CAPSTONE PROJECT

PROJECT TITLE

CROP RECOMMENDATION SYSTEM USING MACHINE LEARNING

PRESENTED BY

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OUTLINE

- Problem Statement.
- Proposed System/Solution.
- System Development Approach.
- Algorithm & Deployment.
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- Conclusion.
- Future Scope.
- References.

PROBLEM STATEMENT

India is an agrarian country where a majority of the population depends on agriculture for their livelihood. However, farmers often face difficulties in selecting the most suitable crop to cultivate due to lack of technical knowledge, climate change, and variability in soil fertility. Incorrect crop selection leads to poor yield and economic losses. To address this, it becomes essential to guide farmers with intelligent systems that can recommend crops based on soil nutrients and environmental conditions. The critical challenge is to develop a system that can accurately predict the most suitable crop using available data such as nitrogen, phosphorus, potassium levels, pH value, temperature, humidity, and rainfall.

PROPOSED SOLUTION

- **Data Collection:**
  We use a dataset containing important soil nutrients like Nitrogen (N), Phosphorus (P), and Potassium (K), along with environmental factors such as temperature, humidity, pH level, and rainfall. The data is sourced from reliable public platforms like Kaggle.
- **Data Preprocessing:**
  Before training the model, the data is cleaned by removing any missing or incorrect values. Then, important features are selected and normalized to improve the quality of predictions.
- **Machine Learning Model:**
  A Random Forest Classifier is trained on this prepared data to learn patterns that link soil and weather conditions to suitable crops. This model was chosen because it generally performs better than others like Decision Trees or Naive Bayes for this task.

PROPOSED SOLUTION

- **Deployment:**
  The trained model is integrated into a user-friendly web application developed using Streamlit. Farmers or users can enter current soil and weather data, and the app will instantly provide a recommended crop.
- **Evaluation:**
  The model's performance is tested using different data samples, and it achieved high accuracy in predicting the correct crop. This ensures the system's recommendations are reliable.
- **Result:**
  The final system successfully suggests suitable crops such as rice, maize, chickpea, or banana based on the input parameters. It provides quick and accurate recommendations through a simple web interface, making it a practical tool to help farmers improve their crop selection and yield.

SYSTEM APPROACH

This slide explains how the Crop Recommendation system was built and what tools were used.

System Requirements:

- A computer with Python installed
- Internet to download data and tools

Libraries and Tools Used:

- **Python:** To write the code
- **pandas and NumPy:** To work with data
- **scikit-learn:** To create the machine learning model
- **Streamlit:** To build the easy-to-use web app
- **pickle:** To save and use the trained model

