**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

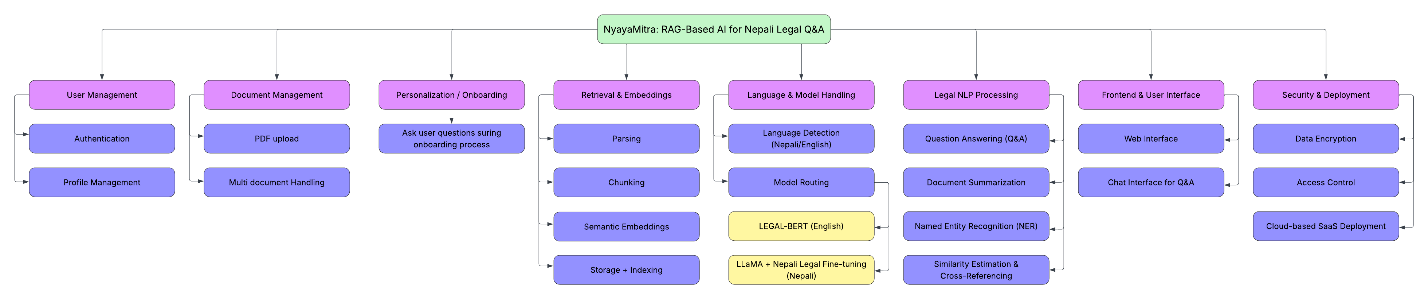


Figure 1: FDD-Functional Decomposition Diagram

## Subsystems

### User Management Module

#### 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. |

#### Use Case Diagram

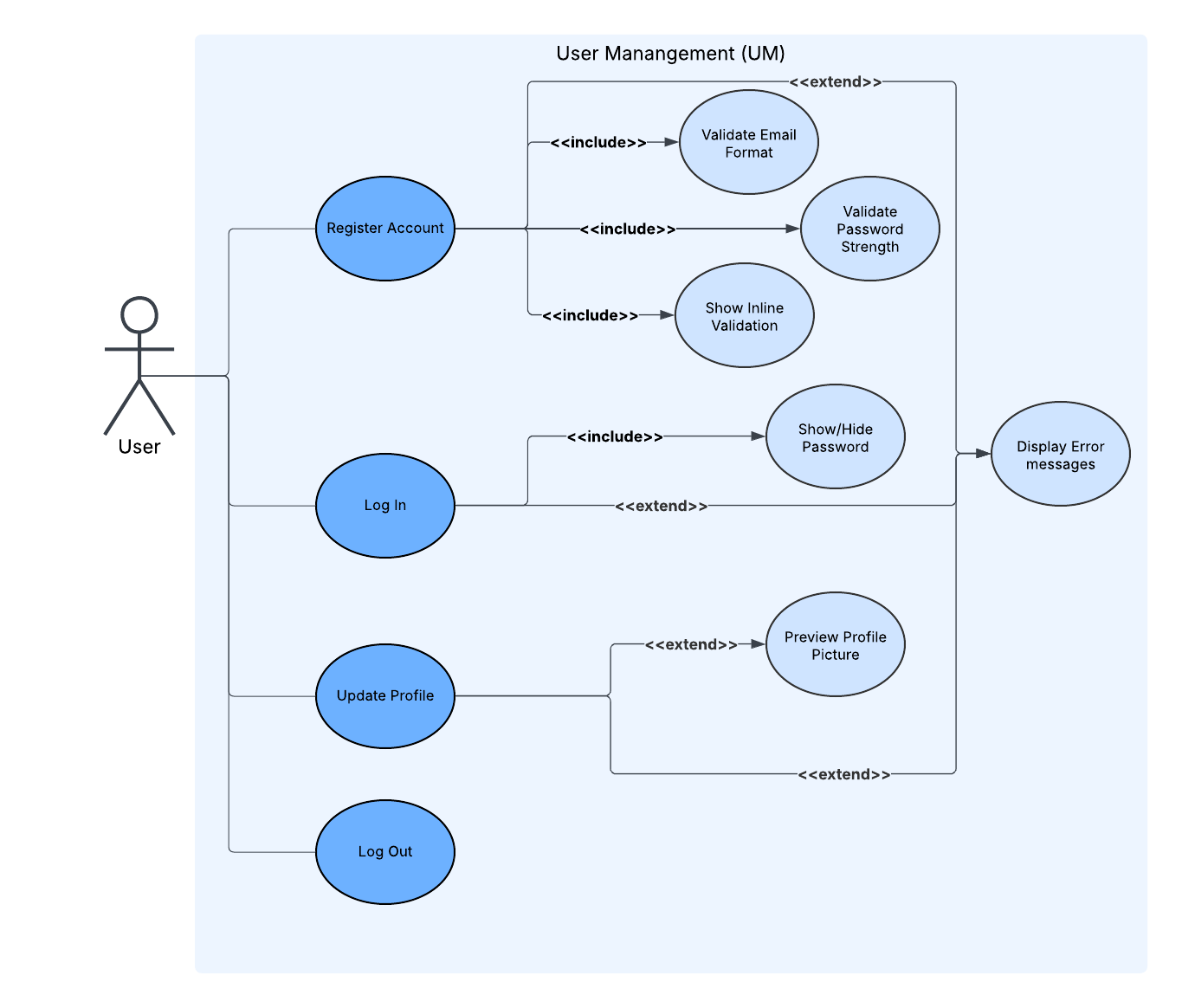


Figure 2: UM-UseCaseDiagram

#### Activity Diagram

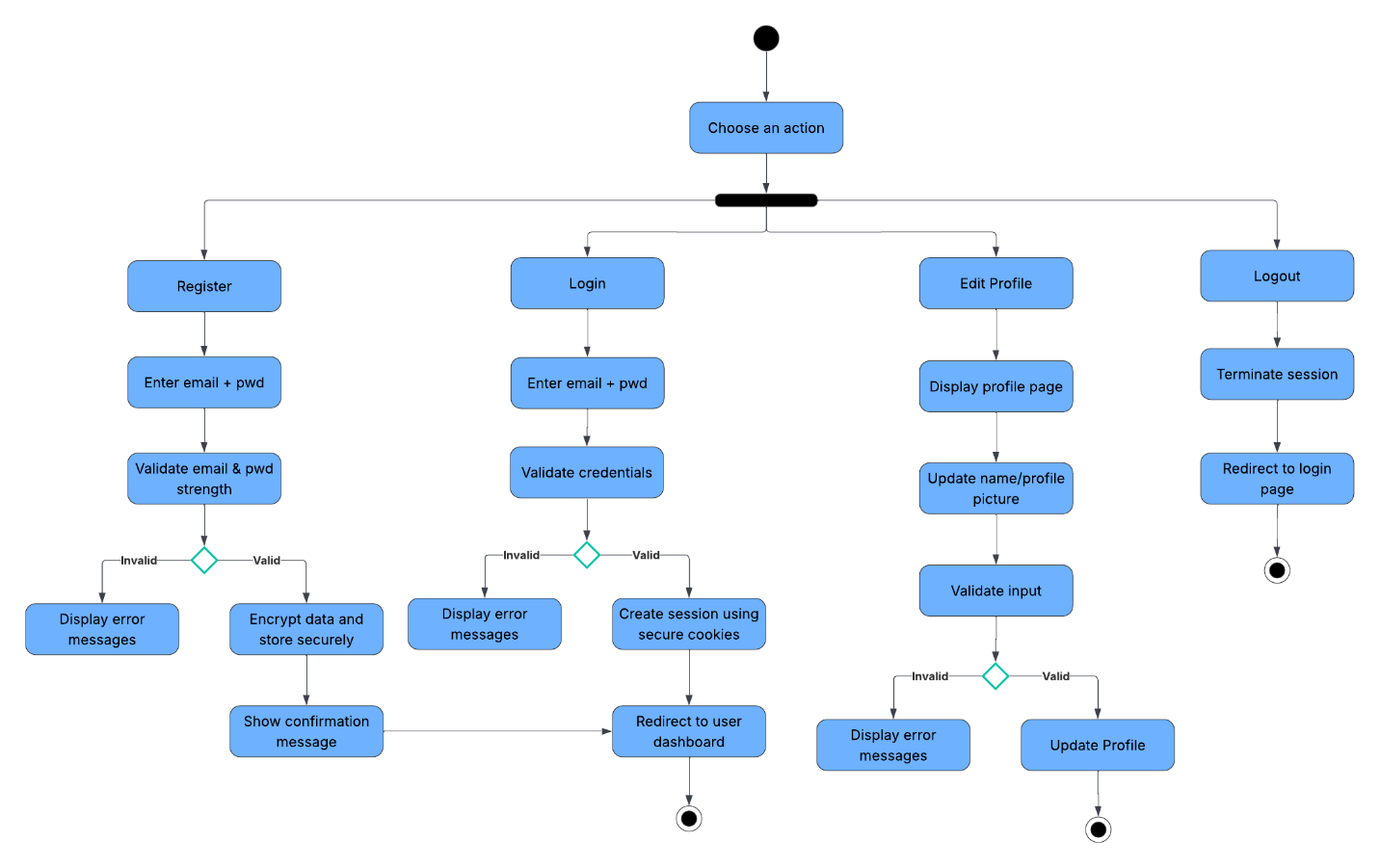


Figure 3: UM-ActivityDiagram

#### ERD

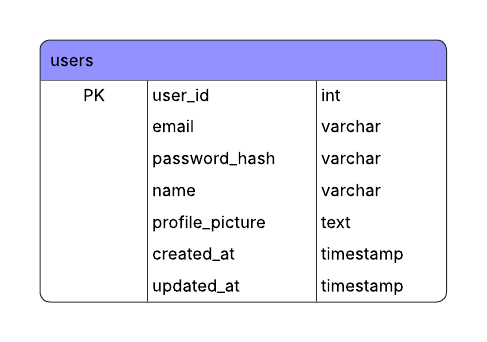


Figure 4: UM-ERD

#### Wireframe



Figure 5: UM-LandingPageWireframe

