Smart Agriculture Monitoring System using ML

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Abstract: *Agriculture plays vital role in every individual's life. As the technology improves, agricultural sector has been improving by the needs of people. Basically, the idea here deals with monitoring of weather, temperature, soil moisture and other agriculture related aspects. The objective of this paper is to upgrade -growth probability. So by making use of Advance technologies good and efficient crop can be yield. Cloud (Firebase) is typically used to store the pre-computed data (data sets) and the data from the efficiency of agriculture sector. This idea comprises of Machine Learning techniques, Cloud Computation [5] and IoT. Here we will use machine learning techniques for predicting crop sensors and comparison between these. IoT includes NPK sensors, temperature sensor, and humidity sensor. The mechanism goes like this- initially the data from humidity, temperature sensor will be noted and NPK sensors will be placed in the soil, the values from the sensors will be sent to cloud by making use of any communication technology (ZigBee, IoT gateway devices). In cloud comparison of pre-computed data and data from sensors happens by making use of machine learning. The outcome from cloud may be stored in the server (Admin) or directly be notified to authorized person of the land in the form for notification. By taking all these parameters into consideration, we can predict the best suitable crop that can be grown and farmers will earn profit in a cost-effective manner.*

Keywords : Firebase, IOT gateways, NPK Sensors, s ZigBee .

I. INTRODUCTION

"Agriculture" is the process of producing food, feed, fiber and many other desired products by the cultivation of certain plants and the raising of domesticated animals (livestock). But now a days it is losingit's potential because of various factors like low profits, failure of monsoon, soil fertility, wrecked weather conditions and even some farmers don't know the base condition like which crop is suitable for their land. So these are hindering India's back-bone. By making use of booming technologies like Machine Learning, IoT and Data Mining, if prior information of weather forecast for a

month or even months, fertility of soil, and which crop is going to have good economy in future, farmers can get good yield and even earn profit. By making use of particular rectification is not possible. sensors we can get soil nutrient content, based on this fertilizers can be applied. This will result in good yield of crop and can prevent excessive fertilizer levels. Agriculture sector contributes major of 18 per cent of India's gross domestic product (GDP) providing 50% of countries workforce. With
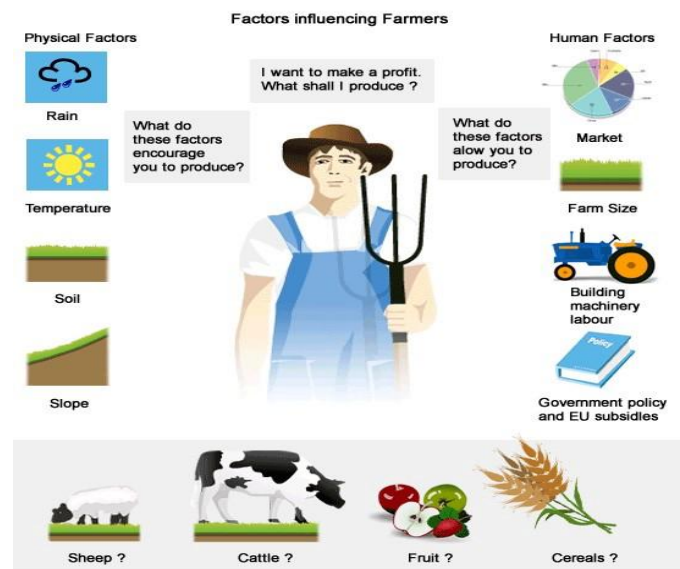

Fig.1. Factors influencing farmers

the rapid growth of population, it is necessary to meet the needs of every individual and feed them. So we need solution to overcome this, i.e. by harnessing technology of machine learning using artificial neural networks, data mining, data sets can be fed and accurate values can be obtained. By the combined efforts of all these we can implement a good project. Then comes the idea of "Smart Agriculture Monitoring System Using Machine Learning". In our project we use Machine Learning algorithms to predict the yield of the crop. Machine learning is a great boon for agriculture it helps in predicting agriculture related yields or crop. Machine learning in agriculture used to upgrade the productivity and quality of the crop with the help of prediction algorithms, it defines the mapping and estimated marketing value of the crop on the basis of past yield results. Whether crop increase or decrease are associated with a specific pattern in the usage of fertilizer we could predict how much amount of fertilizer has to be used for the particular crop with the help of some

k-means and identity cluster. The theme here is to provide farmers with an smart system that help farmers to get rid of agricultural issues, therefore there will be best utilization of resources, time saving, money and manpower. So our goal here is to provide farmers with a best agricultural process from beginning to end.

