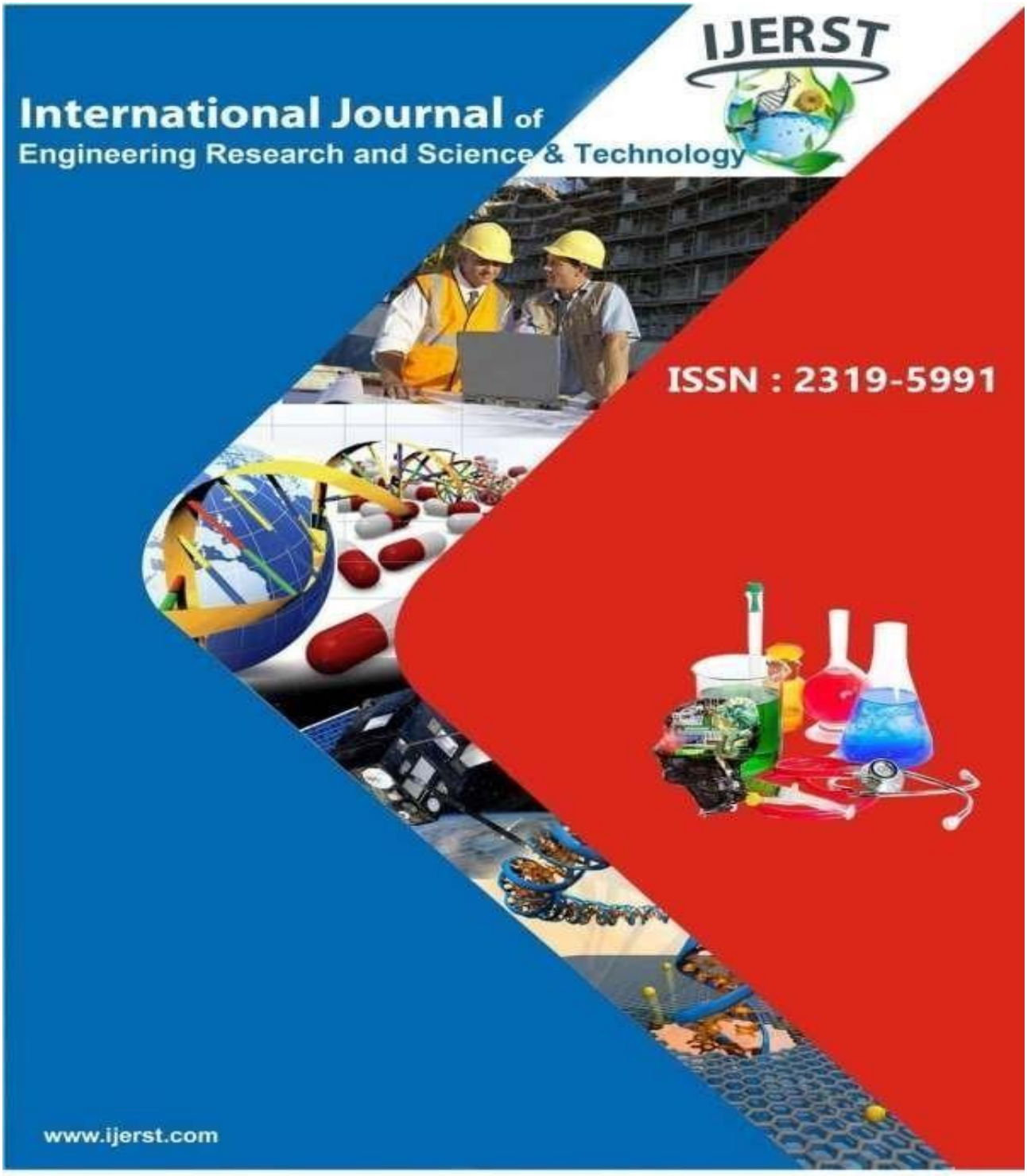

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CROP RECOMMENDER SYSTEM USING MACHINE LEARNING APPROACH

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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 mobile application. GPS helps to identify the user location. 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. Among them, the Random Forest showed the best results with 95% accuracy. Additionally, the system also suggests the best time to use the fertilizers to boost up the yield.

