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Paper Authors
**A. E. Kokila, Patan Imran, Sk. Saleha, Sk. Jasmin, Sk. Bazimun**


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# Design And Development of Efficient ML Model to Predict Best YieldingCrop Selection for a Specific Region at SPSR Nellore District

[1]A. E. Kokila, [2]Patan Imran, [3]Sk. Saleha, [4]Sk. Jasmin, [5]Sk. Bazimun
[1]Assistant Professor, Department of Computer Science and Engineering, Narayana Engineering College,Nellore, Andhra Pradesh, INDIA.
[2,3,4,5]PG Scholar, Department of Master of Computer Applications, Narayana Engineering College,Nellore, Andhra Pradesh, INDIA.

**Abstract—** Agriculture and its allied sectors are undoubtedly the largest providers of livelihoods in rural India. The agriculture sector is also a significant contributor factor to the country's Gross Domestic Product (GDP). Blessing to the country is the overwhelming size of the agricultural sector. However, regrettable is the yield per hectare of crops in comparison to international standards. This is one of the possible causes for a higher suicide rate among marginal farmers in India. This paper proposes a viable and user-friendly yield prediction system for the farmers. The proposed system provides connectivity to farmers via a web application. The user provides the area & soil type as input. Machine learning algorithms allow choosing the most profitable crop list or predicting the crop yield for a user-selected crop. To predict the crop yield, selected Machine Learning algorithms such as Support Vector Machine (SVM), Artificial Neural Network (ANN), Random Forest (RF), Multivariate Linear Regression (MLR), and K-Nearest Neighbour (KNN) are used.

## 1. INTRODUCTION

Agriculture is a significant area for the Indian economy and human survival. It is one of the primary occupations which is essential for human life. It likewise contributes a huge part to our day-to-day life. In most cases, Farmers commit suicide due to production loss because they are not able to pay the bank loans taken for farming purposes. We have noticed in present times that the climate is changing persistently which is harmful to the crops and leading farmers to debts and suicide. These risks can be minimized when various mathematical or statistical methods are applied to data and by using these methods, we can recommend the best crop to the farmer for his agricultural land so that it helps him to get maximum profit. Nowadays agriculture has developed a lot in India. Specific farming is the key to Precision agriculture. Although precision agriculture has achieved better enhancements it is still facing certain issues.

Precision agriculture plays an important role in the recommendation of crops. The recommendation of crops is dependent on various parameters. Precision agriculture focuses on identifying these parameters in a site-specific way to identify issues.

Not all the results given by precision agriculture are accurate to result but in agriculture, it is significant to have accurate and precise recommendations because in case of errors it may lead to heavy material and capital loss. Many research works are being carried out, to attain an accurate and more efficient model for crop prediction. In India farming is not considered a business but also has a huge impact on the social life of people who are associated with it.

There are many festivals and social gatherings celebrated by the different seasons and practices involved in farming. Hence a large part of the population is dependent on the agriculture field directly or indirectly. But the situation of farmers is not good in India. Despite employing half the population in agriculture, the agriculture sector contributes to only 20% of Indian GDP. Hence, it is in dire need of improvement to make a good and profitable yield and also,

a practical need without harming nature. That's where technology comes in and can have majoreffects on the agricultural sector. This project aims to tackle the difficulties faced by the farmersand aims to provide a correct crop for the farmers to grow and avoid undesirable results by providing effective solutions using machine learning techniques. Machine Learning focuses on algorithms like supervised, unsupervised, and Reinforcement learning and each of them has its advantages and disadvantages.

In this, the Machine Learning approach is utilized to recommend the best crop, and Python is used as the programming language because it is generally accepted for experimentation in the Machine Learning field. Machine Learning is an important tool for data analysis that uses learning algorithms to iteratively learn from available data. Machine Learning is an area of artificial intelligence that tries to give computer methods for accumulating, changing, and updating the knowledge of intelligent systems. The model is trained using linear regression analysis. The output predictions are then made by this trained system.

