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Agricultural Based Decisions: AGRODEC Web Application

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Abstract: ***Farmers no longer have to travel large distances in order to obtain agricultural knowledge. With agriculture playing such a vital role as a source of income in one of the world's most populated countries, making the lives of farmers easier is a must. India is the world's largest producer of pulses (25 percent of global output), consumer (27 percent of global consumption), and importer (25 percent of worldwide imports) (14 percent). As these data show, agriculture contributes a significant portion of our country's GDP. As a result, AGRODEC acts as a reference for farmers, advising them on which crops would be most beneficial at certain seasons of the year and soil pH levels.***

Keywords: Web Application, Machine Learning, Model training, Crop Prediction, Rainfall analysis, Data Visualization, Research Centers.

I. INTRODUCTION

In today's Technology driven world everyone is utilizing technology for their development then why agriculture should fall behind. To close the gap between technology and farmers AGRODEC acts as a bridge so that farmers can make the most out of the harvest. As we know today's climatic conditions are changing rapidly and farmers cannot keep track of it, so AGRODEC predicts the crop which is best suited for the farm based on present day soil parameters. We take a few parameters as input and send it to the model for it to predict the crop. Thus the crop is suited for the soil and will give more harvest as compared to the crop harvested in the farm which has been sowed from ancestors as a tradition.

AGRODEC visualizes the rainfall of the past 10 years so that farmers can get the idea of what exactly can be expected in the monsoon season and be prepared with necessary resources for saving the crop.

This system also gives a statistical approach to the farmers' crop sale made in a year, to understand which crop is more beneficial and which one is not. Also, Indian agricultural land percentage is also displayed so that researchers and agricultural students can focus on the unirrigated land and can take necessary steps to make that land productive.

II. SOFTWARE

A. Crop Prediction

Precision agriculture is very popular these days. Precision agriculture is a modern agricultural technology that analyses data such as soil characteristics, soil types, crop production data, and meteorological conditions to recommend the best crop for maximum yield and profit to farmers. Farmers will be able to make more informed decisions about their farming approach with this technique. Predicting the best crop for cultivation is an important component of agriculture, and machine learning algorithms have become increasingly important in such precisions in the recent years.

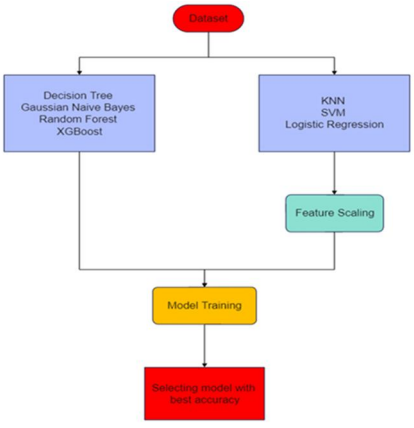


Fig.1 Outline of the model

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The overall procedure of the crop prediction model is depicted in Figure 1. The input data, i.e. the dataset, is initially pre-processed to discover missing values, remove redundant data, and standardize the data. The data is then trained for the model once it has been preprocessed. Using the sklearn library, the dataset is separated into training and test data.

After the dataset has been partitioned, the crop prediction model is built using a variety of machine learning algorithms. For the prediction, the algorithm with the highest accuracy is used. As a result, after preprocessing the data, the model was trained into a training set using the Random Forest Classifier technique.

Algorithm	Accuracy
Decision Tree	90.0
Naïve Bayes	97.08
SVM	10.68
Random Forest	**99.09**
Logistic Regression	95.22

Fig.2 Accuracy of the algorithms

This is mathematical model for the algorithm:

$$RFfi_i = \frac{\sum_{j \in all\ trees} normfi_{ij}}{T}$$

RFfi sub(i) = the importance of feature i calculated from all trees in the Random Forest model

normfi sub(ij) = the normalized feature importance for i in tree j

T = total number of trees

Example with training and testing

Following the training of the dataset, the prediction can be made. We used a variety of factors to predict the crop, including temperature, humidity, soil PH, rainfall, and NPK level in the soil. These are the system's input parameters that can be manually entered by the user. The prediction model in the system is depicted in Figure 3.

