

---

## CAPSTONE PROJECT

### AI AGENT FOR SMART FARMING ADVICE USING IBM RAG AND WATSONX.AI (AGRO BUDDY)

Presented By:

- ⇒ Nellaballi Bhargav Reddy
- ⇒ Lovely Professional University
- ⇒ Computer Science (AIML)

---

## OUTLINE

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

---

# PROBLEM STATEMENT

- In India, the majority of small-scale farmers do not have easy access to expert agricultural advice. This results in poor decision-making when it comes to crop selection, pest and disease management, weather preparedness, and selling produce at competitive prices. While digital tools exist, they are often not localized, real-time, or user-friendly for rural users. There is a significant knowledge gap between scientific agricultural practices and grassroots-level implementation. The lack of personalized support in local languages further widens this gap, limiting farmers' productivity and income potential.

---

# PROPOSED SOLUTION

- We propose an intelligent, multilingual AI Agent designed specifically for small-scale farmers in India. This agent serves as a real-time, location-aware, conversational assistant that delivers actionable advice by combining document retrieval and LLM-based generation.
- **Key Features:**
- 🔍 **Retrieval-Augmented Generation (RAG):** Fetches trusted, relevant data from agricultural reports, APIs, and weather services.
- 💬 **Multilingual Conversations:** Supports local languages like Hindi, Telugu, and Tamil through IBM Language Translator API.
- ☁️ **Weather-Aware:** Provides weekly forecasts with tips on irrigation and pest risks.
- 🌾 **Crop Recommendations:** Suggests crops based on season, soil type, and current climatic trends.
- 🛒 **Mandi Price Lookup:** Fetches real-time crop prices using agrimarket.gov APIs.
- 🗣️ **Voice Interaction (Optional):** Allows speech-to-text inputs for farmers with low literacy levels.
- **Sample Interaction:**
- **User:** "August mein Maharashtra ke liye kaunsa crop sahi hai?"
- **AI Agent:** "Namaste Kisan Bhai! August mein Soybean, Cotton aur Bajra achhe vikalp hain. Yeh crops barish ke mausam mein acchi paidavar dete hain."
- The system democratizes access to expert farming advice, helping farmers make informed decisions at every step.

---

# SYSTEM APPROACH

- The system architecture is modular and cloud-native, making it scalable, responsive, and accessible even in low-bandwidth areas.
- **1. Frontend Interface:**
- **Watsonx Assistant:** Chat UI with intents like "crop advice," "weather forecast," "pest remedy."
- **Custom Web UI (Optional):** Lightweight responsive interface for mobile users.
- **2. Backend & AI Engine:**
- **IBM Watsonx.ai + Granite LLM:** For generating natural, contextual responses.
- **IBM Cloud Functions:** Executes API calls for retrieval and translation logic.
- **3. Knowledge Sources:**
- **Government APIs:** agrimarket.gov.in, IMD, KVK Reports
- **Domain-Specific PDFs and HTMLs stored in IBM Cloud Object Storage**
- **4. Translation & Voice:**
- **IBM Language Translator API:** Converts between English and local languages.
- **IBM Speech-to-Text:** Enables audio queries (planned in future).

---

# SYSTEM APPROACH

## Component

Chat Interface

LLM Engine

Storage

Serverless Logic

APIs Integrated

Language Support

## Technology Used

IBM Watsonx Assistant

IBM Granite Model

IBM Cloud Object Storage

IBM Cloud Functions

IMD, Agrimarket, Soil DB

IBM Language Translator

- **Design Choice:**
- **Intent-Driven Design:** Enables easy extension of features.
- **Feedback Loop:** Users can rate answers for continuous model fine-tuning.
- **Visual Cards:** Market prices, rainfall trends, and crop calendars displayed in structured format.