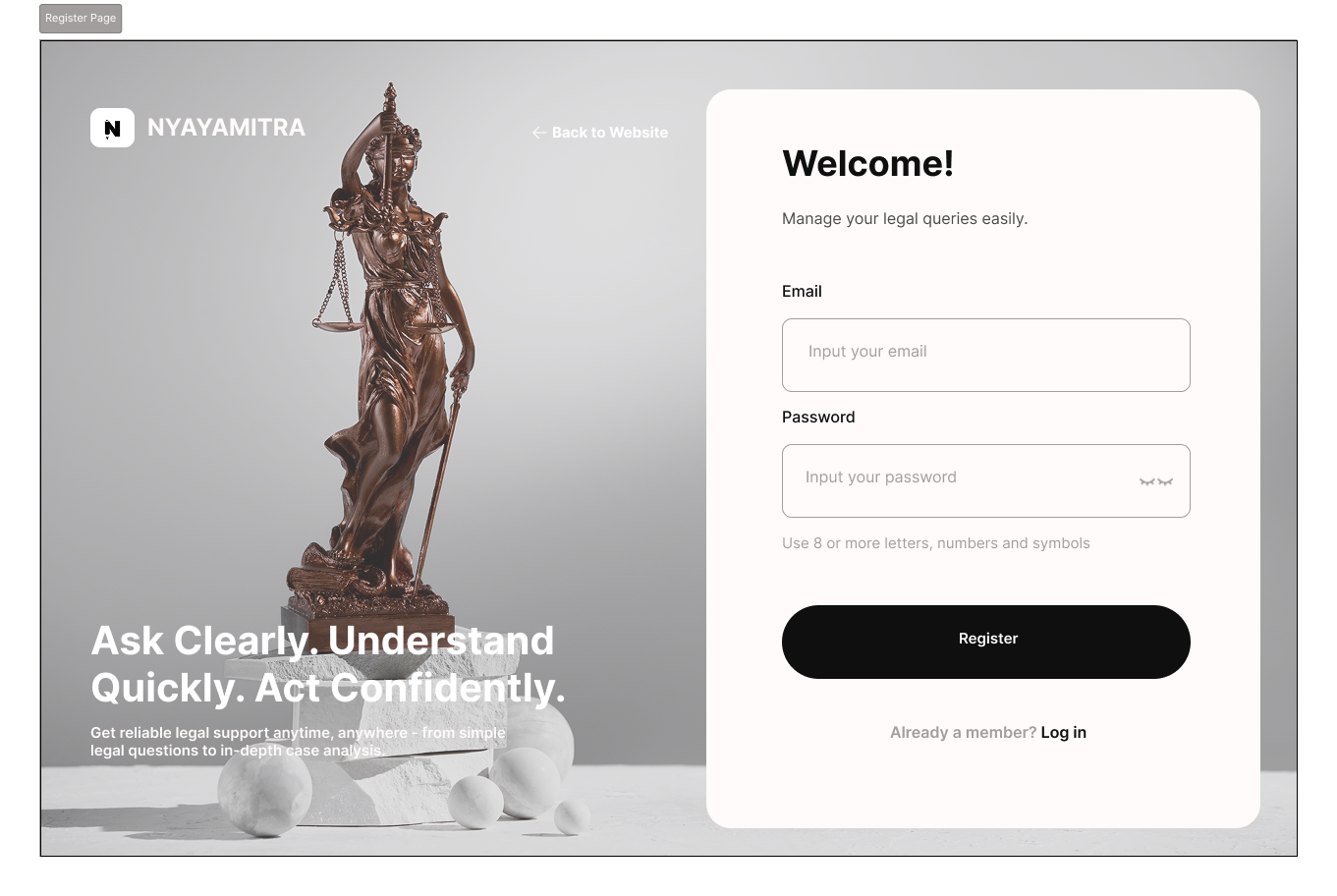


Figure 6: UM-RegisterWireframe

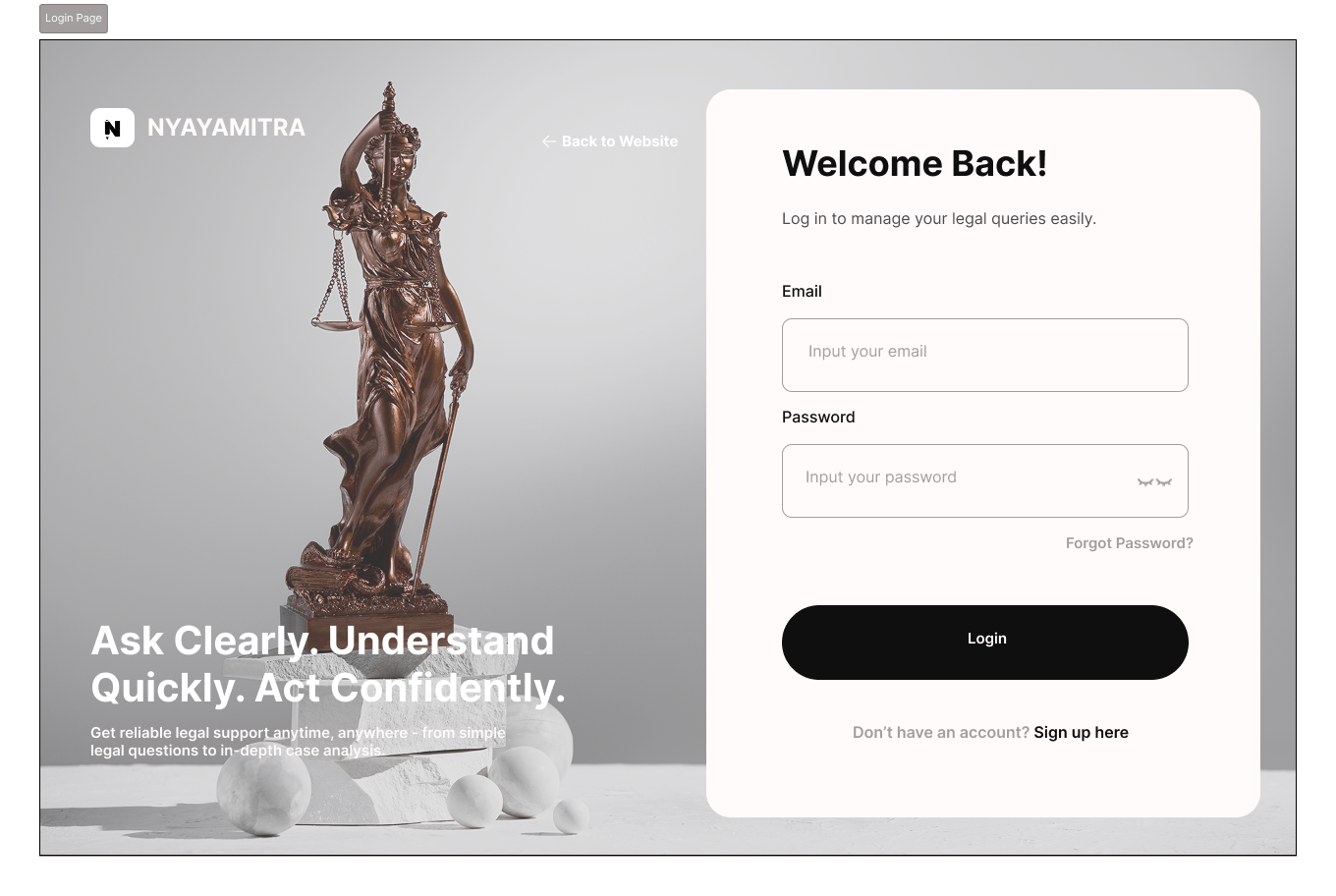


Figure 7: UM-LoginWireframe

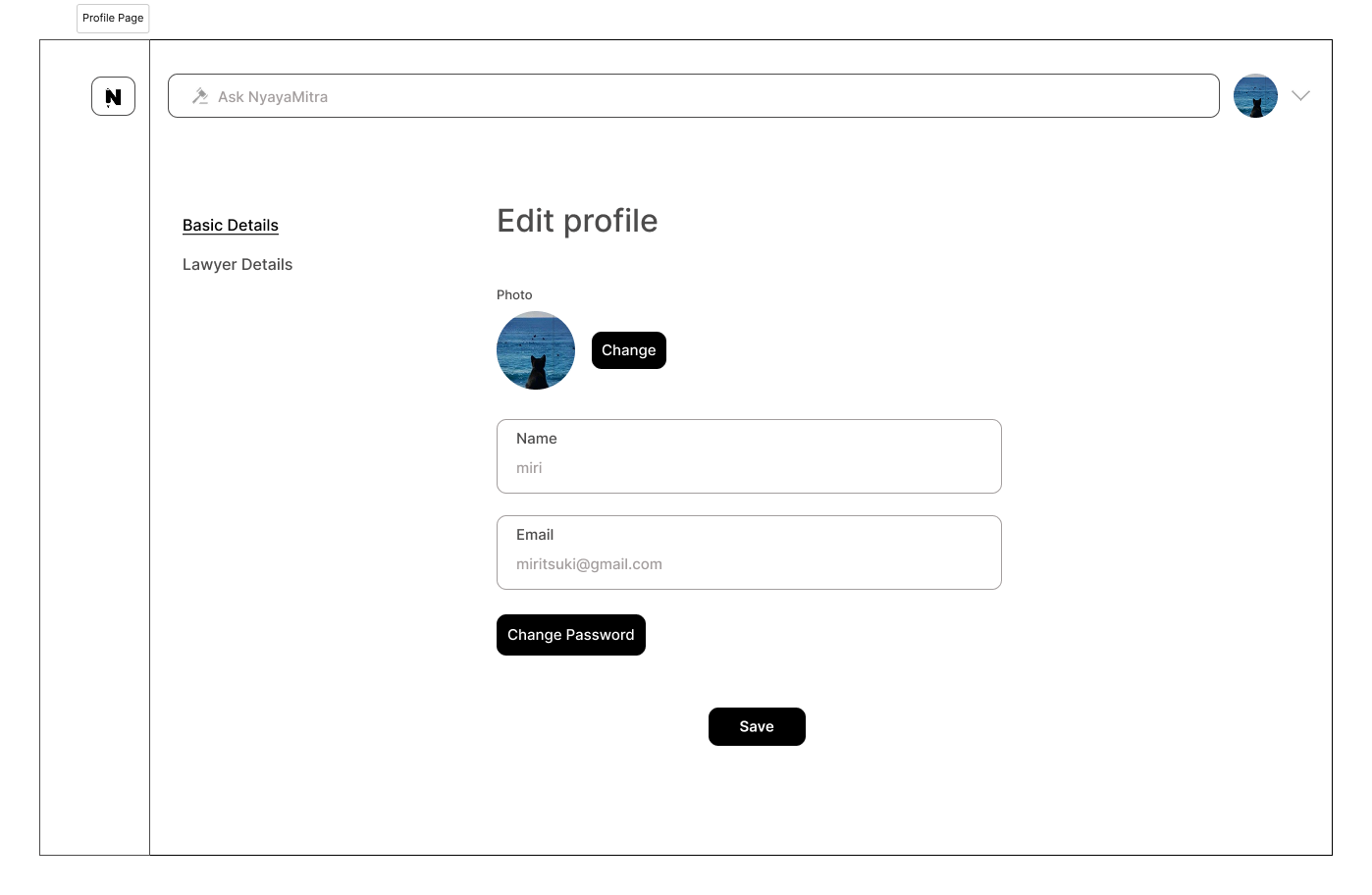


Figure 8: UM-EditProfileWireframe

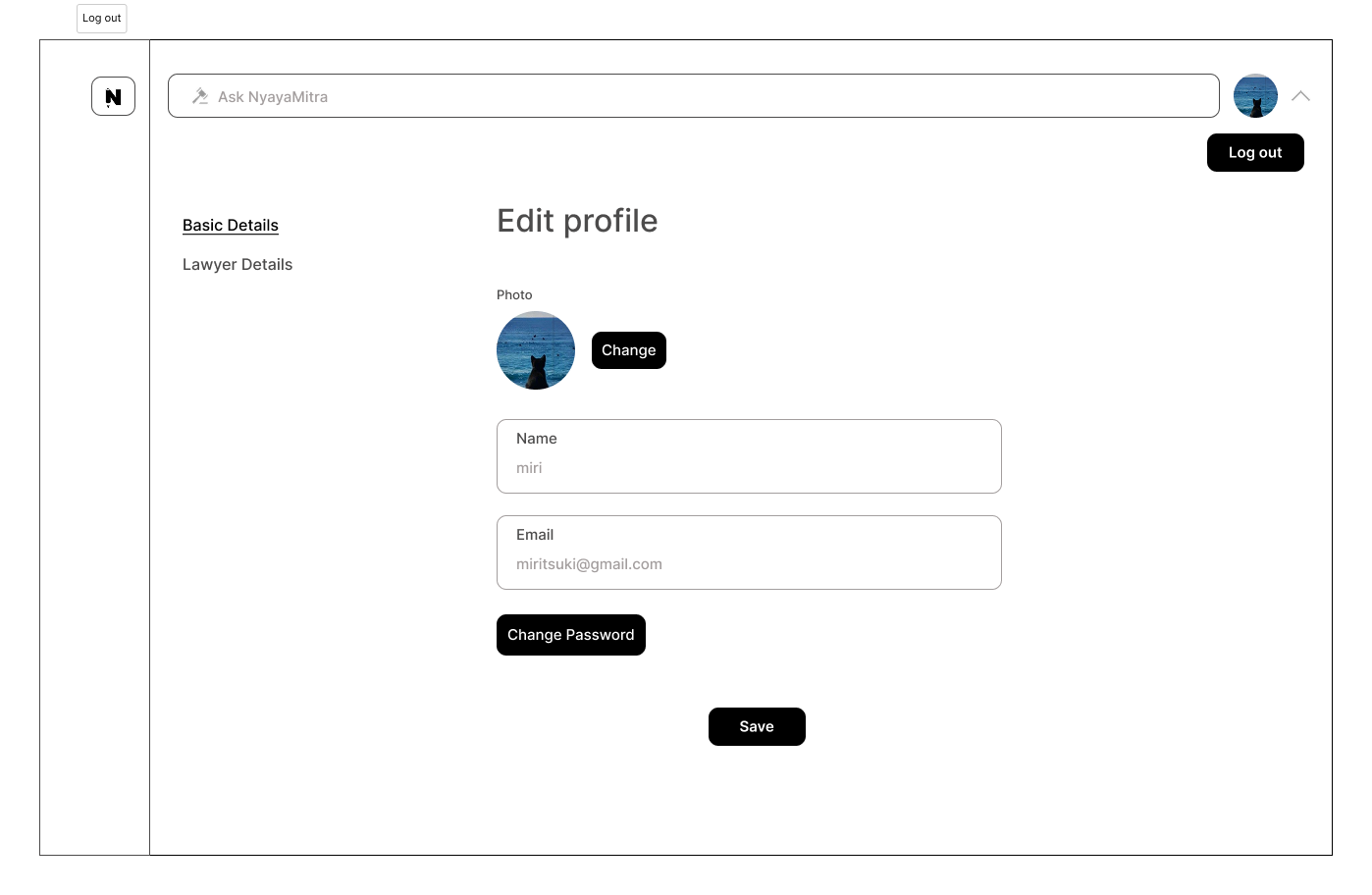


Figure 9: UM-LogoutWireframe

### Document Management Module

#### 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. |

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). | |

#### Use Case Diagram

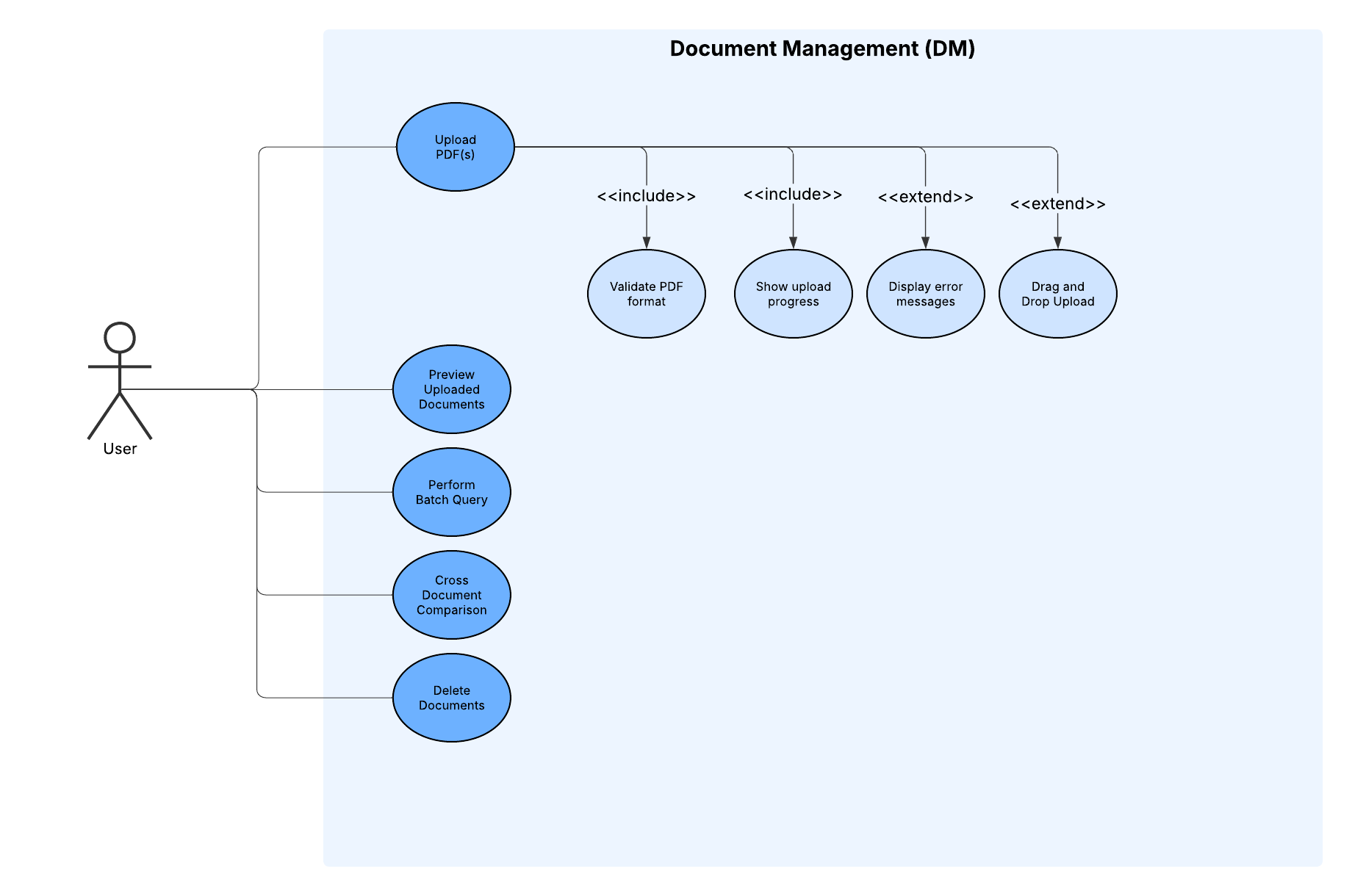


Figure 10: DM-UseCaseDiagram

