CAPSTONE PROJECT

AI AGENT FOR SMART FARMING ADVICE

Presented By:
Student Name-JAYESH SARKAR
College Name-INSTITUTE OF ADVANCE EDUCATION AND RESEARCH
Department-BACHELOR OF COMPUTER APPLICATIONS

OUTLINE

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- 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

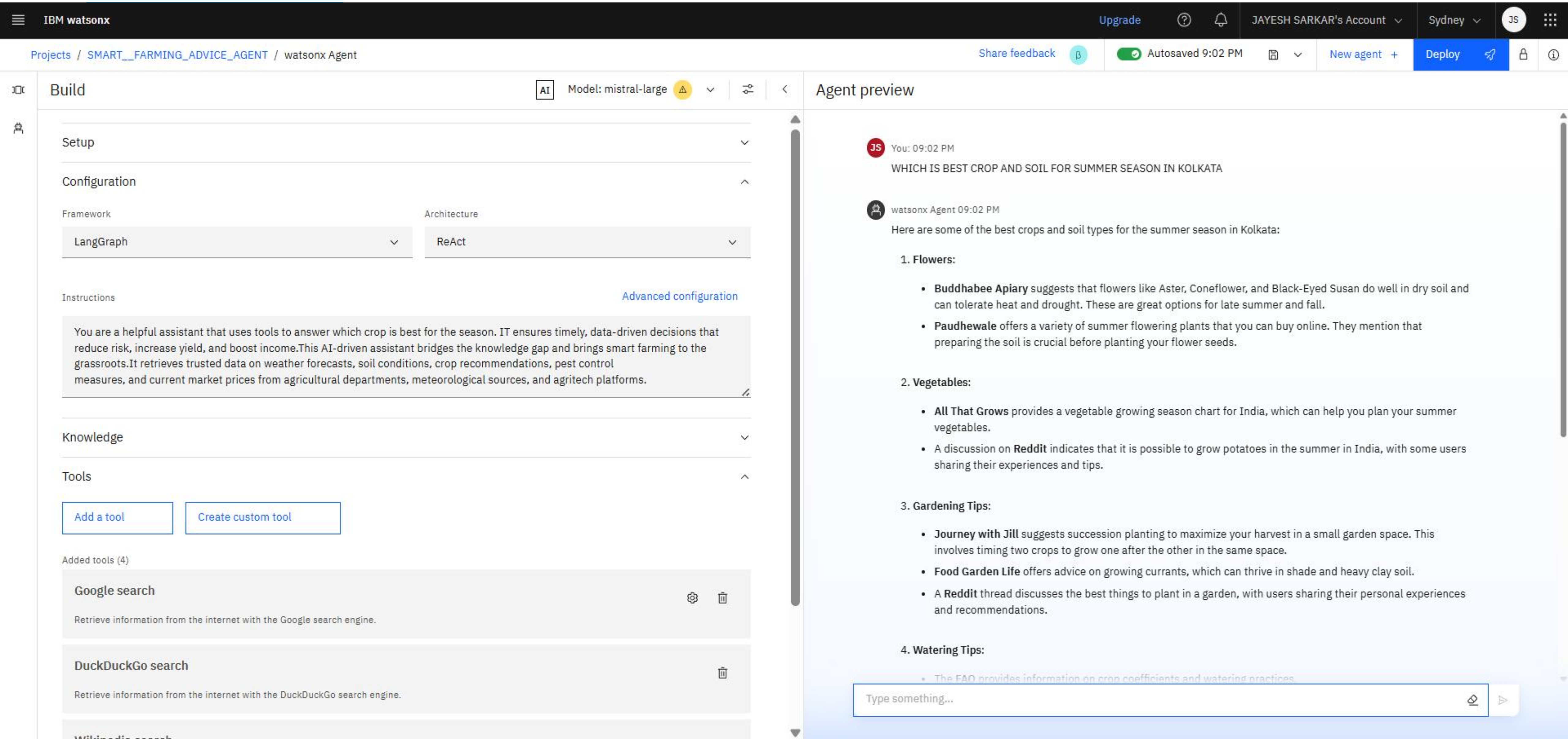
System Requirement: Access to agricultural databases, weather APIs, soil data, market prices, and language translation tools.

