
CAPSTONE PROJECT

AI AGENT FOR SMART FARMING ADVICE

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OUTLINE

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PROBLEM STATEMENT

- An AI Agent for Smart Farming Advice, powered by RAG (Retrieval-Augmented Generation), supports small-scale farmers by delivering real-time, localized agricultural guidance. It retrieves trusted data on weather forecasts, soil conditions, crop recommendations, pest control measures, and current market prices from agricultural departments, meteorological sources, and agri tech platforms. Farmers can interact in their local language and ask questions like “What crop is best for this season?” or “What is today’s mandi rate for tomatoes?” The agent ensures timely, data-driven decisions that reduce risk, increase yield, and boost income. This AI-driven assistant bridges the knowledge gap and brings smart farming to the grassroots.

PROPOSED SOLUTION

- The proposed system aims to assist small-scale farmers by providing real-time, localized agricultural guidance through an AI Agent powered by Retrieval-Augmented Generation (RAG). This system integrates real-time retrieval, machine learning models, and natural language interaction to deliver accurate, actionable farming advice.
- **Data Collection:**
 - Collect historical data on soil conditions, crop yields, rainfall, pest outbreaks, and local farming practices.
 - Retrieve real-time data from weather APIs, mandi (market) databases, agricultural departments, and IoT sensors in the field.
- **Data Preprocessing:**
 - Clean and preprocess data to handle missing values, inconsistencies, and noisy sensor input.
 - Use feature engineering to extract meaningful indicators like soil pH ranges, rainfall trends, or crop suitability scores.
- **AI Algorithm & RAG Integration:**
 - Integrate RAG to retrieve domain-specific knowledge (from agri-dept portals, market rates, expert articles) for answering farmer queries in natural language.
 - Use machine learning for crop and fertilizer recommendation.
- **Deployment:**
 - Deploy the AI Agent via a chatbot interface or mobile app, allowing interaction in local languages.
 - Ensure scalability and fast response time, especially in low-connectivity rural areas.
- **Evaluation:**
 - Evaluate prediction models using metrics like accuracy, precision, and user feedback quality.
 - Continuously improve the system through user interactions, feedback loops, and periodic model retraining.

SYSTEM APPROACH

The Smart Farming AI Agent was developed using IBM Watsonx.ai Studio, which enables building, training, and deploying AI models in a cloud-based environment.

- **System requirements:**
 - IBM Watsonx.ai cloud environment
 - IBM Cloud Object Storage
 - Stable internet and browser access
- **Library required to build the model:**
 - **Watsonx.ai Studio** – For model training and deployment
 - **Watson NLP / Discovery** – For understanding and retrieving relevant content.
 - **APIs** – For weather, soil, and mandi price data.

RESULT

The screenshot displays the IBM Watsonx Agent Lab interface. The top navigation bar includes the IBM Watsonx logo, an 'Upgrade' button, and user information for 'Rakshitha Armugam's Account' in 'Dallas'. The breadcrumb trail shows 'Projects / smart_farming1 / Agent Lab'. The main interface is split into two panels: 'Build' on the left and 'Agent preview' on the right.

Build Panel:

- Model:** mistral-large
- Framework:** LangGraph
- Architecture:** ReAct
- Instructions:** You are a Smart Farming AI Assistant. take preference from user like location, soil type, current season, give the specific answer to user query.
- Tools:** Includes buttons for 'Add a tool' and 'Create custom tool'.

