INTEGRATED SMART FARMING ASSISTANCE SYSTEM USING MACHINE LEARNING

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ABSTRACT – Agriculture is a vital segment of the economy and food production for several countries. However, several issues, such as unpredictable weather conditions, diseases, low crop yield, and market price volatility, are faced by the farming community. These issues have a great impact on the overall crop yield and the financial condition of the farmers. New technologies like Artificial Intelligence and Machine Learning help solve these problems by providing an intelligent solution for them.The proposed system is an "AI-based Smart Agriculture Platform" that will assist the farming community in enhancing the overall crop yield. It has several components, such as crop recommendation, crop disease detection, crop yield prediction, market price prediction, AI farming assistant, smart crop calendar, and an agricultural store.The system will analyze the data related to agriculture, such as soil types, rainfall, temperature, and crops, and provide useful recommendations. Machine learning algorithms will be used for crop yield prediction and market price prediction. The AI assistant will also help the farming community by answering any questions related to farming.The main aim of the system is to provide the farming community with a smart solution for decision-making in the field of agriculture.

I. INTRODUCTION

Agriculture is one of the most important fields that help in the survival of humans and their development. The farmers entirely depend on the environmental factors such as soil, rainfall, and temperature for the success of their crop cultivation. Sometimes, the changes in the weather may hamper the crop growth.

The traditional methods of farming are based on the experiences and observations of the farmers. These methods may not always yield accurate results. With the development of modern technology, artificial intelligence and machine learning can be implemented for the analysis of data for intelligent decisions.

The proposed system is a smart agriculture platform that combines various farming support systems under a single platform. The system provides assistance for crop selection, detection of crop disease, yield prediction, and price estimation. The system also includes a farming assistant that provides answers for farming-related queries and a store for displaying farming products.

II. LITERATURE SURVEY

Several research works have been done on the use of machine learning and artificial intelligence in agriculture. Several researchers have developed systems that help farmers select the best crop to plant based on the nutrients in the soil and the climatic conditions.

Some research works have been done on crop disease detection using image processing techniques. The system processes the images of the crop's leaves and uses machine learning algorithms to detect the disease. Other research works have been done on crop yield prediction using environmental factors such as rainfall, temperature, and nutrients in the soil.

Market price prediction systems have also been developed using historical data on market prices to help farmers determine the best time to sell their products.

Although the developed systems have been useful to farmers, most research works have been done on a single problem in agriculture. The proposed system combines the various features that have been developed to help farmers with a complete solution.

The proposed system combines crop selection, disease detection, yield prediction, and artificial intelligence assistance for a complete solution for farmers

I. .PROPOSED METHODOLOGY

The proposed system is intended for providing an intelligent form of support for agriculture through the application of machine learning algorithms and data analysis. The system will obtain input data from the farmer, which will include crop type, soil type, rainfall, temperature, and other environmental factors.

The data will be processed and analyzed based on the machine learning algorithms. Different modules will be integrated into the system, which will be responsible for different functions, such as crop recommendation, disease detection, yield prediction, price prediction, and an AI farming assistant that will help answer questions and provide useful suggestions.

II. ARCHITECTURE DIAGRAM

The architecture of the system consists of the following parts,

A. User - This is a model of the user who interacts with the system.

B. Web Application - The web application is the interface between the farmer and the system.

C. Input Module - This module is for gathering different types of agricultural data required for prediction.

D. Data Preprocessing - This is the stage where data is cleaned and preprocessed for better analysis.

E. Feature Extraction - Feature extraction is a technique for transforming raw, high-dimensional data (like images, audio, or text) into a smaller, more informative set of numerical features.

F. Machine Learning - This module contains different machine learning models for prediction. It contains CNN, Random Forest algorithm for accurate prediction.

G. Result - The final result produced by the system is displayed to the farmer via the dashboard. This will include recoomendations, predictions, and advice for better crop management.
The architecture of the proposed smart agriculture system is composed of various layers. These layers include input collection, data processing, and machine learning prediction modules. .The farmers will be required to provide input to the system in the form of soil details and crop images or queries via the web interface. The system will then process the collected data and send it to various machine learning models like Random Forest and CNN for analysis.

