Crop Recommendation System

Minor Project 1

RAMANUJAN COLLEGE

University Of Delhi

NAAC Grade A++ with CGPA 3.71

B.voc Software Development

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GitHub Link: CLICK HERE TO OPEN THE PROJECT REPO

Crop Recommendation System

Description:

- The Crop Recommendation System is an application based on machine learning that advises appropriate crop choices, keeping in mind a variety of environmental and soil parameters. It mainly aims to assist farmers and agricultural specialists in making informed decisions concerning crop cultivation, which may help increase yields and also enhance profitability.

- It will take into consideration soil composition, climatic conditions, precipitation, temperature, humidity, and pH levels to determine which crops are best suited to a specific geographical location. It uses predictive modeling techniques to analyze historical datasets, offering recommendations tailored to the conditions of a farm or an agricultural region.

Key Deliverables:

- Crop recommendation web application
- Deployment on a cloud platform

Major Traits:

- Data Acquisition: The system allows the user to input relevant information, such as soil characteristics, climatic data, and geographical positioning.
- Data Preprocessing: The raw data set is first preprocessed to handle missing values, scale or normalize features, and transform categorical variables.
- Machine learning models: A mix of several machine learning algorithms is applied, including decision trees, random forests, support vector machines (SVM), and gradient boosting for building the predictive models.
- The models are trained using historical data and then evaluated through applicable performance metrics to ensure both accuracy and reliability.

Crop Recommendation:

- The system suggesting the best crops corresponding to the specified input parameters through the models developed.

User-Centric Interface:

- The system offers an interface that is user-accessible. It allows users to easily input their information, view suggestions, and explore additional information.

Technologies and Tools Used:

- Python is the programming language of the model development, data preprocessing, and web applications development.

Scikit-learn:

- Machine learning library used for model training, evaluation, and prediction.

Pandas:

- Library is used for preprocessing and analysis of data.

NumPy:

- Library for numerical computing used to deal with arrays and mathematical operations.

Flask:

- web framework to write web application that builds an interface and handle HTTP requests.

HTML/CSS:

- A markup and styling language to design a web interface.

JavaScript

- is the script language for client-side interaction and advanced user interface.

Matplotlib:

- is used for visualizations of data distributions before training the Model

Deployment:

- The Crop Recommendation System is deployed on Render, a cloud platform for hosting web applications. It is hosted on the free tier, which may cause the application to take a few seconds to load initially due to the "sleep mode" feature. The web app is accessible via the following
  URL: CLICK HERE TO VIEW THE PROJECT ON WORLDWIDE WEB

- This deployment ensures that users can interact with the system in real-time, accessing farming insights, crop recommendations, weather updates, and more from anywhere.

Deployment Steps:

- Uploaded the project files, including app.py, the machine learning model (pkl files), and supporting files, to a GitHub repository. Linked the GitHub repository to Render.
- Configured the build environment to install dependencies from requirements.txt and run the application using Gunicorn (gunicorn app:app).

Set up environment variables (if required) for seamless integration.

Implementation and Application:

- Open project file directory where there is an app.Py file

- Install the required dependencies: pip install -r requirements.txt

- Run the app: Python app.py

- Open the web browser and access the application at http://localhost:5000

Contact:

- For any inquiries or questions, please contact
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PROJECT OVERVIEW

1.1 Problem Statement:

Today, precision agriculture-that is, an advanced and modern approach to farming involving elaborate data on soil characteristics, weather conditions, and crop yields-this system aims that farmers make the best choice of crops that will give maximum yield and profitability.

Precision farming is more important because such an approach guides in reducing crop failure and aiding farmers in taking informed decisions.

With this technology, it has the capacity to play a big role in reducing the historical agrarian crisis by allowing farmers to grow the crops ideally suited to their land conditions, thereby ensuring sustainability and enhancing agricultural productivity.

