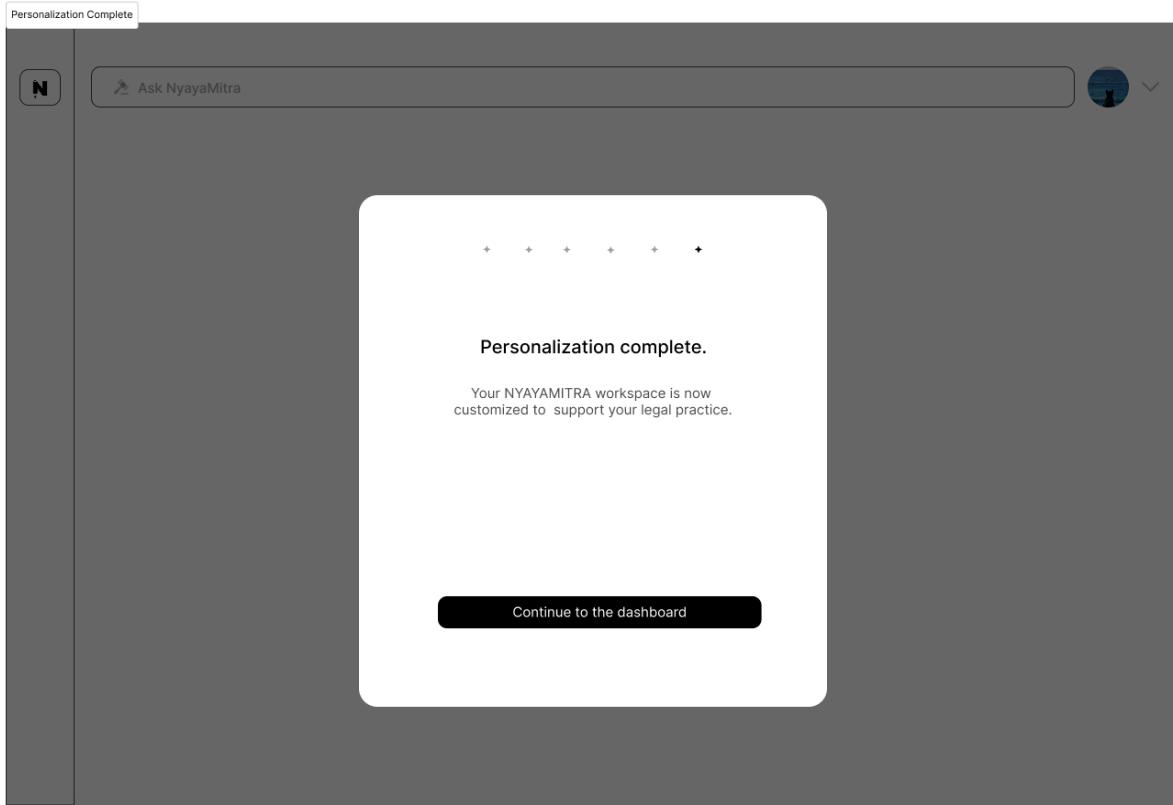


Figure 23: PM-PersonalizationCompleteWireframe

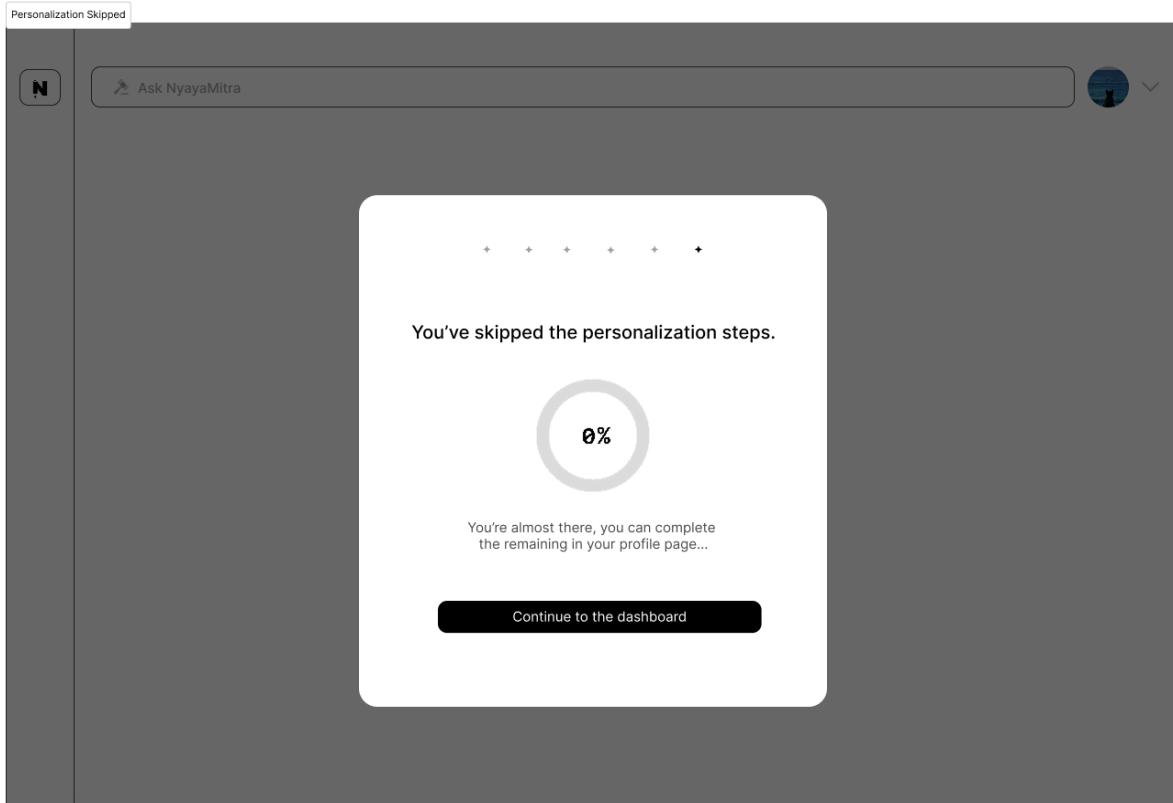


Figure 24: PM-SkippedPersonalizationWireframe

4. Retrieval & Embeddings Module

4.1. SRS Document

Functional Requirement

Table 10: RE--FunctionalRequirement

Requirement Code	Requirement Description
RE-F-1.0	The system must automatically parse uploaded PDF documents to extract textual content.
RE-F-1.1	The system must support parsing of multi-page PDF documents.
RE-F-1.2	The system must divide parsed document content into structured chunks (e.g., sections, articles, paragraphs).

RE-F-1.3	The system must generate semantic embeddings for each document chunk.
RE-F-1.4	The system must store generated embeddings in a vector database for retrieval.
RE-F-1.5	The system must associate each embedding with its corresponding document identifier.
RE-F-1.6	The system must support semantic similarity search across stored embeddings.
RE-F-1.7	The system must retrieve relevant document chunks based on user queries.
RE-F-1.8	The system must support batch retrieval across multiple documents.

Non-Functional Requirement

Table 11: RE--Non-FunctionalRequirement

Requirement Code	Requirement Description
RE-NF-1.0	Document parsing, chunking, and embedding generation must be executed in a secure server environment.
RE-NF-1.1	The system must ensure that embeddings are only retrievable by authorized users.
RE-NF-1.2	Embedding generation must complete within acceptable time limits for documents up to 10 MB in size.
RE-NF-1.3	The vector retrieval process must return relevant results within 5 seconds for standard queries.
RE-NF-1.4	The system must be scalable to handle concurrent embedding generation for multiple documents.
RE-NF-1.5	

	The system must log embedding and retrieval operations for monitoring and debugging purposes.
--	---

Usability Requirement

Table 12: RE--UsabilityRequirement

Requirement Code	Requirement Description
RE-UR-1.0	The system must process documents in the background without requiring manual user intervention.
RE-UR-1.1	Users must receive clear status indicators when documents are ready for semantic search.
RE-UR-1.2	Error messages related to parsing or embedding failures must be descriptive and user-friendly.
RE-UR-1.3	Retrieved document chunks must be presented in a readable and understandable format.
RE-UR-1.4	The system should highlight relevant portions of retrieved content when displaying results.