Agent preview Panel:

- User Query:** What is today's mandi rate for tomatoes?
- Agent Response:** Here are the latest mandi rates for tomatoes in various regions:
 - Rajasthan:** ₹3435 per Quintal (as of 30/07/2025 11:55 AM)
 - Uttar Pradesh:** ₹2874.3 per Quintal
 - Madhya Pradesh:** ₹2871.43 per Quintal
 - Delhi:** ₹29/Kg (₹12 - ₹48) as of 28 Jul'25 (Agmarknet)
 - Nagpur:** ₹2950 per Quintal
 - Kalimati (Nepal):**
 - Tomato Big (Nepali): ₹50 - ₹60 per Kg, Average ₹55 per Kg
 - Tomato Small (Local): ₹24 - ₹30 per Kg, Average ₹26 per Kg
- Disclaimer:** For the most accurate and up-to-date information, please refer to the respective market websites or official mandi price lists.
- Feedback:** How did I get this answer?

The bottom of the image shows a Windows taskbar with the date and time as 20:39 on 30-07-2025.

RESULT

The screenshot displays the IBM Watsonx Agent Lab interface. The top navigation bar includes the IBM Watsonx logo, an 'Upgrade' button, a user profile for 'Rakshitha Armugam's Acco...', and location settings for 'Dallas'. The main header shows the project path: 'Projects / smart_farming1 / Agent Lab'. Below this, the 'Build' section is active, showing the 'Setup' tab with 'Framework' set to 'LangGraph' and 'Architecture' set to 'ReAct'. The 'Instructions' section contains the text: 'You are a Smart Farming AI Assistant. take preference from user like location, soil type, current season, give the specific answer to user query.' The 'Tools' section has buttons for 'Add a tool' and 'Create custom tool'. The 'Agent preview' section on the right shows a chat history with a user query 'in karnataka' and a response from the 'watsonx Agent' providing tomato mandi rates in Karnataka. The response includes a list of rates for Karnataka, Bangalore District, and Udupi. The interface also features a 'Deploy' button and a 'Share feedback' link.

Build

Model: mistral-large

Setup

Configuration

Framework: LangGraph

Architecture: ReAct

Instructions

You are a Smart Farming AI Assistant. take preference from user like location, soil type, current season, give the specific answer to user query.

Knowledge

Tools

Add a tool

Create custom tool

Added tools (1)

Agent preview

For the most accurate and up-to-date information, please refer to the respective market websites or official mandi price lists.

► How did I get this answer?

You: 08:39 PM

in karnataka

watsonx Agent 08:39 PM

Here are the latest mandi rates for tomatoes in Karnataka:

- **Karnataka:** ₹2437 per Quintal (as of 30/07/2025 04:57 AM)
- **Karnataka:** ₹2591.4 per Quintal
- **Bangalore District:** ₹3200 per Quintal (average), with the lowest market price being ₹3000 per Quintal
- **Udupi:** ₹2400 - ₹2500 per Quintal, with the highest mandi rate being ₹25 per kg

For the most accurate and up-to-date information, please refer to the respective market websites or official mandi price lists.

► How did I get this answer?

Type something...

RESULT

The screenshot displays the IBM watsonx Agent Lab interface. The top navigation bar includes the IBM watsonx logo, an 'Upgrade' button, and user information for 'Rakshitha Armugam's Acco...'. The main interface is divided into two primary sections: 'Build' on the left and 'Agent preview' on the right.

Build Section:

- Model:** mistral-large
- Framework:** LangGraph
- Architecture:** ReAct
- Instructions:** You are a Smart Farming AI Assistant. take preference from user like location, soil type, current season, give the specific answer to user query.
- Tools:** Includes buttons for 'Add a tool' and 'Create custom tool'.

Agent preview Section:

- User Query:** You: 08:43 PM
karnataka, black soil, winter
- Agent Response:** watsonx Agent 08:43 PM
Best Crops for Winter Season in Karnataka with Black Soil
 - 1. Chickpea (Gram)**
 - Description:** Chickpea is an important pulse crop during the winter season. It is well-suited for black soils and performs well under rainfed conditions.
 - Source:** [Performance of Chickpea Varieties under Rainfed Black Soils](#)
 - 2. Potato**
 - Description:** Loamy and sandy loam soils, rich in organic matter with good drainage and aeration, are most suitable for potato cultivation. The soil with a pH range of 5.2 to 6.4 is ideal.
 - Source:** [Potato Cultivation](#)
 - 3. Wheat**

The interface also shows a search bar at the bottom and a system tray with the date 30-07-2025 and time 20:44.

