RAG Based Legal Advisor Bot

MINOR PROJECT PRESENTATION

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PROBLEM STATEMENT

• Legal research is time-consuming and requires access to vast, unstructured legal data.

• Traditional chatbots fail to maintain context or differentiate between valid and irrelevant legal prompts.

• Our system aims to bridge this gap using a **RAG-based pipeline** that enhances response quality and maintains domain relevance.

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• It ensures that every query is validated, categorized, and contextually enriched before being answered

INTRODUCTION

• The **RAG-Based Legal Advisor Bot** is an intelligent chatbot designed to assist users with legal queries.

• It integrates **Retrieval-Augmented Generation (RAG)** with **LLMs** to provide contextually accurate and case-specific answers.

• The system uses **Vector Databases**, **inference filtering**, and **memory management** (short-term & long-term) to ensure reliable, domain-specific responses.

• Target users include **law students**, **legal professionals**, and **researchers** seeking quick, verified legal information.

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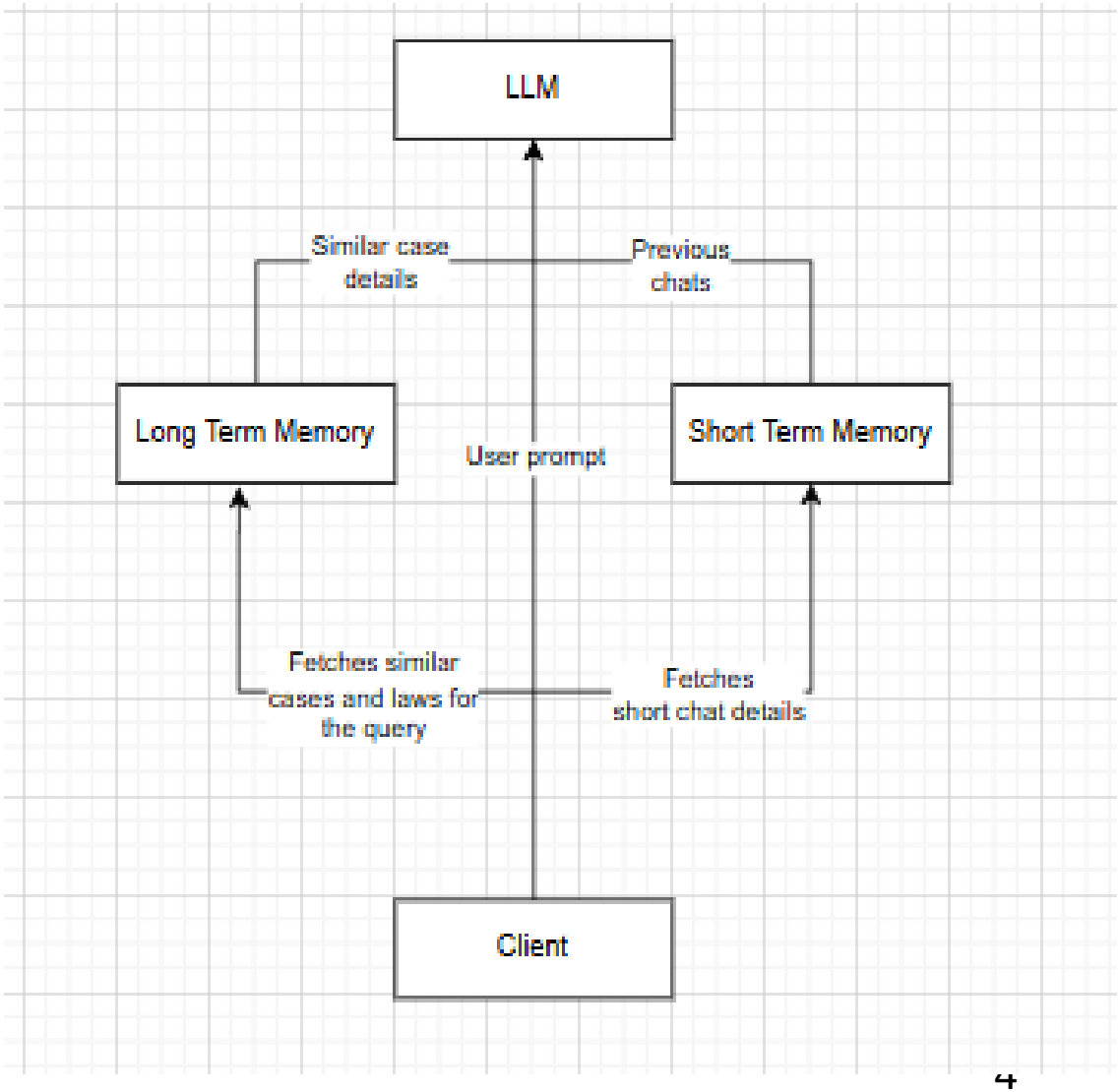

