ISSN: 3107-6513

Crop Recommendation System

M.Padmasrinithi, Dr.M.Usha Devi
Mail id: padmasrinithi14@gmail.com, usha.devi145@gmail.com

ABSTRACT

Crop recommendation systems are an important application of Machine Learning in modern agriculture, aimed at suggesting the most suitable crops based on environmental and soil conditions. With the increasing demand for food production and the challenges posed by climate change, traditional farming methods based on experience and guesswork are no longer sufficient. A datadriven approach helps farmers make informed decisions and improve agricultural outcomes.

The proposed system uses machine learning algorithms such as Decision Trees, Random Forest, and Support Vector Machines (SVM) to analyze various factors including soil nutrients (nitrogen, phosphorus, potassium), temperature, humidity, rainfall, and pH levels. By processing this data, the system identifies patterns and recommends crops that are most likely to yield better productivity under given conditions.The model is trained using historical agricultural datasets and continuously improves its accuracy by learning from new data. This enables the system to adapt to changing environmental conditions and provide reliable recommendations. Farmers can input their field conditions into the system and receive instant crop suggestions through a user-friendly interface.

Overall, the crop recommendation system enhances agricultural productivity, reduces the risk of crop failure, and promotes sustainable farming practices. It supports efficient resource utilization and helps farmers transition towards smart and precision agriculture.

INTRODUCTION

Agriculture plays a vital role in the economic development of many countries, and selecting the right crop based on soil and environmental conditions is essential for improving agricultural productivity. Farmers often face difficulties in deciding which crop to cultivate due to variations in soil type, rainfall, temperature, and other environmental factors. An intelligent system that recommends suitable crops based on these conditions can significantly improve crop yield and reduce losses.

The Smart Crop Recommendation System is developed using machine learning techniques to assist farmers in selecting the most suitable crop for cultivation. The system analyzes important agricultural parameters such as soil type, soil pH, rainfall, temperature, and humidity. By analyzing these factors and historical agricultural data, the system predicts the best crop that can be grown under specific conditions.

Machine learning algorithms are widely used in agriculture to analyze large datasets and identify patterns that are not easily visible through traditional methods. By training the model with agricultural datasets, the system learns the relationship between environmental conditions and crop growth. Once trained, the model can provide accurate crop recommendations based on user input.

EXISTING SYSTEM

The existing crop selection process is mostly based on farmers' experience, traditional knowledge, and general agricultural guidelines. Farmers usually rely on past cultivation practices, advice from local agricultural experts, or seasonal patterns to decide which crop to grow. Some agricultural advisory systems provide general crop suggestions based on climatic zones or seasonal data. However, these systems often lack personalization and do not consider specific soil and environmental conditions of a particular location.

Traditional agricultural methods also struggle to analyze multiple factors simultaneously, such as soil pH, rainfall levels, humidity, and temperature. Without proper data analysis tools, it becomes difficult for farmers to identify the most suitable crop for their land.

Therefore, there is a need for an intelligent system that can analyze multiple agricultural parameters and provide accurate crop recommendations.

In addition to traditional farming practices, some agricultural advisory systems and government platforms provide general guidelines about crop

cultivation based on seasonal patterns and regional climatic conditions. However, these systems often provide only broad recommendations and do not consider the specific soil properties or environmental conditions of individual farms. Farmers may still need to manually analyze several factors such as soil fertility, rainfall patterns, and temperature variations before selecting crops. Due to the lack of automated data analysis and predictive technologies, these systems may not always provide highly accurate or personalized recommendations.

DRAWBACKS FOR EXISTING SYSTEM

The traditional crop selection process mainlydepends on farmers' experience,
local practices, and seasonal assumptions rather than scientific data analysis. Although farmers have valuable practical knowledge, relying only on traditional methods may not always lead to optimal crop selection. The following are some major drawbacks of the existing system.

Lack of Data-Driven Decision Making

In the existing system, crop selection is mostly based on farmers' personal experience and traditional farming practices. These methods do not use scientific data analysis or predictive techniques. As a result, farmers may choose crops that are not suitable for the current soil and environmental conditions, which may reduce productivity and increase the risk of crop failure.

Limited Consideration of Environmental Factors

Traditional crop selection methods usually consider only a few environmental factors such as season and rainfall. However, crop growth depends on multiple factors including soil pH, temperature, humidity, and nutrient levels. The existing system does not analyze all these parameters together, which makes it difficult to identify the most suitable crop for a particular land.

PROPOSED SYSTEM

The proposed Smart Crop Recommendation System uses machine learning algorithms to recommend the most suitable crop based on environmental and soil conditions.

The system collects user input such as:

- Soil Type
- Soil pH
- Rainfall
- Temperature
- Humidity

These inputs are processed using a trained machine learning model. The model analyzes the relationship between these parameters and crop growth patterns using historical agricultural data.

The system is developed using Python and Streamlit, providing a simple and userfriendly interface where users can enter environmental details and instantly receive crop recommendations.