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
Upgrade
JAYESH SARKAR's Account
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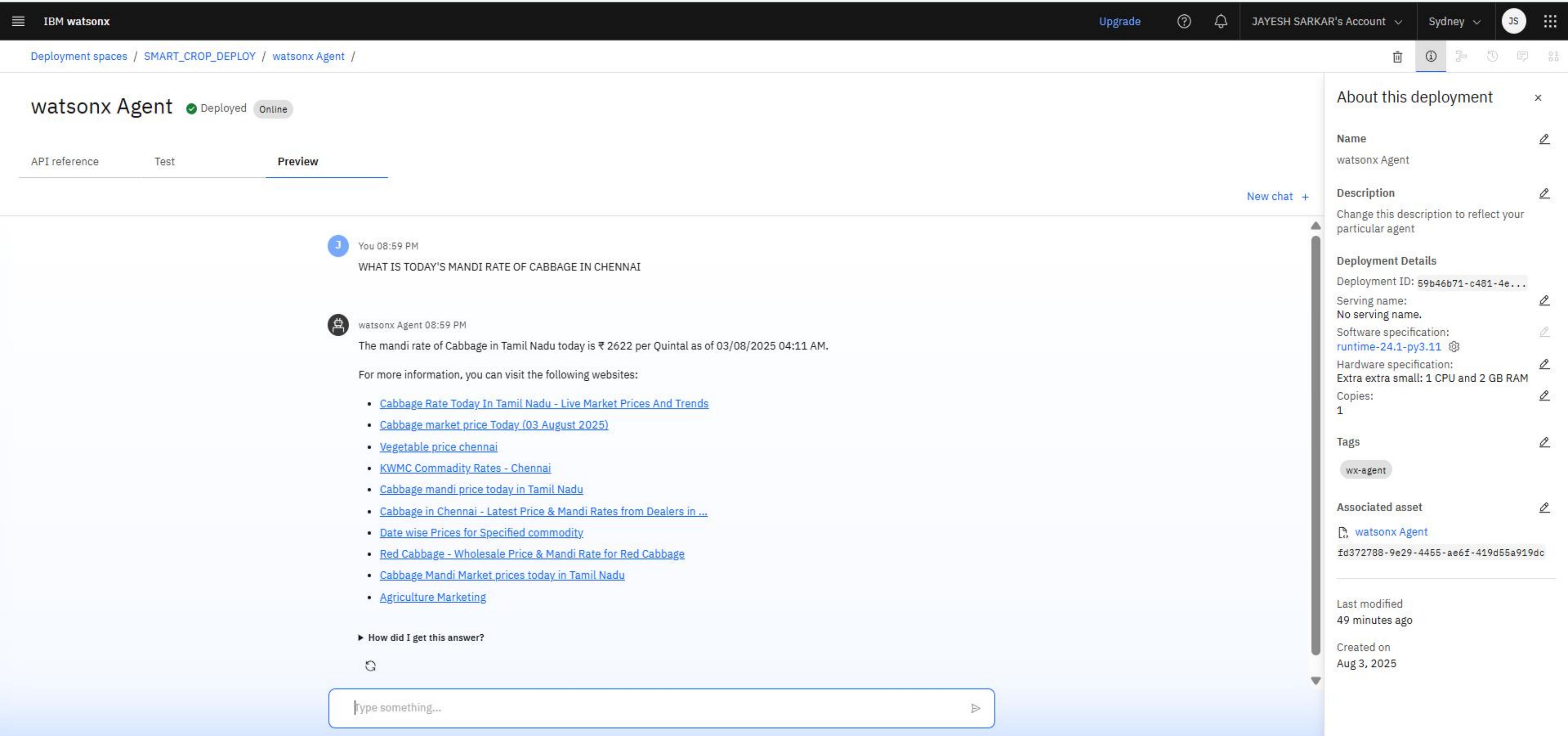
Deploy
Build
AI
Model: mistral-large
Setup
Configuration
Framework
LangGraph
Architecture
ReAct
Instructions
Advanced configuration
You are a helpful assistant that uses tools to answer which crop is best for the season. IT ensures timely, data-driven decisions that reduce risk, increase yield, and boost income.This AI-driven assistant bridges the knowledge gap and brings smart farming to the grassroots.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.
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.
Agent preview
You: 09:02 PM
WHICH IS BEST CROP AND SOIL FOR SUMMER SEASON IN KOLKATA
watsonx Agent 09:02 PM
Here are some of the best crops and soil types for the summer season in Kolkata:
1. Flowers:
Buddhabee Apiary suggests that flowers like Aster, Coneflower, and Black-Eyed Susan do well in dry soil and can tolerate heat and drought. These are great options for late summer and fall.
Paudhewale offers a variety of summer flowering plants that you can buy online. They mention that preparing the soil is crucial before planting your flower seeds.
2. Vegetables:
All That Grows provides a vegetable growing season chart for India, which can help you plan your summer vegetables.
A discussion on Reddit indicates that it is possible to grow potatoes in the summer in India, with some users sharing their experiences and tips.
3. Gardening Tips:
Journey with Jill suggests succession planting to maximize your harvest in a small garden space. This involves timing two crops to grow one after the other in the same space.
Food Garden Life offers advice on growing currants, which can thrive in shade and heavy clay soil.
A Reddit thread discusses the best things to plant in a garden, with users sharing their personal experiences and recommendations.
4. Watering Tips:
Type something...

RESULT



IBM watsonx
Upgrade
JAYESH SARKAR's Account
Sydney
JS
Deployment spaces / SMART_CROP_DEPLOY / watsonx Agent /
watsonx Agent
Deployed
Online
API reference
Test
Preview
New chat +
You 08:59 PM
WHAT IS TODAY'S MANDI RATE OF CABBAGE IN CHENNAI
watsonx Agent 08:59 PM
The mandi rate of Cabbage in Tamil Nadu today is ₹ 2622 per Quintal as of 03/08/2025 04:11 AM.
For more information, you can visit the following websites:
Cabbage Rate Today In Tamil Nadu - Live Market Prices And Trends
Cabbage market price Today (03 August 2025)
Vegetable price chennai
KWMC Commadity Rates - Chennai
Cabbage mandi price today in Tamil Nadu
Cabbage in Chennai - Latest Price & Mandi Rates from Dealers in ...
Date wise Prices for Specified commodity
Red Cabbage - Wholesale Price & Mandi Rate for Red Cabbage
Cabbage Mandi Market prices today in Tamil Nadu
Agriculture Marketing
How did I get this answer?
Type something...
About this deployment
Name
watsonx Agent
Description
Change this description to reflect your particular agent
Deployment Details
Deployment ID: 59b46b71-c481-4e...
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
fd372788-9e29-4455-ae6f-419d55a919dc
Last modified
49 minutes ago
Created on
Aug 3, 2025

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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IBM CERTIFICATIONS

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

Jayesh Sarkar

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

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