# ALGORITHM & DEPLOYMENT

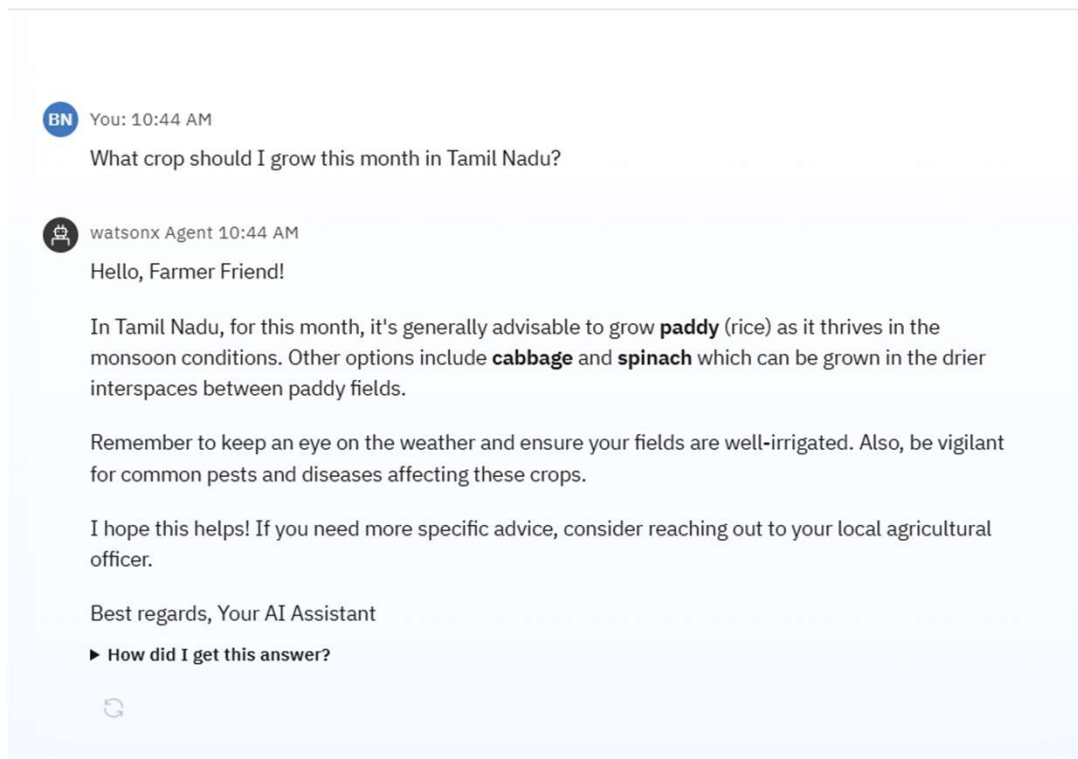
- **Retrieval-Augmented Generation (RAG) architecture is used:**
  - User Query (e.g., “What crop to grow in August in Maharashtra?”)
  - Retrieve related documents based on location and season (weather, soil, crop guides)
  - Feed retrieved context into IBM Granite model
  - Generate a natural language response in preferred language
- **Algorithm Justification:**
  - RAG bridges data retrieval and generation, ensuring fact-based, personalized responses.
  - IBM Granite model is trained on diverse corpora and fine-tuned for agriculture-specific prompts.
- **Deployment:**
  - Backend is deployed on IBM Cloud Functions
  - Frontend connected to Watsonx Assistant
  - Object Storage holds knowledge documents (PDFs, HTMLs)

# RESULT

The AI Agent delivers real-time responses to farmer queries.

Some example results:

Agent preview



The screenshot displays a chat window with a light blue header and a white body. The header contains a blue circular icon with 'BN' and the text 'You: 10:44 AM'. The body shows a user query: 'What crop should I grow this month in Tamil Nadu?'. Below this, a response from 'watsonx Agent 10:44 AM' is shown. The response begins with 'Hello, Farmer Friend!' and provides advice on growing crops in Tamil Nadu, mentioning 'paddy' (rice), 'cabbage', and 'spinach'. It also includes a reminder to monitor weather and irrigation, and a suggestion to consult local agricultural officers. The response ends with 'Best regards, Your AI Assistant' and a link '► How did I get this answer?'. A small circular icon is visible at the bottom left of the chat area.

BN You: 10:44 AM

What crop should I grow this month in Tamil Nadu?

watsonx Agent 10:44 AM

Hello, Farmer Friend!

In Tamil Nadu, for this month, it's generally advisable to grow **paddy** (rice) as it thrives in the monsoon conditions. Other options include **cabbage** and **spinach** which can be grown in the drier interspaces between paddy fields.

Remember to keep an eye on the weather and ensure your fields are well-irrigated. Also, be vigilant for common pests and diseases affecting these crops.

I hope this helps! If you need more specific advice, consider reaching out to your local agricultural officer.

Best regards, Your AI Assistant

► How did I get this answer?