#### Activity Diagram

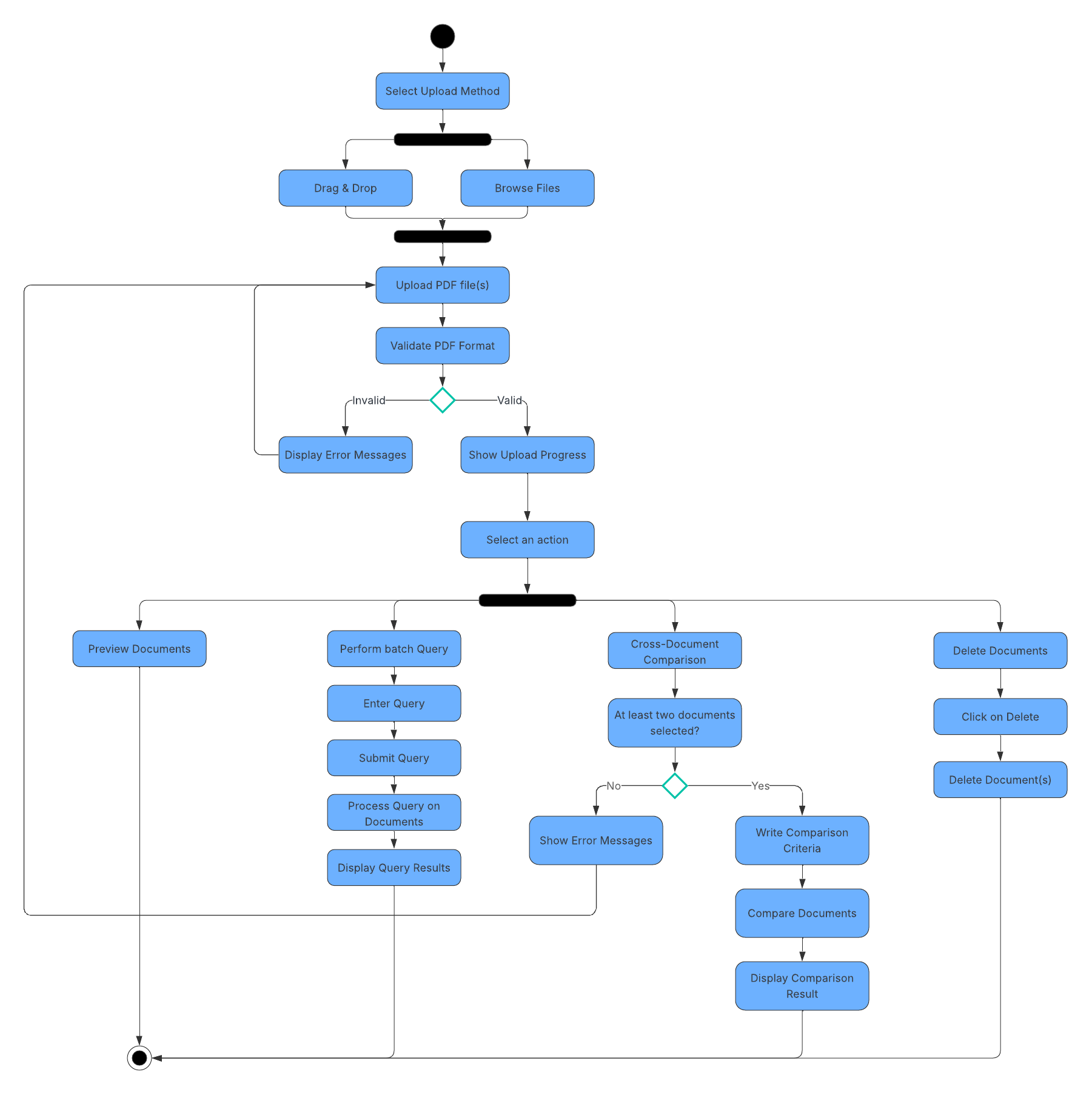


Figure 11: DM-Activitydiiagram

#### ERD

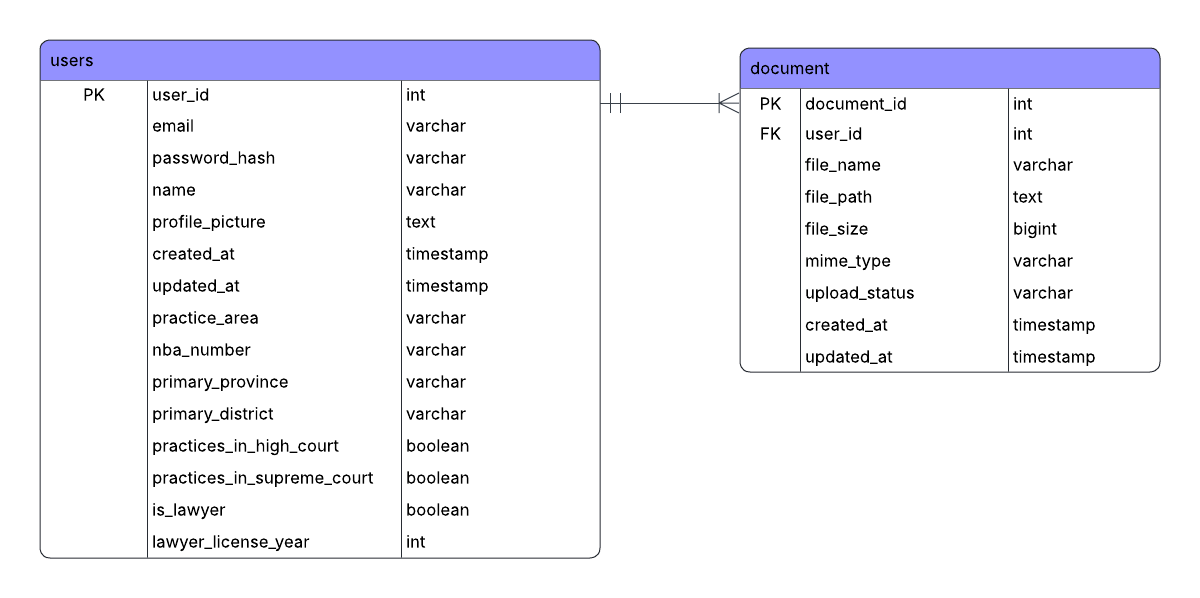


Figure 12:DM-ERD

#### Data Dictionary

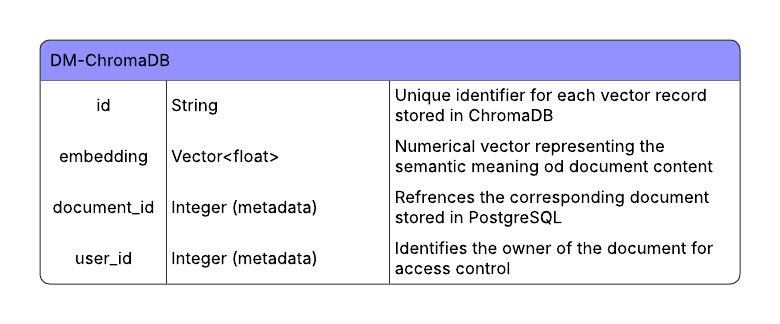


Figure 13: DM-DataDictionary

### Personalization/Onboarding Module

#### 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. | |

#### Use Case Diagram

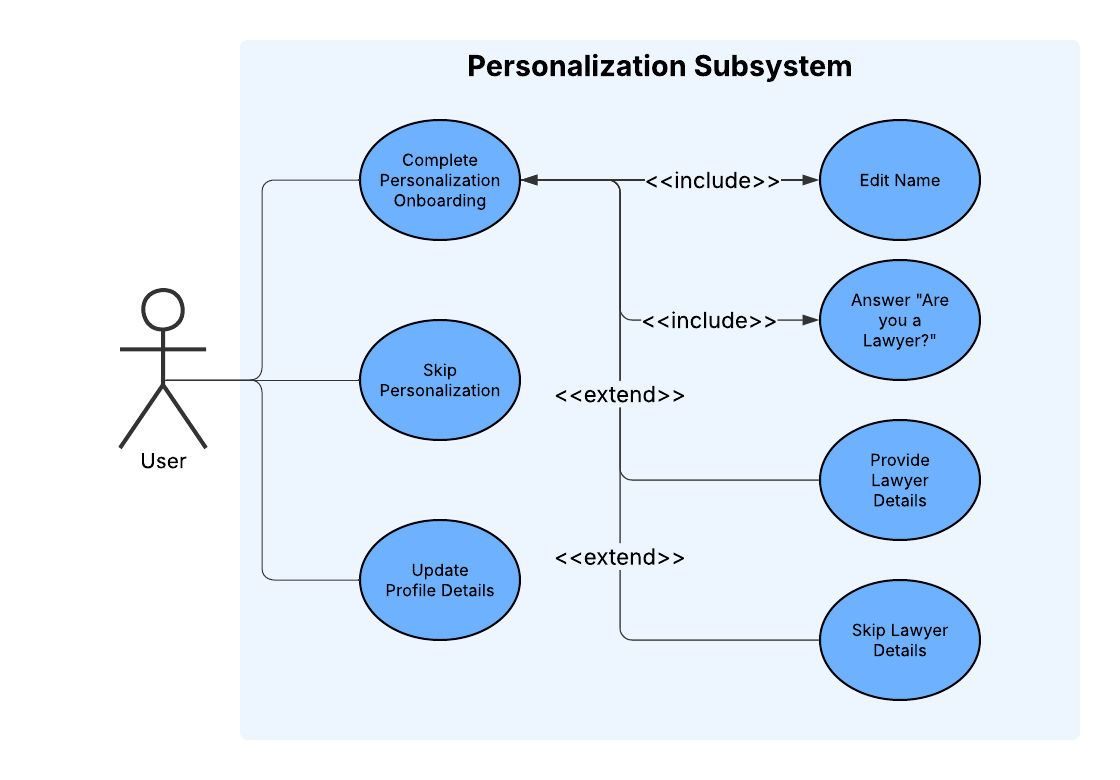


Figure 14: PM-UseCaseDiagram

#### Activity Diagram

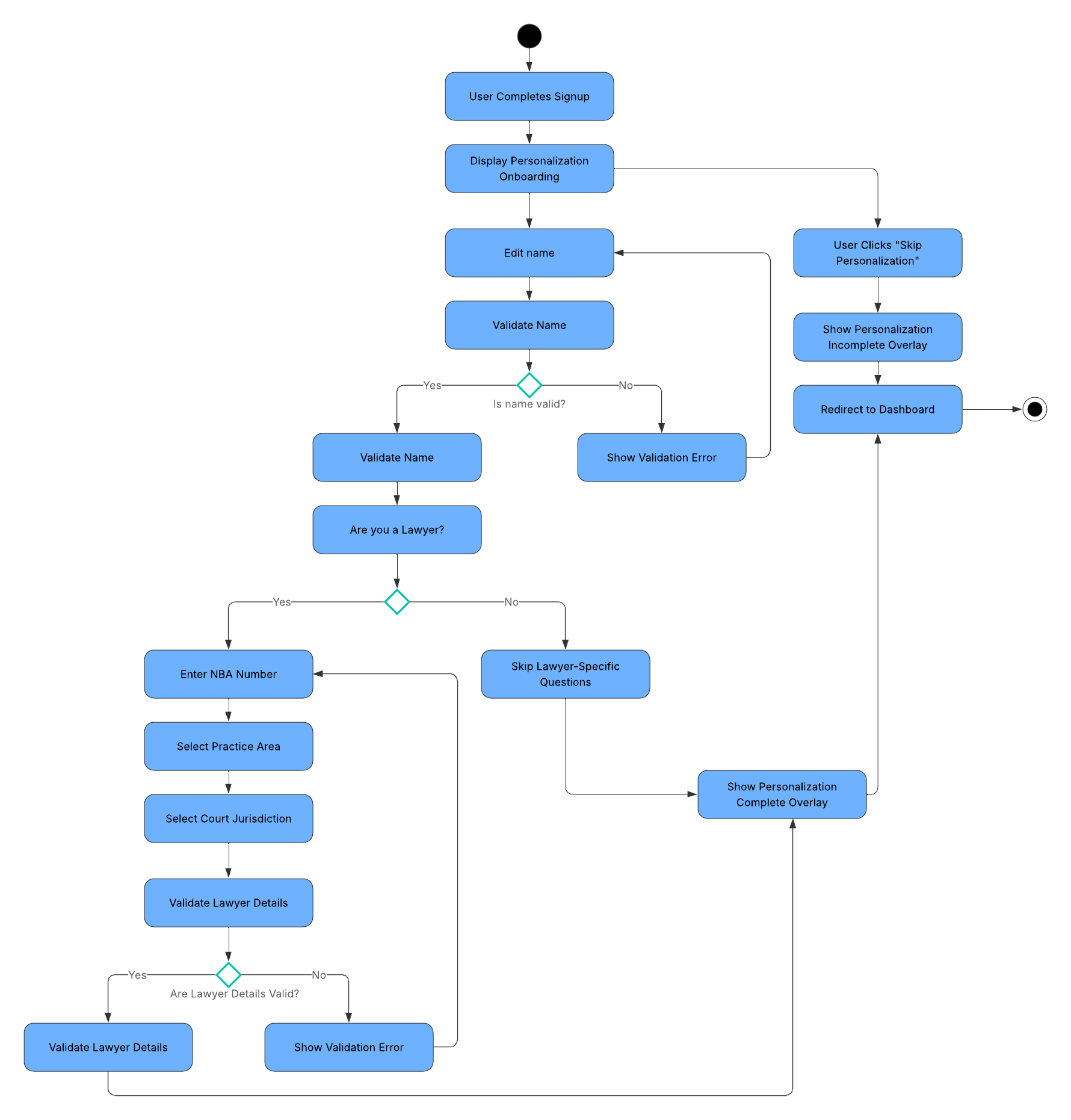


Figure 15: PM-ActivityDiagram

#### ERD

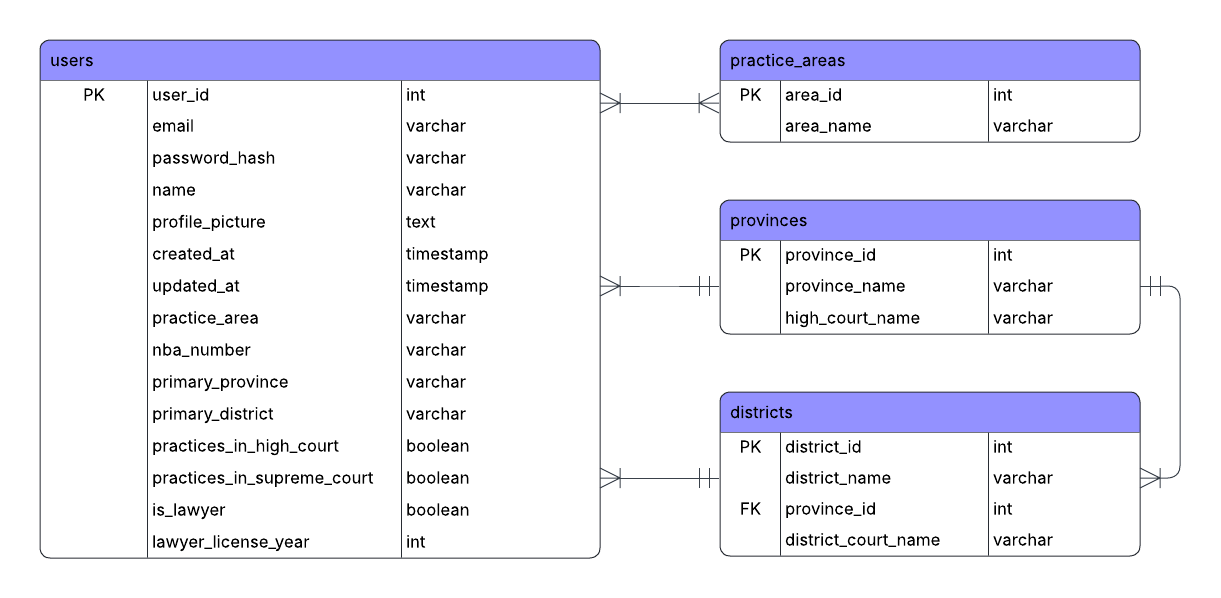


