RAG MCP 서버

With ChromaDB, LangChain, Claude LLC

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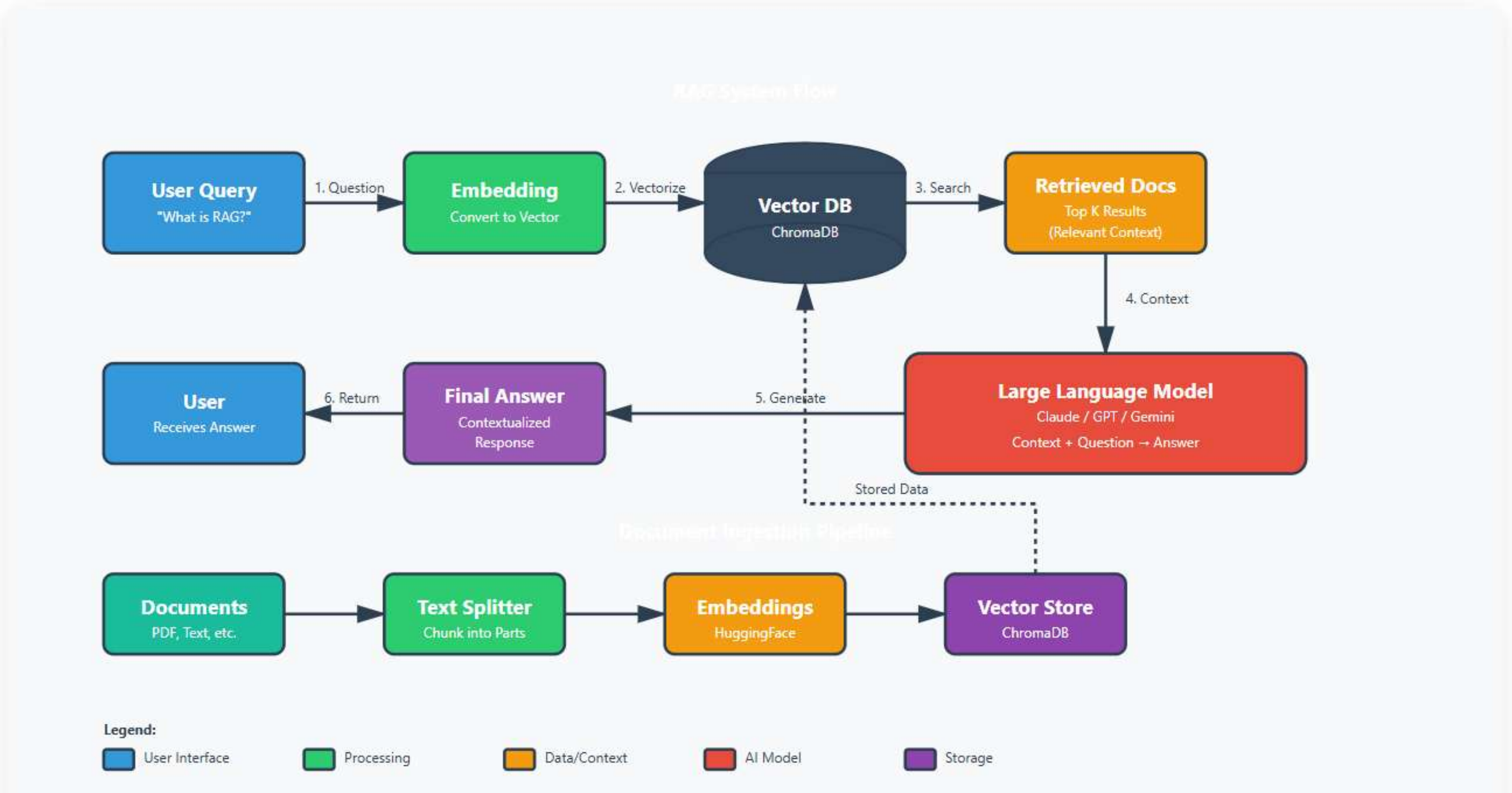
🔍 RAG (Retrieval-Augmented Generation) Architecture



🤖 RAG Process Flow

1 **Document Ingestion (add_documents)**

Receive source documents → Split into chunks using RecursiveCharacterTextSplitter → Convert to vectors using HuggingFace embeddings → Store in ChromaDB with metadata

