Soil Analysis and Crop Fertility Prediction

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Abstract : Agriculture highly depends upon climate, topography, Soil and biology. In which soil plays an important role. In India farming is done traditionally, farmers do farm traditionally without knowing quality and content of the soil. The existing method of soil testing is done by sending the soil sample to laboratories for testing and these testing is time consuming and costly even many time farmers have to travel long distance for soil testing. There are chance of incorrect report due to human error. To overcome this all things, we proposed a system which gives accurate results for soil analysis by taking the pH value and converting it into Nitrogen (N), Phosphorus (P), Potassium (K) values from the soil. We are using Data mining technique which focuses on large data sets to extract information for prediction of crops and we will also provide suitable fertilizers prediction required for the land with predicted fertilizers price.

IndexTerms **- Soil Analysis, pH meter, NPK, Data mining, Fertilizers prediction.**

I. INTRODUCTION

In India, agriculture is one of the important sectors as 50% workforce is involved in agricultural activities. India accounts for 7.68% of total global agricultural output. Agriculture sector in Indian economy is much higher than world's average (6.1%). As Traditional farms in India still have some of lowest per capita productivity and farmer incomes due to lack of development of technology in agricultural sector. As Agricultural sector require a lot of human efforts to do different kind of task like watering crop, cultivating crop, spreading pesticides etc. Soil analysis is important methodology as it gives nutrients present in soil such as NPK values and pH value. By the proposed system human efforts will reduced by monitoring the content and quality of soil by using suitable sensors. Depending on value of NPK our System will predict the list of crops. So according to the list of Fertilizer for the predicted crop is suggested. More economical use of fertilisers and better soil management practices for increasing agricultural production. So that farmers will overcome the exiting method drawback.

II. LITERATURE REVIEW

In the existing system it determined the basic constituents of soil like pH and electrical conductivity which majorly affect the quality of soil. This system includes portable device which is made up using pH and EC sensors and Arduino board along with the analog to digital converter. Sensors sensed the pH and EC of particular soil sample gives the value to the Arduino board in real time. Analog to Digital Converter is used to convert analog pH. value to digital value. Arduino board requires 9V power supply which is given by adapter and sensors require 3.3V-5V power. With the help of Arduino, pH value is converted into Nitrogen, Phosphorus and potassium which determines the soil quality. Arduino displayed NPK values on display screen and farmer have to manually enter NPK values in his own remote device application. Application will give digitally generated fertility report which contain suitable crops and required fertilizer.

III. PROPOSED SYSTEM

The primary objective of this system is to classify the soil according to the nutrients into it. For this, the team has taken datasets of soil samples. The soil will be classified using decision tree algorithm and type of soil will be displayed. Also, the proposed model is going to predict the crops suitable for the particular type of soil.
In addition to this, the team is going to improve the soil if the farmer wants to yield particular crop in the same soil by suggesting the requirements of the nutrients for the same soil.

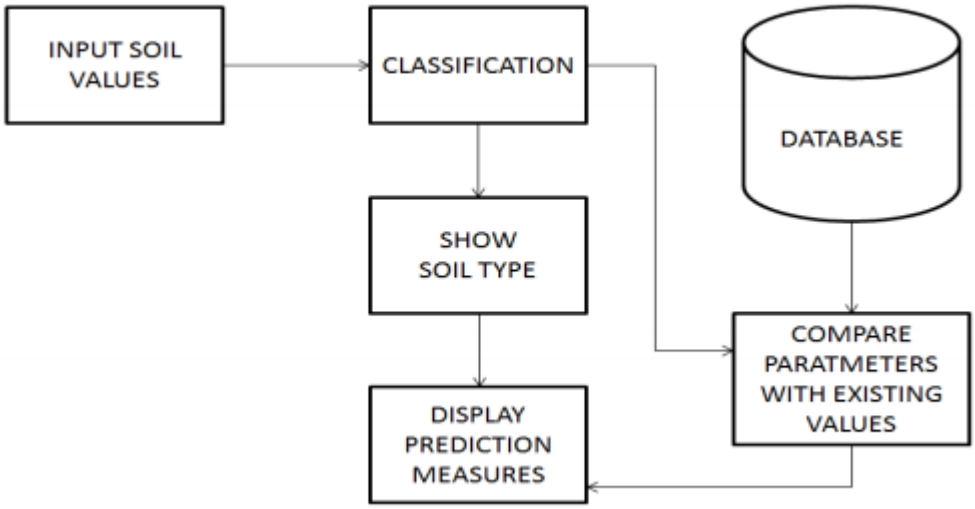

Figure 1.1

The figure 1.1 shows The Proposed System Architecture

Proposed System includes pH meter, Arduino board, ESP8266, MySQL server. Arduino board requires 9V power and ESP8266 also requires 5V power which is provided using adapter.