The machine learning model used in this system is Random Forest Classifier, which is known for its high accuracy and ability to handle complex relationships between variables.

The system predicts the most suitable crop and displays the result through an interactive interface.

ADVANTAGES OF PROPOSED SYSTEM

Improve accuracy

The system recommends suitable crops based on scientific analysis using Machine Learning, eliminating guesswork and helping farmers choose the most appropriate crops for their land.

Higher Agricultural Productivity:

By selecting the right crop according to soil and environmental conditions, farmers can achieve better yield and minimize the risk of crop failure.

User-Friendly Interface:

The system provides a simple and easy-to-use interface where users can input parameters such as soil type, temperature, and rainfall, and receive recommendations without technical difficulty.

Faster Decision Making:

Farmers can quickly obtain crop suggestions without performing complex calculations or analysis, saving time and effort.

Internet Connection: Required for dataset access and updates

FEASIBILITY STUDY

Technical Feasibility

Technical feasibility refers to the availability of the required technology, tools, and technical expertise needed to develop and implement the system.

ISSN: 3107-6513

The Smart Crop Recommendation System is technically feasible because it uses widely available and well-established technologies such as Python programming language, machine learning algorithms, and data analysis libraries. These technologies are open-source and widely supported by the developer community.

The system uses machine learning algorithms like Random Forest, which can effectively analyze relationships between environmental factors such as soil type, rainfall, temperature, humidity, and soil pH. These algorithms are implemented using the Scikit-Learn library, which is a popular machine learning library in Python

Behavioral Feasibility

Behavioral feasibility focuses on how well the users accept and adapt to the new system. It examines whether the users are willing to use the system and whether the system will positively impact their work In the case of the Smart Crop Recommendation System, the primary users are farmers, agricultural experts, and researchers. The system is designed with a simple and user-friendly interface, making it easy for users to interact with the application without requiring advanced technical knowledge.

Economic Feasibility

Economic feasibility evaluates the cost-benefit aspect of the proposed system. It determines whether the financial benefits of implementing the system outweigh the development and operational costs.The Smart Crop Recommendation System is economically feasible because it is developed using open-source technologies and tools such as Python, Scikit-Learn, Pandas, and Streamlit. These tools are freely available and do not require any licensing costs.

ALGORITHM SELECTION:

The research work focuses solely on numeric data for classification purposes. To identify the most suitable algorithm for this type of data, I explored various options and narrowed down the choices to algorithms known for their effectiveness with numeric data and classification tasks. Among these algorithms were

- Linear Regression
- Random Forest

LINEAR REGRESSION:

Linear Regression is a fundamental supervised learning algorithm used for predictive modelling. It aims to establish a linear relationship between input features and a continuous target variable. The algorithm works by fitting a straight line to the data points, minimizing the difference between observed and predicted values. It assumes a linear relationship between the independent and dependent variables, making it suitable for tasks where this assumption holds true. The model's output is represented by a linear equation, where coefficients determine the slope and intercept of the line. In the research the Linear Regression algorithm demonstrated an accuracy -80%, precision-79%, F1 Score -76%, Recall-74%.

RANDOM FOREST:

Random Forest Regression is a powerful ensemble learning method used for energy consumption prediction. It builds multiple decision trees on different subsets of the data and averages their predictions to improve accuracy and reduce overfitting. Unlike linear regression, it can capture nonlinear relationships between Crop recommendation system and factors like, soil type, soil Ph , Temperature . In the research the Random Forest algorithm demonstrated an accuracy -81%, precision-74%, F1 Score -74%, Recall-75%.

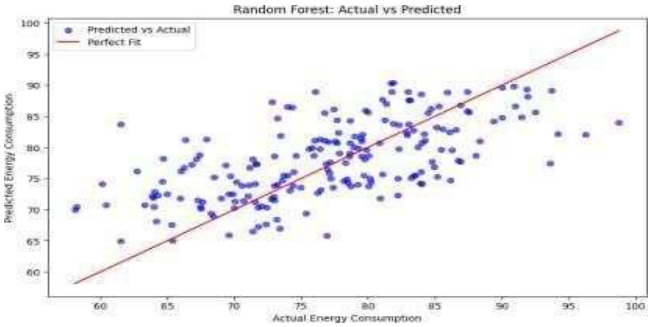

Fig. 1. Random forest Algorithm

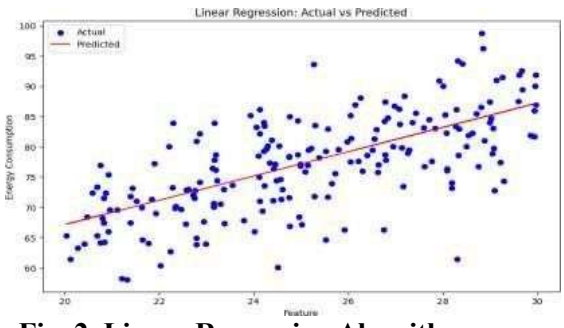

Fig. 2. Linear Regression Algorithm