2 **Vector Search (search_documents)**

Convert user query to embedding → Search ChromaDB using cosine similarity → Return top k documents (default: 4)

3 **Context Construction**

Merge retrieved documents into unified context → Maintain document order and source information → Generate prompt template

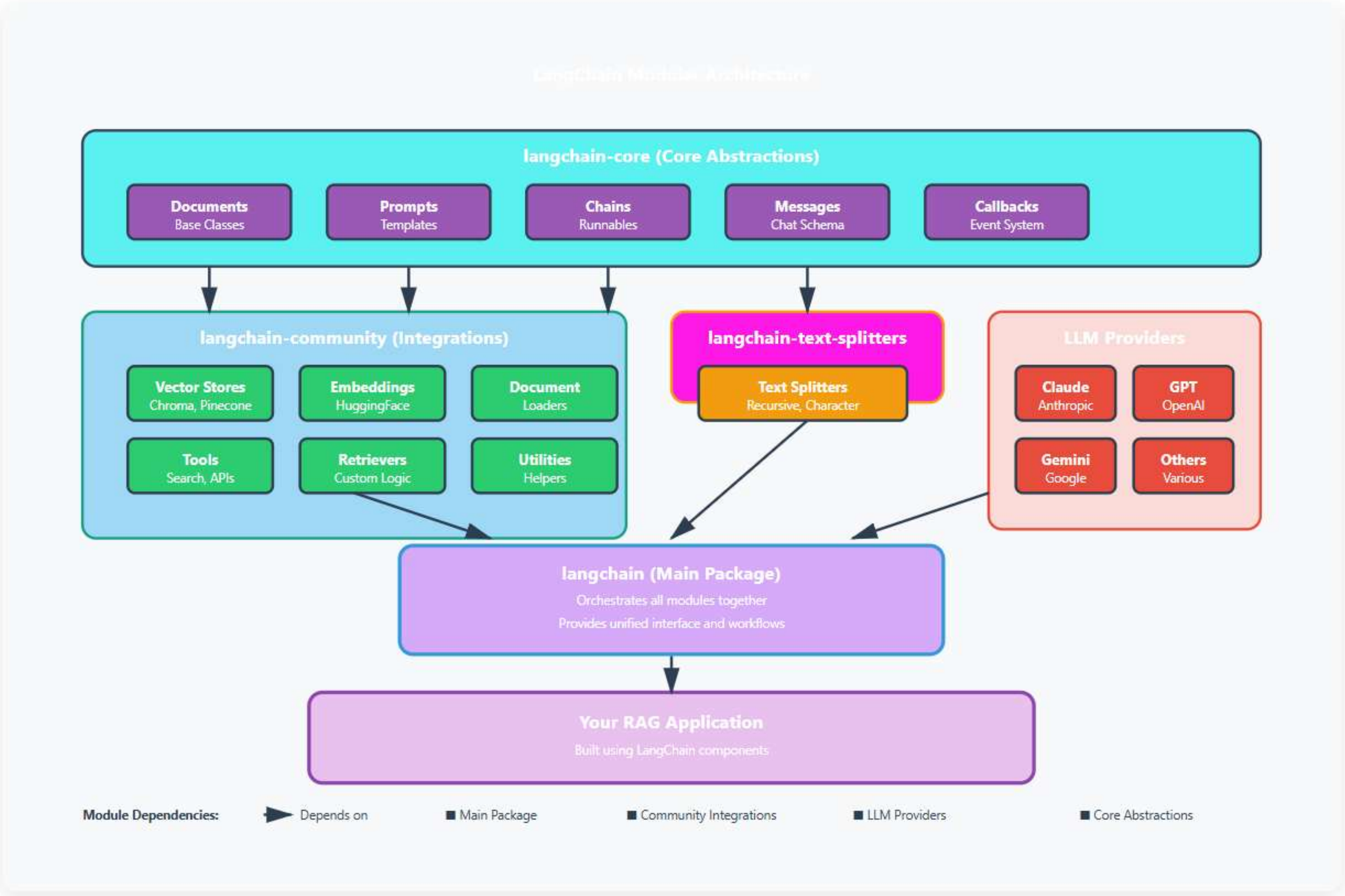
4 **AI Answer Generation (rag_query)**

Send context + question to Claude API → Claude Sonnet 4 model generates answer → Return result with source citations