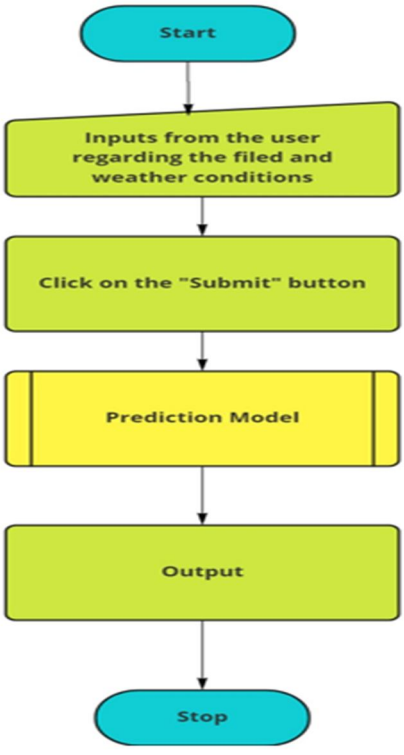


Fig.3 Flow of the prediction model

B. Data Visualization

Data visualization is the graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualization tools provide an accessible way to see and understand trends, outliers, and patterns in data.

AGRODEC uses data visualization to show the user about the real time data analysis of Rainfall which has occurred over the past years, it also gives a brief description of the crop sales done in a year through bar charts and Pie charts.

C. Rainfall Analysis

Rainfall is a very important segment of the farming industry, therefore AGRODEC uses the dataset which contains rainfall that occurred over the past years to analyze the amount of rainfall occurring in each state of India.

We have used data visualization to show the rainfall occurring in each state in those particular years, which can be used for gathering resources to save the crop from excessive rain or various strategies can be adopted for excessive or less monsoon rain.

