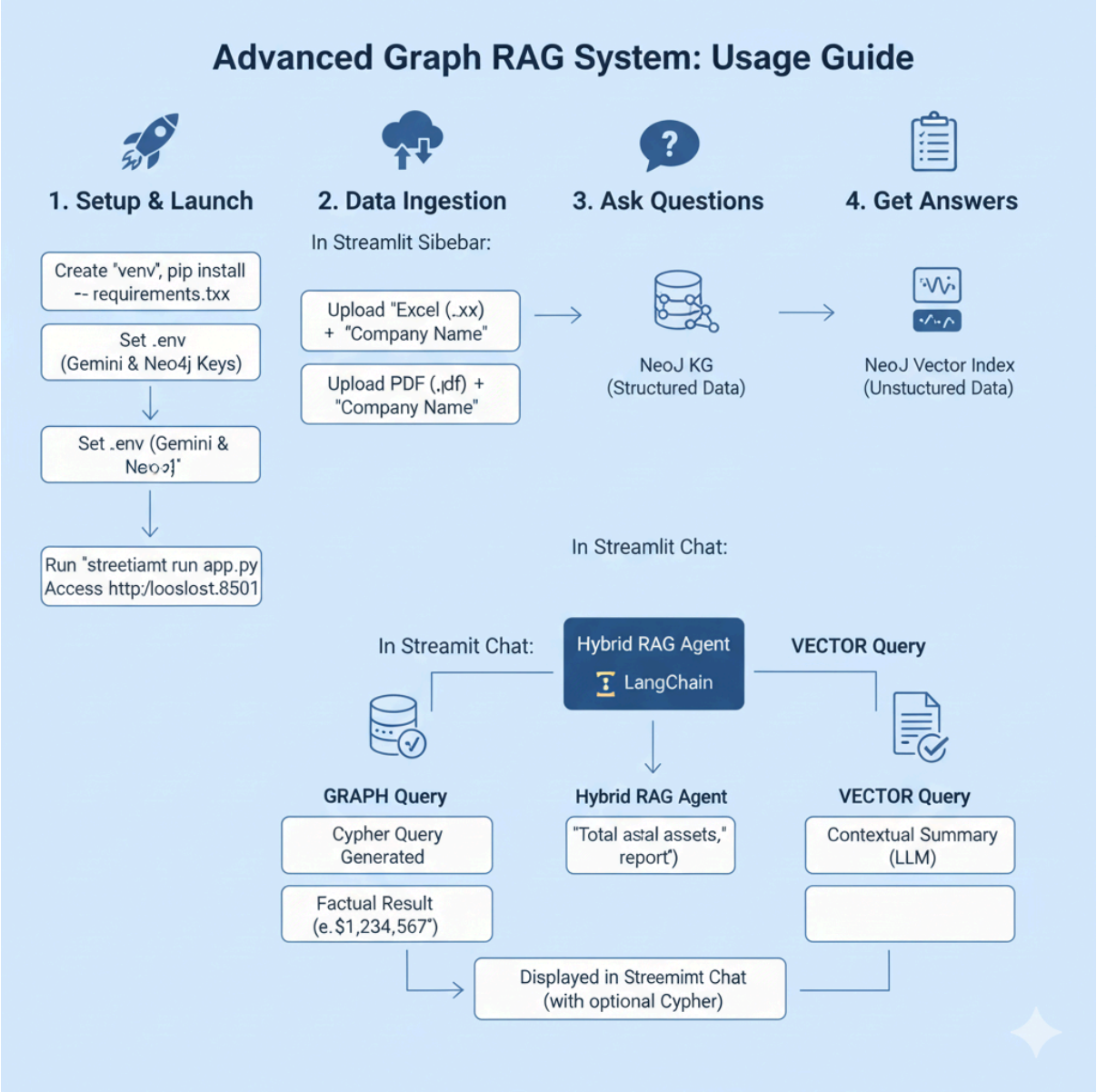
Advanced Graph RAG System: User Guide

This documentation provides the step-by-step instructions for setting up and running the Hybrid RAG application, including how to ingest data and test both the Graph and Vector search functionalities.