The proposed system suggests a favorable crop for cultivation but also provides the seasonal classification of crops to the farmers, as they get maximum production and profit. In supervised learning, the algorithm assembles a mathematical model from a set of data that

contains both the inputs and the desired outputs. An unsupervised learning-the algorithm constructs a mathematical model from a set of data that contains only inputs and no desired output labels. Semi-supervised learning- algorithms expand mathematical models from incomplete training data, where a portion of the sample input doesn't have labels. This proposed system

applied different kinds of Machine Learning algorithms like Decision Trees, Naïve Bayes (NB), Support Vector Machine (SVM), K-Nearest Neighbor (KNN), and Random Forest (RF).

## 2. LITERATURE SURVEY

The steps are taken to boost agriculture primarily involve ingraining technological expertise and inventions to make the agriculture sector more proficient and simplified for farmers by predicting the correct crops using all ML approaches. The paper discusses various algorithmssuch as ANN, Fuzzy Network, and various data mining techniques with their advantages. A further challenge is to have all these incorporated real-time datasets. One of the early works developed a dedicated website to assess the impact of weather parameters on crop production in the identified districts of Andhra Pradesh. The districts were selected based on the region coveredby the crop.

Based on these criteria, one of the districts, SPSR Nellore Dist., A.P with a maximum crop area were chosen. The basis of the crops selected for the study was on prevailing crops in the selected districts. The crops picked included maize, paddy, wheat, and groundnut, for which the yield for a continuous period of 20 years of knowledge. The accuracy of the established model ranged from 76% to 90% for the chosen crops with an average accuracy of 82%. Another important work checks the soil quality and predicts the crop yield along with a suitable recommendation of fertilizers.

The Ph value and the location of the user were inputs used in this model. An API was used to predict the weather, and temperature for the current place. The system used both supervised as well as unsupervised ML algorithms and compares the results of the two. A classifier that uses a greedy strategy to predict the crop yield was proposed. A decision tree classifier that uses an attribute has been shown to yield better results. An ensemble model proposed suggests integrating the effects of different models, which is typically better than the individual models. Random forests ensemble classification uses multiple decision tree models topredict the crop yield. The data are split up into two sets, such as training data and test data, with a ratio of 67% and 33%, with which the mean and standard deviation are calculated.

## 3. PROPOSED WORK

- The novelty of the proposed system is to guide the farmers to maximize the crop yield as well as suggest the most profitable crop for the specific region.
- The proposed model provides crop selection based on economic and environmental conditions, and benefits to maximize the crop yield that will subsequently help to meet the increasing demand for the country's food supplies.

- The proposed model predicts the crop yield by studying factors such as rainfall, temperature, area, season, soil type, etc.
- Here, we are using some machine learning algorithms like Support Vector Machine, K-NN, Random Forest, Decision Tree, and Naïve Bayes.
- Prediction of the crop yield for specific regions by executing various Machine Learning algorithms yields a better result, with a comparison of error rate and accuracy.
- The proposed system provides a user-friendly web application to recommend the most profitable crop.
- Our recommender system suggests the right time for using fertilizers.

- The methods in the proposed system include increasing the yield of crops, real-time analysis of crops, selecting efficient parameters, making smarter decisions, and getting better yield.
- The selection of crops & cropping system plays a major role in improving the productivity and profitability of the farmers.

**Machine Learning:**

Machine learning (ML) is the study of computer algorithms that improve automatically through experience. It is seen as a subset of artificial intelligence. Machine learning algorithms build a mathematical model based on sample data, known as "training data", to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or infeasible to develop conventional algorithms to perform the needed tasks.