4.2. Use Case Diagram

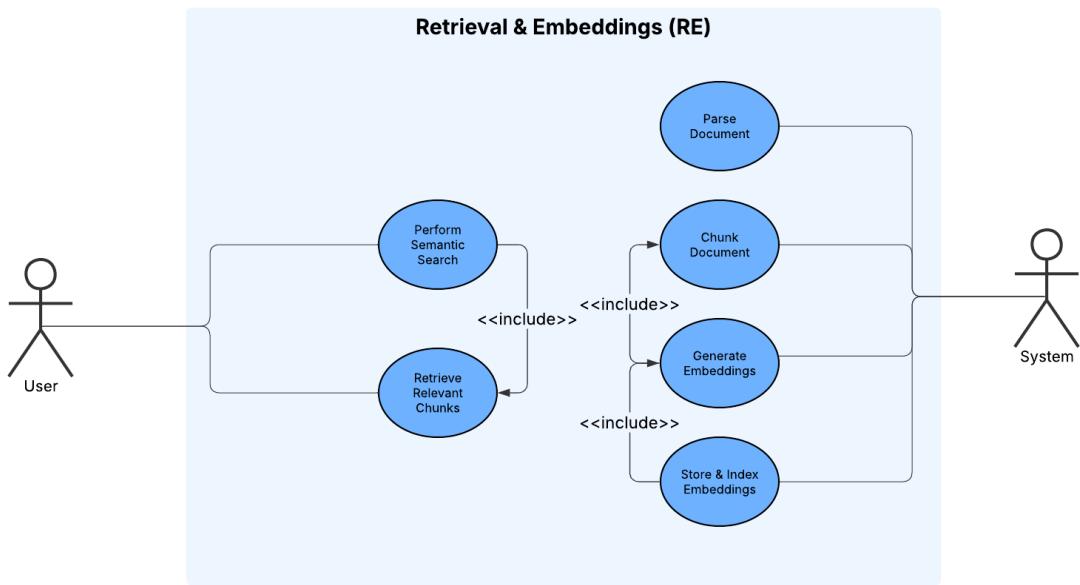


Figure 25: RE-UseCaseDiagram

4.3. Activity Diagram

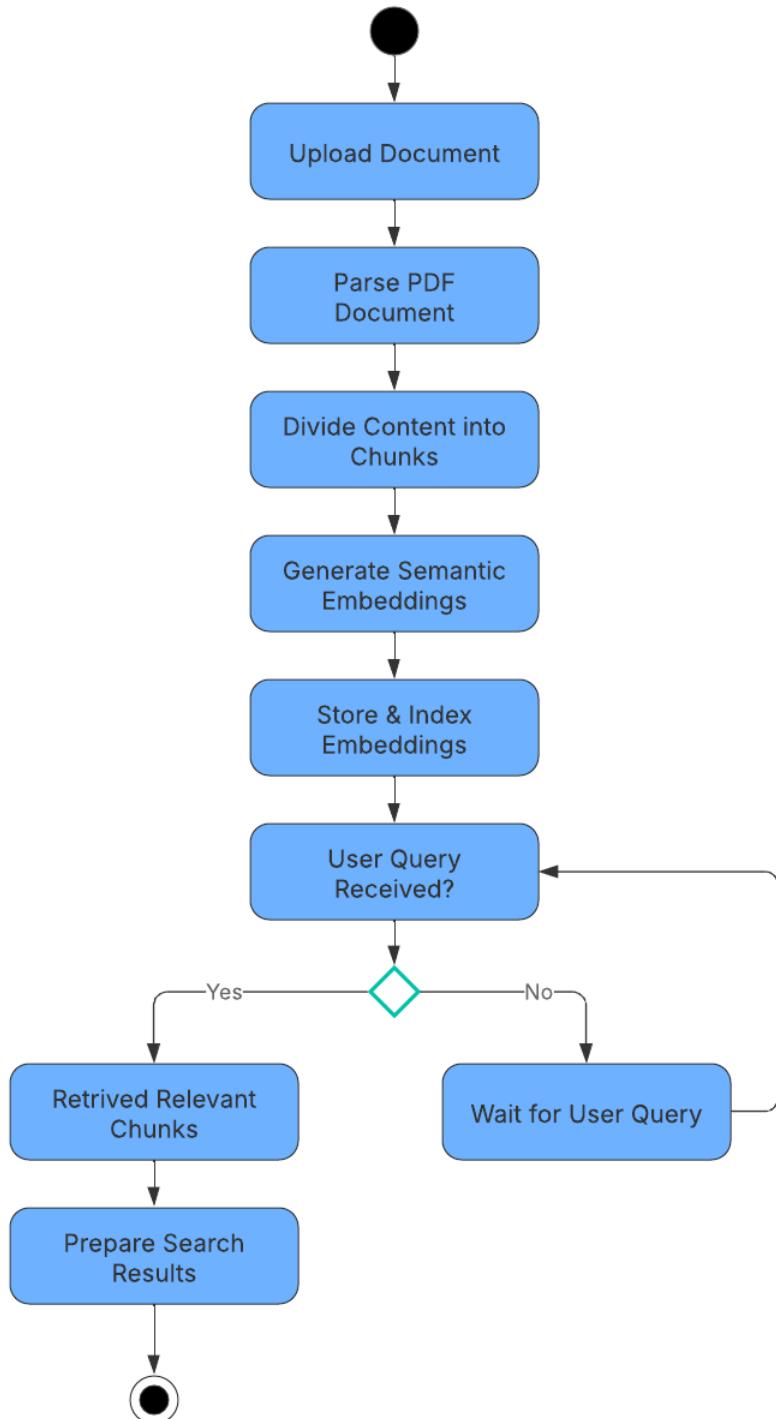


Figure 26: RE-ActivityDiagram

5. Language & Model Handling Module

5.1. SRS Document

Functional Requirement

Table 13: LM--FunctionalRequirement

Requirement Code	Requirement Description
LM-F-1.0	The system must automatically detect the language of uploaded document text.
LM-F-1.1	The system must support detection of English and Nepali languages.
LM-F-1.2	The system must classify documents as either English or Nepali before further processing.
LM-F-1.3	The system must route English documents to the LEGAL-BERT model for processing.
LM-F-1.4	The system must route Nepali documents to NyayaLM fine-tuned on Nepali legal datasets.
LM-F-1.5	The system must ensure that only the appropriate language-specific model processes each document.
LM-F-1.6	The system must allow seamless integration with downstream retrieval and response generation modules.

Non-Functional Requirement

Table 14: LM--Non-FunctionalRequirement

Requirement Code	Requirement Description
LM-NF-1.0	Language detection must complete within acceptable time limits without noticeable delay to the user.
LM-NF-1.1	

	Model routing must be accurate and reliable to prevent incorrect language-model assignment.
LM-NF-1.2	The subsystem must support concurrent processing of multiple documents.
LM-NF-1.3	The subsystem must operate securely and must not expose document content to unauthorized components.

Usability Requirement

Table 15: LM--UsabilityRequirement

Requirement Code	Requirement Description
LM-UR-1.0	The language detection and model routing process must be fully automatic and require no user interaction.
LM-UR-1.1	The system must provide clear logs or status indicators for successful language detection and routing.
LM-UR-1.2	Errors in language detection or model selection must be clearly reported for administrative review.