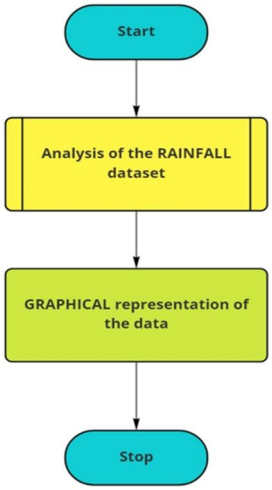


Fig.4 Flow of rainfall analysis

III. PROPOSED SYSTEM

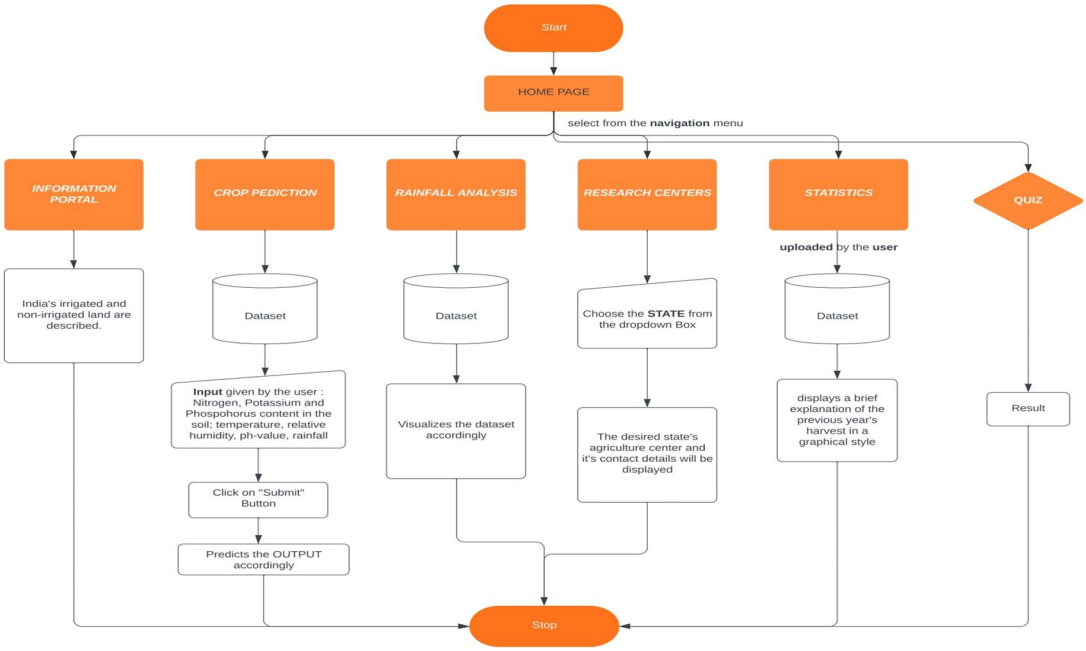
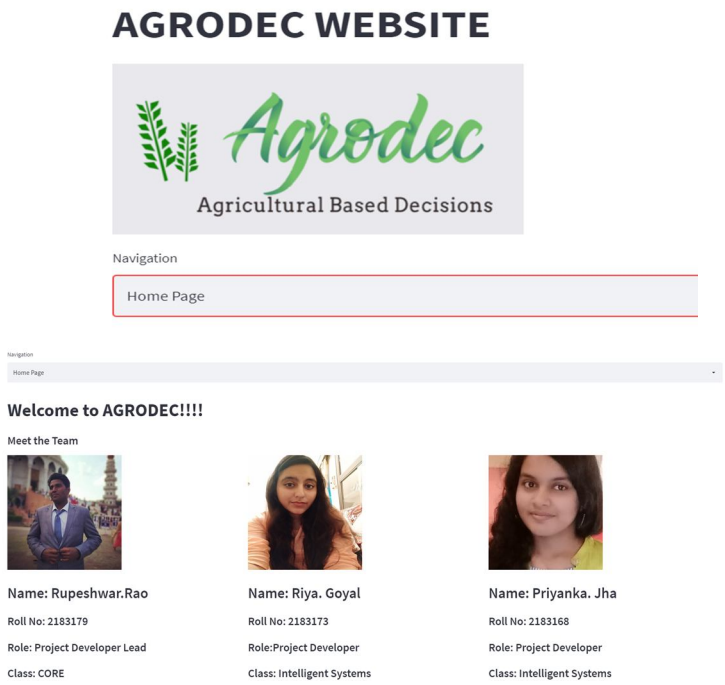