1. Environment Setup (As Executed)

Step 1: Create and Activate Python Virtual Environment

It is best practice to isolate your project dependencies.

Command	Purpose
`python -m venv venv`	Creates a new virtual environment named `venv`.
`.\venv\Scripts\activate`	Activates the virtual environment.

Step 2: Verify Environment Variables and Connections

The `check_env.py` script confirms your `.env` file is properly loaded.

Command	Output Snippet	Purpose
`python check_env.py`	`Gemini API Key Loaded: True` `Neo4j URI Loaded: neo4j+s://...`	Confirms the application can access necessary credentials.

Optional : Run check_rag_llm.py

2. Running the Application

Step 3: Launch the Streamlit Web Application

Run the main application file (`app1.py` or `app.py`) using the Streamlit CLI.

Command	Output Snippet	Purpose
`streamlit run app1.py`	`Local URL: http://localhost:8501`	Starts the web server and opens the application in your browser.

You can now interact with the system via the web interface.

3. Data Ingestion Guide

The application requires data to be loaded into Neo4j before querying. Use the sidebar controls.

3.1 Ingesting Structured Data (Excel / Metrics)

1. In the sidebar, click `Browse files` under "Upload Excel (.xlsx) or PDF (.pdf)".
2. Select your Excel file (e.g., `inventory.xlsx`).
3. Enter a Company Name for Tagging (e.g., "ABC Book Stores").

4. Click `Ingest & Process Data`.
5. Expected Result: A success message confirming the number of metrics or records loaded.

3.2 Ingesting Unstructured Data (PDF / Context)

1. In the sidebar, click `Browse files`.
2. Select your PDF file (e.g., `invoice_INV-202510-017.pdf`).
3. Enter the same Company Name (e.g., "ABC Book Stores").
4. Click `Ingest & Process Data`.
5. Expected Result: A success message confirming the number of text chunks and any structured entities extracted.

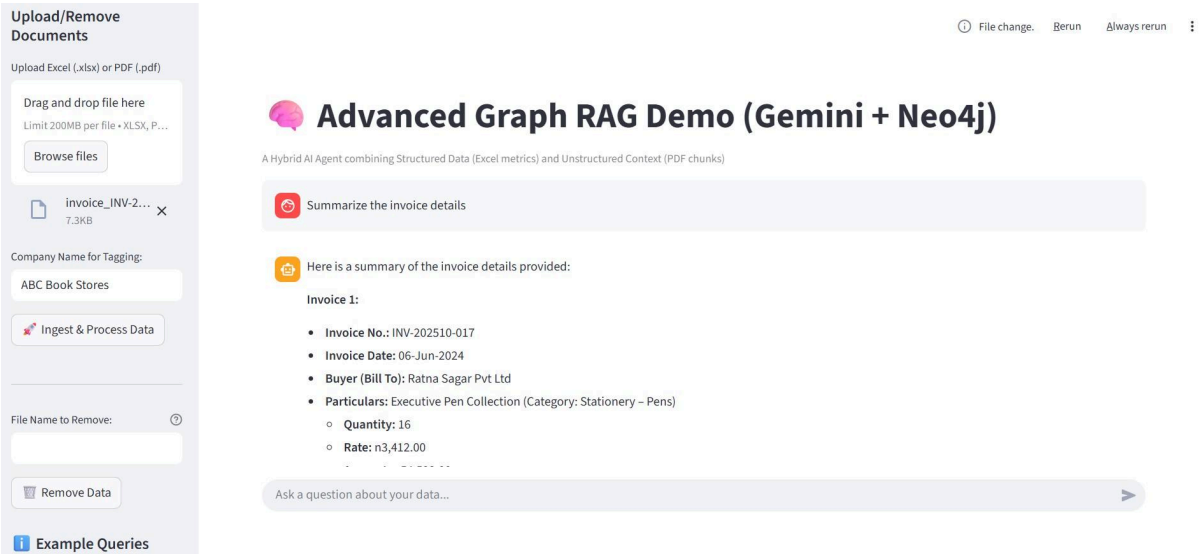
4. Querying and Testing the Hybrid Agent

Use the chat input at the bottom of the page to test both retrieval paths.