5.2. Use Case Diagram

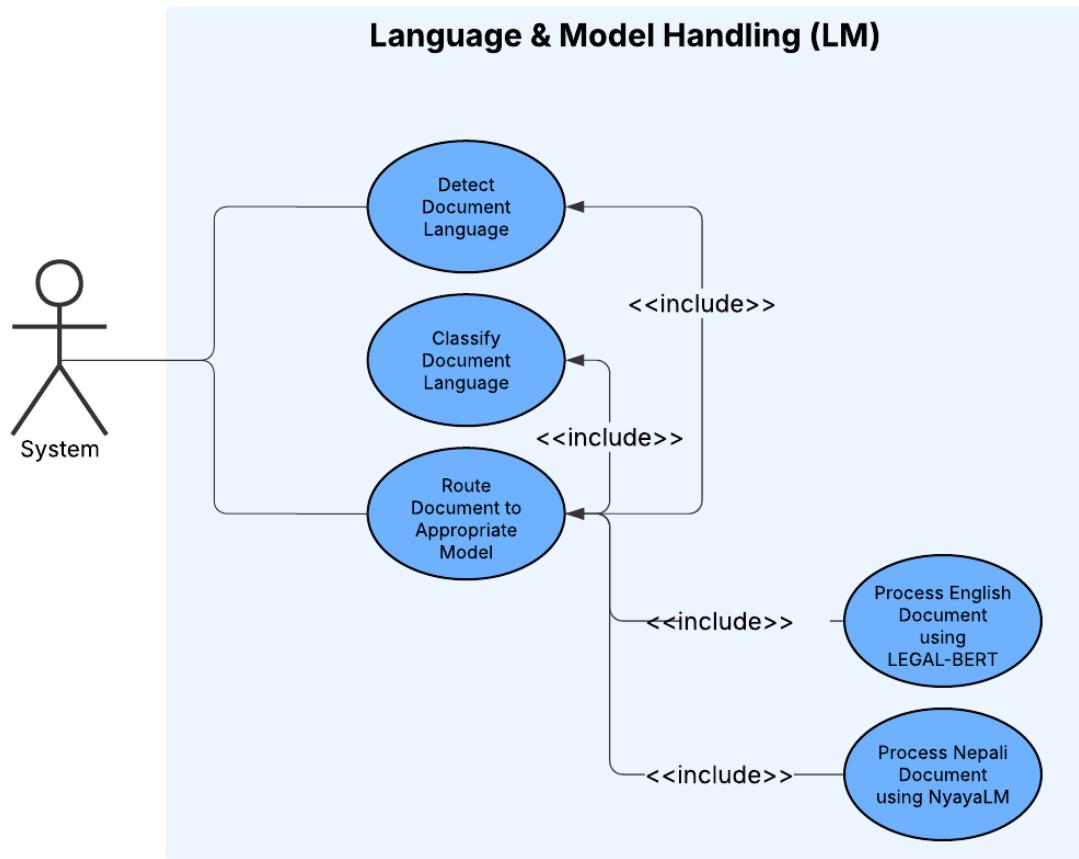


Figure 27: LM-UseCaseDiagram

5.3. Activity Diagram

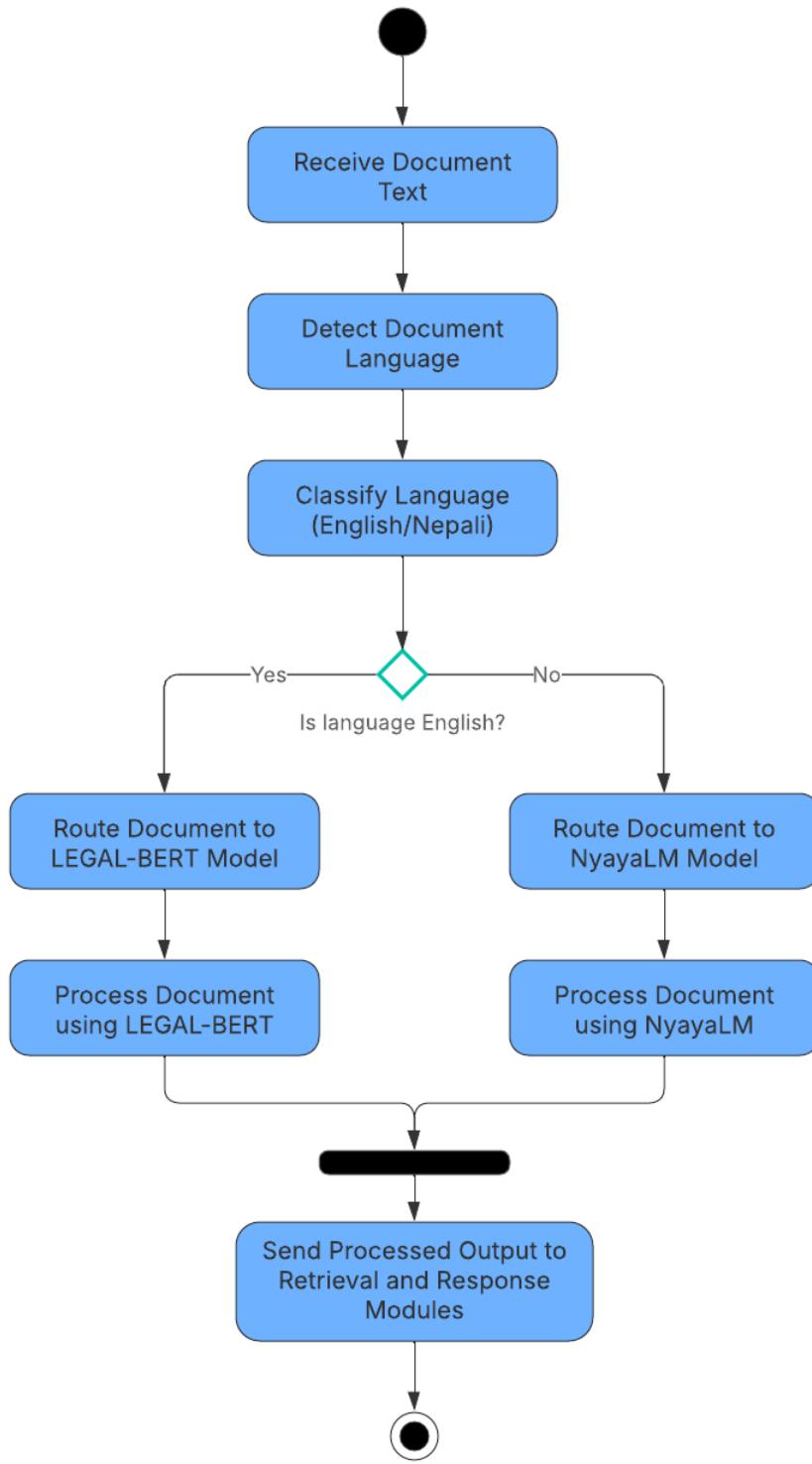


Figure 28: LM-ActivityDiagram

6. Legal NLP Processing Module

6.1. SRS Document

Functional Requirement

Table 16: NLP--FunctionalRequirement

Requirement Code	Requirement Description
NLP-F-1.0	The system must support legal question answering (Q&A) based on user queries.
NLP -F-1.1	The Q&A system must generate citation-first answers referencing source documents.
NLP -F-1.2	The system must extract and identify legal entities including case names, statutes, sections, and organizations.
NLP -F-1.3	The system must generate summaries at the document level.
NLP -F-1.4	The system must generate summaries at the content-chunk level.
NLP -F-1.5	The system must estimate semantic similarity between legal documents.
NLP -F-1.6	The system must support cross-referencing of related legal documents for comparative analysis.
NLP -F-1.7	The system must integrate retrieved document content from upstream retrieval modules.

Non-Functional Requirement

Table 17: NLP--Non-FunctionalRequirement

Requirement Code	Requirement Description
NLP -NF-1.0	The system must generate responses within acceptable time limits for interactive use.

NLP -NF-1.1	Citation accuracy must be maintained to ensure traceability to original legal sources.
NLP -NF-1.2	The subsystem must support concurrent processing of multiple documents.
NLP -NF-1.3	The system must ensure data confidentiality and must not expose document content to unauthorized components.