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 for 16.6% of 2009 GDP and around 50% of

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Vol. 17, Issue 2, 2024

the total workforce. Agriculture's monetary contribution to India's GDP is decreasing. The crop yield is the significant factor contributing in agricultural monetary. The crop yield depends on multiple factors such as climatic, geographic, organic, and financial elements. It 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 ranges 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. The crop yield prediction is a significant problem in the agriculture sector. Every farmer tries to know crop yield and whether it meets their expectations, thereby evaluating the previous experience of the farmer on the specific crop predict the yield.

Agriculture yields rely primarily on weather conditions, pests, and preparation of harvesting operations. Accurate information on crop history is critical for making decisions on agriculture risk management. In this paper, we have proposed a model that addresses these issues.

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 benefit 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. The system also helps to determine The best time to use fertilizers.

The existing system which recommends crop yield is either hardware-based being costly to maintain, or not easily accessible. The proposed system suggests a mobile-based application that

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com

Vol. 17, Issue 2, 2024

precisely predicts the most profitable crop by predicting the crop yield. The use of GPS helps to identify the user location. The user provides an area under cultivation and soil type as inputs. The model also recommends the most profitable crop and suggests the right time to use the fertilizers.

The major contributions of the paper are enlisted below, 1. Prediction of the crop yield for specific regions by executing various Machine Learning algorithms, with a comparison of error rate and accuracy. 2. A user-friendly mobile application to recommend the most profitable crop. 3. A GPS based location identifier to retrieve the rainfall estimation at the given area. 4. A recommender system to suggest the right time for using fertilizers. The organization of the rest of the paper is as follows. Section II discusses the background work of researchers in the field of agriculture and yield prediction. Section III presents the proposed model for yield prediction and recommends which crop for cultivation. The model also suggests the best suitable time for the use of fertilizers. Section IV discusses the results and Section V concludes the paper

2.LITERATURE SURVEY

In contemporary agriculture, the intersection of machine learning and crop recommendation systems represents a pivotal frontier. This literature survey endeavors to delve into the amalgamation of these domains, aiming to illuminate the evolving landscape of agricultural decision-making. By leveraging machine learning techniques, crop recommender systems promise a transformative shift towards precision farming, offering tailored solutions to the myriad challenges faced by farmers worldwide. This survey embarks on a comprehensive exploration of existing literature, traversing the spectrum of methodologies, algorithms, and applications employed in the field. Through critical analysis and synthesis, we aim to discern patterns, highlight successes, and identify areas for further inquiry. Ultimately, this survey seeks not only to elucidate the current state-of-the-art but also to inspire future advancements in the realm of machine

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com

Vol. 17, Issue 2, 2024

learning-powered crop recommendation, driving sustainable and resilient agricultural practices.

In the realm of agricultural technology, the integration of machine learning methodologies into crop recommender systems has emerged as a promising avenue for enhancing agricultural productivity and sustainability. A literature survey in this domain involves an exhaustive exploration of existing research endeavors, with a focus on understanding the methodologies, algorithms, datasets, and evaluation metrics employed in the development and validation of crop recommender systems. Researchers typically initiate this process by identifying key terms such as "crop recommendation," "machine learning," and "agricultural decision support" to guide their searches across prominent academic databases like PubMed, IEEE Xplore, Google Scholar, and ACM Digital Library.

As the literature review progresses, researchers meticulously filter through the retrieved papers, prioritizing those that offer insights into the intricacies of crop recommendation systems and their underlying machine learning frameworks. These papers are scrutinized to discern common themes, emerging trends, and areas where gaps in knowledge persist.

Methodologies employed in the studies are critically evaluated, with a keen eye on the efficacy of various machine learning algorithms such as decision trees, support vector machines, neural networks, and ensemble methods in addressing the multifaceted challenges inherent in crop recommendation tasks.