4.1 Testing the GRAPH Search (Structured/Factual Data)

These queries trigger the LLM to generate a Cypher query.

Example Query	Expected Agent Action	Output Characteristic
"What is the total opening stock amount?"	`Agent Action: Executing Graph Search (Cypher)`	Factual number (e.g., `622076.96`) and the executed Cypher query displayed.
"List all publishers"	`Agent Action: Executing Graph Search (Cypher)`	List of entity names retrieved directly from `Publisher` nodes.

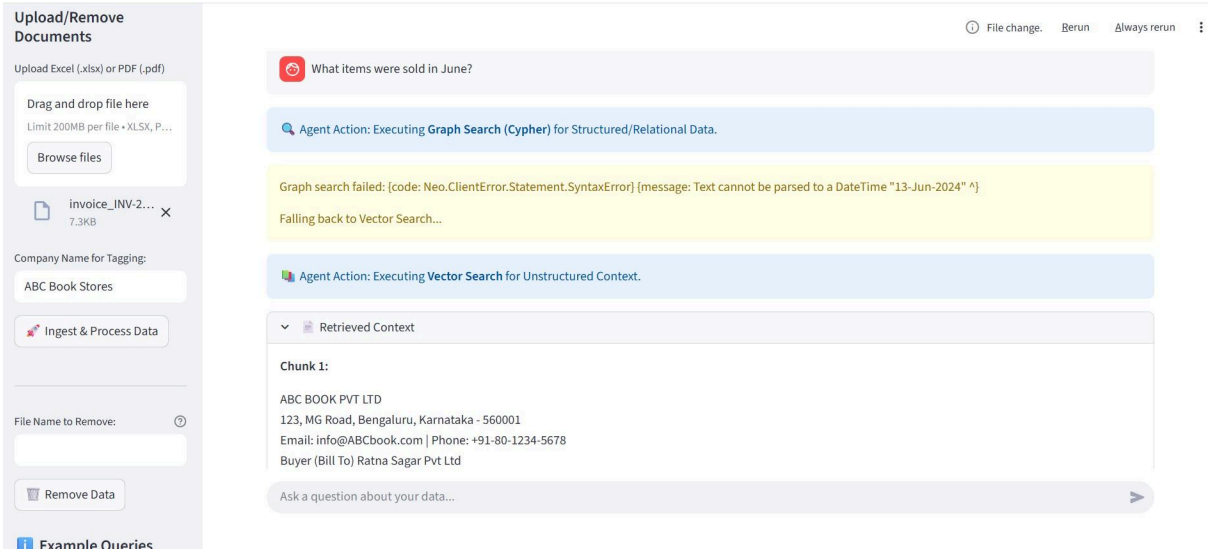


4.2 Testing the VECTOR Search (Unstructured/Contextual Data)

These queries trigger the LLM to search the vector index for context.

Example Query	Expected Agent Action	Output Characteristic
"Summarize the invoice details"	`Agent Action: Executing Vector Search`	A narrative summary generated by the LLM based on the retrieved PDF chunks.
"Explain the bank information"	`Agent Action: Executing Vector Search`	A contextual answer based on the most semantically relevant PDF text.

4.3 Observing the Hybrid Fallback (Critical Test)



The system is designed to route and fallback, as seen in your logs:

1. Query: "What items were sold in June?"
2. Agent Action: `Agent Action: Executing Graph Search (Cypher)`
    - *Observation:* The LLM correctly routed the query as "GRAPH" because it asks for a specific relational detail (items sold in a specific month).
3. Failure & Fallback: `Graph search failed: {code: Neo.ClientError.Statement.SyntaxError} {message: Text cannot be parsed to a DateTime...}`
    - *Reason:* The Cypher generator attempted a date filter that Neo4j could not execute on the stored date format (`13-Jun-2024`).
    - *Action:* The agent automatically fell back to the Vector Search path.
4. Vector Action: `Agent Action: Executing Vector Search`
    - *Result:* The Vector search retrieved text chunks containing "06-Jun-2024" and "13-Jun-2024" and their corresponding items.