Usability Requirement

Table 18: NLP--UsabilityRequirement

Requirement Code	Requirement Description
NLP -UR-1.0	Generated answers must be presented in clear, structured, and readable format.
NLP -UR-1.1	Citations must be clearly visible and linked to their corresponding source documents.
NLP -UR-1.2	Summaries must be concise and understandable for non-technical users.
NLP -UR-1.3	The system must present similarity and cross-reference results in an interpretable manner.

6.2. Use Case Diagram

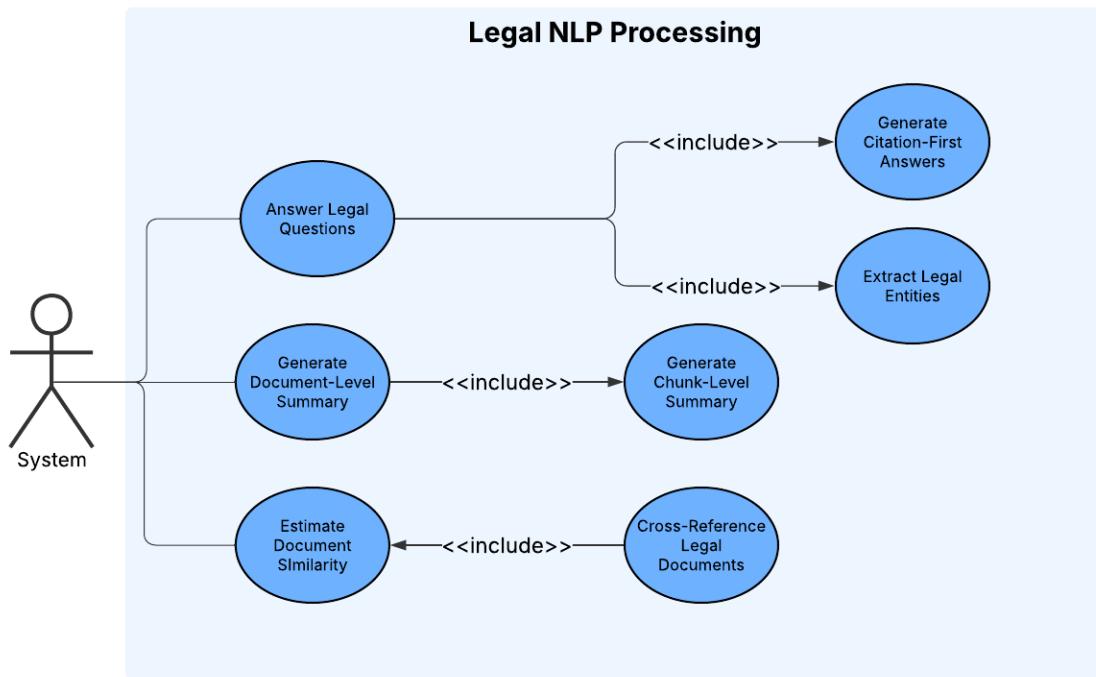


Figure 29: NLP-UseCaseDiagram

6.3. Activity Diagram

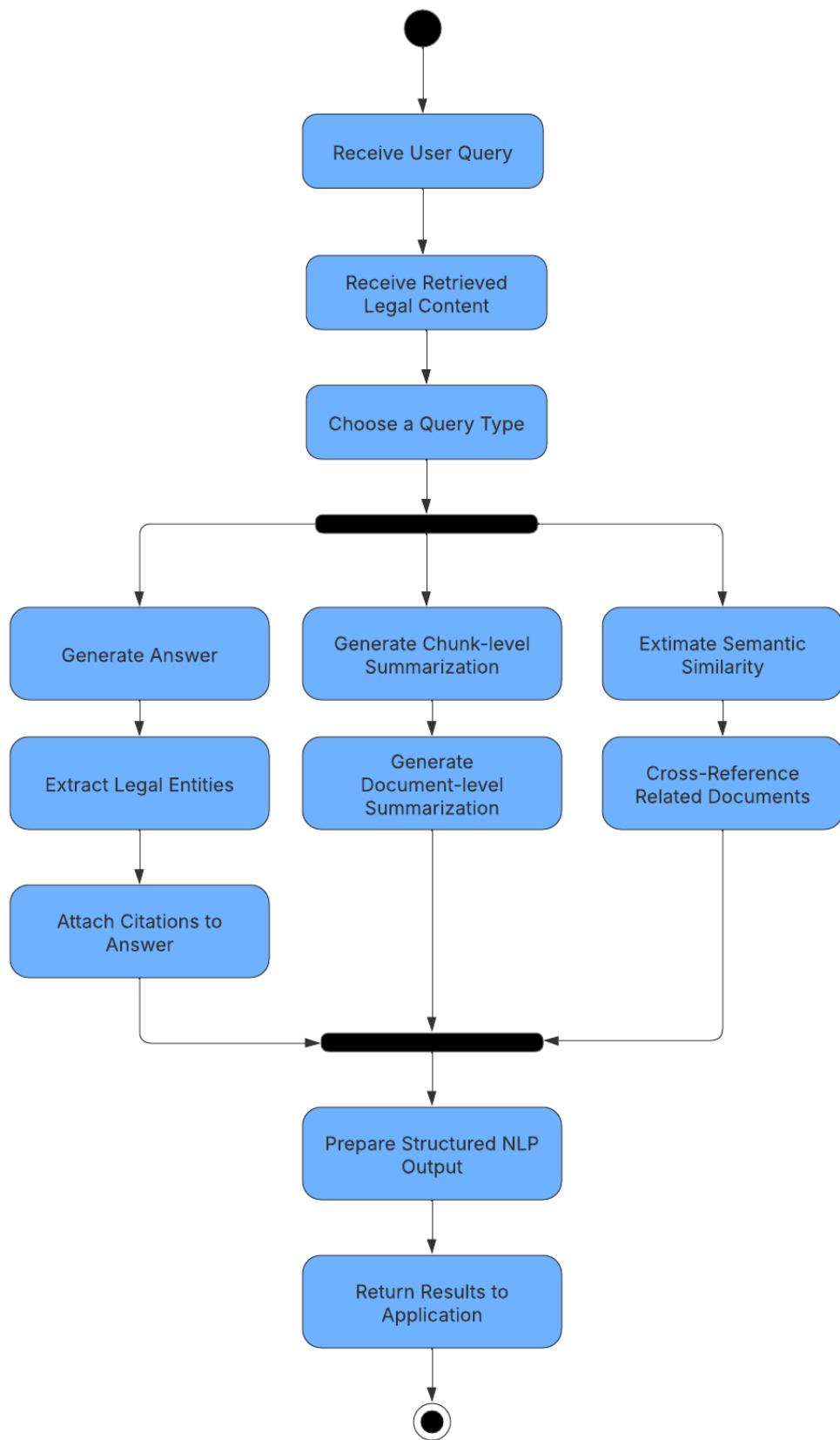


Figure 30: NLP-ActivityDiagram

7. Frontend & User Interface Module

7.1. SRS Document

Functional Requirement

Table 19: FUI--FunctionalRequirement

Requirement Code	Requirement Description
FUI-F-1.0	The system must provide a web-accessible user interface.
FUI -F-1.1	The web interface must allow users to upload PDF documents.
FUI -F-1.2	The system must provide a chat interface for interacting with the legal assistant.
FUI -F-1.3	The chat interface must allow users to submit legal questions in real time.
FUI -F-1.4	The system must display citation-first responses within the chat interface.
FUI -F-1.5	The interface must display uploaded document lists and their upload status.
FUI -F-1.6	The system must allow users to view responses generated by backend NLP modules.
FUI -F-1.7	The system must support interaction with multiple backend subsystems seamlessly.

Non-Functional Requirement

Table 20: FUI--Non-FunctionalRequirement

Requirement Code	Requirement Description
FUI -NF-1.0	

	The web interface must be accessible via standard web browsers.
FUI -NF-1.1	All data exchanged between the client and server must be transmitted over HTTPS/TLS.
FUI -NF-1.2	The user interface must respond to user actions within acceptable time limits.
FUI -NF-1.3	The interface must handle multiple simultaneous users without performance degradation.
FUI -NF-1.4	The frontend must prevent unauthorized access to protected system features.

