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Crop Forecasting and Skillful Handling of Soil Nutrient Crop and Fertlizer Recommendation

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Abstract: *Crop are always in demand in the country, not only for the lives of the people, but also for economic growth, so growing crops is of utmost importance. Using standard technology also increases efficiency and lessens the workload of the farmer. Therefore, in order to increase productivity, it is important to know about soil moisture and types of crops. Each variety of crop and the associated soil requires a particular amount of nutrients so the project need to make the most of what is available. In order to achieve this, it must utilize modern technology and tools. In country like India majority of the population is dependent on agriculture for their livelihood. In this project we present crop and fertilizer recommendation respectively. In crop recommendation application, based on soil data from their side and the application will predict which crop the user should grow. For the fertilizer recommendation application depending on soil data and type of crop they are growing application will predict the fertilizers.*

Keywords: Crop Forecasting

I. INTRODUCTION

Agriculture is the pillar of any industrialized country's economy. Consumes 85% of the available fresh water. Utilization can be optimized by observing soil humidity, which is useful for crop production. Indian agriculture sector accounts for 18 percent of India's GDP and provides employment to 50% of the country's workforce. But latest studies have shown a steady decline in the contribution made by agriculture to the Indian economy although it is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India.

Type of soil plays a important role in the yield of crop. Recommending fertilizers help the farmers to make the best decision for their crop growth. For the better yield we need to consider the soil type and soil fertility. Achieving the maximum crop growth is the major goal of the project.

In this paper we present the efficient use of fertilizers based on the crop recommended from the application developed. This helps to increase the yield of crops.

II. LITERATURE SURVEY

S. Bhanumathi, M. Vineet and Rohit in 2019 made an effort in order to know the crop production analysis and is processed by implementing both the random forest algorithm and backpropagation algorithm. These models were experimented with different types of crops in various regions across India to predict the output. Even fertilizers data was trained using back propagation algorithm and evaluated to get the result of how much nitrogen, phosphorus is required for the area of land. Both the models for crop production were compared in predicting the output and by various parameters with respect to the error rate.

They compared the error rate obtained while comparing the random forest and backpropagation where we got the error rate lesser to the random forest then back propagation while predicting the output for both the models and the compassion is plotted in the graph. For prediction of the yield the user will enter the data. User should enter the details one after another then the output of yield prediction is shown. The obtained result will be helpful for the farmers to know the yield of the crop so, he can go for the better crop which gives high yield and also say them the efficient use of fertilizer so that he can use only the required amount of fertilizers for that field. This way we can help farmers to grow the crop which gives them better yield.

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In July 2017 group of researchers Sabina Rahaman, Harshitha M, Anusha R, and Chandana M from department of electronics and communication BMS Institute of Technology, Bangalore have invented a research which detects NPK Ratio Level Using SVM Algorithm and Smart Agro Sensor system they have integrated a sensing module with an Image processing setup to monitor the essential details needed for plant growth from the soil. As inputs, they have got Temperature/Humidity, Soil Moisture, and PH level. Which means those things directly affect to the fertilizer level of the soil. Furthermore, Image Acquisition, enhancing the image using Grey scale analysis, Adaptive Histogram analysis, and feature extraction Methods have used by the research team for better results.

The soil parameters like temperature, moisture, PH, humidity and light are monitored using various sensors. The values obtained are converted to digital using an Analog to Digital converter and serially sent to the cloud through a Raspberry pi. Finally, the output is displayed in the laptop/mobile application. The system supervises the overall soil characteristics with the aid of IOT. In order to maintain efficient crop productivity, soil parameters namely: PH level, soil moisture, temperature and humidity are continuously monitored using sensors. A system is designed where the fertility of soil is improved, and the quality of the soil can be increased by the development of optimal transducer. The amount of NPK are obtained as low, medium and high. An Arduino microcontroller is used for data acquisition and the analog output is converted to digital.

A system is designed where a microcontroller-based device is connected to the EC sensor, PH sensor and a color sensor. The values are read from the sensors and transmitted to a mobile application over Bluetooth serial communication. A system used for the detection of the soil parameters and the PH level with the aid of artificial neural network and image processing techniques respectively was proposed.

C. P. Wickramasinghe and his team in 2019 through there project, authors have analyzed that can make the agricultural industries more efficient and profitable with the aid of technology. This project puts forward a solution based on IOT.

