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Smart Agro: Precision Crop Suggestion using Machine Learning Technique

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Abstract -*Agriculture sector has an important role in the country's economy. A steep decline in this sector is observed as the crop loss and the suicide rate of the farmers are increasing day by day. The young population of the country are disinterested in this profession and the methods used for cultivation are predominantly unscientific. The climatic conditions and the soil components have drastically changed, thus olden methods of cultivation are not very effective. The soil wants to be clinically tested to find the NPK (nitrogen, phosphorus, and potassium) values. Other parameters considered are temperature, humidity, soil moisture, and soil pH which are obtained in real-time from the sensors. This proposed system uses SVM (Support Vector Machine) algorithm to predict the suitable crop to cultivate in the land. It also has an advisory system through which farmers can check their required crop can be cultivated in their land. The system also recommends the usage of fertilizers in the land. The use of these new technologies make a change from traditional methods to precision farming. Crop loss can be reduced thereby increasing the profit of the farmers. The system is developed as a web application where the farmers can easily check out the suitable crop. The proposed system is very beneficial for the farmers to take a valuable decision. Thus more young populations with low experience can engage in farming and increase the economic growth of the country.*

***Key Words*: Agriculture, Crop prediction, NPK value, SVM algorithm, Crop Suggestion, Precision Farming.**

1. INTRODUCTION

Agriculture has a key role in the food industry and it is the backbone of our economy. As there is a great increase in population and increasing demand of the economic growth, the agriculture industry should be able to meet it smoothly. But we are facing a great decrease in GDP [4] However, nowadays people are losing hope in agriculture sector due to the unexpected losses they face. One of the major reasons for this is that the traditional way of making assumptions couldn't meet the expectation [3]. The natural disasters just take over the essence of the soil, making it contaminated. Thus the changed soil nature cannot match farmer's assumption. This leads to massive crop loss. Precision farming is not familiar to most of the farmers. They are often ignorant of the scientific methods available in farming. Due to massive pollution of air, soil and water, the soil and the climatic conditions have changed drastically. Thus a change from traditional methods to precision farming is critical nowadays to lift up the agricultural sector. In this paper, we introduce a system through which one could analyze the soil nature and hence plant the crop, according to the nutrients present in the soil.

1.1 Problem Formulation

Agriculture plays a major part in deciding country's economy. But unfortunately the agricultural sector is gradually coming down. One of the major reason is that people lack the knowledge about crops, fertilizers and productivity. Due to huge losses farmers attempt suicide this leads to a very low graph in employment status in the agricultural sector, which parallel impacts our economy too. One of the major factor is our varying climatic condition and soil condition, thus the ancestral knowledge that our farmers use in agriculture becomes ineffective. Many farmers don't prefer in scientifically testing soil and they their own methodologies. But this may lead to inadequate way of farming, adding immense fertilizers and destroying soil's natural humus, over exploitation of fertilizers, this all lead to decrease in soil fertility. This project encourages precision farming by scientifically testing the soil and planting the crops accordingly.

1.2 Objective

Agriculture is one of the professions which is being practiced for decades. But as year passes this profession is losing people's faith. One of the reasons behind this is an unscientific way of practicing agriculture. As time passes, traditional methods are becoming less effective. To overcome this, the system proposed here analyses the given environmental and soil conditions and predict the suitable crop for that situation. Farmers can analyze the soil, its moisture content, whether the soil is alkaline or acidic, temperature and its humidity [1]. This helps to use minimal use of fertilizers and protect the soil from contaminating from chemicals. We do precision farming, by using sensors we are analyzing data real time. Such that we can optimize the agricultural techniques and increase productivity. Farmers can know the required amount of fertilizer for the land and put it accordingly, instead of dumping excessively [2]. Through this paper, we encourage the unskilled population of the country to choose agriculture as their occupation, by making it more profitable and sustainable