Machine learning is closely related to computational statistics, which focuses on makingpredictions using computers. The study of mathematical optimization delivers methods, theory, and application domains to the field of machine learning. Data mining is a related field of study, focusing on exploratory data analysis through unsupervised learning. In its application across business problems, machine learning is also referred to as predictive analytics. Machine learning involves computers discovering how they can perform tasks without being explicitly programmed to do so. It involves computers learning from data provided so that they carry out certain tasks. For simple tasks assigned to computers, it is possible to program algorithms telling the machine how to execute all steps required to solve the problem at hand on the computer's part, no learning is needed

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## 5. Methodology

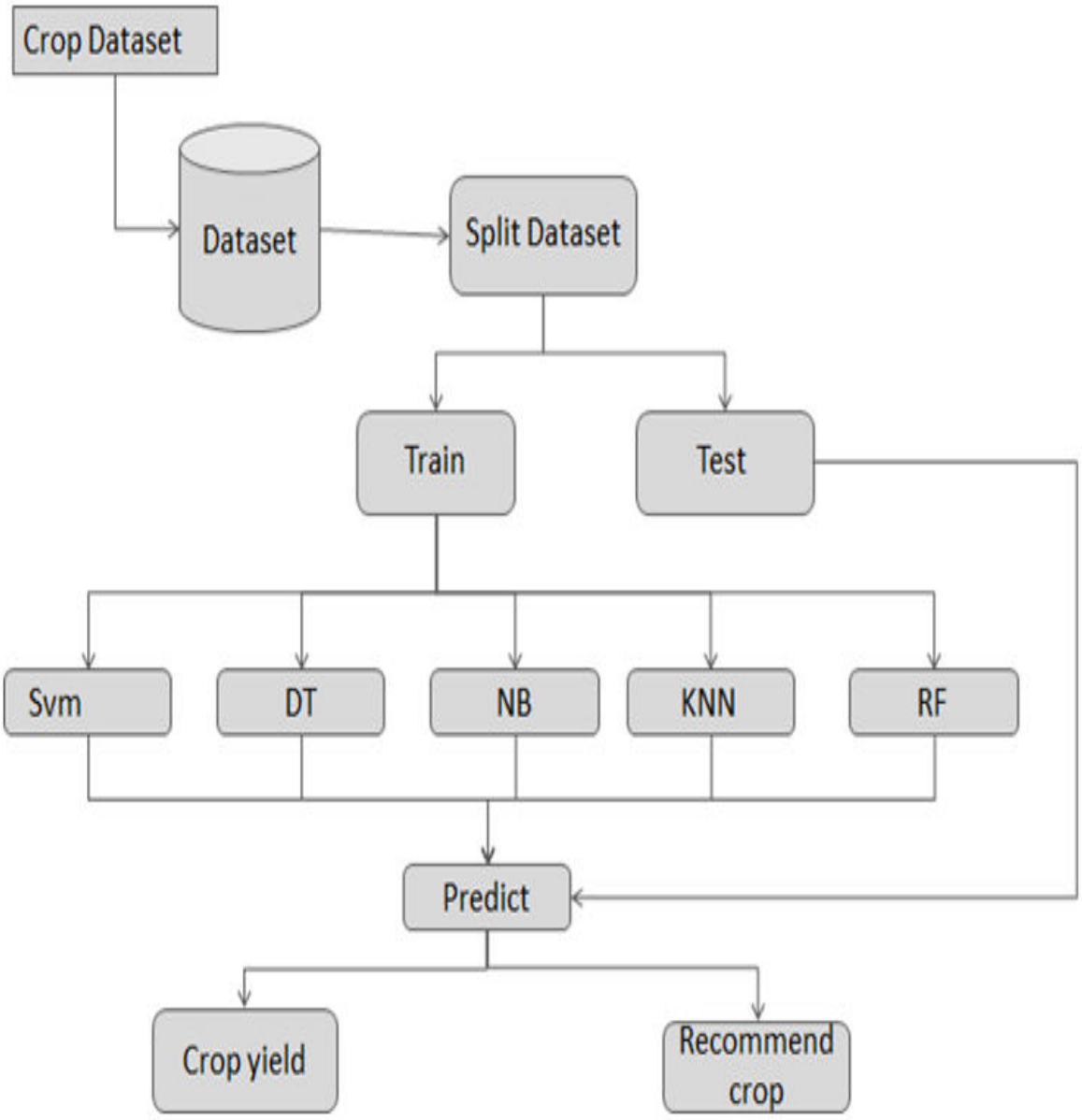


Fig 1: Architecture Description

**i. Service Provider**

In this module, the service provider performs various operations like loading the crop dataset, splitting the dataset into train and test data, viewing the accuracy of each classifier in a chart, viewing all crop yield and production predictions, viewing all crop recommendations, download predicted dataset, view crop yield prediction per acre and so on.
It will store all the data and the user will access it. Only the admin will do changes in a database. It will provide us with trained accuracy in bar and line charts, we can view all crop recommendations and predictions of crop production, and download predicted datasets.

