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Smart Farming System Using Data Mining

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Abstract

Smart farming system is an autonomous & sophisticated mechanism, which will aid in the growth of agriculture yield by applying hi-tech agriculture techniques without human intervention. The paper represents an overview of a recent smart farming software solutions. The proposed system works on the data mining techniques & data obtained from satellite information, Internet, from soil testing report fed in the existing databases. It elegantly makes use of the clustering algorithms for taking decisions based on the awareness of weather changes, by keeping track of crop growing stages, with proper water utilization, along with the decision of fertilizer to be used according to crop stage, as well as the pesticide to be used to protect crops from diseases and insect attack. This system is capable of increasing the productivity of fields by managing farm operations smartly.

Keywords: Data Mining, Satellite Information, Preprocessing, Smart Decision System**.**

INTRODUCTION

Agriculture is the biggest water consumer, while the irrigation accounts for approximately 70% of global water consumption. The domestic and industrial sectors account for 10% and 20%, respectively, although these percentages vary considerably across countries. As population is increasing day by day, the demand of food is on gain too. There are certain more factors that affect more crop yield, such as environmental factors like erratic weather conditions leading to crop loss, farmer's ignorance in embracing newer technologies that can be used for enhancement of gross profit from agriculture. In spite of all such problems, agriculture is a cardinal source of employment and plays a key role in socio-economic development of India.

So, in order to improve the condition, we can make use of technology in smarter way. In order to make this possible we need more productivity from farming. The domestic and industrial sectors account for 10% and 20%. Without improved efficiencies, agricultural water consumption is expected to increase globally by around 20% in few years. In the proposed system, Data mining is used for all data mapping & processing. Data Mining is about finding rules in data. The technology of data mining is narrowly connected to data storage and is intertwined with database management system. Data mining involves the process of finding large quantity of previously unknown data, and then their use in important business decision making. Key phrase here is 'unknown datum' which means that the datum is buried in large quantity of operational data, which if analyzed, provides relevant information to agriculture decision makers. The overall goal of the data mining process is to extract information from a data set to extract previously unknown, interesting patterns such as groups of data records (cluster analysis), unusual records (anomaly detection) and transform it into an understandable structure for further use. The. **data mining** is the process of finding correlations or patterns among dozens of fields in large relational databases. Here, K-nearest neighbor technique is used for smart farming decision making.

Smart farming system covers 3 issues of farming-

1) Water required for crop at particular Day/Stage.
2) Fertilizer to be used at particular stage according to the micro-nutrients (Nitrogen, Potassium, Phosphorous) as well as Macronutrients (Calcium, Magnesium, Sulphur) present in soil.
3) Pesticides to be used depend on various environmental factors such as humidity, Pollution (air, soil and water) etc.

In the smart farming system the decision about the water requirement to the crop at particular moment will be given by getting the information about the temperature, humidity, probability of rainfall on current day, as well as on previous day and on the next day.

LITERATURE SURVEY

There are various traditional techniques available for irrigation, exp. Traditional sprinkler system and Rotary system for irrigation. All these are the manual techniques but we need dynamic control over the residential irrigation system, as in previous system more water is wasted so, various hardware/software based irrigation system as well as mobile based system introduced.

Irrigation System- In the first Hardware/Software based irrigation system hardware (sensor) and software (Desktop application) the Iris scheduling software is used. It is a freeware application, which provides expert system based irrigation advices using automatically collected or manually inserted data. This system includes complex software that gets information from different sources such as whether station, sensors satellite information and data from Internet and from database available. Various kinds of sensors are used for different purpose such as to monitor air humidity, solar

radiation, soil temperature, soil moisture, air temperature, etc. Other sensors are used for monitoring plants their growth rate, chemical exchange, response on irrigation. This software uses expert system and artificial intelligence methods and algorithm for interpretation of data. On the basis of this data it provides real-time decision about current irrigation time as well as about future. The mobile based irrigation system use Arduino UNO (Open source prototyping platform depend on user friendly hardware and software which can be customized according to user need). Arduino UNO board consists of microcontroller used to control motor. It is programmed in such way that it can sense moisture level in soil with hydrometer sensor and inform Arduino UNO. If the moisture level is below threshold for particular crop, then notification of water required will be send on farmers mobile App from the Arduino UNO. Both of these techniques are costly, as it requires huge hardware and also if the sensor stops working then whole system will go down or not give accurate result. In mobile application some of the factors are considered for water required calculation, so, we need more effective mechanism that gives result even when hardware fails. With the help of data mining Smart farming system, we calculate the water required by finding correlations or patterns among dozens of fields in large relational databases.

