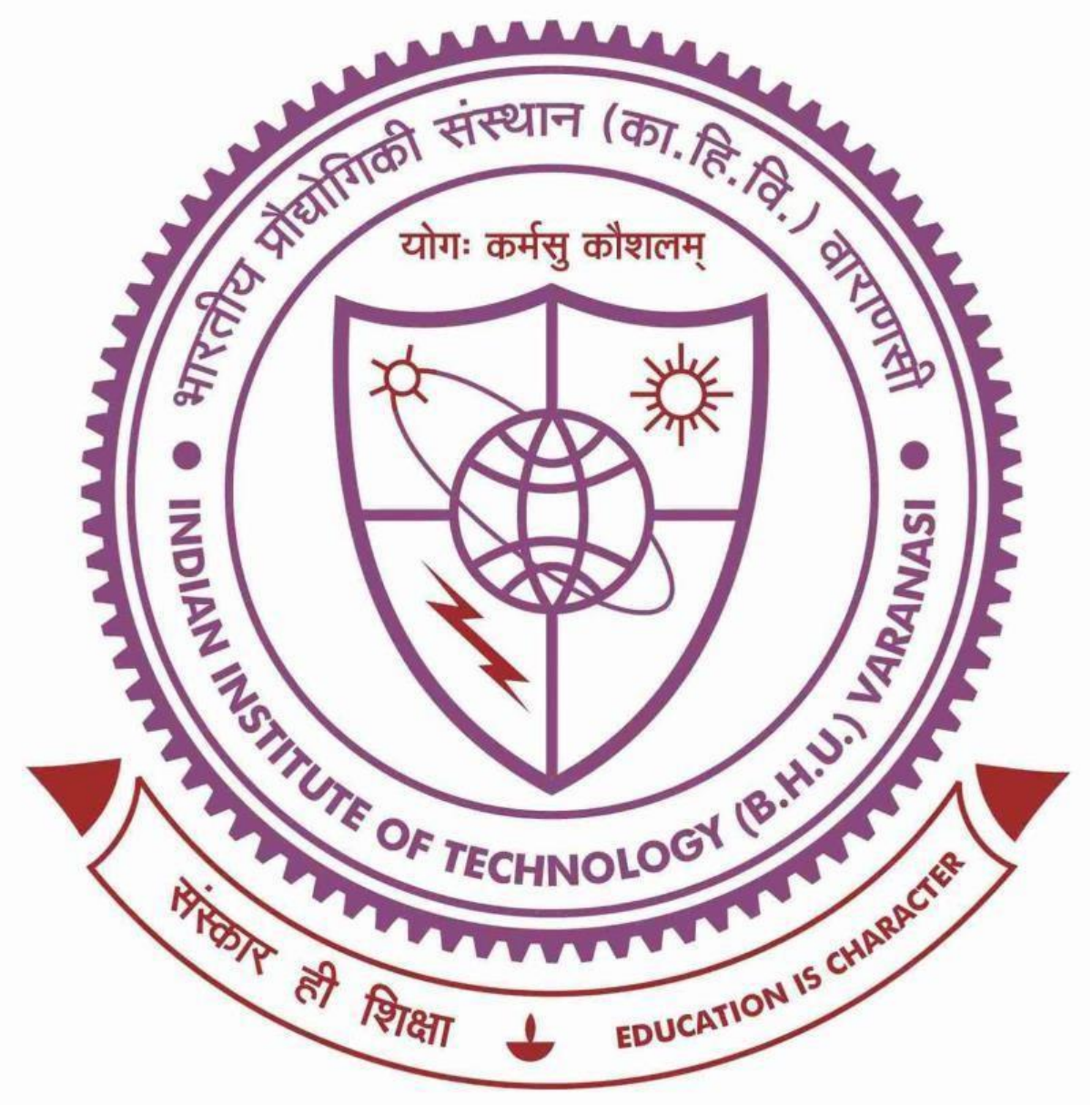
Vidhi.ai: The RAG Based AI Agent for Indian Legal Systems