Figure 16: PM-ERD

#### Wireframe

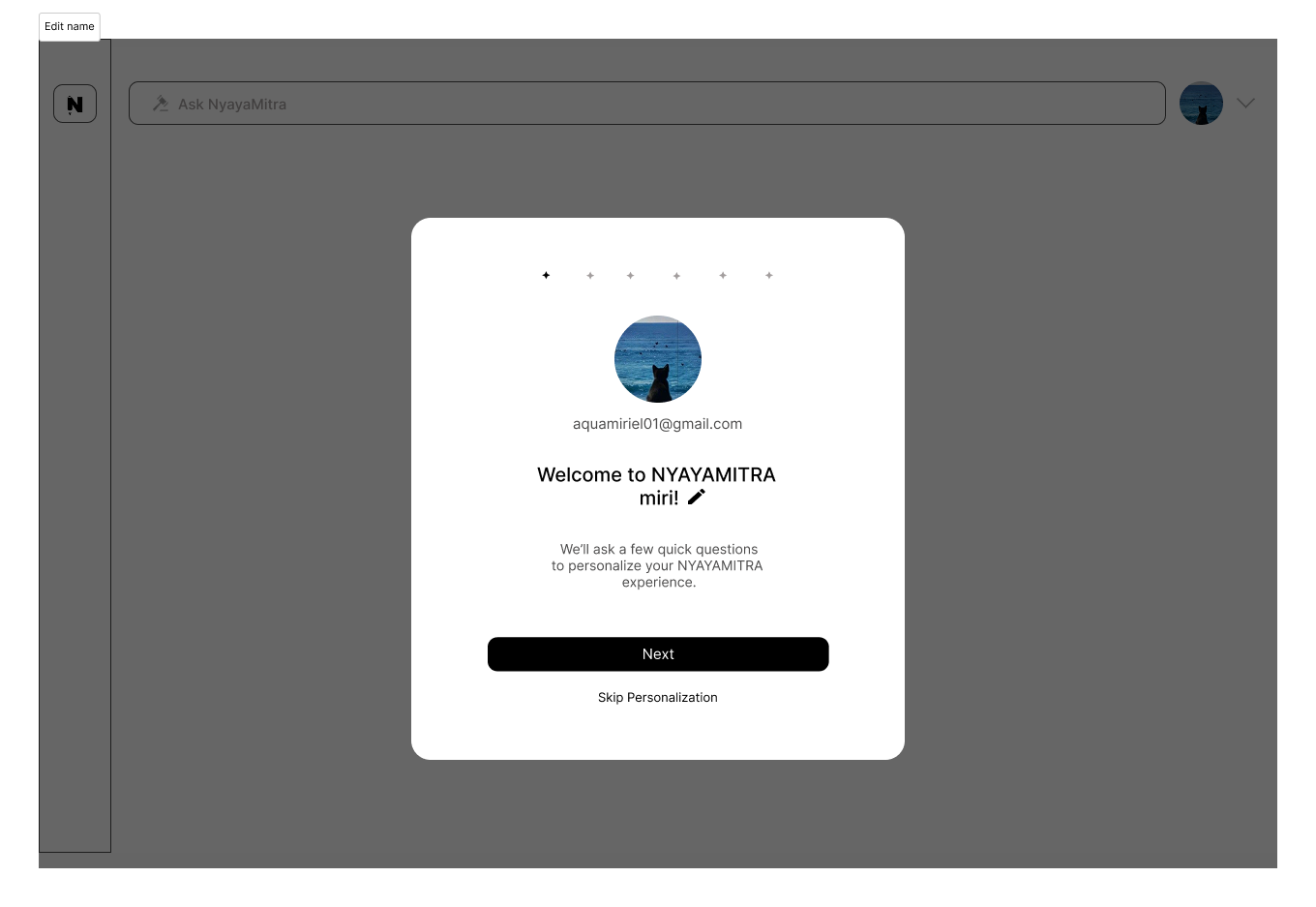


Figure 17: PM-EditNameWireframe

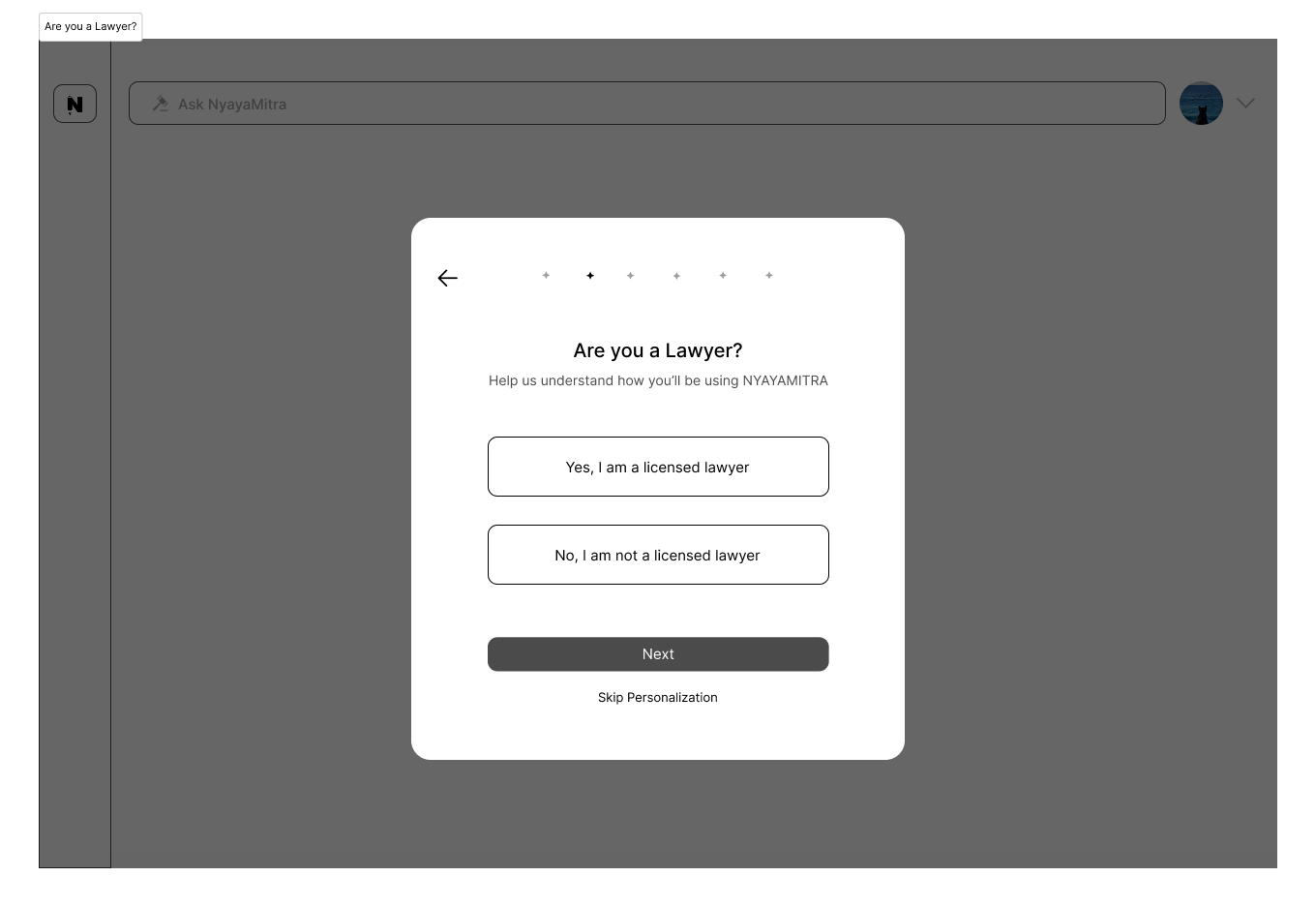


Figure 18: PM-AreYouALawyerWireframe

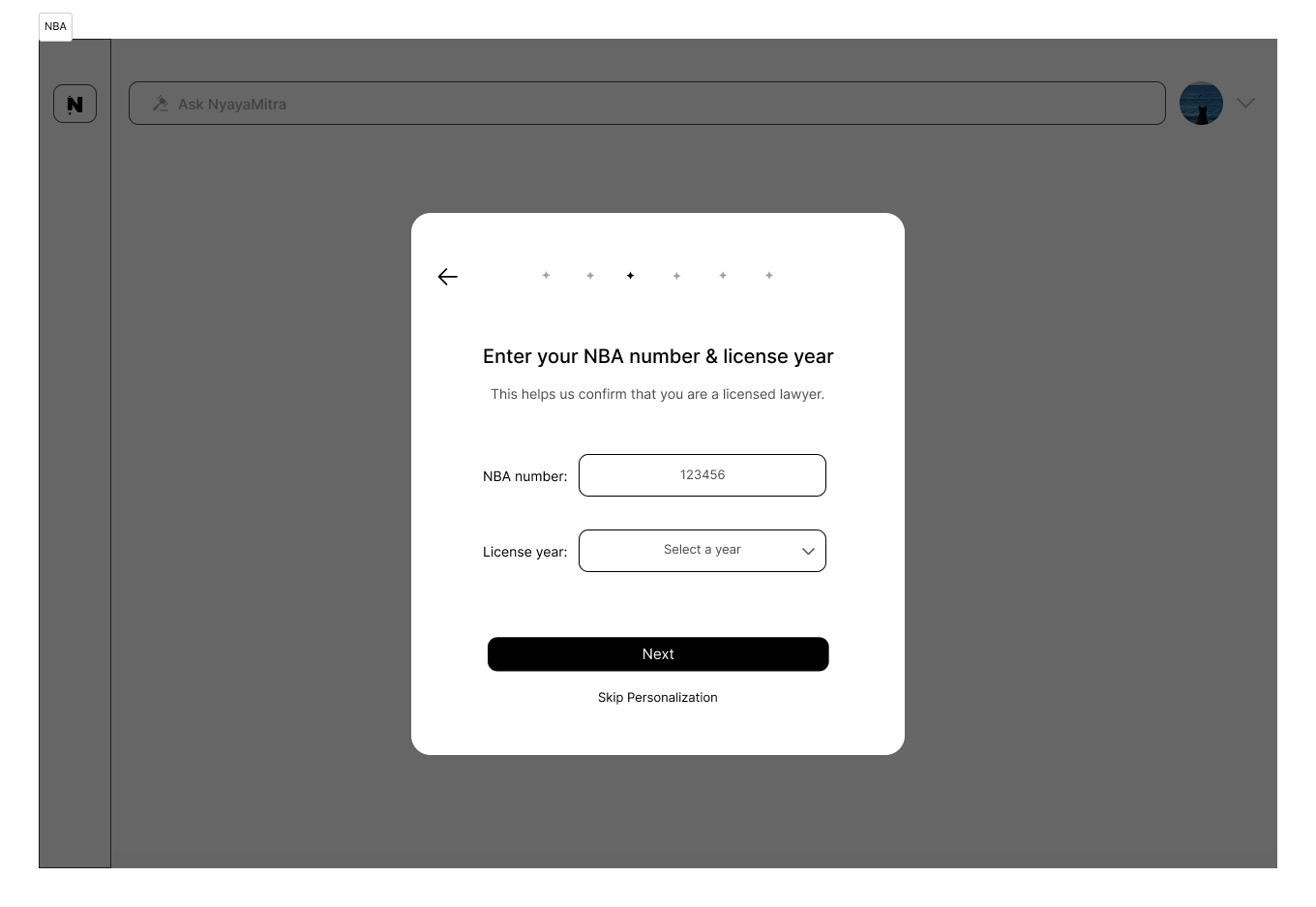


Figure 19: PM-NBA&LicenseYearWireframe

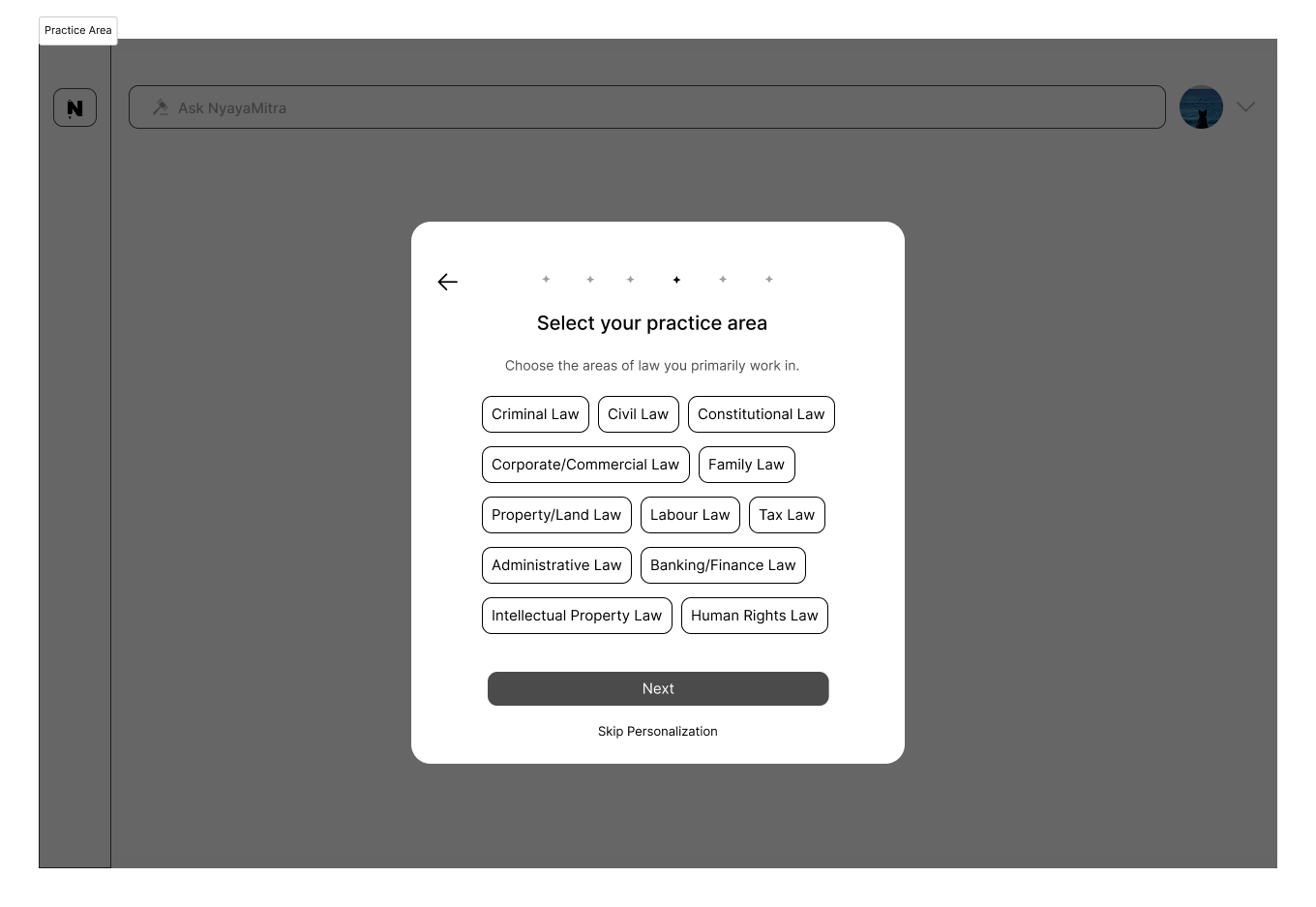


Figure 20: PM-PracticeAreaWireframe

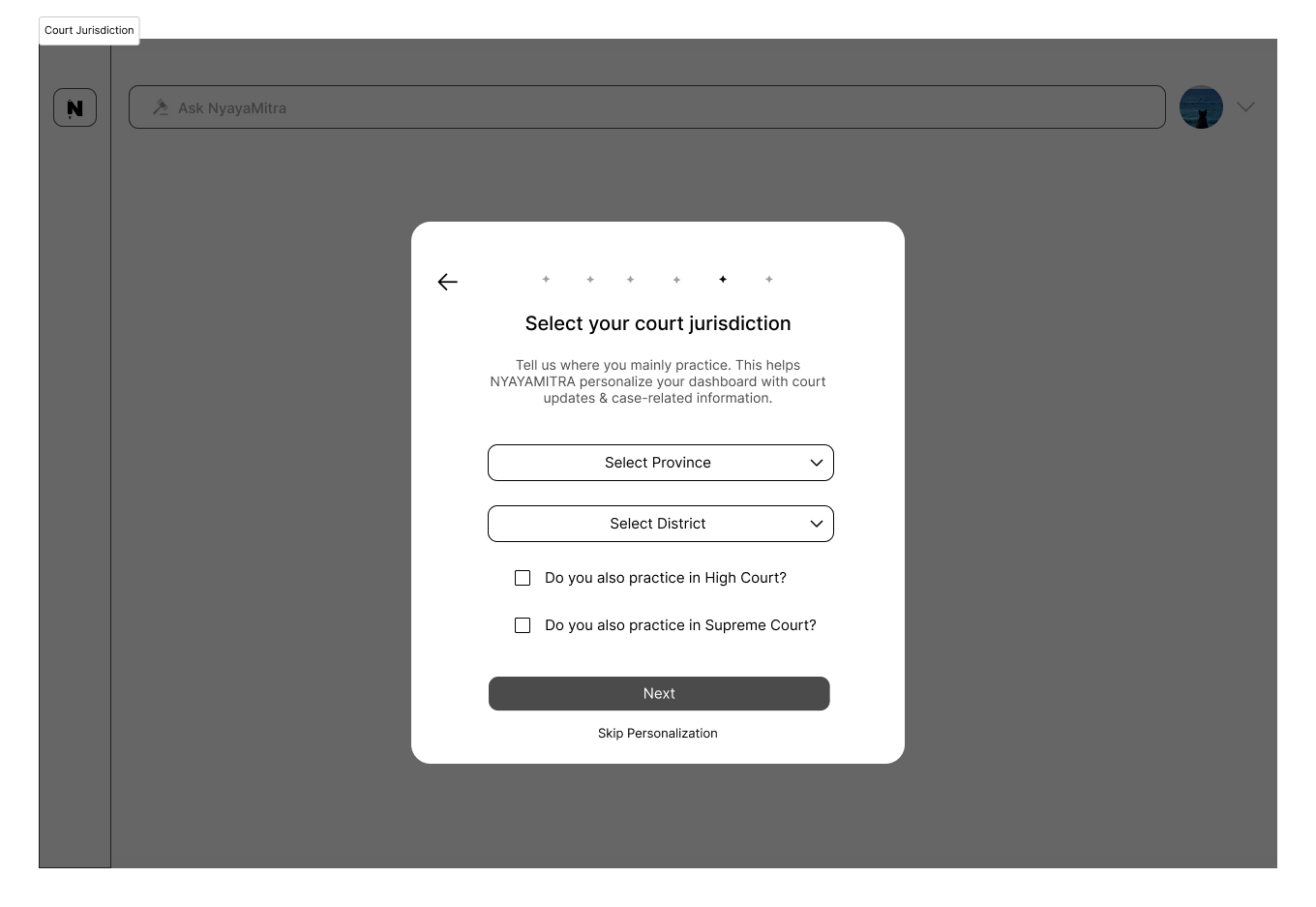


Figure 21: PM-CourtJurisdictionWireframe

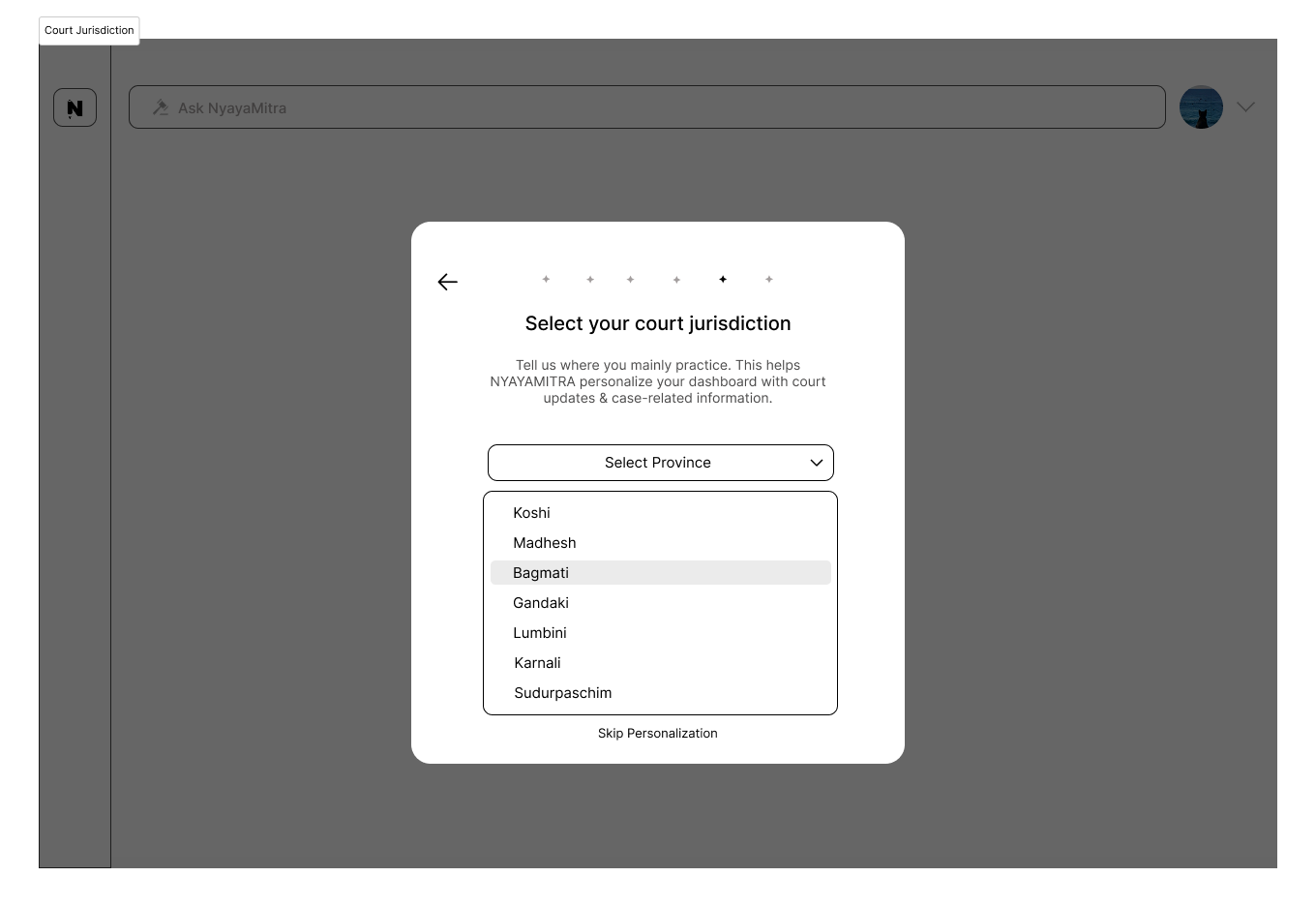


Figure 22: PM-SelectProvinceWireframe

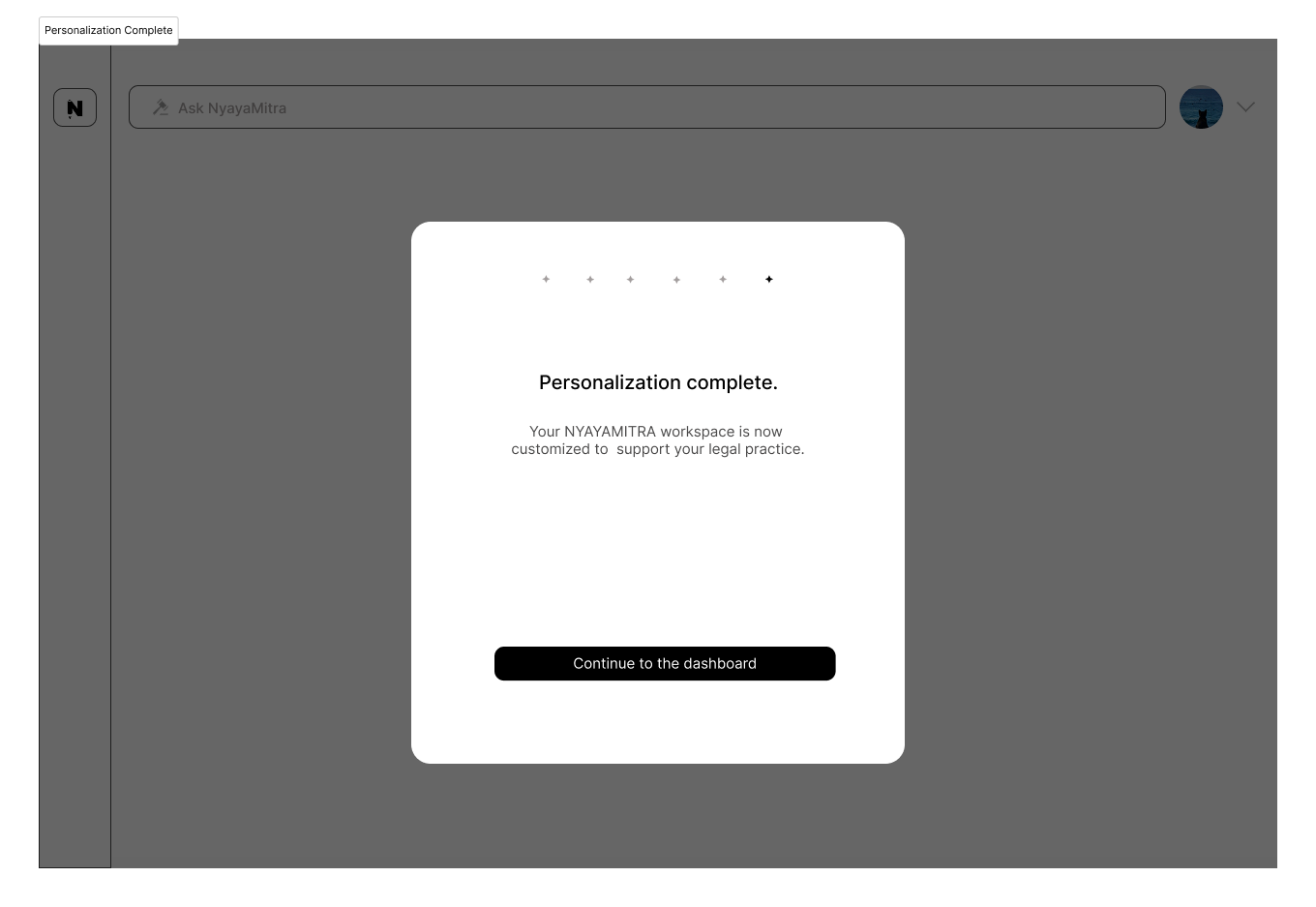