Usability Requirement

Table 21: FUI--UsabilityRequirement

Requirement Code	Requirement Description
FUI -UR-1.0	The user interface must be intuitive and easy to navigate.
FUI -UR-1.1	The document upload interface must support drag-and-drop functionality.
FUI -UR-1.2	The chat interface must display responses in a clear and readable format.
FUI -UR-1.3	Citations in chat responses must be clearly visible and easy to understand.
FUI -UR-1.4	The interface must provide feedback messages for successful or failed actions.
FUI -UR-1.5	The interface must maintain consistent layout and styling across all pages.

7.2. Use Case Diagram

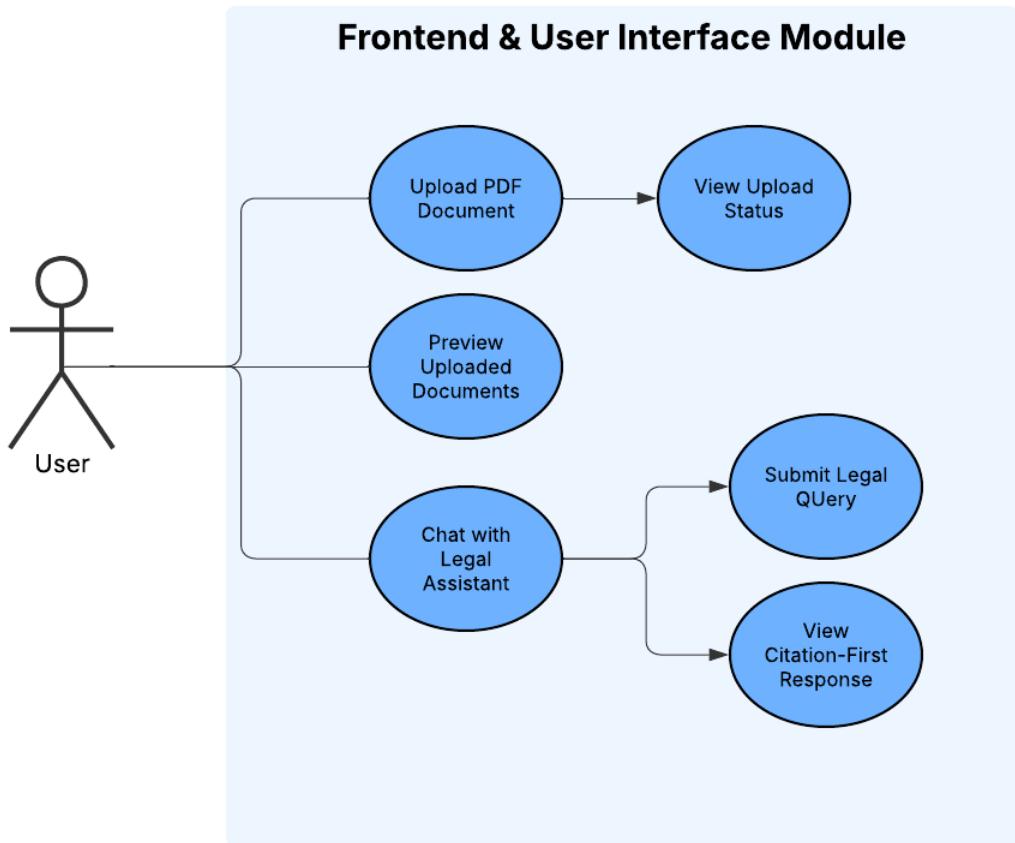


Figure 31: FUI-UseCaseDiagram

7.3. Activity Diagram

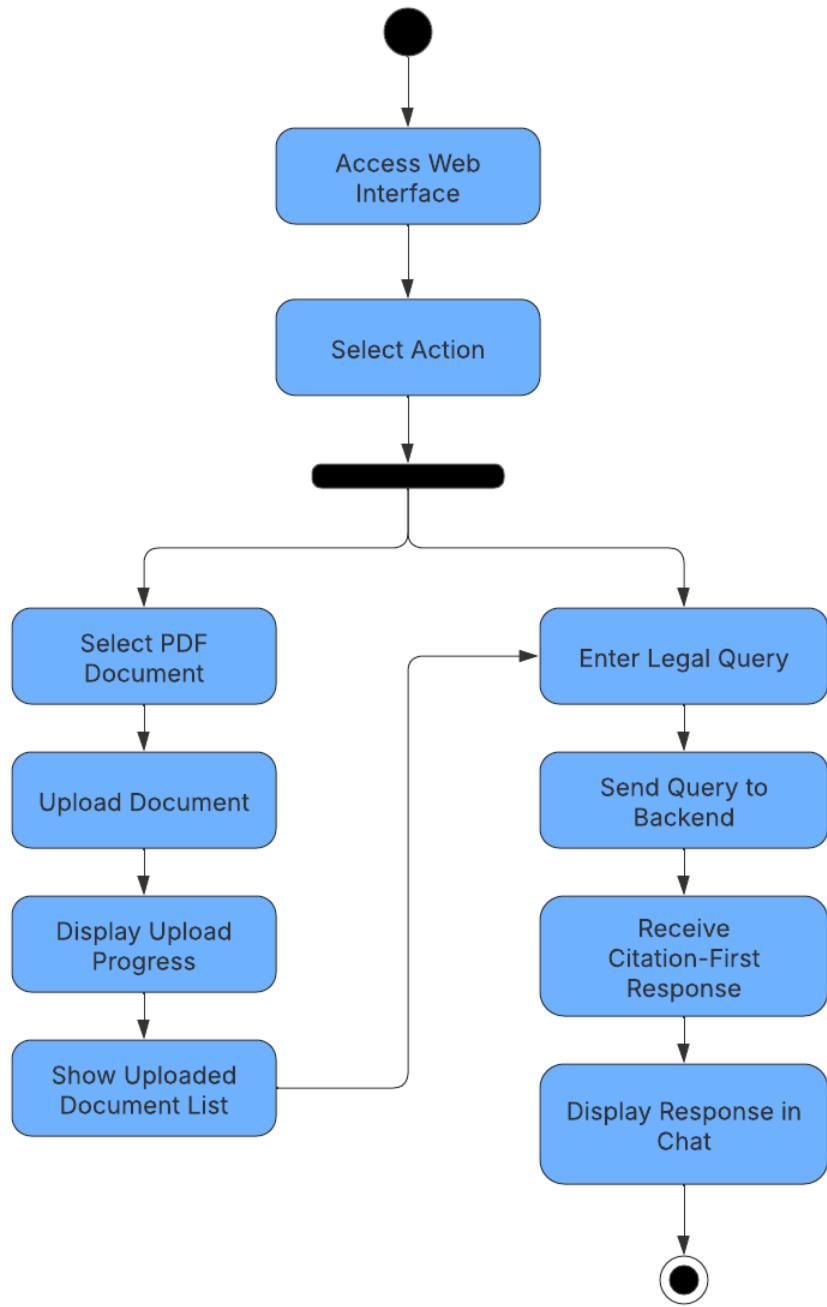


Figure 32: FUI-ActivityDiagram

8. Security & Deployment Module

8.1. SRS Document

Functional Requirement

Table 22: SD--FunctionalRequirement

Requirement Code	Requirement Description
SD-F-1.0	The system must ensure end-to-end encryption for all uploaded legal documents.
SD -F-1.1	The system must encrypt data during transmission using secure communication protocols.
SD -F-1.2	The system must encrypt stored documents to prevent unauthorized access.
SD -F-1.3	The system must implement access control mechanisms based on user authentication and authorization.
SD -F-1.4	The system must prevent unauthorized users from accessing protected documents and system features.
SD -F-1.5	The system must deploy the application as a cloud-based SaaS solution.
SD -F-1.6	The system must support secure access from multiple devices and locations.
SD -F-1.7	The system must integrate security controls across all subsystems.