2. PROPOSED SYSTEM

The sensors to be used are:

- Temperature and humidity sensor (DHT11)
- Soil moisture sensor
- pH sensor

The factors like temperature, humidity, soil moisture, soil pH are taken as real time using the sensors. For efficient calculation of NPK values, the soil is clinically tested. The four factors and NPK values are now considered and predicts which crop will be suitable in that particular. The sensors are interfaced with Raspberry Pi, and it collects the data. The data from the sensors along with NPK values is given to the machine learning algorithm (SVM). The predicted output is displayed in a webpage, where the farmers can easily access it. The system can also advise whether the particular crop can be cultivated in the land and give appropriate fertilizer suggestion.

2.1 ALGORITHM

SVM algorithm is generally applied to linearly separable binary sets. A hyperplane is designed such that it classifies the support vectors or training vectors in two classes. The best choice will be the hyperplane which leave a maximum margin from the classes. The libraries used in the algorithm are mainly Scikit-learn, Numpy and Panda. Python pandas is a library for manipulating data and analyzing it. Numpy handles multidimensional arrays and matrixes. Scikit-learn has clustering and regression algorithms. The SVM algorithm is imported from here. The framework used here Django, which encourages a rapid development, clean and pragmatic design.

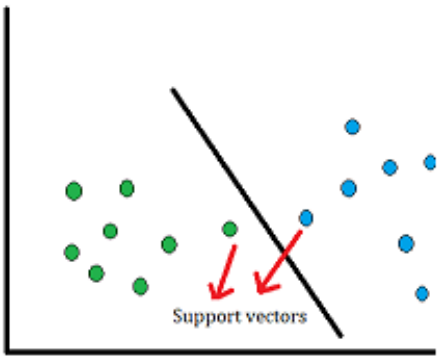

Fig -1: Support Vectors

The algorithm is used in the system due to its advantages:

- Better performance practically
- Computationally cheaper
- Mapping high dimensional features
- Faster prediction

2.2 HARDWARE COMPONENTS

Raspberry Pi 3 B

The Raspberry Pi is a small single-board computer. There are 40 pins for general purpose input/output. The sensors are interfaced here. The operating system is loaded and data are stored through a micro SD port. The Raspberry Pi 3 B has a Broadcom BCM2837 SoC and a 64-bit processor. A 5V power supply has to be given to the raspberry Pi. This model has been choose due to its advantages

- Compact size
- Low cost
- Low power consumption
- All data structures can be used.

Soil Ph Sensor

The soil pH can be categorized into three: acidic, alkaline or neutral. It is one of the important factors determining the soil fertility. The general pH ranges of the plants varies from 5.5 to 7.5 with exceptions like Sweet potato, blueberries etc. which prefer acidic soil and pine, oak etc. which prefer alkaline soil. Therefore for proper estimation of PH real time we use this sensor. The presence of microorganisms and availability of nutrients is also strongly determined by the pH of soil.

Soil Moisture Sensor

The sensor is used to measure the volumetric water content and the other plasmatic materials in soil. The two exposed pads forms the probe of the sensor. More the water in the soil, better conductivity between the pads are observed. Thus an output of high signal is produced by the sensor.

DHT11 Sensor

A low cost sensor to measure the temperature and humidity. A capacitive humidity sensor and thermistors are used to measure the air. The digital signal is send to Raspberry Pi. It is commonly used and fairly simple to use.

Monitor

A monitor is used to the see the output from the controller. It is connected to Raspberry pi using a VGA to HDMI cable. The farmers access the webpage through this monitor. Input devices like keyboard can be connected to input the values to it.

2.3 DATASET COLLECTION

Dataset collection is an integral part of the research, as the selection of it decides the accuracy of the project. Dataset used in this project is collected from the Agricultural university of Kerala, Manuthy [5]. A list of over 25 crops are prepared which are predominantly cultivated in the region

which includes grains, vegetables, cash crops, medicinal plants and many. The dataset is prepared with 5 attributes like temperature, humidity, ph, moisture and NPK values .NPK has an important role in deciding the suitable crop for that land.

