

CAPSTONE PROJECT

AI AGENT FOR SMART FARMING ADVICE

Presented By:

Student Name-NUPUR GUPTA

College Name-INSTITUTE OF ADVANCE EDUCATION AND RESEARCH

Department-BACHELOR OF COMPUTER APPLICATIONS

OUTLINE

- **Problem Statement**
- **Proposed System/Solution**
- **System Development Approach**
- **Algorithm & Deployment**
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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 agritech platforms.

PROPOSED SOLUTION

- The proposed system aims to address the challenge of predicting which are the best crops that can be grown on a particular area. This involves leveraging AI and Retrieval-Augmented Generation (RAG) techniques to provide accurate, real-time agricultural guidance to small-scale farmers.. The solution will consist of the following components:
- Data Collection:
 - Gather historical data on weather and soil condition, including time, date, location, and other relevant factors.
 - Utilize real-time data sources, such as weather conditions, market prices, and soil conditions, to enhance prediction accuracy.
- Data Preprocessing:
 - Clean and preprocess agricultural data to handle missing values, outliers, and inconsistencies
 - Feature engineering to extract key factors affecting crop choice, soil health, and market trends..
- Agentic AI Logic:
 - Implemented a Retrieval-Augmented Generation (RAG) based AI agent that retrieves relevant agricultural data and generates contextual answers to farmer queries, incorporating factors like weather, soil conditions, crop seasonality, and market trends to ensure accurate and localized guidance..
- Deployment:
 - Developed a user-friendly interface or application that provides real-time predictions for best crop recommended at different locations.
 - Deployed the AI agent on a scalable and reliable platform like IBM Cloud, ensuring efficient server infrastructure, low response time, and easy accessibility for farmers across devices and regions.
- Evaluation:
 - Evaluated the AI agent's performance using relevance and user feedback metrics, and continuously fine-tune the system based on farmer interactions and real-time monitoring to improve response accuracy and usefulness.
 - Result:

SYSTEM APPROACH

System Requirement: Access to agricultural databases, weather APIs, soil data, market prices, and language translation tools.

Libraries/Tools Required: Google, Weather, Webcrawler, Wikipedia Search, watsonx.ai.studio, watsonx.ai.runtime, IBM Granite, IBM Cloud SDKs.

ALGORITHM & DEPLOYMENT

- Algorithm Selection:
 - The chosen AI architecture is Retrieval-Augmented Generation (RAG), which combines the power of information retrieval with natural language generation. It is ideal for this problem as it enables the system to fetch accurate, real-time agricultural data (like weather, soil, and market rates) and generate contextual, language-friendly responses to farmer queries. This ensures that the advice is both data-driven and easy to understand, making it highly effective for grassroots-level smart farming support.
- Data Input:
 - The input features for the RAG-based AI agent include real-time and historical data such as weather conditions, soil health reports, crop calendars, pest alerts, and mandi (market) prices. Additionally, user queries in local languages are processed to extract context and intent, enabling the system to retrieve the most relevant agricultural information for accurate and personalized recommendations.
- Training Process:
 - The AI agent leverages pre-trained language models fine-tuned on agricultural datasets, FAQs, and government advisories. Instead of traditional training, it uses retrieval mechanisms to fetch relevant documents in real time. Key considerations include curating high-quality domain-specific data, optimizing retrieval accuracy, and periodically updating the knowledge base to ensure the system remains relevant and context-aware.
- Prediction Process:
 - The AI agent does not make traditional predictions but dynamically generates responses by retrieving and synthesizing relevant data in real-time. When a farmer submits a query, the system uses live inputs such as current weather, soil reports, pest updates, and mandi prices. These inputs guide the retrieval process to fetch the most contextually appropriate information, which is then used by the RAG model to generate accurate and personalized advice instantly.

RESULT

IBM watsonx

?

🔔

NUPUR GUPTA's Account

Sydney

NG

[Deployment spaces](#) / [SMART_CROP_DEPLOY](#) / [watsonx Agent](#) /

watsonx Agent ✔ Deployed Online

API reference

Test

Preview

New chat +

N

You 08:50 PM

WHAT IS TODAY'S MANDI OF APPLE

🤖

watsonx Agent 08:50 PM

The current mandi price of apple is ₹8075/Quintal as of 03 August 2025.

N

You 08:51 PM

BEST CROP FOR SUMMER IN KOLKATA

🤖

watsonx Agent 08:51 PM

Based on the search results, the best crop for summer in Kolkata is:

1. Balsam

2. Cosmos

3. Gaillardia

4. Gomphrena

5. Portulaca

6. French Marigold

7. Nasturtium

8. Sunflower

type something...

➤

About this deployment

Name

watsonx Agent

Description

Change this description to reflect your particular agent

Deployment Details

Deployment ID: 2cd8441c-5a7e-45...

