Knox College RAG Assistant

Data Science Capstone — Fall 2025

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Introduction

Motivation

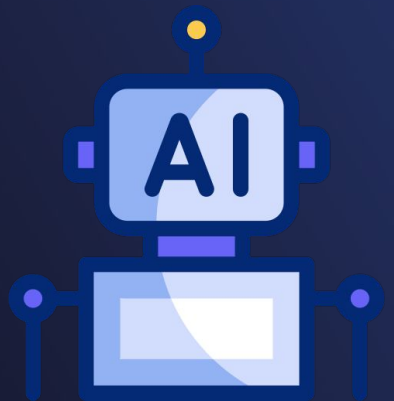
- Knox policies are long, hard to search, and spread across multiple PDFs
- Students often ask the same questions repeatedly
- Existing chatbots guess answers → not safe for academic rules

Goal of the Project

- Build a system that gives accurate, document-based answers
- No hallucination, no guessing — only official Knox information
- Create an approachable assistant for students and staff

What is Agentic AI?

- AI systems that can take actions, not just generate text
- Can use tools, APIs, databases, and external functions
- Have memory, retrieval, and decision-making
- More reliable for structured tasks
- Used to build automated assistants and workflows

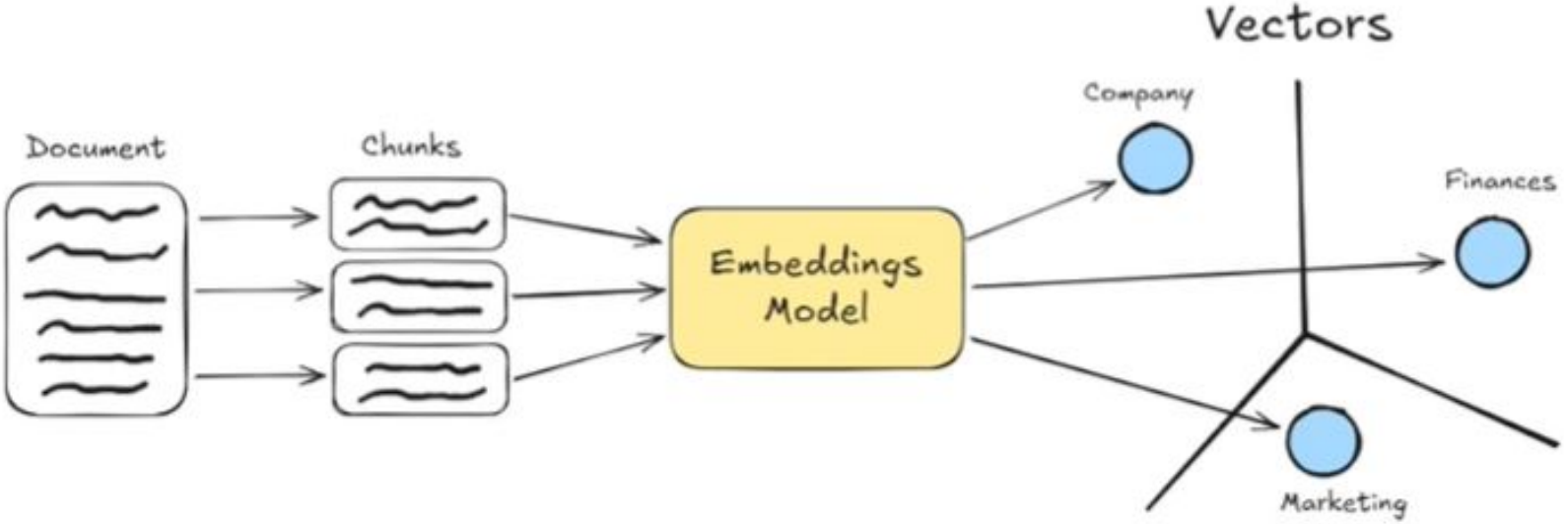


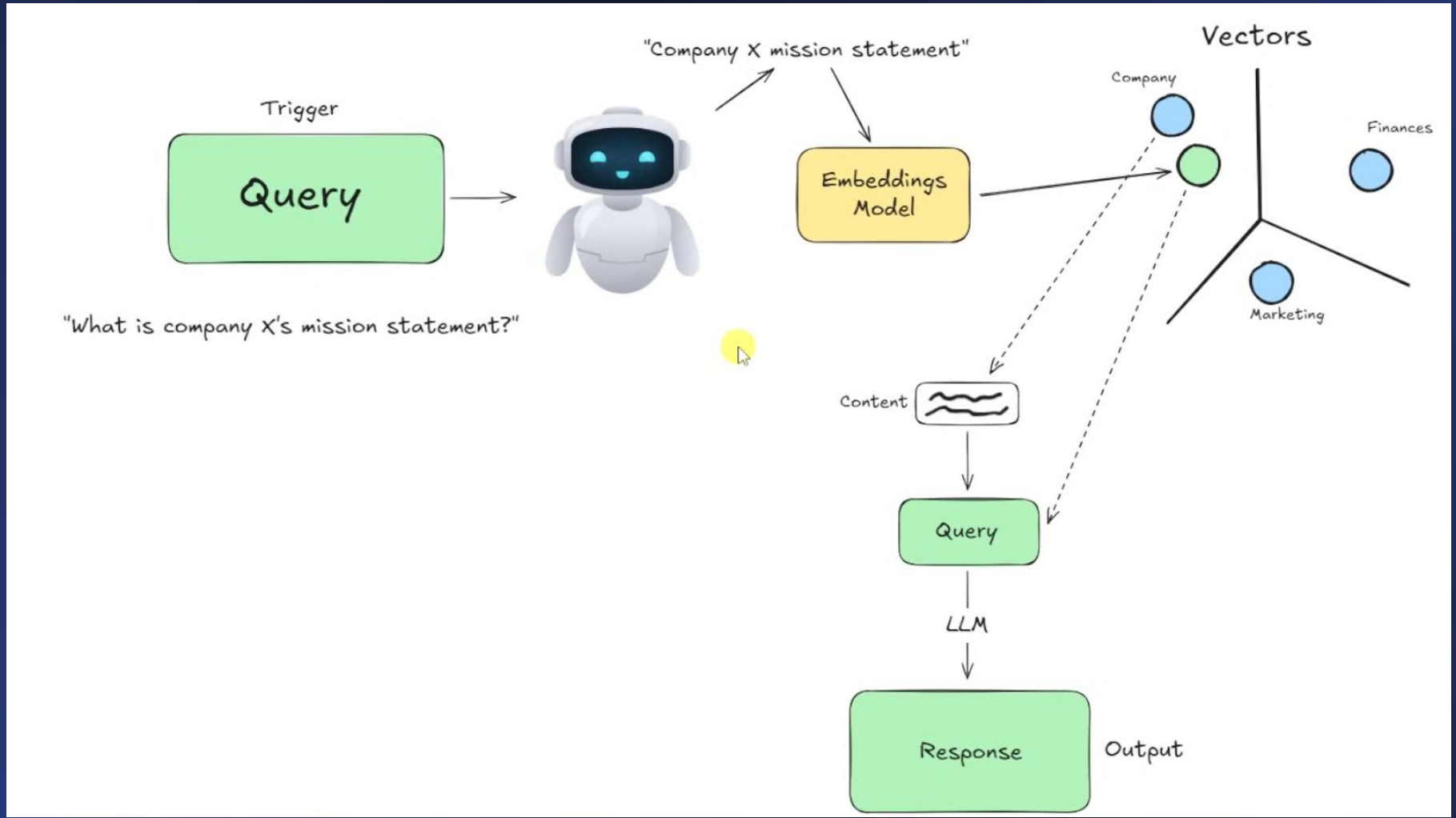
What is RAG?

RAG = Retrieval-Augmented Generation

- AI that looks up information first, then answers
- It searches your documents before responding
- Makes answers accurate and grounded in real text
- Prevents AI from guessing or hallucinating
- Perfect for policy, rules, and academic information

Traditional RAG (Vector DB)




Trigger
Query
"What is company X's mission statement?"
"Company X mission statement"
Embeddings Model
Vectors
Company
Finances
Marketing
Content
Query
LLM
Response
Output

What is n8n?

- A tool that lets you build workflows visually
- You can connect different apps without coding
- Helps automate tasks step-by-step
- Works like a “flowchart that actually runs”
- Supports AI tools, APIs, documents, vector DBs, and more

Why I used n8n in my RAG project

- I needed a pipeline that fetches PDFs, splits them, embeds them, and stores vectors
- n8n already has built-in nodes for:
  - Google Drive
  - Gemini models
  - Pinecone vector store
  - RAG Agents
- Easier than writing hundreds of lines of Python
- Visual workflows let me see exactly what's happening
- Keeps updating the knowledge base completely automatic
- Perfect for a college knowledge-base assistant