LITERATURE SURVEY

Study	Key Focus	Tools/Techniques	Findings
Lewis et al. (2020)	Retrieval-Augmented Generation (RAG) for factual QA	Dense retriever + Generative LLM	Enhanced factual accuracy by **~40%** in domain-specific QA tasks
Chalkidis et al. (2021)	LegalBERT – domain adaptation for legal text	BERT fine-tuning on court judgments	Improved classification accuracy by **+15%** vs. general BERT
Henderson et al. (2023)	Fine-tuned LLMs for legal reasoning	Domain-specific LLM training	Reduced hallucinations by **30–40%**
Johnson et al. (2021)	Hybrid retrieval with VectorDB (FAISS + BM25)	FAISS, BM25 ranking algorithm	Achieved **+60% semantic recall** and better lexical precision
Zhong et al. (2022)	Memory-augmented conversational systems	Context-preserving STM & LTM	Improved multi-turn coherence by **~25%**

CHALLENGES & LIMITATIONS

- **Unstructured Legal Data:** Lack of standardized formatting affects data consistency and retrieval.
- **Data Privacy:** Restricted access to confidential legal documents for training.
- **LLM Hallucination:** Occasional generation of inaccurate or fabricated references.
- **Memory Constraints:** Limited context retention across long or multi-session queries.
- **Jurisdiction & Language Variance:** Lower accuracy for regional or non-English legal texts
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- **Lack of Evaluation Metrics:** No standardized benchmarks for legal factuality.
- **Latency Issues:** Real-time retrieval + generation may increase response delay.

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PROPOSED METHODOLOGY

Key Components:

1. User Interface: Accepts user query (legal question).

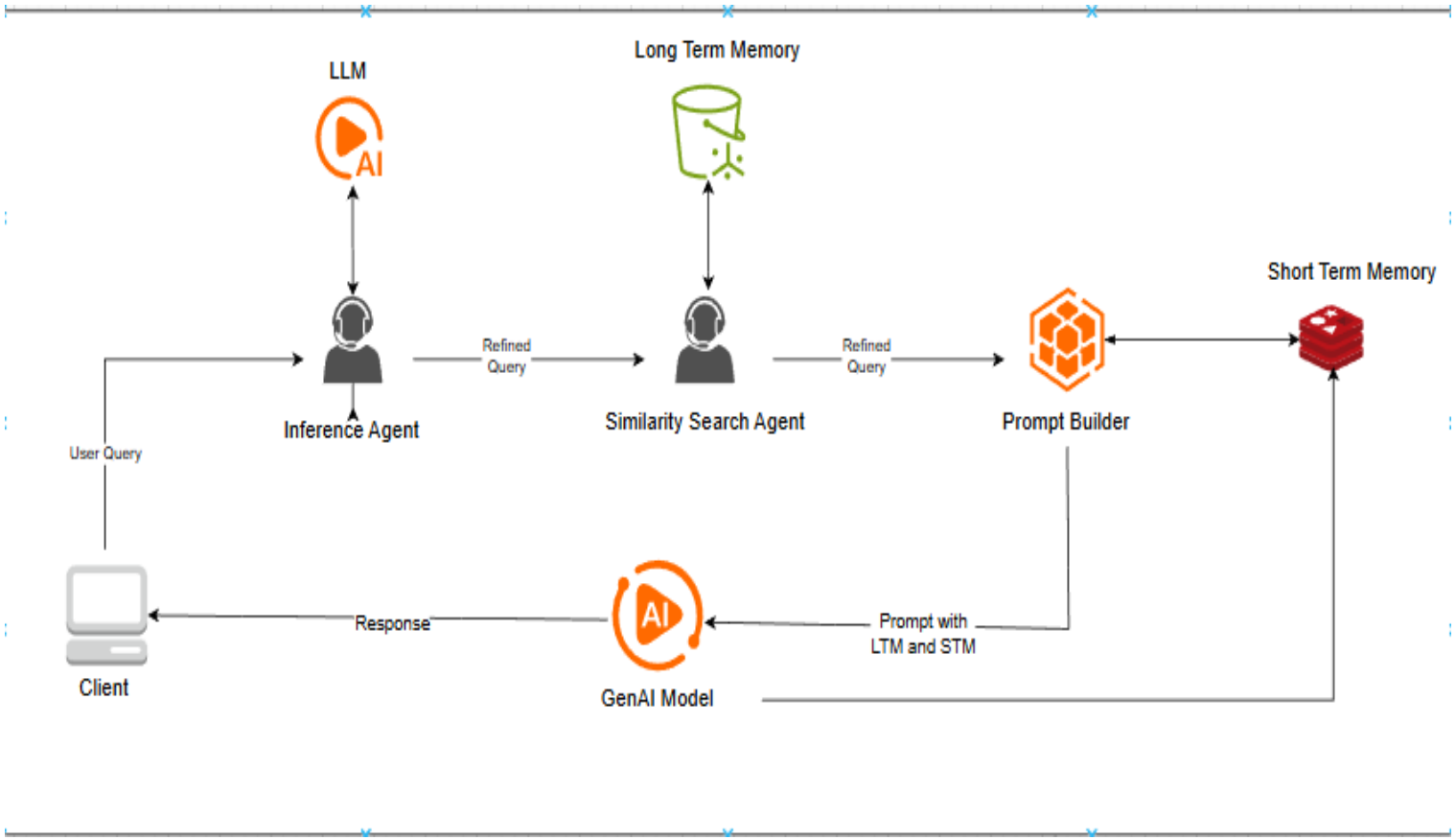
2. Inference Layer: Filters out non-legal or spam queries.

3. Query Categorization: Classifies into:

- Compare Two Cases
- Summarize a Case
- Get Data over a Law
- Find Similar Cases
- Provide Advice
- Invalid Query

4. RAG Module:

- Retrieves contextually similar legal data using **VectorDB (FAISS + Cosine Similarity)**.
- Re-ranks top results with **BM25 algorithm**.



