CAPSTONE PROJECT

AI AGENT FOR SMART FARMING ADVICE

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PROBLEM STATEMENT

Small-scale farmers often lack timely and reliable access to localized agricultural information critical for making informed decisions. To bridge this gap, we propose developing an intelligent AI Agent powered by Retrieval-Augmented Generation (RAG) that aggregates trusted data from government agriculture departments, meteorological agencies, and agritech platforms—including weather forecasts, soil health, crop advice, pest management, and market prices. This agent will understand natural language queries in farmers' local languages and deliver clear, actionable guidance on crop selection, sowing, pest control, irrigation, and mandi rates. Leveraging IBM Cloud Lite services and the IBM Granite platform, the solution combines efficient data retrieval with advanced AI language generation to empower farmers with real-time, location-specific insights that reduce risk, improve yields, and enhance income while promoting sustainable, climate-resilient smart farming at the grassroots level.

PROPOSED SOLUTION

To empower small-scale farmers with timely, accurate, and localized agricultural advice, we developed an intelligent AI Agent on IBM Cloud using the advanced Granite-3.3-8B-Instruct Model within IBM watsonx.ai. The agent understands natural language queries in farmers' local languages and dynamically retrieves trusted, real-time data from multiple sources including Google Search, DuckDuckGo, Wikipedia, and a custom web crawler covering weather, soil health, crop recommendations, pest control, and market prices.

A custom filtering tool within IBM Agent Lab ensures that the agent's responses remain focused strictly on farming-related content. The AI Agent provides clear, actionable guidance on crop selection, sowing schedules, irrigation, pest management, and mandi prices. Built with tuned architecture and parameters, thoroughly tested for accuracy, and deployed on IBM Cloud Lite and Granite platforms, this scalable solution delivers data-driven insights that help farmers reduce risks, improve yields, and increase income — supporting sustainable, climate-resilient smart farming at the grassroots level.

SYSTEM APPROACH

This project aims to build a smart AI assistant to help small-scale farmers get accurate and local farming advice quickly and easily. Here's the overall plan to develop and run this system:

System Requirements

- Hardware:
  - Use IBM Cloud to host and run the AI agent.
  - Farmers can use smartphones or any internet-connected device to interact with the agent.
- Software:
  - IBM watsonx.ai platform for building and managing the AI assistant.
  - The Granite-3.3-8B-Instruct model to understand and answer farming questions.
  - Tools to connect with trusted sources like Google Search, DuckDuckGo, Wikipedia, and a custom web crawler to get fresh data.
  - A filtering system to make sure answers are only about farming.
  - Support for local languages so farmers can ask questions naturally

User needs:

- Simple way to ask questions in local language.
- Clear and practical advice about farming decisions.

Tools and Libraries Needed:

- IBM watsonx.ai and its Agent Lab for building and fine-tuning the AI model.
- APIs for Google Search, DuckDuckGo, Weather and Wikipedia to gather external info.
- Custom web crawler scripts for collecting farming data from websites.
- Filtering tools inside IBM Agent Lab to keep responses relevant.(filter created by own)
- IBM Cloud tools for deploying and monitoring the AI assistant.
- Language tools to handle local languages correctly.