Figure 23: PM-PersonalizationCompleteWireframe

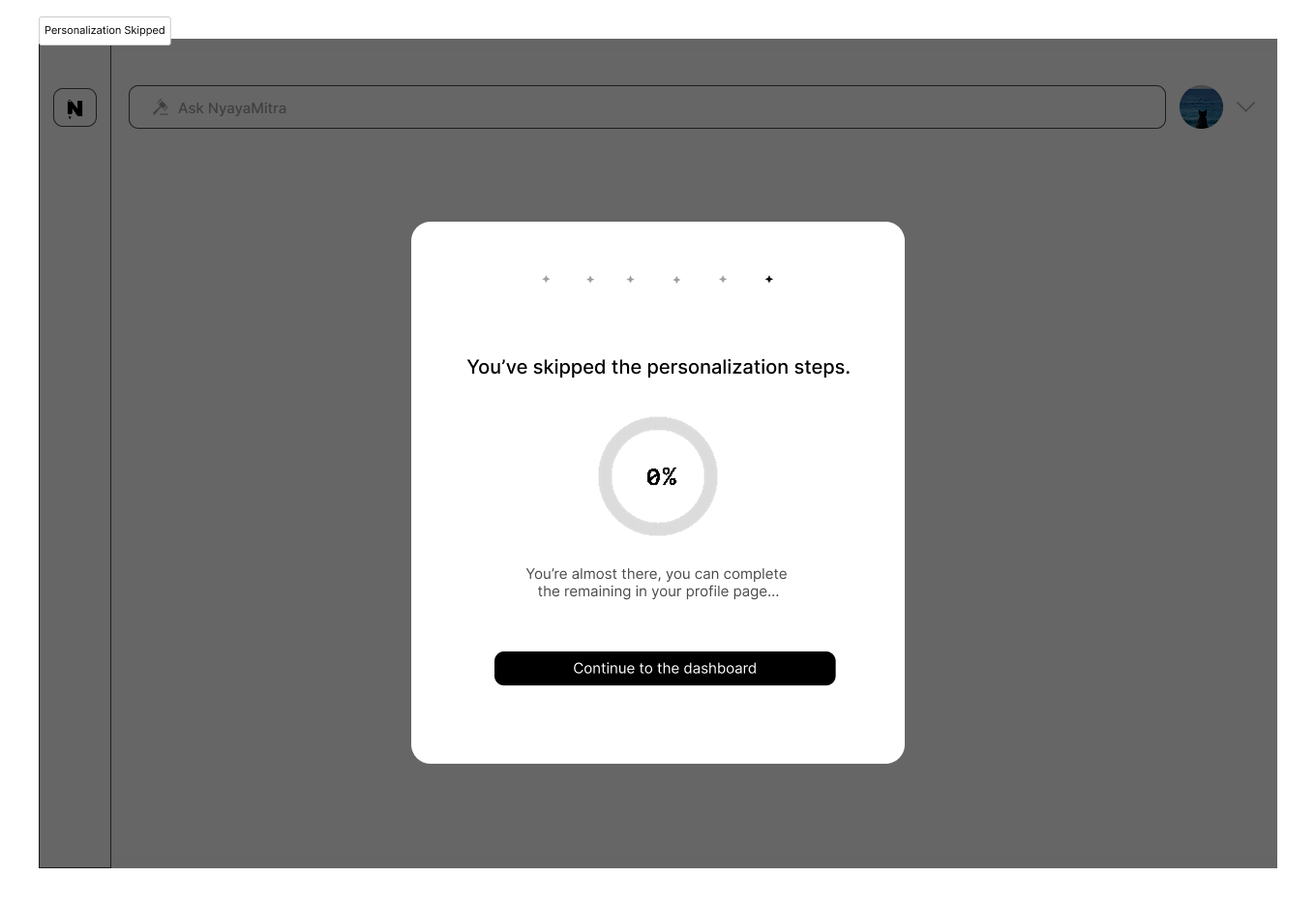


Figure 24: PM-SkippedPersonalizationWireframe

### Retrieval & Enbeddings Module

#### 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. | |

#### Use Case Diagram

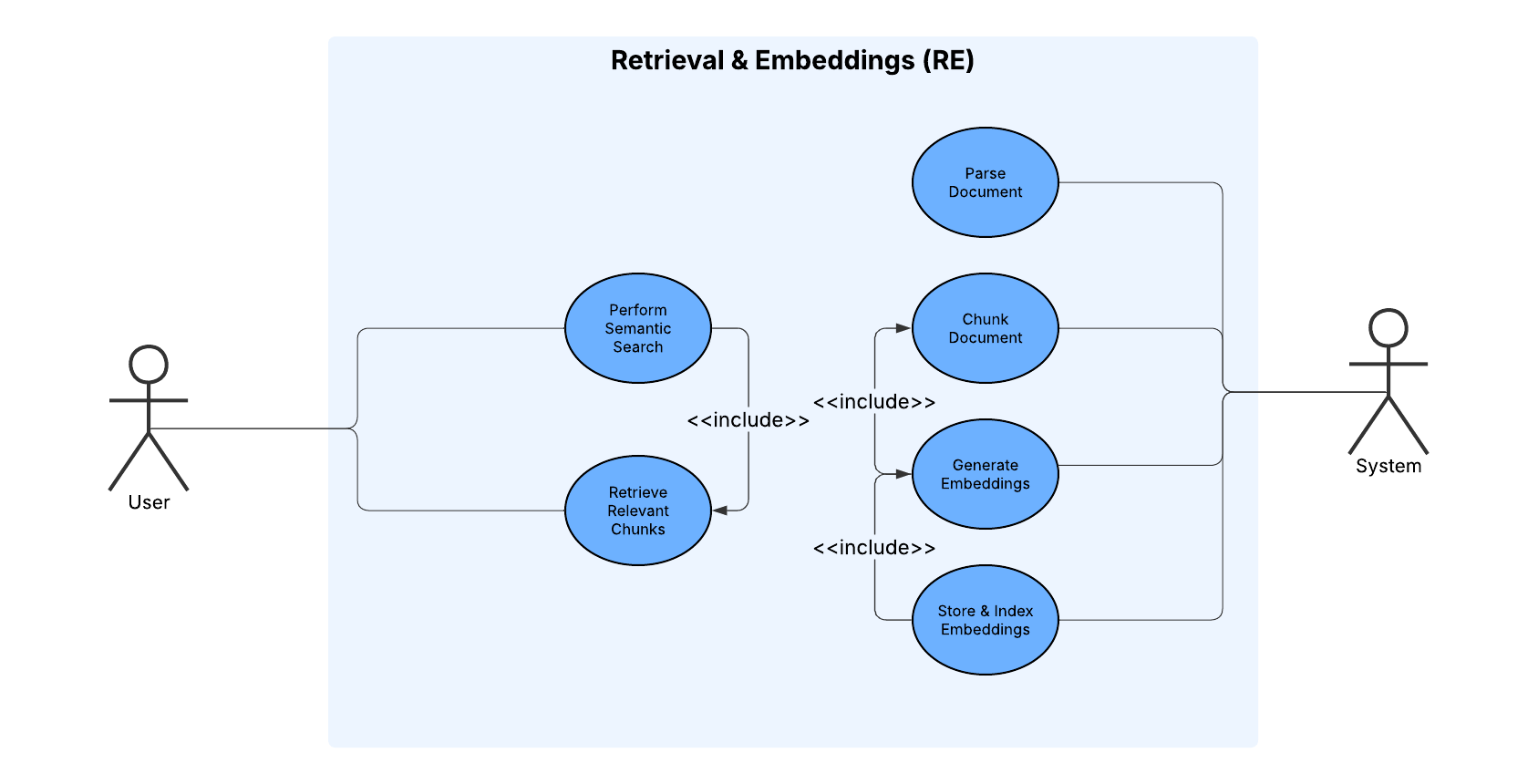


Figure 25: RE-UseCaseDiagram

#### Activity Diagram

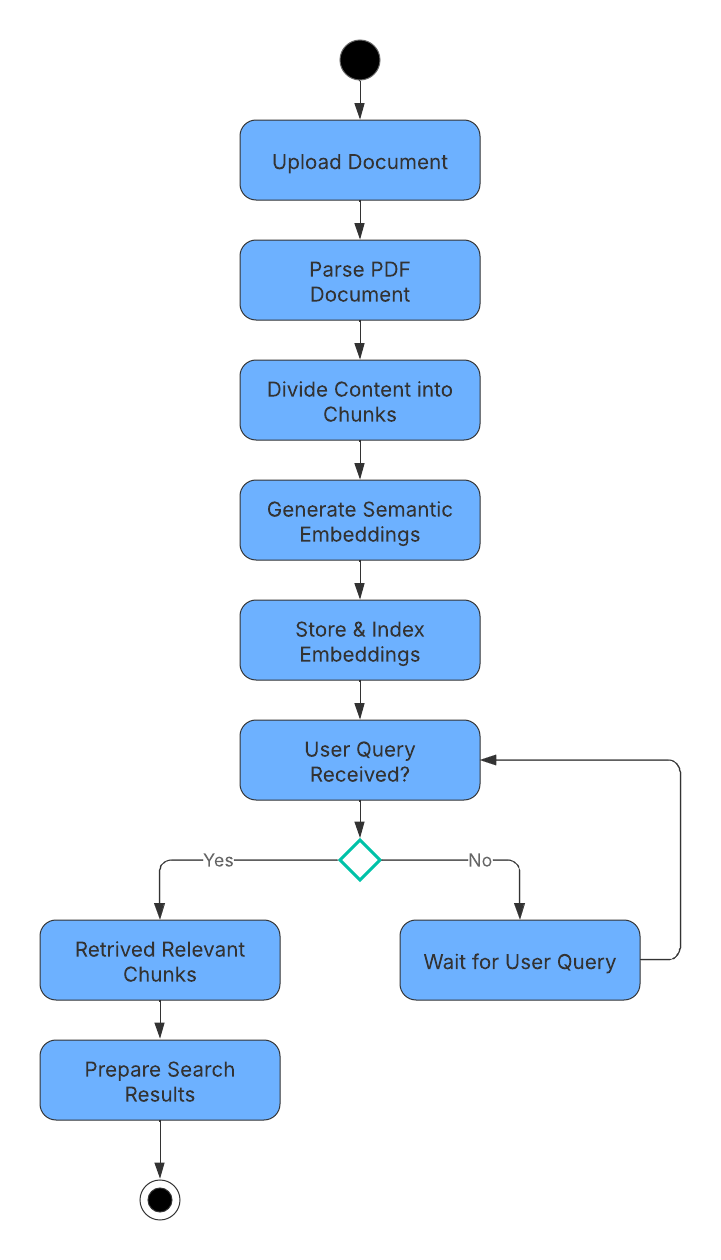


Figure 26: RE-ActivityDiagram

### Language & Model Handling Module

#### 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. | |

#### Use Case Diagram

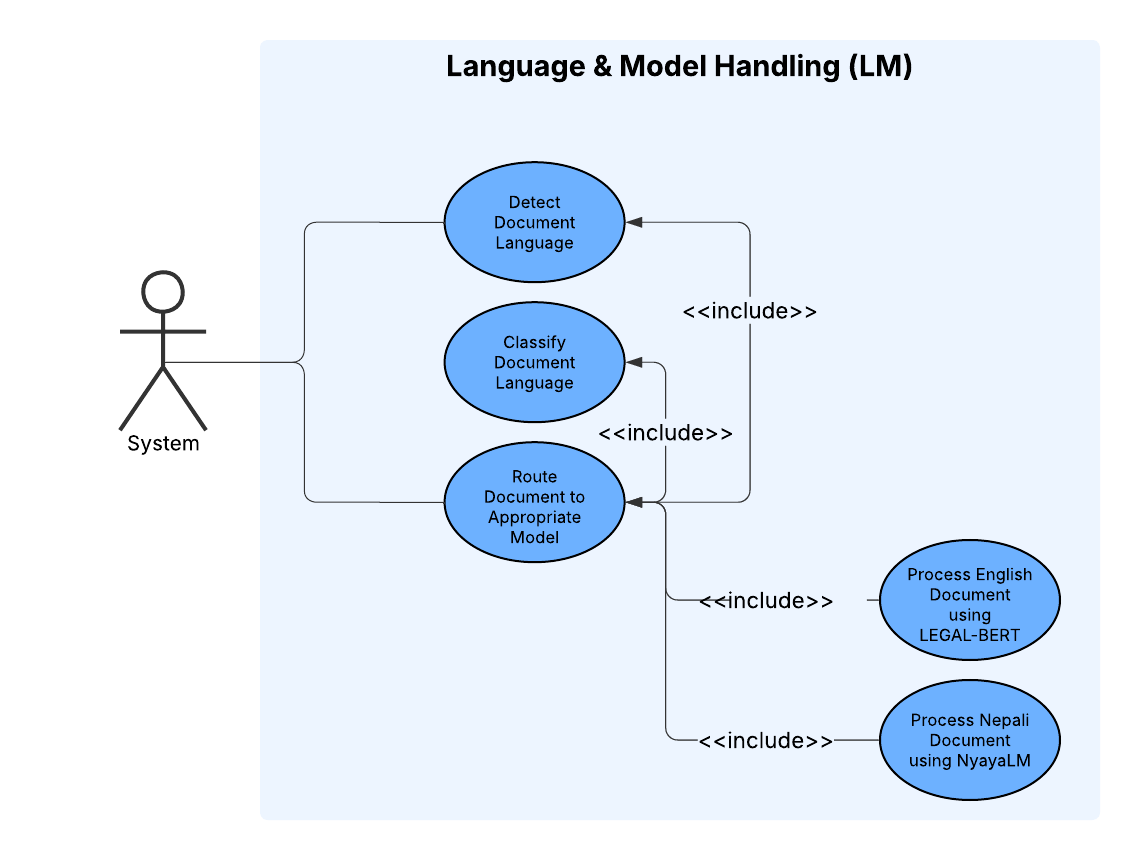


