DocuVault - Document Management System with RAG Chatbot

📖 Project Overview

DocuVault is a comprehensive Django-based Document Management System (DMS) designed for secure, efficient, and intelligent document handling. It features role-based access control, version tracking, robust collaboration tools, and a state-of-the-art **AI-powered RAG (Retrieval-Augmented Generation) chatbot** that allows users to query their documents in natural language.

🚀 Features

🤖 AI-Powered RAG Chatbot

The system integrates a sophisticated RAG pipeline to provide intelligent document interaction:

- **Intelligent Document Search**: Ask questions about your documents in natural language.
- **Context-Aware Responses**: Utilizes the **Qwen2.5-7B** Large Language Model (LLM) for high-quality, accurate answers.
- **Source Citations**: Transparently provides citations, showing exactly which document pages were used to generate the answer.
- **Conversation Memory**: Maintains context across multi-turn conversations for natural follow-up questions.
- **Document Indexing**: Automatic vectorization of PDF documents using **Qwen3-Embedding-0.6B**.
- **GPU Acceleration**: Fully supports CUDA for fast inference on supported hardware.
- **Permission-Aware**: Respects document access levels; users can only query documents they are authorized to view.
- **Hallucination Prevention**: Strictly adheres to the provided context to minimize false information.

👥 User Management & Authentication

- **Guest Users**: Limited access to view public documents and register accounts.
- **Regular Users**: Full document management capabilities for their own files.
- **Admin Users**: Complete system administration and oversight.
- **Role-Based Access Control (RBAC)**: Granular permission system with custom roles and hierarchical levels (1-100).
- **Secure Authentication**: Robust login and registration system.
- **User Profiles**: Rich profiles with avatars, bios, and activity history.

📄 Document Management

- **Upload & Storage**: Securely upload and store documents with support for various file types.
- **Access Control Levels**:
  - **Public**: Accessible to all users.
  - **Private**: Restricted to the owner.

    - **Role-Based**: Accessible to users with a specific role level or higher.
    - **Custom**: Shared with specific individual users.
- **Version Control**: comprehensive history of document versions with change notes.
- **Metadata Tracking**:
    - Title, description, category, and tags.
    - File size, type, view counts, and download counts.
- **Document Locking**: Prevents concurrent edits to ensure data integrity.
- **Soft Delete**: Safety mechanism to recover accidentally deleted documents.

🔍 Search & Discovery

- **Advanced Search**: Full-text search capabilities with powerful filters.
- **Organization**:
    - **Categories**: Hierarchical system with color-coding and icons.
    - **Tags**: Flexible tagging for cross-category organization.
- **Filtering & Sorting**: Filter by owner, date, access level; sort by views, title, date, etc.

