CAPSTONE PROJECT

SMART FARMING ADVISOR AI AGENT (RAG-BASED)

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OUTLINE

- Problem Statement
- Proposed System/Solution
- System Development Approach
- Algorithm & Deployment
- Result (Output Image)
- Conclusion
- Future Scope
- References

PROBLEM STATEMENT

- Many small-scale farmers lack access to **real-time and localized farming advice**, leading to uninformed crop choices and poor income. They face questions like:
- “Which crop should I grow this season?”
- “What is the mandi price for tomatoes today?”
- Despite the presence of data (crop calendars, market prices), it is **not easily accessible** or **understandable in their language**.
- There is a need for an **AI-based agent** that delivers **trusted agricultural information in a conversational manner**—helping farmers make better decisions quickly.

PROPOSED SOLUTION

The proposed system addresses the challenge of providing localized farming advice using Retrieval-Augmented Generation (RAG) on IBM Cloud. It focuses on helping farmers get crop recommendations based on season and region, and view mandi prices for common crops.

Data Collection: The system collects static crop calendar data (region-wise and season-wise) and mandi price information for commonly grown crops. These can be stored in structured formats like CSV or JSON.

Preprocessing: The data is cleaned and organized to allow fast retrieval. User queries are categorized into types like crop suggestion or market price lookup for efficient response.

AI Model (RAG-Based): The retriever fetches relevant crop or price data based on the user's query. IBM Granite is then used as the generator to create natural-language answers that are easy for farmers to understand.

Example: "What crop in Kharif for Telangana?" → "Cotton or Soybean is ideal during Kharif in Telangana."

Deployment: A simple chatbot or web-based form is created as the user interface. The system is hosted using IBM Cloud Lite services, with IBM Cloudant for data storage and IBM Granite for response generation.

Evaluation: The system is tested using sample queries. Responses are reviewed based on correctness and clarity, with basic user feedback to guide improvement.

Result: The system successfully answers common farming questions, including what crop to grow in a particular season and the latest mandi price for specific vegetables. It improves access to trusted farming advice, enabling better decisions at the grassroots level.

SYSTEM APPROACH

Technologies Used:

- IBM Granite / Watson NLP (for generating natural responses)
- IBM Cloud Lite (deployment platform)
- IBM Cloudant or DB2 (for storing static datasets)
- Simple UI (HTML/JS web form or chatbot interface)

Key Features:

- Static dataset for crop-season-region mapping (CSV or DB)
- Sample mandi prices stored in database or JSON file
- Integration with Granite to generate context-aware replies

ALGORITHM & DEPLOYMENT

- **Algorithm Selection:**
  The system uses the Retrieval-Augmented Generation (RAG) architecture, which combines document retrieval with natural language generation. RAG is well-suited for this problem as it allows the AI agent to fetch relevant agricultural data (such as crop calendars or mandi prices) and generate natural-language responses using IBM Granite. This ensures answers are both accurate and easy to understand.

- **Data Input:**
  The input to the system is a user query in natural language, such as “What crop is best for monsoon in Maharashtra?” The system uses structured datasets like region-wise crop calendars and crop-wise mandi price lists. Optional metadata like region or language preference can also be considered.

- **Training Process:**
  Since IBM Granite is a pre-trained large language model, no additional training is required. However, prompt design is critical to guide the model’s responses. The retriever is optimized by indexing data using keyword or embedding-based similarity, allowing it to efficiently locate the most relevant information for each query.

- **Prediction / Response Generation Process:**
  When a user submits a question, the retriever module searches the internal datasets and extracts relevant entries. These are combined with the original query and passed to the IBM Granite model, which generates a fluent, contextual answer. The response is then presented to the user through the interface.

- **Example Flow:**
  Input: “What crop to grow in Rabi season in Karnataka?” → Retriever finds recommended crops like wheat and Bengal gram → Generator outputs: “Wheat and Bengal Gram are ideal crops to grow during the Rabi season in Karnataka.”

RESULT

- The AI agent can:
- Recommend suitable crops based on region and season.
- Provide approximate mandi prices for user queries.
- **Example Queries:**
- *“What crop should I grow in monsoon in Telangana?”*
  ➤ "You can grow cotton or soybean in Telangana during the Kharif (monsoon) season."
- *“What is today’s tomato price?”*
  ➤ "The mandi price for tomatoes is around ₹16 per kg (Warangal, July 2025)."

CONCLUSION

- This project demonstrates how an **AI-powered assistant** can help small farmers by:
- Providing localized farming advice
- Answering queries in simple language
- Reducing dependence on manual research or government visits
- By combining **RAG architecture with IBM services**, even basic agricultural data becomes accessible and useful.