Fig. 5 Proposed System

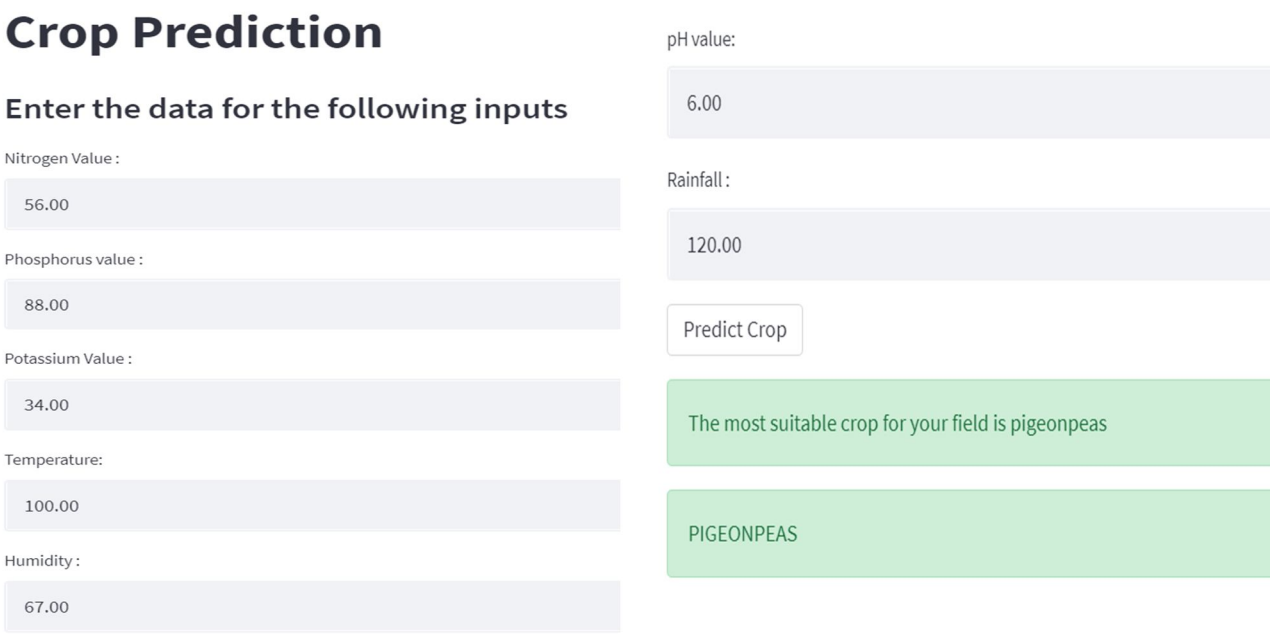
A. Execution of the Program

When we run the command, the program's User Interface will appear on the screen. The user can choose from a variety of system functions attributable to the program's interface.



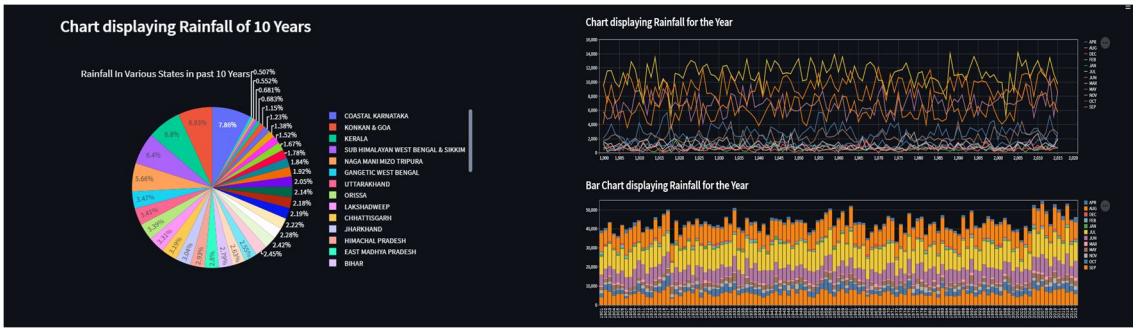
After selecting "**Crop Prediction**" from the dropdown menu, the user will be directed to a page where he can enter the information requested on the page about the field and weather, and then submit the information. As a result, the crop that is suited for growing will be displayed based on the inputs provided.

