# MINOR PROJECT System Requirements Specification Report

on

TITLE: PolyDoc Multi-lingual Document Understanding System.

# BACHELOR OF COMPUTER APPLICATION (BCA)

# KLE TECHNOLOGICAL UNIVERSITY

by

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#### 1. Introduction

### 1.1 Purpose

The purpose of this Software Requirements Specification (SRS) is to define the functional and non-functional requirements for **PolyDoc**, a multi-lingual document understanding and system. This system is being developed to address the growing need for intelligent document processing that can handle multiple languages (particularly Indian languages like Hindi and Kannada), extract meaningful information from various document formats, and provide AI-powered analysis capabilities.

#### 1.2 Scope

**PolyDoc** is a comprehensive document processing system that provides the following capabilities:

#### What the system will do:

- Process multi-format documents (PDF, DOCX, TXT, Images)
- Extract text using advanced OCR technology with multi-language support
- Preserve original document layouts during processing
- Provide AI-powered document summarization
- Enable real-time chat interface with documents
- Implement vector-based semantic search
- Support Hindi, Kannada, and English language processing
- Offer document management capabilities (upload, view, delete)

#### **System Benefits:**

- Reduces manual document processing time by 80%
- Supports underrepresented languages (Hindi, Kannada)
- Preserves document formatting and layout integrity
- Provides intelligent document insights through AI
- Enables efficient document search and retrieval
- Offers free and open-source AI model integration

#### Goals:

- Create an accessible multi-lingual document processing platform
- Demonstrate advanced NLP capabilities for Indian languages
- Provide a user-friendly web interface for document interaction

# 1.3 Definitions, Acronyms, Abbreviations

Term	Definition
API	Application Programming Interface
AI	Artificial Intelligence
DFD	Data Flow Diagram
ERD	Entity-Relationship Diagram
FastAPI	Modern Python web framework for building APIs
GenAI	Generative Artificial Intelligence
GPU	Graphics Processing Unit
ML	Machine Learning
MongoDB	NoSQL document database
NLP	Natural Language Processing
OCR	Optical Character Recognition
PDF	Portable Document Format
PolyDoc	Multi-lingual Document Understanding System
REST	Representational State Transfer
SRS	Software Requirements Specification
UI	User Interface
UML	Unified Modelling Language
Vector DB	Vector Database for semantic search

#### 1.4 References

- IEEE Standard 830-1998 IEEE Recommended Practice for Software Requirements Specifications
- FastAPI Documentation <a href="https://fastapi.tiangolo.com/">https://fastapi.tiangolo.com/</a>
- MongoDB Documentation <a href="https://docs.mongodb.com/">https://docs.mongodb.com/</a>
- Transformers Library Hugging Face Transformers Documentation
- OCR Research Papers Multi-lingual OCR techniques and implementations
- React Documentation <a href="https://reactjs.org/docs/">https://reactjs.org/docs/</a>
- Vite Build Tool <a href="https://vitejs.dev/guide/">https://vitejs.dev/guide/</a>
- Python 3.9+ Documentation <a href="https://docs.python.org/3/">https://docs.python.org/3/</a>

#### 1.5 Overview

This SRS document is organized into five main sections:

- Section 1 (Introduction) provides the purpose, scope, definitions, and overview of the document.
- Section 2 (Overall Description) describes the product perspective, functions, user characteristics, constraints, and dependencies.
- Section 3 (Specific Requirements) details functional and non-functional requirements with interface specifications.
- Section 4 (System Models) presents UML diagrams including use cases, data flow, and entity-relationship diagrams.
- Section 5 (Other Requirements) covers safety, legal compliance, backup, and audit requirements.

# 2. Overall Description

# 2.1 Product Perspective

**PolyDoc** is designed as a standalone web-based application with clearly defined system relationships, dependencies, and boundaries.

**Relation to Existing Systems:** PolyDoc operates as an independent system, functioning as a self-contained document processing platform. It is accessible through standard web browsers without the need for additional plugins and integrates with the host operating system's file system to enable document upload and download. For data storage, PolyDoc connects with MongoDB to manage documents and associated metadata.