Non-Functional Requirement

Table 23: SD--Non-FunctionalRequirement

Requirement Code	Requirement Description
SD -NF-1.0	

	All data transmission must use industry-standard encryption protocols (HTTPS/TLS).
SD -NF-1.1	Encryption mechanisms must not significantly degrade system performance.
SD -NF-1.2	The system must maintain high availability in a cloud environment.
SD -NF-1.3	The system must be scalable to handle increasing numbers of users and documents.
SD -NF-1.4	The system must comply with basic data security and privacy best practices.

Usability Requirement

Table 24: SD-UsabilityRequirement

Requirement Code	Requirement Description
SD -UR-1.0	Security features must operate transparently without requiring user intervention.
SD -UR-1.1	Access-denied messages must be clearly displayed when unauthorized actions are attempted.
SD -UR-1.2	Users must be able to access the system securely from different devices and browsers.

8.2. Use Case Diagram

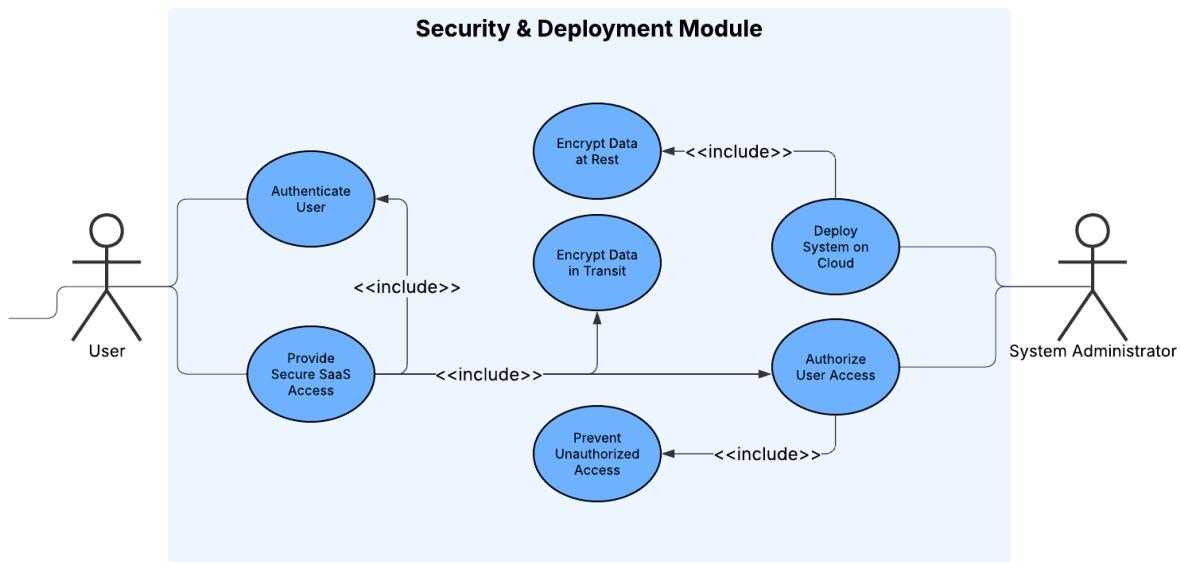


Figure 33: SD-UseCaseDiagram

8.3. Activity Diagram

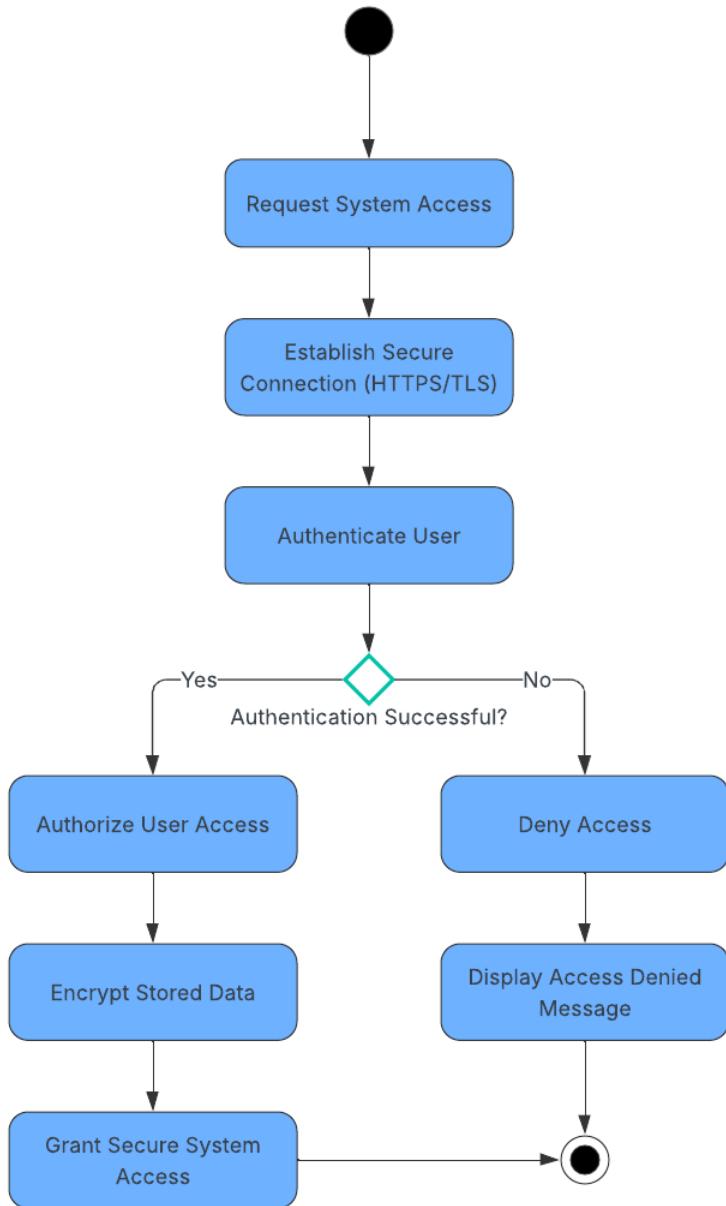


Figure 34: SD-ActivityDiagram

Test Plan

1. User Management Module

Module	Test Case ID	Requirement	Test Description	Expected Result
User Registration	TC-UR-01	UM-F-1.0	Register with valid email and strong password	Registration successful
	TC-UR-02	UM-F-1.1	Register with invalid email format	Error message displayed
	TC-UR-03	UM-F-1.2	Register with weak password	Password validation error
	TC-UR-04	UM-F-1.2	Register with strong password	Registration successful
	TC-UR-05	UM-NF-1.0	Verify HTTPS during registration	Data transmitted securely
	TC-UR-06	UM-NF-1.1	Verify password storage	Password stored as hash
	TC-UR-07	UM-NF-1.2	Inline validation feedback	Real-time validation shown
User Login	TC-UL-01	UM-F-1.3	Login with valid credentials	User logged in successfully
	TC-UL-02	UM-F-1.3	Login with incorrect password	Login error displayed
	TC-UL-03	UM-F-1.3	Login with unregistered email	Login denied
	TC-UL-04	UM-NF-1.3	Verify secure session cookies	Secure flags enabled
	TC-UL-05	UM-NF-1.2	Login page load time	Loads within 2–3 seconds
Profile Management	TC-PM-01	UM-F-1.4	View user profile	Profile details displayed
	TC-PM-02	UM-F-1.4	Update name	Name updated successfully
	TC-PM-03	UM-F-1.4	Upload profile picture	Image preview displayed
	TC-PM-04	UM-UR-1.3	Profile page usability	Easy navigation confirmed
	TC-PM-05	UM-UR-1.4	UI consistency	Consistent styling across pages
Logout	TC-LO-01	UM-F-1.5	Logout from system	Session terminated
	TC-LO-02	UM-NF-1.3	Access protected page after logout	Access denied