CROP INPUT & OUTPUT



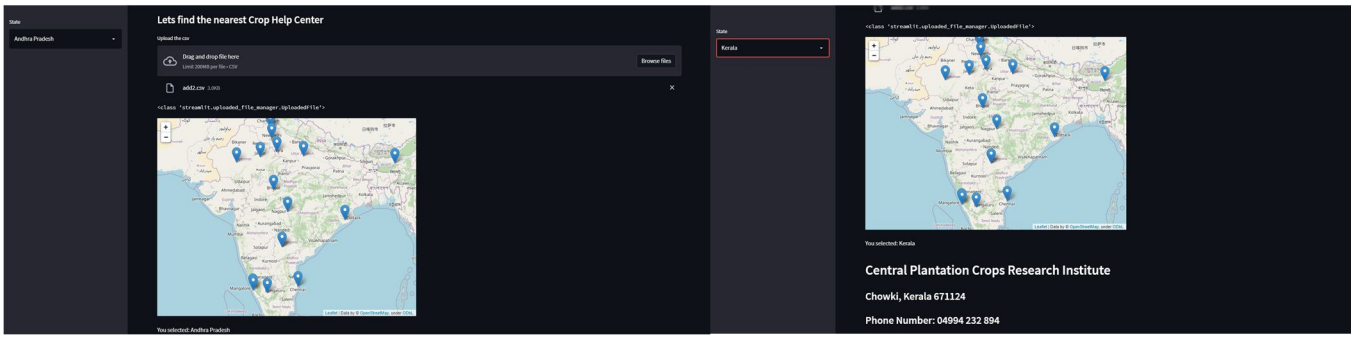
B. Rainfall Analysis

After selecting "**Rainfall Analysis**" from the dropdown menu, the user will be taken to a page that displays a graphical representation of the previous year's rainfall distribution so that the farmer may get a sense of how the rainfall has changed over time.



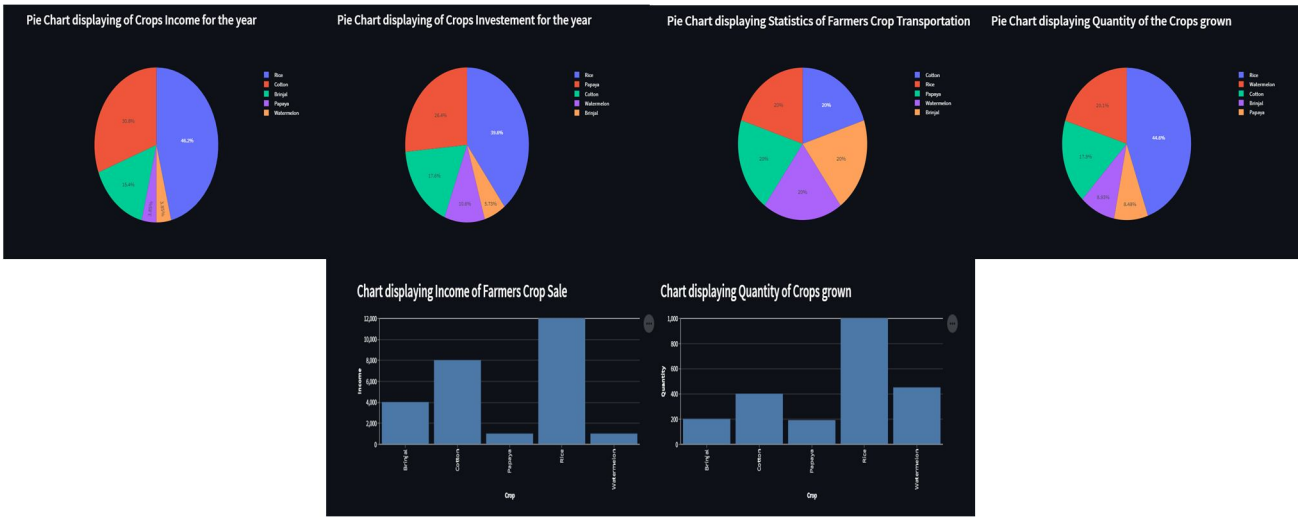
C. Research Centers

After selecting "**Research Centers**" from the dropdown menu, the user will be directed to a page where he or she can explore the various sites and contact information for these agricultural facilities/centers across India.



D. Statistics

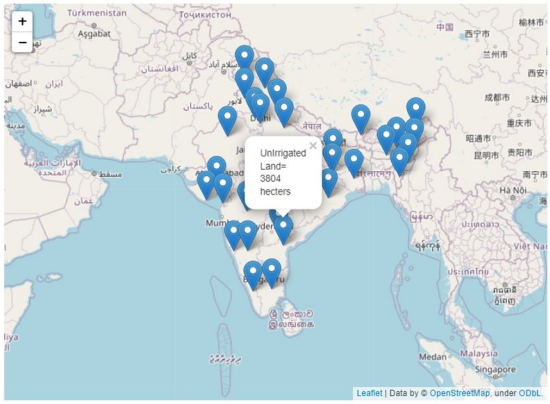
After selecting "**Statistics**" from the dropdown menu, the user will be directed to a page where they can upload a dataset containing the previous year's harvest, investment, and income in order to obtain a graphical representation of the data for better comprehension and future harvesting.



