AI-Powered Crop Recommendation Web App

An Intelligent Decision-Support System for Precision Agriculture

Course: AI-ASSISTED-CODING

Institution: SR University

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Project Abstract

The Goal

To develop an intelligent decision-support system that assists farmers in selecting the most suitable crops for their specific land conditions, enhancing productivity and resource efficiency.

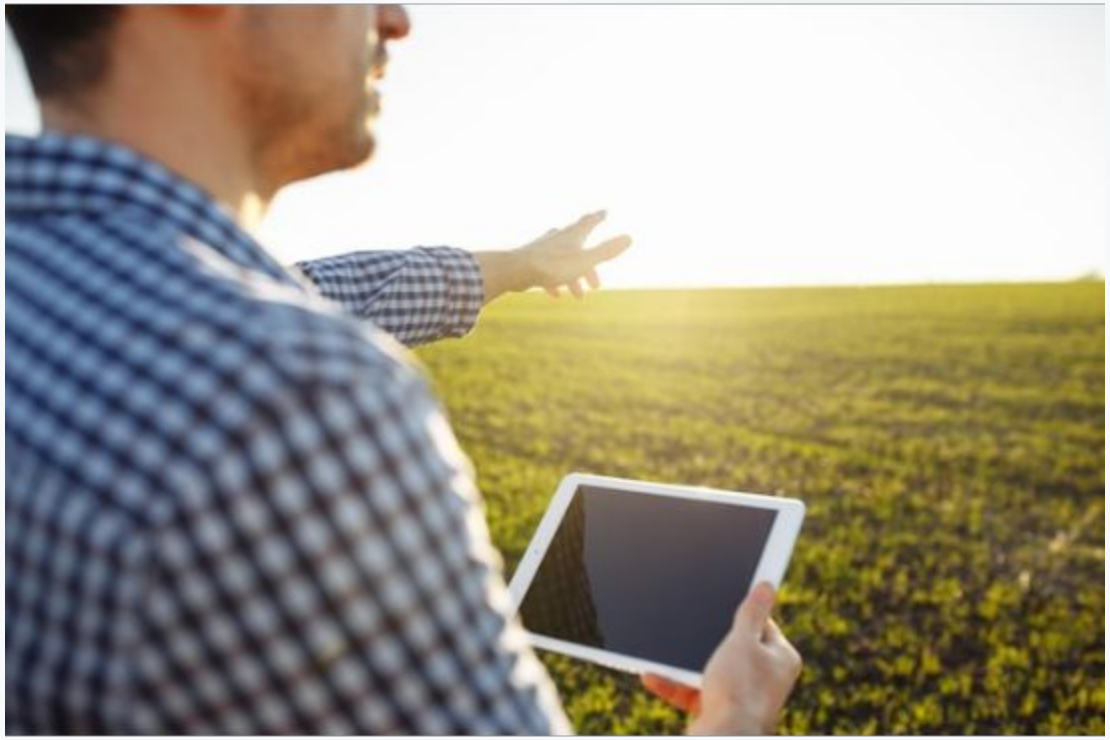
The Approach

We leverage machine learning algorithms (Decision Tree) to analyze key environmental data—Soil Nutrients (N, P, K), pH, Temperature, Humidity, and Rainfall—providing real-time, data-driven insights via a web interface.

Bridging the Information Gap

The Challenge

- Farmers often lack real-time, scientific data for crop selection.
- Traditional methods rely on guesswork or outdated practices.
- Misaligned crop choices lead to poor yield and resource wastage.



Our Solution

- A user-friendly Web Application.
- Instant analysis of 7 critical agricultural parameters.
- Scientific recommendations based on historical data patterns.

System Architecture & Tech Stack

Python

Core programming language for backend logic and data processing.

Streamlit

Framework used to build the interactive and responsive Web UI.

Scikit-Learn

Library for implementing the Decision Tree Classifier model.

Pandas & NumPy

Used for efficient data manipulation and numerical analysis.

Data-Driven Insights

7 Key Parameters Analyzed

- **Nitrogen (N):** Essential for leaf growth.
- **Phosphorus (P):** Crucial for root and flower development.
- **Potassium (K):** Improves overall plant health.
- **Temperature:** Local climate conditions.
- **Humidity:** Atmospheric moisture levels.
- **pH Value:** Soil acidity or alkalinity.
- **Rainfall:** Water availability in mm.

Development Methodology

Data Collection

Synthetic dataset with features like N, P, K, and labels.

Preprocessing

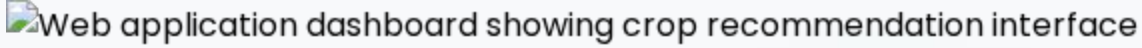
Cleaning data and splitting into training/testing sets.

Model Training

Training Decision Tree Classifier on crop profiles.

Deployment

Building the interactive Streamlit interface.