Furthermore, researchers delve into the datasets utilized in these studies, assessing their size, diversity, and representativeness, as well as the suitability of the evaluation metrics employed to gauge system performance accurately. Through a synthesis of the findings gleaned from the literature survey, researchers gain valuable insights into successful approaches, innovative methodologies, and areas ripe for further investigation. Comparative analyses are often conducted to elucidate the strengths and weaknesses of different approaches, taking into account factors such as scalability, interpretability, and adaptability to diverse agricultural

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Vol. 17, Issue 2, 2024

contexts.

In addition, researchers employ citation tracking as a complementary strategy to ensure the comprehensiveness of the survey, aiding in the discovery of additional relevant sources that might have been overlooked initially. Ultimately, the outcomes of the literature survey are meticulously documented and reported, serving as a foundational resource for guiding future research endeavors and informing the development of robust crop recommender systems grounded in machine learning principles. This process not only contributes to the advancement of knowledge in the field but also provides valuable insights for stakeholders seeking to leverage machine learning for improved decision-making in agriculture.

3. EXISTING SYSTEM

One of the early works developed a dedicated website to assess the impact of weather parameters on crop production in the identified districts of Madhya Pradesh. The districts were selected on the basis of the region covered by the crop. Based on these criteria, the first five top districts 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, soybean, wheat and paddy, for which the yield for a continuous period of 20 years of knowledge, were tabulated. 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 from the user were inputs used in this model. AnAPI was used to predict the weather, 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 in . 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 has been shown to be typically better than the individual

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com

Vol. 17, Issue 2, 2024

models. Random forests ensemble classification uses multiple decision tree models to predict 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. This work also incorporates the clustering of similar crops to get the most accurate results.

Disadvantages

1) An existing model doesn't predict the crop yield for the data sets of the given region.

2) The data sets are not cleaned and pre processed. The null values are not replaced with mean values.

3.1 PROPOSED SYSTEM

In the proposed system, the system has proposed a model that addresses these issues. 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 benefit to maximize the crop yield that will subsequently help to meet the increasing demand for the country's food supplies [8]. The proposed model predicts the crop yield by studying factors such as rainfall, temperature, area, season, soil type etc

The system also helps to determine the best time to use fertilizers. The existing system which recommends crop yield is either hardware-based being costly to maintain, or not easily accessible. The proposed system suggests a mobile-based application that precisely predicts the most profitable crop by predicting the crop yield.

The use of GPS helps to identify the user location. The user provides an area under cultivation and soil type as inputs. According to the requirement, the model predicts the crop yield for a specific crop. The model also recommends the most profitable crop and suggests the right time to use the fertilizers.

Advantages

1. Prediction of the crop yield for specific regions by executing various Machine Learning algorithms, with a comparison of error rate and accuracy.

International Journal of Engineering Research and Science & Technology

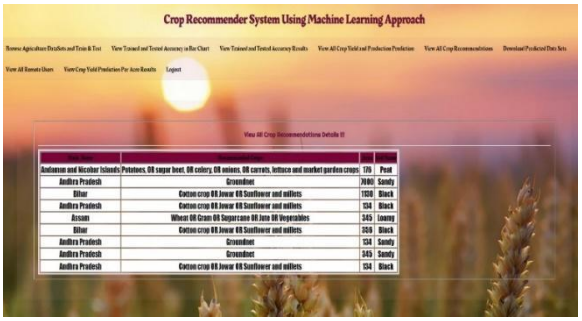
ISSN 2319-5991 www.ijerst.com

Vol. 17, Issue 2, 2024

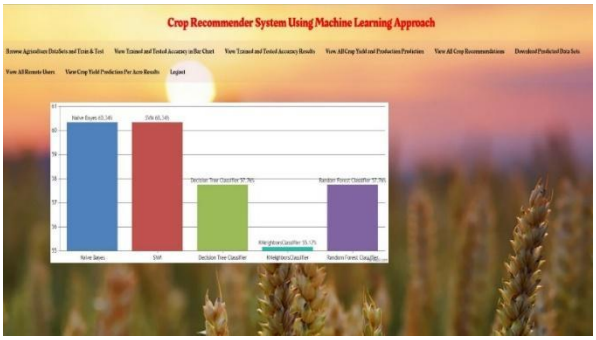
2. A user-friendly mobile application to recommend the most profitable crop.