II. LITERATURE REVIEW

The paper "A Survey on Crop Prediction using Machine Learning Approach" [1] is mainly focused on the techniques and measures taken to improve farming by inculcating the technical knowledge and developments in order to make the agricultural sector more reliable and easy for the farmers by predicting the suitable crop by using Machine learning techniques by sensing parameters like soil, weather and market trends. Parameters considered are PH, Nitrogen Phosphate-Potassium (NPK) contents of soil, temperature, rainfall and humidity. We consider Artificial Neural Network, Information Fuzzy Network and other Data Mining Techniques. The complete research comes up to a conclusion that Artificial Neural Network is the suitable technique for our project.

The paper "Smart Farming Prediction using Machine Learning" [2] is mainly focused on the prediction of the most profitable crop that can be grown in the agricultural land using machine learning techniques. This paper includes the use of an android system that will give the real time crop analysis using various weather station reports and soil quality. Thus, farmers can grow the most profitable crop in the best suitable months.

The paper "AGRORATES: Location Based Agricultural Yields Rate Prediction By Using Android [3] they developed an Android application it will be used by every farmer with the help of smart phones. Here farmers can check the information regarding cultivation of crop, weather reports, marketing details everything but in this case farmer has to check daily updated data from agricultural experts.

The paper "Automation in Agriculture Using IOT and Machine Learning" [4] mainly focuses on improving efficiency of agricultural sector. Internet of Things (IoT) is a milestone in evolution of technology. IoT helps us in many fields among which agriculture is one of the primary ones. With the help of IoT along with Machine Learning in the field of agriculture, we can increase the efficiency of crop production. Different weather parameters are taken into consideration with which the best suitable crop to be grown are predicted with the help of supervised learning like Decision Tree, Classifier, Regression.

Modern day technology is used to improve the wide range of production practices employed by farmers. It makes use of hybrid seeds of selected variety of a single crop, technologically advanced equipment and lots of energy subsidies in the form of irrigation water, fertilizers and pesticides. Farms have changed a lot in the last 50 years, livestock are usually raised inside, yields are higher, less manual labor is needed, and it's not common to see dairy cows, pigs, and poultry on the same farm. Why is this? The answer is simple technology. Let's take a look at the few of the way's technology has changed farming. Livestock genetics and breeding, crop genetics and pest management,

labor and mechanization and Livestock facilities. These are the major problems that Indian agriculture is facing:

1. Instability: Farmers starts cultivating without the information about monsoons.
2. Inadequate use of manures and fertilizers: Inadequate use of manures like cow dung or vegetable refuse and chemical fertilizers make agriculture less productive.
3. Use of poor-quality seeds: Not much use has been made of improved varieties of seeds.
4. The system and techniques of farming: Neglect of crop rotation.
5. The marketing of agricultural products.
6. Due to low profit people are diverting towards other professions.

III. PROPOSED SYSTEM

In order to improve agricultural yields, we have come up with an idea that is by inculcating the technical knowledge and developments in order to make this agricultural sector more reliable and easier for the farmers by predicting the suitable crop by using Machine learning techniques by sensing parameters like soil, weather and market trends. Parameters considered are Nitrogen, phosphate, potassium (NPK) contents of soil, temperature, rainfall and humidity. With the help of sensors and Machine Learning (Artificial Neural Network, decision tree algorithms) in the field of agriculture, different weather parameters are taken into consideration with which the best suitable crop to be grown are predicted. With the different sensors, the soil and atmospheric conditions are determined.
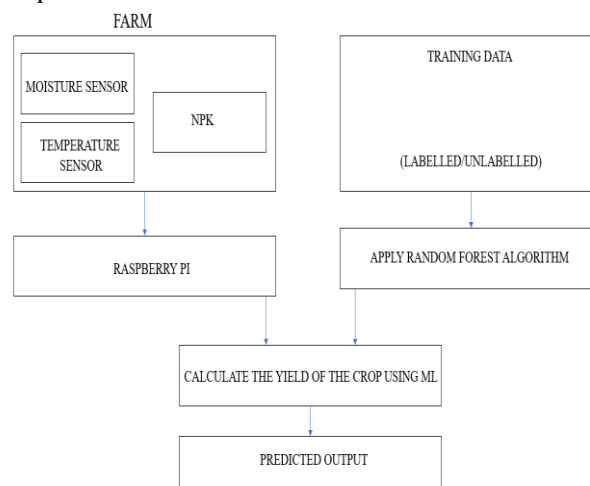