Our System consists of handheld device which is build using pH meter whose one wire is connected to ground and another to A0 pin of Arduino board. Initially when we insert pH meter into soil then it senses value and sends to Arduino, where analog pH range is converted into actual pH range. Now this actual pH value of soil is sent to server using Wi-fi module (ESP8266).

At server side we will convert pH to NPK and depending on these values we decide fertility level of soil and classify into either LOW, MEDIUM, HIGH class. This fertility class is decided by Machine Learning Classification Algorithm. Now list of crops suitable for that fertility class will be displayed. We have also provided a module where farmer can enter crop he wants to grow and depending on that system will suggest fertilizer to improve yield of that crop in his soil with the price of the fertilizer.

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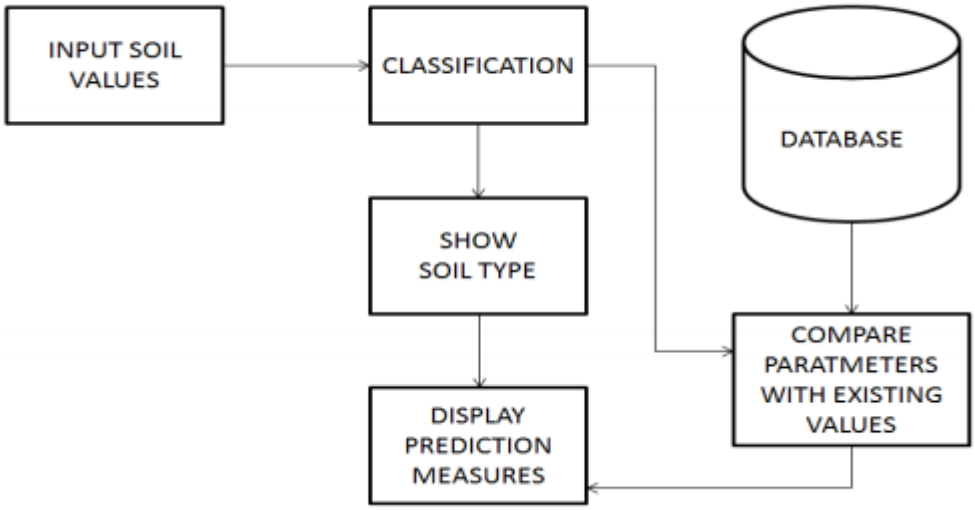

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IV. WORKING

- pH meter takes the value from soil and passes the value to Arduino.
- Arduino UNO continuously read the output value of the pH meter.
- With the help of ESP8266-01 WIFI Module, Arduino sends the readings to server.
- Then according to the NPK values, server will suggest which crop can be grown for that particular soil and also it will suggest fertilizers to be used.
- The server matches this NPK data from the Database.
- The list of predicted crops is shown along with suggestion of fertilizers.

V. MODULES

Here in this project we divide modules in two parts Hardware module and Software module.

1. Hardware Module

A. pH meter

pH meter whose one wire is connected to ground and another to A0 pin of Arduino board. Initially when we insert pH meter into soil then it senses value and sends to Arduino, where analog pH range is converted into actual pH range. pH meter takes the value from soil and passes the value to Arduino.

B. Arduino Uno

Arduino UNO continuously read the output value of the pH meter. After every 30 sec Arduino is set to take the reading from the pH meter and the reading is send to server via WI-FI module.

C. Wi-Fi Module ESP8266

Now this actual pH value of soil is sent to server using Wi-fi module (ESP8266).