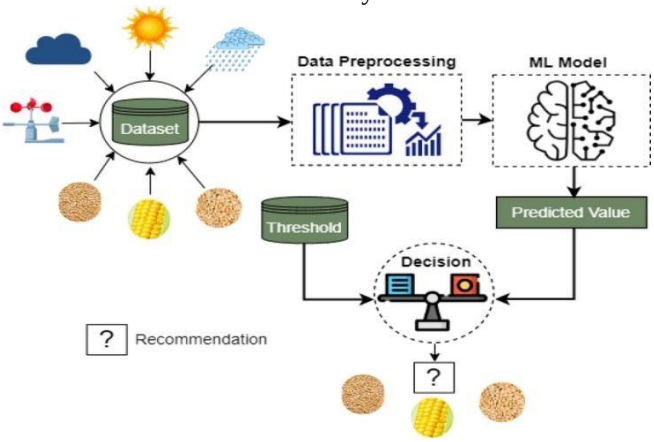
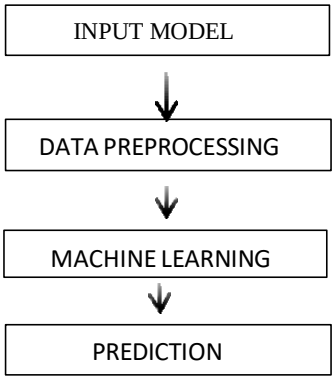


Fig 1: Architecture of Smart Agriculture Using ML



III. PHASES AND METHODOLOGIES

DATA COLLECTION - The agricultural data like crop-related data, soil-related data, rainfall-related data, and temperature-related data will be collected from reliable sources.

DATA PREPROCESSING - The collected data will be cleaned and organized. It will be converted into a suitable format for machine learning.

MODEL TRAINING - Random forest and convolutional neural network models of machine learning will be used for training the models.

MODEL TESTING - The models will be tested by giving sample input to them.

WEB APPLICATION DEVELOPMENT - A web application will be developed for giving a user interface to the farmers.

PREDICTION AND RECOMMENDATION - The system will process the input given by the farmer and provide a prediction or recommendation. It will provide the best result with accuracy by using machine learning models and algorithms.

IV. OUTPUT ANALYSIS

A. Crop Recommendation Results

Crop recommendation results are given by the Random Forest Machine Learning model, which analyzes the soil nutrients and conditions. The information given as input is correct, and the result generated by the model is also of the correct accuracy.

The results given or generated by the system are the crops that can be grown efficiently in the given conditions, which can help the farmer choose the appropriate crops for his or her field, avoiding the risk of crops failing and improving the productivity of crops.

B. Plant Disease Detection Results

Plant disease detection results are generated by the Plant Disease Detection module, which uses a Convolutional Neural Network (CNN) Machine Learning model for analysis of the given image of the plant leaf.

The results generated by this module are the type of disease that the plant leaf might be suffering from, which can help the farmer detect the disease in the early stages and take appropriate steps, such as using pesticides, to maintain the health of the crops.

C. Smart Crop Calendar Results

Smart crop calendar results are generated by the system, which creates a calendar for the important tasks related to crops, depending on the type of crops grown and the date on which they are sown

D. Agricultural Store Module Results

The agricultural store module helps farmers to explore and buy farming products like seeds, fertilizers, and pesticides. The system stores selected products in a cart and calculates the total price of products during prediction.
The result of this module is to calculate the total price of selected agricultural products. This helps farmers to easily buy required products for farming by using this system.

E. AI Farming Assistant Results

The AI farming assistant module offers intelligent answers to farmers' queries related to agricultural activities. The system fetches relevant details from the farming dataset based on the user's query.
The output of this system is an appropriate answer to help farmers with farming activities.

F. Crop Yield Prediction Results

The crop yield prediction module uses a machine learning model to predict the crop yield based on environmental and crop-related factors. The basic values which we have to give in the form of predicted results and accuracy.

G. Market Price Prediction Results

The market price prediction module to predict the price of crops based on various factors like type of crop.

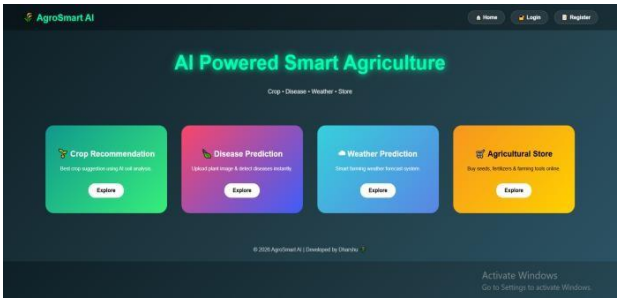


Fig. 2 Home page of Smart Agriculture System

LOGIN PAGE :