**System Dependencies:** The frontend of the system is built using React with Vite, while the backend relies on the Python FastAPI framework to provide REST API services. Document storage and user data are maintained in MongoDB. For natural language processing tasks, PolyDoc utilizes Hugging Face Transformers. Multi-language OCR engines support text extraction from diverse documents, and a vector database is employed to enable semantic search and document similarity comparisons.

**System Boundaries:** Input is provided in the form of various document formats through the web interface, while output includes processed text, summaries, chat responses, and search results. The system interacts externally with file systems and web browsers, and internally it performs document processing using AI and ML models

#### 2.2 Product Functions

#### **Major System Functions**

**Document Upload and Processing** support multiple file formats including PDF, DOCX, TXT, and images. It provides multi-language OCR capabilities with support for Hindi and Kannada, ensures layout preservation during text extraction, and includes automatic language detection.

**AI-Powered Document Analysis** enables intelligent document summarization, key information extraction, content categorization, and semantic understanding of documents.

**Interactive Document Chat** offers a real-time question-answering interface with context-aware responses based on document content. It supports multi-turn conversations and generates language-specific responses.

**Vector-Based Search** provides semantic document search, content similarity matching, advanced query processing, and multilingual search capabilities.

**Document Management** ensures secure document storage, file organization and categorization, document metadata management, and version control with history tracking.

**User Interface** features a responsive web interface, an intuitive document upload workflow, real-time processing status updates.

#### 2.3 User Characteristics

#### **Primary User Types**

**Academic Researchers** typically include graduate students, professors, and research scholars with intermediate to advanced computer literacy. Their usage pattern involves processing research papers, theses, and other academic documents. They often require multi-lingual document analysis in English, Hindi, and Kannada.

**Business Professionals** include corporate employees, consultants, and analysts with basic to intermediate computer literacy. They primarily use the system for processing business documents, reports, and presentations. Their language needs are mainly English, with occasional support for regional languages.

**Students** consist of undergraduate and graduate learners with basic to intermediate computer literacy. They use the system for study materials, assignment processing, and research support. Their requirements often involve multi-lingual educational content processing.

Government Officials include public sector employees and administrators with basic computer literacy. Their primary usage pattern is the processing of official documents and multilingual form analysis.

#### 2.4 Constraints

#### **Technical Constraints**

**Performance Constraints** specify that the system requires a minimum of 8GB RAM for AI model execution and at least 10GB of free disk space for model caching. GPU acceleration is preferred but not mandatory. Each document processed must not exceed a maximum file size of 10MB.

**Platform Constraints** define that the application is web-based and requires support from modern browsers. The backend runs on Python 3.9+ while the frontend build process depends on Node.js 18+. Windows 10/11 is the primary target operating system for compatibility.

**Resource Constraints** include an AI model loading time of 2 to 5 minutes during the first startup, with memory usage reaching up to 4GB during heavy processing. Network bandwidth is required for the initial download of AI models, which ranges from 2 to 3GB.

**Budget Constraints** emphasize development using free and open-source technologies, avoiding licensing fees for core AI models. Cloud deployment costs may apply if hosting is used, while minimal hardware requirements are expected for deployment.

**Regulatory Constraints** require compliance with data privacy and document content security standards. The system must also ensure open-source license compatibility and avoid any commercial restrictions on AI model usage.

#### 2.5 Assumptions and Dependencies

#### **Assumptions**

The **user environment** assumes that users have access to modern web browsers such as Chrome, Firefox, Safari, or Edge, along with a stable internet connection for the initial setup and model downloads. It is also assumed that users possess basic computer literacy, sufficient for file upload and navigation.

The **technical environment** assumes that the host system meets the minimum hardware requirements, while the Python and Node.js ecosystems remain stable. Additionally, it is expected that the MongoDB database will be consistently available and reliable.

The **business environment** assumes the continued availability of open-source AI models and user acceptance of the processing time required for AI operations. It is also based on the expectation of a growing demand for multi-lingual document processing.

#### **Dependencies**

The system has several external dependencies. **External libraries and frameworks** include the Hugging Face Transformers library for AI models, the FastAPI framework for backend services, React and Vite for frontend development, and the MongoDB database system.