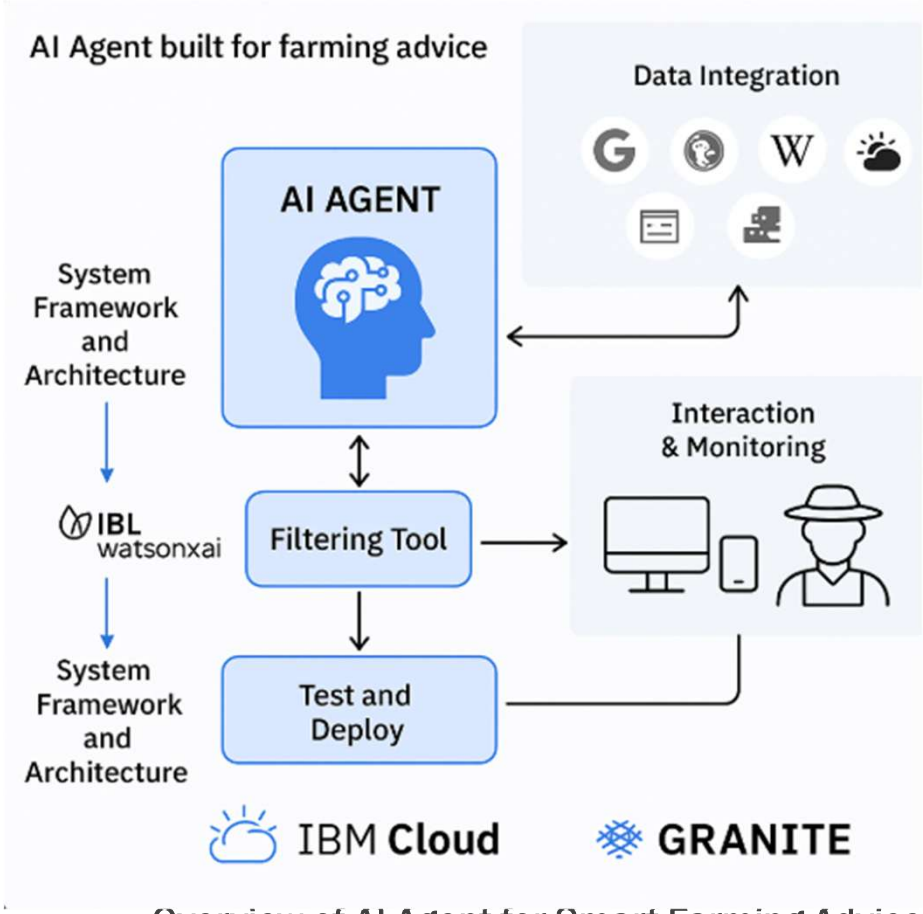
This approach ensures the AI assistant is reliable, easy to use, and gives farmers the right advice anytime they need it.

ALGORITHM & DEPLOYMENT

To support small-scale farmers, I built an intelligent AI Agent on IBM Cloud using the Granite-3.3-8B-Instruct model that understands local language queries. It retrieves trusted farming data and provides clear, real-time advice to improve crop yields and income.

- **Select a strong AI model:**
  Use the Granite-3.3-8B-Instruct deployed on IBM watsonx.ai to build an intelligent AI Agent tailored for farming advice(Capability of Retrieval Augmented Generation (RAG)).
- **Set up the system framework and architecture:**
  Configure the agent's environment, model parameters, and workflows to ensure it understands agriculture-specific queries well.
- **Integrate multiple reliable data sources and web tools:**
  Connect the AI Agent with Google Search, DuckDuckGo, Wikipedia, Weather and a custom web crawler to dynamically gather updated weather, soil, crop, pest, and market price information.

- **Implement a filter for relevant responses:**
  Build(creating) a filtering tool within IBM Agent Lab to exclude answers unrelated to agriculture, keeping responses focused and helpful.
- **Program clear agent instructions:**
  Provide detailed guidance so the AI understands queries in local languages and gives actionable advice on crop selection, irrigation, pest control, and mandi prices.
- **Test extensively with sample farmer queries:**
  Validate that the agent produces accurate, understandable, and context-aware answers for typical farming questions.
- **Deploy the AI Agent on IBM Cloud:**
  Make the solution available to farmers through web or mobile interfaces, ensuring scalability and real-time responsiveness using IBM Cloud Lite and Granite platforms.
- **Interaction & Monitoring :**
  Farmers or applications connect to the deployed AI Agent through web/mobile interfaces or API calls to receive real-time, location-specific agricultural guidance. Continuously monitor agent performance, user feedback, and update data sources or model tuning to improve accuracy and relevance over time.