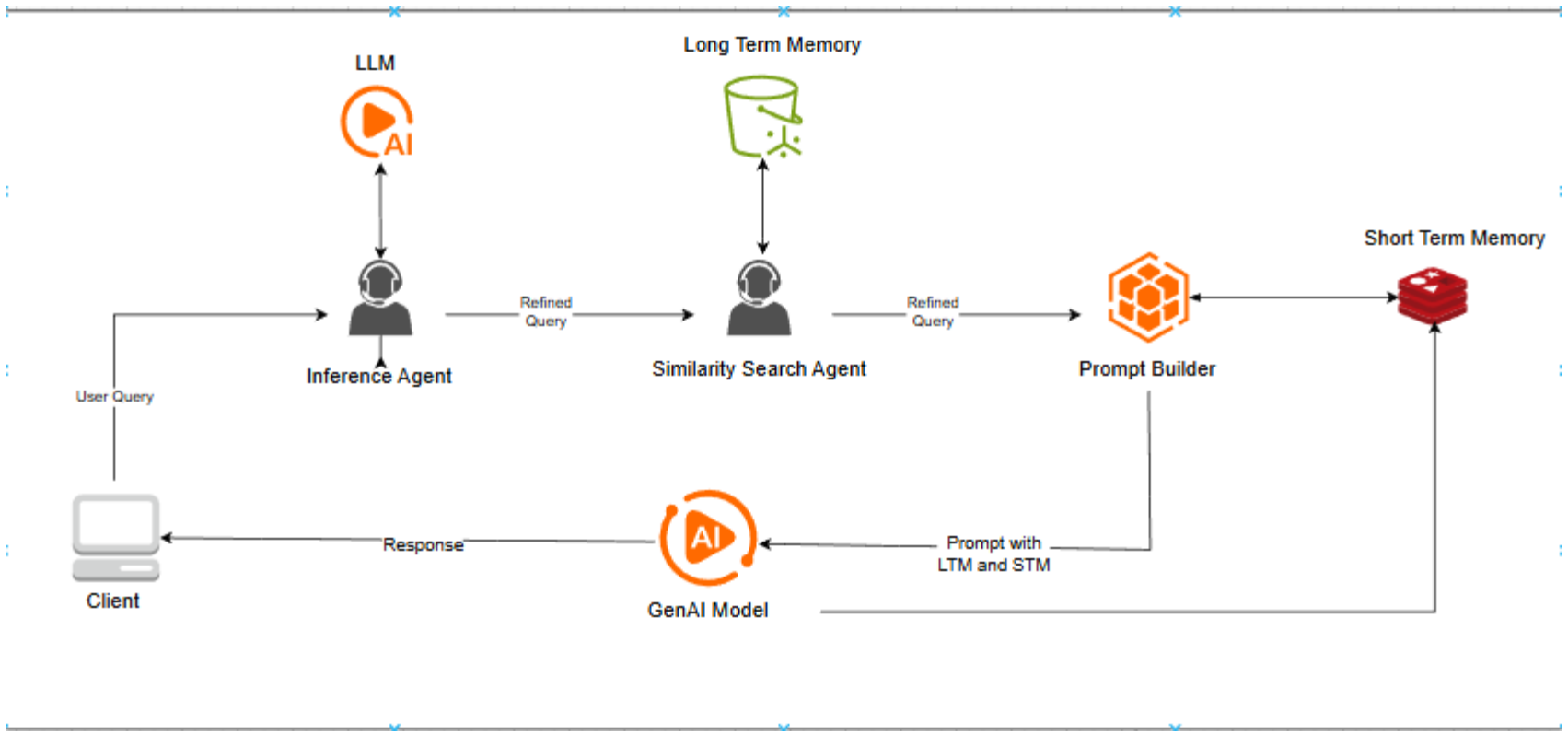
PROPOSED METHODOLOGY

5. LLM Integration: Generates accurate, human-like legal responses.

6. Memory System:

- **Short-Term Memory:** Stores conversation context (per session).
- **Long-Term Memory:** Stores case embeddings in VectorDB.

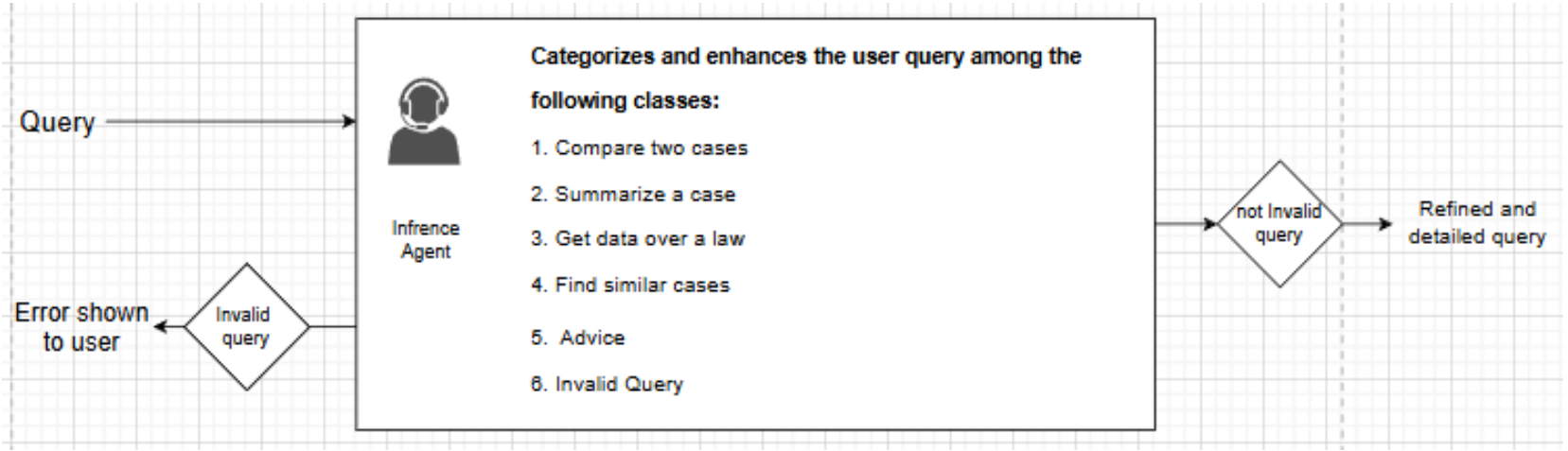
7. Response Delivery: LLM's refined answer is stored for future reference.



