Group 13

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Finance AI Agent

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Problem

How can we **efficiently extract actionable insights** from 10-K filings to **support better financial decision-making?**

Information Overload

10-Ks are long and complex, and often hard to parse quickly

Unstructured Data

10-K text lacks structure, limiting traditional analysis

Missed Opportunities

Hidden signals often go unnoticed, leading to reactive rather than proactive decision-making

Lack of Context Tools

Current tools can’t capture relationships or context well

Solution

A scalable **GraphRAG system** that transforms unstructured 10-K filings into a structured knowledge graph, enabling **AI-powered answers** to user questions and context-aware insights through intelligent retrieval and language generation.

Organized Information

- Extracts and structures key sections from 10-K fillings
- Save time and effort by making information easy to search and compare

Connected Insights

- Builds a network of relationships between risks, strategies, and financial topics.
- Helps uncover patterns that are often hidden

Smart Answers

- Allows users to ask questions in plain English.
- Delivers clear, AI-powered answers backed by filing content.

Faster & Better Decisions

- Empowers investors with instant, actionable insights.
- Turns complex regulatory documents into strategic decision-making tools.

Data

Existing data from **10-K filings**, retrieved via SEC EDGAR and company websites using CrewAI + Serper tools.

Design:

- Queried SEC EDGAR using **CIK** to fetch 10-K **accession numbers by year**
- Cleaned and parsed filings into **structured JSON format**
- Extracted key sections for **NLP and graph-based analysis**

Outcome and Target:

- Context-aware **answers to user financial queries** using our AI agent
- In later stages, potential **trading signal generation** based on filing insights

Explanatory Features:

Our cleaned 10-K JSON files include **8 structured elements:**

- **company_name**, **cik**, **cusip_number**, **source**
- **item1** (Business Overview)
- **item1a** (Risk Factors)
- **item7** (Management Discussion & Analysis)
- **item7a** (Quantitative & Market Risk)

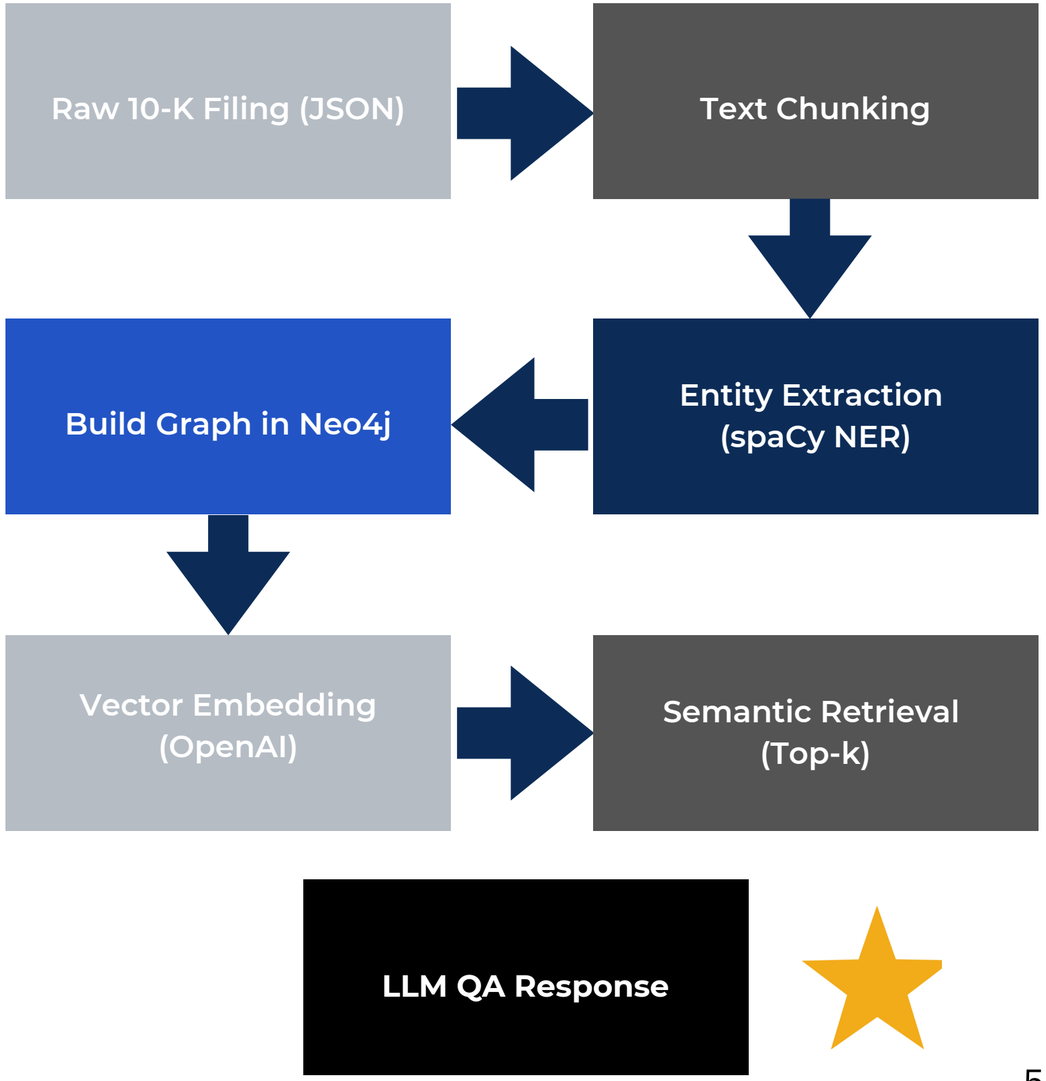
Automation Cadence:

- **Data is refreshed annually** to ensure up-to-date 10-K filings
- Script supports **flexible parameters** for form type and date range
- Uses an update_log to **track progress and resume** if interrupted

Methodology

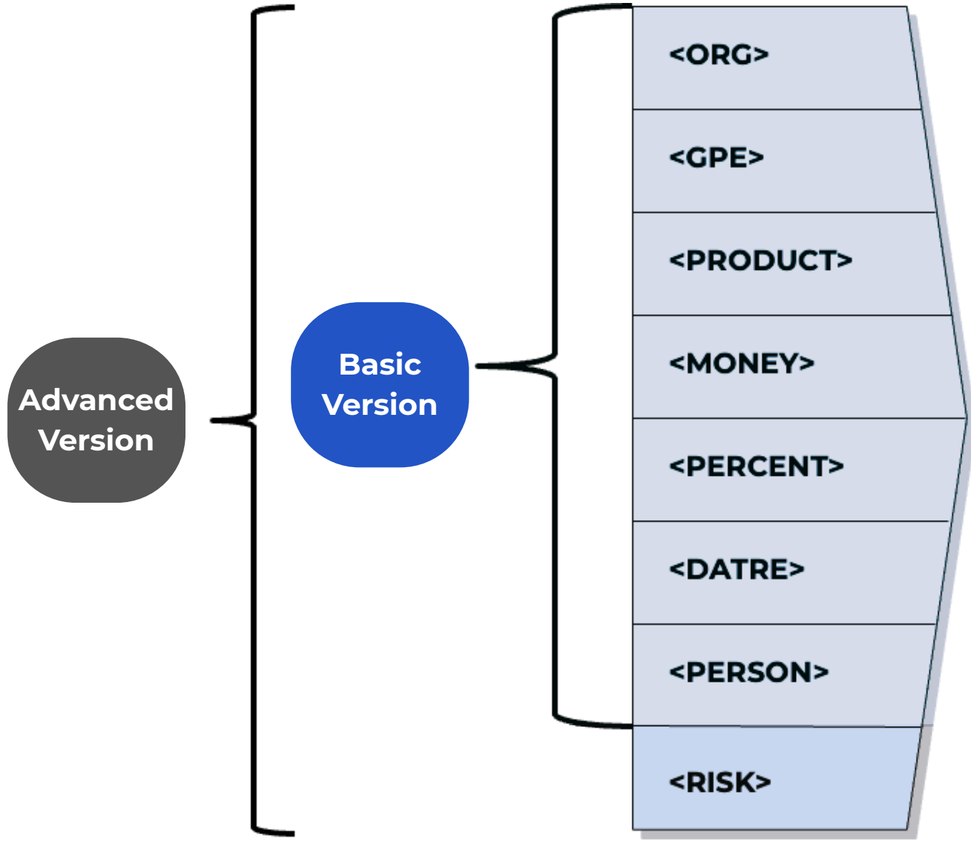
Overview of the Pipeline
GraphRAG System Architecture

- **Paragraph-level chunking** improves granularity for retrieval.
- **spaCy** used for extracting **financial entities**: ORG, GPE, PRODUCT, etc.
- **Neo4j graph schema** includes TextChunk, Entity, and MENTIONS, CO_OCCURS_WITH relationships.