**ii. Remote User**

In this module, remote users register, and log in to the system. After successful login, he/she performs predicts the crop yield and production, and predict the crop recommendation. It can perform a certain registration process to enroll the user details.

**iii. Crop Yield and Production**

After the registration process is completed, user should enroll the area name and predict the crop production for a specific yield.

**iv. Predict Crop Recommendation**

Here, after enrolling the area name and soil type we can see the predicted crop for a specific region.

**v. Home Page**

It is the main page where users can store and access the data.

**vi. Prediction**

In this module, to predict the crop yield and production based on the state name, District name, Mandal name, Sub-Mandal name, crop name, no. of acres, and soil type using various machine Learning Classifier. And also recommend the crop based on state and soil type.

**vii. Graph Analysis**

In this module, the service provider generates different graphs to quantify the classification accuracies, crop yield and production, top crop recommendations, and so on.

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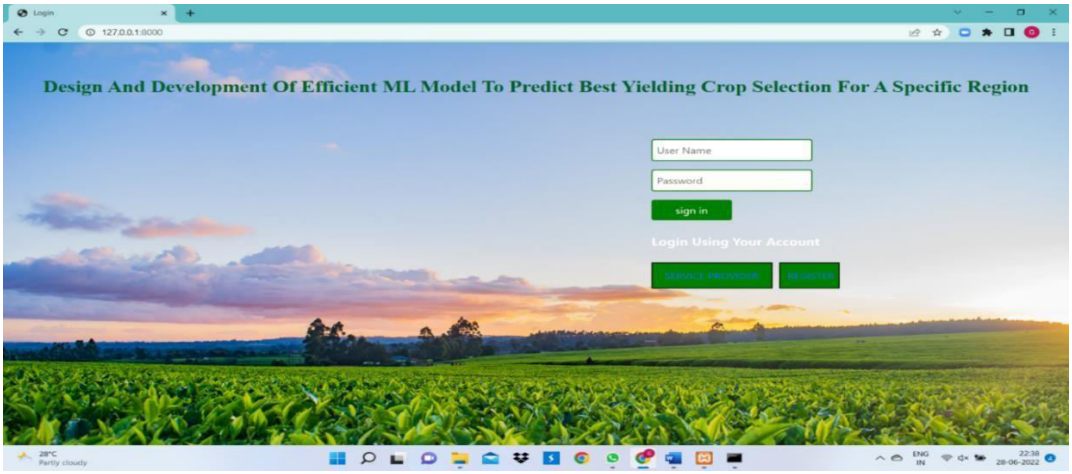
## 6. RESULTS

The proposed system is simulated under the environment of windows-7, using the python technology, JavaScript, and MySQL 5.0 to store the data while processing. The web application deployed and tested in the test server Tomcat 7.0. The results and the UI design are presented below. Further, the UI screen illustrates the various standard Machine Learning Algorithms are used.