Fertilizer system- Fertilization decision system is commonly designed for soil nutrient evaluation, management and crop fertilization by integrating modern information technology, with soil quality evaluation and crop fertilization theory, to achieve the comprehensive utilization of the knowledge of the expert. This knowledge based fertilizer decision system was designed in C++.This system works in 4 stages.

1) System Objects- Knowledge about Soil, nutrients, Crop, Fertilizer's properties, crop related properties, etc.
2) Fertilizer Knowledge- Knowledge about last fertilizer used, fertilizer absorption rate etc.
3) Relationship between objects and knowledge.
4) Fertilizer knowledge representation and storage.

In order to facilitate fertilization decision, 4 knowledge base are implemented i.e. Basic knowledge base, Nutrient evaluation knowledge base, Fertilizer rate calculation knowledge base, Fertilizer allocation knowledge base. But, the processing time of this system is slow and unable to handle huge amount of dataset also the time required for processing this data is more

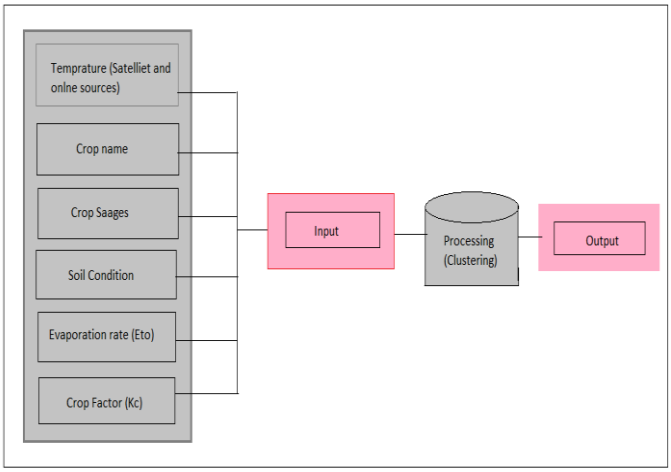
Pesticide- Pesticide Decision System is designed to protect crops from diseases and insect attack. It also helps to increase the productivity of crop. Insufficient knowledge of farmer about the pesticide usage causes harmful impact on the environment, the economy and human health. So, some less harmful pesticides are identified then develop and populate database. According to that the pesticide determination takes place in smart phone application. But, in this system focus was only given on collection of 62 harmless pesticides. But considering 62 fertilizers is not sufficient to cop up with all the diseases on plant and also the solution of the unusual disease on plant is given. Also the wireless monitoring system was introduced it aims at reducing the level of the pesticides and ensuring a high quality production. A wireless sensor network is designed, which determine the disease development during the growing season [9].

PROPOSED SYSTEM

The main motive behind the smart farming system is to provide better solution to farmer for high yield. In this system all 3 main modules i.e. Irrigation, Fertilizer and pesticide modules are integrated. Smart farming system is a web application with huge amount of dataset available in backend. The data mining is used in the process of finding correlations or patterns among the dozens of fields in relational databases. Clustering algorithm is used. Clustering is the process which partitions given data set into homogeneous group based on similarities and dissimilarity.

Initially farmer have to send soil for testing and feed the soil testing report details (which include nitrogen, potassium, phosphorus, calcium, magnesium, etc.) in application. These details are necessary for prediction of water required, fertilizer and pesticides. Also for the first time have to save the exact location of farm so that the longitude and latitude of farm is identified which is useful to get the exact temperature of farm location. Temperature of farm location is identified from satellite and online whether forecasting sources. We need to insert initial crop information such as crop name, crop stage, soil condition, etc.

Irrigation system- In irrigation module water required per hector is identified. Irrigation depends on certain factors such as Crop name, Crop stage, soil condition, Eto (Evaporation rate), Current day and next day temperature, humidity, etc. Block diagram of smart irrigation system is as follows.



Block diagram shows the working of smart irrigation system it takes temperature, crop name, crop stage, soil condition, crop factor as input. All this inputs are preprocessed then give the result as water required per hector.

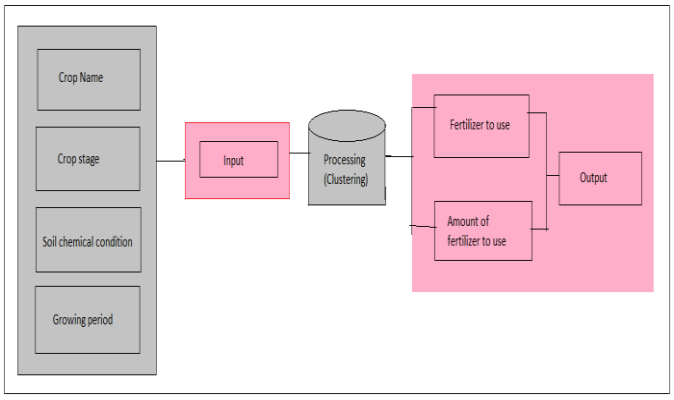
Evaporation Rate (Eto) –The amount of water gets evaporated depends on climate. The higher the values of Eto is found in area which are hot, dry, windy, sunny whereas low values are observed in area where it is cool, humid, cloudy with little or

no wind. To calculate evaporation rate the following formula is user.