Entity Extraction: From Basic NER to Risk-Aware Enrichment

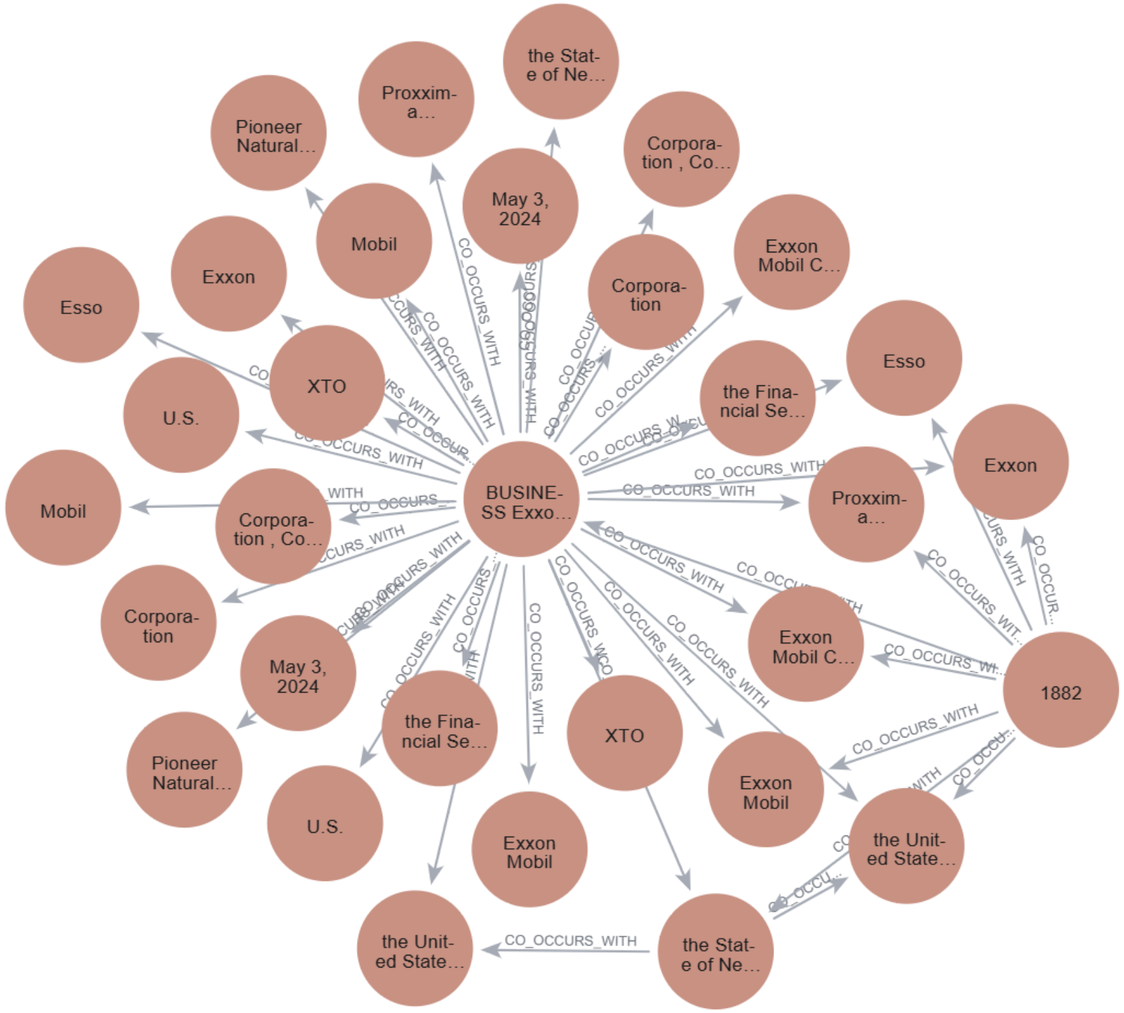
Aspect	Basic Version	Advanced Version
NLP Method	spaCy NER	spaCy NER + PhraseMatcher
Entity Coverage	Generic entities	Generic + Risk-specific phrases
Write Strategy	One-by-one MERGE	Batched UNWIND MERGE
Performance	Slower on large data	Optimized for bulk graph creation
Use Case	Initial proof of concept	Scalable, production-grade graph enrichment