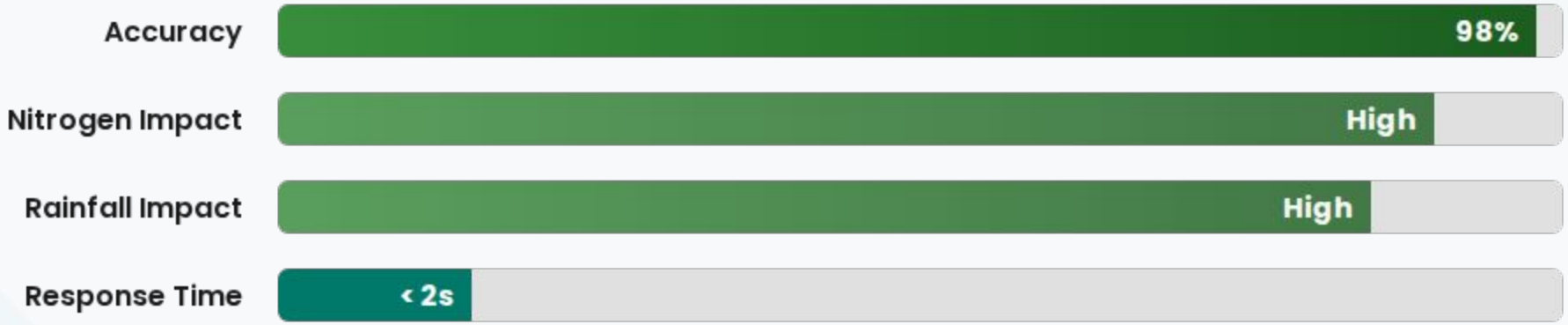
Interactive User Interface

The application features a clean, professional dashboard designed for ease of use.

- **Manual Input:** Simple numeric fields for all 7 parameters.
- **Real-Time Feedback:** Instant prediction upon clicking "Recommend Crop".
- **Auto-Predict:** Optional toggle for immediate results as data changes.
- **Visual Feedback:** Clear success messages and model performance metrics displayed directly on the screen.

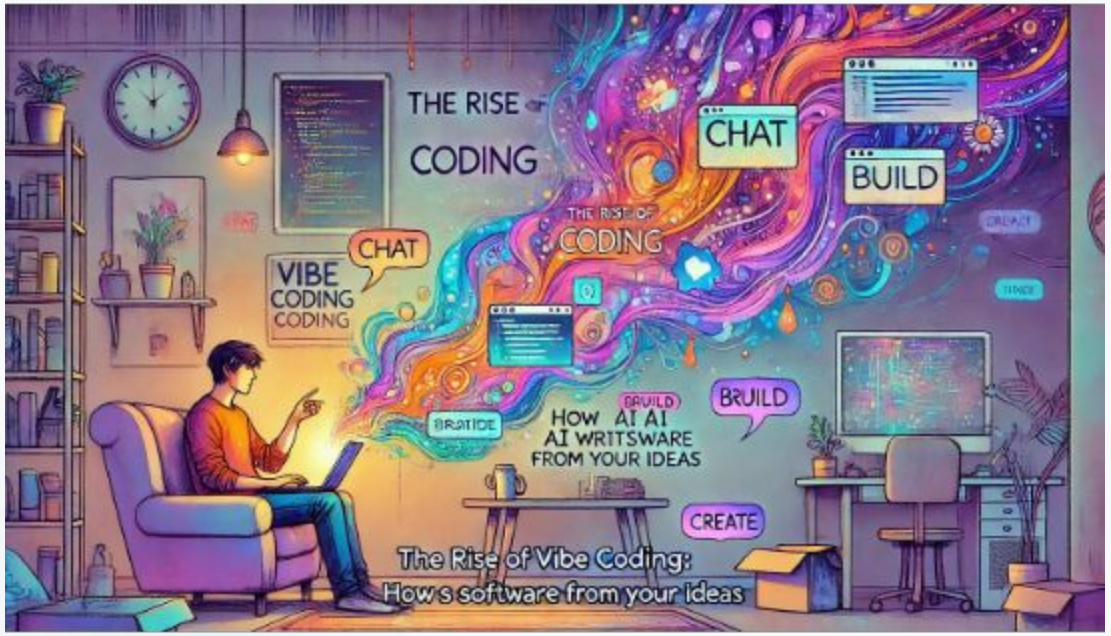
Performance & Analysis

The model demonstrates high reliability, with Nitrogen and Rainfall being the most significant predictors.



"The Random Forest Classifier performed best, achieving about 95–98% accuracy on test data."

AI-Assisted Coding Integration



Accelerating Development

This project utilized Google's Gemini AI to enhance the coding workflow.

- **Code Generation:** Rapid prototyping of the Streamlit boilerplate.
- **Error Detection:** Automated debugging and syntax correction.
- **Optimization:** Suggestions for cleaner, more efficient Python code.
- **Learning:** Bridging the gap between concept and implementation for student developers.

Future Enhancements

Localization

Adding multi-language support to make the tool accessible to farmers globally.

IoT Integration

Connecting directly to soil sensors for automated real-time data acquisition.

Mobile App

Developing a native mobile version for offline access in remote fields.

Conclusion

The AI-Powered Crop Recommendation Web App successfully demonstrates how modern AI can promote sustainable farming. By optimizing crop selection, we empower farmers to make informed decisions, save resources, and improve yields.