Figure 27: LM-UseCaseDiagram

#### Activity Diagram

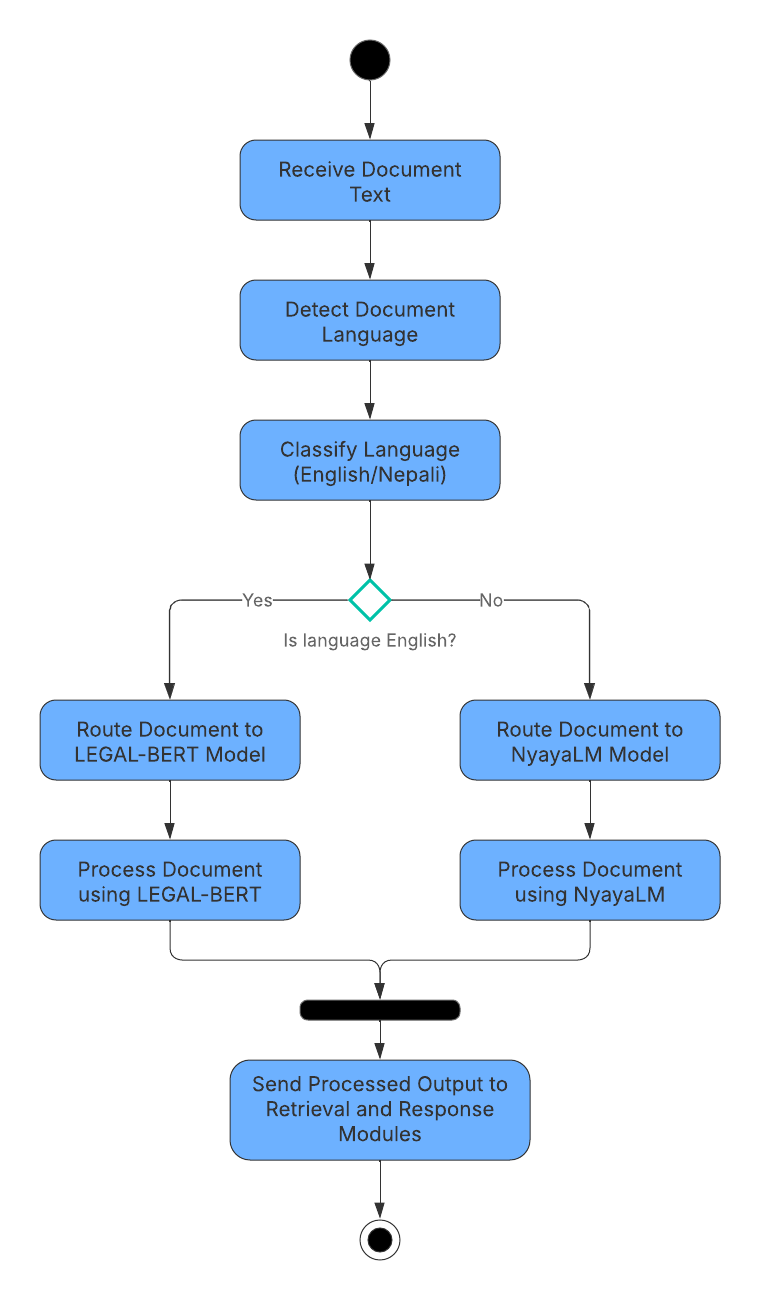


Figure 28: LM-ActivityDiagram

### Legal NLP Processing Module

#### 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. |

#### Use Case Diagram

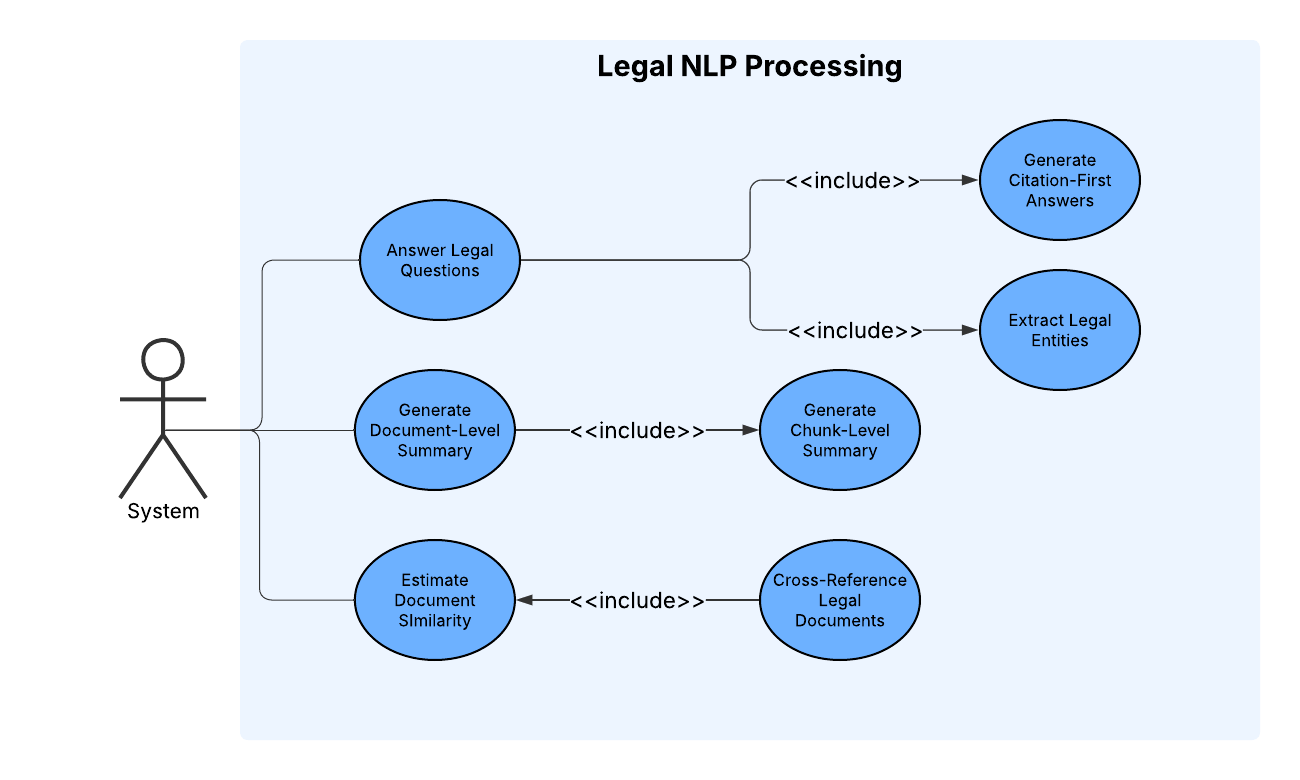


Figure 29: NLP-UseCaseDiagram

#### Activity Diagram

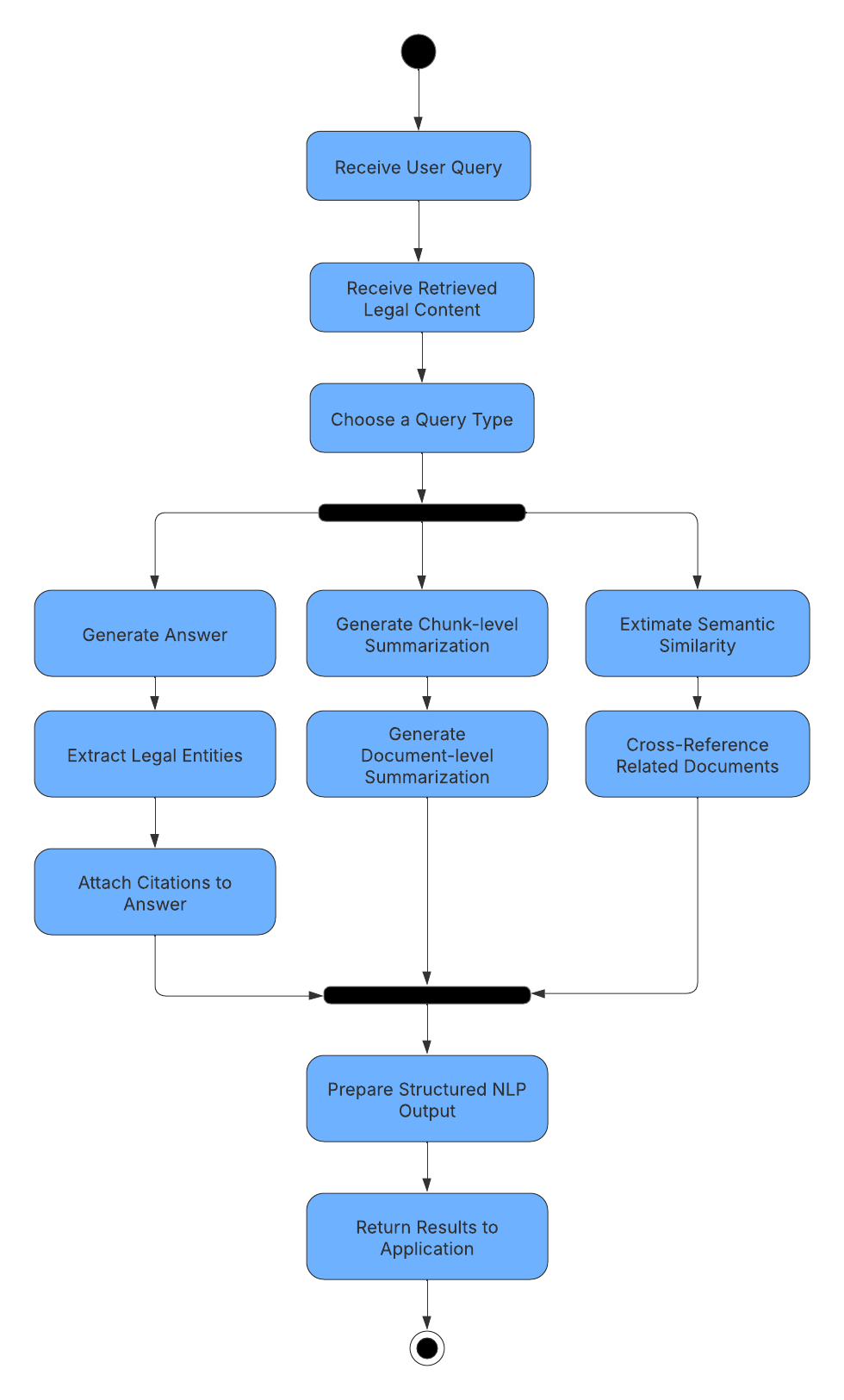


Figure 30: NLP-ActivityDiagram

### Frontend & User Interface Module

#### 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. |

#### Use Case Diagram

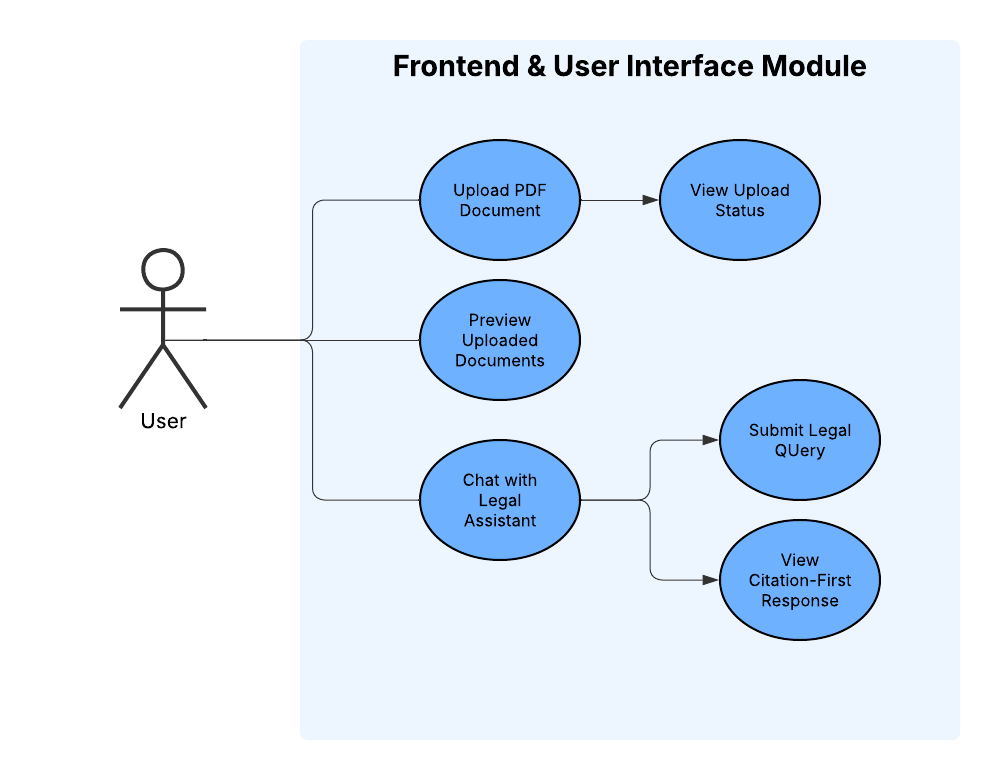


