JESA

SOFTWARE REQUIREMENTS SPECIFICATION DOCUMENT

FOR

Hexagon Smart Completions Intelligent Agent

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1. Project Context

The Hexagon Smart Completions Intelligent Assistant is an AI-powered conversational solution that uses Retrieval-Augmented Generation (RAG) combined with vision-based reasoning to support field engineering, completions, and commissioning workflows. The system integrates with existing Hexagon documentation (including images with annotated callouts)

This AI agent will be deployed in a secure and user-friendly web interface, providing role-based answers to different categories of users including **Administrators**, **Supervisors**, **Field Technicians**, and **Project Engineers**.

2. Overall Description

2.1. Product Perspective

The key objectives of this project are:

- Build an intelligent, conversational virtual agent capable of answering questions from Smart Completions documentation.
- Provide targeted assistance for multiple roles (Administrator, Supervisor, Field Technician, Project Engineer).
- Ensure the AI can interpret screenshots and annotated visual content found in the documentation (such as red circles, highlighted boxes, callouts).
- Integrate advanced security features with robust role-based authentication.
  Deliver a modern, responsive, and futuristic user interface for excellent user experience.
- Ensure an open-source, modular, and scalable technology stack, with the option to add future features.

2.2. Product Functions

- Semantic Q&A
- Visual reasoning (OCR + LayoutLM)
- Secure role-based access
- Responsive interface
- Dynamic data API enrichment

2.3. User Classes and Characteristics

User Class	Description
Administrator	Config and oversight
Supervisor	Task approval
Field Technician	Field inspections
Project Engineer	Setup, progress tracking

2.4. Operating Environment

- Web browsers
- FastAPI backend
- Vector DB (Weaviate)
- Clerck
- Dockerized on Linux

3. System Features

Web Interface	Backend Services	LLM Agent System	Database Layer
- Dashboard - Knowledge Manager -Analytics & Reporting	- REST API - Authentication Service - Role & Permissions Manager	- LLM Orchestrator - Chain-of-Thought Engine - Prompt Templates - Hybrid RAG - Action Tools (Knowledge Base, Excel, Word, Logging)	- MongoDB for document and structured data - Vector database for embeddings

3.1. Semantic Question Answering Using RAG

High priority: Retrieves relevant text using vector DB + LLM. Supports multi-turn questions.

3.2. Visual Reasoning (OCR / LayoutLM)

High priority: Parses screenshots, highlighted callouts, forms.

3.3. Secure Role-based Authentication

High priority. Uses Keycloak with OAuth2, JWT, session expiry.

3.4. Dynamic Data API Retrieval

Medium priority. Brings live data from external API into answers.

4. Data Sources

Source	Format
Hexagon Smart Completions manuals	PDF
JESA Procedures	Word, PDF, Excel

5. Functional Requirements

- The agent must be capable of multi-turn, context-aware conversations.
- It must deliver role-based filtered answers depending on the user's access.
- It should be able to analyze text and visual elements, including highlighted screenshots.
- It must provide secure login with robust user session control.
- The application must handle future document additions with minimal rework.

6. Authentication & Authorization

- **Clerk**
  - SaaS identity management
  - OAuth2 & JWT based
  - User registration, password management, role handling
  - Integrates seamlessly with the React frontend

7. Technologies and Roles

Technology	Role in the Solution
React.js	Building the user interface with dynamic, real-time updates
FastAPI	Backend API, high-performance, async endpoints to serve chat responses
LangChain with RAG	Orchestrate language model calls, tool routing, memory management, answer user questions reliably, with context-aware
SentenceTransformers	Generating vector embeddings for semantic search
Weaviate	Vector database to store searchable knowledge chunks
PaddleOCR	Extracting raw text from screenshots
LayoutLM (Hugging Face)	Understanding form layouts, text positions, and graphical annotations in screenshots
OpenAI GPT-4	Reasoning engine to generate fluent answers
Clerk	User identity and role-based authentication
JWT	Secure token-based session management
Docker	Containerization of the complete stack