Agro-Farm Care – Crop, Fertilizer & Disease Prediction (Web App)

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Abstract - *Data Mining is a rising studies area in crop yield analysis. Yield prediction is a completely essential problem in agriculture. Any farmer is interested in knowing how much yield he is about to expect also, it will end-user-helpful to farmers for indicting which fertilizers to be used as well as knowing the crop diseases all at one place. The project comes with a model to be precise and accurate in predicting crop, fertilizers, Crop disease and deliver the end-user with proper recommendations about the required fertilizer ratio based on atmospheric and soil parameters of the land which enhance to increase the crop yield and increase farmer revenue.*

Key Words: Decision Tree, Random Forest, Crop, Disease

1. INTRODUCTION

Agriculture has an extensive history in India. Recently, India is ranked second in the farm output worldwide. Agriculture-related industries such as forestry and fisheries contributed 16.6% of 2009 GDP and around 50% of the total workforce. Agriculture's monetary contribution to India's GDP is decreasing. The crop yield is the significant factor contributing to agricultural monetary growth. The crop yield depends on multiple factors such as climatic, geographic, organic, and financial elements. I is difficult for farmers to decide when and which crops to plant because of fluctuating market prices. Citing to Wikipedia figures India's suicide rate has ranged from 1.4-1.8% per 100,000 populations, over the last 10 years. Farmers are unaware of which crop to grow, and what is the right time and place to start due to uncertainty in climatic conditions. The usage of various fertilizers is also uncertain due to changes in seasonal climatic conditions and basic assets such as soil, water, and air. In this scenario, the crop yield rate is steadily declining. The solution to the problem is to provide a smart user-friendly recommender system to the farmers [1]

2. OBJECTIVES

Create a system for predicting crops according to soil details, predicting fertilizers according to soil and crop details, and detecting diseases in the plant. The objective of our system is to help farmers because it's difficult to grow crops when you understand the weather. Moreover, it involves several factors to soil and crop. Recommendation systems are Deep Learning based algorithms that help farmers. These results are based on their soil condition and trained dataset.

This system can provide a mechanic for crop prediction, Fertilizer prediction, plant disease prediction. This will help farmers get a sense of what crops should be grown based on soil details, what fertilizers to use in crops, and disease detection.

3. LITERATURE SURVEY

Numerous articles have been reviewed and their conclusions are summarized in this section. This section presents documents that were studied before and during project development. The documents provided a better understanding of existing solutions, how algorithms could be optimized and how selection could be facilitated algorithms on the basis of their performance

Table -1: Sample Table format

Title	Author	Year/Journal Name	Summary
Plant Leaf Disease Detection	P. Sharma, P. Hans, and S. C. Gupta	2019/ IEEE	K Nearest Neighbor (KNN) classification is applied to the outcome of the three stages.
Prediction of Crop Yield and Fertilizer Recommendation using ML	Devdatta A. Bondre, Mr. Santosh Mahagaonkar	2020/ IJEAST	This paper proposes and implements a system to predict crop yield from previous data.
Predicting fertilizer treatment of	Nusrat Jahan, Rezvi Shahariar	2020/ Researchate	Here, image based data analysis with machine learning

maize using decision tree			technique is used
Predicting Crop Diseases Using Data Mining	Umair Ayub, Syed Atif Moqurrab	2019/IEEE	This paper focuses on prediction of loss due to grass grub insect.
Crop Yield Prediction and Efficient use of Fertilizers	S.Bhanumathi, M.Vineeth and N.Rohit	2019/IEEE	Analyze the various related attributes like location, pH value from which alkalinity of the soil is determined.
Prediction Model for Automated Leaf Disease Detection & Analysis	Nikita Goel, Dhruv Jain, Adwitiya Sinha	2018/IEEE	It is a method that can be adopted to prevent plant loss and can be carried out by real-time identification of plant diseases

3. TECHNICAL DEFINITION

3.1. Random Forest

Random forests or random selection forests are an ensemble gaining knowledge of approach for the category, regression, and different systems that operate with the aid of using building a mess of selection bushes at education time.