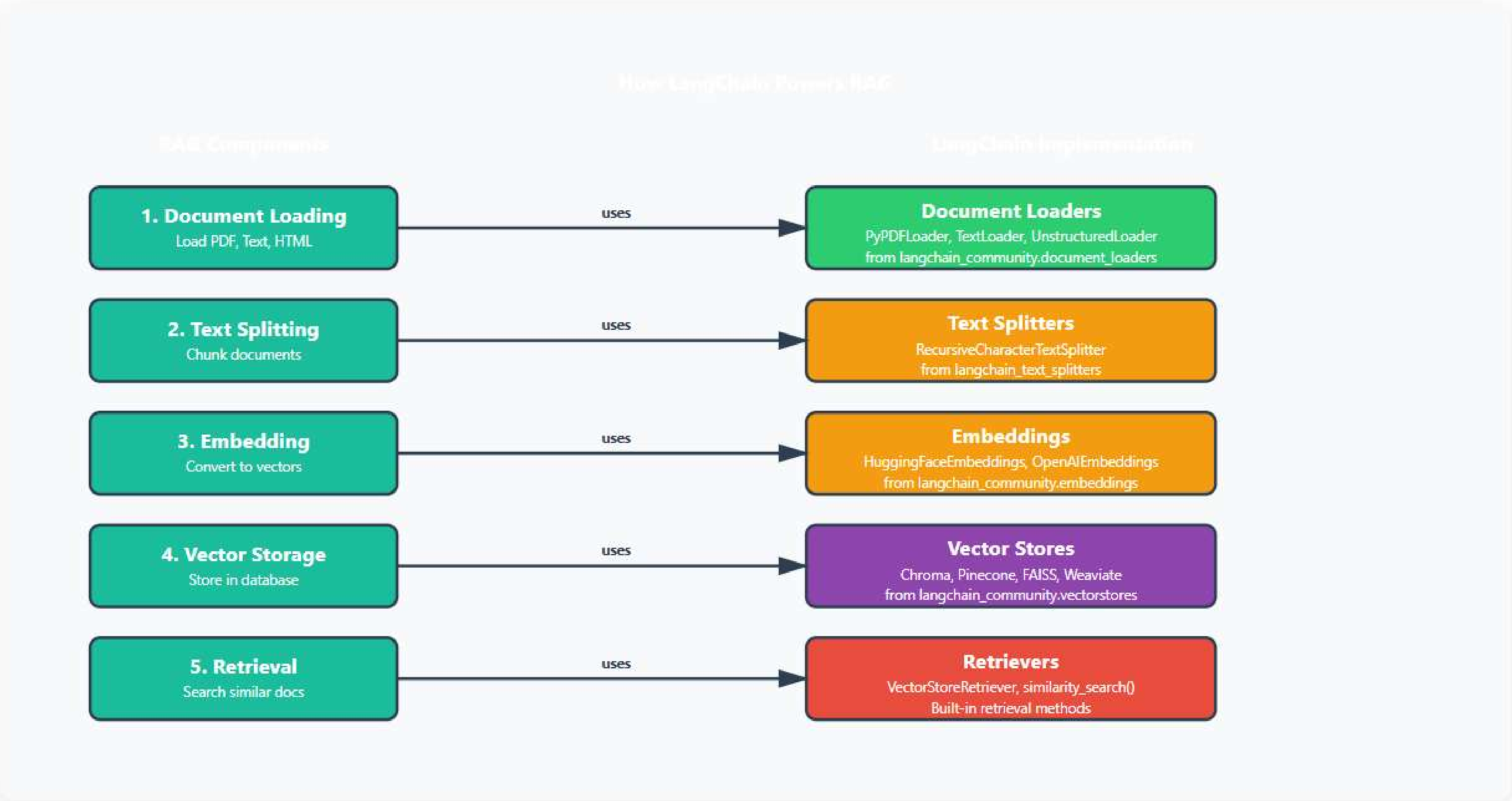
5 **Result Formatting & Return**

Format answer text + reference document info → Include metadata (source, chunk position, etc.) → Deliver final result to user