**AI model dependencies** involve the availability of pre-trained language models for Hindi and Kannada, reliable OCR models for accurate text extraction, sentence transformer models for vector embeddings, and summarization models that deliver consistent performance.

**System dependencies** include the operating system's file handling capabilities, a reliable web server deployment environment, strong database connectivity and performance, and stable network access for external model downloads.

# 3 Specific Requirements

# 3.1 Functional Requirements

#### FR ID

#### REQUIREMENT DESCRIPTION

FR1: DOCU	MENT UPLOAD AND VALIDATION
FR1.1	The system SHALL accept document uploads in PDF, DOCX,
	TXT, and common image formats (PNG, JPG)
FR1.2	The system SHALL validate file size limits (maximum 10MB per document)
FR1.3	The system SHALL verify file format integrity before processing
FR1.4	The system SHALL provide real-time upload progress indicators
FR1.5	The system SHALL generate unique identifiers for each uploaded document
FR2: MUL	TI-LANUAGE OCR PROCESSING
FR2.1	The system SHALL extract text from image-based documents using OCR
FR2.2	The system SHALL support Hindi, Kannada, and English text recognition

FR2.3  The system SHALL preserve original document layout duritext extraction  FR2.4  The system SHALL automatically detect document language  FR2.5  The system SHALL maintain text formatting and structure information  FR3: AI-POWERED DOCUMENT ANALYSIS  FR3.1  The system SHALL generate intelligent summaries of process documents  FR3.2  The system SHALL extract key information and topics from document content  FR3.3  The system SHALL provide content categorization based document type  FR3.4  The system SHALL support multi-language summarization
FR2.5  The system SHALL maintain text formatting and structure information  FR3: AI-POWERED DOCUMENT ANALYSIS  FR3.1  The system SHALL generate intelligent summaries of process documents  FR3.2  The system SHALL extract key information and topics from document content  FR3.3  The system SHALL provide content categorization based document type
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document content  The system SHALL provide content categorization based document type
document type
FR3.4 The system SHALL support multi-language summarizate
capabilities
FR3.5 The system SHALL maintain summary quality metrics a confidence scores
FR4: INTERACTIVE CHAT INTERFACE
FR4.1 The system SHALL provide a chat interface for document-bas question answering
FR4.2 The system SHALL maintain conversation context acromultiple queries
FR4.3 The system SHALL generate responses based on document content
FR4.4 The system SHALL support multi-language query processing
FR4.5 The system SHALL provide source attribution for corresponses
FR6: DOCUMENT MANAGEMENT
FR6.1 The system SHALL store processed documents with metadat
FR6.2 The system SHALL provide document listing with filter capabilities

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FR6.3	The system SHALL support document deletion and archival
FR6.4	The system SHALL maintain document access history and statistics
FR6.5	The system SHALL provide document export capabilities
FR7: U	SER SESSION MANAGEMENT
FR7.1	The system SHALL maintain user session state across browser refreshes
FR7.2	The system SHALL provide session timeout management
FR7.3	The system SHALL support concurrent user sessions
FR7.4	The system SHALL maintain user preferences and settings
FR7.5	The system SHALL provide session activity logging
FR8:	SYSTEM CONFIGURATION
FR8.1	The system SHALL provide configurable processing parameters
FR8.2	The system SHALL support AI model switching and updates
FR8.3	The system SHALL provide system health monitoring capabilities
FR8.4	The system SHALL support backup and restore operations
FR8.5	The system SHALL provide system performance metrics
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# **3.2 Non-Functional Requirements**