# RESULT

**BN** You: 10:48 AM

"My tomato plants have black spots on leaves. What should I do?"

 watsonx Agent 10:48 AM

I'm sorry to hear about your tomato plants, Kisan Bhai. Black spots on leaves can be a sign of a fungal disease called 'Early Blight'. Here's what you can do:

1. **Identify the Problem:** Confirm it's Early Blight by checking for additional symptoms like wilting leaves and brown spots on fruits.
2. **Remove Affected Parts:** Cut off and dispose of the infected leaves and stems. Avoid composting them to prevent spreading the disease.
3. **Apply Fungicide:** Use a suitable fungicide like Mancozeb or Triforine. Follow the instructions on the label for application rates and timing.
4. **Crop Rotation:** Practice crop rotation to prevent the buildup of pathogens in the soil.
5. **Watering Practices:** Water your plants early in the morning to allow leaves to dry quickly, reducing the humidity that promotes fungal growth.
6. **Sanitation:** Keep your farm clean and free of debris that could harbor the fungus.

|Type something...



---

# CONCLUSION

- This project showcases how AI can be effectively used to empower Indian farmers by providing personalized, localized, and real-time agricultural advice. By combining the strengths of document retrieval and language models, the AI agent becomes a virtual farming assistant. This project improves decision-making, enhances productivity, and ultimately increases the income of small-scale farmers. The use of IBM Cloud ensures scalability and reliability for rural deployments.

---

## FUTURE SCOPE

- Integrate camera-based pest detection using AI image classification
- Add voice note feature for illiterate users
- Expand to more Indian languages and dialects
- Add support for government subsidy eligibility and scheme updates
- Integrate with IoT sensors for soil moisture and pH data
- Deploy through SMS/IVR for regions with no smartphone access

---

# REFERENCES

- [agrimarket.gov.in](http://agrimarket.gov.in) (Govt. Mandi Prices)
- [imdagrmet.gov.in](http://imdagrmet.gov.in) (Weather Forecast)
- [data.gov.in](http://data.gov.in) (Agriculture Datasets)
- [soilhealth.dac.gov.in](http://soilhealth.dac.gov.in) (Soil Health Reports)
- IBM Watsonx.ai and IBM Granite Documentation
- Krishi Vigyan Kendra Guidelines

