CAPSTONE PROJECT

AI AGENT FOR SMART FARMING ADVICE

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OUTLINE

- **Problem Statement** (Should not include solution)
- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Algorithm & Deployment**
- **Result (Output Image)**
- **Conclusion**
- **Future Scope**
- **References**

Problem Statement

- Small-scale farmers in rural areas often lack access to timely and localized agricultural guidance.
- Challenges such as unpredictable weather, changing soil conditions, pest outbreaks, and fluctuating
- market prices impact their decisions and income. Traditional advisory systems are limited in reach
- and fail to provide real-time, location-specific support.
- Farmers need a solution that understands their language, responds to their queries instantly, and
- offers reliable agricultural advice drawn from trusted sources to improve yield and income.

Proposed Solution

- The proposed system aims to deliver real-time, localized agricultural advice to small-scale farmers using AI and Retrieval-Augmented Generation (RAG). The solution includes:
- **Data Collection:**
  Collect soil (N, P, K, pH), temperature, humidity, rainfall, mandi prices, and pest control info from trusted APIs and datasets.
- **Data Preprocessing:**
  Clean and normalize data. Convert voice/text queries into structured format for better model understanding.
- **Machine Learning Algorithm:**
  Use RAG to retrieve relevant documents and generate responses. Sentence embeddings help match farmer queries with accurate answers.
- **Deployment:**
  Develop a chatbot interface with local language support. Deploy backend on cloud with API integration for real-time updates.
- **Evaluation:**
  Evaluate model accuracy using precision/recall. Monitor retrieval quality and improve based on feedback.
- **Result:**
  Provides quick, reliable farming suggestions and market insights to help farmers make informed decisions.

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 (AutoAI)
- IBM Cloud Deployment Space
- Web browser with internet connection
- Basic knowledge of IBM Cloud and AutoAI

Libraries Required:

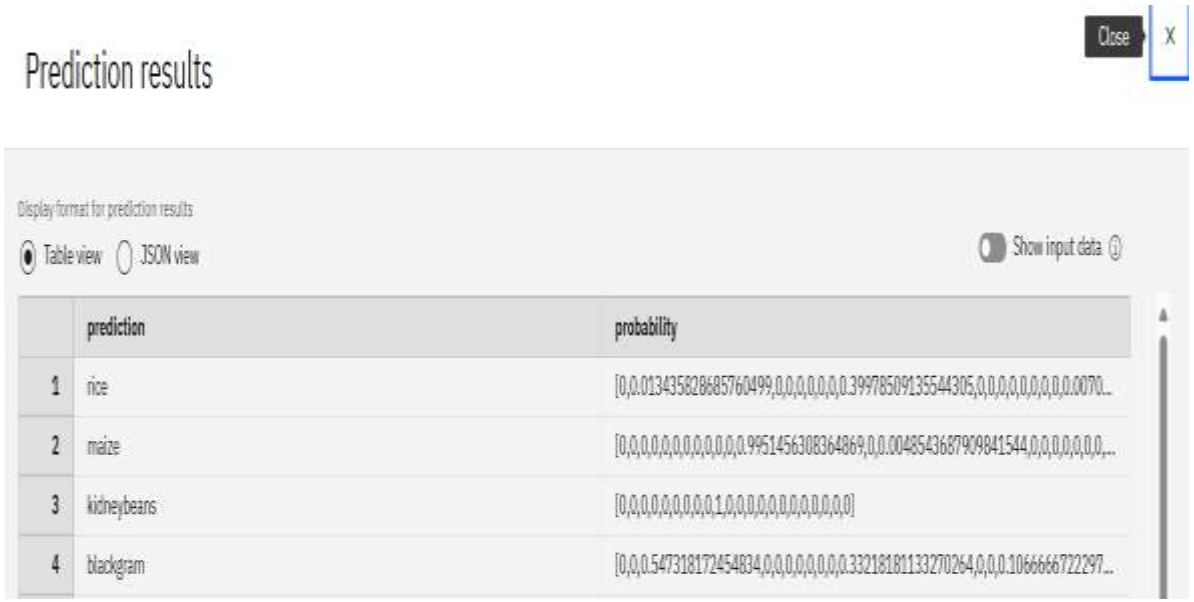
- No manual libraries required for model building (AutoAI automates the process)
- For testing and endpoint integration:
  - ibm-watson-machine-learning (to access the deployed model)
  - requests (optional for Python API calls)
  - **cURL** (for testing API endpoints from the terminal)