Overview of AI Agent for Smart Farming Advice

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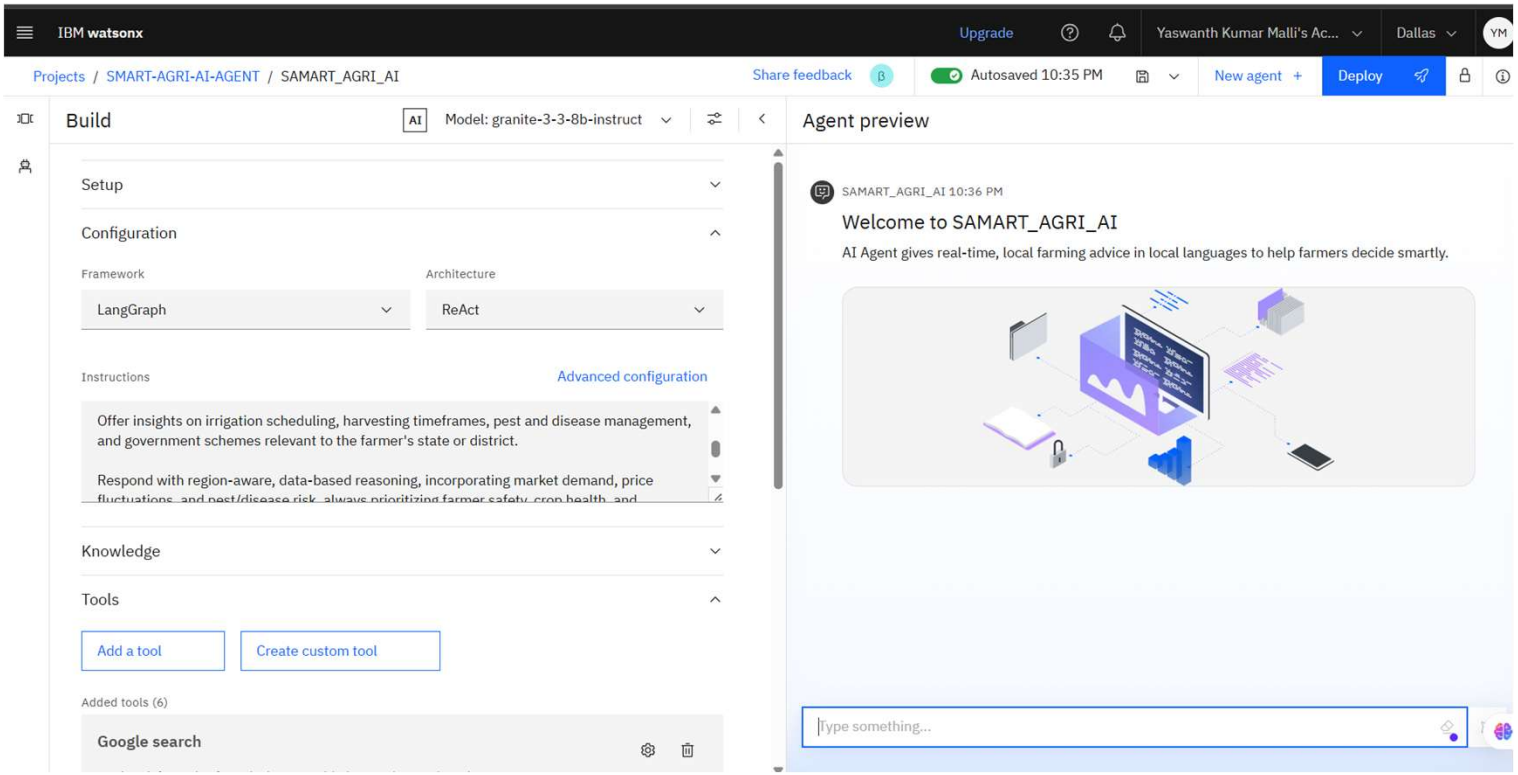
RESULT



AI Agent configuration screen showing SMART_AGRI_AI built using the Granite 3-3-8b-instruct model with LangGraph-ReAct framework to provide region-specific farming advice.

