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# CAPSTONE PROJECT

## AI AGENT FOR SMART FARMING ADVICE

**Presented By:**

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# OUTLINE

- Problem Statement
- Proposed System/Solution
- System Development Approach
- Algorithm & Deployment
- Result
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- Future Scope
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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.

# ALGORITHM & DEPLOYMENT

- **Algorithm Selection:**
  - We used a Retrieval-Augmented Generation (RAG) approach combined with machine learning for crop recommendations. RAG helps the AI Agent fetch relevant farming data and answer user queries in natural language.
- **Data Input:**
  - The AI Agent uses real-time data from weather services, soil databases, crop guides, and mandi prices. It tailors responses based on user queries and location, ensuring personalized and timely farming advice..
- **Training Process:**
  - The AI Agent uses pretrained models integrated within Watsonx.ai to understand user queries and retrieve relevant information. The logic is rule-based and retrieval-driven rather than learned from custom data.
- **Prediction Process:**
  - Based on the query, the system retrieves relevant data and generates answers (e.g., best crop to grow, today's market rate) in a farmer-friendly format.

# 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. The left panel, titled 'Build', contains sections for 'Setup', 'Configuration', 'Instructions', 'Knowledge', and 'Tools'. Under 'Configuration', 'LangGraph' is selected for the Framework and 'ReAct' for the Architecture. 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 right panel, titled 'Agent preview', shows a chat history. The user's query is 'What is today's mandi rate for tomatoes?'. The agent's response is: '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

 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?](#)' The bottom of the interface shows a Windows taskbar with the date '30-07-2025' and time '20:39'.

Agent Lab (beta) — Docs | IBM x Agent Lab — smart\_farming1 | x smart\_farming1 — Projects | IB x smart\_farming1 — Projects | IB x +

datapatform.cloud.ibm.com/wx/agents?context=wx&project\_id=11a07a13-3876-4dea-8dca-1e4199358f84

Incognito

IBM watsonx Upgrade ? ? Rakshitha Armugam's Acco... Dallas RA

Projects / smart\_farming1 / Agent Lab Share feedback β Unsaved New agent + Deploy

Build AI Model: mistral-large ⚠

Setup

Configuration

Framework Architecture

LangGraph ReAct

Instructions Advanced configuration

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

YOU: 06:39 PM

What is today's mandi rate for tomatoes?

watsonx Agent 08:39 PM

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
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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...

ENG IN 20:39 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' and buttons for 'Share feedback', 'Unsaved', 'New agent +', and 'Deploy'.

The 'Build' section on the left contains the following components:

- Setup**: A dropdown menu.
- Configuration**:
  - Framework**: A dropdown menu with 'LangGraph' selected.
  - Architecture**: A dropdown menu with 'ReAct' selected.
- Instructions**: A text area with the instruction: 'You are a Smart Farming AI Assistant. take preference from user like location, soil type, current season, give the specific answer to user query.' A link for 'Advanced configuration' is present.
- Knowledge**: A dropdown menu.
- Tools**: A dropdown menu with buttons for 'Add a tool' and 'Create custom tool'.
- Added tools (1)**: A section for added tools.

The 'Agent preview' section on the right shows a chat interface:

- User Message (RA)**: 'You: 08:39 PM in karnataka'.
- Agent Response (watsonx Agent)**: '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

The chat interface also includes a text input field with the placeholder 'Type something...' and a 'Send' button.



# RESULT

The screenshot displays the IBM watsonx Agent Lab interface in a web browser. The browser's address bar shows the URL: `datapatform.cloud.ibm.com/wx/agents?context=wx&project_id=11a07a13-3876-4dea-8dca-1e4199358f84`. The interface is divided into two main panels: 'Build' on the left and 'Agent preview' on the right.

**Build Panel:**

- Model:** mistral-large (with a warning icon)
- 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. (with a link to 'Advanced configuration')
- Knowledge:** (empty section)
- Tools:** (empty section with buttons 'Add a tool' and 'Create custom tool')
- Added tools (1):** (empty list)

**Agent preview Panel:**

- User Input:** 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 bottom of the screen shows a Windows taskbar with various application icons and system information: ENG IN, 20:44, 30-07-2025.