Algorithm & Deployment

- **Data Input**
  - Input features: Nitrogen (N), Phosphorus (P), Potassium (K) levels in soil
  - pH value, temperature, humidity, and rainfall
  - Dataset used: *Crop Recommendation Dataset (Kaggle)*
- **Algorithm Selection**
  - IBM Watsonx.ai AutoAI automatically selects the best ML pipeline for crop prediction.
  - Evaluates multiple algorithms and hyperparameters to find the most accurate model.
- **Training Process**
  - Dataset uploaded to Watsonx.ai AutoAI.
  - AutoAI builds and compares multiple pipelines.
  - Best-performing model saved as a **Model Asset**.
- **Deployment Process**
  - Model promoted to **Deployment Space** in IBM Cloud.
  - New deployment created and activated for use.
- **Prediction Process**
  - User provides new soil and climate input values.
  - Model predicts the most suitable crop with up to **99% confidence**.

Result

- Model successfully trained using IBM Watsonx.ai AutoAI.
- Best pipeline selected automatically with highest accuracy.
- Model deployed on IBM Cloud deployment space.
- Prediction Example:
- Input: N=4, P=14, K=41, Temperature=19.851 , Humidity=89.807 , pH=6.430 , Rainfall=102.818
- Output: Pomegranate (Confidence: 99%)
- Demonstrates high accuracy in crop prediction, supporting precision agriculture.



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Conclusion

- IBM Watsonx.ai AutoAI 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.