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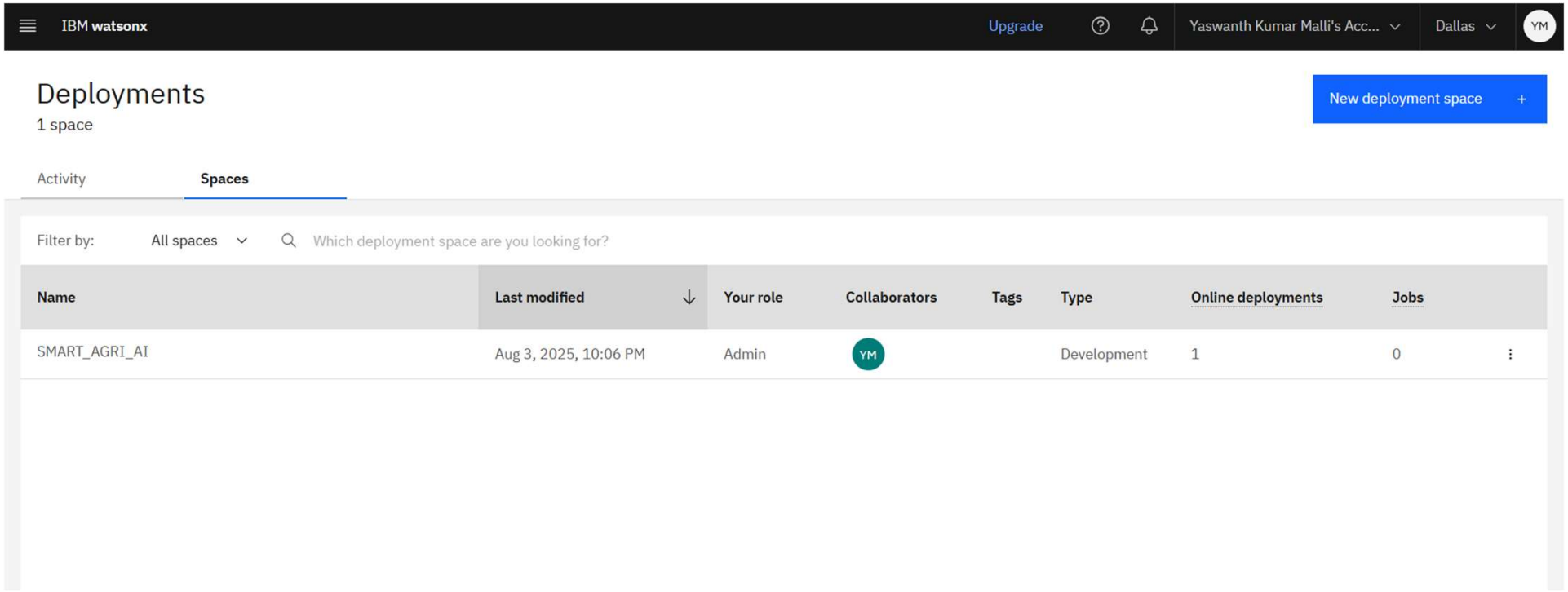
RESULT



Deployment dashboard showing the SMART_AGRI_AI agent successfully deployed in a development space, with one active online deployment and admin access.