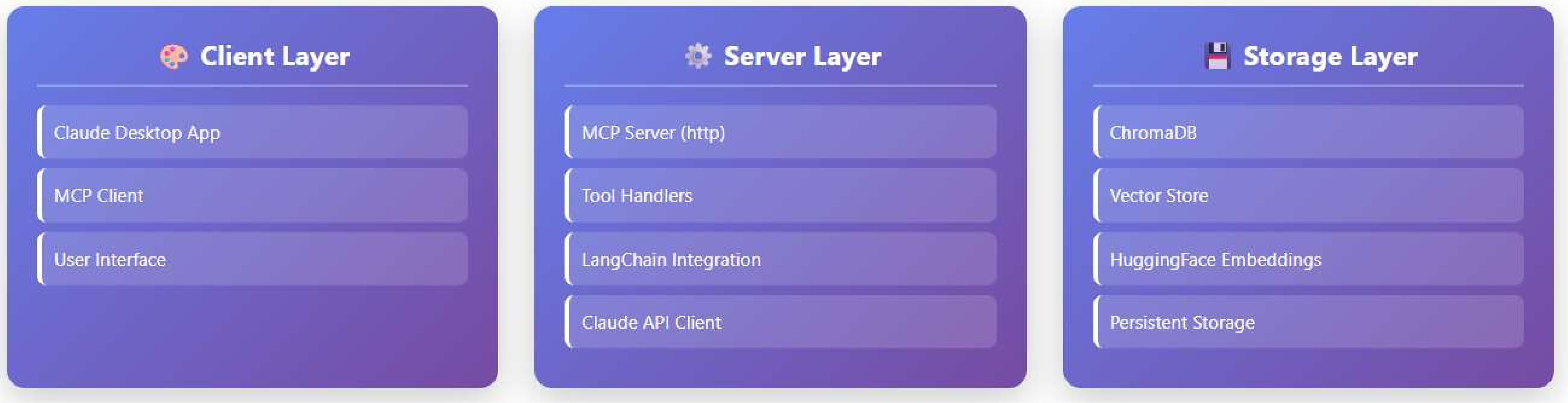
⛓️ LangChain 1.0 Architecture



🔗 RAG + LangChain Integration


How LangChain Powers RAG
RAG Components
LangChain Implementation
1. Document Loading
Load PDF, Text, HTML
uses
Document Loaders
PyPDFLoader, TextLoader, UnstructuredLoader
from langchain_community.document_loaders
2. Text Splitting
Chunk documents
uses
Text Splitters
RecursiveCharacterTextSplitter
from langchain_text_splitters
3. Embedding
Convert to vectors
uses
Embeddings
HuggingFaceEmbeddings, OpenAIEmbeddings
from langchain_community.embeddings
4. Vector Storage
Store in database
uses
Vector Stores
Chroma, Pinecone, FAISS, Weaviate
from langchain_community.vectorstores
5. Retrieval
Search similar docs
uses
Retrievers
VectorStoreRetriever, similarity_search()
Built-in retrieval methods

📐 System Architecture



🎨 Client Layer

- Claude Desktop App
- MCP Client
- User Interface

⚙️ Server Layer

- MCP Server (http)
- Tool Handlers
- LangChain Integration
- Claude API Client

💾 Storage Layer

- ChromaDB
- Vector Store
- HuggingFace Embeddings
- Persistent Storage

Download source

```
#Download source
$> git clone https://github.com/hjkim7796/RAG-CHROMA-MCP-SERVER.git

$> dir RAG-CHROMA-MCP-SERVER

Directory: C:₩hjkim₩PythonProject₩RAG-CHROMA-MCP-SERVER


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
d-----        11/21/2025  12:06 PM                .venv
d-----        11/21/2025  11:58 AM                docs
-a----        11/21/2025  11:58 AM             68 .gitignore
-a----        11/21/2025  11:58 AM         227607 abc.pdf
-a----        11/21/2025  11:58 AM          16847 add_pdf_to_mcp.py
-a----        11/21/2025  11:58 AM           5657 mcp-http-proxy.py
-a----        11/21/2025  11:58 AM            383 query-chromaDB.py
-a----        11/21/2025  11:58 AM          20699 rag_mcp_http_server.py
-a----        11/21/2025  11:58 AM           7821 README_HTTP.md
-a----        11/21/2025  11:58 AM            347 requirements.txt
-a----        11/21/2025  11:58 AM           6936 requirements_freeze.txt
-a----        11/21/2025  11:58 AM          11420 test_server.py
-a----        11/21/2025  11:58 AM           2034 test_server_with_proxy.py
```

