
CAPSTONE PROJECT

AI AGENT FOR SMART FARMING ADVICE

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OUTLINE

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PROBLEM STATEMENT

The Challenge:

Small-scale farmers often face difficulties in deciding the most suitable crop to grow due to a lack of access to accurate data on soil health, weather conditions, and market trends. This leads to low productivity and financial losses.

Objective:

To develop an AI Agent for Smart Farming Advice, powered by IBM Cloud Auto-AI, which provides real-time, data-driven crop recommendations to help farmers make informed decisions and maximize agricultural yield.

PROPOSED SOLUTION

The proposed system aims to help small-scale farmers receive real-time, localized farming guidance using AI with Retrieval-Augmented Generation (RAG). The solution will include:

❖ Data Collection:

- ❑ Gather agricultural data such as weather forecasts, soil conditions, crop growth stages, pest reports, and market prices.
- ❑ Utilize trusted sources such as agricultural departments, meteorological agencies, and agri-tech platforms.

❖ Data Preprocessing:

- ❑ Clean and preprocess data to handle missing values and inconsistencies.
- ❑ Perform feature engineering to extract relevant agricultural insights (e.g., soil nutrients, seasonal patterns).

❖ Machine Learning Algorithm:

- ❑ Implement a Retrieval-Augmented Generation (RAG) model to provide precise and contextual farming advice.
- ❑ Integrate domain-specific knowledge bases to improve accuracy and relevance of recommendations.

❖ Deployment:

- ❑ Develop a user-friendly interface (web or mobile app) for farmers to get advice in real-time.
- ❑ Enable multi-language support for better accessibility.

❖ Evaluation:

- ❑ Test the AI agent using accuracy metrics and feedback from farmers.
- ❑ Continuously improve recommendations based on user feedback and updated datasets.

SYSTEM APPROACH

The system development for the AI Agent for Smart Farming Advice involves using IBM Cloud Auto-AI to automate model training, deployment, and testing, ensuring a smooth and efficient workflow.

System Requirements:

- IBM Cloud Account
- IBM Watsonx.ai Studio (Auto-AI)
- IBM Cloud Deployment Space
- Web browser with internet connection
- Basic knowledge of IBM Cloud and Auto-AI

Libraries Required:

- No manual libraries required for model building (Auto-AI automates the process)
- For testing and endpoint integration:
 - `ibm-watson-machine-learning` (to access the deployed model)
 - `cURL` (for testing API endpoints from the terminal)

ALGORITHM & DEPLOYMENT

Algorithm Selection:

- IBM Watsonx.ai Auto-AI automatically selects the best machine learning pipeline for crop prediction.
- Evaluates multiple algorithms and hyperparameters to find the most accurate model.

Data Input:

- Uses soil nutrients (N, P, K), pH value, temperature, humidity, and rainfall as input features.
- Data sourced from Kaggle Crop Recommendation Dataset.

Training Process:

- Auto-AI automatically preprocesses data, performs feature engineering, and trains multiple models.
- Best-performing pipeline is selected and saved as a model asset.

Prediction Process:

- Model is deployed on IBM Cloud deployment space.
- Takes new soil and climate parameters as input and predicts the most suitable crop with up to 99% confidence.

- [illegible]

Prediction results

Close

×

Display format for prediction results

☒ Table view
 ☐ JSON view

☐ Show input data ⓘ

| | prediction | probability |
|----|-------------|--|
| 1 | jute | [0,0.0071428574621677406,0,0,0,0,0,0,0.5295665740966797,0,0,0,0,0,0,0.00... |
| 2 | rice | [0,0.0071428574621677406,0,0,0,0,0,0.22956655025482178,0,0,0,0,0,0,0.0... |
| 3 | maize | [0,0,0,0,0,0,0,0,0,0.8951456308364869,0,0.0048543687909841544,0,0,0,0,0.1... |
| 4 | kidneybeans | [0,0,0,0,0,0,0,0,0.1,0,0,0,0,0,0,0,0,0,0] |
| 5 | chickpea | [0,0,0.1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0] |
| 6 | pigeonpeas | [0,0,0.14576270580291747,0,0,0,0,0,0,0.003389830514788628,0,0,0.00915906... |
| 7 | mothbeans | [0,0,0.06947368383407593,0,0,0,0,0,0,0.017894737422466278,0,0,0.91157894... |
| 8 | mungbean | [0,0,0,0,0,0,0,0,0,0,0,0,0.1,0.9,0,0,0,0,0] |
| 9 | blackgram | [0,0,0.6030216217041016,0,0,0,0,0,0,0.3314172506332398,0,0.004587155953... |
| 10 | lentil | [0,0,0.03498966693878174,0,0,0,0,0,0,0.876530933380127,0,0,0.06991090774... |
| 11 | pomegranate | [0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0] |
| 12 | banana | [0,0.791701889038086,0,0,0,0,0.1,0.09230972528457643,0,0,0,0,0,0,0.0011... |
| 13 | coffee | [0,0,0,0,0.1,0,0,0,0,0,0,0,0,0,0,0,0,0] |

CONCLUSION

- **IBM Watsonx.ai Auto-AI simplified the entire model-building process.**
- **Successfully predicted suitable crops based on soil and climate parameters.**
- **Achieved up to 99% confidence in crop predictions.**
- **Supports farmers in making data-driven crop selection decisions.**
- **Helps improve agricultural yield and profitability through AI-based solutions.**

FUTURE SCOPE

- **Integrate IoT sensors for real-time soil and climate data collection.**
- **Expand model to cover more crop varieties and multiple geographic regions.**
- **Improve prediction accuracy with advanced model tuning.**
- **Develop a mobile application for farmers to access crop recommendations easily.**
- **Incorporate satellite and weather forecasting data for better decision-making.**

REFERENCES

- **Crop Recommendation Dataset:**
<https://www.kaggle.com/datasets/siddharthss/crop-recommendation-dataset>
- **IBM Cloud:** <https://cloud.ibm.com>
- **IBM Watsonx.ai Auto-AI Documentation**

IBM CERTIFICATIONS



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IBM SkillsBuild

Completion Certificate



This certificate is presented to
Naga Poornima Gulla

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 !