🤝 Collaboration

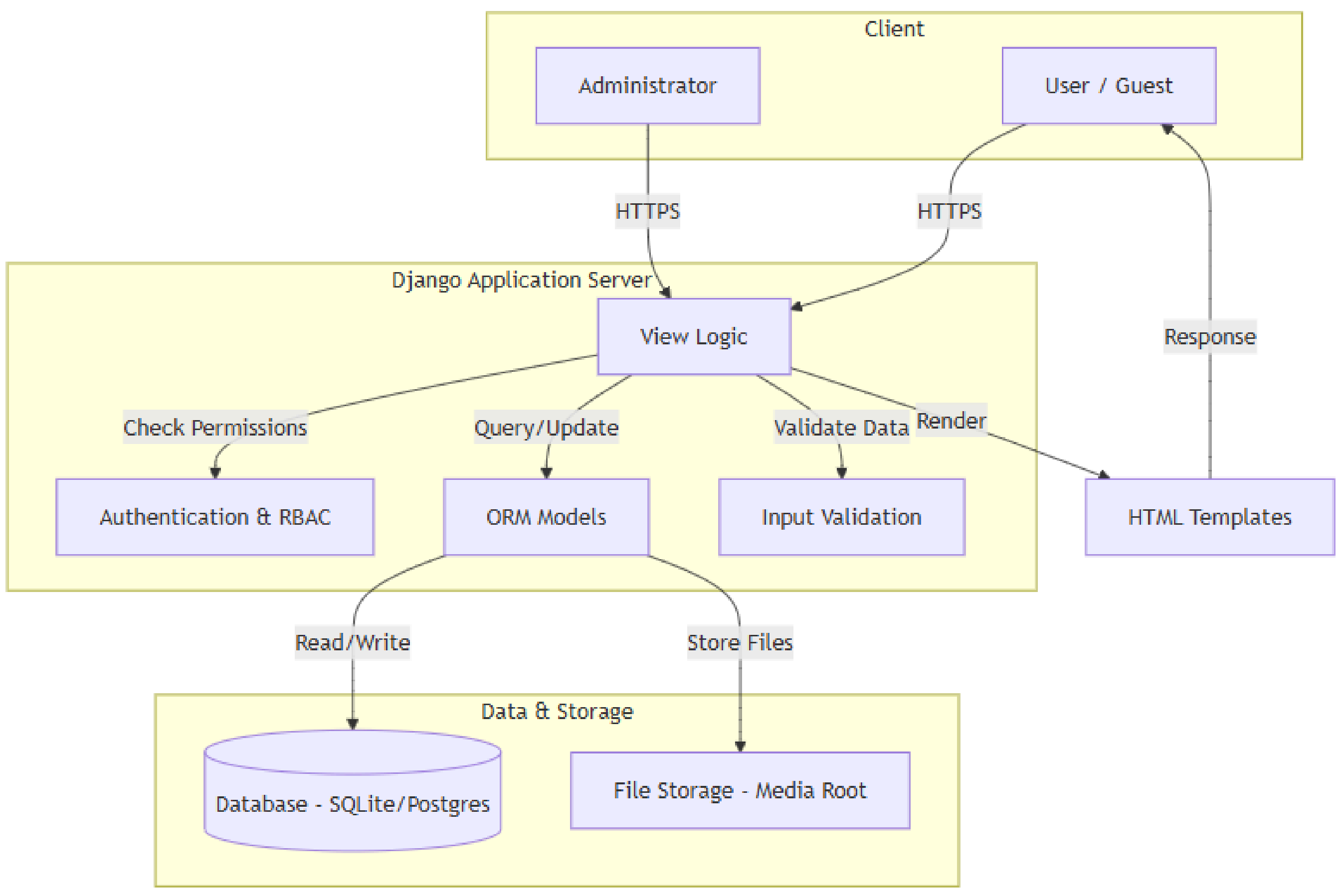
- **Comments & Replies**: Threaded discussions directly on documents.
- **Sharing**:
    - Direct sharing with specific users.
    - **Shareable Links**: Generate temporary, secure links with password protection, expiration dates, and access limits.
- **Notifications**: Real-time alerts for shares, comments, mentions, and permission changes.

🛠️ Additional Tools

- **Favorites/Bookmarks**: Quick access to frequently used documents.
- **Activity Logging**: Detailed audit trail of all user actions.
- **Dashboard**: Personalized overview of recent activity and stats.
- **Bulk Operations**: Upload multiple documents simultaneously.
- **File Preview**: View documents before downloading.

🏗️ System Architecture

DMS Architecture Diagram



Project Structure

```
DocuVault/
├── config/                # Django project settings (settings, urls, wsgi)
├── documents/             # Main Django app
│   ├── models.py          # Database models
│   ├── views.py           # View functions
│   ├── rag_views.py       # RAG chatbot views
│   ├── urls.py            # URL routing
│   ├── forms.py           # Form definitions
│   ├── admin.py           # Admin interface
│   ├── rag/               # RAG system modules (See RAG Architecture below)
│   ├── templates/         # HTML templates
│   └── migrations/        # Database migrations
├── media/                 # User uploaded files
│   ├── documents/         # Document files
│   ├── avatars/           # User avatars
│   └── rag/               # RAG data (Vector DB)
├── static/                # Static files (CSS, JS)
├── fix_dependencies.py    # Automated installer
├── test_rag.py            # RAG testing script
└── manage.py              # Django management
```

RAG Module Architecture

The RAG system is modular and self-contained within `documents/rag/`:

```
documents/rag/
├── __init__.py              # Module exports
├── config.py                # Central configuration (RAGConfig)
├── document_processor.py    # PDF loading and chunking (DocumentProcessor)
├── embeddings.py            # Embedding generation (EmbeddingManager)
├── vector_store.py          # ChromaDB vector database (VectorStore)
├── llm_manager.py           # LLM loading and inference (LLMManager)
├── retriever.py             # Query processing and retrieval (Retriever)
└── conversation.py          # Chatbot with memory (RAGChatbot)
```