QUERY CATEGORIZATION & VALIDATION

Categories the system detects:

1. Compare two cases
2. Summarize a case
3. Get data over a law
4. Find similar cases
5. Advice
6. Invalid Query



- Inference layer marks query valid/invalid and rejects spam/irrelevant requests.
- Valid queries proceed to RAG pipeline for retrieval and response generation.

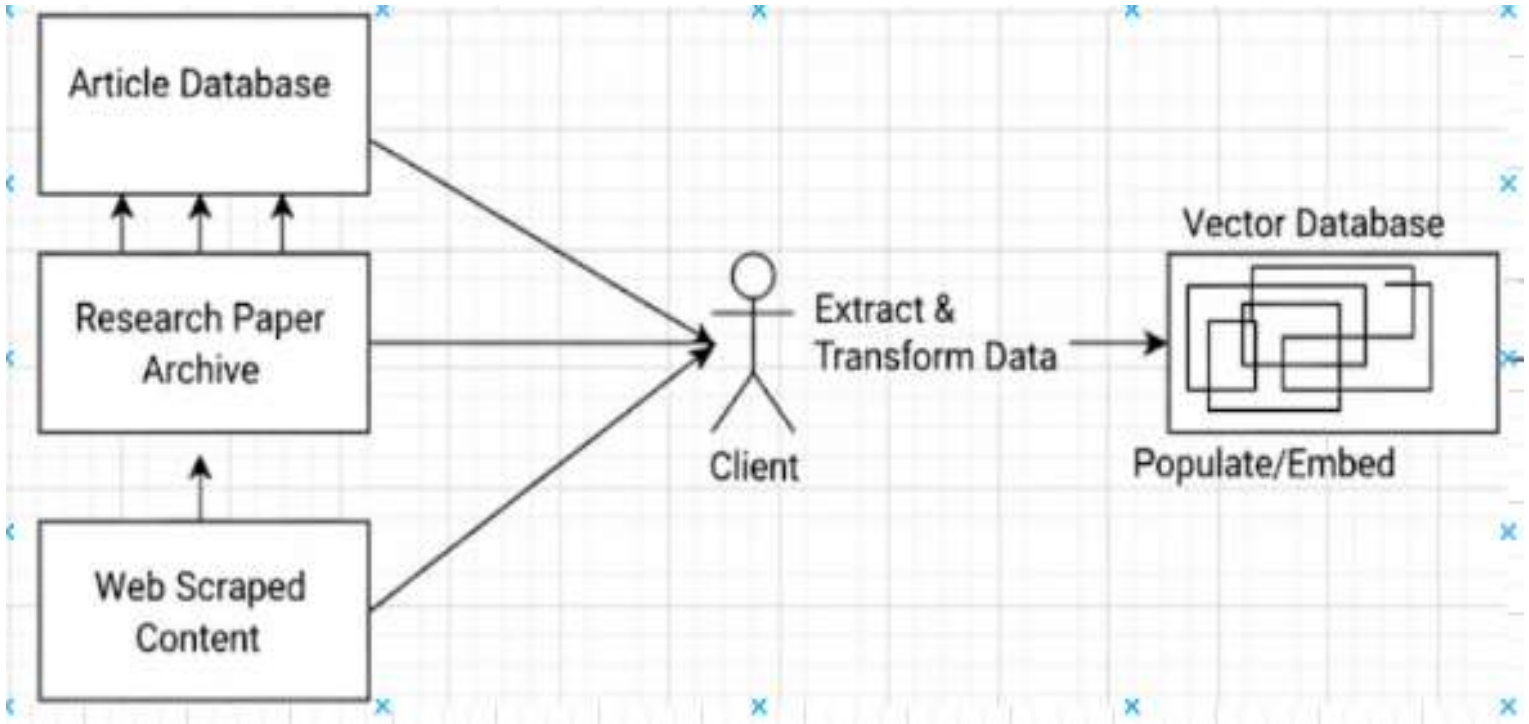
DATA PIPELINE & VectorDB POPULATION

- Data sources: court judgments, case summaries, legal articles, research papers, scraped content.

