# AI BASED FARMER'S ASSISTANT

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**Abstract:** The foundation of the Nation's development is agriculture. The rapid advancement of technology has left our farmers behind. This project gives awareness regarding latest technologies that is necessary for them. The farmer can get access to the agricultural data like best crop for plantation and suitable fertilizers and also get to know about the plant leaf disease. This project will help farmers by providing accurate information about farming. This will also help common users to access the information based on their requirements regarding crops and fertilizers prediction and crop diseases. A website powered by machine learning that, in response to user input like Nitrogen, Phosphorous, Humidity, Rainfall, suggests the best crops to produce and fertilisers also detects the disease caught by their crops. This project uses Random Forest Algorithm for crop suggestion and ResNet for Plant leaf disease detection.
**Keywords:** Random Forest, ResNet, Crop Suggestion, Plant Leaf Disease Detection.

## INTRODUCTION

Agriculture has always been essential to the nation's development because it is the art and science of soil cultivation. Every country's growth is mostly attributed to the agricultural sector. Farmers currently have limited knowledge of modern technologies and methods utilized in agriculture.

### A. Artificial Intelligence

Artificial intelligence (AI) is a concept that will help machine think has how we humans think to solve complex problems without human intervention. This AI concept will really have big impact in the future and helps in upgrading lives. Generally, AI systems inputs a large amount of training data, then analyze them and grouping into the patterns and using them to make predictions in future. For example, chatbots that are fed examples of text chats can learn to provide answers for the users, or the image recognition tool will be able to identify and describe few objects reviewing large amount of examples.AI technology can be applied to many different industries and sectors. Self-driving cars is one of the highlighted examples of artificial intelligence.

### B. Machine Learning

Machine learning (ML) is a branch of artificial intelligence (AI) that enables computers to automatically learn from data and previous experiences in order to recognize patterns and predict future events with a minimum of human interaction. Instead of depending on any preconceived equation that might serve as a model, ML algorithms use computation techniques to learn directly from data. The performance of ML algorithms adaptively improves with an increase in the number of available samples during the 'learning' processes. Machine learning algorithms are molded on a training dataset to create a model. As new input data is introduced to the trained ML algorithm, it uses the developed model to make a prediction. The training data are then entered into the chosen algorithm to begin the machine learning process. The final machine learning algorithm is developed using training data, which might be known or unknown data.

### C. Random Forest Algorithm

A machine learning algorithm that uses supervised learning is called random forest. It is employed in classification and regression. In order to solve a challenging problem and improve the performance of the model, numerous classifiers are combined in this procedure. Random Forest is a classifier that combines several decision trees on various subsets of the input dataset and uses the average to improve dataset prediction.

Instead of relying just on one decision tree, the random forest considers the prediction from each tree and forecasts the eventual result while taking into account the majority votes. The accuracy of the algorithm improves with the number of trees used. In terms of classification issues, it delivers superior outcomes.

The bagging approach is used by Random Forest to train the data. Ensemble employs two categories of techniques:

1. **Bagging:** Bagging develops various training subsets using replacement and sample training data; the result is based on majority voting. Consider Random Forest.
2. **Boosting:** By building sequential models with the maximum accuracy possible, this technique turns weak learners become strong ones. ADA BOOST and XG BOOST, for instance

The Random Forest approach, which provides accuracy for model-based predictions and the actual results of predictions in the dataset, was utilized to achieve high accuracy.