# NFR ID REQUIREMENT DESCRIPTION

	NFR1: PERFORMANCE REQUIREMENTS	
NFR1.1	Document upload response time SHALL be less than 30 seconds for files up to 10MB	
NFR1.2	OCR processing time SHALL not exceed 2 minutes per document	
NFR1.3	AI model loading time SHALL be less than 5 minutes on system startup	
NFR1.4	Chat response time SHALL be less than 15 seconds for typical queries	
NFR1.5	Search query response time SHALL be less than 5 seconds	
NFR1.6	System SHALL support concurrent processing of up to 10 documents	
NFR2: RELIABILITY REQUIREMENTS		
NFR2.1	System uptime SHALL be 99% during operational hours	
NFR2.2	Document processing success rate SHALL be 95% or higher	
NFR2.3	System SHALL gracefully handle processing failures with error recovery	
NFR2.4	Data integrity SHALL be maintained across system restarts	
NFR2.5	System SHALL provide automatic backup mechanisms	
NFR2.6	Critical errors SHALL be logged with appropriate detail for debugging	
NFR3: USABILITY REQUIREMENTS		
NFR3.1	User interface SHALL be intuitive requiring minimal training	
NFR3.2	System SHALL provide clear error messages and user guidance	
NFR3.3	Interface SHALL be responsive across desktop and tablet devices	
NFR3.4	System SHALL support accessibility standards (WCAG 2.1 Level AA)	
NFR3.5	Processing status SHALL be clearly communicated to users	
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NFR3.6	Help documentation SHALL be integrated within the application	
	NFR4: SECURITY REQUIREMENTS	
NFR4.1	Uploaded documents SHALL be stored securely with access controls	
NFR4.2	System SHALL prevent unauthorized access to user documents	
NFR4.3	Data transmission SHALL use secure communication protocols (HTTPS)	
NFR4.4	User sessions SHALL implement proper authentication and authorization	
NFR4.5	Sensitive data SHALL be encrypted at rest and in transit	
NFR4.6	System SHALL implement input validation to prevent malicious uploads	
	NFR5: SCALABILITY REQUIREMENTS	
NFR5.1	System architecture SHALL support horizontal scaling	
NFR5.2	Database design SHALL accommodate growing document volumes	
NFR5.3	AI model management SHALL support model updates without system downtime	
NFR5.4	System SHALL handle increased user load through load balancing	
NFR5.5	Storage capacity SHALL be expandable without data migration	
NFR5.6	Processing queue SHALL manage multiple concurrent document requests	
NFR6: COMPATIBILITY REQUIREMENTS		
NFR6.1	System SHALL be compatible with major web browsers (Chrome, Firefox, Safari, Edge)	
NFR6.2	Backend SHALL run on Windows, Linux, and macOS environments	
NFR6.3	System SHALL maintain backward compatibility with older document formats	
NFR6.4	API SHALL follow REST principles for third-party integration	
NFR6.5	System SHALL support standard document encoding formats	
NFR6.6	Database schema SHALL be version-controlled for future updates	

# **3.3 External Interface Requirements**

# 3.3.1 User Interfaces

# UI ID REQUIREMENT DESCRIPTION

	UI1: MAIN DASHBOARD INTERFACE
UI1.1	Clean, modern web interface with responsive design
UI1.2	Navigation menu with clear sections: Upload, Documents, Chat.
UI1.3	Real-time system status indicators and processing queues
UI1.4	Multi-language interface support (English, Hindi, Kannada)
	UI2: DOCUMENT UPLOAD INTERFACE
UI2.1	Drag-and-drop file upload area with progress indicators
UI2.2	File format validation with clear error messaging
UI2.3	Upload queue management with batch processing capabilities
UI2.4	Preview functionality for supported document types
	UI3: DOCUMENT PROCESSING INTERFACE
UI3.1	Real-time processing status with detailed progress information
UI3.2	Processing results display with extracted text preview
UI3.3	Document metadata display (language, size, processing time)
UI3.4	Options for reprocessing or downloading results
	UI4: CHAT INTERFACE
UI4.1	Conversational chat interface with message history
UI4.2	Document context selector for targeted queries
UI4.3	Response formatting with source attribution
<b>UI4.4</b>	Multi-language input and response support
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# 3.3.2 Hardware Interfaces

# **HW ID** Requirement Description

	HW1: Server Hardware Interface
HW1.1	Minimum 8GB RAM for AI model execution
HW1.2	10GB+ storage for model caching and document storage
HW1.3	Multi-core CPU support for concurrent processing
HW1.4	Optional GPU acceleration for enhanced AI performance
	HW2: Client Hardware Interface
HW2.1	Standard web browser with JavaScript support
HW2.2	Minimum 2GB RAM for smooth browser operation
HW2.3	Stable internet connection for file uploads and API communication
HW2.4	Display resolution support from mobile to desktop sizes