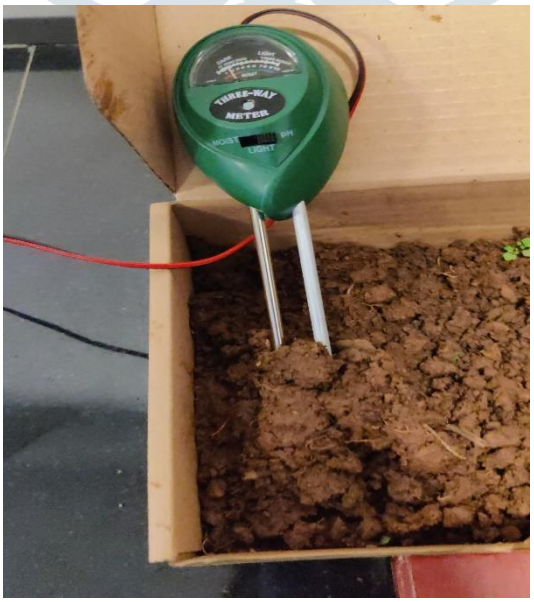


Figure 1.2

Figure 1.2 shows pH meter in soil taking values

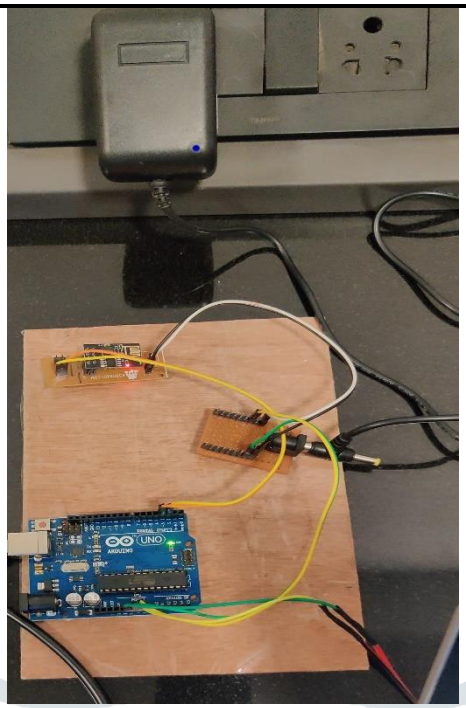


Figure 1.3

Figure 1.3 shows Soil Analysis mode

2. Software Module

A. Admin Facility

The basic steps for every online portal are login and registration, which is done by the admin itself to get forward and do their work done privately. While doing this it allows the access only to the legitimate user only. Admin has the authority to Truncate the data. Admin also has the authority to send the link to farmer for password change. Admin can change the layout of the home page. Admin can view the previous and present data of pH to NPK. Admin has the authority to see the predicted results by pressing the Apply button by which the prediction of crop will be from Naive Dataset. Admin has the authority to handle the search engine. If the website is down admin can correct the errors and recover the site.

B. Other Facilities

There are many more facilities in web application like Records and Results.

1. Records

One can manage log of pH to NPK converter with date and time mentioned in the table even they can Truncate the data. According to soil fertility, fertility is divided into three categories. If the fertility of soil is 0 then it's category will be MEDIUM, If the fertility of soil is 1 then it's category will be HIGH, If the fertility of the soil is 2 then it's category will be VERY HIGH.

2. Results

One can see the Predicted results as the present pH to NPK value is received from records, here in results by clicking the Apply button predicted list of crops will be shown and by clicking the view button from the list of crops, NPK values will be shown for that particular crop and which fertilizer to use for that crop with the rate of the fertilizer per kgs will be shown.