- *Final Answer:* The LLM used this context to generate the correct items: "Executive Pen Collection" and "1984 by George Orw".

This demonstrates the core value of the Hybrid Agent: robustness and redundancy when one search method fails.

OUTPUT:
In terminal:

```
PS C:\Users\MUKESH\kras> python -m venv venv
PS C:\Users\MUKESH\kras> .\venv\Scripts\activate
(venv) PS C:\Users\MUKESH\kras> python check_env.py
--- Environment Check ---
Gemini API Key Loaded: True
Neo4j URI Loaded: neo4j+s://86596595.databases.neo4j.io
------------------------
(venv) PS C:\Users\MUKESH\kras> python check_rag_llm.py
============================================================
📚 FLEXIBLE PDF READER - File or URL
============================================================

--- Test 1: Local File ---
📄 Loading PDF: data_sources/Annual_Report.pdf
✅ Successfully loaded 25 page(s)
📖 First page preview: APPENDIX D
EXAMPLE OF ANNUAL REPORT
...

--- Test 2: PDF from URL ---
📥 Downloading PDF from URL:
https://www.w3.org/WAI/ER/tests/xhtml/testfiles/resources/pdf/dummy.pdf
✅ Downloaded to: temp_downloaded.pdf
📄 Loading PDF: temp_downloaded.pdf
✅ Successfully loaded 1 page(s)
📖 First page preview: Dummy PDF file
...
🧹 Cleaned up temporary file: temp_downloaded.pdf

============================================================
🎯 INTERACTIVE MODE
============================================================

📎 Enter PDF file path or URL (or 'skip' to exit): skip
(venv) PS C:\Users\MUKESH\kras> streamlit run app1.py

  You can now view your Streamlit app in your browser.
```

Local URL: http://localhost:8501
Network URL: http://192.168.1.21:8501

WARNING: All log messages before absl::InitializeLog() is called are written to STDERR
E0000 00:00:1759604250.726943 2240 alts_credentials.cc:93] ALTS creds ignored. Not running on GCP and untrusted ALTS is not enabled.
E0000 00:00:1759604250.744594 2240 alts_credentials.cc:93] ALTS creds ignored. Not running on GCP and untrusted ALTS is not enabled.
E0000 00:00:1759604463.157705 11316 alts_credentials.cc:93] ALTS creds ignored. Not running on GCP and untrusted ALTS is not enabled.
E0000 00:00:1759604463.162833 11316 alts_credentials.cc:93] ALTS creds ignored. Not running on GCP and untrusted ALTS is not enabled.

> Entering new GraphCypherQAChain chain...
Generated Cypher:
MATCH (b:Book) RETURN sum(b.Total_Opening_Stock_amount) AS total_opening_stock_amount
Full Context:
[{'total_opening_stock_amount': 622076.96}]