# 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 message at 09:07 PM asking 'which crop is suitable for red soil?'. The watsonx Agent responds at the same time with the text '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 of the screen.

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.

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# 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

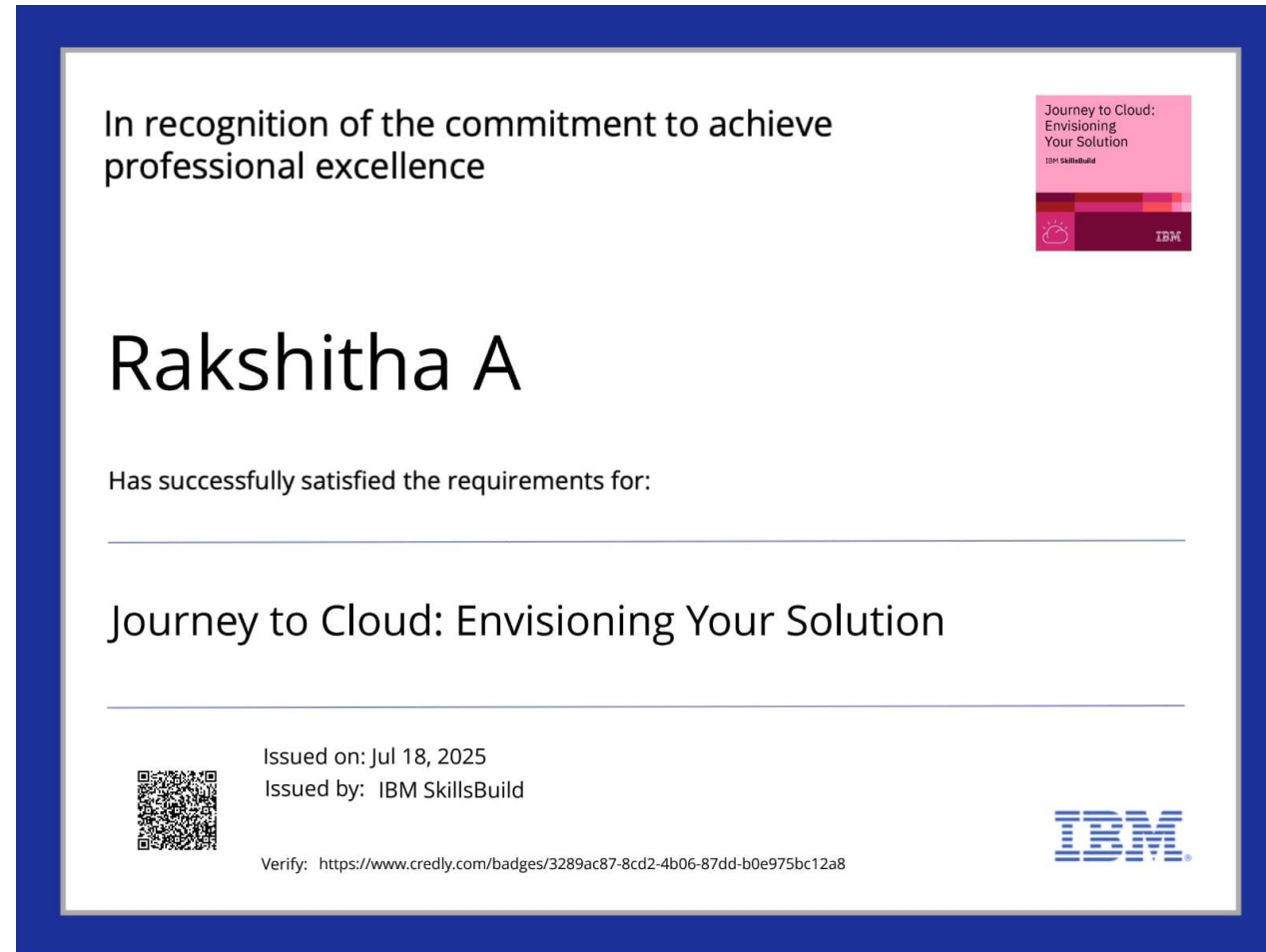


Issued on: Jul 15, 2025  
Issued by: IBM SkillsBuild

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



# IBM CERTIFICATIONS



# IBM CERTIFICATIONS

**IBM SkillsBuild**

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**