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Trendy Agricultural Scheme with Data Mining

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Abstract

Smart farming system is a self-contained and sophisticated mechanism that will aid in the growth of agricultural yield by utilizing high-tech agriculture techniques without the need for human intervention. The paper provides a summary of recent smart farming software solutions. The proposed system is based on data mining techniques and data obtained from satellite information, the Internet, and soil testing reports, which are fed into existing databases. It elegantly employs clustering algorithms for making decisions based on weather changes, by keeping track of crop growing stages, with proper water utilization, as well as the fertilizer to be used according to crop stage, as well as the pesticide to be used to protect crops from disease and insect attack. This system has the capability of increasing the productivity of fields by managing farm operations smartly.

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

INTRODUCTION

Agriculture is the largest water consumer, with irrigation accounting for roughly 70% of global water consumption. Domestic and industrial sectors account for 10% and 20%, respectively, though these percentages vary greatly across countries. As the world's population grows, so does the demand for food. There are additional factors that influence crop yield, such as environmental factors such as erratic weather conditions that cause crop loss, and farmer ignorance in embracing newer technologies that can be used to increase gross profit from agriculture. Despite these challenges, agriculture remains a critical source of employment and plays an important role in India's socioeconomic development of India.

So, in order to improve the situation, we can make better use of technology. More agricultural productivity is required to make this possible. Domestic and industrial sectors contribute 10% and 20%, respectively. Without improved efficiencies, agricultural water consumption is expected to rise by around 20% globally in the coming years. Data mining is used for all data mapping and processing in the proposed system. Finding rules in data is what data mining is all about. Data mining technology is closely related to data storage and is intertwined with database management systems. Data mining is the process of discovering large amounts of previously unknown data and then applying it to important business decisions.

The key phrase here is 'unknown datum,' which means that the datum is buried in a large volume of operational data that, when analyzed, provides relevant information to agricultural decision makers. The overall goal of data mining is to extract information from a data set in order 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 future use.

The process of discovering correlations or patterns among dozens of fields in large relational databases is known as data mining. In this case, the K-nearest neighbor technique is used to make smart farming decisions.

The smart agricultural system addresses three farming issues.
1) Water required for crop on a specific day/stage.
2) Fertilizer to be used at specific stages based on soil micronutrients (Nitrogen, Potassium, Phosphorous) and Macronutrients (Calcium, Magnesium, Sulphur).
3) Pesticides used are determined by environmental factors such as humidity, pollution (air, soil, and water), and so on.

The smart farming system will make a decision about how much water to give to the crop at any given time based on information about the temperature, humidity, and likelihood of rain on the current day, as well as the previous day and the next day.

LITERATURE SURVEY

Traditional irrigation techniques include the traditional sprinkler system and the rotary irrigation system. All of these are manual techniques, but we need dynamic control over the residential irrigation system because more water is wasted in the previous system, so various hardware/software based irrigation systems as well as mobile based systems were introduced. Irrigation System- The Iris scheduling software is used in the first Hardware/Software based irrigation system hardware (sensor) and software (Desktop application). It is a freeware application that provides expert irrigation advice based on data collected automatically or manually. This system includes complex software that gathers information from various sources such as whether the station, sensors, satellite information, and data from the Internet and available databases.

Sensors of various types are used for various purposes such as monitoring air humidity, solar radiation, soil temperature, soil moisture, air temperature, and so on. Other sensors are used to monitor plant growth rate, chemical exchange, and irrigation response. For data interpretation, this software employs expert system and artificial intelligence methods and algorithms. Based on this information, it makes real-time decisions about current and future irrigation times. Arduino UNO is used in the mobile irrigation system (Open source prototyping platform depend on user friendly hardware and software which can be customized according to user need). The Arduino UNO board is made up of a microcontroller that is used to control a motor.

Other sensors are employed. It is programmed to detect moisture levels in soil using a hydrometer sensor and to notify the Arduino UNO. If the moisture level for a specific crop falls below a certain threshold, the Arduino UNO will send a notification of water needed to the farmer's mobile app. Both of these techniques are expensive because they require large amounts of hardware, and if the sensor fails, the entire system will fail or produce inaccurate results. Some factors are considered in mobile applications for water required calculation; therefore, we require a more effective mechanism that provides results even when hardware fails. We calculate the amount of water needed using a data mining Smart farming system by looking for correlations or patterns in large relational databases, among dozens of fields.

Fertilizer decision system- A fertilizer decision system is commonly designed for soil nutrient evaluation, management, and crop fertilization by integrating modern information technology, soil quality evaluation, and crop fertilization theory, in order to achieve the comprehensive utilization of expert knowledge. C++ was used to create this knowledge-based fertilizer decision system. This system operates in four stages.