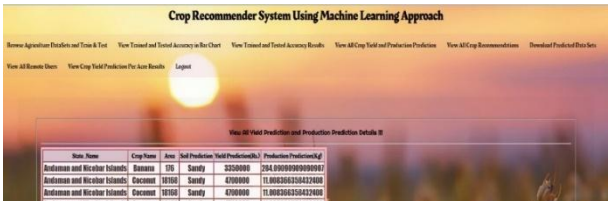
3. A GPS based location identifier to retrieve the rainfall estimation at the given area.

4. A recommender system to suggest the right time for using fertilizers.

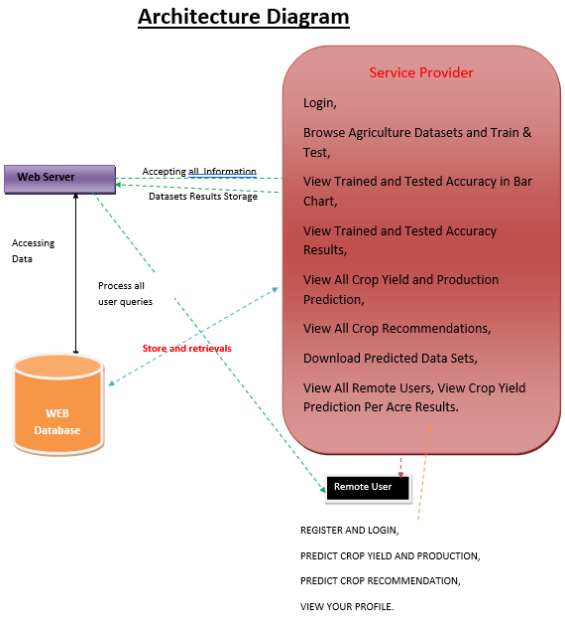


4. OUTPUTSCREENS





5.ARCHITECTURE



6.MODULES

Service Provider

In this module, the Service Provider has to login by using valid user name and password. After login successful he can do some operations such as

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com

Vol. 17, Issue 2, 2024

Browse Agriculture Data Sets and Train & Test, View Trained and Tested Accuracy in Bar Chart, View Trained and Tested Accuracy Results, View All Crop Yield and Production Prediction, View All Crop Recommendations, Download Predicted Data Sets, View All Remote Users, View Crop Yield Prediction Per Acre Results.

View and Authorize Users

In this module, the admin can view the list of users who all registered. In this, the admin can view the user's details such as, user name, email, address and admin authorizes the users.

Remote User

In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful user will do some operations like PREDICT CROP YIELD AND PRODUCTION, PREDICT CROP RECOMMENDATION, VIEW YOUR PROFILE.

7. CONCLUSION

This paper highlighted the limitations of current systems and their practical usage on yield prediction. Then walks through a viable yield prediction system to the farmers, a proposed system provides connectivity to farmers via a mobile application. The mobile 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 to accuracy, various machine learning algorithms such as Random Forest, ANN, SVM, MLR, and KNN were implemented and tested on the given datasets from the Maharashtra and Karnataka states. The various algorithms are compared with their accuracy. The results obtained indicate that Random Forest Regression is the best among the

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com

Vol. 17, Issue 2, 2024

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.

The future work will be focused on updating the datasets from time to time to produce accurate predictions, and the processes can be automated. Another functionality to be implemented is to provide the correct type of fertilizer for the 1070given crop and location. To implement this thorough study of available fertilizers and their relationship with soil and climate needs to be done. An analysis of available statistical data needs to be done.

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