RESULT

The screenshot displays the IBM watsonx Agent web interface. The browser's address bar shows the URL: `datapatform.cloud.ibm.com/ml-runtime/deployments/37eaaed-ba40-460c-9ce0-cc9b2b388e52/chat?space_id=b8483dd8-dd69-439d-ad3f-2eea1e29da45&context=wx&flush=true`. The page header includes the IBM watsonx logo, an 'Upgrade' button, and user information for 'Rakshitha Armugam's Acco...' in 'Dallas'. The breadcrumb trail indicates the location: 'Deployment spaces / smart_farming3 / watsonx Agent /'. The main heading is 'watsonx Agent' with a green 'Deployed' status and an 'Online' tag. Below this are tabs for 'API reference', 'Test', and 'Preview', with 'Preview' being the active tab. A 'New chat +' button is located in the top right corner of the chat area. The chat history shows a user asking 'which crop is suitable for red soil?' at 09:07 PM. The watsonx Agent responds at the same time, stating 'Here are some crops that are suitable for red soil:' followed by a bulleted list: Potatoes, Tomatoes, Lettuce, Kale, Cotton, Wheat, Rice, and Pulses. At the bottom of the chat area is a text input field with the placeholder 'Type something...' and a send button. The Windows taskbar is visible at the very bottom, showing the search bar and various application icons.

Deployment spaces / smart_farming3 / watsonx Agent /

watsonx Agent ✓ Deployed Online

API reference Test **Preview**

New chat +

R You 09:07 PM
which crop is suitable for red soil?

watsonx Agent 09:07 PM
Here are some crops that are suitable for red soil:

- Potatoes
- Tomatoes
- Lettuce
- Kale
- Cotton
- Wheat
- Rice
- Pulses

Type something...

CONCLUSION

- The Smart Farming AI Agent, built using IBM Watsonx and RAG, provides farmers with real-time, data-driven agricultural advice. By combining AI with live weather and mandi data, it offers accurate crop suggestions and market insights. This project shows how AI can empower small-scale farmers, Improving decision-making and promoting sustainable farming. With future enhancements, it can become a valuable tool for rural development.

FUTURE SCOPE

The Smart Farming AI Agent has strong potential for expansion and enhancement. Future improvements could make the system more robust, accessible, and impactful for farmers across regions.

1. Integration of Voice and Local Languages

Add voice-based interaction for farmers who may not be comfortable typing.

2. Mobile and Offline Access

Develop a mobile app or WhatsApp chatbot version.

3. Satellite and Drone Integration

Use remote sensing data to analyze soil moisture, crop health, and disease detection.

4. Sustainable Farming Suggestions

Promote organic fertilizers, climate-resilient crops, and rainwater harvesting tips as part of long-term sustainability.

REFERENCES

- IBM Watsonx.ai – Official Product Documentation
- IBM Granite Foundation Models – IBM Research Blog
- Facebook AI Research – Retrieval-Augmented Generation (RAG) Whitepaper
- Open Government Data Platform (India) – Agricultural Market Prices

IBM CERTIFICATIONS

In recognition of the commitment to achieve
professional excellence



Rakshitha A

Has successfully satisfied the requirements for:

Getting Started with Artificial Intelligence



Issued on: Jul 15, 2025
Issued by: IBM SkillsBuild

Verify: <https://www.credly.com/badges/f915c48f-7c32-4e6a-8fea-4959c2bcc539>




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Completion Certificate



This certificate is presented to

Rakshitha A

for the completion of

**Lab: Retrieval Augmented Generation with
LangChain**

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT)

Learning hours: 20 mins



THANK YOU