

AgriBuddy: AI-Powered Agricultural Assistant for Sustainable Farming in Tanzania

IBM Call for Code Global Challenge - 2024

October 25, 2024

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1 Project Summary

AgriBuddy is an AI-powered agricultural assistant designed to address the challenges faced by Tanzanian farmers, providing critical farming advice, weather forecasts, crop recommendations, and market insights. Leveraging Watsonx.ai for localized weather analysis, API-driven data for real-time updates, and Data Refinery for visualization, AgriBuddy is a solution tailored to support sustainable agricultural practices in Tanzania.

2 The Issue We Aim to Solve

Agriculture in Tanzania faces challenges including unpredictable weather patterns, limited access to market information, and resource constraints for crop management. These challenges reduce productivity and resilience among farmers. AgriBuddy aims to empower Tanzanian farmers with data-informed insights to promote sustainable farming practices and improve agricultural productivity.

3 How Our Technology Solution Can Help

AgriBuddy provides Tanzanian farmers with timely, contextual insights. Watsonx.ai enables intelligent forecasting and responses to agricultural queries, while IBM's API integration and Data Refinery visualizations enhance data accessibility and decision-making.

4 Our Idea

AgriBuddy is a virtual assistant that:

- **Offers Intelligent Responses:** Utilizes Watsonx.ai for weather prediction and agricultural advice.
- **Provides Data-Driven Insights:** Integrates IBM Weather API to relay real-time weather and crop data.
- **Delivers Visual Analytics:** Uses Data Refinery for user-friendly visualizations of data trends and predictions.
- **Supports Sustainable Practices:** Recommends resource management strategies based on up-to-date weather forecasts and soil data.

By harnessing natural language processing and machine learning, AgriBuddy delivers personalized, location-specific support, enhancing crop yields and market access for Tanzanian farmers.

5 Technology Implementation

5.1 IBM watsonx Product(s) Used

- **Watsonx.ai:** Provides AI capabilities for natural language understanding, weather forecasting, and query handling.

- **Watsonx.governance:** Ensures model compliance, tracking, and transparency, safeguarding fairness and accuracy.
- **Watsonx Assistant:** Manages conversational interactions to deliver contextual insights to farmers.

5.2 Other IBM Technologies

- **Watson Machine Learning:** Facilitates training and deploying models focused on crop suitability and price forecasting.
- **Watson Studio Data Refinery:** Powers visual analysis of crop, weather, and soil data to help users see trends and make informed decisions.
- **Natural Language Understanding:** Interprets queries for tailored agricultural responses.
- **IBM Weather API:** Supplies real-time weather data essential for agricultural planning, integrated with Watsonx.ai for precision.

