International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 07, July-2023

Smart Agriculture for Crop Productivity using Machine Learning

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I. Abstract

India is an Agriculture based economy whose most of the GDP comes from farming. The motivation of this project comes from the increasing suicide rates in farmers which May be due to low harvest in crops. Climate and other environmental changes have become a major threat in the agriculture field. Machine learning is an essential approach for achieving practical and effective solutions for this problem. Predicting yield of the crop from historical available data soil, rainfall parameters and historic crop yield. We achieved this using the machine learning algorithm.

Keywords—crop prediction, agriculture, machine learning.

II. Introduction

Every person's life depends heavily on agriculture. It is crucial for survival in the first and most important way. For decades, agriculture has been the most well-known profession in India. The expansion and development of India's economy have been significantly influenced by agriculture. Speaking of India, agriculture is the foundation of the country's economy, thus switching from conventional farming methods to the greatest and most innovative ones will always improve the situation. In India, the rural economy is approximately 70% dependent on agriculture. However, over a ten-year period, between 1.4 and
1.8 farmers in India committed suicide. Crop damage brought on by improper crop rotation causes farmers to suffer large losses. The farmer's intuition and other unimportant considerations, such as the need for quick money, an exaggerated belief in the land's ability to produce yields, and a lack of vital market knowledge, frequently override his or her decisions regarding which cropto plant.

Crop forecast used to be based on yield experiences from the previous year, but today's variable weather, soil conditions, etc. have a significant impact on the yield. To boost productivity, it is also necessary to identify plant illnesses as soon as possible. By suggesting a good crop that may be produced in a given area and at a specific time for a higher yield, machine learning algorithms can be a huge assistance in theagriculture business. For sustainable

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intensification and efficient resource use, crop yield prediction is a crucial but challenging topic. Every farmer is curious about the yield that will be produced and whether it will meet their expectations.

III. LITERATURE REVIEW

Different studies considered various ways to predict agricultural Yield through machine learning techniques to enhance crop yield. They have used multiple approaches to recommend and predict crops and their Yield accordingly. This section will discuss the procedures considering their limitations and strengths to find suitable methodologies to conduct further study.

In [1], the dataset included a number of characteristics that were taken into account to forecast the production of agricultural products, such as rainfall, temperature, and season. The accuracy attained with this method was greaterthan 75%.

The Sorghum Yield Prediction [2] focuses on a single crop production of sorghum using linear regression and a convolution neural network (CNN). The detection of the sorghum yield has an accuracy of 74.5%. The weight estimation has an average precision of 99%. Additionally, because the dataset originated in America, it might not implement the model of Indian crop productivity. The Paddy Yield predictor [3] discusses the necessity to extend the implementation to non- paddy crops as well. By taking into account extra factors such the chemical presence of phosphorus, nitrogen, and zinc in the soil, the work can be improved to anticipate the better association rule.

When used for more crops in more locations, it might have a more diversified applicability.

In [4], The K-nearest neighbors (KNN) algorithm, a machine learning technique, uses real-time values to advise the crop that would grow the best in a certain field. Crop needs are stored in a standardised dataset. Real-time readings are taken by sensors, and the results are relayed to a cloud server. The system recommendsthe field's ideal crop.

In [5], utilises the ARIMA model to estimate the crop-suggesting pH, moisture, and temperature variables. In this, input values from the database are used to predict values for a future period of time. This is applied to crop forecasting. After that, the K means algorithm is applied to the projected categorization values, resulting in the creation of k clusters of crops. The KNN algorithm can forecast N appropriate crops.

In [6], employs an Internet of Things (IoT)-based zonal irrigation system to control irrigation by keeping track of soil moisture. In agriculture, managing irrigation effectively is a challenge. Here, the goal is to optimise the growing environment while cutting down on energy and water waste. The system sends an ON/OFF instruction to the user after comparing the sensor's values with the matching value in the database.