- Data transform: cleaning, chunking, metadata tagging, embedding generation (sentence transformers).

- VectorDB (FAISS): stores embeddings for long-term memory & similarity search.

- Re-ranking: BM25 (BM2.5 variant) applied to top K from FAISS to pick best context pieces.

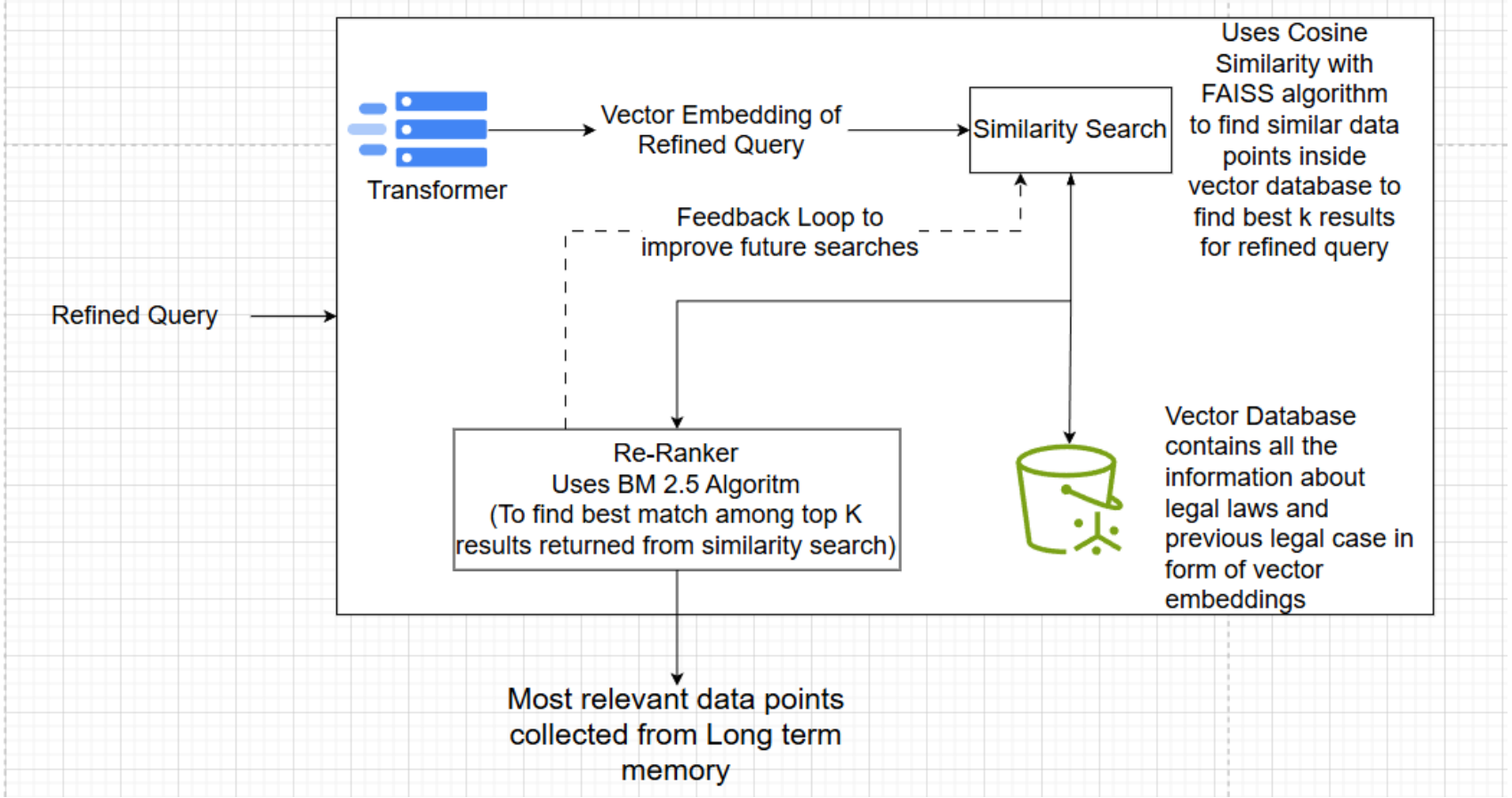


SIMILARITY & RE-RANKING DETAILS

- Semantic search: FAISS + cosine similarity to fetch top-K semantically similar chunks.