🔧 Technical Details

Technology Stack

- **Backend**: Django 4.2.26
- **Database**: SQLite (default) / PostgreSQL (production ready)
- **Frontend**: HTML, Vanilla CSS, JavaScript
- **AI/ML Frameworks**:
  - **LangChain** 0.1.20
  - **Transformers** (HuggingFace)
  - **Sentence-Transformers**
  - **PyTorch** (with CUDA support)
- **Vector Database**: ChromaDB (Persistent storage)

RAG Components & Models

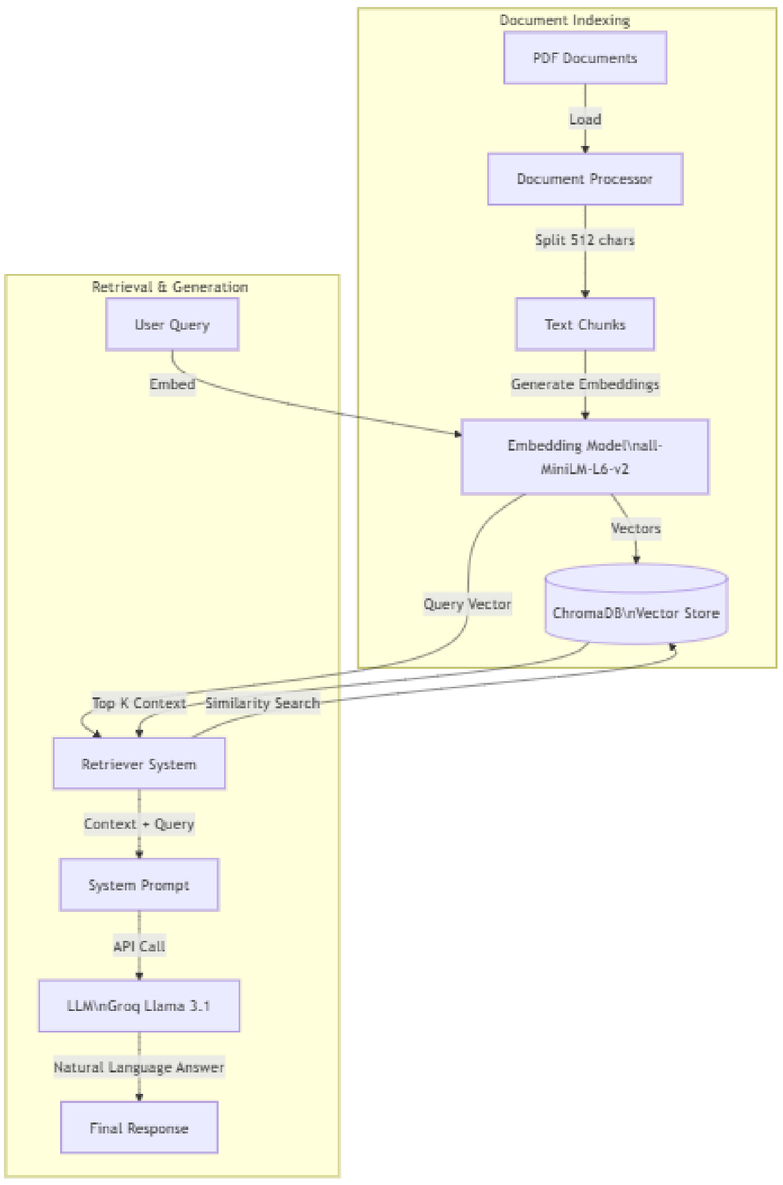
The RAG system is built on high-performance open source models and cloud-based inference:

1. **Large Language Model (LLM)**:
   - **Model**: `llama-3.1-8b-instant` (via Groq)
   - **Provider**: Groq API
   - **Role**: Generates natural language answers based on retrieved context with ultra-low latency.
   - **Note**: Requires a `GROQ_API_KEY` environment variable.
2. **Embeddings**:
   - **Model**: `all-MiniLM-L6-v2`
   - **Library**: Sentence-Transformers
   - **Role**: Converts text into semantic vector representations for similarity search.
   - **Performance**: Fast and efficient model optimized for semantic search tasks.
3. **Vector Store**:
   - **Technology**: ChromaDB
   - **Role**: Stores document embeddings and metadata for fast retrieval.
4. **Configuration (`config.py`)**:

- **Chunk Size**: 512 characters
- **Chunk Overlap**: 100 characters
- **Similarity Threshold**: 0.15
- **Max New Tokens**: 512

RAG Workflow

RAG Flowchart



1. **Ingestion**: PDFs are loaded via `DocumentProcessor`.
2. **Chunking**: Text is split into overlapping chunks (512 chars).
3. **Embedding**: `EmbeddingManager` converts chunks to vectors using `all-MiniLM-L6-v2`.
4. **Storage**: Vectors are stored in `VectorStore` (ChromaDB).
5. **Retrieval**: User query is embedded; `Retriever` fetches relevant chunks.
6. **Generation**: `LLMManager` sends the query + context to Groq's `llama-3.1-8b-instant` for response generation.
7. **Memory**: `RAGChatbot` manages conversation history for context.

🗄️ Database Models

Core Models

1. **User** (Extended AbstractUser): Custom user model with role, bio, avatar, and department.
2. **Role**: Hierarchical roles (levels 1-100) for RBAC.
3. **Document**: Central model for files, including access levels, versioning, and counters.
4. **Category**: Hierarchical organization with colors and icons.
5. **Tag**: Many-to-many tagging system.

Supporting Models

6. **DocumentVersion**: Tracks history of document changes.
7. **DocumentComment**: Threaded comments on documents.
8. **SharedLink**: Manages temporary, secure sharing links.
9. **Favorite**: User bookmarks.
10. **ActivityLog**: Comprehensive audit trail.
11. **Notification**: User alerts system.

RAG System Models

12. **ChatSession**: Manages user chatbot sessions.
13. **ChatMessage**: Stores individual messages and their source citations.
14. **DocumentEmbedding**: Tracks indexing status and metadata for RAG.

🔐 Permission & Security

Access Levels

- **Public**: Open to all.
- **Private**: Owner only.
- **Role-Based**: Restricted by role hierarchy (e.g., Level 30+).
- **Custom**: Explicitly granted to specific users.

Security Features

- **Authentication**: Django's secure password hashing and session management.
- **CSRF Protection**: Enabled on all forms.
- **Input Validation**: Strict file upload validation (size/type) and XSS protection.
- **SQL Injection**: Prevented via Django ORM.
- **Audit Logging**: All sensitive actions are logged.

🛣️ URL Structure

- **Auth**: `/register/`, `/login/`, `/logout/`

- **Core**: `/` (Home), `/dashboard/`
- **Documents**: `/documents/`, `/documents/create/`, `/documents/<id>/` (view/edit/delete/download)
- **RAG Chatbot**: `/chatbot/`
- **Collaboration**: `/documents/<id>/comments/create/`, `/documents/<id>/share/`
- **Admin**: `/admin/users/`, `/admin/roles/`
- **Profile**: `/profile/`, `/profile/edit/`

🔧 Installation & Setup

Prerequisites

- **Python**: 3.10+
- **RAM**: 8GB+ (16GB recommended for RAG).
- **Groq API Key**: Required for the chatbot functionality.
- **Storage**: ~5GB free space (mostly for dependencies and vector DB).

Quick Start

1. **Clone Repository**:
```
git clone https://github.com/ft-prince/DocuVault.git
cd DocuVault
```
2. **Environment Setup**:
```
pip install uv

uv venv
# Windows
venv\Scripts\activate
# Linux/Mac
source venv/bin/activate

uv sync
```
3. **Install Dependencies**:
```
# Automated
python fix_dependencies.py

# OR Manual
pip install -r requirements.txt
pip install -r requirements_rag.txt

# OR just use uv
uv sync
```

4. **Set Environment Variables**:
   Create a `.env` file in the project root and add your Groq API key:
   ```
   GROQ_API_KEY=your_api_key_here
   ```
5. **Database Migration**:
   ```
   python manage.py migrate
   ```
6. **Create Admin**:
   ```
   python manage.py createsuperuser
   ```
7. **Run Server**:
   ```
   python manage.py runserver
   ```
   - App: http://127.0.0.1:8000/
   - Admin: http://127.0.0.1:8000/admin/
   - Chatbot: http://127.0.0.1:8000/chatbot/

Windows Automated Setup

Use the provided scripts for a one-click setup:

- PowerShell: `.\setup_windows.ps1`
- CMD: `setup_windows.bat`

RAG Model Setup

The system uses `all-MiniLM-L6-v2` for embeddings, which will be downloaded automatically on the first run (~80MB). The LLM is accessed via the Groq API, so no large local model download is required.