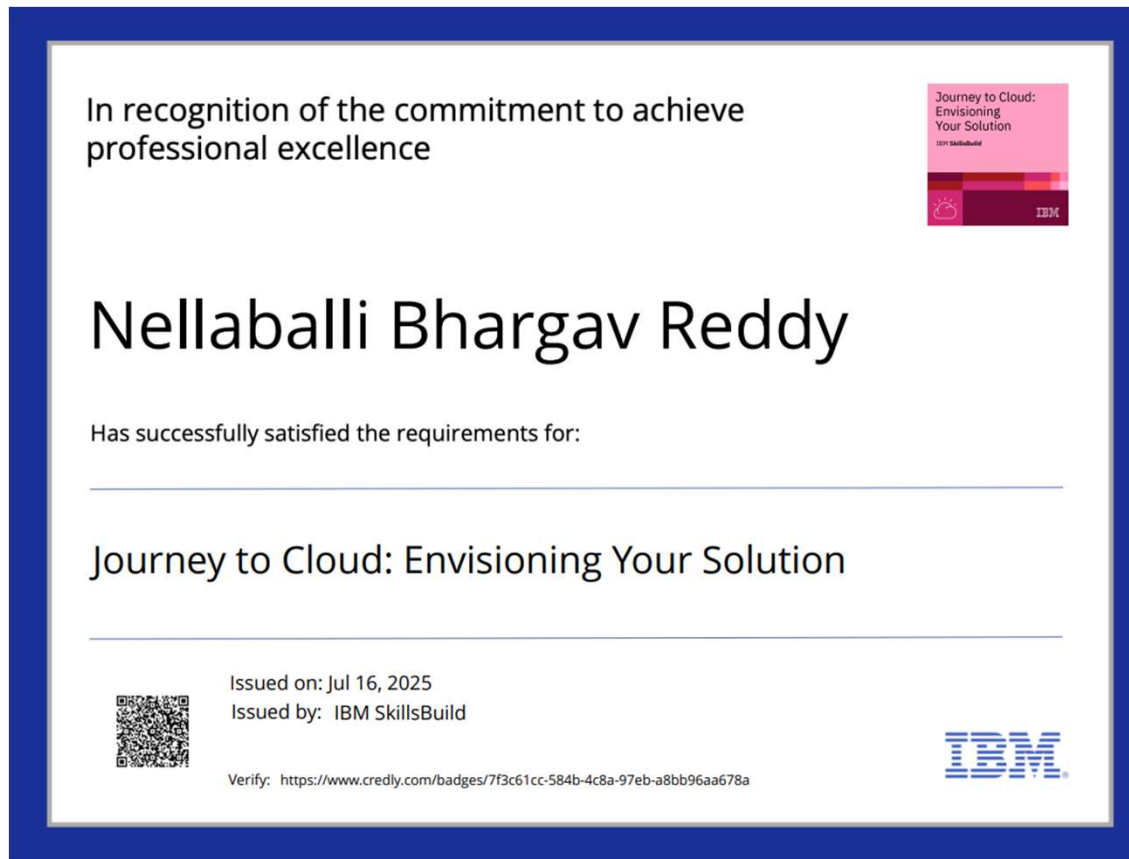
## IBM CERTIFICATIONS

- Screenshot/ credly certificate( getting started with AI)



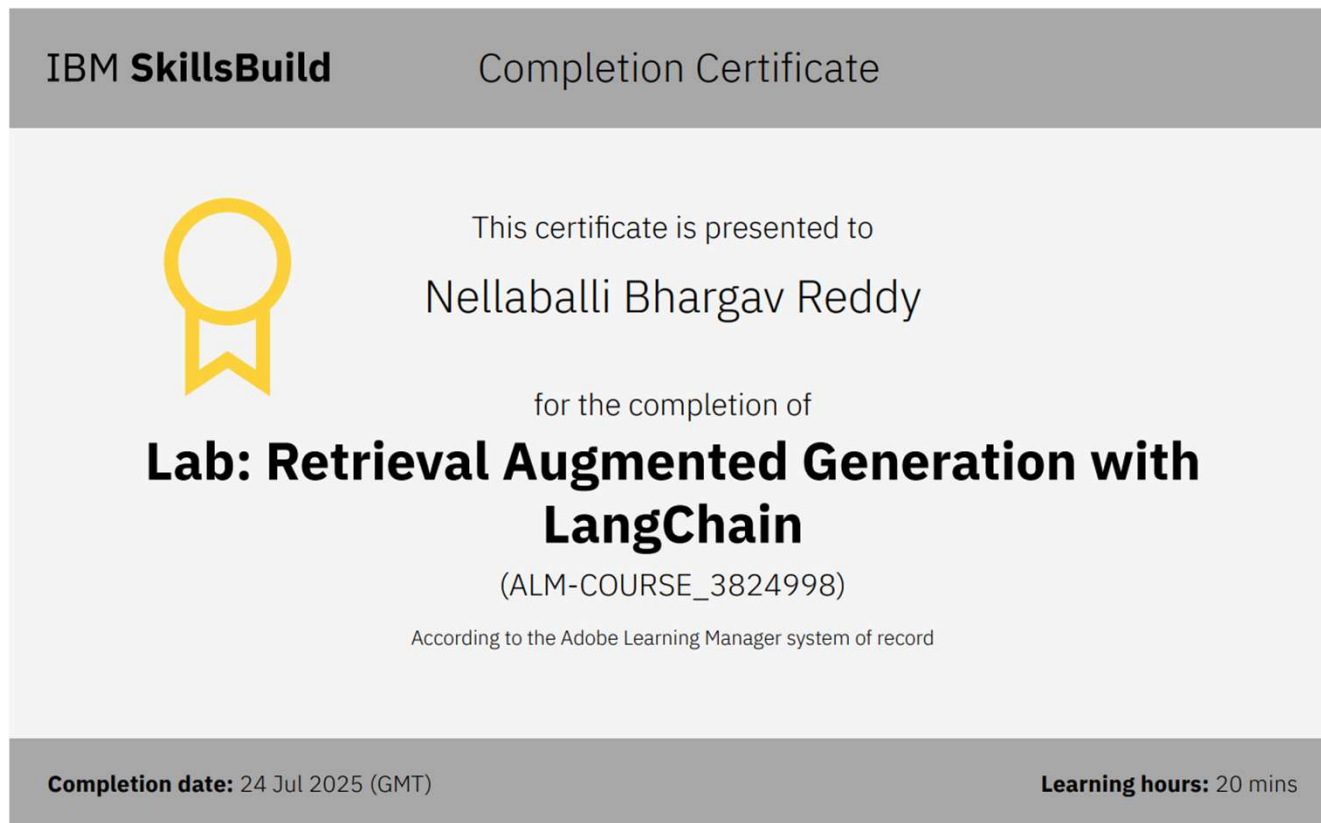
## IBM CERTIFICATIONS

- Screenshot/ credly certificate( Journey to Cloud)



## IBM CERTIFICATIONS

- Screenshot/ credly certificate( RAG Lab)



---

**THANK YOU**