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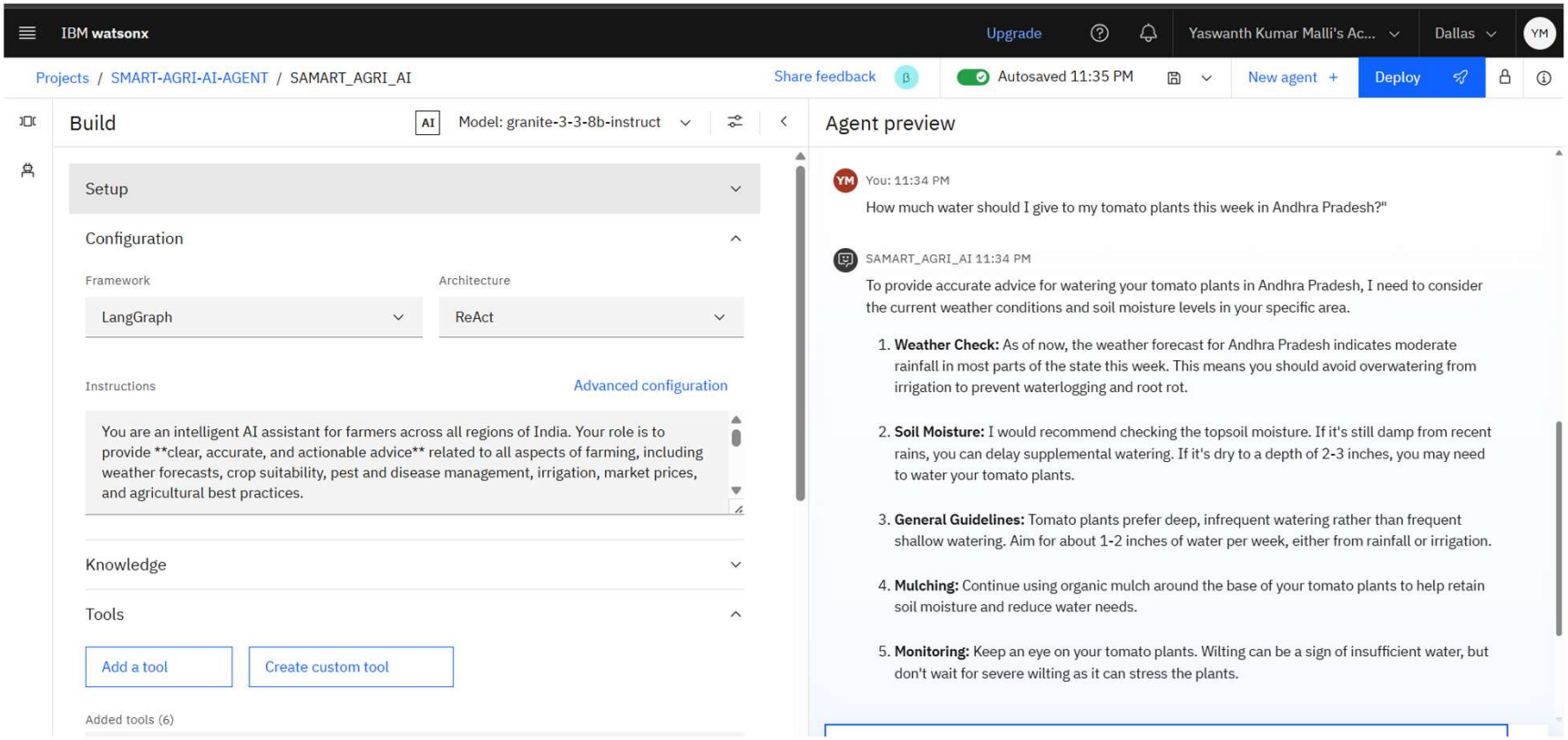
RESULT



Agent preview shows the SMART_AGRI_AI responding to a real farmer query about watering tomato plants in Andhra Pradesh, using weather and soil data to generate region-specific, actionable advice.

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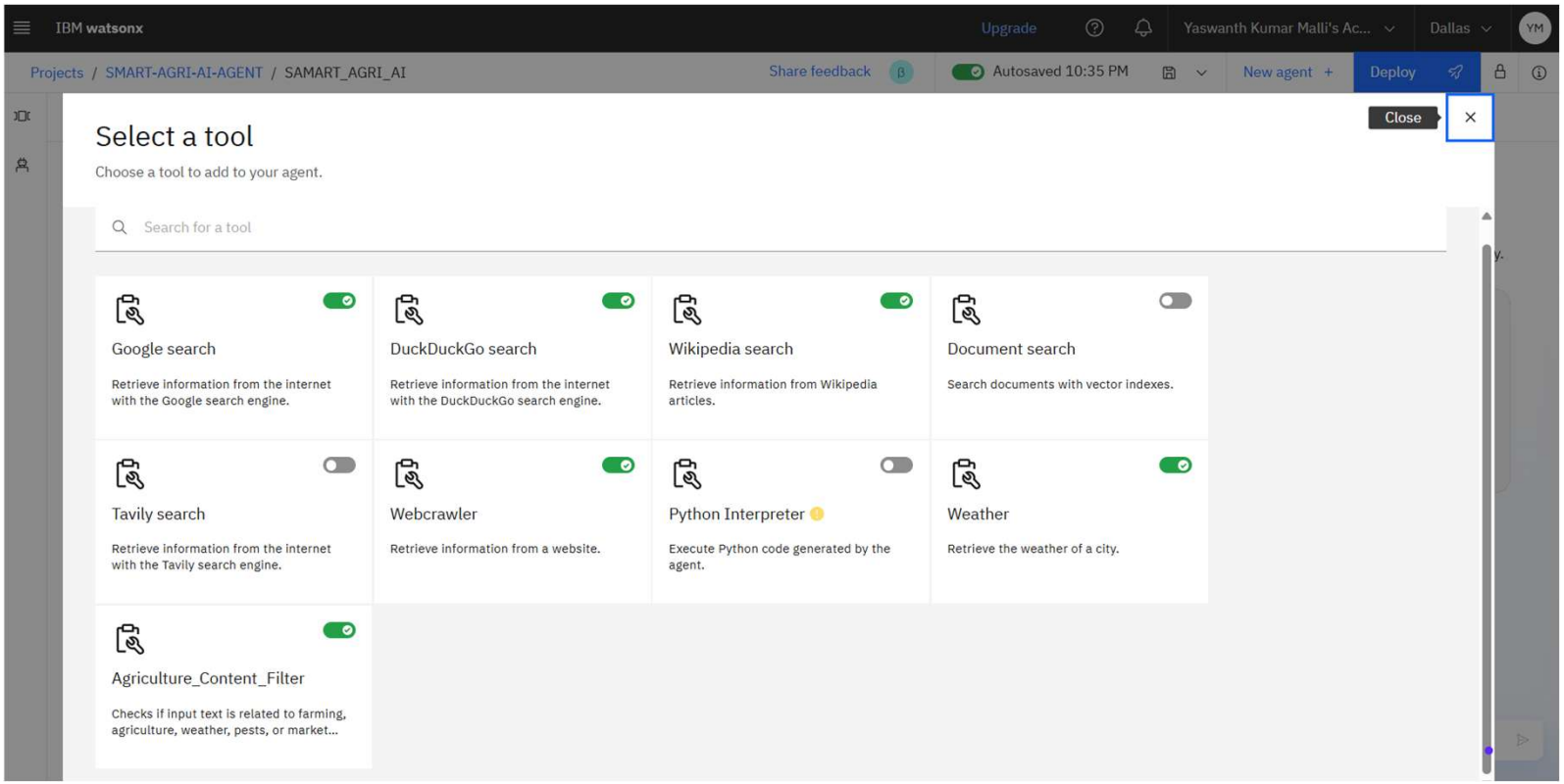
RESULT