6 Solution Architecture

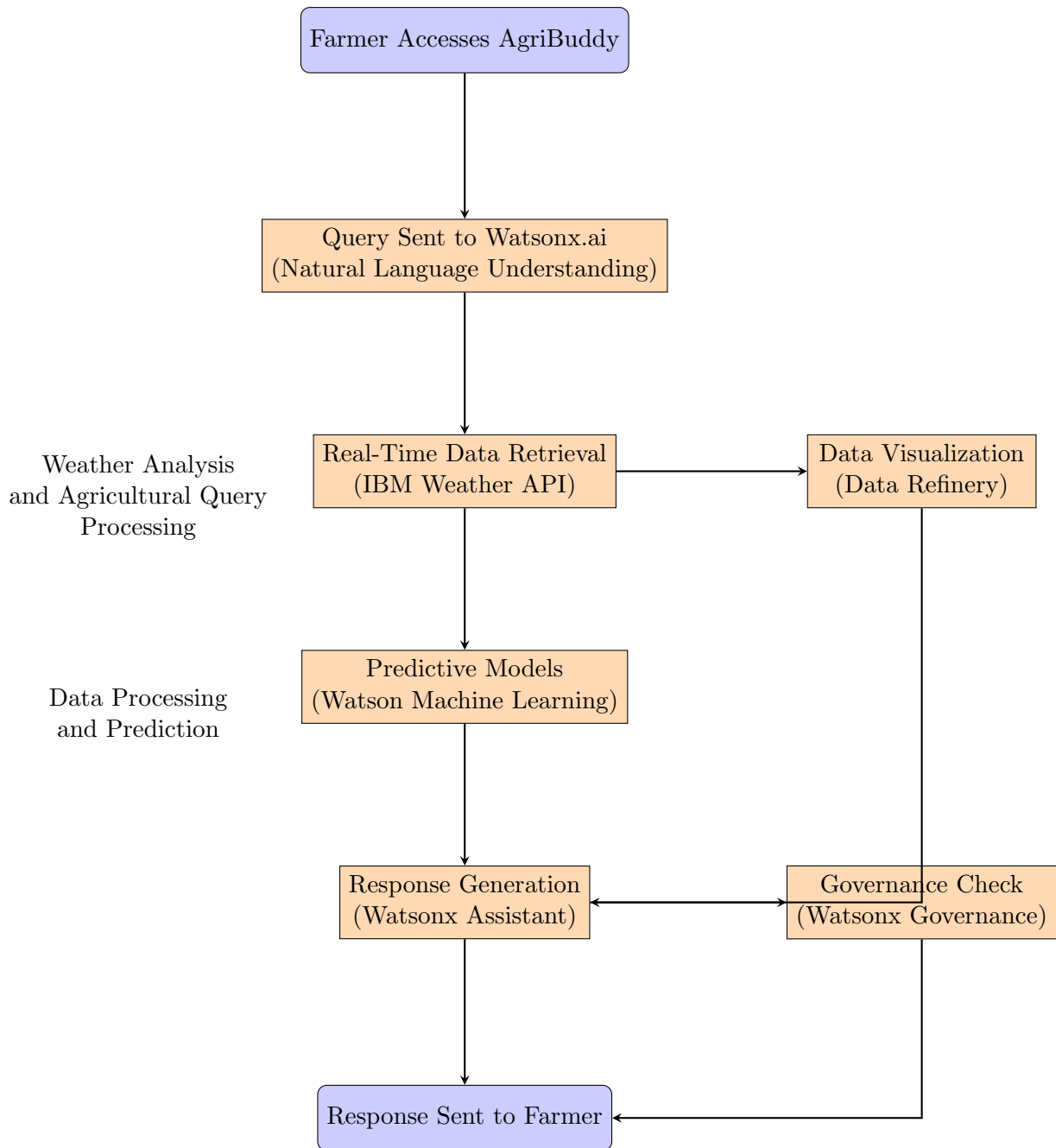


Figure 1: Solution Architecture Flowchart for AgriBuddy

Workflow:

1. Farmers access AgriBuddy via mobile or web platforms.
2. Queries are processed through Watsonx.ai and Watson Natural Language Understanding for precise information retrieval.
3. Real-time data is retrieved via the IBM Weather API and visualized in Data Refinery, providing an interactive interface.

4. Predictive models in Watson Machine Learning recommend actions based on current data.
5. Watsonx Governance tracks model lineage and compliance.

7 Demonstration Scenario

Example Interaction:

- **Farmer:** "Hello AgriBuddy, I'm planning to plant maize next week. Any advice?"
- **AgriBuddy:** "Hello! I'd be happy to help you with your maize planting plans. Let me check the weather forecast and soil conditions for your area. Could you please confirm your location?"
- **Farmer:** "I'm in Arusha, Tanzania."
- **AgriBuddy:** "Thank you. I've checked the forecast for Arusha for the coming week. Here's my advice:
 - **Weather:** Moderate rainfall is expected in 3 days, creating a favorable environment for planting.
 - **Soil Condition:** Soil moisture levels are adequate. If it doesn't rain as forecasted, consider light irrigation post-planting.
 - **Recommended Varieties:** For Arusha, varieties like UH6303 or H614 are well-suited for this season.
 - **Planting Depth:** Plant seeds 5-6 cm deep for optimal germination.
 - **Fertilizer:** Apply NPK fertilizer at planting. The current market price for DAP is TSh 110,000 per 50kg bag.
 - **Pest Alert:** There is a moderate risk of armyworm infestation. Monitor the crop regularly after germination.
 - **Insurance:** Consider enrolling in Tanzania's crop insurance program for coverage against weather and pest risks.

Would you like more details on any of these recommendations?"

- **Farmer:** "Yes, tell me more about the insurance option."
- **AgriBuddy:** "Certainly! Tanzania's crop insurance program covers losses due to natural disasters and pests. Key points:
 - **Coverage:** Losses due to weather, pests, and disease.
 - **Premium:** Premiums vary by crop; maize premiums are approximately TSh 1,500 per acre.
 - **Enrollment Deadline:** Enrollment typically closes a few weeks before the planting season.
 - **Process:** Sign up through local cooperatives or agricultural centers.
 - **Required Documents:** Land ownership proof, national ID, and bank details.

Insurance could protect your investment this season given weather conditions. Would you like help with enrollment?"

- **Farmer:** "Not right now, but thanks. One more question - when should I apply the first fertilizer?"
- **AgriBuddy:** "Apply the basal fertilizer just before or at planting. This should include all phosphorus and potassium, and one-third of nitrogen. The next application of nitrogen should occur 20-25 days post-planting. I can set a reminder for this if you'd like."
- **Farmer:** "Yes, please set a reminder. Thank you, AgriBuddy!"

8 Project Development Roadmap

1. **Data Collection and Preparation:** Gather agricultural, weather, and market data relevant to Tanzanian farmers.
2. **Model Development:** Develop AI models tailored to Tanzanian agricultural conditions.
3. **UI/UX Development:** Design an accessible interface for rural users.
4. **Testing and Validation:** Conduct a pilot with Tanzanian farmers for usability feedback.
5. **Deployment:** Deploy the solution on mobile and web platforms for Tanzanian farmers.

9 How to Run the Project

Local Setup:

- Install dependencies from `requirements.txt`.
- Configure IBM Weather API, Watsonx Assistant, and Data Refinery settings.

Run Instructions:

```
python3 agri_buddy_app.py
```

Live Demo: Access the demo at <https://youtu.be/yWKXG7YLFi0> (credentials available upon request).

10 Acknowledgments

Special thanks to IBM Call for Code, the Tanzanian agricultural community, and supporting organizations for their resources.

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12 License

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