Figure 31: FUI-UseCaseDiagram

#### Activity Diagram

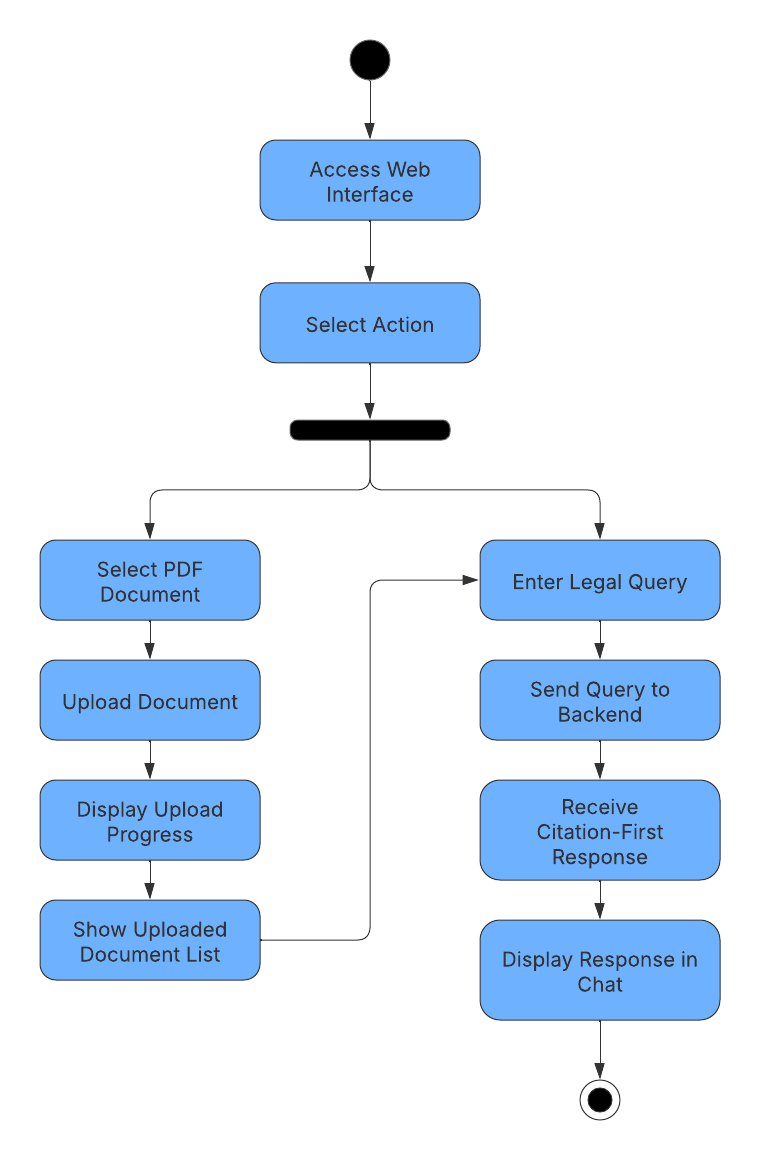


Figure 32: FUI-ActivityDiagram

### Security & Deployment Module

#### 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. | |

#### Use Case Diagram

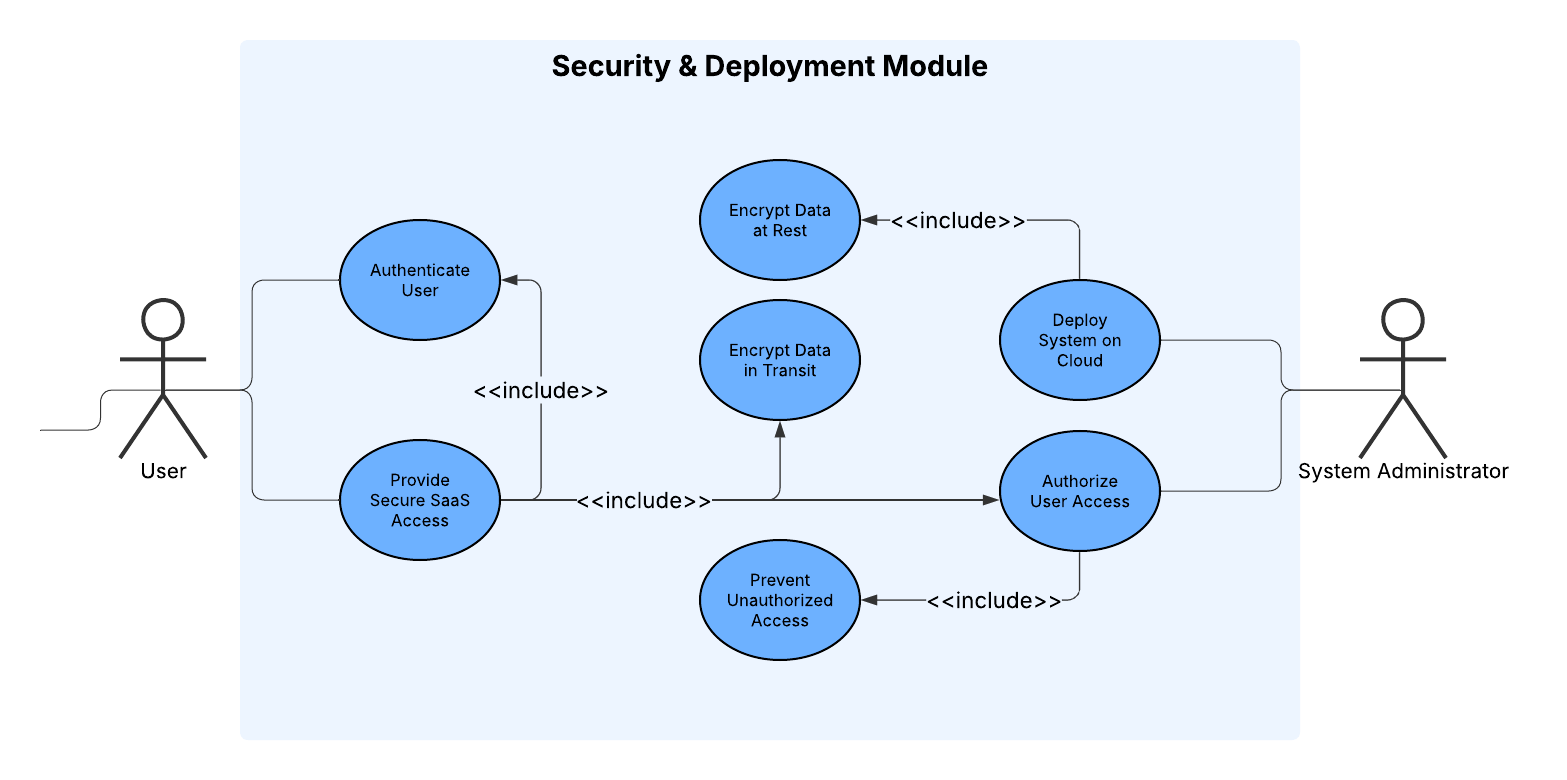


Figure 33: SD-UseCaseDiagram

#### Activity Diagram

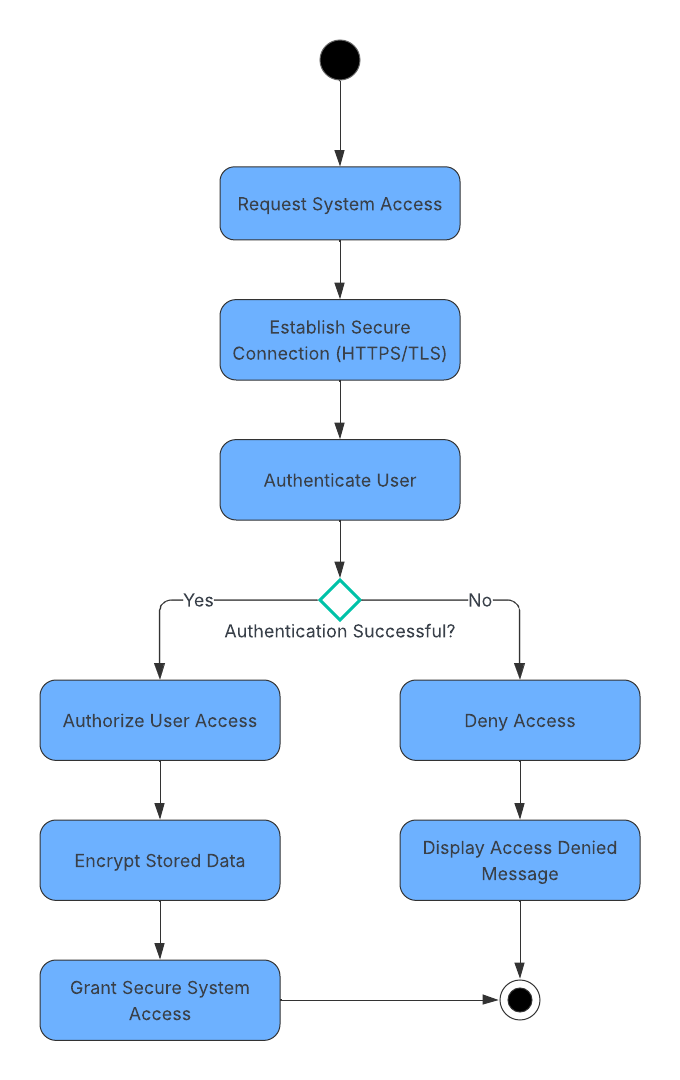


Figure 34: SD-ActivityDiagram

# Test Plan

## User Management Module



Figure 35: UM-TestPlan

## Document Management Module

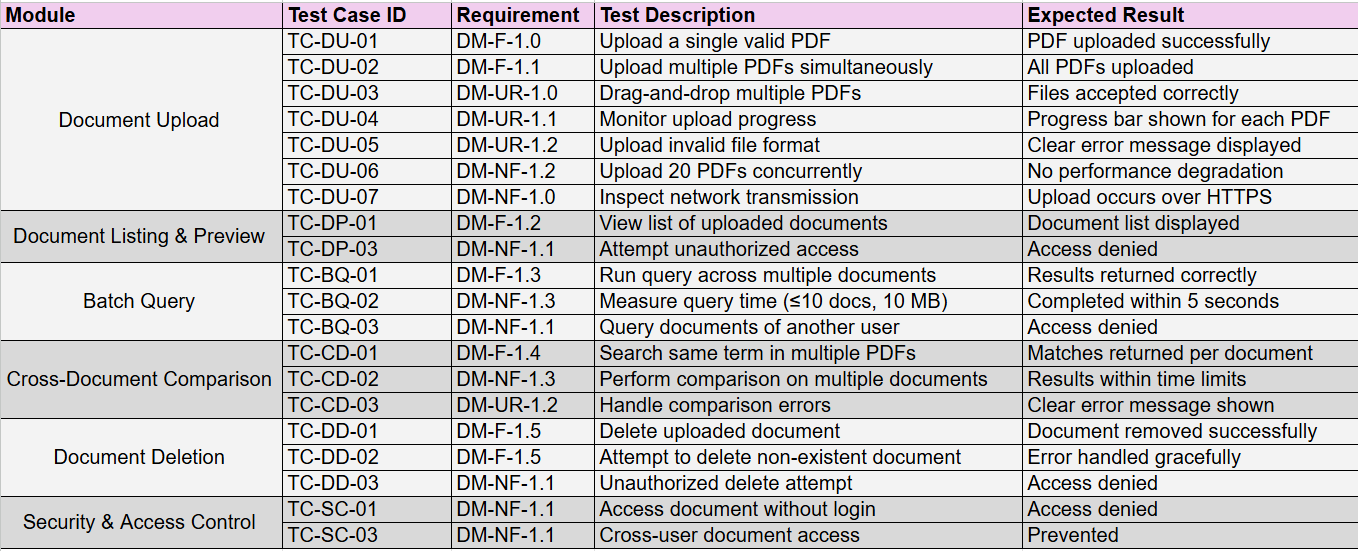