Figure 35: UM-TestPlan

2. Document Management Module

Module	Test Case ID	Requirement	Test Description	Expected Result
Document Upload	TC-DU-01	DM-F-1.0	Upload a single valid PDF	PDF uploaded successfully
	TC-DU-02	DM-F-1.1	Upload multiple PDFs simultaneously	All PDFs uploaded
	TC-DU-03	DM-UR-1.0	Drag-and-drop multiple PDFs	Files accepted correctly
	TC-DU-04	DM-UR-1.1	Monitor upload progress	Progress bar shown for each PDF
	TC-DU-05	DM-UR-1.2	Upload invalid file format	Clear error message displayed
	TC-DU-06	DM-NF-1.2	Upload 20 PDFs concurrently	No performance degradation
	TC-DU-07	DM-NF-1.0	Inspect network transmission	Upload occurs over HTTPS
Document Listing & Preview	TC-DP-01	DM-F-1.2	View list of uploaded documents	Document list displayed
	TC-DP-03	DM-NF-1.1	Attempt unauthorized access	Access denied
Batch Query	TC-BQ-01	DM-F-1.3	Run query across multiple documents	Results returned correctly
	TC-BQ-02	DM-NF-1.3	Measure query time (≤ 10 docs, 10 MB)	Completed within 5 seconds
	TC-BQ-03	DM-NF-1.1	Query documents of another user	Access denied
Cross-Document Comparison	TC-CD-01	DM-F-1.4	Search same term in multiple PDFs	Matches returned per document
	TC-CD-02	DM-NF-1.3	Perform comparison on multiple documents	Results within time limits
	TC-CD-03	DM-UR-1.2	Handle comparison errors	Clear error message shown
Document Deletion	TC-DD-01	DM-F-1.5	Delete uploaded document	Document removed successfully
	TC-DD-02	DM-F-1.5	Attempt to delete non-existent document	Error handled gracefully
	TC-DD-03	DM-NF-1.1	Unauthorized delete attempt	Access denied
Security & Access Control	TC-SC-01	DM-NF-1.1	Access document without login	Access denied
	TC-SC-03	DM-NF-1.1	Cross-user document access	Prevented

Figure 36: DM-TestPlan

3. Personalization Module

Module	Test Case ID	Requirement	Test Description	Expected Result
Onboarding Process	TC-PI-01	PM-F-1.0	Verify onboarding starts immediately after signup	Onboarding pop-up displayed
	TC-PI-02	PM-NF-1.0	Measure onboarding load time	Loads within acceptable time
	TC-PI-03	PM-UR-1.0	Verify pop-up sequence clarity	Clear step-by-step flow shown
Edit Name	TC-NC-01	PM-F-1.1	Enter valid name during onboarding	Name saved successfully
	TC-NC-02	PM-UR-1.1	Submit empty name	Validation error shown
	TC-NC-03	PM-NF-1.2	Verify name consistency	Stored profile matches input
Lawyer/Non-Lawyer Selection	TC-LS-01	PM-F-1.2	Display Yes/No lawyer question	Question shown correctly
	TC-LS-02	PM-F-1.3	Select "Yes (Lawyer)"	Lawyer-specific fields displayed
	TC-LS-03	PM-F-1.7	Select "No (Non-Lawyer)"	Lawyer fields skipped
Lawyer Details Module	TC-LD-01	PM-F-1.4	Enter valid NBA number	NBA number saved
	TC-LD-02	PM-F-1.5	Select practice area	Practice area saved
	TC-LD-03	PM-F-1.6	Select court jurisdiction	Jurisdiction saved
	TC-LD-04	PM-UR-1.1	Leave any field empty	Validation error displayed
	TC-LD-05	PM-NF-1.4	Verify access control	NBA number not publicly exposed
Skip Personalization	TC-SP-01	PM-F-1.9	Skip personalization at any step	User redirected to dashboard
	TC-SP-03	PM-UR-1.2	Skip confirmation clarity	Skip action clearly indicated
Completion & Redirection	TC-CR-01	PM-F-1.8	Submit valid onboarding data	Personalization marked complete
	TC-CR-02	PM-F-1.10	Verify post-onboarding navigation	Redirected to dashboard
	TC-CR-03	PM-UR-1.3	Completion confirmation	Success message shown
Profile Management	TC-PU-01	PM-F-1.11	Edit name after onboarding	Name updated
	TC-PU-02	PM-F-1.11	Edit lawyer details	Updated details saved
	TC-PU-03	PM-NF-1.2	Verify data consistency	Profile reflects latest data

Figure 37: PM-TestPlan

4. Retrieval & Embedding Module

Module	Test Case ID	Requirement	Test Description	Expected Result
PDF Parsing	TC-PM-01	RE-F-1.0	Upload a valid PDF document	Text successfully extracted
	TC-PM-02	RE-F-1.1	Upload a multi-page PDF	All pages parsed correctly
	TC-PM-03	RE-UR-1.2	Upload corrupted PDF	Clear error message shown
	TC-PM-04	RE-NF-1.0	Verify parsing environment	Parsing occurs securely on server
Chunking	TC-CH-01	RE-F-1.2	Divide text into chunks	Structured chunks created
	TC-CH-02	RE-F-1.2	Verify chunk boundaries	Logical sections preserved
	TC-CH-03	RE-UR-1.3	Display retrieved chunk	Content readable
Embedding Generation	TC-EM-01	RE-F-1.3	Generate embeddings for chunks	Embeddings created
	TC-EM-02	RE-NF-1.2	Measure embedding time (≤ 10 MB)	Completed within limits
	TC-EM-03	RE-NF-1.4	Concurrent embedding generation	No system degradation
	TC-EM-04	RE-NF-1.5	Verify operation logs	Logs created successfully
Vector Storage	TC-VS-01	RE-F-1.4	Store embeddings in ChromaDB	Embeddings stored successfully
	TC-VS-02	RE-F-1.5	Associate embedding with document ID	Correct mapping maintained
	TC-VS-03	RE-NF-1.1	Unauthorized access attempt	Access denied
Semantic Retrieval	TC-SR-01	RE-F-1.6	Perform similarity search	Relevant chunks returned
	TC-SR-02	RE-F-1.7	Query document content	Correct chunks retrieved
	TC-SR-03	RE-NF-1.3	Measure retrieval response time	Results within 5 seconds
	TC-SR-04	RE-UR-1.4	Display highlighted results	Relevant text highlighted
Batch Retrieval	TC-BR-01	RE-F-1.8	Query across multiple documents	Results aggregated correctly
	TC-BR-02	RE-NF-1.4	Concurrent batch queries	Stable performance
Background Processing & Status	TC-BG-01	RE-UR-1.0	Upload document and wait	Background processing starts
	TC-BG-02	RE-UR-1.1	Check document status	Status indicators shown
	TC-BG-03	RE-UR-1.2	Trigger processing error	User-friendly message displayed

Figure 38: RE-TestPlan

5. Language & Model Handling Module

Module	Test Case ID	Requirement	Test Description	Expected Result
Language Detection	TC-LD-01	LM-F-1.0	Upload English document	Language detected as English
	TC-LD-02	LM-F-1.1	Upload Nepali document	Language detected as Nepali
	TC-LD-03	LM-F-1.2	Upload mixed-language content	Correct dominant language classified
	TC-LD-04	LM-NF-1.0	Measure detection time	Completed without noticeable delay
	TC-LD-05	LM-UR-1.2	Trigger detection failure	Error logged and reported
Document Classification	TC-DC-01	LM-F-1.2	Classify English document	Marked as English
	TC-DC-02	LM-F-1.2	Classify Nepali document	Marked as Nepali
	TC-DC-03	LM-NF-1.1	Validate classification accuracy	No incorrect assignments
Model Routing	TC-MR-01	LM-F-1.3	Route English document	Sent to LEGAL-BERT
	TC-MR-02	LM-F-1.4	Route Nepali document	Sent to NyayALM
	TC-MR-03	LM-F-1.5	Verify routing control	Only correct model processes document
	TC-MR-04	LM-NF-1.1	Stress test routing accuracy	No cross-model routing errors
Concurrency & Performance	TC-CP-01	LM-NF-1.2	Process multiple documents simultaneously	No performance degradation
	TC-CP-02	LM-NF-1.0	Measure latency under load	Response within acceptable limits
Security & Access Control	TC-SC-01	LM-NF-1.3	Attempt unauthorized document access	Access denied
	TC-SC-02	LM-NF-1.3	Verify data exposure prevention	No document leakage
Integration & Logging Module	TC-IN-01	LM-F-1.6	Forward processed output downstream	Successful integration
	TC-IN-02	LM-UR-1.1	Verify routing logs	Clear logs generated
	TC-IN-03	LM-UR-1.2	Trigger routing failure	Error clearly logged for admin