Eto = P(0.46 Tmean+8)

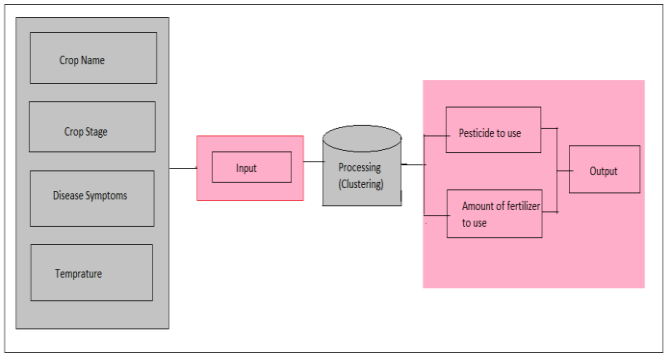
Where, Eto – Evaporation rate, P - Mean of longitude & latitude Tmean -Mean of daily temperature Current day, next day temperature, humidity is retrieved from satellite. All this inputs are treated as an input for application. Before data mining algorithm can be used, target data set must be assembled so that mining can uncover patterns actually present in the data, the target data set must be large enough to contain these pattern. Here, clustering algorithm is used for partitioning a set of data (or objects) into a set of meaningful sub-classes. After clustering the record that gives more accurate result according to productivity of previous year will get selected and required water amount per hector will be predicted.

Fertilizer System- Fertilizer module is implemented to identify name and amount fertilizer to be used on particular crop and at particular stage of development. History of crop will be kept in data set. Fertilizer to be used depends on micronutrients (Nitrogen, Potassium, Phosphorus) and macronutrients (Calcium, Magnesium, Sulphur) [6-7]. If pH level<7 then the soil is alkaline and if pH>=7 the soil will be saline. Due to illiteracy farmer directly apply fertilizer without testing soil it affects on the crop yield. So, soil testing soil testing is mandatory. In the proposed system soil testing is mandatory that help us to identify the proper amount of fertilizer to use according to available nutrient, crop stage etc. Block diagram gives clear idea about fertilizer system.



Fertilizer module takes crop name, crop stage, soil chemical condition and growing period as input then after preprocessing or clustering the fertilizer name and its quantity will be given as output.

Pesticide-Pesticide module is crucial for quality control & prevention of diseases. Excess or incorrect of use of pesticide causes side effect on crop on crop so it is necessary to apply proper amount of pesticide. Number of factors need to be consider for deciding the pesticide to be used for example Humidity, temperature, sudden change in environment, excess use of water, water pollution, air pollution, soil pollution(due to industries around farm),etc. Humidity and temperature will be retrieved from satellite and from online sources and then all the other factors will be selected by farmer along with the symptoms of disease for example holes on leaves, insect attack on crop, etc. according to all this data cluster will be formed and then pesticide name and amount of pesticide, and also number of days to apply fertilizer according to the stages will be given as an output. Here, cluster can be form according to the temperature and humidity then after preprocessing the relevant pesticide will be suggested to the farmer with their amount and per day use. Block diagram of pesticide system is as follows.



Block diagram show pesticide system it takes crop name, crop stage, disease symptoms, temperature then it processes the input and gives pesticide to use and its amount as output.

CONCLUSION

In this paper, we introduced the approaches of smart farming system that will result in maximum crop yield. This system is very prominent about the results as its advance than the previously developed approaches. The clustering algorithms used for computing in this system are the logics written for pattern matching which elegantly returns the perfect outputs as per the input parameters passed, by using the data mining. This results into the proactive approach of giving outputs by smartly tracking the future conditions possible to arise. Because of autonomous in nature, this system won't need any possible interventions or time-to-time handling or changing of the data. It will precisely focus on the growth & cultivating of crops and will increase the productivity by applying its tactics. The smart farming system will also alert the farmers about critical weather conditions which will again make every possible anomaly to be sustained. Water is limited resource and its conservation is the biggest crisis nowadays, but using this system will aid into proper utilization of water & no wastage or under-over supply. Summarizing all the smart farming system is an idol solution for future farming.

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