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PRECISION CROP CARE RECOMMENDER SYSTEM USING ML

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Abstract : Agriculture is the primary industry in India and provides employment and generates income. However, Indian farmers often face issues with low productivity due to incorrect crop selection and fertilizer usage. The Precision Crop Care Recommender System is a modern farming technique that utilizes research data on soil characteristics, crop production statistics, and soil types to suggest the optimum crop and fertilizers to farmers based on their specific location. This system significantly boosts production and reduces the number of times farmers pick the wrong crop. The recommendation system employs machine learning models such as Random Forest, Naive Bayes, Support Vector Machine, and Logistic Regression for high accuracy and efficiency. The fertiliser suggestion system is based on Python logic. The system compares the crop's ideal nutrients with the user-entered information to suggest fertilizers based on the nutrient's variation classification as HIGH or LOW.

Keywords **– Machine Learning, Algorithms, Random Forest, Recommender System, Agriculture.**

I. INTRODUCTION

A farmer's decision on which crop to grow is often influenced by irrelevant factors like the desire for quick profits, lack of awareness about market demand, or overestimating a soil's potential. A poor decision by the farmer could result in financial strain for the family and contribute to the high number of farmer suicides in India. With agriculture contributing to a significant portion of India's economy, it is crucial to provide farmers with tools to make informed decisions about crop selection. To address this need, we propose an intelligent system that considers environmental and soil parameters to recommend the most suitable crop for a particular season. Additionally, the system provides fertilizer suggestions based on the optimal nutrients required for the recommended crop. By leveraging this system, Indian farmers can make informed decisions and improve their productivity, ultimately benefiting their families and the larger economy.

Farmers often make decisions on what crop to grow based on intuition and irrelevant factors such as market trends, soil sustainability, and financial desperation. However, these decisions can have devastating consequences on their families and the economy as a whole. In India, where agriculture and related industries contribute to a significant portion of the Gross Value Added, the wrong crop choice can lead to financial strain and even farmer suicide cases. Therefore, the decision of which crop to grow is a critical one and should be made with careful consideration and informed guidance.

An important need is to develop a system that can provide Indian farmers with predictive information, allowing them to make informed decisions about which crops to grow. To address this need, we suggest an intelligent system that assesses various environmental factors such as temperature, rainfall, and geographic location, as well as soil characteristics including N, P, K, pH value, soil type, and nutrient concentration. This system would then recommend the crop that is most suitable for the farmer's requirements. In addition, the system would also provide a recommendation for fertilizers based on the ideal nutrient requirements of the selected crop. This approach can help Indian farmers make better decisions and increase their chances of success in agriculture.

II. RELATED WORKS

Authors [1] proposed a system for water management systems and improved current irrigation techniques in their work, "Low-cost IOT + ML design for smart farming with multiple application." An IoT and ML-based agricultural system constantly keeps farmers informed of the potential weather patterns and offers the best recommendations for crops and irrigation techniques, resulting in increased production.

In article [2], the authors put forth a smart system that may help farmers manage their crops by taking into account sensed data (temperature, humidity), as well as other parameters (soil type, farm location, rainfall), which indicate the crop that would do best in that environment.

Using four modules and the well-known machine learning method MODIFIED SUPPORT VECTOR REGRESSION, Reference Paper [3] calculates real-time sampling of soil parameters. The modules comprise analysing the real-time sensor data, an IoT device interfaced sensor, an agricultural cloud, and an agricultural user interface (AUI). The first module is a mobile Internet of Things device (NodeMCU) with environmental sensors including pH and soil moisture sensors. Processing of various crops and tiny plants recommended using a modified support vector machine method is part of the real-time data analysis module. A simple web interface is the agri-user interface. Thus, with the aid of soil attributes and a modified support vector machine, a farmer will be able to determine the kinds of crops and tiny plants that may be cultivated on farmland.

IOT and machine learning are two of the new technologies that the author of article [4] proposes using. Using an IOT system, real-time data from the field may be gathered. The trained model receives input from the field area's gathered data. Then, using the data, the trained model generates the predictions. The model's output significantly aids in planting the appropriate crops in the targeted field area.

In the reference work [5], it is established that a model is put out for predicting the kind of soil and suggesting a crop that may be grown in that soil. Different machine learning techniques, including KNN, SVM, and logistic regression, have been used to evaluate the model. The current model is the most accurate of the ones currently in use.