Project Report on Vidhi.ai. for Submission of Groclake Agentathon: Next Generation Agentic Apps(By Plotch.ai)

Submitted by: Team E_404

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DECLARATION

We hereby declare that the project Vidhi.ai is an original work developed with the primary objective of creating an advanced RAG based legal AI assistant tailored for Indian laws. Vidhi.ai utilizes GPT-4 through ModelLake by GrocLake (Plotch.ai) and incorporates the latest Retrieval-Augmented Generation (RAG) techniques to provide accurate and reliable legal information.

The system's knowledge base is up-to-date with the latest legal reforms, including:

- Bharatiya Nyay Sanhita (BNS), replacing the Indian Penal Code (IPC).
- Bharatiya Nagarik Suraksha Sanhita (BNSS), replacing the Criminal Procedure Code (CrPC).
- Bharatiya Sakshya Adhiniyam (BSA), replacing the Indian Evidence Act.
- The Constitution of India.

Additionally, Vidhi.ai integrates DuckDuckGO Web Search for real-time updates and supports PDF uploads for personalized interaction, allowing users to chat with legal documents for better comprehension.

This project is created with a focus on accessibility, usability, and innovation, aimed at simplifying legal queries for users. However, We acknowledge that Vidhi.ai, being an AI-based system, may have limitations, and users are advised to consult professional lawyers for critical legal matters.

We affirm that all components of this project were developed with the highest ethical and professional standards, ensuring compliance with relevant laws and intellectual property regulations.

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Project Live @ https://ayush09062004.github.io/Vidhi.ai/
Github :- https://github.com/ayush09062004/Vidhi.ai
https://github.com/ayush09062004/Vidhi.ai_ChatApp
https://github.com/ayush09062004/Vidhi.ai_ChatWithPdf

ACKNOWLEDGMENT

First and foremost, We extend our heartfelt thanks to GrocLake (by Plotch.ai) for providing access to the ModelLake platform and enabling the integration of the powerful GPT-4 model, which forms the backbone of Vidhi.ai. Their innovative technology and resources were instrumental in bringing this project to life.

We would like to thank IIT BHU, Varanasi for providing us the opportunity and helped us to gain an invaluable experience and wonderful time during the project.

We also want to acknowledge the importance of DuckDuckGO for its web search capabilities and express my appreciation for the open-source and proprietary tools like Gradio, Hugging Face Spaces etc. used in the development of Vidhi.ai. These tools helped ensure that the system is both functional and user-friendly.

A special thanks to our family and friends(special mention to Aheli Poddar{github: https://github.com/XAheli}, whose guidance, patience, motivation, and belief in our abilities gave us the strength to overcome challenges and strive for excellence.

Lastly, We extend our gratitude to the legal and technological communities for their ongoing efforts to make information more accessible and accurate. This project is our humble attempt to contribute to this vision by simplifying access to Indian legal knowledge.

Thank you all for your support, guidance, and encouragement.

Name: Kashish Tiwari & Ayush Raj
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Introduction:

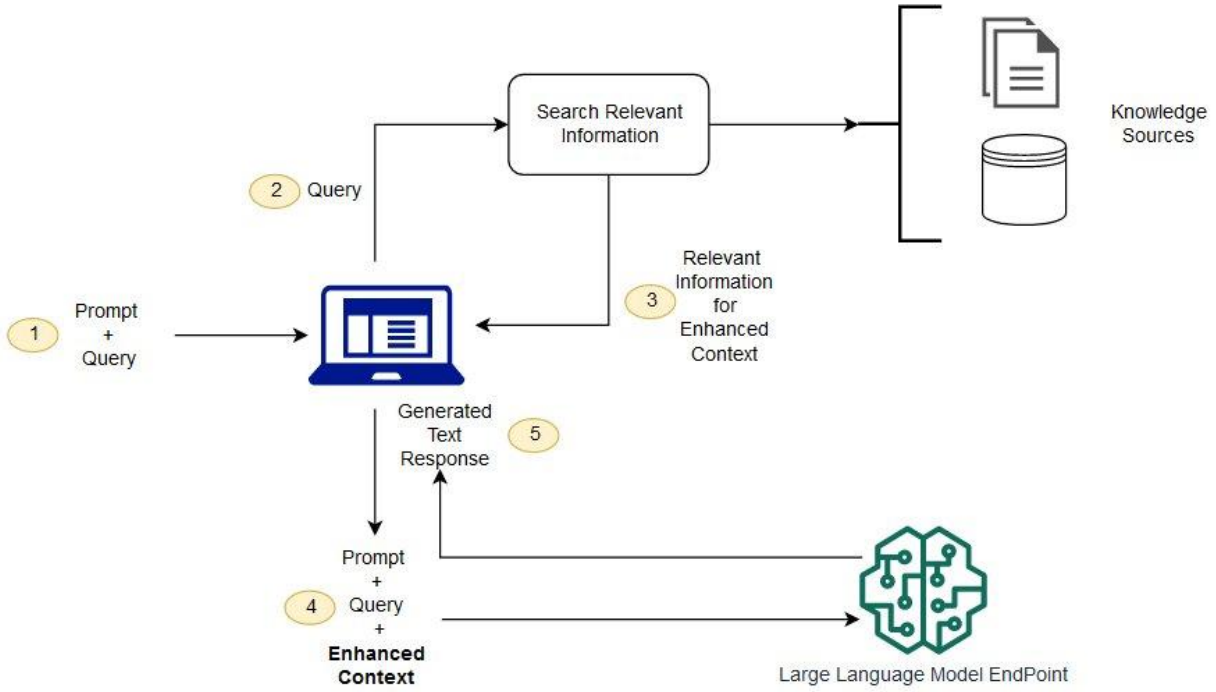

Fig.1. RAG Pipeline [1]

Vidhi.ai is an innovative AI-powered legal assistant designed to simplify and enhance access to Indian legal knowledge. Built using the advanced **GPT-4** model via **ModelLake**, offered by **GrocLake (by Plotch.ai)**, Vidhi.ai leverages the latest Retrieval-Augmented Generation (RAG) technology to provide accurate, contextually relevant, and up-to-date answers to legal queries.

The legal framework in India is undergoing significant transformations, with the introduction of:

- Bharatiya Nyay Sanhita **(BNS)**, replacing the Indian Penal Code (IPC).
- Bharatiya Nagarik Suraksha Sanhita **(BNSS)**, replacing the Criminal Procedure Code (CrPC).
- Bharatiya Sakshya Adhiniyam **(BSA)**, replacing the Indian Evidence Act.

Vidhi.ai integrates these updated laws along with the **Constitution of India** into its knowledge base, ensuring users have access to the most recent legal developments. To further enhance accuracy and relevance, the platform also incorporates **DuckDuckGO Web Search** for real-time information retrieval.

In addition to answering legal queries, Vidhi.ai provides a unique feature allowing users to upload legal PDFs and interact with them. This functionality empowers users to extract specific information, clarify doubts, and gain a better understanding of complex legal documents.

Vidhi.ai is designed for individuals, legal professionals, and organizations seeking quick, reliable, and user-friendly assistance with Indian laws. However, as an AI-based system, it has limitations, and users are advised to consult professional lawyers for critical legal matters.

This project represents a significant step toward **democratizing access to legal information** in India, combining technological innovation with a user-centric approach to make legal assistance more accessible and efficient.