Fig.2. System Architecture

Weather conditions of a particular region and price of a crop is considered and collected from the various government agencies and weather forecasting departments in order to give the farmers accurate information regarding the weather and prices of the crop. All these data are collected and stored in cloud and the data from sensors are computed, using machine learning techniques. And the result regarding weather, NPK value and best suitable crop suitable will be sent to the farmer in the form of notification.
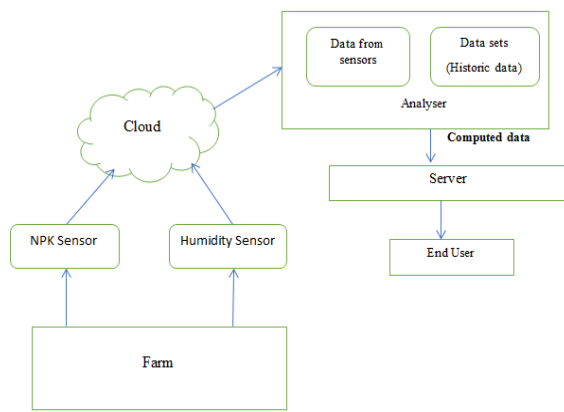
Fig.3. Data flow diagram

IV. MATHODOLOGY

A. Dataset

Dataset is a set of data most commonly a single database table that corresponds to particular variable. Take an input dataset such as maize and rice apply Random Forest Algorithm for the selection of features such as how much water is needed by crops, Minimum Temperature, Maximum Temperature using the classification of these features we can identify the factors that are most important for productivity .The dataset list values can be such as height and weight of the object. For implementing a predicting model, we require a set of 3000 datasets and apply a high accuracy algorithm.

B. Clustering

Clustering is also known as cluster analysis is the grouping of objects so that the object in the same group is similar to each other than to others group. When data is unlabeled and not in continuous form this technique is used for grouping the data into categories. For this present problem of the agricultural data this clustering technique gave us one of the best results as the correlation of the data.so when it comes to datasets such as maximum temperature and minimum temperature, we can group this clustering algorithm so that our prediction model will be more accurate than the trained data. Based on the attributes the techniques can be applied two types i.e. two-dimensional clustering and three-dimensional clustering.

C. Bayesian Network

This is a graphical model that represents a set of variables which can be used for Statistical analysis of the attribute in a given dataset. These networks are ideal for taking occurrences and predicting the several possible known causes was the contributing factor. Example can be like that Bayesian network can be used to represent the relationship between diseases and symptoms. In this model the data are represented in charts which are directed by nodes. the nodes represent the function and the edges represent the dependency of data.

D. Artificial Neural Network

Artificial neural Network is one of the most used techniques for the prediction model. ANN is usually based on imitation of human brain just like our brain it has neurons for transmitting one data to another. All the neurons are connected together in layers. The application of Neural Network is widely used in agriculture practices. It compares

patterns nonlinear effect and underline concept of the relation between them and hence it is a kind of ML technique which has a vast memory. One of the disadvantages of ANN is that where the dataset is significantly different compared to trained data set. Neural networks can be used inn language translation and picture recognition.

E. Random Forest Algorithm

This is the most popular and powerful supervised machine learning algorithm capable of performing both classification, regression tasks, that operate by constructing a multitude of decision trees at training time and the class that is the mode of the classification or mean prediction (regression) of the individual trees. The more trees in a forest the more robust the prediction. This forest algorithm correct for decision trees habit of over fitting to their training set.