III. EXISTING MODEL

Researchers have become increasingly aware of the problems faced by Indian agriculture and are working hard to find solutions. One way is to use advanced techniques like Regularized Greedy Forest to determine the best crop sequence for a given time period. Another approach involves using historical meteorological data to train a model that can identify weather patterns that could harm apple production. The model can then predict the apple yield based on monthly weather patterns. The use of various algorithms such as Artificial Neural Network, K Nearest Neighbors, and Regularized Greedy Forest has been demonstrated to help select the best crop based on predicted yield rates, which are influenced by multiple factors. Additional features of the system include pesticide prediction and online trading for agricultural commodities. These efforts can help Indian farmers make better decisions and increase their chances of success in agriculture.

Upon conducting further research, it has been discovered that researchers and others involved in crop care are primarily focusing on either soil or weather conditions, but not both factors together. It is important to consider both of these factors as they play crucial roles in crop growth and success. By taking a comprehensive approach that considers both soil and weather conditions, better solutions can be developed for crop care and yield optimization.

IV. PROPOSED MODEL

In order to address the drawbacks mentioned above, we have developed an efficient Crop Recommendation system. This system considers all the relevant parameters, such as temperature, rainfall, location, and soil condition, to predict the most suitable crop for farmers to grow. Essentially, this system serves as an Agro Consultant, providing farmers with expert recommendations on which crops to grow. Additionally, we offer fertilizer recommendations for crops grown in different states, making it easy and reliable for farmers to plan and make informed decisions about their crop choices.

The implementation of a crop care recommended system is a new technology that allows for the different connections like database,csv files. This enables farmers to access real-time data and make informed decisions to optimize their production.By using this system, farmers can gather data on various aspects of their crops, including soil moisture, temperature, humidity, and nutrient levels. This information can help farmers make informed decisions about how to care for their crops and can lead to increased efficiency and productivity.The use of this technology can also reduce the need for manual labor, streamline the agricultural process, and provide a more sustainable approach to farming. Additionally, it can help farmers detect issues such as pest infestations and soil nutrient deficiencies in a timely manner, allowing them to address these problems before they become major issues.

An agricultural management system utilizing a crop care recommended system has the potential to serve multiple purposes including soil and crop monitoring, water resource management. The system monitor soil moisture, temperature, humidity, nutrient levels, and other soil properties to ensure optimal crop growth.The real-time data gathered and provide valuable insights into crop and soil conditions, enabling farmers to make informed decisions about crop care and management. This can lead to increased efficiency, productivity, and sustainability in agriculture.By providing farmers with real-time data and insights, they can make informed decisions about which crops are suitable for their land based on the NPK (Nitrogen, Phosphorus, and Potassium) value.

The crop care recommended system can provide farmers with accurate and up-to-date information about the nutrient levels in their soil, which can help them determine which crops are best suited for their land. The NPK value is an important indicator of soil fertility, and by monitoring this value, farmers can make informed decisions about which crops will thrive in their particular soil conditions.The first step in building a crop care recommended system is to identify the various components needed to monitor and collect data, including the NPK value. This includes sensors, actuators, and other pieces of hardware that can be used to monitor soil moisture, temperature, humidity, nutrient levels, and other soil properties.

Once the data is collected, it can be analysed and used to make better decisions about when and how to apply fertilizer, water, and other elements of the agricultural process. This can help farmers optimize their crop production and increase yields while reducing waste and environmental impact.

