Software Requirements Specification

for

AI - Driven Knowledge Synthesis Platform

Version 1.0 approved

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Revision History

Name	Date	Reason For Changes	Version

1. Introduction

1.1. Purpose

This SRS defines the requirements for the AI-Driven Knowledge Synthesis Platform, an advanced system that automates the conversion of unstructured data (e.g., PDFs, research papers, spreadsheets, web articles) into structured, multimodal outputs (summaries, quizzes, flashcards, podcasts) using Retrieval-Augmented Generation (RAG) and NLP models.

Key Objectives

- Eliminate manual content curation inefficiencies in education and corporate training.
- Provide cross-document knowledge synthesis to generate cohesive insights.
- Deliver personalized outputs (e.g., summaries for educators, quizzes for students).
- Support scalable deployment on Microsoft Azure for institutional use.

1.2. Document Conventions

- **Priority Levels:**
  - ➢ **High (H):** Core functionality (e.g., document ingestion, RAG pipelines).
  - ➢ **Medium (M):** Enhanced features (e.g., multimodal outputs).
  - ➢ **Low (L):** Nice-to-have features (e.g., advanced analytics).
- **Requirement IDs:** REQ-XX (e.g., REQ-1 for document parsing).
- **TBD:** Placeholder for pending decisions (e.g., third-party API integrations).

1.3. Intended Audience and Reading Suggestions

Audience	Focus Areas
Developers	Sections 2–4 (System Architecture, Functional Requirements)
Testers	Section 4 (System Features) for test case derivation

Project Managers	Sections 1–2 (Scope, Dependencies)
Educators/Users	Section 5 (Nonfunctional Requirements) for usability and security

1.4. Product Scope

- **Problem Statement:**
  - Current tools (e.g., Quizlet, Grammarly) address niche tasks but lack cross-document synthesis and multimodal output generation.
  - Manual curation of training materials/reports is time-consuming (70% reduction goal).
- **Solution:**
  - Unified AI Pipeline: Combines RAG, NLP, and multimodal generation.
- **Use Cases:**
  - **Education:** Auto-generate lecture slides, quizzes, and audio summaries.
  - **Corporate Training:** Synthesize reports from spreadsheets, PDFs, and articles.

1.5. References

[1] "Azure AI Search Documentation," 25 February 2025. [Online]. Available: https://learn.microsoft.com/en-us/azure/search/. [Accessed 10 March 2025].

[2] "FAISS GitHub Wiki," Meta AI Research, 24 February 2025. [Online]. Available: https://github.com/facebookresearch/faiss/wiki. [Accessed 10 March 2025].

[3] "Flask Documentation (3.1.x)," Pallets, 5 January 2025. [Online]. Available: https://flask.palletsprojects.com. [Accessed 10 March 2025].

[4] "LangChain Documentation," LangChain, Inc., 30 January 2025. [Online]. Available: https://python.langchain.com/docs/introduction/. [Accessed 10 March 2025].

[5] "LangChain HuggingFace Integrations Documentations," LangChain, Inc., 16 October 2024. [Online]. Available: https://python.langchain.com/docs/integrations/providers/huggingface/. [Accessed 10 March 2025].

[6] "LangChain Python API Reference," LangChain Inc., 2 March 2025. [Online]. Available: https://python.langchain.com/api_reference/. [Accessed 10 March 2025].

[7] "Gradio Documentation," Gradio, 9 March 2025. [Online]. Available: https://www.gradio.app/docs. [Accessed 10 March 2025].

[8] "Python 3.13.2 documentation," 10 March 2025. [Online]. Available: https://docs.python.org/3/. [Accessed 10 March 2025].

[9] "GitHub Docs," GitHub, Inc., [Online]. Available: https://docs.github.com/en. [Accessed 10 March 2025].

2. Overall Description

2.1. Product Perspective

- **System Context:**
  - Inputs: PDFs, PPTs, spreadsheets, web articles.
  - Processing: Document Chunking → Vector Embeddings → RAG-Based Retrieval → Output Generation.
- **Outputs:** Summaries, quizzes, flashcards, podcasts.
- **Integration:**
  - Frontend: Gradio (Python) + JavaScript for interactivity.
  - Backend: LangChain, Hugging Face Transformers, FAISS.
  - Deployment: Docker containers on Microsoft Azure.