**Fig 2 Home Page**




This is the Home Page of my project and it displays Register, Service Provider.

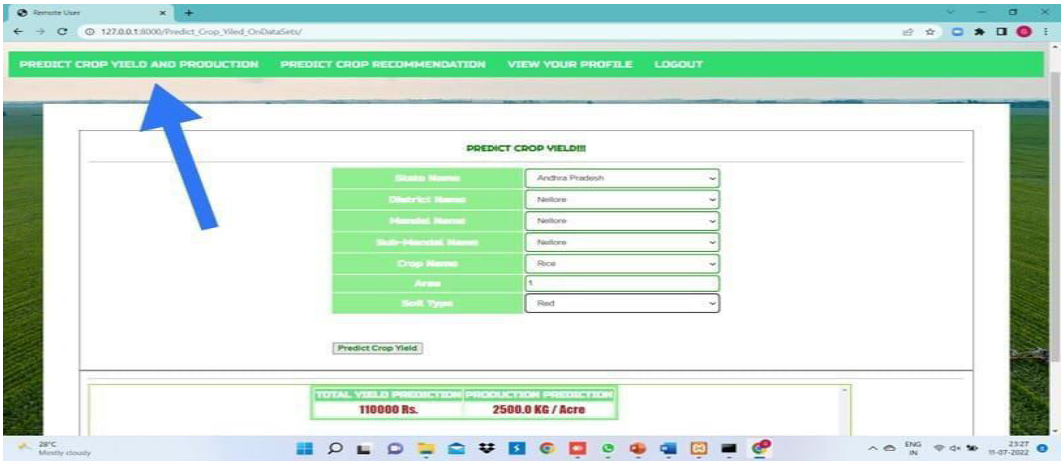



**Fig 3 Predict Crop Yield and Production**

- ✓ Here we should enter state name, district name, Mandal name, crop name, area number, and soil type.

- ✓ Then Predict Crop Yield.

- ✓ Here the production of the crop will display.

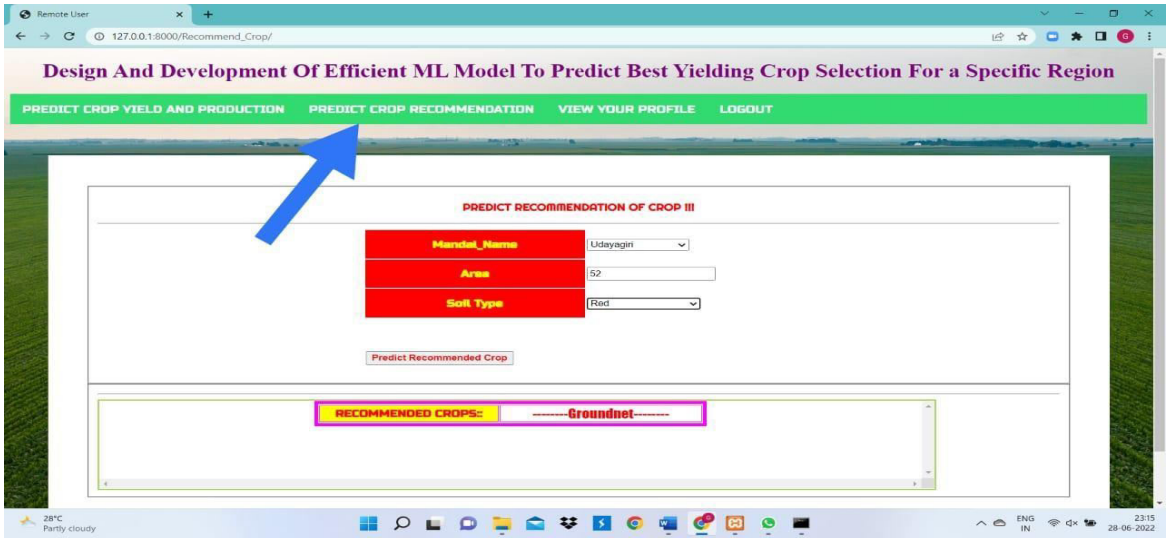



**Fig 4 Predict Crop Recommendation**

- ✓ Here we should enroll the Mandal name and area soil type.