VI. RESULTS

Figure 1.4
Figure 1.4 shows the Login of the proposed system

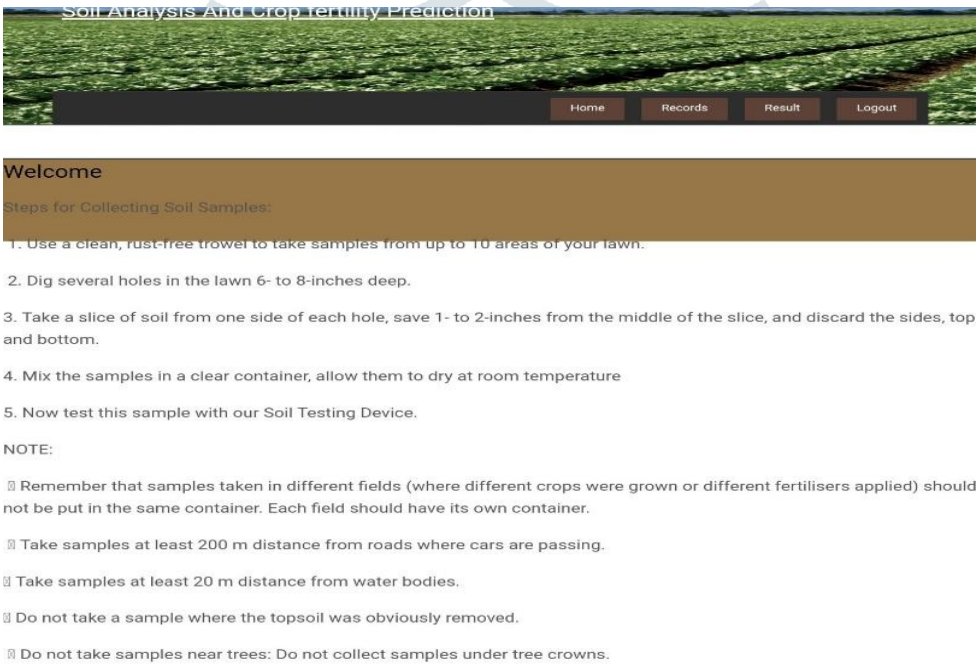
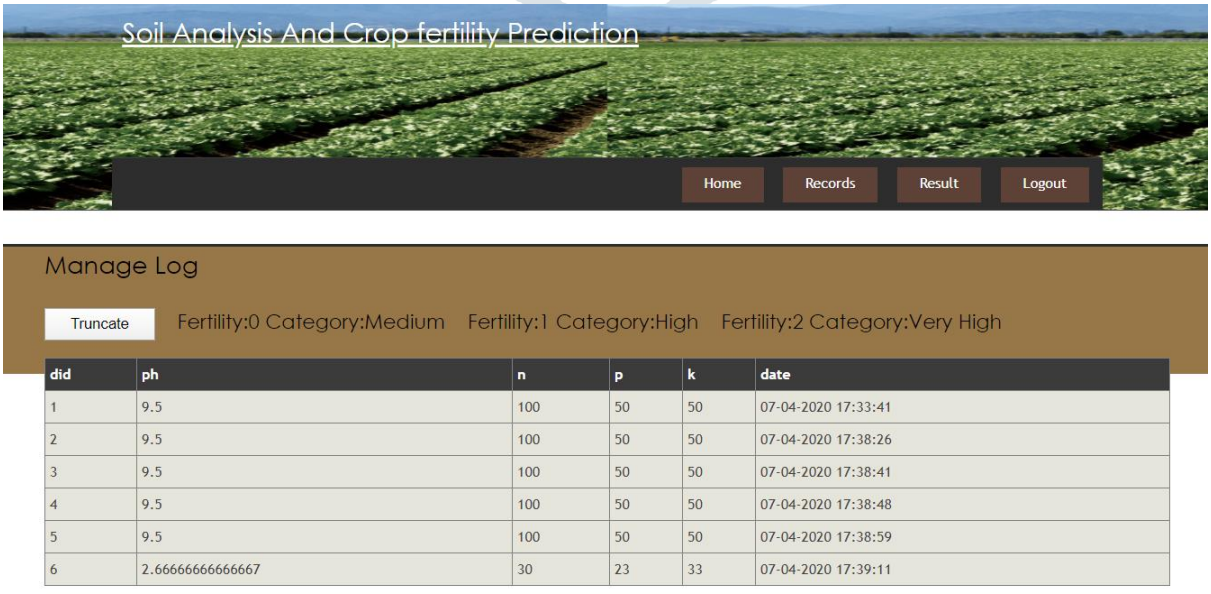


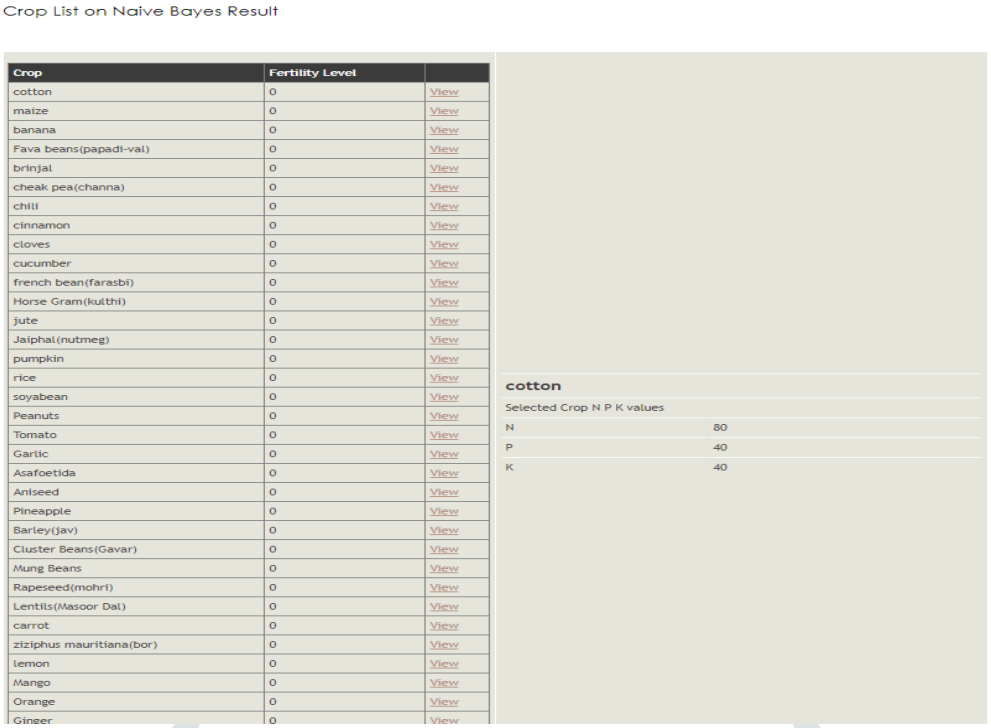
Figure 1.5
Figure 1.5 shows the Home page