1.2 Objectives:

To train and develop a classification Model under supervised machine learning, that will predict and/or recommend optimum crop to be cultivated by farmers based on several parameters and help them make an informed decision before cultivation.

1.3 Key features:

(1) Dynamic Crop Recommendation

Provides tailored crop suggestions based on soil properties, weather, pH levels, and climatic conditions.

(2) Predictive Modeling

Leverages advanced machine learning algorithms (e.g., Decision Trees, Random Forests, SVM) for accurate and reliable crop prediction.

(3) User-Centric Interface

An easy-to-use interface for farmers and agricultural specialists to input data and view recommendations.

(4) Real-Time Deployment

Hosted on a cloud platform (Render), ensuring global accessibility for users.

(5) Data Visualization

Provides graphical insights into soil and climatic data to help users understand underlying patterns.

(6) Customizability

Allows users to input specific farm data or regional information for highly localized recommendations.

(7) Scalable and Robust Framework

Built using Python and Flask, ensuring efficient operation and the ability to scale for broader use cases.

1.4 **Data Dictionary:**

Attribute	Description	Type	Example Values
N	Nitrogen content in the soil (measured in parts per million)	Numeric	90, 112
P	Phosphorus content in the soil (measured in parts per million)	Numeric	40, 60
K	Potassium content in the soil (measured in parts per million)	Numeric	25, 50
Temperature	Average temperature of the region (in °C)	Numeric	25, 19.1
Humidity	Relative humidity in the region (percentage)	Numeric	70, 85
pH	Soil pH level indicating acidity or alkalinity	Numeric	6.5, 7.2
Rainfall	Annual precipitation levels (in millimeters)	Numeric	800, 1200
Crop	The crop that can be grown in the given conditions	Categorical	Rice, Wheat, Maize

1.5 Project Scope and Objectives:

The goal is to develop a machine-learning-based Crop Recommendation System that assists farmers in making informed crop choices based on environmental and soil parameters.

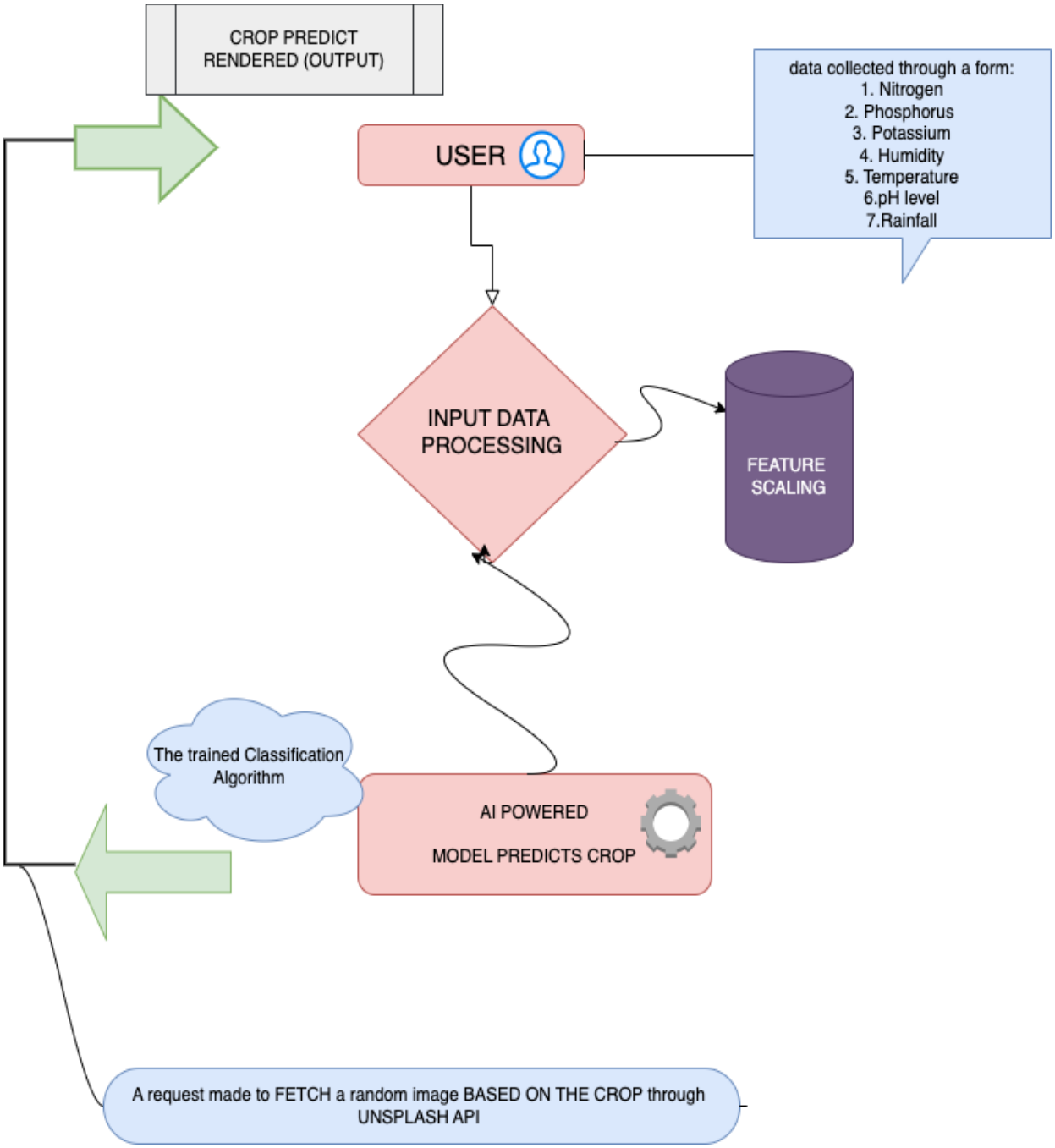
1.6 Risk Table:

Risk	Mitigation Strategy
Incomplete or noisy datasets	Use robust preprocessing and gather supplementary datasets.
Model underperformance	Implement hyperparameter tuning and test multiple algorithms.
Deployment challenges	Choose a reliable cloud platform and conduct deployment tests.
User interface issues	Conduct usability testing with feedback from target users.

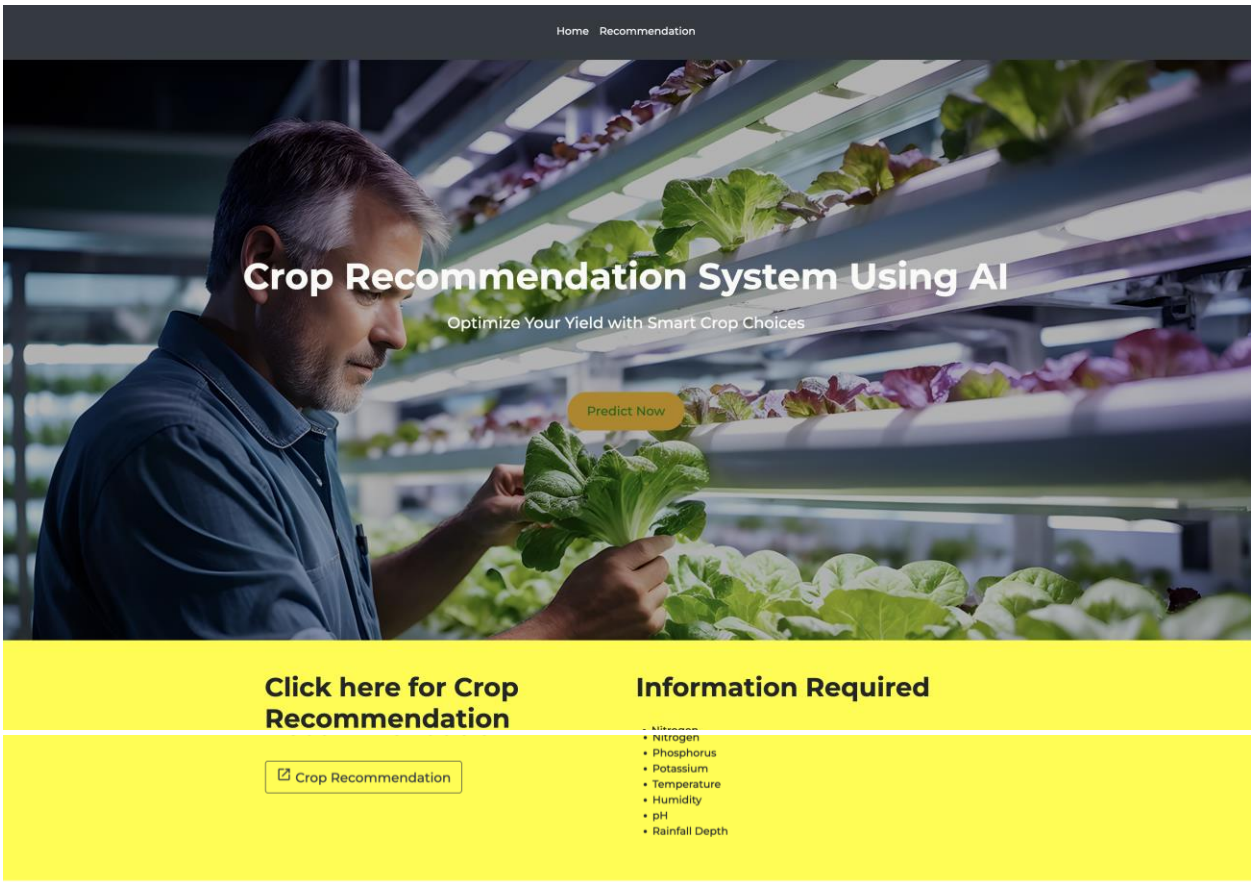
1.7 Milestones and Timeline:

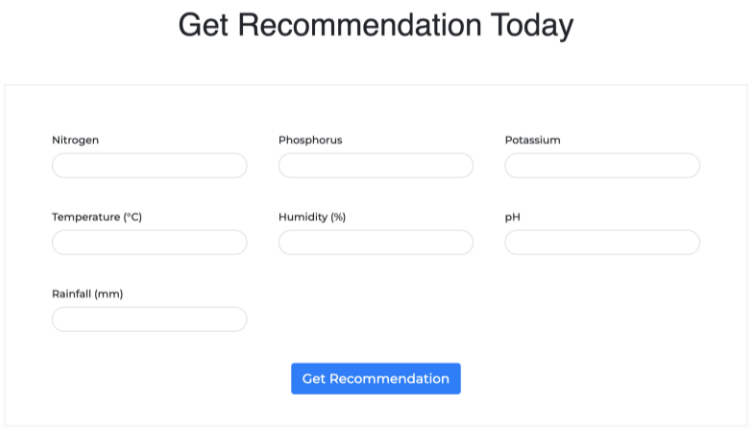
Tasks	Timeline
Phase 1: Requirement Analysis	Week 1
Phase 2: Data Preparation, Clean, preprocess, and analyze data	Week 2
Phase 3: Model Development, Build and test machine learning models (Decision Tree, Random Forest)	Week 3
Phase 4: System Design, Design architecture and user interface	Week 4
Phase 6: Deployment, deploy system on Render and perform testing	Week 5
Phase 7: Final Testing and Delivery, validate system performance, refine UI, and deliver final product	Week 6

1.8 System Architecture



1.9 Interface Screenshots





Get Recommendation Today

Nitrogen
20

Phosphorus
25

Potassium
56

Temperature (°C)
25

Humidity (%)
90

pH
4.5

Rainfall (mm)
105

Get Recommendation

Get Recommendation

Pomegranate is the best crop to be cultivated right there.