# 3.3.3 Software Interfaces

SW ID	Requirement Description
	SW1: Database Interface (MongoDB)
SW1.1	Document storage with GridFS for large file handling
SW1.2	Metadata indexing for efficient search and retrieval
SW1.3	User session and preference storage
SW1.4	System configuration and settings management
	SW2: AI Model Interface
SW2.1	HuggingFace Transformers library integration
SW2.2	Model loading and caching mechanisms
SW2.3	GPU/CPU computation backend switching
SW2.4	Model versioning and update management
	SW3: OCR Engine Interface
SW3.1	Multi-language OCR service integration
SW3.2	Image preprocessing and enhancement
SW3.3	Text extraction with layout preservation
SW3.4	Confidence scoring and quality metrics
	SW4: File System Interface
SW4.1	Temporary file storage for processing pipeline
SW4.2	Secure document archival and retrieval
SW4.3	Log file management and rotation
SW4.4	Configuration file reading and validation

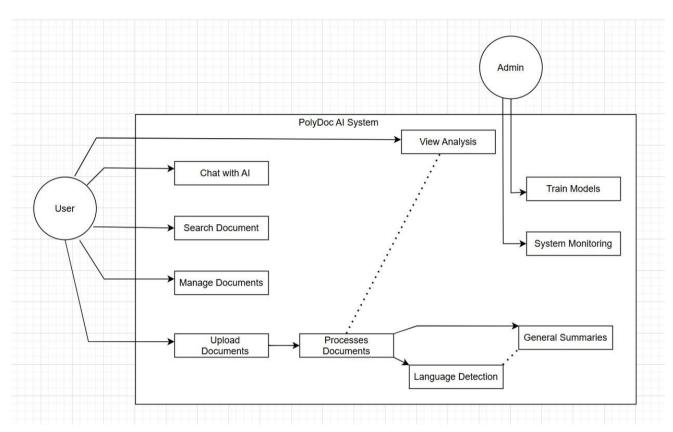
# 3.3.4 Communication Interfaces

# **COM ID** Requirement Description

COM1: RES	T API Interface	
COM1.1	RESTful API endpoints following OpenAI 3.0 specification	
COM1.2	JSON-based request/response format	
COM1.3	HTTP status codes for proper error handling	
COM1.4	API versioning for backward compatibility	
COM2: Web	Socket Interface	
COM2.1	Real-time status updates during document processing	
COM2.2	Live chat functionality with immediate response delivery	
COM2.3	Processing progress notifications	
COM2.4	System health and status broadcasting	
COM3: File Transfer Interface		
COM3.1	Secure file upload with multipart/form-data encoding	
<b>COM3.2</b>	File download with proper MIME type handling	
COM3.3	Resume capability for large file transfers	
COM3.4	Upload progress tracking and cancellation support	