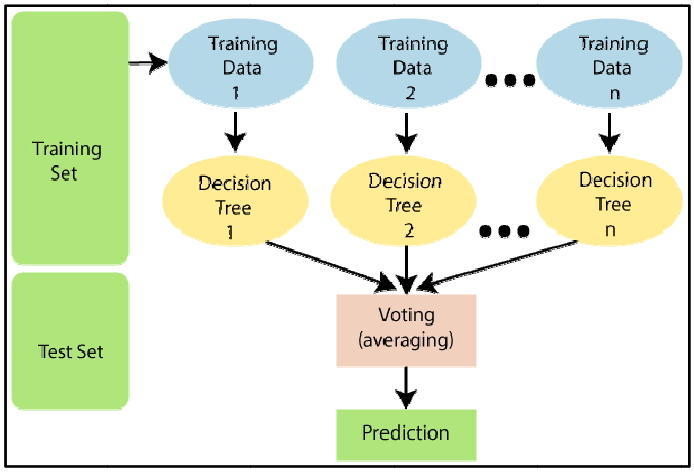


Fig 1: Working of Random Forest

### D. ResNet- Residual Networks

A residual neural network (ResNet) is also used for Control Neural Network It is a gateless or open-gated variation of the Highway Net, which was the first functionally complete, extremely deep feed forward neural network with hundreds of layers—much deeper than earlier neural networks. ReLU-containing double- or triple-layer skips are used to create ResNet models, with batch normalisation coming in between. Dense Nets are models that have numerous parallel skips. A non-residual network is referred to as a plain network while discussing residual neural networks. The identity block and the convolution block are the two primary categories of ResNets blocks.

## II. PROPOSED SYSTEM

An orderly description of the structure, behavior, and system perspectives is called system architecture. The system architecture outlines the key elements, their connections, organizational structures, and interactions. Business strategy, quality attributes, and many other aspects are included in the architecture and design of software. There are two stages to software architecture and design: software architecture and software design. Software architecture describes the basic components of a software system, each of which is made up of the software's components as well as the relationships and qualities between them. The functional requirements in architecture set the nonfunctional choices apart. Software design is the procedure through which a specification of the software artifact is made with the intention to achieve particular goals, utilizing a few of simple elements and subject to a number of limitations. Functional needs are fulfilled in design.

 

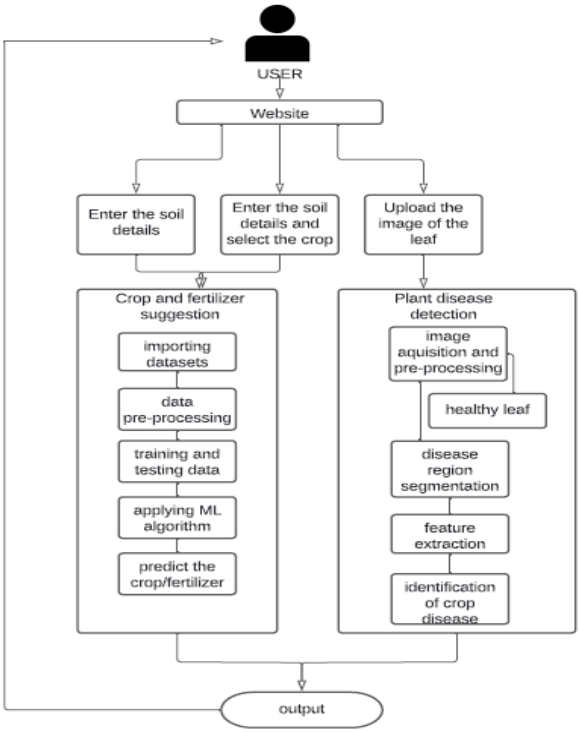


Fig2: Architecture of the system

Here the user accesses the website and choose one of the options: Crop, fertilizer suggestion or disease detection and enter the required input values.

**a)** If the user chooses the crop or fertilizer then certain steps takes place like importing datasets, data pre-processing, training testing data, applying ML algorithm and then finally crop/fertilizer will be predicted.

**b)** If the user chooses disease detection, then certain steps take place like image acquisition and pre-processing, disease region segmentation, feature extraction and then disease will be identified.

Finally, the obtained output is viewed by the user.

## A. IMPLEMENTATION

The process of making a new or updated system design operational is known as system implementation. The following is necessary for implementation:

### Module Implementation for Crop Suggestion

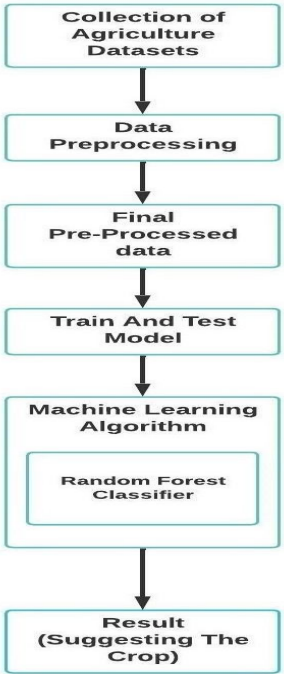


Fig 3: Module Implementation for Crop Suggestion

**Module Implementation for Plant Leaf Disease Detection**

- Gathering data entails using tried-and-true, time-tested techniques to collect, gauge, and examine exact findings for research.
- Data preprocessing, which is a component of data preparation, refers to any type of processing performed on raw data to prepare it for another data processing action.
- Testing and training the training set and test set of the model are separated. In this study, the model will be trained using 80percent of the data while being tested using 20% of the data.
- We use the data to train machine learning algorithms like Random Forest, Logistic Regression, and Decision Tree.
- Advice on the kinds of crops to grow that are most suited for the particular circumstances. Recommend the crop and type of fertilizer best suited for the particular crop.

## CLASSIFICATION OF PLANT LEAF DISEASE DETECTION

It entails the following actions:

A. Data gathering
B. Pre-processing
C. Feature Extraction
D. Classification

**A. Data gathering:** Here the datasets consist of 75 thousand pictures that will cover 14 crops. This data is taken from plant dataset.

**B. Data Pre-processing:** This pre-processing includes data augmentation and normalization

1. Data Augmentation: This is done for the better learning of the model.
2. Normalization: This is done to make all the pixel values have the same mean and standard deviation.

**C. Feature Extraction:** Relevant features are extracted first to solve the classification problem. System that detects the diseases using images of the different leaves, focus on the texture feature.

**D. Classification:** Some of the classifiers that can be used here are Logistic Regression, ANN, CNN, Classification trees and ResNet34.

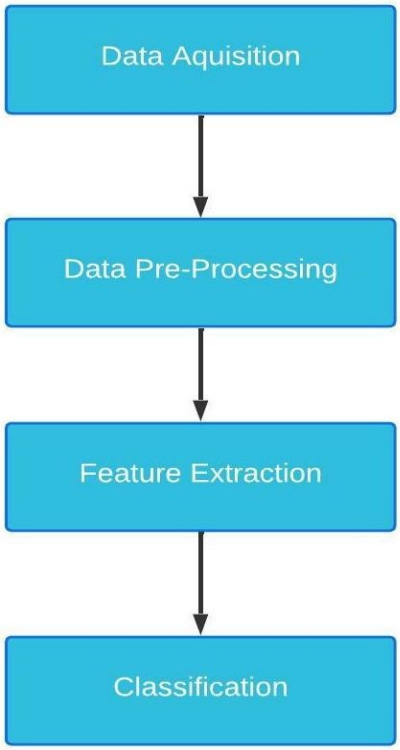


Fig 4: Detection process for leaf diseases

## III. TESTING

The process of software and hardware testing is used to assess the accuracy, comprehensiveness, security, and excellence of developed computer systems.

| TEST CASE NO. | TEST CASES | INPUT DATA | EXPECTED OUTPUT | OBTAINED OUTPUT |
|---|---|---|---|---|
| 1 | Displaying the Website | Running the code and entering the URL displayed http://127.0.0.1:5000 | The Main Home page is to be loaded | Home page is loaded successfully |
| 2 | Crop Suggestion | Enter the soil nutrients value including the pH and rainfall values as input | Best suitable Crop to grow has to suggested | Best suited Crop to grow is suggested |
| 3 | Fertilizer Suggestion | Enter the soil nutrients values and select the crop | Corresponding Location with accuracy 99% to be displayed | Corresponding Location with accuracy 99% is displayed |
| 4 | Plant Leaf Disease Detection | Upload the image of plant leaf | Disease and its cause should be identified along with prevention and cure for the disease | Disease and its cause are identified, prevention and cure for the disease is suggested |
| 5 | Stopping the web server | Press Ctrl + c at the visual studio terminal | The web server should be shut down | The web server gets shut down |

Table 1: Test Case Specification

## IV. EXPERIMENTAL RESULTS

The model detects the given input data and suggest crop and fertilizer and also suggest the plant leaf disease.