Figure 36: DM-TestPlan

## Personalization Module

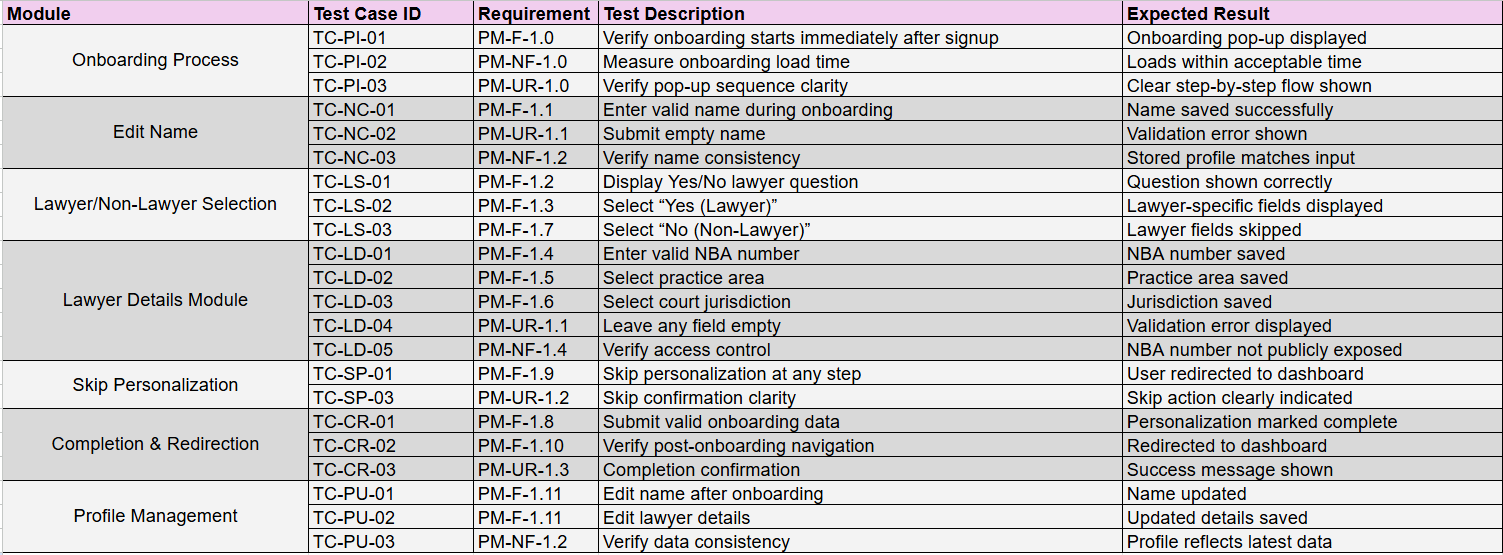


Figure 37: PM-TestPlan

## Retrieval & Embedding Module



Figure 38: RE-TestPlan

## Language & Model Handling Module

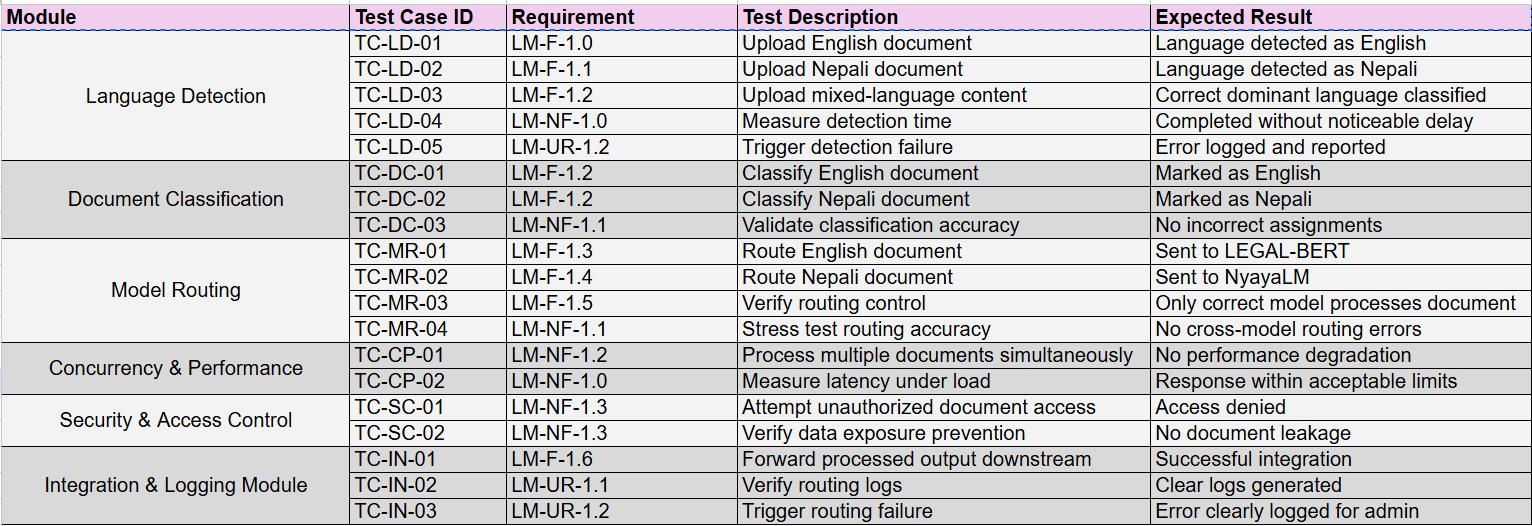


Figure 39: LM-TestPlan

## Legal NLP Processing Module



Figure 40: NLP-TestPlan

## Frontend & User Interface Module

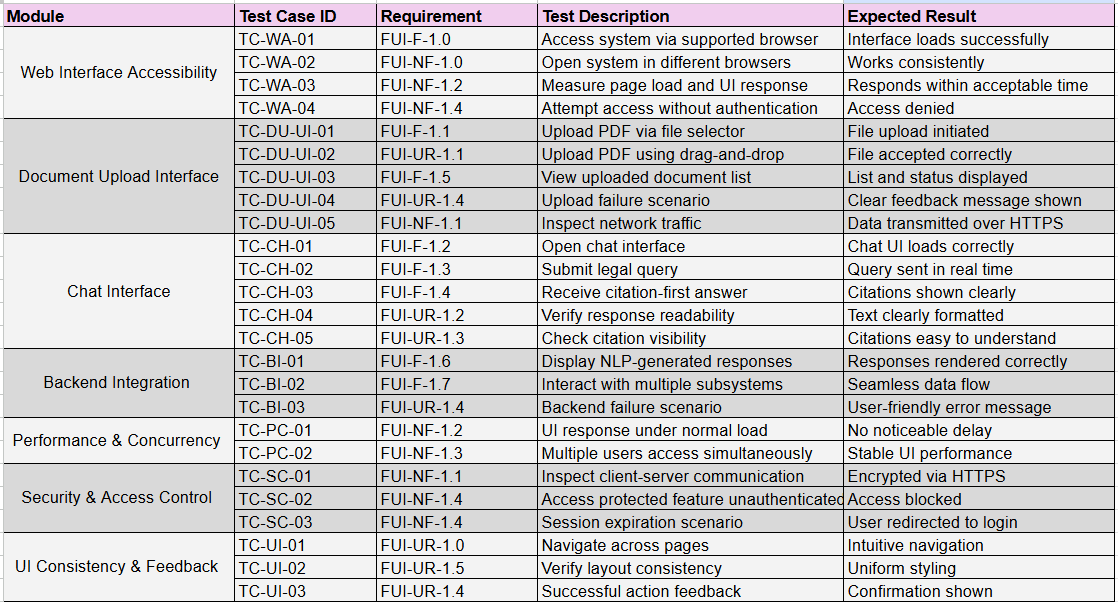


Figure 41: TestPlan

## Security & Deployment Module

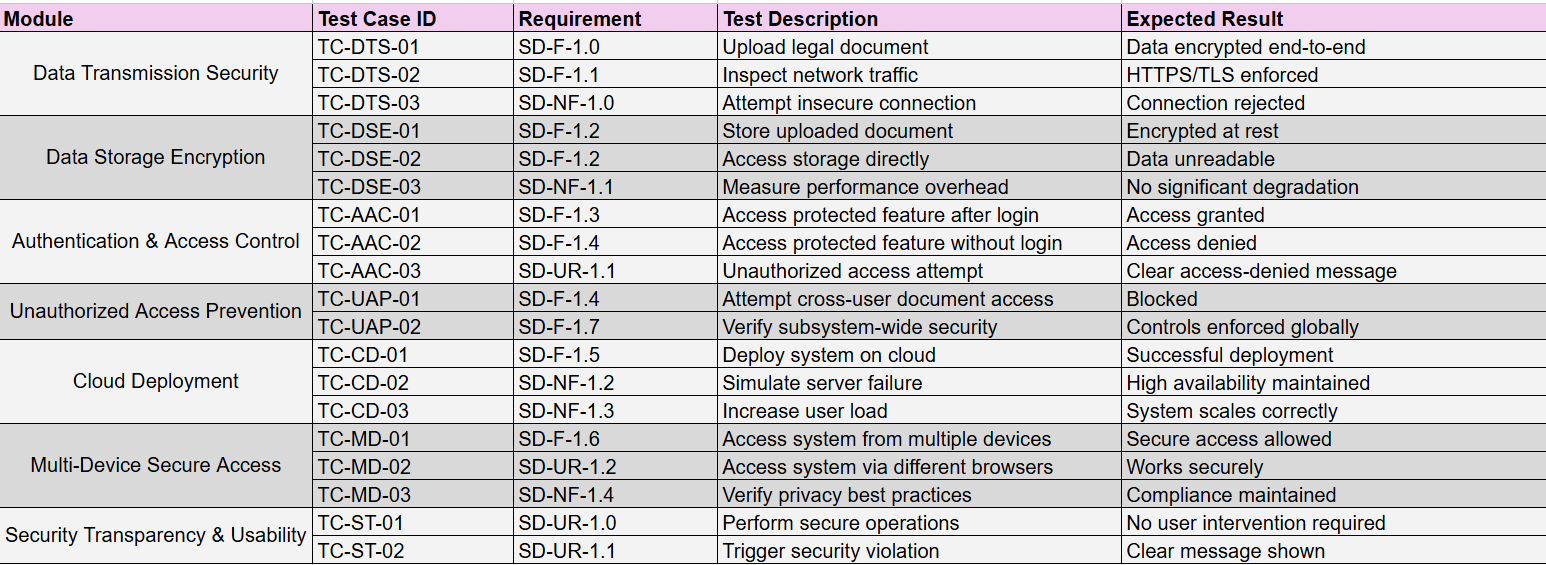


Figure 42: SD-TestPlan