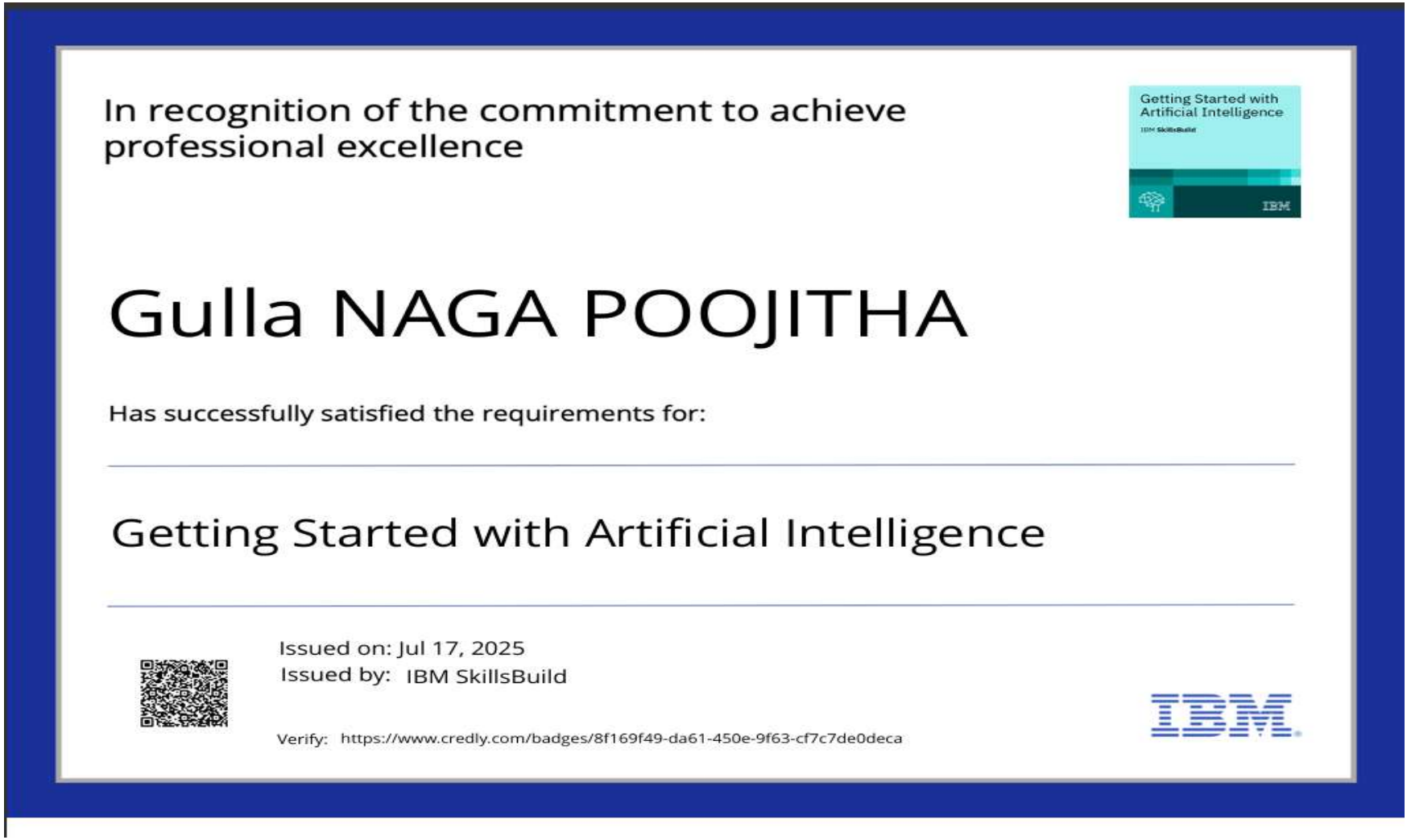
FUTURE SCOPE

- 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 AutoAI Documentation
- Indian Chamber of Food and Agriculture (ICFA): https://www.icfa.org.in

IBM Certifications



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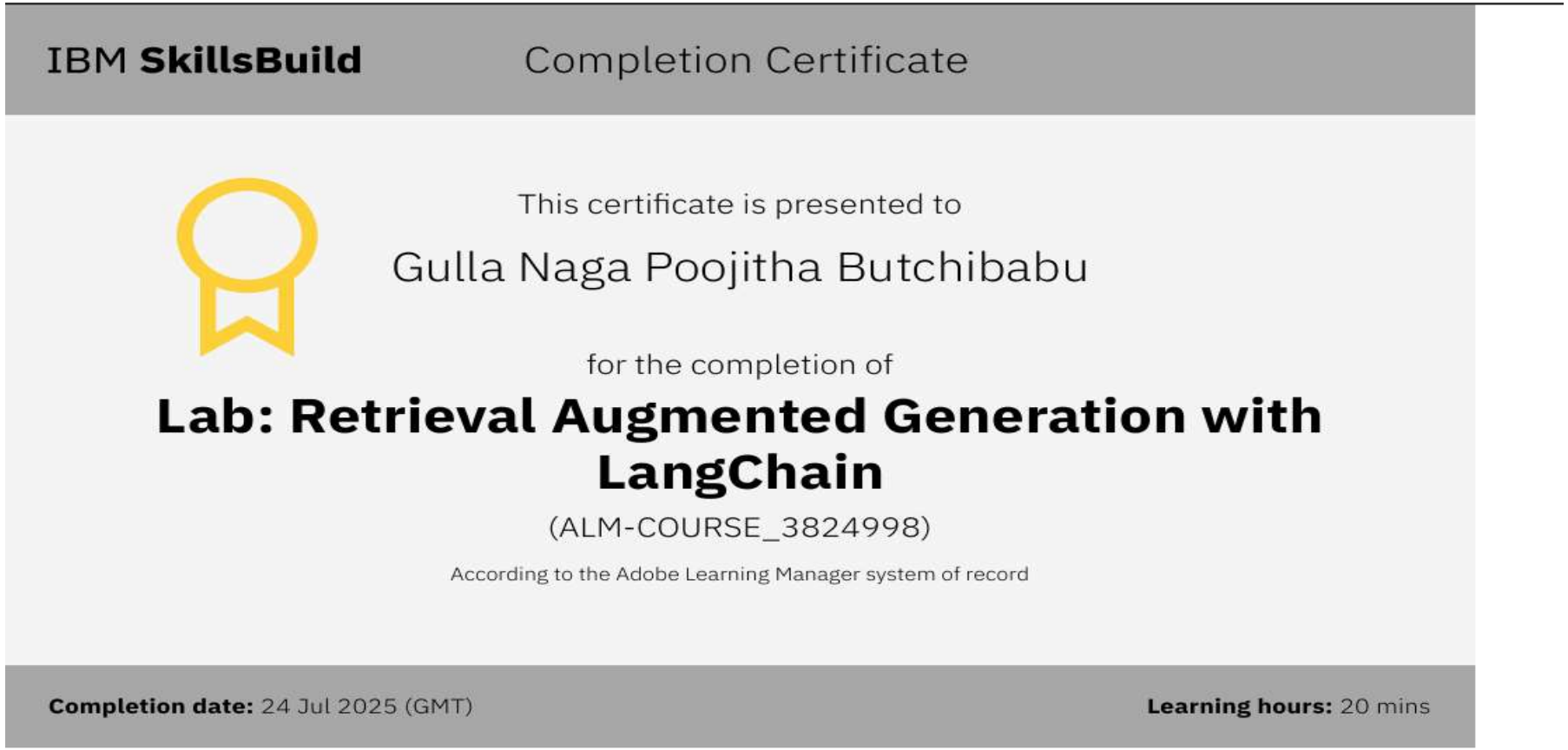

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