Run rag-mcp-server

#Go to the source folder

```
$> cd <user-project-folder>
```

#Config a virtual environment (venv) in VS Code for Python to ensure your project uses the correct isolated environment.

```
$> python -m venv .venv
$> .venv/Scripts/activate.ps1
```

#Install all python packages

```
(.venv)> pip install -r requirements.txt
```

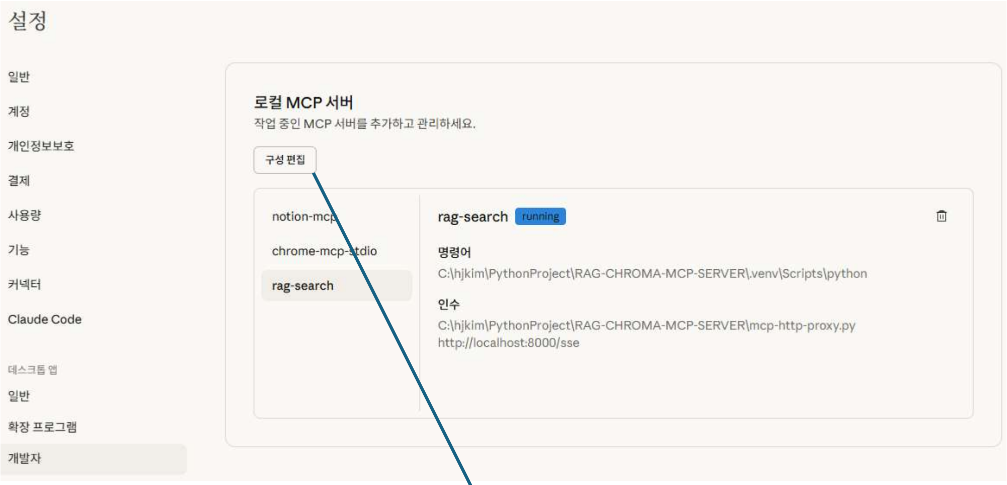
#Run rag mcp server

```
(.venv)> python rag_mcp_http_server.py
```

Test rag-mcp-server

```
#Go to the source folder
(.venv)> cd <user-project-folder>

#Check server is working properly
(.venv)> python test_server.py

#Check proxy server is working properly
(.venv)> python test_server_with_proxy.py
```

Config for Claude Desktop integration



로컬 MCP 서버

작업 중인 MCP 서버를 추가하고 관리하세요.

rag-search running

명령어

C:\hjkim\PythonProject\RAG-CHROMA-MCP-SERVER\.venv\Scripts\python

인수

C:\hjkim\PythonProject\RAG-CHROMA-MCP-SERVER\mcp-http-proxy.py
http://localhost:8000/sse

```
File location: %APPDATA%₩Claude₩claude_desktop_config.json
{
  "mcpServers": {
    "rag-search": {
      "command": "C:₩₩hjkim₩₩PythonProject₩₩RAG-CHROMA-MCP-SERVER₩₩.venv₩₩Scripts₩₩python",
      "args": ["C:₩₩hjkim₩₩PythonProject₩₩RAG-CHROMA-MCP-SERVER ₩₩rag_mcp_server.py"]
  }
}
```

