

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

Sourabh Patil, Kunal Goswami, Kuldip Singh, Ashish Ramdasi  
Computer Engineering, Sinhgad Academy of Engineering

**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 today's present environmental conditions or might not even be financially viable.

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

- Suitability of a crop for the particular landholding.
- 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 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.

### ➤ 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

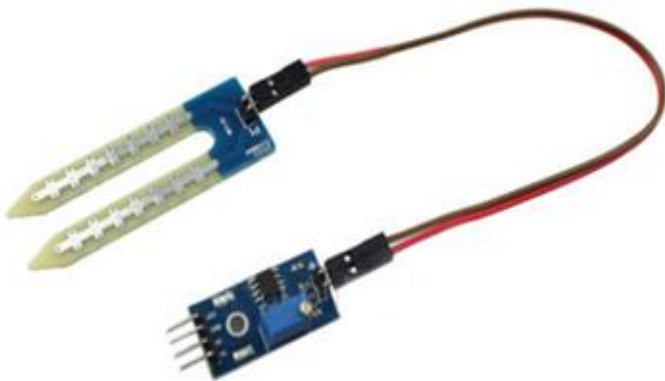
## II. METHODOLOGY

### 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.

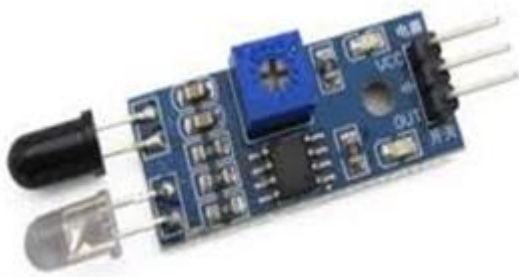
- *Soil moisture sensor:*

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.



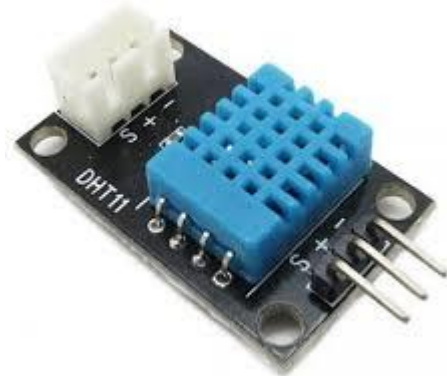
- *Infrared sensor*

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.



- *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.



### A. 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).

### B. 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  $d1(x1', x2', x3')$

$X1'$  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.

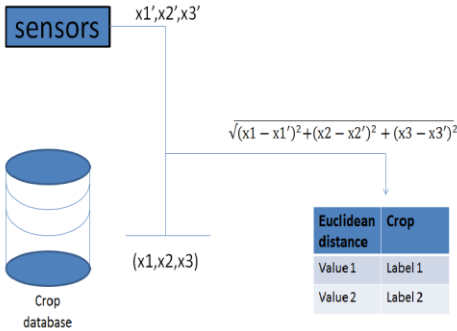
Euclidean distance  $d1 = \sqrt{(x1-x1')^2 + (x2-x2')^2 + (x3-x3')^2}$

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 Crop
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. The below graph shows the variation of prices of sugarcane over a period of a year. We also consider other factors like:

- The growing period required for the crop
- Price achieved after harvesting

Following are the results of the crop cotton

#	LABEL	NO_OF_MONTHS
1	COTTON	6
2	SUGARCANE	4
3	GROUNDNUT	4
4	WHEAT	4

Fig 1

Fig 1 shows the no of months required for growing a particular crop. This factor is taken into consideration before the system suggest a price for the particular crop. The system suggests the price after X no of months where

$X = \text{no\_of\_months} + \text{sowing month};$

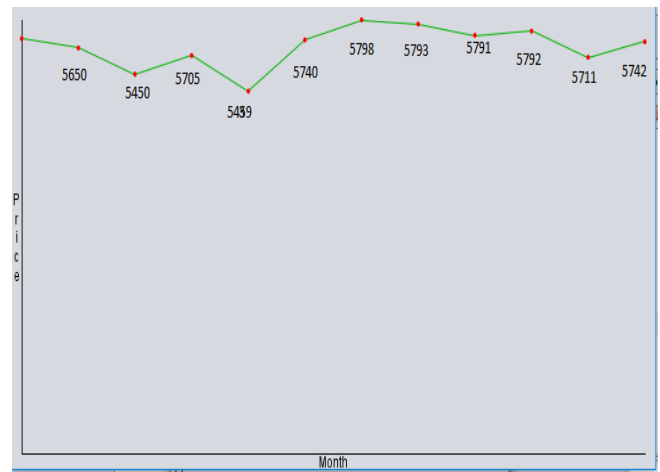


Fig 2

Fig 2 shows the price fluctuation over the years of crop cotton and as we see that the maximum price achieved by cotton is Rs 5798 in the month of July therefore we recommend selling the farmers product in the month of July to maximize profit. However, the date of selling is subjected to the condition of no\_of\_months required to grow that particular crop.

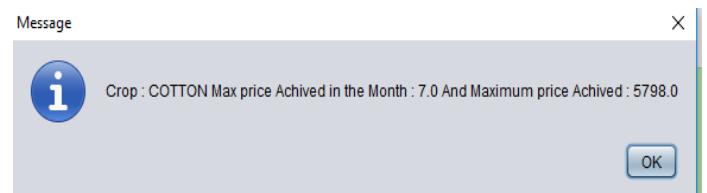


Fig 3:-

### III. 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.

### IV. ACKNOWLEDGMENT

We thank A.P.Ramdasi for assistance with Machine learning, IOT, Data mining techniques, and computer engineering department, Sinhgad Academy of Engineering for comments that greatly improved the manuscript.

### REFERENCES

- [1] Farmer's Analytical Assistant , KAnOE - Centre for Knowledge Analytics and Ontological Engineering, PESIT, PES University, Bangalore, India.
- [2] Analytical Hierarchy Process for Land Suitability Analysis , Institute for Agricultural Technology of East Kalimantan Center for Agricultural Technology Assessment and Development Samarinda, Indonesia.
- [3] Fu Bing, "Research on the agriculture intelligent system based on IOT",in IEEE International Conference on Image Analysis and Signal Processing , Zhangjiajie,China,pp. 1-4
- [4] Ren GuoPing, "Study on land intensive use for potential evaluation in Yueyanglou district of Yueyang city," in 5rd IEEE International Conference on Measuring Technology and Mechatronics Automation, Hong Kong, China, pp. 1060-1063.
- [5] Liu Dan,Cao Xin,and Huang Chongwei,, "Intelligent agriculture greenhouse environment monitoring system based on IOT technology,"in IEEE International Conference on Intelligent Transportation, Big Data and Smart City, Las Palmas de Gran Canaria, Spain, pp. 487- 490.
- [6] Ji-chun Zhao,Jun-feng Zhang,and Yu Feng , "The study and application of the IOT technology in agriculture," in 3rd IEEE International Conference on Computer Science & Information Technology,Changsha,China,pp.462-465.
- [7] Duan Yan-e, "Design of intelligent agriculture management information system based on IoT," in 4rd IEEE International Conference on Intelligent Computation Technology and Automation, Washington, DC, USA,pp.1045-1049.
- [8] Shuangyin Liu,Longqin Xu, "Study on key technology of subtropical characterized agricultural intelligent service system,"in Second IEEE International Symposium on Computational Intelligence & Design,Changsha, Hunan, China,pp: 561-565.
- [9] Applying Machine Learning to Extract New Knowledge in Precision Agriculture Applications.
- [10] A review of the application of data mining techniques for decision making in agriculture.