# RAG-Based Electronic Design Assistant for Renesas Electronics

## Overview

This project is a Retrieval-Augmented Generation (RAG) based AI assistant designed to answer queries related to Renesas Electronics by consuming information from the Renesas KnowledgeBase: https://en-support.renesas.com/knowledgeBase.  
  
The assistant is built using LLMs (Large Language Models) with an advanced retrieval system to fetch relevant documents, process images, and provide accurate, reference-backed answers. The bot is deployed on the cloud with a Streamlit interface.

## Features

✅ Knowledge-Based Q&A: Extracts and retrieves relevant information from the Renesas KnowledgeBase. Provides precise, reference-backed answers with source links.

✅ Image Processing: Includes images from the KnowledgeBase in responses when relevant. Accepts hand-drawn sketches and user-uploaded images as input for enhanced assistance.

✅ Web-Based Search (Fallback Mechanism): If the required information is not found with high confidence, the bot can invoke another agent to search across Renesas.com for possible answers.

✅ Cloud Deployment: Deployed on a cloud platform for easy access. Uses a Streamlit UI for an interactive experience.

## Architecture

1️⃣ Data Ingestion: Scrapes and indexes Renesas KnowledgeBase articles. Stores structured data in a vector database for fast retrieval.

1️⃣ Query Processing: User query is vectorized and matched against indexed data. Relevant documents and images are retrieved.

1️⃣ Answer Generation (RAG): Retrieved content is passed to an LLM for natural language response generation. Includes relevant images and reference links in responses.

1️⃣ Image-Based Q&A: Accepts hand-drawn circuit sketches or uploaded images. Uses image processing + LLM to extract insights and provide recommendations.

1️⃣ Fallback Search (Renesas.com): If no high-confidence answer is found in the KnowledgeBase, the bot triggers a web search for additional sources.

## Installation

### 1. Clone the Repository

```bash  
git clone https://github.com/yourusername/renesas-design-assistant.git  
cd renesas-design-assistant  
```

### 2. Install Dependencies

```bash  
pip install -r requirements.txt  
```

### 3. Set Up Environment Variables

Create a `.env` file and configure the following:

```env  
OPENAI\_API\_KEY=your\_openai\_api\_key  
VECTOR\_DB\_PATH=./vectorstore  
```

### 4. Run the Streamlit App

```bash  
streamlit run app.py  
```

## Deployment

### Cloud Deployment Options

- AWS Lambda + API Gateway

- Google Cloud Run

- Azure App Services

The model is packaged as a FastAPI backend, with a Streamlit frontend for interaction.

## Usage

- Ask questions about Renesas components, circuit design, and technical documentation.

- Upload images of hand-drawn circuits to get AI-powered insights.

- Receive reference-backed answers with images and links.

- Fallback to web search when answers are unavailable in the knowledge base.

## Roadmap

- [ ] Enhance image processing for better sketch recognition.

- [ ] Fine-tune LLM for improved accuracy on technical queries.

- [ ] Integrate multi-modal capabilities for deeper circuit analysis.

## Contributors

- Your Name ([@yourgithub](https://github.com/yourgithub))

Feel free to contribute by opening issues or submitting pull requests! 🚀

## License

This project is licensed under the MIT License.

## References

- Renesas KnowledgeBase: https://en-support.renesas.com/knowledgeBase

- Renesas Official Website: https://www.renesas.com