Test rag-mcp-server

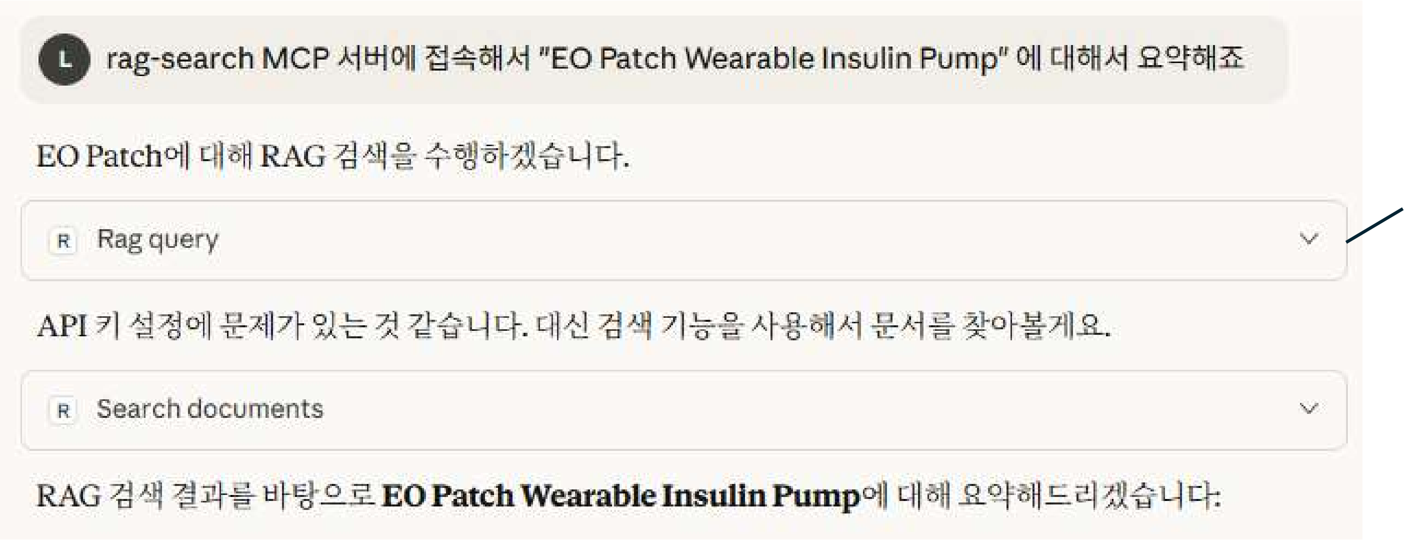
```
#Go to the source folder
(.venv)> cd <user-project-folder>

#Check server is working properly
(.venv)> python test_server.py

#Check proxy server is working properly
(.venv)> python test_server_with_proxy.py
```

Add a pdf document

```
#Go to the source folder
(.venv)> cd <user-project-folder>

#Add pdf document to RAG system
(.venv)> python add_pdf_to_mcp.py abc.pdf

...

============================================================
✅ PDF successfully added to RAG system!
============================================================
```

Test query on claude desktop

Query: **rag-search MCP 서버에 접속해서 "EO Patch Wearable Insulin Pump" 에 대해서 요약해죠**



rag-search MCP 서버에 접속해서 "EO Patch Wearable Insulin Pump" 에 대해서 요약해죠

EO Patch에 대해 RAG 검색을 수행하겠습니다.

API 키 설정에 문제가 있는 것 같습니다. 대신 검색 기능을 사용해서 문서를 찾아볼게요.

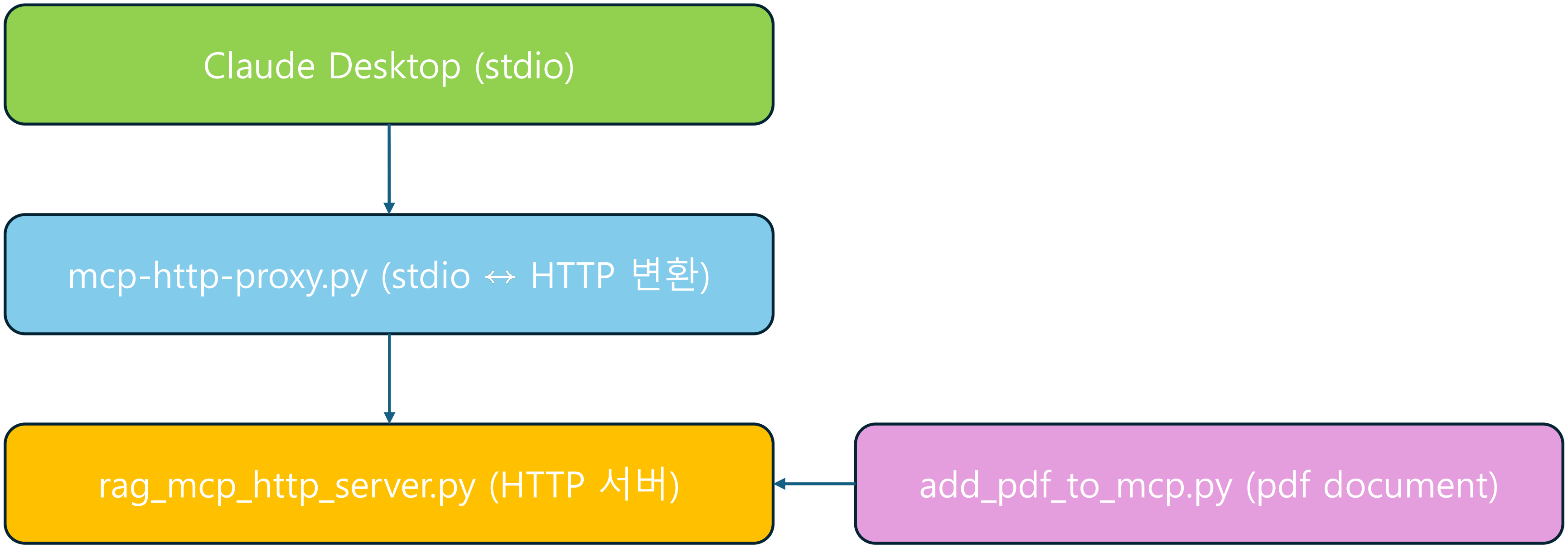
RAG 검색 결과를 바탕으로 **EO Patch Wearable Insulin Pump**에 대해 요약해드리겠습니다:

Rag query를 활성화 하려면 .env 파일을 생성한 후 아래와 같이 추가
ANTHROPIC_API_KEY=your-api-key-here

📦 File Description

- rag_mcp_server.py - Main RAG MCP server
- add_pdf_to_mcp.py – Example for adding a PDF document to RAG system
- query-chromaDB.py – Example for querying to chromaDB
- test_server.py - Example for testing the RAG MCP server
- test_server_with_proxy.py - Example for testing the Proxy server
- requirements.txt – All python package list
- README_HTTP.md - Detailed User Guide

How it works



Claude Desktop (stdio)

mcp-http-proxy.py (stdio ↔ HTTP 변환)

rag_mcp_http_server.py (HTTP 서버)

add_pdf_to_mcp.py (pdf document)

🚀 Key Features

- **add_documents** - Adding documents to the vector DB
- **search_documents** - Similarity-based search
- **rag_query** - Query via RAG (using Claude), Need API key
- **delete_collection** - Delete collection

🛠️ Available MCP Tools

1 add_documents

Add documents to the vector database. Automatically handles chunk splitting and embedding.

Parameters:

- texts: Array of document texts
- metadatas: Array of metadata objects
- chunk_size: Chunk size (default: 1000)
- chunk_overlap: Overlap size (default: 200)

2 search_documents

Search for similar documents in the vector database using cosine similarity.

Parameters:

- query: Search query string
- k: Number of results (default: 4)
- filter: Optional metadata filter

3 rag_query

Answer questions using RAG. Retrieves relevant documents and generates answers with Claude.

Parameters:

- question: Question text
- k: Number of docs to search (default: 4)
- language: Answer language (ko/en)

4 get_collection_info

Retrieve current collection information including document count and storage location.

Parameters:

- None (no parameters required)

5 delete_collection

Delete entire collection. All documents and embeddings will be permanently removed.

Parameters:

- confirm: Confirmation flag (must be true)

✨ Key Features

🔤 Automatic Text Chunking

Documents are automatically split into manageable chunks (1000 chars with 200 char overlap) while preserving semantic coherence.

🧠 Smart Embeddings

Uses sentence-transformers/all-MiniLM-L6-v2 model for high-quality embeddings. Runs locally without API keys.

💾 Persistent Storage

ChromaDB stores vectors persistently on disk. Data survives server restarts and can be queried anytime.

🎯 Similarity Search

Cosine similarity-based vector search efficiently finds the most relevant documents for any query.

🏷️ Metadata Management

Store and filter documents by custom metadata (source, category, tags, etc.) for precise retrieval.

🌍 Multilingual Support

Supports multiple languages through HuggingFace embeddings and Claude's multilingual capabilities.

💻 Technology Stack

LangChain	v1.0.7
ChromaDB	v1.3.5
Claude AI	Sonnet 4
HuggingFace	Transformers v5.1.2
MCP	v1.21.2
Python	v3.12