

AI Based crop recommendation system

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ABSTRACT : The proposed system, “AI Driven Crop Recommendation System for Smart Agriculture,” aims to assist farmers in selecting the most suitable crop based on soil and environmental conditions using machine learning techniques. Traditional crop selection methods rely heavily on farmers’ experience and may lead to incorrect decisions due to unpredictable environmental factors. The proposed system analyzes soil nutrients such as Nitrogen (N), Phosphorus (P), Potassium (K), along with climatic parameters including temperature, humidity, rainfall, and soil pH. Machine learning algorithms are used to analyze these parameters and recommend the most appropriate crop for cultivation. The system helps farmers improve agricultural productivity, reduce crop failure risks, and make data-driven decisions. The implementation includes a web-based interface that allows users to input environmental parameters and receive instant crop recommendations. This system contributes to the development of smart agriculture by integrating artificial intelligence with traditional farming practices.

Key Words : Crop Recommendation System, Machine Learning, Smart Agriculture, Soil Nutrients Analysis, Precision Farming, Artificial Intelligence

- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)
- Temperature
- Humidity
- Rainfall
- Soil pH

Based on these parameters, machine learning models such as Decision Tree, Random Forest, and Naïve Bayes are used to train the dataset and recommend the best crop for cultivation.

Machine learning techniques are widely used in modern agriculture to analyse agricultural data and predict crop productivity. In the proposed system, machine learning algorithms are trained using agricultural datasets containing soil nutrient levels and environmental parameters.

The system analyses the input parameters provided by the user and predicts the most suitable crop that can be cultivated in the given soil and climatic conditions.

1.INTRODUCTION

Agriculture is an essential part of the economy and plays a vital role in the food production of various countries. Farmers usually face difficulties in choosing the best crop according to their soil nutrients, climate, and rainfall patterns. If they choose the crop wrongly, it can cause financial losses.

With the help of Artificial Intelligence (AI) and Machine Learning (ML), intelligent machines can analyze data and provide recommendations regarding the best crop to be grown in a specific region.

The AI-Driven Crop Recommendation System can assist farmers in making better decisions regarding crop selection based on soil nutrients such as Nitrogen, Phosphorus, and Potassium, and environmental factors including temperature, humidity, rainfall, and pH level.

2.2 System Architecture

Crop diseases significantly affect agricultural productivity. Early detection of crop diseases helps farmers take preventive actions and reduce losses.

In this system, crop disease detection is performed using image processing and machine learning techniques. Images of plant leaves are analyzed to identify symptoms of diseases such as leaf spots, blight, and fungal infections. The trained model detects disease patterns and provides suggestions for proper treatment.

The overall architecture of the proposed system is shown in Fig. 1.

2. PROPOSED SYSTEM

2.1 Crop Recommendation Using Machine Learning

Machine Learning algorithms play a significant role in analysing agricultural data. In this system, different machine learning algorithms are used to analyse soil and climate data to predict the most suitable crop.

The system uses parameters such as:



2.3 System Architecture

The system architecture consists of multiple modules that work together to provide crop recommendations and disease detection.

The main components include:

1. **Data Collection Module** – Collects soil and climate data.
2. **Data Preprocessing Module** – Cleans and prepares the dataset.
3. **Machine Learning Model** – Trains the model using agricultural datasets.
4. **Prediction Module** – Recommends suitable crops based on user input.
5. **Disease Detection Module** – Identifies crop diseases using leaf images.
6. **User Interface** – Allows farmers to interact with the system through a web application.

2.4 System Implementation

The system is implemented using modern web and machine learning technologies.

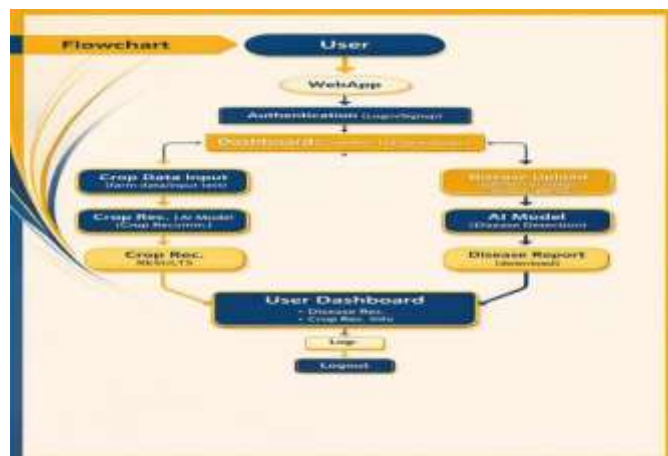
The frontend interface is developed using HTML, CSS, and Bootstrap, providing a user-friendly platform for farmers. The backend is developed using the Django framework, which handles data processing and machine learning integration.

Machine learning models are developed using Python libraries such as Scikit-learn, Pandas, and NumPy. The agricultural dataset is stored in a MySQL database, which maintains soil parameters, crop information, and prediction results.

The system processes user input and generates crop recommendations and disease detection results instantly.

Table -1: Sample Table format

Parameter	Description
Nitrogen	Soil nutrient required for plant growth
Phosphorus	Helps in root development
Potassium	Improves plant resistance
Temperature	Environmental condition affecting crop growth
Rainfall	Water availability for crops



3. CONCLUSIONS

The AI Driven Crop Recommendation and Crop Disease Detection System provides an intelligent solution for modern agriculture. By analyzing soil nutrients and environmental parameters, the system recommends suitable crops that can improve agricultural productivity. The disease detection module helps farmers identify plant diseases at an early stage and take preventive measures. The integration of Artificial Intelligence and Machine Learning with agriculture enables data-driven decision-making and promotes sustainable farming practices.

4. ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the project guide and faculty members for their valuable guidance and support during the development of this research work. The authors also thank the Department of Artificial Intelligence and Machine Learning, Adarsh Institute of Technology and Research Centre, Vita, for providing the necessary facilities and support.

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