In [7], Real-time sampling of soil parameters is determined using a well-liked machine learning approach called Modified Support Vector Regression. It has a mobile IoT device (NodeMCU), sensors that measure soil moisture and pH, an agricultural cloud for data storage, an analysis tool that uses a modified Support Vector Machine algorithm to process the crop type, and a simple web interface called the Agri user interface. (AUI). With the help of the proposed soil attributes, the farmer will be able to choose the best crop to plant.

In [8] use machine learning algorithms like the Kohonen Self Organizing Map and the Back Propagation Network. The technology evaluates the soil's quality to predict the crop. The dataset is trained to distinguish between organic, inorganic, and real estate soil types. To reduce error in the result, the accuracy provided by various network learning algorithms is compared.

In [9], To test the model, a sample of two consecutive years was taken. They used k-nearest neighbor and M5-Prime methods. Thus, it acquired the highest average correlation factors, the lowest average MAE (Mean Absolute Error), the lowest average RMSE (Root Mean Squared Error), and the lowest average RRSE (Root Relative Squared Error Loss Error). The most crop yield models with the fewest errors were produced by the M5-Prime. In the end, it was determined that this was a very suitable implementation for large crop yield prediction in the planning and estimation of agricultural yield sectors. The model's training dataset, however, was somewhat limited. The number of records was restricted to 6000, which could lead to an

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over-fitting of the model when employing ML techniques.

In [10], It is described how neural networks can be strengthened for in-depth learning to achieve a precise aesthetic state that significantly exceeds even human ability. A thorough understanding enables trainees to clearly distinguish between tasks and the text, image, or audio documents that are provided. The study on the learning depth of neural network architectures which are employed in many systems to have accurate classification and automatic feature extraction is presented in the paper.

IV. EXISTING SYSTEM

The Temperature sensor, PH sensor, soil moisture sensors are used for the crop prediction technique. The Temperature sensor used for sense the temperature of soil around 10 meters. The pH sensor used for sensing the data from surrounding area to detect the soil alkaline or acidic which will help for the sustainability of crop. The datas of both Temperature sensor and PH sensor are transferred by Raspberry Pi through internet. Data will be processed and provide the predicted data. Data will be processed and provide the predicted data. Data will be processed and provide the predicted data. Data will be processed and provide the predicted data. If the Moisture level of soil is lower than the crop requirement then the motors are switched ON until the moisture level of soil reaches the required moisture level.

- ❖ TEMPERATURE SENSOR

  The temperature sensor(DHT11) senses the temperature and humidity of the surrounding area. DHT11 has four pins VCC, DATA, NC, and GND.

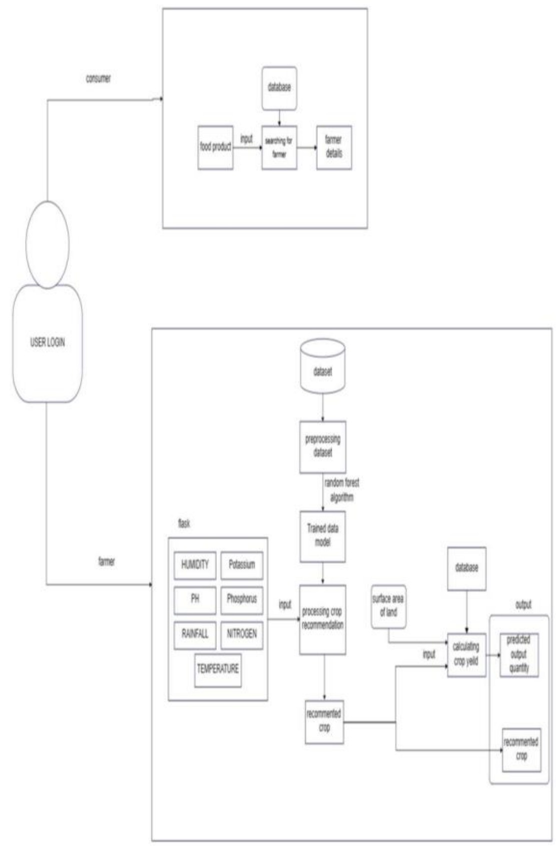
- ❖ SOIL MOISTURE SENSOR

  The soil moisture sensor is connected to the amplifier which converts the low input into high input. The Amplifier has four pins VCC, GND, A0, and D0.