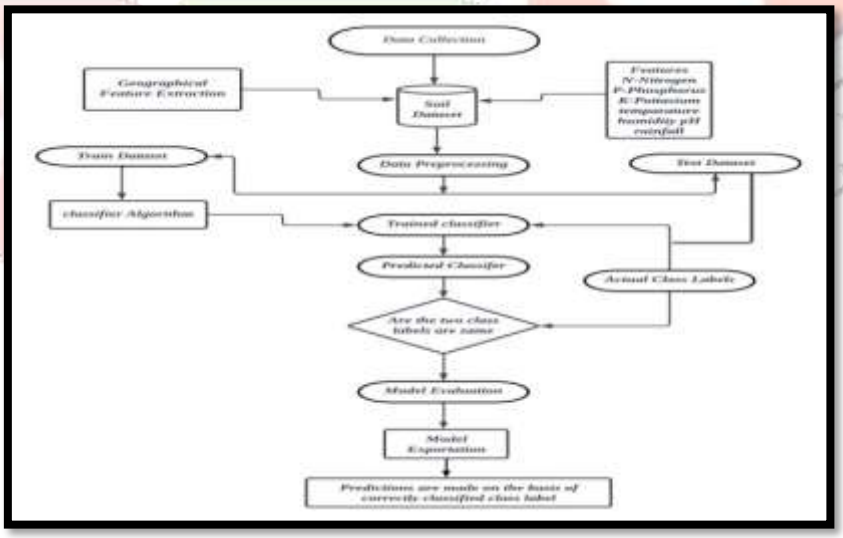

Fig 1 – Proposed model plan

V. RESULTS AND DISCUSSION

The performance analysis of crop care recommended system It has revolutionized By connecting devices, sensors, and other data points across a network, It can gain insights into the performance of their operations in real-time. This can be used to leading to improved efficiency and cost savings for farmer.Crop care recommendation systems are an important tool for modern agriculture, providing farmers with the information they need to optimize their crop yields while minimizing inputs such as water, fertilizer, and pesticides. These systems use a variety of data sources, including weather data, soil sensors, and satellite imagery, to provide farmers with personalized recommendations on when and how to irrigate, fertilize, and control pests and diseases.

The results of crop care recommendation systems can be significant, leading to increased crop yields, reduced inputs, and lower costs for farmers. These systems can also improve environmental sustainability by reducing the amount of water and chemicals used in agriculture.One example of a successful crop care recommendation system is the GreenSeeker system developed by the Noble Research Institute. This system uses sensors to measure plant reflectance and provide farmers with recommendations on fertilizer application rates. A study by the Noble Research Institute found that using the GreenSeeker system led to a 7-14% increase in crop yields and a 10-20% reduction in fertilizer use.

However, there are also challenges associated with crop care recommendation systems. One of the biggest challenges is the need for accurate data inputs, including weather and soil data. These inputs can be difficult to obtain in some regions, particularly in developing countries where agricultural infrastructure may be limited.Another challenge is the need for effective communication between farmers and the companies or organizations providing the recommendation systems. Farmers may be hesitant to adopt new technologies or may not understand how to interpret the recommendations provided by the systems.

In conclusion, crop care recommendation systems have the potential to significantly improve agricultural productivity and sustainability, but their success depends on accurate data inputs and effective communication between farmers and technology providers. Ongoing research and development of these systems will be important to overcome these challenges and further improve crop yields and environmental outcomes in agriculture.

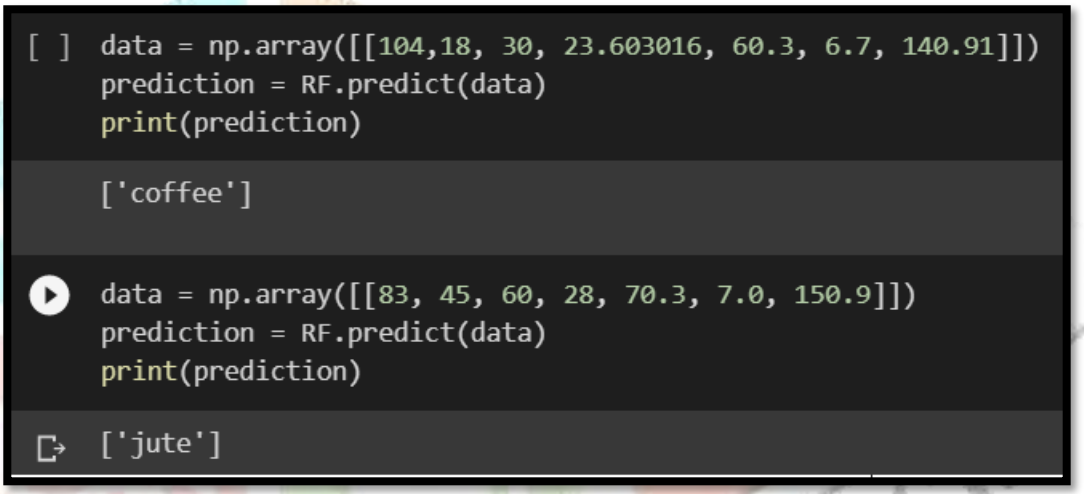

Fig 2 – Output of model

Algorithm	Accuracy (%)
Decision Tree	90%
SVM	97%
Logistic Regression	95%
Random Forest	99%

Table 1 – Accuracy of algorithms

VI. CONCLUSION

This technology assists the farmer in selecting the best crop by offering information that most farmers do not monitor, reducing the likelihood of crop failure and boosting output.The system that recommends the right crop to farmers can provide useful information that can help reduce the risk of crop failure and increase productivity. It can also help prevent financial losses. The system can be accessed online by millions of farmers across the country. We have achieved high levels of accuracy, ranging from 70.06 percent to 95.09 percent, using various models such as Decision Trees, Support Vector Machine, Logistic Regression and

Random Forest algorithms. Our next goal is to integrate the crop recommendation system with a yield predictor subsystem that can give farmers an estimate of their potential production if they follow the recommended crop.

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