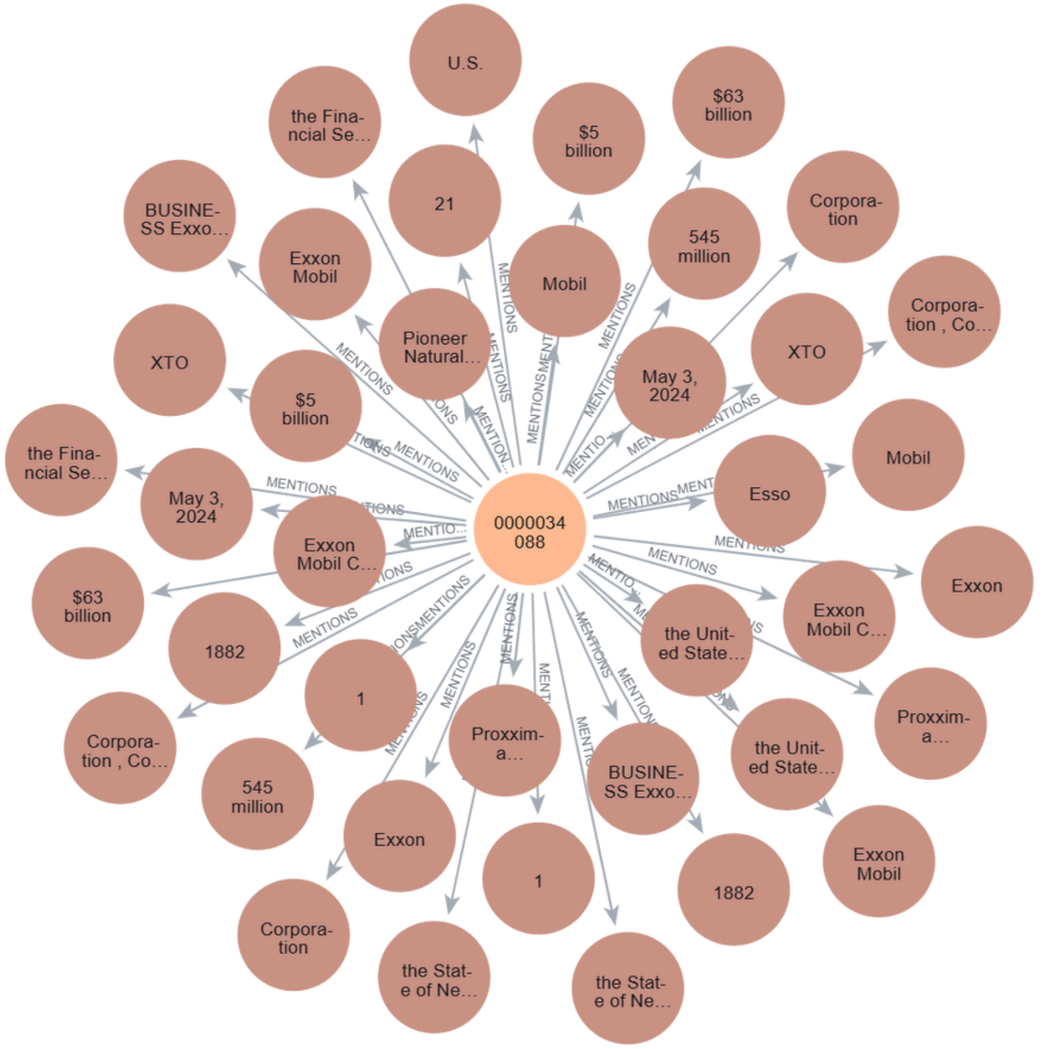


** Risk: "supply chain disruption", "macroeconomic downturn", "foreign exchange risk", "component shortage", "regulatory changes", "inflation risk", "pandemic impact", "political instability","competitive pressure", "litigation risk"*