Madhumathi R, Arumuganathan T, Shruti R 2020 The output for various soil parameters for different soil samples are obtained through this system and the recommendation quantity of fertilizers are suggested which minimizes the usage of excess fertilizers there by maximizing the yield.

Usman Ahmed in 2021 This paper proposed an improved genetic algorithm (IGC) to recommend an optimal setting for nutrients to different crops.

Researchers, B. Milovic and V. Radojevic have done research on the importance of data mining in Agriculture. In order to maintain the growth of the selected crop and generate a fertilizer plan to handle widely distributed data set with the nutrient levels the plant need in different time periods. They have used data mining techniques to organize the data set and gather the required data by using patterns and algorithms.

There are many type of data mining techniques that can be used for agriculture according to there research. As an example, they have used K-nearest neighbor for simulating daily precipitations and other weather variables and estimating soil water parameters and climate forecasting. And Neural Networks for the forecasting of water resources variables in agriculture.

III. PROBLEM STATEMENT

The production of agriculture is affected by several climate factors. Like metrological parameters (Humidity, wind speed, temperature) soil parameters (PH, organic carbon, phosphorus, fiber etc.) And due to continuously change in climate conditions everything is messed.

In India farmers still follow the traditional technology which they adopted from their ancestor. But the problem is that in earliest time climate was very healthy everything has happened on time. But now most of the things have been changed due to global warning and many other factors. The main problem with agriculture in India is lack of rainfall in seasonal time.

To overcome these above issues, we need to develop a system which will able to find the hidden facts or results, patterns and insights. The farmer can predict which crop should sow so that he can get more benefit. In proposed system we are applying data analytics technique on agriculture production- based datasets and find the insight so that it can help to the farmers and their decision making.

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IV. EXISTING SYSTEM

This section provides the proposed methodology used for crop and fertilizer recommendation. The purpose of crop and fertilizers recommendation is to estimate production in agriculture sector for better crop management and make strategic decisions for improving crop yield in future. The existing model can be incorporated with a decision support system that can be used in precision agriculture which aims at complete farm management.

V. PROPOSED SYSTEM

Recommendation of the crop using the efficient algorithm and suggest how much quantity of fertilizer should be used to get the proper yield for the crop using random forest algorithm. The data mining techniques on historical climate and crop production data several predictions are made which increase the crop productivity.

The decision support system must be implemented for the farmers to take proper decisions about soil and crop to be cultivated. we have collected the dataset with attributes of the crop season, area and production in hectares and analyzed with various algorithms.

VI. METHODOLOGY

The data analysis is process of inspecting cleansing, modelling data with the goal of discovering useful information and conclusions. It is a process of analyzing, extracting and predicting the meaningful information from huge data to extract some pattern. This process is used by companies to turn the raw data of their customer to useful information. This analysis can also be used in the field of agriculture. Agricultural researchers insist on the need for an efficient mechanism to predict and improve the crop growth and majority of research works in agriculture focus on biological mechanisms to identify crop growth and improve its yield. The outcome of crop yield primarily depends on parameters such as variety of crop, seed type and environmental parameters such as sunlight (Temperature), soil (PH),, water (PH), rainfall and humidity. By analyzing the soil and atmosphere at particular region best crop in order to have more crop yield and the net crop yield can be predicted. This prediction will help the farmers. To choose appropriate crops for their farm according to the soil type, temperature, soil ph, npk, fertilizer and months.

India is a highly populated country and randomly change in the climatic conditions need to secure the world food resources. Farmers face serious problems in drought conditions. Type of soil plays a major role in the crop yield. Suggesting the use of fertilizers may help the farmers to make the best decision for their cropping situation. The number of studies information and communication technology can be applied for recommendation of crop.

Smart agriculture is the way of conveying information from traditional farmers to the educated farmers. To obtain estimates of aggregate physical production functions for the yield of various crops in specified states, considering various technological factors and a newly developed weather index as inputs.

6.1 Crop Recommendation

The outcome of crop recommendation primarily depends on parameters such as variety of crop, seed type and environmental parameters such as sunlight, ph, npk. By analyzing the soil and atmosphere at particular region best crop in order to have more crop in order to have more crop yield and the net crop yield can be predicted. This prediction will help the farmers. To choose appropriate crops for their farm according to the soil type, temperature, ph, fertilizers.