did	ph	n	p	k	date
1	9.5	100	50	50	07-04-2020 17:33:41
2	9.5	100	50	50	07-04-2020 17:38:26
3	9.5	100	50	50	07-04-2020 17:38:41
4	9.5	100	50	50	07-04-2020 17:38:48
5	9.5	100	50	50	07-04-2020 17:38:59
6	2.66666666666667	30	23	33	07-04-2020 17:39:11

Figure 1.6

Figure 1.6 shows the Records page where it gets updated after every 30 secs with date and time if the system is in use.


Crop List on Naive Bayes Result

Crop	Fertility Level	
cotton	0	View
maize	0	View
banana	0	View
Fava beans(papadi-val)	0	View
brinjal	0	View
cheak pea(channa)	0	View
chili	0	View
cinnamon	0	View
cloves	0	View
cucumber	0	View
french bean(farasbi)	0	View
Horse Gram(kulthi)	0	View
jute	0	View
Jaiphal(nutmeg)	0	View
pumpkin	0	View
rice	0	View
soyabean	0	View
Peanuts	0	View
Tomato	0	View
Garlic	0	View
Asafoetida	0	View
Aniseed	0	View
Pineapple	0	View
Barley(Jav)	0	View
Cluster Beans(Gavar)	0	View
Mung Beans	0	View
Rapeseed(mohri)	0	View
Lentils(Masoor Dal)	0	View
carrot	0	View
ziziphus mauritiana(bor)	0	View
lemon	0	View
Mango	0	View
Orange	0	View
Ginger	0	View

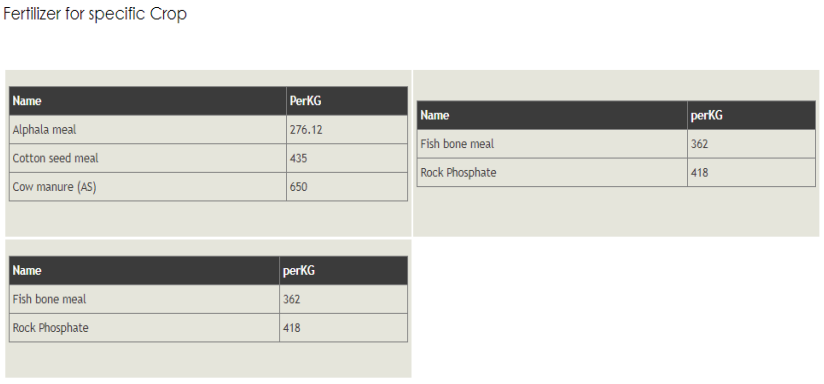
cotton

Selected Crop N P K values

N	80
P	40
K	40

Figure 1.7

Figure 1.7 shows the Results in which this is the list of predicted Crops.


Fertilizer for specific Crop

Name	PerKG
Alphala meal	276.12
Cotton seed meal	435
Cow manure (AS)	650

Name	perKG
Fish bone meal	362
Rock Phosphate	418

Name	perKG
Fish bone meal	362
Rock Phosphate	418

Figure 1.8

Figure 1.8 shows the Suggested Fertilizers with price Per KG for the listed Crops.

VII. CONCLUSION

By using Soil Analysis and crop fertility farmers can grow crop successfully. In this project we have developed soil testing method using a handheld device which will determine the pH of that soil. Then on basis of pH we will give values of nutrients i.e. NPK present in soil. On the basis of values, we get from our device we predict list of suitable crops and fertilizers along with price of price of fertilizers. We had overcome drawback of manual soil testing process by replacing the process with our model which gives real time result. The proposed method is very efficient and ready to use.

VIII. REFERENCES

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