3.2. Logistic Regrerssion

Logistic regression is any other effective supervised ML set of rules used for binary category problems (while the goal is categorical). Logistic regression basically makes use of a logistic characteristic described underneath to version a binary output variable. The number one distinction between linear regression and logistic regression is that logistic regression's variety is bounded among zero and 1. In addition, instead of linear regression, logistic regression does now no longer require a linear courting among inputs and output variables. this is because of making use of a nonlinear log transformation to the chances ratio

3.3.Decision Tree

Decision trees (DTs) are the most effective modeling strategies and are maximum suitable for modeling interventions wherein the applicable occasions arise over a quick time period. The important dilemma of the decision trees is their inflexibility to version choice problems, which contain ordinary events and are ongoing over time. In general, DTs are built with 3 styles of nodes, specifically decision nodes, chance nodes, and terminal nodes. An easy illustrative tree is supplied. The tree flows from left to proper beginning with a decision node (square) representing the preliminary coverage decision (opportunity

interventions. Each control approach is then accompanied with the aid of using danger nodes representing unsure occasions (i.e., 'disorder free' or 'dead', with a view to having possibilities connected to them. Finally, endpoints of DTs are represented with the aid of using a terminal node (triangle) on the proper of the tree. The final results measures (e.g., software value) are usually connected to those endpoints. Costs, however, are connected to occasions in the tree, in addition to endpoints. The anticipated values (expenses and effectiveness) related to every department are expected with the aid of using 'averaging out' and 'folding back' the tree from proper to left.

3.4. ResNet

The structure of this network is geared toward permitting massive quantities of convolutional layers to feature efficiently. However, the addition of a couple of deep layers to a network regularly affects the degradation of the output. This is referred to as the trouble of vanishing gradient wherein neural networks, whilst getting skilled via lower backpropagation, depends upon the gradient descent, descending the loss feature to discover the minimizing weights. Due to the presence of a couple of layers, the repeated multiplication effects withinside the gradient turning into smaller and smaller thereby "vanishing" main to a saturation withinside the community overall performance or maybe degrading the overall performance.

The number one concept of ResNet is using leaping connections which might be ordinarily known as shortcut connections or identification connections. These connections by and large feature through hopping over one or a couple of layers forming shortcuts among those layers. The intention of introducing those shortcut connections became to solve the major trouble of vanishing gradient confronted through deep networks. These shortcut connections eliminate the vanishing gradient trouble through once more the use of the activations of the preceding layer. These identification mappings first of all do now no longer do something a good deal besides bypassing the connections, ensuing withinside the use of preceding layer activations.

4. PROPOSED SOLUTION

The purpose of Agro-Farm care is for research purposes which can be helpful in the agricultural sector. It contains several models that describe which crop be grown based on different conditions, it also suggests fertilizers be used also the other feature is that it can detect the disease from which crop is suffering, all these features can be helpful in research purposes which can directly or indirectly benefit the farmers, not only it gives the results but also it provides the suggestion based on three results,

1. Developing a user-friendly web-based system for farmers

2. By providing their soil details like nitrogen, phosphorus, potassium, pH level farmer get the idea of which crop is best for their soil.

3. By providing their soil details like nitrogen, phosphorus, potassium farmer get the idea of which fertilizer is best for their crop.

4. By providing an image of a leaf farmer gets an idea of which disease caught their crop and they also suggest how you can prevent it.

5. The Dataset used in this project is imported from Kaggle

6. The dataset consists of 20 different types of crops Each row has Nitrogen, Phosphorus, Potassium, and other details The system consists of three major features that are:

• The crop recommendation application
• The fertilizer recommendation application
• The plant disease prediction application

4.1. Requirements

Software:

• Jupyter Notebook: Jupyter Notebook is an open-source software program this is an interactive computational environment, wherein you could integrate code execution, wealthy text, mathematics, plots, and wealthy media, it's far used for modifying and walking the application, additionally it turned into first-rate appropriate for us to broaden our challenge, we're the usage of Jupiter Notebook for appearing a diverse set of rules on the information we take a look at the accuracy of every set of rules.

• VSCode: Visual Studio Code is a code editor that may be used with a whole lot of programming languages, it's far a code editor made with the aid of using Microsoft for Windows, Linux, and macOS. Features encompass guide for debugging, syntax highlighting, sensible code completion, snippets, code refactoring, and embedded Git. In VSCode we're developing an internet site with the usage of HTML, CSS and Javascript, and Flask.

• Spyder: Spyder is an open-source cross-platform integrated development environment (IDE) for programming withinside the Python language

Frontend:

• HTML: HTML stands for HyperText Markup Language HTML is the same old markup language for developing Web pages HTML describes the shape of a Web web page HTML includes a sequence of factors HTML is used as a skeleton on this challenge

• CSS: CSS stands for Cascading Style Sheets CSS describes how HTML factors are to be displayed on the screen, paper, or indifferent media CSS saves loads of work.