The SMART_AGRI_AI agent is configured with essential tools like Google Search, Wikipedia, Weather, Webcrawler, and a custom Agriculture Content Filter.

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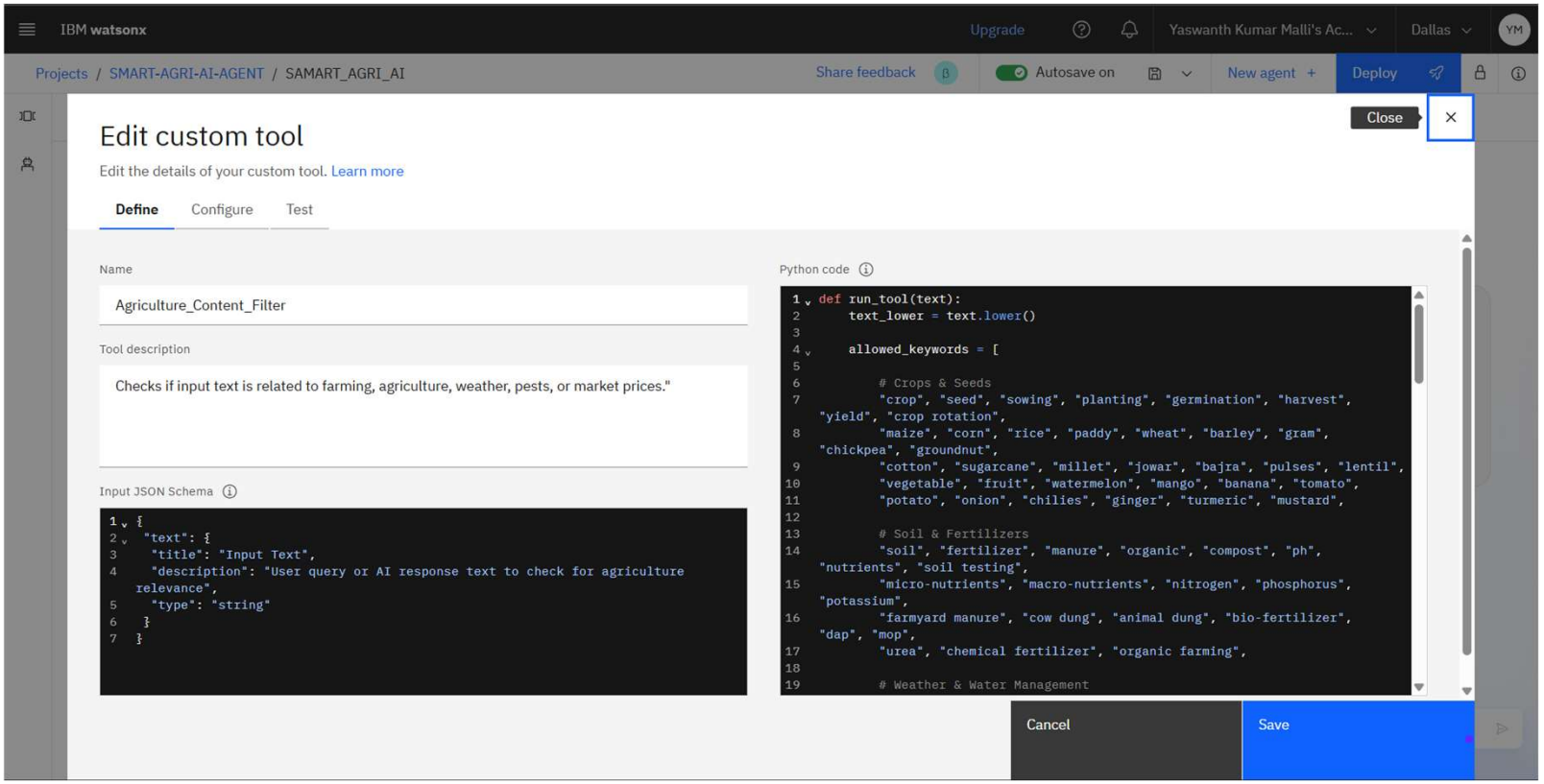
RESULT