2.2. Product Functions

Function	**Description**	**Priority**
Multi-Format Ingestion	Parse PDFs, CSVs, HTML into structured text.	H
Semantic Embedding	Generate embeddings using LangChain Transformers.	H
Cross-Document Synthesis	Retrieve related content across documents via FAISS.	H
Dynamic Output Generation	Create summaries, quizzes, podcasts tailored to user roles.	M

2.3. User Classes and Characteristics

User Class	**Characteristics**
Educators	Create course materials; need batch processing.
Students	Generate study aids; prefer mobile-friendly outputs.
Professionals	Synthesize reports; require compliance with corporate templates.
Administrators	Manage user access, monitor system performance.

2.4. Operating Environment

- **Backend**: Python 3.13, LangChain, Hugging Face Transformers.
- **Frontend**: Gradio, Chart.js for visualizations.

- **Database**: FAISS (vector storage), Azure SQL (metadata).
- **Deployment**: Azure Web Application.

2.5. Design and Implementation Constraints

- **Data Privacy**: GDPR/FERPA compliance for educational data.
- **Performance**: <2s response time for queries.

2.6. User Documentation

- User Manual: PDF + interactive in-app guide.
- API Docs: Swagger/OpenAPI for developers.

2.7. Assumptions and Dependencies

- Assumption: Users have basic technical literacy to upload documents.
- Dependency: Microsoft Azure for cloud hosting.

3. External Interface Requirements

3.1. User Interfaces

- **Dashboard:** Role-based views (educator/student/professional).
- **Upload Portal:** Drag-and-drop with real-time preview.
- **Output Customization:** Sliders for summary length, quiz difficulty.

3.2. Hardware Interfaces

- **Minimum:** 4GB RAM, 2GHz CPU (local testing).
- **Cloud:** Azure VMs with GPU support (NLP tasks).

3.3. Software Interfaces

Component	Integration Purpose
LangChain	Document chunking, RAG pipelines.
Hugging Face	Text generation (e.g., GPT-4 for summaries).
Azure Cognitive Services	Text-to-speech for podcasts.

3.4. Communications Interfaces

- APIs: RESTful endpoints (Flask backend).
- Security: OAuth 2.0 (user auth), TLS 1.3 (encryption).

4. System Features

4.1. Multi-Format Document Ingestion

i. **REQ-1:** Support PDF, CSV, PPTX, HTML uploads.

ii. **REQ-2:** Auto-detect file type and extract text.

4.2. Cross-Document Knowledge Synthesis

iii. REQ-3: Hybrid search (keyword + vector similarity) via FAISS.

iv. **REQ-4:** Metadata tagging for source attribution.

4.3. Multimodal Output Generation

v. **REQ-5:** Role-based summarization (e.g., "student" vs. "professor" mode).

vi. **REQ-6:** Auto-generate MCQs with distractor options.

5. Other Non-functional Requirements

5.1. Performance Requirements

i. Process 100+ documents in parallel.

ii. 99.9% uptime for Azure-hosted instances.

5.2. Safety Requirements

iii. Plagiarism checks via source embedding traceability.

5.3. Security Requirements

iv. AES-256 encryption for data at rest.

5.4. Software Quality Attributes

v. **Scalability**: Modular design for new output types.

vi. **Usability:** 90% success rate in user testing.

5.5. Business Rules

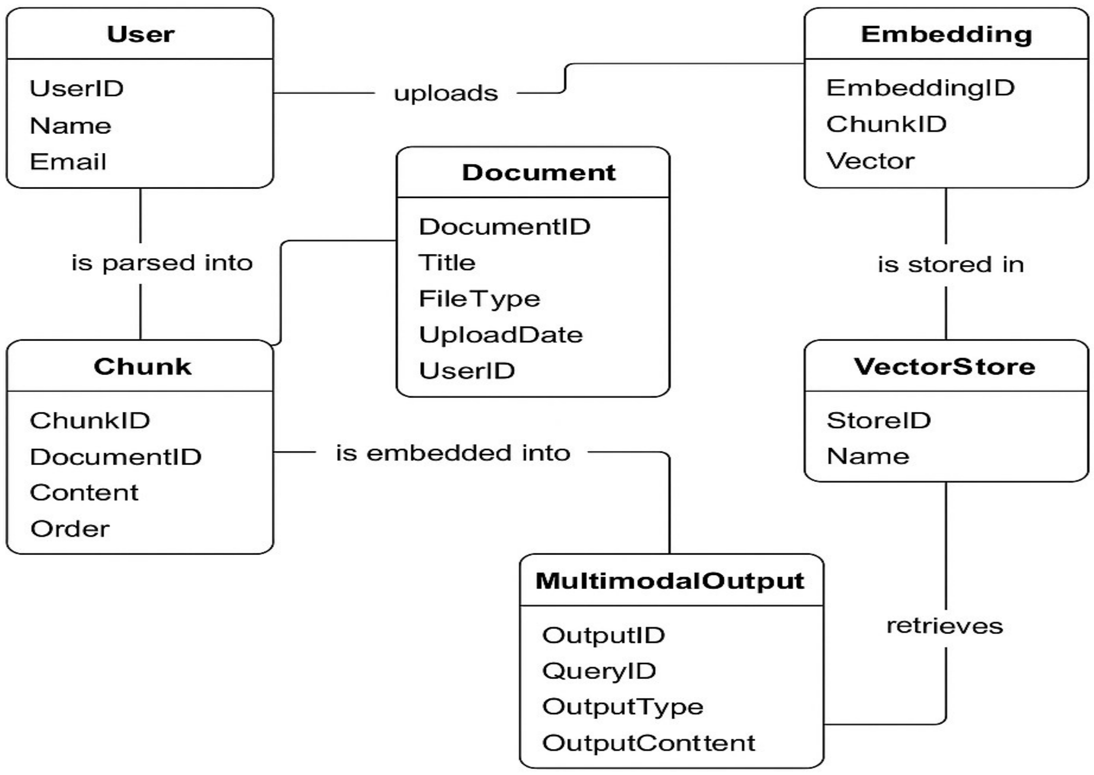
vii. Only admins can deploy NLP model updates.