6.2 Fertilizer Recommendation

India is a highly populated country and randomly change in the climatic conditions need to secure the world food resources, farmers face serious problem in drought conditions. Type of soil plays a major role in the crop recommendation. Suggesting the use of fertilizers may help the farmers to make the best decision for their cropping situation. Based on soil type and soil PH we suggest what kind of fertilizer should be used for particular crop.

6.3 Random Forest Algorithm

Random forest algorithm is a supervised classification algorithm. We can see it from its name, which is to create a forest by some way and make it random. There is a direct relationship between the number of trees, the more accurate the result. But one thing to note is that creating the forest is not the same as constructing the decision with information gain or gain index approach.

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VII. HOW RANDOM FOREST ALGORITHM WORKS?

There are two stages in Random Forest algorithm, one is random forest creation, the other is to make a prediction from the random forest classifier created in the first stage. The whole process is shown below, and its easy to understand using the figure.

Firstly shows the random forest creation pseudocode:

1. Randomly select **"k"** features from total **"m"** features where **K<<m**
2. Among the **"K"** features, calculate the node **"d"** using the best split point
3. Split the node into **daughter nodes** using the **best split**
4. Repeat the **a to c** steps until **"l"** number of nodes has been reached
5. Build forest by repeating steps a to d **"n"** number of times to create **"n"** number of trees

F11	F12	F13	F14	F15	T1
F21	F22	F23	F24	F25	T2
:	:	:	:	:	:
:	:	:	:	:	:
Fm1	Fm2	Fm3	Fm4	Fm5	Tm

F11	F12	F13	F14	F15	T1
F81	F82	F83	F84	F85	T8
:	:	:	:	:	:
:	:	:	:	:	:
Fj1	Fj2	Fj3	Fj4	Fj5	Tj

F21	F22	F23	F24	F25	T2
F51	F52	F53	F54	F55	T5
:	:	:	:	:	:
:	:	:	:	:	:
Fm1	Fm2	Fm3	Fm4	Fm5	Tm

F31	F32	F33	F34	F35	T3
F61	F62	F63	F64	F65	T6
:	:	:	:	:	:
:	:	:	:	:	:
Fk1	Fk2	Fk3	Fk4	Fk5	Tk

In the next stage, with the random forest classifier created, we will make the prediction. The random forest prediction pseudocode is shown below:

1. Take the test features and use the result of each randomly created decision tree to predict the outcome and store the predicted outcome(target)
2. Calculate the votes for each predicted target
3. Consider the high voted predicted target as the final prediction from the random forest algorithm

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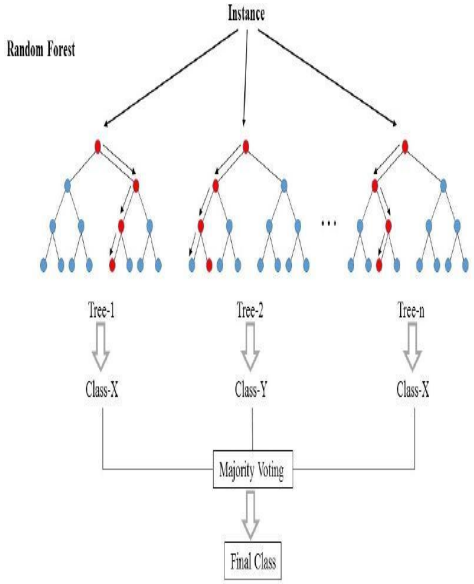
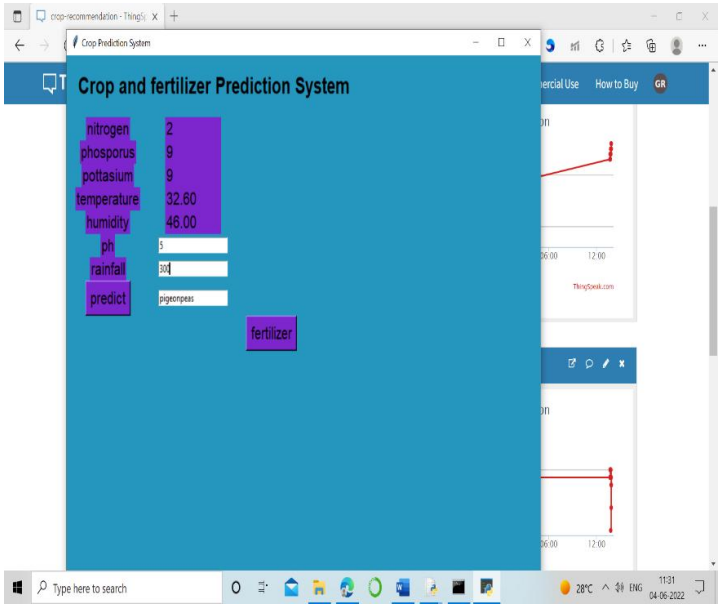