# 4 System Models

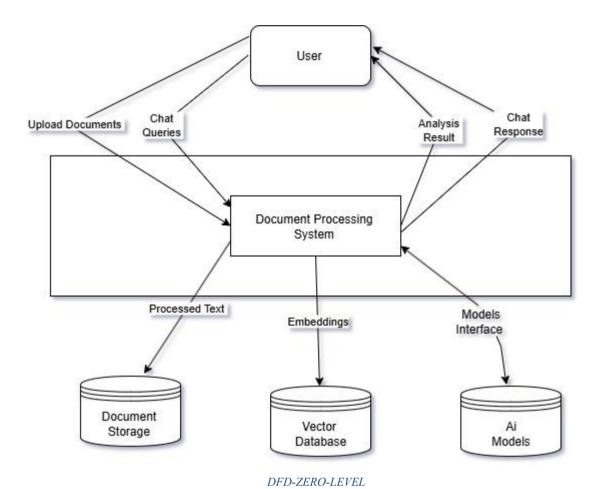
# 4.1 Use Case Diagrams



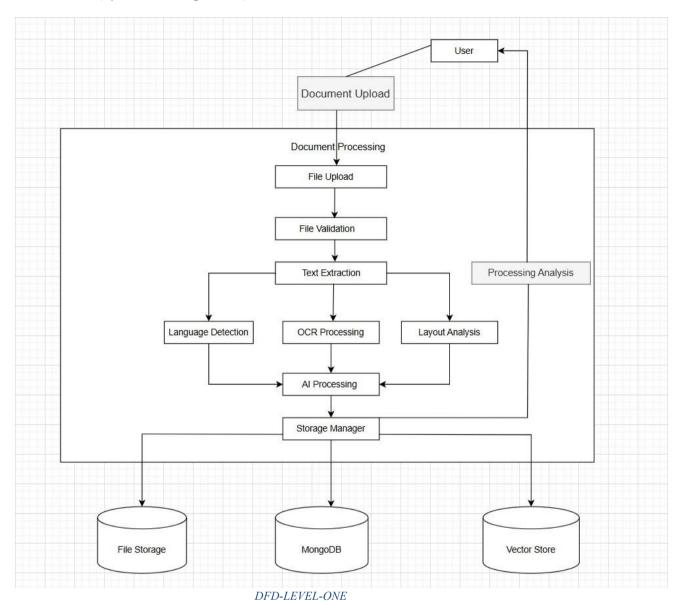
USE CASE DIAGRAM 1

# 4.2 Data Flow Diagrams (DFD)

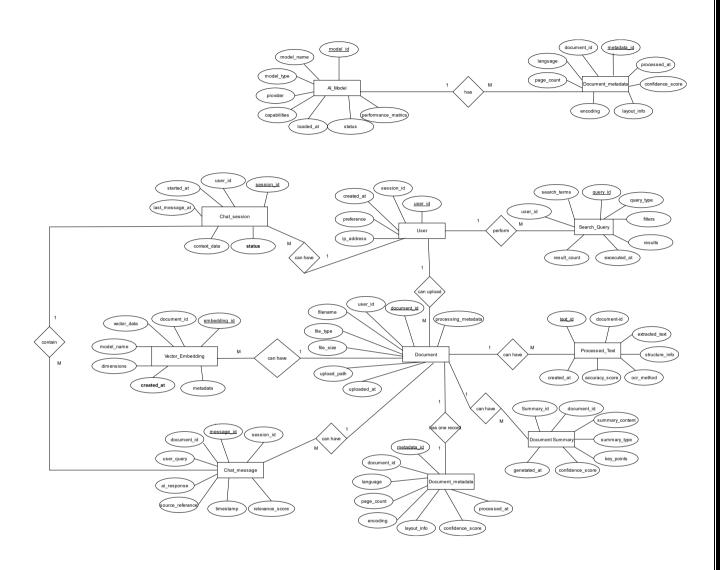
# Level 0 DFD (Context Diagram)



# **Level 1 DFD (System Decomposition)**



# 4.3 Entity-Relationship Diagrams (ERD)





# **Other Requirements**

# **5.1 Safety Requirements**

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ID	REQUIREMENT DESCRIPTION
SR1: DATA SAFETY	
SR1.1	The system SHALL implement automatic data backup mechanisms to prevent document loss
SR1.2	The system SHALL provide data validation to ensure document integrity during processing
SR1.3	The system SHALL implement graceful error handling to prevent system crashes during document processing
SR1.4	The system SHALL provide rollback mechanisms for failed processing operations
SR1.5	The system SHALL isolate user documents to prevent cross-user data contamination
SR2: SYSTEM SAFETY	
SR2.1	The system SHALL implement resource monitoring to prevent system overload

SR2.2	The system SHALL provide circuit breakers for external service dependencies
SR2.3	The system SHALL implement proper exception handling for AI model failures
SR2.4	The system SHALL provide system health checks and automatic recovery mechanisms
SR2.5	The system SHALL implement safe shutdown procedures for maintenance operations
SR3: USER SAFETY	
SR3.1	The system SHALL validate all user inputs to prevent malicious content processing
SR3.2	The system SHALL implement rate limiting to prevent system abuse
SR3.2 SR3.3	
	The system SHALL implement rate limiting to prevent system abuse