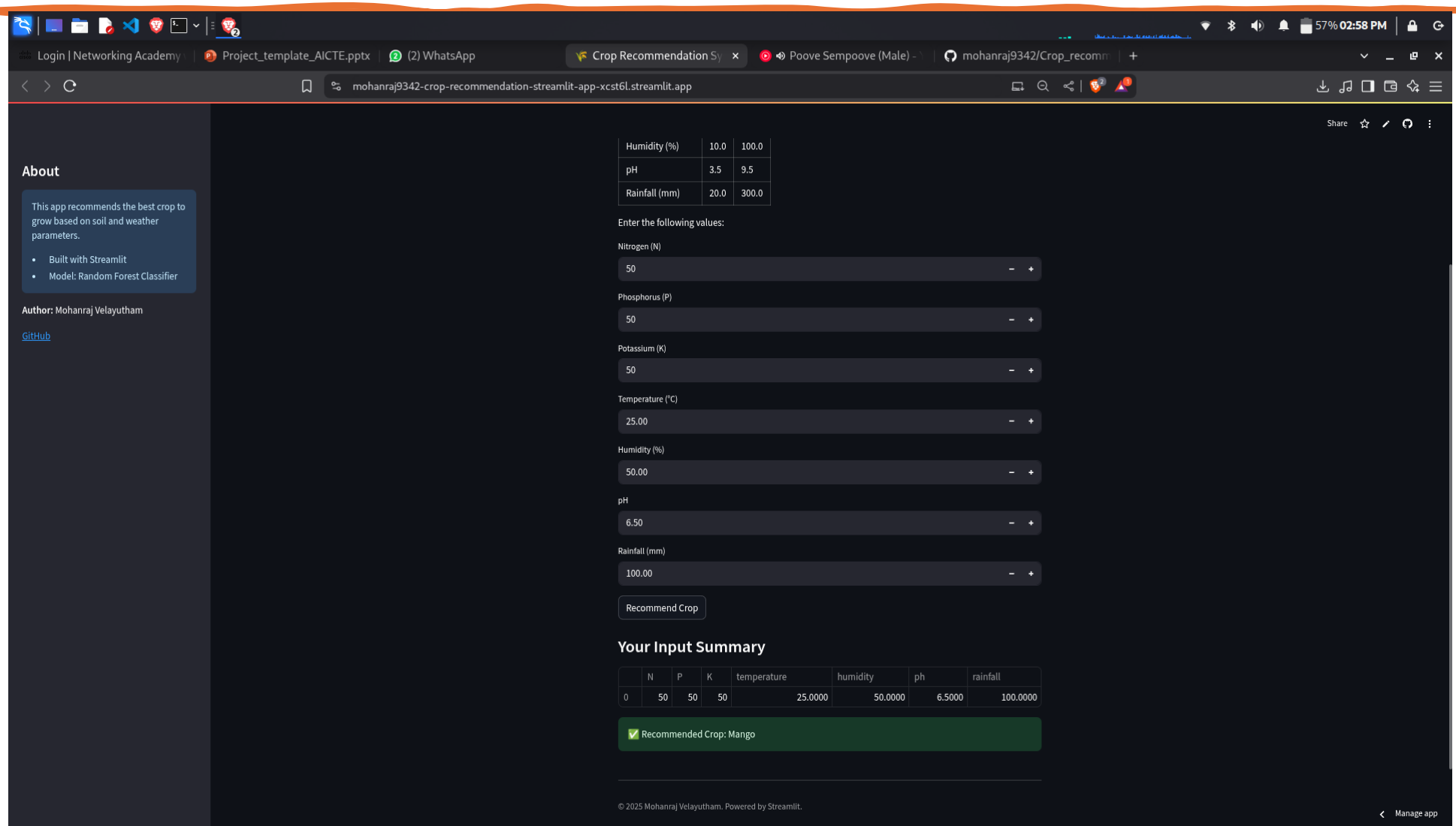
ALGORITHM & DEPLOYMENT

- **Algorithm Selection:**
  We used the **Random Forest Classifier**, a machine learning algorithm that works well for classification problems. It was chosen because it can handle complex data with many features and gives accurate crop predictions based on soil and weather conditions.
- **Data Input:**
  The model takes input features like Nitrogen (N), Phosphorus (P), Potassium (K), temperature, humidity, pH, and rainfall to make predictions.
- **Training Process:**
  The algorithm was trained on a dataset of past soil and climate data along with the crops grown. We split the data into training and testing sets to check how well the model learns. Techniques like tuning model parameters helped improve accuracy.
- **Prediction Process:**
  Once trained, the model can predict the best crop when given new input values. The system is deployed as a web app using Streamlit, where users enter soil and weather data and get instant crop recommendations.

RESULT

- **Model Accuracy:**
  Achieved around **89%** accuracy in recommending the correct crop based on input parameters.
- **Effectiveness:**
  The model effectively predicts suitable crops by analyzing soil nutrients (N, P, K), temperature, humidity, pH, and rainfall data.
- **Visualization:**
  - Graph comparing predicted crops vs actual crops from test dataset to evaluate model precision.
  - Confusion matrix showcasing classification performance and highlighting prediction accuracy across different crop classes.
- **Summary:**
  The model demonstrates strong performance in recommending appropriate crops, assisting farmers in optimizing crop selection for better yield and resource management.

RESULT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About
This app recommends the best crop to grow based on soil and weather parameters.
Built with Streamlit
Model: Random Forest Classifier
Author: Mohanraj Velayutham
GitHub
Humidity (%) 10.0 100.0
pH 3.5 9.5
Rainfall (mm) 20.0 300.0
Enter the following values:
Nitrogen (N)
50
Phosphorus (P)
50
Potassium (K)
50
Temperature (°C)
25.00
Humidity (%)
50.00
pH
6.50
Rainfall (mm)
100.00
Recommend Crop
Your Input Summary
N P K temperature humidity ph rainfall
0 50 50 50 25.0000 50.0000 6.5000 100.0000
✅ Recommended Crop: Mango
© 2025 Mohanraj Velayutham. Powered by Streamlit.
Manage app

CONCLUSION

- The **Crop Recommendation System** successfully predicts the best crop based on soil and weather parameters with good accuracy.
- This solution can help farmers make informed decisions, leading to improved crop yield and resource efficiency.
- Challenges faced include collecting diverse, high-quality data and tuning the model for optimal performance.
- Future improvements may involve incorporating real-time weather updates and expanding the model to cover more crop varieties.
- Accurate crop recommendations are essential for sustainable agriculture and maximizing farmers' productivity.

FUTURE SCOPE

- Incorporate **additional data sources** like satellite imagery, seasonal climate forecasts, and pest/disease alerts for improved recommendations.
- Optimize the machine learning model using **advanced techniques** like ensemble methods or deep learning for higher accuracy.
- Expand the system to support **multiple regions or states** with localized crop recommendations.
- Integrate **real-time weather data** and IoT sensors for dynamic and timely advice.
- Explore **edge computing** to enable offline, on-field recommendations via mobile devices.
- Develop a **user-friendly mobile app** for wider accessibility among farmers.

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- Breiman, L. (2001). *Random Forests*. Machine Learning Journal.
- *Best Practices in Data Preprocessing and Model Evaluation*. Data Science Central, 2022.
- GitHub Repository: https://github.com/mohanraj9342/Crop_recommendation/
- Streamlit Web Link: https://mohanraj9342-crop-recommendation-streamlit-app-xcst6l.streamlit.app/

I sincerely appreciate your time and consideration.
It was a pleasure sharing my project with you.
If you have any questions or feedback, I'd be happy to hear them.

Thank you...