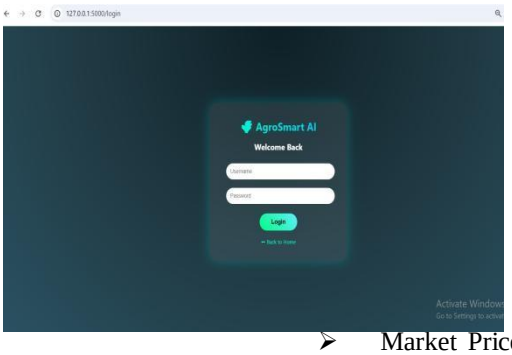


Fig. 3 Login page of Smart Agriculture System

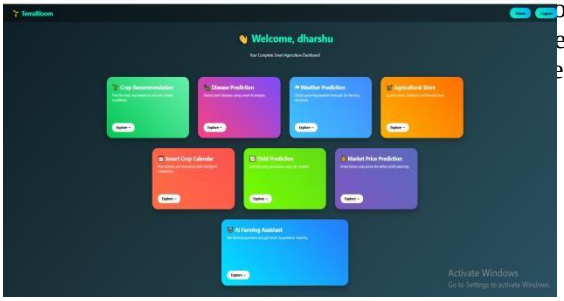


Fig. 4 Dashboard of Smart Farming System

V. SCREENSHOTS AND GRAPHS

- Crop Recommendation - The system's crop recommendation feature employs a Random Forest Machine Learning model for analyzing soil nutrients and environmental factors

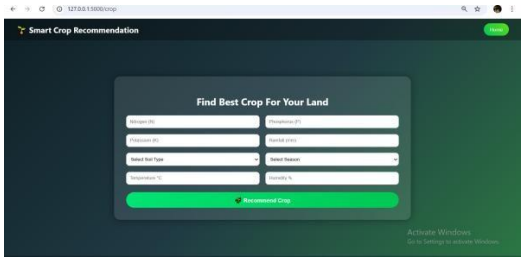


Fig.5 Crop Recommendation using Random Forest

- Disease Detection - The plant to analyze plant leaf images. The trained model processes the input image and identifies patterns related to plant diseases.

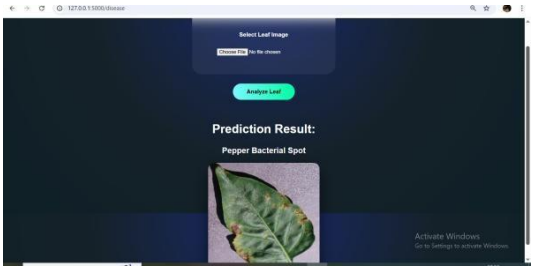


Fig. 6 Disease Detection using CNN

- Market Price Prediction - The module for market price prediction to predict the prices of the crop in the future based on the type of crop, location of the market, demand for the crop, and supply of the crop. The predicted prices help farmers decide whether to sell or not. This helps farmers to their loss due to price changes and es their profit.

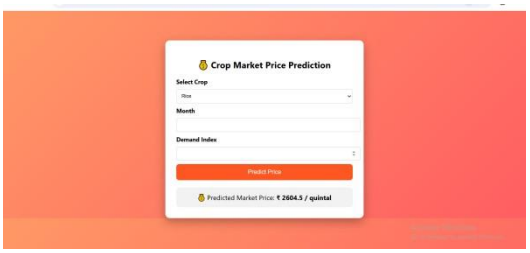


Fig.7 Market Price Prediction

VI. RESULT AND DISCUSSIONS

The Integrated Smart Agriculture Assistance System has been developed through the use of machine-learning technologies. This system aids in guiding farmers by providing information regarding production and how to optimise their production methods. The crop recommendation feature is an application that helps the user determine which crop to plant, based on the nutritional content of the soil, and the climatic conditions such as temperature, humidity, pH and rainfall. The system includes an image-processing tool that uses convolutional neural network technology to detect whether a plant exhibits symptoms of diseases and to calculate the likelihood that a plant infected with a disease will produce a given amount of crop. The system includes an image-processing tool that uses convolutional neural networks to determine the likelihood of crop production based on various environmental conditions. The market pricing prediction is an analytical tool that scores the predicted price of a crop based on the economics of demand, supply, and proximity to the farmer to better enable the farmer to plan when to market their crops. The smart crop timetable is an application that produces a schedule for the irrigation, fertilisation, and harvesting of a particular crop, based on the type of crop and the planting date.

CONCLUSION

The Integrated Smart Farming Assistance System Using Machine Learning proposed within this research paper contains an intelligent method that provides farmers with assistance in modern-day agriculture. The system will use multiple modules to give farmers assistance in making informed decisions regarding which crops to plant, how to detect diseases in their crops, predicting the yield of their crops, predicting market prices (for their harvested products), and creating a direct link with the farmers to generate a smart calendar for planting crops. By looking at the many variables within the environment such as soil nutrients, the smart farming assistance system can help farmers choose which crops will grow best, help farmers identify diseased plants, predict yield amounts and how much they can sell their products for at the market. The Integrated Smart Farming Assistance System Using Machine Learning will support the development of an integrated smart farming solution.