VIII. RESULT/PERFORMANCE ANALYSIS

Analysis is the processing of breaking a complex topic or substance into smaller parts to gain a better understanding of it. Analysts in the field of engineering look at requirements, structures, mechanisms, and systems dimensions. Analysis is an exploratory activity. The analysis phase is where the project lifecycle begins. The analysis phase is where you break down the deliverables in the high -level project charter into the more detailed business requirements.



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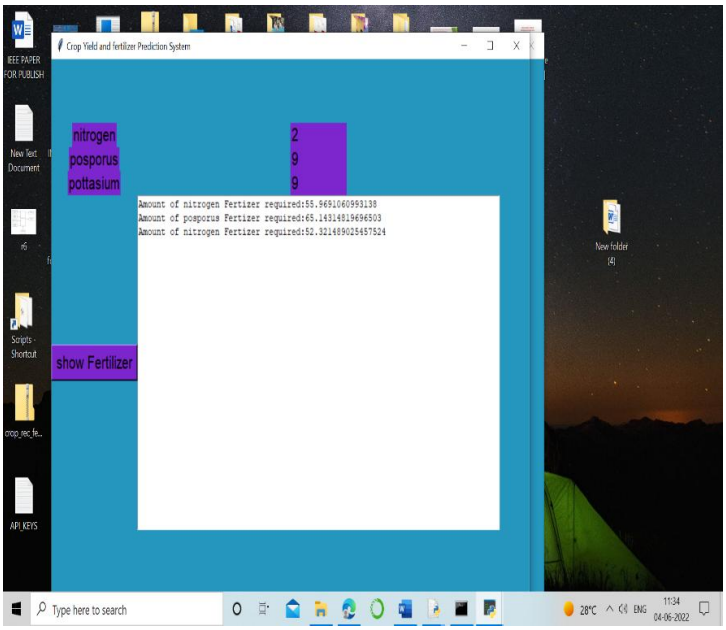

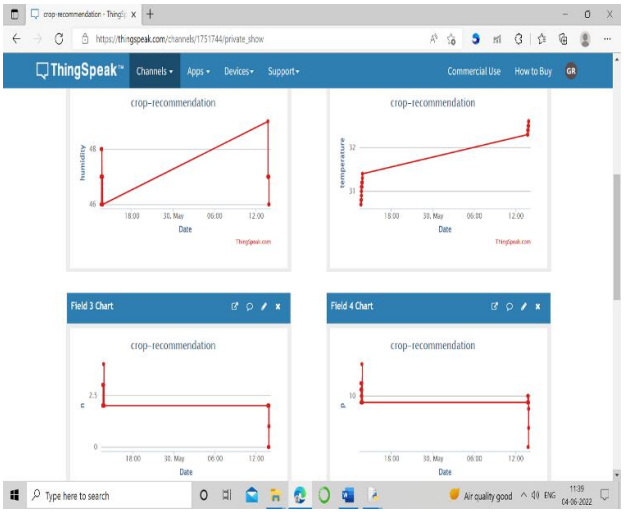

The output of this paper is that it recommends both the crop and fertilizers based on the data gathered by testing the soil with the help of sensors. The tested data from Arduino is dumped into the system and then the output graph is displayed with the help of thingspeak. Based on the data collected from the graph the NPK and temperature values are taken and then the crop and fertilizers are recommended.

IX. CONCLUSION

Agriculture is the backbone of countries like India. However the usage of technology towards agriculture is to be given paramount importance towards agriculture. This paper propose a system which will help farmers to have an idea of crop to be grown based on many parameters using this farmer can make decisions on whether to grow that particular crop or go for alternate crop in case recommendations are unfavorable. This research work ca be enhanced to next level. We can build a recommender system of agriculture production and distribution for farmers. By which farmers can make decision in which season which crop should be grown so that they can get more benefit.

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