I have created a tool filters input text and allows only farming-related content such as crops, soil, weather, pests, and market prices. It blocks non-agriculture topics to keep responses focused.

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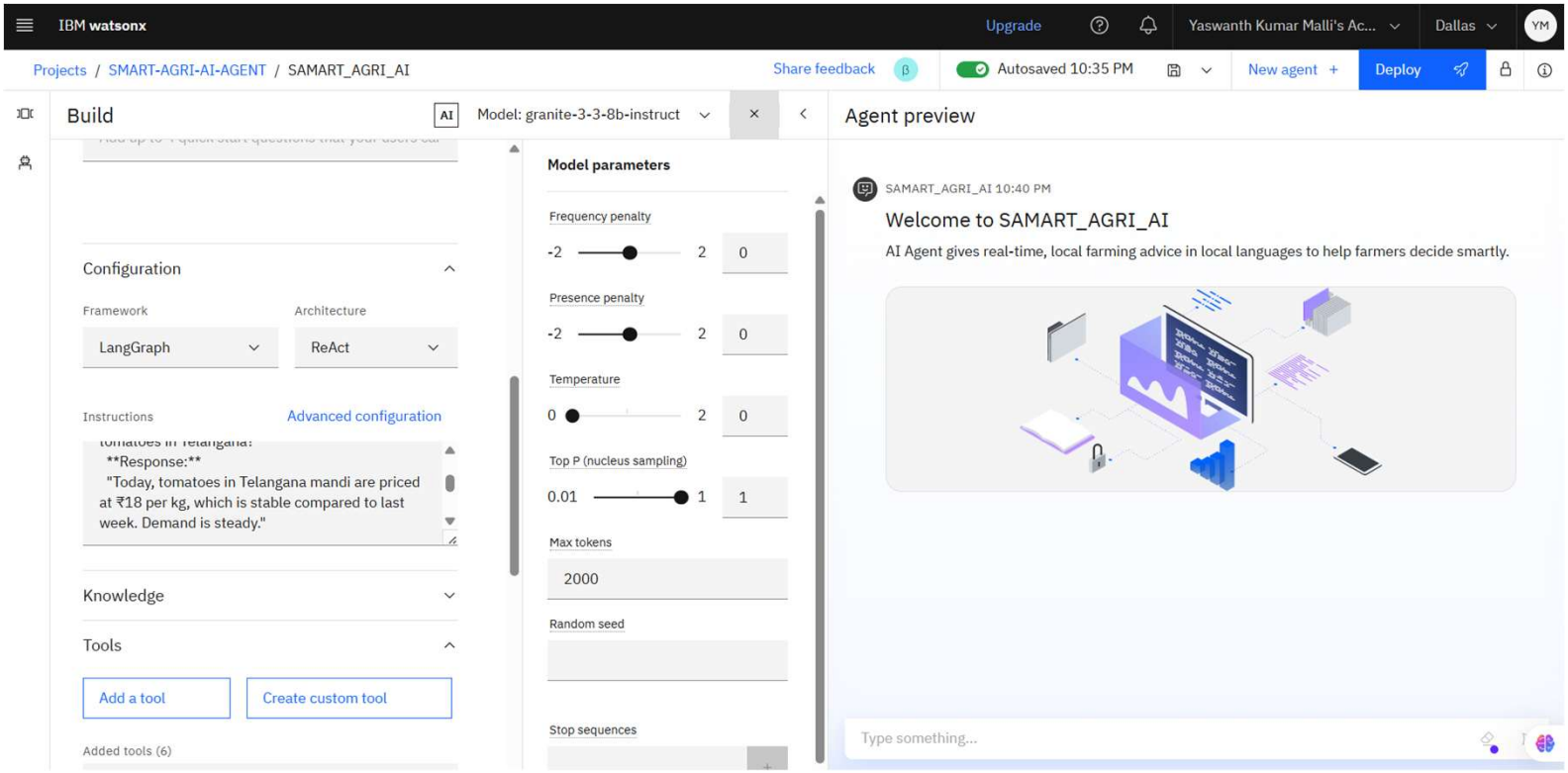
RESULT