- ✓ Then crop will be recommended.

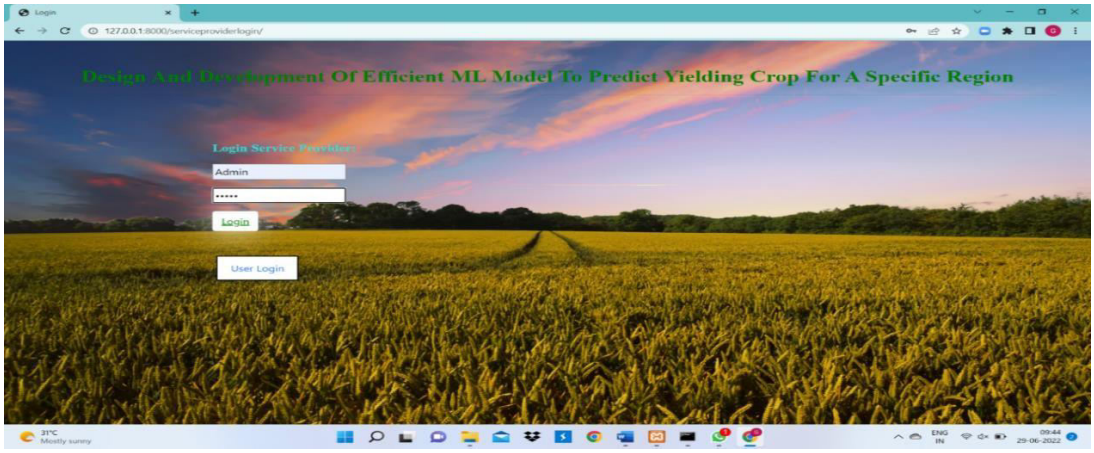



**Fig 5 Service Provider**

- ✓ Admin will log in at service provider.
- ✓ service provider performs various operations like loading the crop dataset, splitting the dataset into train and test data, viewing the accuracy of each classifier in a chart, viewing all crop yield and production prediction, viewing all crop recommendations, downloading predicted dataset, view crop yield prediction per acre.

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**Fig 6 Browse Agriculture Datasets and Train & Test**

Here we can see which type of model is using here and how much accuracy is possible.