- BM25 Re-ranker: uses lexical matching to re-order top hits for best textual match (BM2.5 variant).

- Combined approach: semantic recall (FAISS) + lexical precision (BM25) → better relevance.

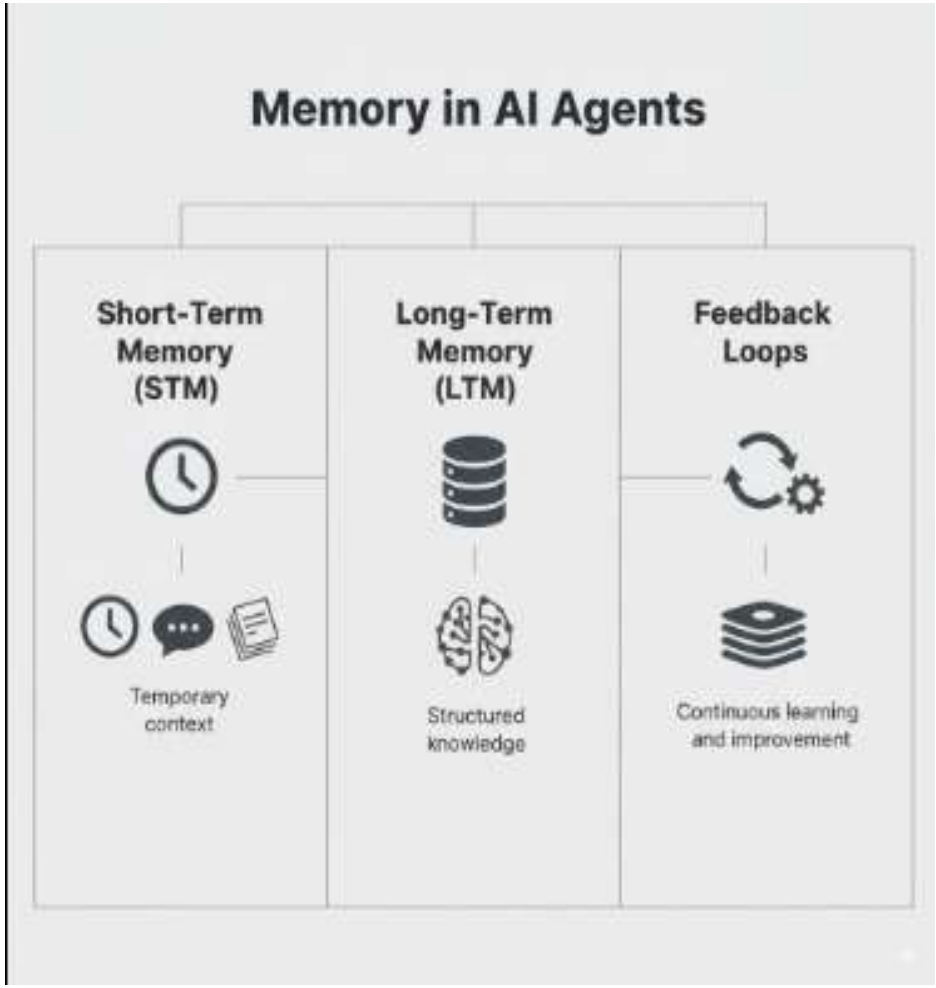


MEMORY MANAGEMENT(STM & LTM)

- Short-Term Memory: Stores session context (previous queries + responses) for coherent multi-turn dialogs.

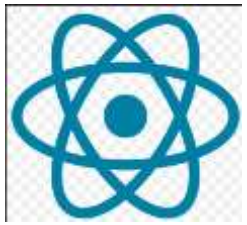
- Long-Term Memory: VectorDB holds embeddings of legal documents and past responses for retrieval.