• JAVASCRIPT: JavaScript is a high-stage programming language; It turned into at the beginning designed as a scripting language for web sites however have become extensively followed as a general-motive programming language, and is presently the maximum famous programming language in use JavaScript consists of out maximum of the functions

Backend:

• Flask: Flask is a framework written in Python. The backend of this challenge is programmed with the assistance of Flask Flask is an API of Python that lets us accumulate internet applications. It evolved with the aid of using Armin Ronacher. Flask's framework is greater expressed than Django's framework and is likewise less complicated to research as it has much less base code to put into effect an easy internet-Application.

Deep Learning:

• Python: Python is an interpreted general-motive programming language Python is dynamically typed and garbage-collected. It helps a couple of programming paradigms, such as structured (particularly, procedural), object-orientated and useful programming. Python is the language used on this challenge to application and educates diff models

4.2. Workflow of The System

1. Data Flow Diagram
Data flow diagrams are used to graphically constitute the flow of data in enterprise statistics. DFD describes the techniques which might be concerned in a model to switch facts from the entrance to the record garage and reviews generation. Data float diagrams may be divided into logical and physical. The logical data diagram describes facts via a model to carry out the positive capabilities of an enterprise
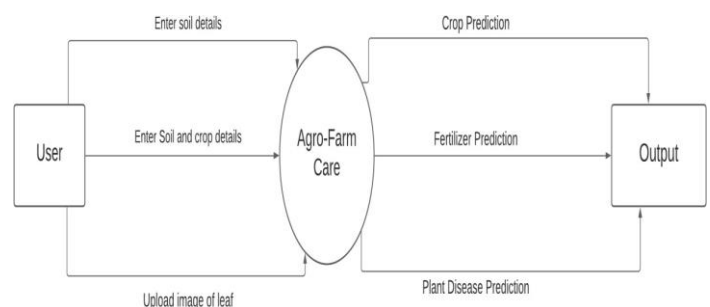

Fig 1: Data Flow Diagram

2.Sequence Diagram

A sequence diagram indicates item interactions organized in time series. It depicts the items and lessons worried withinside the situation and the series of messages exchanged among the items had to perform the capability of the situation. Sequence diagrams are usually related to use case realizations withinside the Logical View of the gadget below development. Sequence diagrams are from time to time referred to as occasion diagrams or occasion scenarios
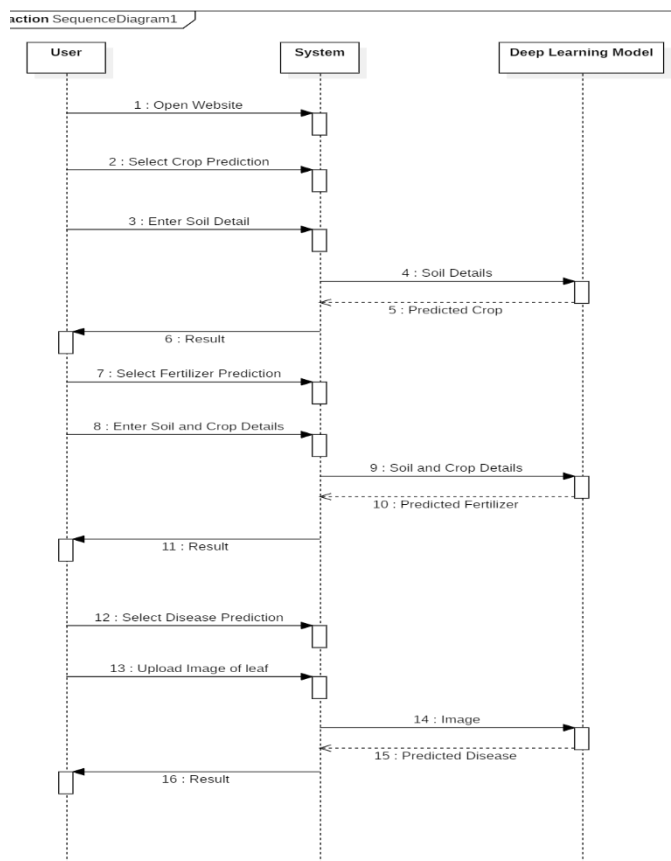
Fig 2: Sequence Diagram

