Analysis of Crop Selection on Basis of Dynamic Environmental Factors and Live Market Condition using Techniques of Machine Learning and IOT.

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Abstract:- Agriculture has got a prime role in Indian economy. Most of the problems in the agriculture sector is due to the selection of primitive methods of farming and static selection of crop throughout the year without any precaution taken to analyse the scientific condition for crop selection. This paper will help in bringing a more scientific approach to crop selection using techniques of IOT such as various sensors varying from temperature to soil humidity and use of microcontrollers such as Arduino for computation of Real time data. The real-time data taken from microcontroller will be fed into a system that will be using data mining techniques to compare with target trained datasets for prediction of accurate crop selection. The prediction of crop will also be based on prices listed on National Commodity and Derivative Exchange (NCDEX).

Keywords*:- intelligent agriculture; data mining; IOT; machine learning; decision making.*

I. INTRODUCTION

Agriculture plays a vital role in Indian economy. It employs over 58 percent of rural household directly. The productivity of the land holdings has deteriorated over centuries. Crops grown before may not be the perfect fit for present condition of the soil. Moreover, temperature change and sporadic and lesser rainfall has aggravated the problem. Many crops suited before for the particular landholding might not be suited in todays present environmental conditions or might not even be financially viable.

Our paper specifically identifies and tries to solve these two areas of concern:

i). Suitability of a crop for the particular landholding.
ii). Financial viability of the particular crop.
To identify the suitability of a particular we take help of sensors data such as temperature sensors, soil humidity, IR sensors etc. These data will be compared with our existing database of the best possible environmental conditions for a particular crop. The best possible crop is chosen by finding its label against already clustered data. By doing so we will be able to eliminate traditional approach to crop selection which generally is of following historical methods.

After the crops has been selected we try to analyse the financial viability of the crops i.e. the profitability associated with the crops over a period of years. The historical and present data will be retrieved from a real-time market such as NCDEX.By analysing data over a period of few years and present market conditions we will be able to accurately predict the financial viability of the crops. After doing so the farmers can make an informed choice about growing a particular crop.

II. LITERATURE SURVEY

[1] This paper deals with finding the suitability of a crop by using a linear Regression model. Various techniques of extrapolation are used to find expected temperature and rainfall. To calculate prices too extrapolation of previous data prices is carried out. [2] In this paper decision making between contesting entities are made through implementations of Analytical Hierarchy Planning (AHP). This method has been developed by Thomas L.Satty.AHP uses pair wise comparison scale assessment where importance of every element is considered. We have used pair wise comparison scale assessment for calculating land and price dependency in our project. [3] This paper summarizes all the data mining techniques that could be used for decision making in agriculture. Different data mining techniques are discussed in this paper ranging from the use of Artificial Neural Networking Bayesian Networks in agriculture. The Association Rule mining and support vector machines techniques are also analyzed in this paper. By considering all the above techniques mentioned in the paper our project will be implementing the k-nearest neighbor algorithm as we are dealing with a supervised learning problem. [4] This paper introduces us with a concept called as Wisdom agriculture. Wisdom agriculture is the advanced stage of agricultural production is a set of emerging Internet, mobile Internet, cloud computing and networking technology as a whole, relying on the sensor nodes deployed in various agricultural production field (environment temperature and humidity, soil moisture, carbon dioxide, image) intelligent sensing, intelligent warning, intelligent decision-making, intelligent analysis, expert online guide agricultural production environment and wireless communication network, to provide accurate planting, visual management, intelligent decision for agricultural production. Agricultural IOT application will be a large number of sensor nodes monitoring network, information collected by various sensors to help farmers to find

problems, and to accurately determine the location of the problem so, agriculture will gradually from a human centred, depending on the isolated machinery production mode to the information and software centric mode of production, and extensive use of a variety of automated and intelligent remote-control equipment

III. METHODOLOGY

A. Collection of data

Data is collected through sensors such as temperature sensors, humidity sensors, IR sensors. We use Arduino for recording and storing those values. As the data is volatile we use sd card shield to store those values and later transfer it to a relational database. The following sensors will be used in our project to collect environmental data.

- *Soil moisture sensor*

It measures the volumetric water content in soil Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity.

Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners.

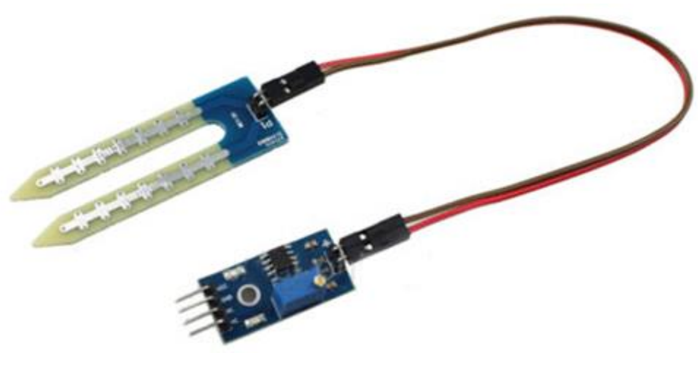

Fig 1:- Soil Sensor

- *Infrared sensor*

It is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor.