- ❖ pH SENSOR

  The pH sensor module interfaced to Raspberry Pi using MCP3008.The pH sensor module has three pins VCC, GND and OUT.

PROPOSED SYSTEM ARCHICTECTURE



In this proposed system, there are two categories ofuser logins: farmer logins and consumer logins.

- ❑ Farmer

  A model can be trained to recommend crops based on the inputs of some factors that are present in agricultural land, like potassium, phosphorus, nitrogen, temperature, humidity, pH, and rainfall. The yield of the crop can be predicted by determining the surface area of agricultural land.

- ❑ Consumer

  Recommending the farmer who has the stack of products needed by the consumer by usinga database management system.

  The model for recommending crops can be trained by using a random forest algorithm with anaccuracy of 99.3%.

  Random Forest is a classifier that contains a number of decision trees on various subsets of

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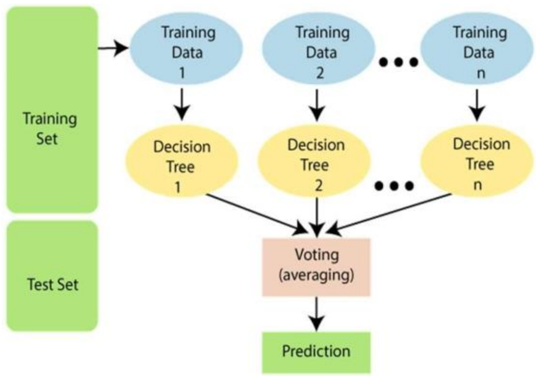
the given dataset and takes the average to improve thepredictive accuracy of that dataset.



The random forest algorithm has a greater accuracy score than other algorithms.

	precision	recall	f1-score	support
apple	1.00	1.00	1.00	31
banana	1.00	1.00	1.00	32
blackgram	0.97	1.00	0.99	35
chickpea	1.00	1.00	1.00	39
coconut	1.00	1.00	1.00	30
coffee	1.00	1.00	1.00	32
cotton	1.00	1.00	1.00	28
grapes	1.00	1.00	1.00	33
jute	0.94	0.97	0.95	31
kidneybeans	1.00	1.00	1.00	30
lentil	0.96	1.00	0.98	26
maize	1.00	1.00	1.00	29
mango	1.00	1.00	1.00	29
mothbeans	1.00	0.95	0.97	39
mungbean	1.00	1.00	1.00	31
muskmelon	1.00	1.00	1.00	31
orange	1.00	1.00	1.00	40
papaya	1.00	1.00	1.00	43
pigeonpeas	1.00	1.00	1.00	32
pomegranate	1.00	1.00	1.00	38
rice	0.97	0.95	0.96	40
watermelon	1.00	1.00	1.00	27
accuracy			0.99	726
macro avg	0.99	0.99	0.99	726
weighted avg	0.99	0.99	0.99	726

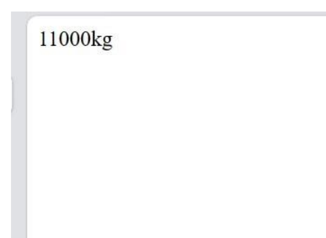
V. RESULT

The below figure is flask application to get the input of7 parameters to predict the suitable crop for that land.

The below figure indicates that Rice is suitable crop for that land. It can be recommended based on the 7 parameters which are getting from the farmer.

The below figure indicates that the surface area of theagricultural land is getting from the user.

The below figure shows the amount of output from the cropin Kilogram.



VI. CONCLUSION

If the farmer not aware of which crop is suitable for his land, then our project is used to recommend him the suitable crop for his land by getting the inputs of 7 parameters like Nitrogen, Phosphorus, Potassium, Temperature, rainfall, PH, Humidity. The farmer can also predict the amount of output of the crop. By this project the consumer and farmers interacts each other, it leads to consumers can buy the products directly from the farmer.

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