Figure 39: LM-TestPlan

6. Legal NLP Processing Module

Module	Test Case ID	Requirement	Test Description	Expected Result
Legal Question Answering	TC-QA-01	NLP-F-1.0	Submit legal question	Answer generated successfully
	TC-QA-02	NLP-F-1.7	Provide retrieved document chunks	Q&A uses correct content
	TC-QA-03	NLP-NF-1.0	Measure response time	Response within acceptable limits
	TC-QA-04	NLP-NF-1.3	Unauthorized query attempt	Access denied
Citation-First Answer	TC-CF-01	NLP-F-1.1	Generate answer with citations	Citations shown before explanation
	TC-CF-02	NLP-NF-1.1	Verify citation accuracy	Citations trace to source documents
	TC-CF-03	NLP-UR-1.1	Display citations in output	Clearly visible and linked
Legal Entity Extraction	TC-EE-01	NLP-F-1.2	Extract case names	Case names identified correctly
	TC-EE-02	NLP-F-1.2	Extract statutes and sections	Legal references extracted
	TC-EE-03	NLP-F-1.2	Extract organizations	Entities detected accurately
Document-Level Summarization	TC-DS-01	NLP-F-1.3	Generate document summary	Coherent summary produced
	TC-DS-02	NLP-UR-1.2	Review summary readability	Clear for non-technical users
Chunk-Level Summarization	TC-DS-03	NLP-NF-1.0	Measure summarization time	Completed within limits
	TC-CS-01	NLP-F-1.4	Summarize content chunks	Chunk summaries generated
	TC-CS-02	NLP-UR-1.2	Verify clarity of summaries	Easy to understand
Semantic Similarity	TC-SS-01	NLP-F-1.5	Compare two legal documents	Similarity score generated
	TC-SS-02	NLP-UR-1.3	Display similarity results	Interpretable format shown
Cross-Referencing	TC-SS-03	NLP-NF-1.2	Concurrent similarity checks	Stable performance
	TC-CR-01	NLP-F-1.6	Identify related documents	Cross-references generated
	TC-CR-02	NLP-UR-1.3	Display cross-references	Clearly presented to user
Integration & Security	TC-IN-01	NLP-F-1.7	Receive content from retrieval module	Data integrated correctly
	TC-IN-02	NLP-NF-1.3	Inspect data exposure	No unauthorized access
	TC-IN-03	NLP-NF-1.2	Process multiple requests concurrently	No performance degradation

Figure 40: NLP-TestPlan

7. Frontend & User Interface Module

Module	Test Case ID	Requirement	Test Description	Expected Result
Web Interface Accessibility	TC-WA-01	FUI-F-1.0	Access system via supported browser	Interface loads successfully
	TC-WA-02	FUI-NF-1.0	Open system in different browsers	Works consistently
	TC-WA-03	FUI-NF-1.2	Measure page load and UI response	Responds within acceptable time
	TC-WA-04	FUI-NF-1.4	Attempt access without authentication	Access denied
Document Upload Interface	TC-DU-UI-01	FUI-F-1.1	Upload PDF via file selector	File upload initiated
	TC-DU-UI-02	FUI-UR-1.1	Upload PDF using drag-and-drop	File accepted correctly
	TC-DU-UI-03	FUI-F-1.5	View uploaded document list	List and status displayed
	TC-DU-UI-04	FUI-UR-1.4	Upload failure scenario	Clear feedback message shown
	TC-DU-UI-05	FUI-NF-1.1	Inspect network traffic	Data transmitted over HTTPS
Chat Interface	TC-CH-01	FUI-F-1.2	Open chat interface	Chat UI loads correctly
	TC-CH-02	FUI-F-1.3	Submit legal query	Query sent in real time
	TC-CH-03	FUI-F-1.4	Receive citation-first answer	Citations shown clearly
	TC-CH-04	FUI-UR-1.2	Verify response readability	Text clearly formatted
	TC-CH-05	FUI-UR-1.3	Check citation visibility	Citations easy to understand
Backend Integration	TC-BI-01	FUI-F-1.6	Display NLP-generated responses	Responses rendered correctly
	TC-BI-02	FUI-F-1.7	Interact with multiple subsystems	Seamless data flow
	TC-BI-03	FUI-UR-1.4	Backend failure scenario	User-friendly error message
Performance & Concurrency	TC-PC-01	FUI-NF-1.2	UI response under normal load	No noticeable delay
	TC-PC-02	FUI-NF-1.3	Multiple users access simultaneously	Stable UI performance
Security & Access Control	TC-SC-01	FUI-NF-1.1	Inspect client-server communication	Encrypted via HTTPS
	TC-SC-02	FUI-NF-1.4	Access protected feature unauthenticated	Access blocked
	TC-SC-03	FUI-NF-1.4	Session expiration scenario	User redirected to login
UI Consistency & Feedback	TC-UI-01	FUI-UR-1.0	Navigate across pages	Intuitive navigation
	TC-UI-02	FUI-UR-1.5	Verify layout consistency	Uniform styling
	TC-UI-03	FUI-UR-1.4	Successful action feedback	Confirmation shown

Figure 41: TestPlan

8. Security & Deployment Module

Module	Test Case ID	Requirement	Test Description	Expected Result
Data Transmission Security	TC-DTS-01	SD-F-1.0	Upload legal document	Data encrypted end-to-end
	TC-DTS-02	SD-F-1.1	Inspect network traffic	HTTPS/TLS enforced
	TC-DTS-03	SD-NF-1.0	Attempt insecure connection	Connection rejected
Data Storage Encryption	TC-DSE-01	SD-F-1.2	Store uploaded document	Encrypted at rest
	TC-DSE-02	SD-F-1.2	Access storage directly	Data unreadable
	TC-DSE-03	SD-NF-1.1	Measure performance overhead	No significant degradation
Authentication & Access Control	TC-AAC-01	SD-F-1.3	Access protected feature after login	Access granted
	TC-AAC-02	SD-F-1.4	Access protected feature without login	Access denied
	TC-AAC-03	SD-UR-1.1	Unauthorized access attempt	Clear access-denied message
Unauthorized Access Prevention	TC-UAP-01	SD-F-1.4	Attempt cross-user document access	Blocked
	TC-UAP-02	SD-F-1.7	Verify subsystem-wide security	Controls enforced globally
	TC-CD-01	SD-F-1.5	Deploy system on cloud	Successful deployment
Cloud Deployment	TC-CD-02	SD-NF-1.2	Simulate server failure	High availability maintained
	TC-CD-03	SD-NF-1.3	Increase user load	System scales correctly
	TC-MD-01	SD-F-1.6	Access system from multiple devices	Secure access allowed
Multi-Device Secure Access	TC-MD-02	SD-UR-1.2	Access system via different browsers	Works securely
	TC-MD-03	SD-NF-1.4	Verify privacy best practices	Compliance maintained
	TC-ST-01	SD-UR-1.0	Perform secure operations	No user intervention required
Security Transparency & Usability	TC-ST-02	SD-UR-1.1	Trigger security violation	Clear message shown

Figure 42: SD-TestPlan