Appendix A: Glossary

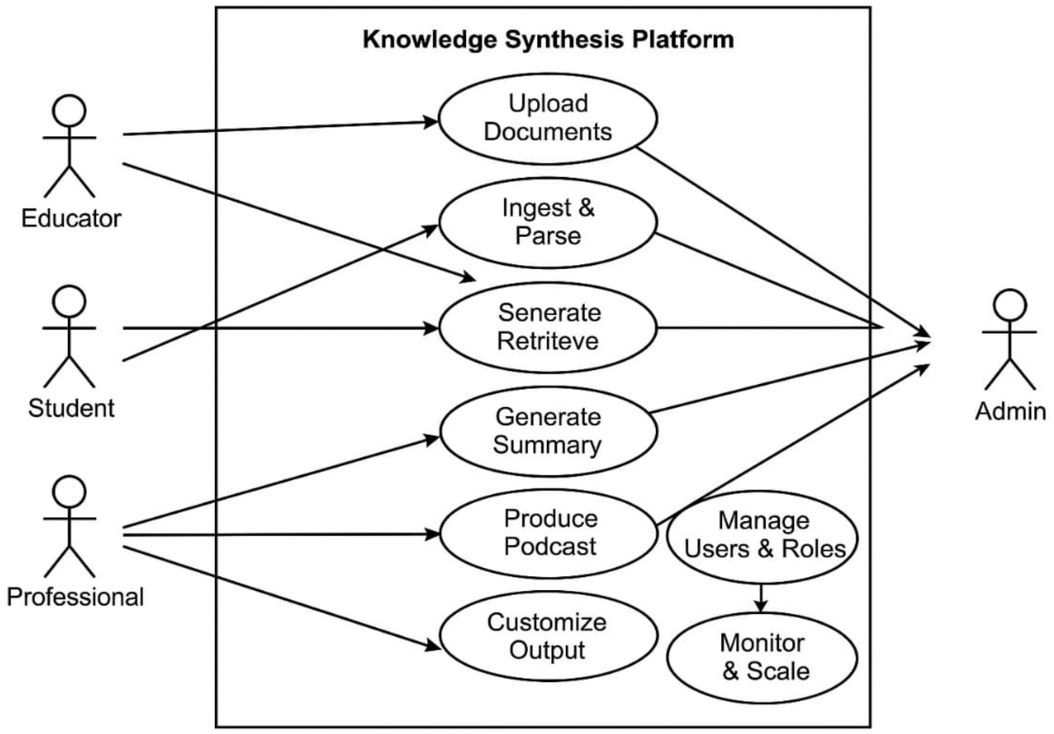
- **RAG Pipeline:** A retrieval-augmented generation system that enhances response relevance.
- **FAISS**: Facebook's vector similarity search library for efficient retrieval of semantically relevant document chunks during RAG pipeline execution.
- **Embedding:** A numerical representation of text for semantic similarity.
- **Docker:** A platform for containerizing applications

Appendix B: Analysis Models

ENTITY-RELATIONSHIP DIAGRAM (ERD)



THE USE CASE DIAGRAM



Appendix C: To Be Determined List

i. **TBD-1:** Finalize TTS API (Azure vs. Google WaveNet).

ii. **TBD-2:** Implement RBAC for enterprise clients.