3.Fertilizer

This contains fertilizer prediction model working of this model is same as crop prediction model, it takes information and predicts which fertilizer is to be used

4.Diseases

The last and one of the main sections is a disease that includes crop disease, prediction model. Here, the user has to upload the photograph of the crop then the model will predict the disease also it will provide the additional suggestion to take precautions and how to cure the disease
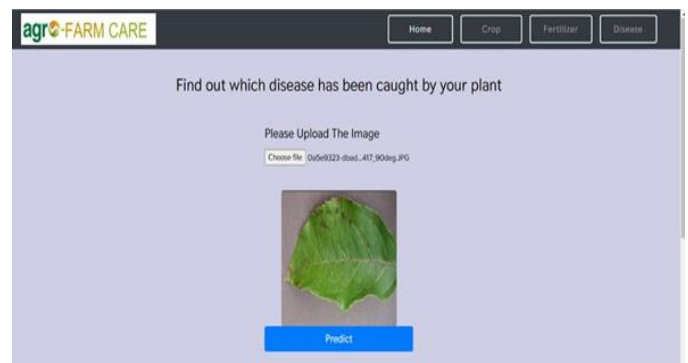

Fig 3: UI

4.3. Data Collection and Preprocessing

Data series is described because the system of collecting, measuring, and reading correct insights for studies the usage of fashionable proven techniques. A researcher can compare their speculation on the premise of amassed facts. In maximum cases, facts series is the number one and maximum crucial step for studies, regardless of the sphere of studies. The technique of facts series is extraordinary for extraordinary fields of study, relying on the specified information.

4.4 User Interface

The interface is mainly divided into four section
1.Home

Home includes the necessary information about the system and it works

2.Crop

The crop section consists of crop recommendation model, the crop recommendation model takes details from the user then processes the information and provides a page that has the output and suggestions

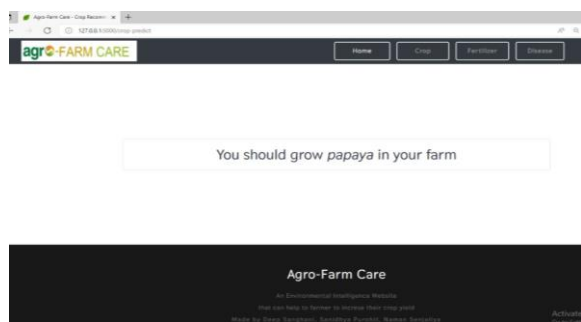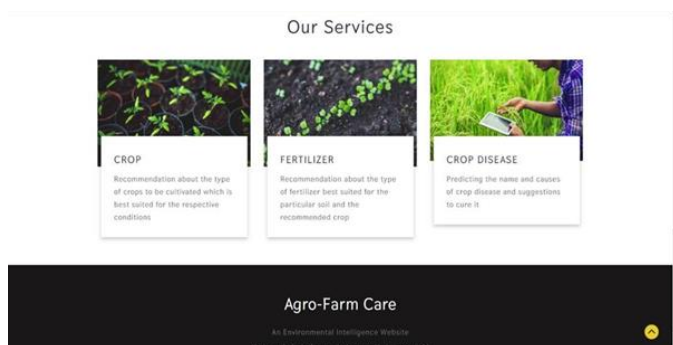
Fig 4: Disease Prediction output

Fig 5: Output

Fig 6: Home UI

Fig 7: Soil Details

5. METHODOLOGY

Developing a user-friendly web-based system for farmers By providing their soil details like nitrogen, phosphorus, potassium, pH level farmer gets the idea of which crop is best for their soil.

By providing their soil details like nitrogen, phosphorus, potassium farmer gets the idea of which fertilizer is best for their crop

By providing an image of leaf farmer gets an idea which disease caught their crop and they also suggest how you can prevent it. The Dataset used in this project is imported from Kaggle

Dataset consist of 20 different types of crops

Each row has Nitrogen, Phosphorus, Potassium, and other detail

6. CONCLUSION AND FUTURE SCOPE

The prediction of crop yield based on soil data and proper implementation of algorithms have proved that a higher crop yield can be achieved. From the above work, we conclude that for soil classification Random Forest is a suitable algorithm with an accuracy of 99.09% compare to Gaussian Naive Bayes. The work can be extended further to add the following functionality. Building a Website can be built to help farmers by uploading an image of farms. Crop diseases detection uses image processing in which users get pesticides based on disease images and Fertilizer prediction based on soil condition.

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