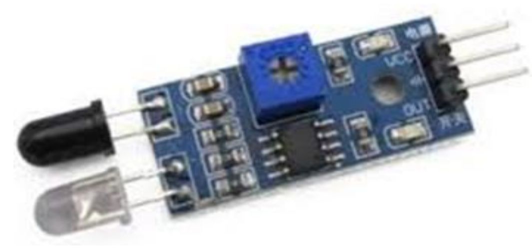

Fig 2:- Infrared Sensor

- *Temperature sensor*

A sensor used to measure ambient temperature. This particular sensor has three pins – a positive, a ground, and a signal. This is a linear temperature sensor. A change in temperature of one degree centigrade is equal to a change of 10 millivolts at the sensor output.

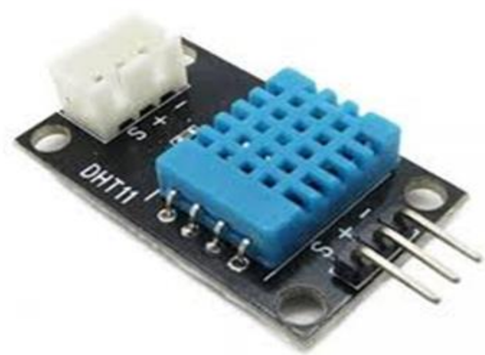

Fig 3:- Temperature and humidity Sensor

B. Data cleaning

As we retrieve data from sensors it becomes even more important to clean and remove any discrepancies in data. Some of the recurring data cleaning operations are:

- Check for the missing values and replacing it with either default values or computing an interpolation to fit it in the curve.
- Remove and replace the improper format entries (e.g., zero for the price typically indicates missing data).
- Normalizing the values from the sensors. (e.g. scaling of temperature and humidity values).

C. Prediction of Crop

Prediction of crop depends on two factors:

- Suitability of the environmental condition.

- The values from the sensors will be fed into a KNN classifier and the Euclidean distance would be calculated. The top four crops would be selected on basis of increasing order of Euclidean distance. For e.g. a tuple of data generated from sensor data

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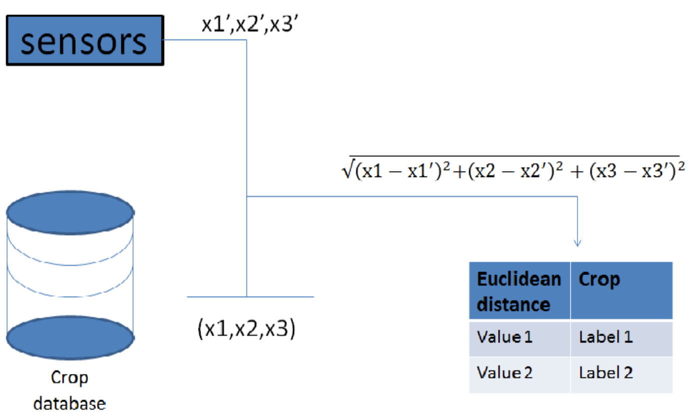
d1(x1’, x2’, x3’)
X1’ representing Temperature values.
X2’ representing humidity values.
X3’ representing IR values.

The Euclidean distance between the values generated and the values in the crop database would be calculated.

Euclidean distance d1=√(x1-x1’) ^2+(x2-x2’) ^2+(x3-x3’)2

Here the tuple of data (x1, x2, x3) are the most suitable data for a particular crop stored in crop database.

X1 representing Temperature values.
X2 representing humidity values.
X3 representing IR values.



Euclidean distance	Crops	Selected Crops
0.25	wheat	✔
0.30	Rice	✔
0.75	Pulse	✔
0.80	Beans	✔
0.90	Maize	×

- *Financial viability of the Crop*

After the crop has been selected on basis of environmental factors we then use market conditions of those selected crops to finally choose a favorable crop. We start by observing the trend of the particular crop over a period of time preferably one year and find its peak value. The data for prices are obtained from National Commodity and Derivative exchange. All the prices of the selected crops in stage i) would be analyzed and recorded in a table. Now to select a particular crop we would also be considering the productivity of the farmers land. This in turn will give rise to three different sub models i.e.

- More land productivity and most suitable crop selected gives maximum price.
- More land productivity and most suitable crop selected does not gives maximum price.
- Less land productivity and most suitable crop selected gives maximum price.
- Decision taken by our algorithm to predict best crop considering the model i) and iii) would be the most suitable crop giving the maximum price as this would maximize profitability.

Euclidean distance	Crops	Selected crops	Land productivity	Price	Final selection
0.25	wheat	✔	more	120	✔
0.30	Rice	✔	more	100	×
0.75	Pulse	✔	more	75	×
0.80	Bean	✔	more	55	×
0.90	Maize	×	more	40	×

Euclidean distance	Crops	Selected crops	Land productivity	Price	Final selection
0.25	wheat	✔	less	120	✔
0.30	Rice	✔	less	100	×
0.75	Pulse	✔	less	75	×
0.80	Bean	✔	less	55	×
0.90	Maize	×	less	40	×

For model

- Decision would be taken on basis of maximizing profitability even if we have to compromise on the environmental suitability factor. Our objective would be to maximize profit gains for the farmers even if some environmental factors are not the most suitable conditions.

Euclidean distance	Crops	Selected crops	Land productivity	Price	Final selection
0.25	wheat	✔	more	75	×
0.30	Rice	✔	more	100	×
0.75	Pulse	✔	more	150	✔
0.80	Bean	✔	more	55	×
0.90	Maize	×	more	40	×

IV. CONCLUSION

The above project will help farmers in making choices that are more scientific and profitable by eliminating traditional practices in selection of crops in field of agriculture.

V. ACKNOWLEDGMENT

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