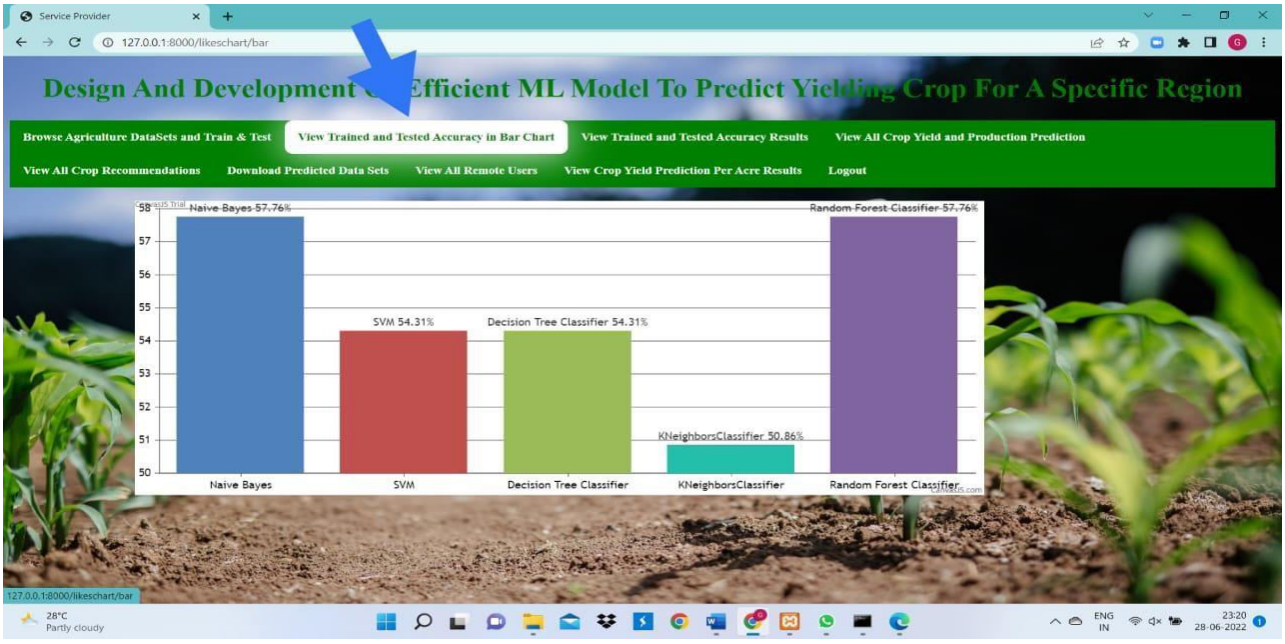


**Fig 7 View Trained and Tested Accuracy in Bar Chart**

Here we can see how much accuracy is possible as a bar chart.

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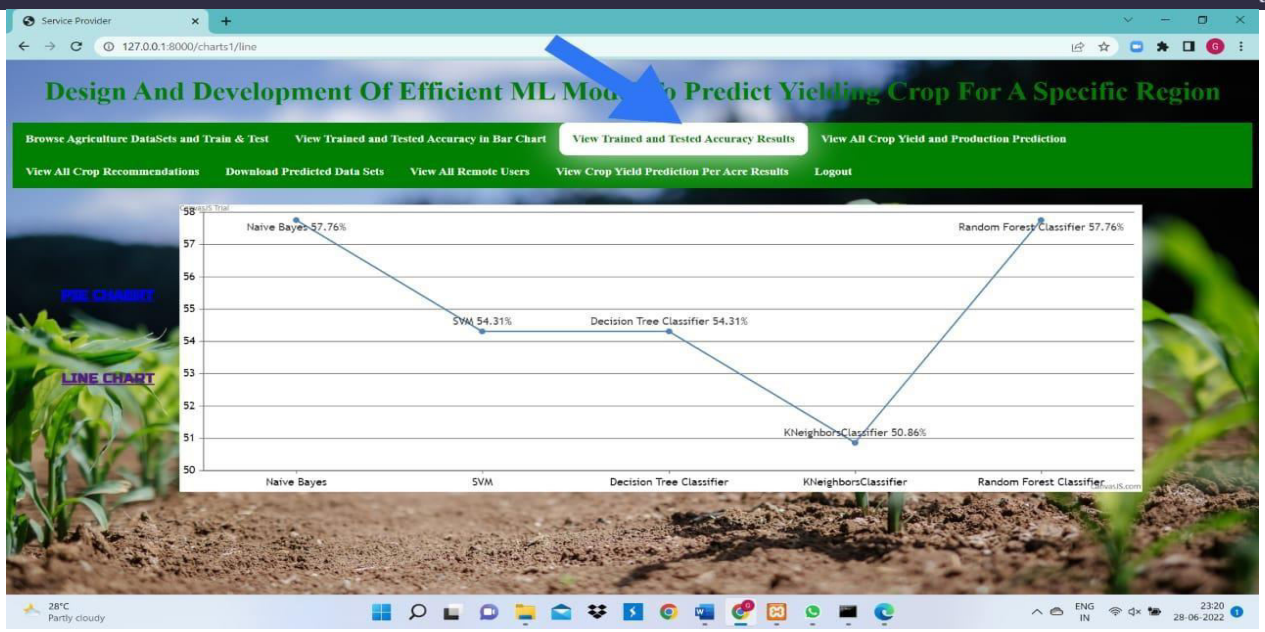


**Fig 8 View Trained and Tested Accuracy Results**

Here we can see how many accurate results are possible.