The data sets considered are rainfall, perception, production, temperature to construct random forest, a collection of decision trees by considering two-third of the records in the datasets. These trees are applied on the remaining records for accurate classification. The resultant data sets (training set) can be applied on the test data for correct prediction of crop yield based on the input attributes. RF algorithm was used to study the performance of this approach on the dataset. The advantage of random forest algorithm is, Over fitting is less of an issue with Random Forests, unlike decision tree machine learning algorithms. There is no need of pruning the random forest.

This algorithm runs efficiently on large databases and it has higher classification accuracy. There are three parameters in the random forest algorithm. ntree-the name suggests, the number of trees to grow. Larger the tree, it will be more computationally expensive to build models. mtry - It refers to how many variables we should select at a node split. The default value is p/3 for regression and sqrt(p) for classification and always try to avoid using smaller values of m-try to avoid over fitting. node size - It refers to how many observations we want in the terminal nodes. This parameter is directly related to tree depth. Higher the number, lower the tree depth. With lower tree depth, the tree might even fail to recognize useful signals from the data.
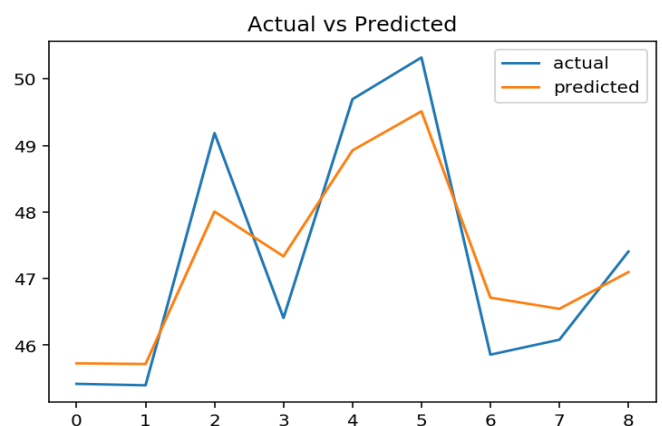
V. RESULT

Fig.4. Actual vs. predicted crop prediction

The above graph shows the actual vs predicted values,here we use CPI values(crop production index) CPI=Production per Area. Here X axis indicates index and Y axis indicates CPI values. (CPI values are obtained from dataset).
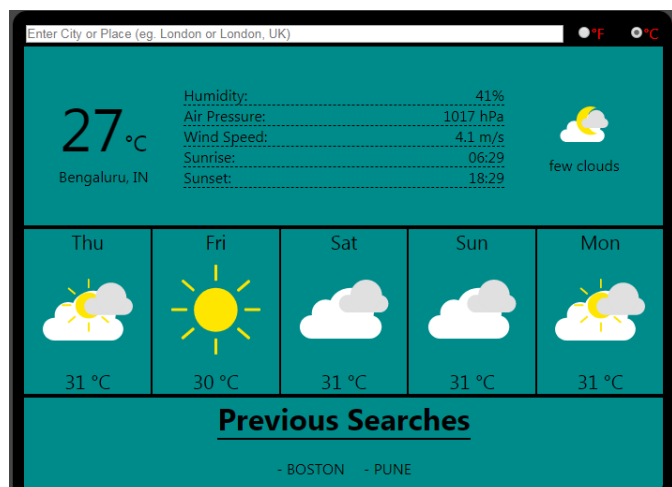

Fig.5. Weather forecast

The above image shows the weather forecast of a particular region for few days, which includes the information like humidity, weather description, temperature and much more.

VI. CONCLUSION

The main idea here is to make use of machine learning techniques which can help in maintaining farm details, climatic reports, soil fertility and price details of various crops. The sensor is fabricated which has concentric arrangement of source and receiving signals. It is based on the machine learning principle where decision making algorithms learn by a solution results in variation in the output of the sensor. The system thus designed is advantageous as it reduces the undesired use of fertilizers to be added in the soil. One can select the fertilizer quantity to be used for reducing the deficiency in the soil at a particular field. Machine learning technique gives the predicted values that helps farmer to know about fertilizers required timing also it suggest the crop to sow for the particular period of time. So the farmers can get the good yield of cultivation.

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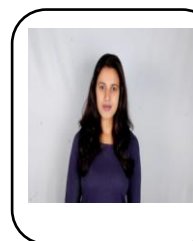
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