- After LLM responds, key Q&A pairs are appended to short-term memory and optionally added to long-term DB after validation.



EXPERIMENT SETUP

- Backend: Python, LangChain, custom inference layer.
- VectorDB: FAISS (cosine similarity).
- Re-ranking: BM25 (BM2.5 tuning).
- LLMs: OpenAI/Gemini APIs (or fine-tuned model if available).
- Embeddings: Sentence Transformer models.
- Frontend: ReactJS / Streamlit.
- Metrics: Relevance, Accuracy, Latency, User Satisfaction.



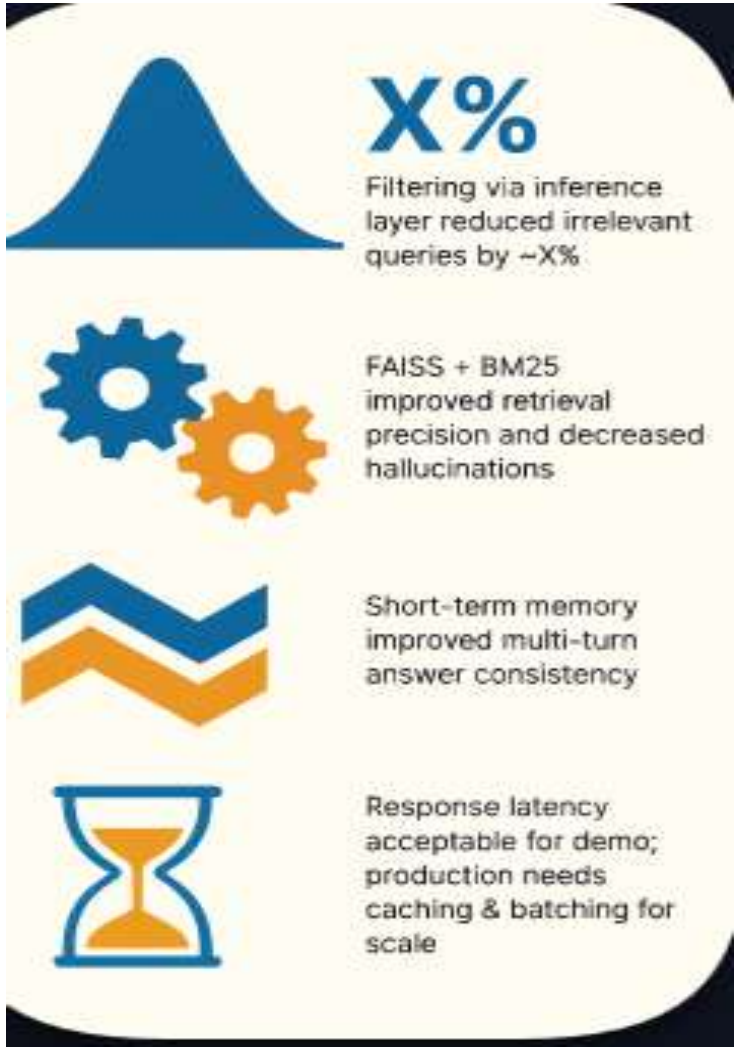
RESULT ANALYSIS

- Filtering via inference layer reduced irrelevant queries by ~X% (replace X with your number).

- FAISS + BM25 improved retrieval precision and decreased hallucinations.

- Short-term memory improved multi-turn answer consistency.

- Response latency acceptable for demo; production needs caching & batching for scale.



CONCLUSION & FUTURE WORK

RAG-Based Legal Advisor Bot

- **Improves factual grounding & context** in legal Q&A by using verified legal sources (case laws, statutes, documents).
- **Hybrid retrieval (FAISS + BM25)** ensures high recall and precision, reducing irrelevant or hallucinated responses.
- **Inference layer** filters low-confidence outputs for factual and contextual accuracy.
- **LLM generation** provides concise, professional legal answers.

Future Work

- Fine-tune legal LLMs for domain expertise.
- Add multilingual & jurisdiction-based support.
- Enable continuous VectorDB updates.
- Introduce compliance checks and latency optimizations.

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