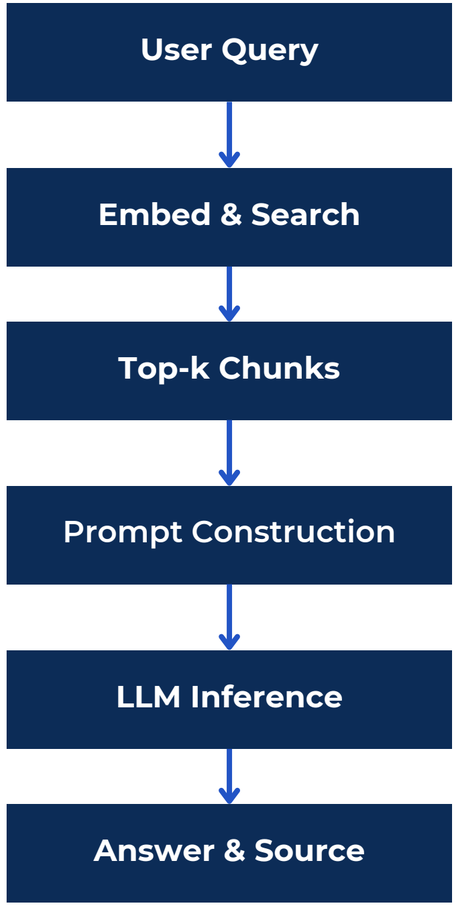
Graph Relationship built with Neo4j

Two major relationship: CO_OCCUR_WITH & MENTIONS





LLM QA Response: Empowered by Vector Embedding and Semantic Retrieval



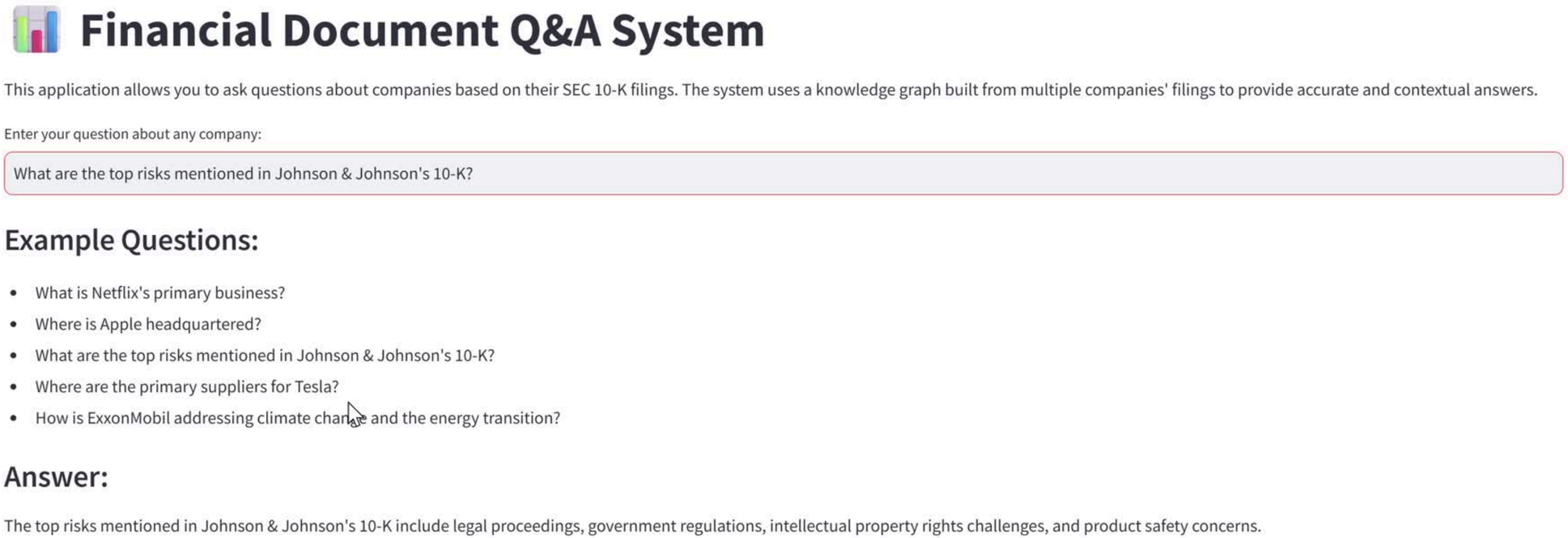
What Happens
Free-form natural-language question (e.g. “What are NetApp’s core products?”)
Encode question into a 1536-dim vector via OpenAI Embeddings
Top-k vector search over paragraph chunks in Neo4j
Assemble top-k chunks + question into a single prompt
Call ChatOpenAI (temperature=0) with RetrievalQAWithSourcesChain
Return concise answer back to the UI

KEY BENEFIT

- **Grounded**: only feeds retrieved facts → no hallucinations
- **Scalable:** any new 10-K filing auto-embeds + updates graph
- **Traceable:** answer always cites its source chunks

Result

Query Answers about 10k-fillings with the LangChain



https://finance-graph-rag.streamlit.app/

Conclusion

Summary

We built a **GraphRAG-powered Finance AI Agent** that extracts insights from 10-K filings.

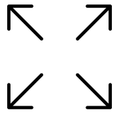
Our pipeline integrates **data automation**, **NLP-based entity extraction**, and **graph-based retrieval** for context-aware querying.

Users can now **interactively ask financial questions** via our deployed **Streamlit demo**.

This validates our end-to-end pipeline
From raw data to intelligent, grounded answers

Next Steps

Refine LLM + Graph integration for better query precision and robustness.



Scale to more companies and filing types with optimized data pipelines and storage.

Evaluate system performance through both domain experts and benchmark tools.

Explore potential for **trading signal generation** and **agent deployment** in **real-time**.

Thank You

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