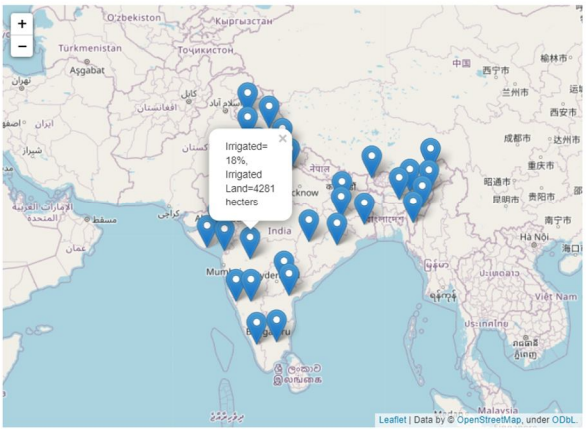
E. Information Portal

After selecting "**Information Portal**" from the dropdown menu, the user will be directed to a page where the Indian Map would be displayed. In this Map, Indian states are located and when you click on any state, the Irrigated Land percentage and Unirrigated Land in hectares will be shown. This is a very important segment as this can be used as reference to make sure all the agricultural land is used for cultivation and not left unused.

UnIrrigated Land in India

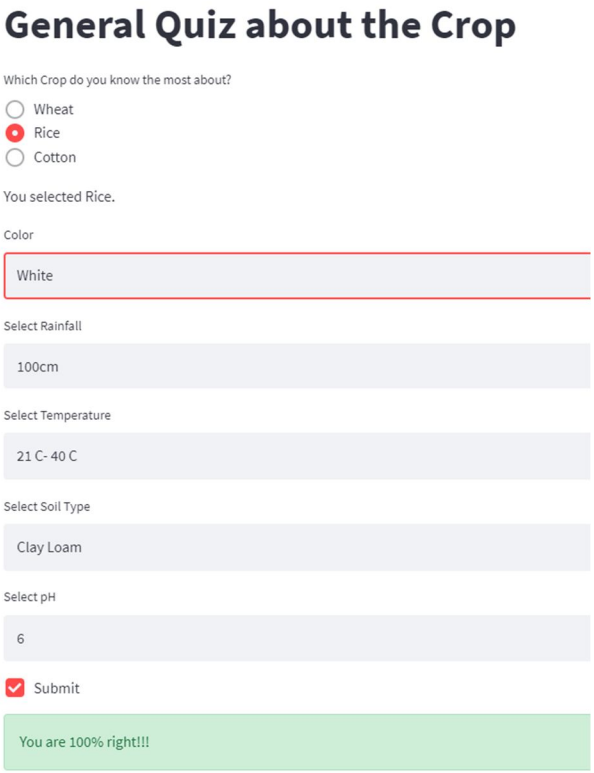


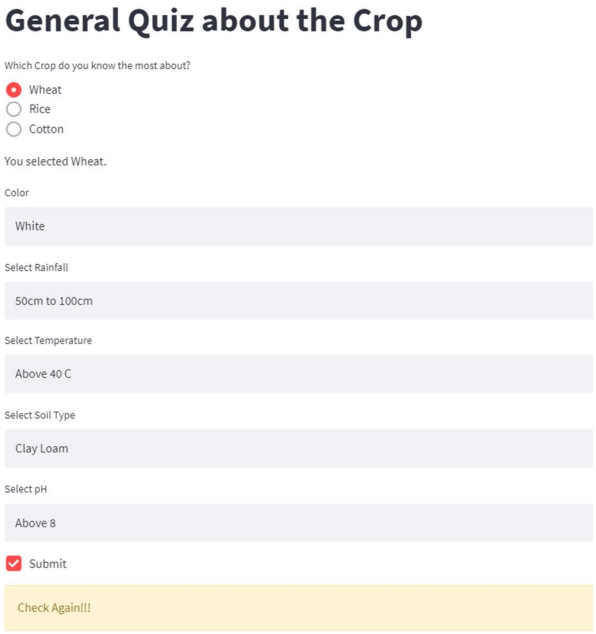
Irrigated Land in India



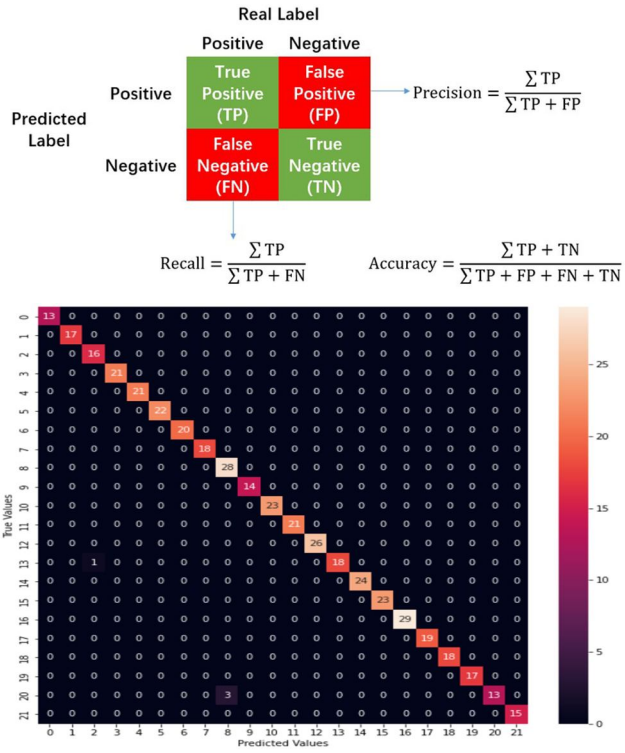
F. Quiz

After selecting "**Quiz**" from the dropdown menu, the user will be directed to a page where a few important questions regarding the crops would be asked to test the user's knowledge about the crop. This quiz is made with a motive that users will have the details remembered even if the resources are not available.





IV. MATHEMATICAL MODEL



Input : N = 107, P = 34, K = 32, temp = 26.774, humidity = 66.41, pH = 6.7, rainfall = 177.77

Processing :The data is processed and gathered in a list to provide to the prediction algorithm for the outcome once the user's input has been submitted. This data was fed into multiple algorithms, and it was observed that the Random Forest Classifier produces the best accurate results, both in testing and in training. When compared to the other algorithms, it also provides the best results.



Outputs : **'coffee'**

V. ACKNOWLEDGEMENTS

We would like to express our gratitude to our teacher, Prof. Amol Dande as well as our Principal Dr.Ravande who gave us this golden opportunity to work on this Project 'AGRODEC' which has helped us in developing our skills in various fields like Web Application using Machine Learning and Streamlit . Last but not the least we would like to thank our parents and our friends who helped in the development and completion of this Project.

VI. FUTURE ENHANCEMENTS

1) We will implement the project in the form of web application, application and website so it can be utilized by all.
2) We want to implement this in all native languages.
3) We want to bring all agricultural students and farmers together with the use of this technology for the betterment of farming.
4) Crop prediction with more accuracy and updated dataset.
5) Rainfall prediction so that farmers can grow the required crop accordingly.
6) Price Prediction of the crop, which focuses on farmer benefit and consumer benefit as well.

VII. CONCLUSION

The proposed framework gives farmers a help to decide which crop will produce the maximum benefit based on soil's present conditions. We aim to bring agricultural students and farmers together so they both can help each other in better understanding the soil and crops.

We aim to make all the agricultural land in India into cultivating land as most of the agricultural land is not used properly, so by highlighting the region and taking help of researchers we can turn that land into cultivating land.