📝 Usage Examples

RAG Chatbot

```python
from documents.rag import RAGChatbot, RAGConfig
from documents.rag.document_processor import DocumentProcessor

# Initialize
config = RAGConfig()
chatbot = RAGChatbot(config=config)
chatbot.initialize()

# Index Documents
processor = DocumentProcessor(config=config)
docs = processor.load_documents_from_directory('./my_docs')
chatbot.index_documents(docs)

# Query
answer, sources = chatbot.query("What is the project timeline?")
print(answer)
```

Document Management (Code)

```python
# Create a restricted document
doc = Document.objects.create(
    title='Confidential Report',
    file='report.pdf',
    owner=user,
    access_level='role',
    required_role_level=50  # Only for senior roles
)

# Check permissions
if doc.can_view(user):
    print("Access Granted")
```

⚙️ Configuration Options (RAG)

Modify `documents/rag/config.py` to tune performance:

Parameter	Default	Description
`CHUNK_SIZE`	512	Characters per chunk.
`CHUNK_OVERLAP`	100	Overlap between chunks to preserve context.
`N_RESULTS`	6	Number of chunks to retrieve per query.

Parameter	Default	Description
`SIMILARITY_THRESHOLD`	0.15	Minimum relevance score for retrieval.
`MAX_NEW_TOKENS`	512	Maximum length of the LLM response.
`TEMPERATURE`	0.2	Creativity of the response (0.0-1.0).

🚦 Future Enhancements

- [ ] **Multi-language Support**: Expand RAG capabilities to non-English documents.
- [ ] **Document Summarization**: Auto-generate summaries upon upload.
- [ ] **Async Indexing**: Use Celery for background document processing.
- [ ] **Real-time Collaboration**: WebSocket integration for live editing/viewing.
- [ ] **Cloud Storage**: AWS S3 / Google Drive integration.
- [ ] **Hybrid Search**: Combine keyword search with semantic search.
- [ ] **Multi-modal Support**: RAG support for images and tables within PDFs.

� Project Implementation Timeline

The project development is structured into distinct phases to ensure a robust and scalable delivery.

Phase	Description	Date	Key Deliverables	Phase Status
Phase 1	**Planning & Architecture**	Oct 01 - Oct 14, 2025	• ✅ Requirement Analysis • ✅ Database Schema Design • ✅ Technology Stack Selection • ✅ UI/UX Wireframes	✅ Completed
Phase 2	**Core DMS Development**	Oct 15 - Nov 11, 2025	• ✅ User Authentication & RBAC • ✅ Document CRUD Operations • ✅ File Upload & Storage System • ✅ Basic Search Functionality	✅ Completed
Phase 3	**RAG System Integration**	Nov 12 - Nov 30, 2025	• ✅ PDF Processing & Chunking Pipeline • ✅ Vector Database (ChromaDB) Setup • ✅ LLM Integration (Groq) • ✅ Chatbot Interface Implementation	✅ Completed

Phase	Description	Date	Key Deliverables	Phase Status
Phase 4	**Advanced Features & UI**	Dec 01 - Dec 14, 2025	• 🔄 Advanced Search & Filtering • 🔄 Collaboration Tools (Comments, Sharing) • ⏳ Dashboard & Analytics • 🔄 Frontend Styling & Responsiveness	🔄 In Progress
Phase 5	**Testing & Optimization**	Dec 15 - Dec 21, 2025	• ⏳ Unit & Integration Testing • ⏳ Performance Tuning (RAG Latency) • ⏳ Security Audits • ⏳ User Acceptance Testing (UAT)	⏳ Pending
Phase 6	**Deployment & Handover**	Dec 22 - Dec 28, 2025	• ⏳ Production Environment Setup • ⏳ CI/CD Pipeline Configuration • ⏳ Final Documentation • ⏳ Project Handover	⏳ Pending

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� 📄 License

This project is open source and available for educational and commercial use.

👥 Contributing

Contributions are welcome! Please submit a Pull Request.