System Architecture

Components

- Google Drive → source of Knox PDFs
- Data Loader → reads and extracts PDF text
- Text Splitter → breaks documents into chunks
- Gemini Embeddings → converts chunks into vectors
- Pinecone → stores and retrieves vectors
- n8n Agent → retrieves chunks and answers questions
- Chat Interface → user asks questions

Challenges & Solutions

Technical Challenges

- PDFs had inconsistent formatting
- Long PDFs → chunks sometimes broke mid-topic
- Embeddings sometimes returned irrelevant chunks
- Agent occasionally ignored rules early in testing
- Pinecone namespace mixing when re-uploading documents

Workflow Challenges

- Hard to debug the workflow end-to-end
- Keeping all nodes connected correctly in n8n
- Ensuring the agent ALWAYS retrieves before answering

How I Solved Them

- Tuned chunk size to 1200 with 150 overlap
- Added strict system prompt to force retrieval
- Created a dedicated Knox namespace in Pinecone
- Tested agent behavior with dozens of queries
- Added nodes step-by-step and debugged visually in n8n
- Rebuilt some nodes to prevent silent failures

Limitations & Future Work

Limitations

- Only 4 Knox PDFs included
- PDFs must be manually updated
- Some documents are long → chunking imperfect
- Answers limited strictly to available documents
- No user interface (only n8n chat)

Future Work

- Add more campus documents
- Automated PDF updating (daily or weekly scheduler)
- Deploy as a web app or mobile chatbot
- Add conversation history + analytics dashboard
- Add authentication for student-specific questions
- Improve chunking for long PDF sections

Conclusion

1. Summary

- Built a domain-specific RAG assistant for Knox College
- End-to-end system using n8n, Gemini, and Pinecone
- Provides accurate, document-grounded answers

2. Impact

- Reduces misinformation and policy confusion
- Saves time for students, RAs, staff, and faculty
- Creates a reliable, always-available assistant

3. Practical Usefulness

- Helps students quickly find official rules and policies
- Can scale to more campus departments
- Lays foundation for a full Knox AI helpdesk