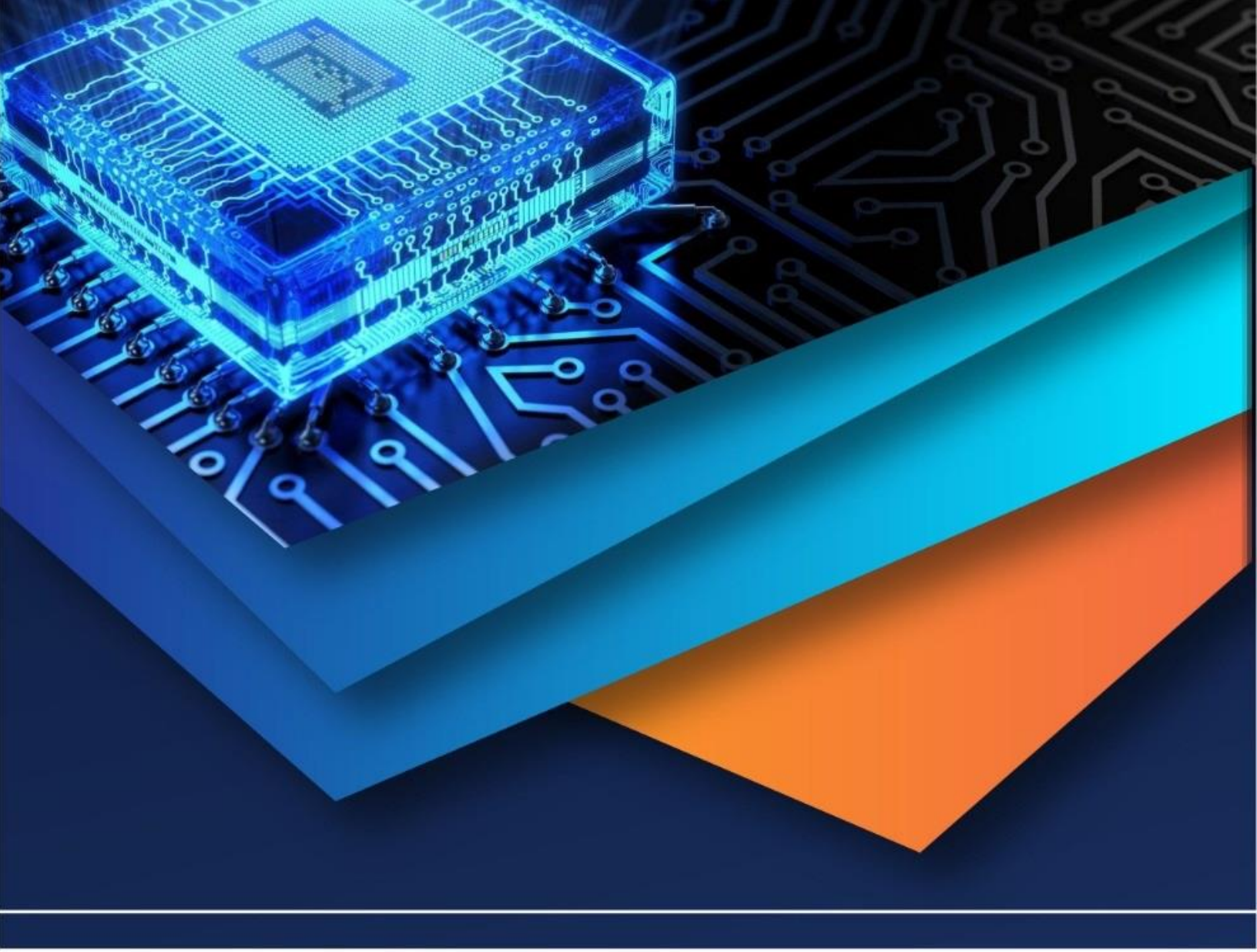
We have listed agricultural research centers by using Map and pinpoint locations of the states in India. A farmer can contact them with a phone call and can get his/her doubts cleared regarding the soil or crops.

Last but not the least, we have given farmers a tool to visualize what earning and Investment has been made in a year on the crop so they can understand more about the crop being harvested. A small quiz to get to know the crop completely so if no resources are available then also the user should know few details about the crop.

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