# 5.2 Legal/Regulatory Compliance

#### LR ID Requirement Description

# LR1: Data Protection Compliance LR1.1 The system SHALL comply with applicable data protection regulations (GDPR, CCPA) LR1.2 The system SHALL provide user consent mechanisms for data processing LR1.3 The system SHALL implement data retention policies with automatic deletion LR1.4 The system SHALL provide user rights implementation (access, rectification, erasure) LR1.5 The system SHALL maintain data processing audit trails LR2: Intellectual Property Compliance

LR2.1 The system SHALL respect copyright limitations on processed documents

- LR2.2 The system SHALL provide proper attribution for AI model usage

  LR2.3 The system SHALL comply with open-source license requirements
- LR2.4 The system SHALL implement content filtering for copyrighted material
- LR2.5 The system SHALL provide legal disclaimers for AI-generated content

#### LR3: Accessibility Compliance

- **LR3.1** The system SHALL comply with Web Content Accessibility Guidelines (WCAG 2.1)
- **LR3.2** The system SHALL provide alternative text for visual elements
- **LR3.3** The system SHALL support keyboard navigation for all functions
- LR3.4 The system SHALL provide screen reader compatibility
- **LR3.5** The system SHALL implement proper colour contrast and font sizing options

# 5.3 Backup & Recovery

#### BR ID REQUIREMENT DESCRIPTION

BR1: DATA BACKUP REQUIREMENTS	
BR1.1	The system SHALL perform automated daily backups of all user documents and metadata
BR1.2	The system SHALL maintain multiple backup versions with configurable retention periods
BR1.3	The system SHALL implement incremental backup strategies to optimize storage usage
BR1.4	The system SHALL provide backup integrity verification mechanisms
BR1.5	The system SHALL support both local and cloud backup storage options
BR2: SYSTEM RECOVERY REQUIREMENTS	
BR2.1	The system SHALL provide point-in-time recovery capabilities for data restoration
BR2.2	The system SHALL implement disaster recovery procedures with documented RTO/RPO targets

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BR2.3	The system SHALL provide system configuration backup and restoration
BR2.4	The system SHALL support partial recovery for individual user documents
BR2.5	The system SHALL maintain recovery testing procedures and documentation
BR3: BUSINESS CONTINUITY	
BR3.1	The system SHALL provide high availability architecture with minimal downtime
BR3.2	The system SHALL implement failover mechanisms for critical system components
BR3.3	The system SHALL provide data synchronization across backup systems
BR3.4	The system SHALL maintain service degradation procedures during partial failures
BR3.5	The system SHALL provide communication protocols for system outage notifications

# 5.4 Audit and Logging

# AL ID

# REQUIREMENT DESCRIPTION

AL1: SYSTEM AUDIT REQUIREMENTS	
AL1.1	The system SHALL maintain comprehensive audit logs for all user actions
AL1.2	The system SHALL log all document processing activities with timestamps and user identification
AL1.3	The system SHALL implement tamper-proof logging mechanisms
AL1.4	The system SHALL provide audit trail search and filtering capabilities
AL1.5	The system SHALL maintain audit log retention policies compliant with regulations
AL2: SECURITY LOGGING	

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AL2.1	The system SHALL log all authentication attempts and failures	
AL2.2	The system SHALL monitor and log suspicious user activities	
AL2.3	The system SHALL implement real-time security event alerting	
AL2.4	The system SHALL log system configuration changes and administrative actions	
AL2.5	The system SHALL provide security incident response logging capabilities	
AL3: PERFORMANCE AND SYSTEM MONITORING		
AL3.1	The system SHALL log system performance metrics including response times and resource usage	
AL3.2	The system SHALL monitor AI model performance and accuracy metrics	
AL3.3	The system SHALL implement application error logging with detailed stack traces	
AL3.4	The system SHALL provide system capacity monitoring and alerting	
AL3.5	The system SHALL maintain operational dashboards for system health monitoring	
	AL4: COMPLIANCE LOGGING	
AL4.1	The system SHALL maintain data access logs for compliance reporting	
AL4.2	The system SHALL log data processing activities for regulatory audit purposes	

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AL4.3	The system SHALL implement log export capabilities in standard formats
AL4.4	The system SHALL provide automated compliance reporting features
AL4.5	The system SHALL maintain log archival procedures for long-term storage