

Smart Crop Recommendation System Using Machine Learning and Real-Time Weather Data

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Abstract

Agriculture is experiencing multiple challenges due to climatic unpredictability, imbalance of soil nutrients and less access to expert advice on time requiring farmers to select a crop is a complex and an important decision. This project introduces us to a Smart Crop Recommendation System, which is an AI based web application that recommends suitable crops according to the composition of nutrients in soil and real-time weather condition. The system enables the user to enter basic soil parameters like Nitrogen, Phosphorus, and Potassium value and the required inputs like temperature, humidity, rainfall, etc., are dynamically fetched using OpenWeatherMap API based on the user's location. Machine learning models, namely Random Forest and CatBoost are used to train machine learning models on agricultural data sets, in order to understand complex relationships between soil and climatic factors.

The system produces Top-3 recommendations for crops to be planted and confidence values which can be used to make informed decisions. A data processing, normalization, and model inferility capability can be established for the Fine Arts with a scalable Fast API Backend and a React frontend with user-friendly TypeScript capabilities. Firebase is labored for a secure authentication, data storage, and scalability. In order to increase the accessibility and usability, the platform features a multilingual AI chatbot that provides fertilizer suggestions and crop care instructions in people's local languages. Experimental evaluation shows the prediction accuracy is roughly 96%, which shows the system and effectiveness of the proposed system. The solution supports a data-driven approach to region-specific and sustainable agricultural practices and helps farmers to enhance productivity and mitigate the risks from the inappropriate choice of crop practices.

Keywords

Crop Recommendation, Machine Learning, Precision Agriculture, Real Time Weather Data, Agricultural Decision Support.