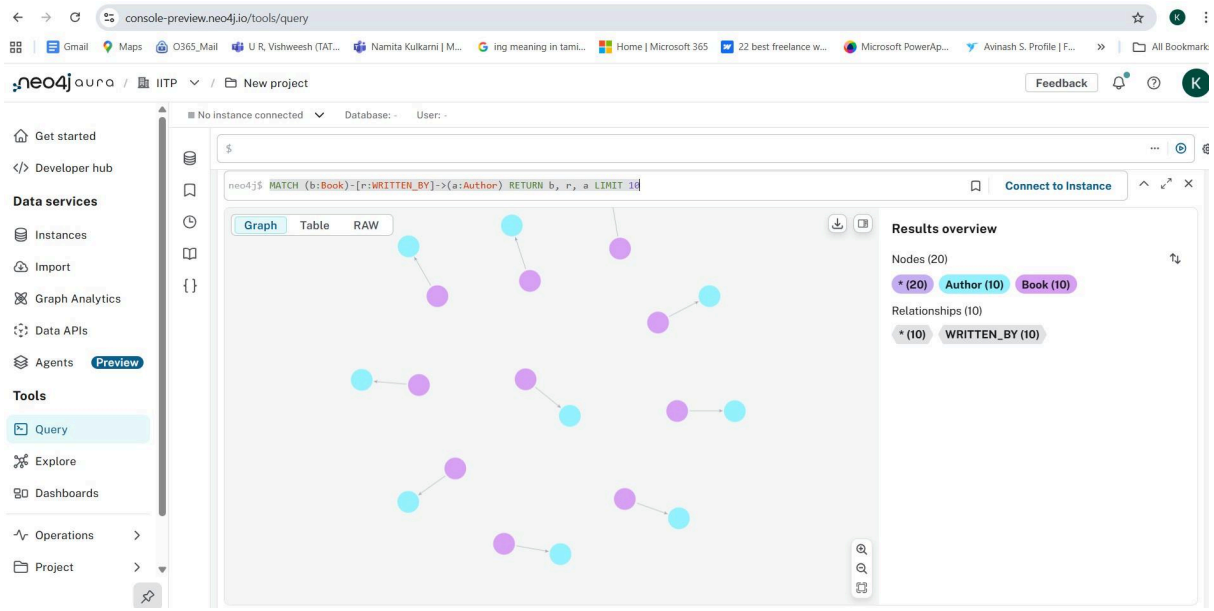
> Finished chain.

> Entering new GraphCypherQAChain chain...
Generated Cypher:
MATCH (p:Publisher) RETURN p.name AS publisher_name
Full Context:
[{'publisher_name': 'Camlin / Stationery Supplier'}, {'publisher_name': 'HarperOne'}, {'publisher_name': 'Little Brown and Company'}, {'publisher_name': 'Scribner'}, {'publisher_name': 'IndiaInk'}, {'publisher_name': 'Picador'}, {'publisher_name': 'HarperCollins'}, {'publisher_name': 'Penguin Random House'}, {'publisher_name': 'Plata Publishing'}, {'publisher_name': 'Generic Stationery'}]

> Finished chain.
E0000 00:00:1759604515.209963 16748 alts_credentials.cc:93] ALTS creds ignored. Not running on GCP and untrusted ALTS is not enabled.
E0000 00:00:1759604517.347883 16748 alts_credentials.cc:93] ALTS creds ignored. Not running on GCP and untrusted ALTS is not enabled.
E0000 00:00:1759604517.352885 16748 alts_credentials.cc:93] ALTS creds ignored. Not running on GCP and untrusted ALTS is not enabled.

> Entering new GraphCypherQAChain chain...
Generated Cypher:
cypher
MATCH (i:Invoice)
WHERE datetime(i.invoice_date).month = 6
RETURN i.item_description AS item_sold

In Neo4j Page:
Open the neo4j browser:
In Query bar enter :`MATCH (b:Book)-[r:WRITTEN_BY]->(a:Author) RETURN b, r, a LIMIT 10`
Note: `(specific required data).` Then run to see output as a graph or table view.



Optional:(Not Recommended) - With remaining additional files:

data_sources/Annual_Report.pdf is manually added file to run with human intervention which will be upload and called in pdf, py file and in excel. Py file where already a sample file is inserted.

Now run: `streamlit run app. py instead of run app1.py` (Note carefully)
(Here
Excel Data - only taken as structured data and so stored only in Graph data and agent will work only on cypher (graph search).
PDF Data - only taken as unstructured data and so stored at neo4j as vector based and agent will on vector based to find answer on nearest vector search value.)

Flow:
Question >> LLM if Keyword in Graph >> Answer >> LLM rephrase Human Language >> Output
Question >> LLM not found Keyword go to Vectorsearch with nearest value >> Answer >>LLM rephrase Human Language >> Output.

Delete Entire Memory in Neo4j with this options; with running query as
MATCH (n) DETACH DELETE n;

Note: Refer Documentation file to understand complete Solution