Serving name: No serving name.

Software specification: runtime-24.1-py3.11

Hardware specification: Extra extra small: 1 CPU and 2 GB RAM

Copies: 1

Tags

wx-agent

Associated asset

watsonx Agent

23bc9f15-db8a-47f9-b291-6b95259ba031

Last modified

54 seconds ago

Created on

Aug 3, 2025

edunet

foundation

RESULT

IBM watsonx

Upgrade ?

NUPUR GUPTA's Account

Sydney

NG

Projects / SMART_FARMING_ADVICE / Agent Lab

Share feedback

Unsaved

New agent +

Deploy

Build

AI Model: mistral-large

Setup

Configuration

Framework LangGraph Architecture ReAct

Instructions

You are a helpful assistant that uses tools to answer questions in detail. When greeted, say "Hi, I am watsonx.ai agent. How can I help you?"

Knowledge

Tools

Add a tool Create custom tool

Added tools (4)

Google search

Retrieve information from the internet with the Google search engine.

DuckDuckGo search

Retrieve information from the internet with the DuckDuckGo search engine.

Wikipedia search

Agent preview

NG You: 08:54 PM

गर्मियों के लिए कौन सी मिट्टी और कौन सी फसल सर्वोत्तम है

watsonx Agent 08:54 PM

गर्मियों में कौन सी मिट्टी और कौन सी फसल सर्वोत्तम है?

गर्मियों में कई फसलें उगाई जा सकती हैं, जो विभिन्न प्रकार की मिट्टी में अच्छी तरह से उगती हैं। यहां कुछ फसलें और उनके लिए उपयुक्त मिट्टी के बारे में जानकारी दी गई है:

1. ग्वार:

मिट्टी: ग्वार की खेती के लिए लगभग हर प्रकार की मिट्टी उपयुक्त है, जैसे की रेतीली दोमट मिट्टी, लाल मिट्टी, काली मिट्टी आदि।

जलवायु: गर्म और शुष्क जलवायु में अच्छी तरह से उगती है।

2. धनिया:

मिट्टी: धनिया की खेती के लिए अच्छी जल निकासी वाली मिट्टी उपयुक्त है।

सिंचाई: गर्मी में धनिया की फसल सुरक्षित रखने के लिए मिनी स्प्रिंकलर सिस्टम सबसे अच्छा है।

3. बाजरा:

मिट्टी: बाजरे की खेती के लिए लगभग हर प्रकार की मिट्टी उचित मानी जाती है। जैसे की रेतीली दोमट मिट्टी, लाल मिट्टी, काली मिट्टी आदि।

जलवायु: गर्म और शुष्क जलवायु में अच्छी तरह से उगती है।

4. मक्का:

मिट्टी: मक्का की अच्छी फसल के लिए गहरी और उपजाऊ मिट्टी की आवश्यकता होती है।

जलवायु: गर्मी के मौसम में अच्छी तरह से उगती है।

Type something...

CONCLUSION

The AI-powered smart farming assistant has proven effective in delivering real-time, localized, and relevant agricultural advice to small-scale farmers. By integrating RAG architecture with trusted data sources and local language support, the system bridges the knowledge gap at the grassroots level. Challenges faced include ensuring data consistency across sources, handling regional language nuances, and maintaining system responsiveness in low-connectivity areas. Future improvements include adding voice interfaces and offline capabilities. Accurate and timely information empowers farmers to make better decisions, ultimately enhancing yield, reducing risk, and improving income stability.

FUTURE SCOPE

Potential enhancements for the AI-powered farming system include integrating more diverse and region-specific data sources such as satellite imagery, IoT sensor data from farms, and hyper-local weather updates. The retrieval mechanism and generation model can be further optimized for faster and more context-aware responses. Expansion to multiple regions with support for various local dialects and crops will increase accessibility. Emerging technologies like edge computing can enable offline advisory services in remote areas, while advanced AI techniques such as multi-modal learning and federated learning can further personalize and secure the farming advice.

REFERENCES

- Vizniuk, M., et al. (2025).

- A Comprehensive Survey of Retrieval-Augmented Large Language Models for Decision Making in Agriculture.
- ScienceDirect.
- Highlights the role of RAG in delivering intelligent, context-aware agricultural support.

- ShizishanGPT (2024).

- Domain-Specific RAG Agent for Smart Farming using Knowledge Graphs and LLMs.
- arXiv.
- Describes a farming-focused RAG system that inspired architecture for this project.

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Completion Certificate



This certificate is presented to

Nupur Gupta

for the completion of

**Lab: Retrieval Augmented Generation with
LangChain**

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 25 Jul 2025 (GMT)

Learning hours: 20 mins



THANK YOU