Sheet1

	A	B	C	D	E	F
1	PH	MOI	TEMP	HUM	NPK	VALUE
2	5	20	16	60	90-35-45	0
3	5	20	16	60	110-45-45	1
4	6	13.5	20	55	135-65-15	2
5	6.5	25	26	85	90-45-45	3
6	5.5	75	25	80	50-50-75	5
7	5.5	56.8	21	75	80-25-100	6
8	5.6	78	20	90	75-50-75	7
9	5.5	35	25	80	75-75-75	8
10	5.5	9	10	75	75-75-150	9
11	5.5	75	20	70	50-50-150	10
12	4.5	40	16	95	10.2-3.2-5.4	11
13						
14						
15						
16						

Fig -2: Sample Dataset

2.4 METHODOLOGY

The suggested system is a web based application which suggests and advises the suitable crop required for the land. The front end of the system is developed using JavaScript, Jinja, HTML and CSS. Both the admin and user can login through the dashboard. Admin can do the training of the data and view the user details whereas the user login has the prediction and advisory options.

Django server of version 2.7 is used in this system, through which the data is transferred to the client. Many clients can be connected wirelessly to this device using the IP address. Three sensors namely DHT11, soil moisture sensor and soil PH sensor are interfaced with Raspberry Pi 3. Python language is used in the development of this system. The collected data is processed by the Raspberry Pi.

The intelligence is given to the machine through SVM algorithm. The model is trained for over 30000 combination thus increasing the accuracy. The data has to be pre-processed before training. Data is pre-processed through methods like Data Cleaning, Label Encoding and CSV File generation. The two libraries used for Data Cleaning are Numpy and Pandas. Categorical values can't be recognized by the machine, thus converting it into numerical values. For example the predicted value rice can be labelled to '0' and maize can be labelled to '1'

3. CONCLUSIONS

The proposed system provides an agriculture solution for crop prediction using a machine learning algorithm which is used for crop prediction on data sensed by sensors which can be viewed in web application. It gives the best profitable crops which can be cultivated in the environmental condition. The system can also advise whether particular crop can be cultivated in the land or not. As the system lists out all possible crops, it helps the farmer to take accurate decision of which crop to be cultivated. In the future, we can access the proposed system using an android application, so that farmers can easily access it. The parameters considered for the predictions can also be increased for better predictions.

REFERENCES

[1] R. Dagar, S. Som and S. K. Khatri, "Smart Farming – IoT in Agriculture," 2018 International Conference on Inventive Research in Computing Applications (ICIRCA), Coimbatore, 2018, pp. 1052-1056
doi: 10.1109/ICIRCA.2018.8597264

[2] T. Siddique, D. Barua, Z. Ferdous and A. Chakrabarty, "Automated farming prediction," 2017 Intelligent Systems Conference (IntelliSys), London, 2017, pp. 757-763.
doi: 10.1109/IntelliSys.2017.8324214

[3] T Raghav Kumar, Bhagavatula Aiswarya, Aashish Suresh, Drishti Jain, Natesh Balaji , Varshini Sankaran "Smart Management of Crop Cultivation using IOT and Machine Learning", International Research Journal of Engineering and Technology, Volume: 05 ,Issue: 11 |,Nov 2018

[4] G. Ravichandran and R. S. Koteeshwari, "Agricultural crop predictor and advisor using ANN for smartphones," 2016 International Conference on Emerging Trends in Engineering, Technology and Science (ICETETS), Pudukkottai, 2016, pp. 1-6.
doi: 10.1109/ICETETS.2016.7603053

[5] Kerala Agricultural University 2016."Package of Practices Recommendations : Crops",15th edition,Kerala Agricultural University, Thrissur -392 p.