This configuration fine-tunes the SAMART_AGRI_AI agent on IBM watsonx to give accurate, farmer-friendly responses by adjusting model parameters, instructions, and response behavior for localized agriculture support.

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CONCLUSION

This project successfully developed and deployed an intelligent AI Agent using IBM Cloud and watsonx.ai powered by the advanced Granite-3.3-8B-Instruct. By integrating multiple trusted external data sources and employing a custom filtering mechanism, the agent delivers accurate, real-time, and localized agricultural advice in farmers' local languages. The solution effectively addresses the knowledge gap faced by small-scale farmers, providing actionable guidance on crop selection, pest control, irrigation, and market prices. Deployed on scalable IBM Cloud platforms, this AI Agent empowers farmers to make better-informed decisions, improve crop yields, reduce risks, and increase their income—contributing to sustainable and climate-resilient agriculture at the grassroots level.

This demonstrates how cutting-edge AI and cloud technologies can be harnessed to transform traditional farming practices and positively impact rural livelihoods.

FUTURE SCOPE

- Support more local languages so more farmers can use the AI easily.
- Add new data sources like satellite images and sensors to get better information about soil and crops.
- Give personalized farming tips based on each farmer’s land and past crops.
- Allow the AI to work even without internet or in places with poor connectivity.
- Connect with local markets to help farmers buy and sell at current prices.
- Improve the advice over time by learning from farmers’ feedback.
- Make mobile apps or voice assistants so farmers can use the AI more easily.
- These upgrades will help farmers get smarter advice, grow better crops, and earn more in Future.

REFERENCES

- Anap V. N., Gaikar P. S., Jadhav R. M., Lohale S. H. (2025). ***Artificial Intelligence in Agriculture:*** *Innovations, Challenges, and Future Prospects*. Journal of Scientific Research and Reports, 31(3), 267-273.
  This review covers how AI technologies optimize farming by analyzing sensor and satellite data, enabling precision farming practices such as irrigation and pest control, and how AI robotics improve agricultural productivity.
  DOI: 10.9734/jsrr/2025/v31i32900
- Ibrahim A. S. (2025). ***AI-IoT based Smart Agriculture Pivot for Plant Diseases Detection and Treat****ment*. Scientific Reports.
  This research proposes an AI-IoT system that combines deep learning and hardware for plant disease detection and treatment with high accuracy using ResNet50, alongside mobile application support for farmers. It represents a promising model for integrating AI and IoT in crop health monitoring
- World Economic Forum (2025). ***Future Farming in India:*** *A Playbook for Scaling Artificial Intelligence*. Provides strategies for scaling AI in agriculture, overcoming adoption barriers, and supporting smart farming practices

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IBM **SkillsBuild** Completion Certificate

This certificate is presented to

Yaswanth Kumar Malli

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

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THANK YOU

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