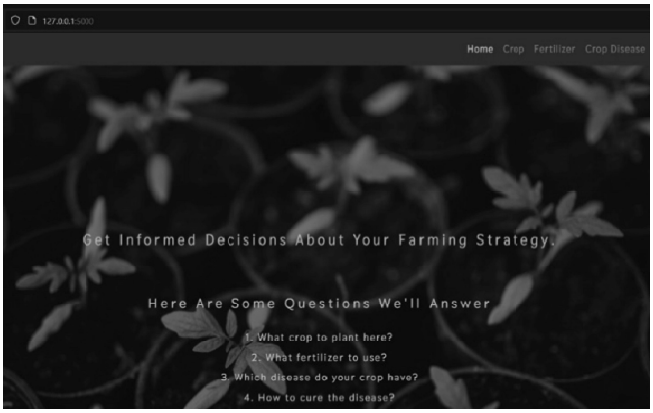


Fig 5:UI Home Page

The below figure is the crop suggestion page

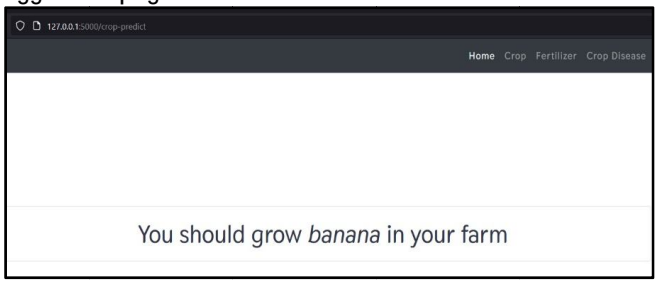


Fig 6: Displaying the result

 

On uploading the leaf image, the results for the same will be displayed here

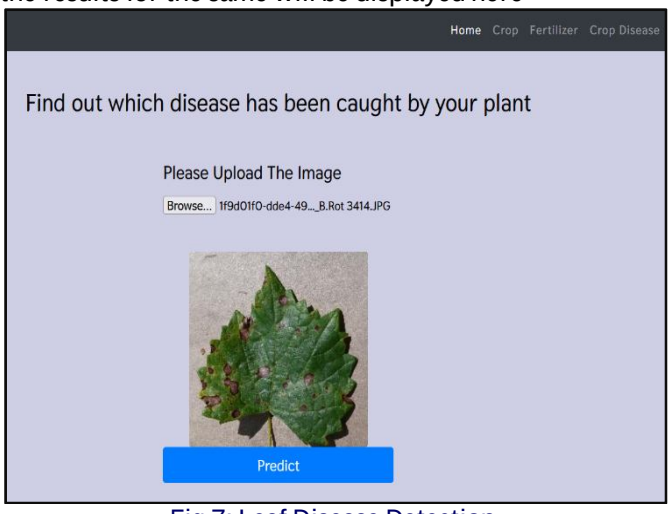


Fig 7: Leaf Disease Detection

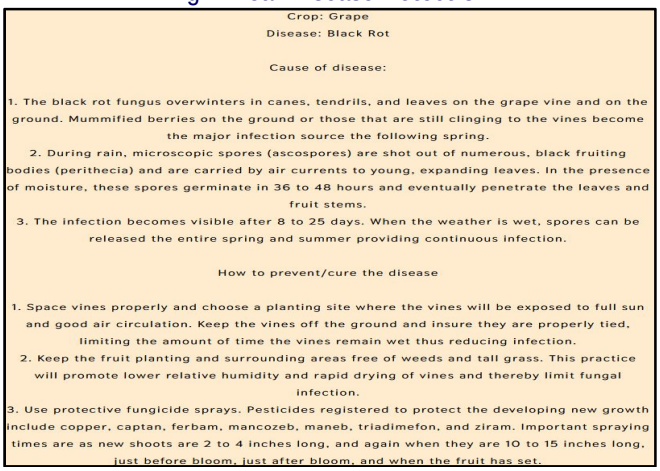


Fig 8: Displaying the disease

## V. CONCLUSION

To address the problem of the farmers this project was proposed. Our online application will assist users and farmers in making smarter choices regarding the crop to be farmed. It will also recommend about the type of fertilizer best suited for the particular crop. Predicting the name and causes of crop disease and also how to prevent or suggestion to cure it.

## VI. FUTURE ENHANCEMT

As part of our future work, we intend to give farmers access to voice bots that will allow them to ask questions using the microphone on their phones. Once the voice input has been converted to text and has been searched online and converted to voice, the voice bot will respond to the farmer's question.

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