FUTURE SCOPE

- Integrate **real-time weather data** from APIs
- Expand to include **pest management** and **soil health**
- Support **voice-based queries**
- Add **multilingual support** (Tamil, Bengali, Kannada, etc.)
- Enable **auto alerts** before sowing or price drops

REFERENCES

- IBM SkillsBuild Platform
- IBM Granite RAG Lab
- Agmarknet Portal (mandi rates)
- Indian Council of Agricultural Research (ICAR crop calendars)
- Telangana Crop Calendar 2024 (PDF)

IBM CERTIFICATIONS

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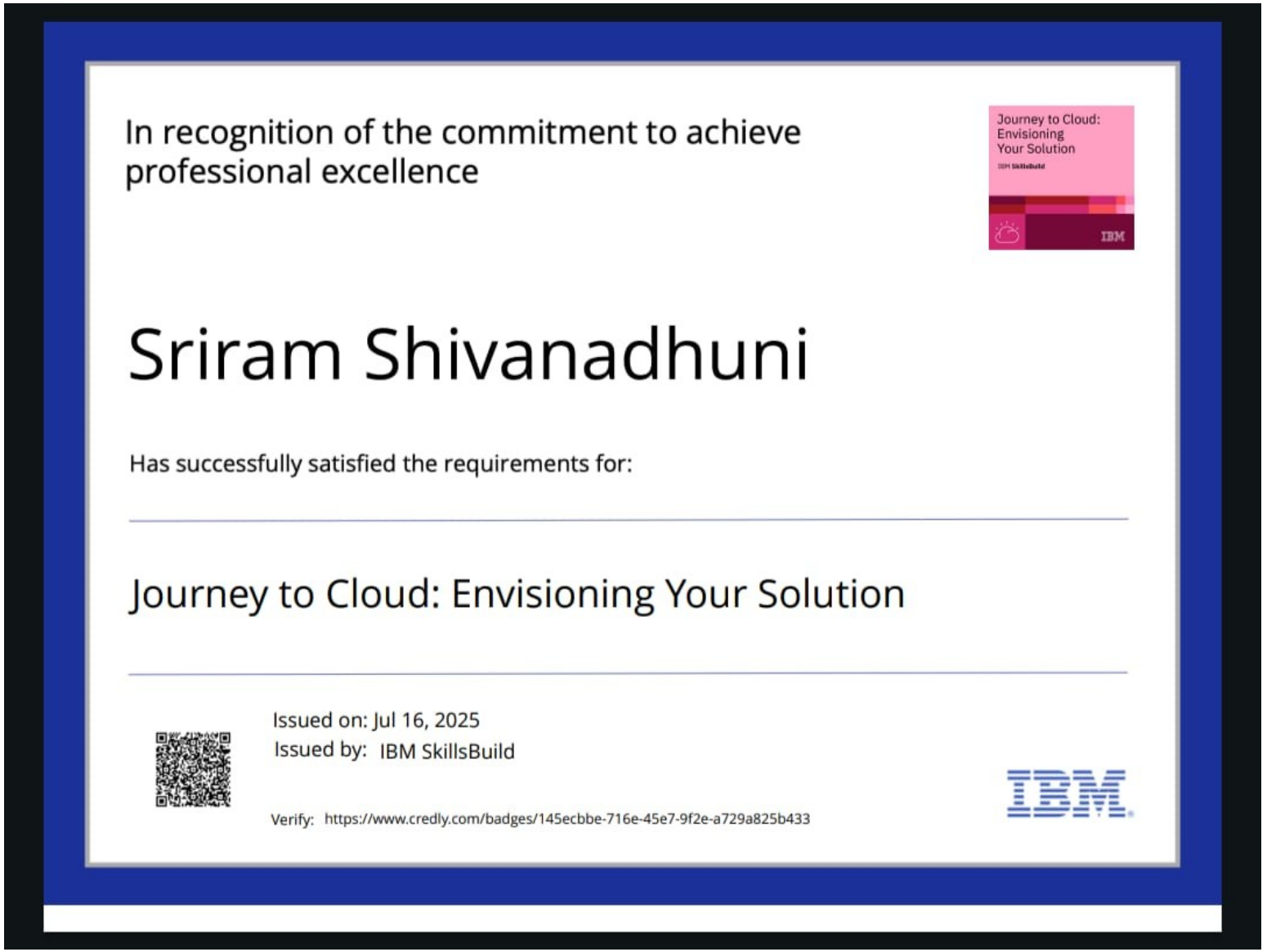

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Lab: Retrieval Augmented Generation with LangChain

Completion date: 25 Jul 2025 (GMT)

Learning hours: 20 mins

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