Process:

Processes Involved in the Project

1. **Document Upload and Text Extraction**:
    - Users can upload PDF documents containing legal information or for Vidhi.ai Chat app we have uploaded PDF documents for knowledgebase which contains legal information.
    - The system uses the **PyPDF2** library[2] to extract text from the uploaded PDFs.
    - The extracted text is stored in a knowledge base for further processing.
2. **Knowledge Base Creation**:
    - The extracted text is pre-processed, cleaned and split into smaller chunks for efficient retrieval.
    - These chunks are indexed and stored in a structured format for semantic search using **FAISS**[3] & **Sentence Transformers**[4] from Transformers library of Hugging Face.
3. **Semantic Search:**
    - When a user submits a query, the system performs a semantic search[5] on the knowledge base.
    - The search identifies relevant chunks of text that match the query contextually.
4. **Web Search Fallback:**
    - If no relevant information is found in the knowledge base, the system performs a **DuckDuckGo search**[6].
    - The top search results are fetched and used as additional context for generating a response.
5. **AI-Powered Summarization and Response Generation:**
    - The system uses a large language model (LLM) to summarize the retrieved information.[7]
    - The summarized context is then used to generate a concise and accurate response to the user's query.
    - The response is tailored to Indian laws and is limited to 100-120 words for brevity.
6. **Gradio Chat Interface:**
    - The system provides a user-friendly interface built using Gradio[8].
    - Users can interact with the chatbot, upload PDFs, and receive responses in real-time.
    - The interface also includes features like automatic summarization of uploaded documents and a history of user interactions.

7. **Error Handling and Fallback Mechanisms:**
    - The system includes robust error handling to manage issues like failed PDF text extraction, search errors, or LLM response generation failures.
    - Fallback mechanisms ensure that users receive a response even if the primary processes fail.
8. **Deployment and Sharing:**
    - The Gradio interface is deployed with a shareable link, allowing users to access the system from any device.
    - The system is designed to handle multiple users simultaneously.
9. **Technologies Used**
    - Python Libraries: PyPDF2 for PDF text extraction.
    - DuckDuckGo Search for web scraping.
    - Gradio for building the chat interface.
    - Logging for tracking and debugging.
    - Large Language Model (LLM): The system uses Groclake's Modellake API for text summarization and response generation.
    - Frontend Development: HTML, CSS, and JavaScript for the main website.
    - Bootstrap[9] for responsive design.
    - Font Awesome for icons.[10]
10. **Challenges Faced**
    - **Text Extraction from PDFs:** Some PDFs with complex formatting or scanned images posed challenges for text extraction.
        - The system uses fallback mechanisms to handle such cases.
    - **Semantic Search Accuracy:** Ensuring high accuracy in semantic search required fine-tuning the chunking and retrieval processes.
    - **Response Length Control:** Limiting responses to 100-120 words while retaining key details was a challenge. The system uses prompt engineering and token limits to achieve this.
    - **Integration with External APIs:** Integrating DuckDuckGo search and Groclake's Modellake API required careful handling of API responses and error cases.
11. **Future Enhancements**
    - **Support for More Document Formats:** Extend support to other formats like DOCX, TXT, and scanned images using OCR preferred Pytesseract[11].
    - **Multilingual Support:** Add support for multiple Indian languages to make the system more accessible.

- **Advanced NLP Techniques:** Incorporate advanced NLP techniques like named entity recognition (NER) and sentiment analysis for better context understanding.
- **User Authentication and History:** Add user authentication to save chat history and uploaded documents for future reference.
- **Mobile App Development:** Develop a mobile app for easier access and usage on the go.

Conclusion

Vidhi.ai is a powerful AI legal assistant that simplifies the process of accessing legal information. By combining document processing, semantic search, web scraping, and AI-powered summarization, the system provides accurate and concise legal advice tailored to Indian laws. The project demonstrates the potential of AI in making legal services more accessible and efficient. With future enhancements, Vidhi.ai can become an indispensable tool for individuals and professionals navigating the complexities of Indian law.

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