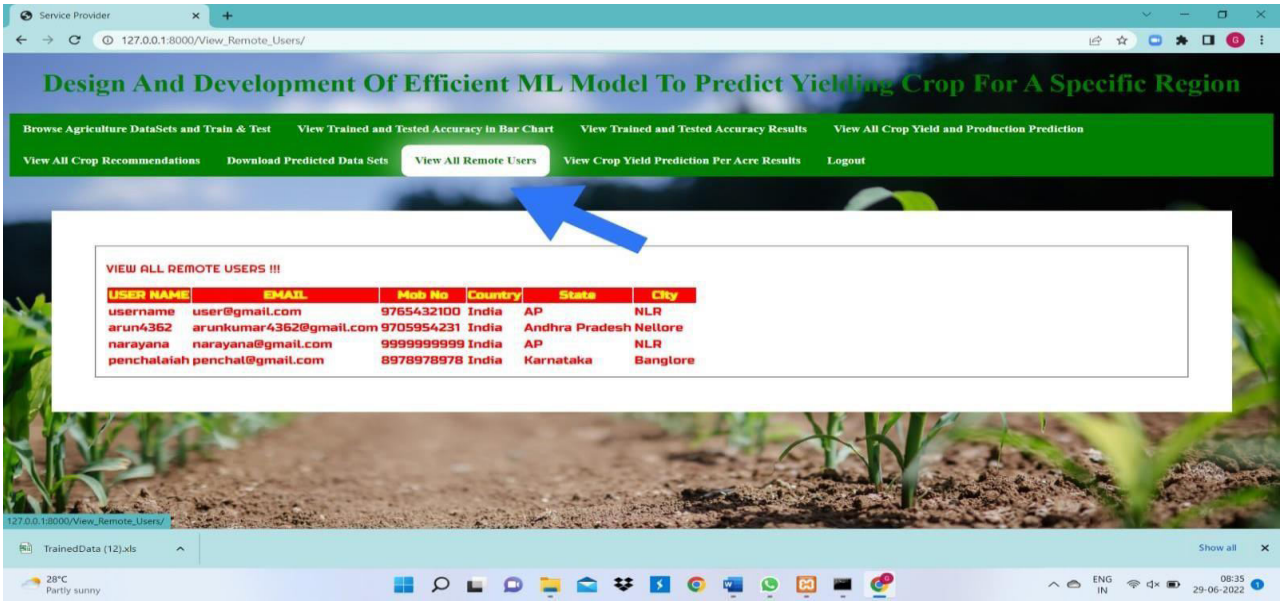


**Fig 9 View all Remote Users**

We can see those who registered and are accessing crop recommendations and predictions.

## 7. CONCLUSION

This project highlighted the limitations of current systems and their practical usage in yield prediction. Then walks through a viable yield prediction system for the farmers, a proposed system provides connectivity to farmers via a mobile application. The web application includes multiple features that users can leverage for the selection of a crop. The inbuilt predictor system helps the farmers to predict the yield of a given crop. The inbuilt recommender system allows a user exploration of the possible crops and their yield to take more educated decisions. For yield accuracy, various machine learning algorithms such as Random Forest, ANN, SVM, MLR, and KNN were implemented and tested on the given datasets from the Andhra Pradesh state. The various algorithms are compared with their accuracy. The results obtained indicate that Random Forest Regression is the best among the set of standard algorithms used on the given datasets with an accuracy of 95%. The proposed model also explored the timing of applying fertilizers and recommends appropriate duration.

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