1) System Objects- Information about soil, nutrients, crops, fertilizers, crop properties, and so on.
2) Fertilizer Knowledge- Knowledge of the most recent fertilizer used, fertilizer absorption rate, and so on.
3) The connection between objects and knowledge.
4) Representation and storage of fertilizer knowledge.

Four knowledge bases have been implemented to help with fertilisation decisions: basic knowledge base, nutrient evaluation knowledge base, fertiliser rate calculation knowledge base, and fertiliser allocation knowledge base. However, the processing time of this system is slow and it is unable to handle large amounts of data; additionally, the time required to process this data is longer.

A wireless monitoring system was also introduced, with the goal of lowering pesticide levels and ensuring high-quality production. A wireless sensor network is created to monitor disease development during the growing season [9].

PROPOSED SYSTEM

The primary goal of the smart farming system is to provide farmers with better solutions for increased yield. All three main modules, namely irrigation, fertiliser, and pesticide, are integrated in this system. Smart farming system is a web application with a massive amount of data stored in the backend. Data mining is used to discover correlations or patterns among dozens of fields in relational databases. The clustering algorithm is employed. Clustering is the process of grouping a set of data into homogeneous groups based on similarities and dissimilarities.

Farmers must first send soil for testing and then feed the soil testing report details (which include nitrogen, potassium, phosphorus, calcium, magnesium, and so on) into the application. These specifics are required for estimating the amount of water, fertilizer, and pesticides needed. Also, for the first time, the exact location of the farm must be saved so that the longitude and latitude of the farm can be identified, which is useful for determining the exact temperature of the farm location. The temperature at the farm location is determined using satellite and online weather forecasting sources. We must enter basic crop information such as crop name, crop stage, soil condition, and so on.

Irrigation system- The irrigation module determines the amount of water required per hector. Irrigation is affected by variables such as crop name, crop stage, soil condition, Eto (Evaporation rate), current and next day temperature, humidity, and so on. The following is a block diagram of a smart irrigation system.The block diagram depicts the operation of a smart irrigation system, which accepts temperature, crop name, crop stage, soil condition, and crop factor as input. All of these inputs are preprocessed, and the result is the amount of water required per hector.

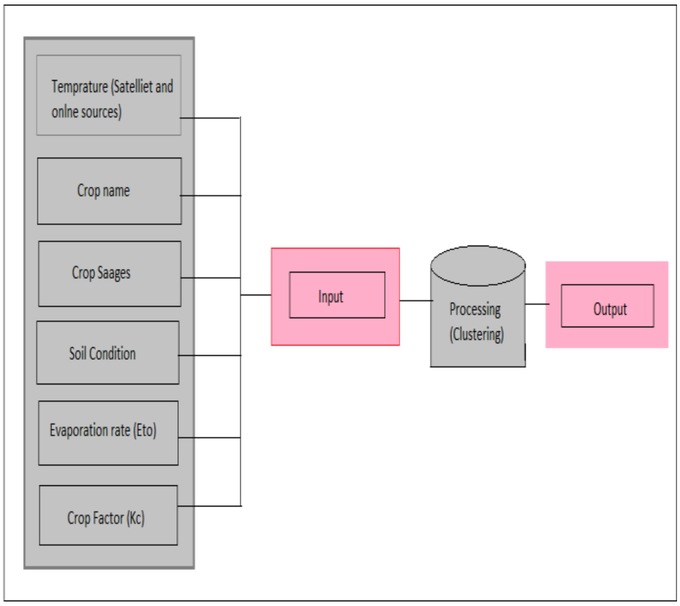
Evaporation Rate (Eto) -The amount of water evaporated is affected by the climate. Higher Eto values are found in areas that are hot, dry, windy, and sunny, whereas low values are found in areas that are cool, humid, cloudy, and have little or no sunlight. The following formula is used to calculate evaporation rate.

$$Eto = P(0.46\ Tmean+8)$$

Where, P - Mean of longitude and latitude, Eto - Evaporation rate Tmean -Daily temperature average Temperature and humidity for today and tomorrow are retrieved from satellite. All of these inputs are treated as application inputs. Before using a data mining algorithm, a target data set must be assembled in order for mining to uncover patterns that are actually present in the data; the target data set must be large enough to contain these patterns. In this case, the clustering algorithm is used to divide a set of data (or objects) into a set of meaningful sub-classes. After clustering, the record with the most accurate result based on previous year productivity will be chosen, and the required water amount per hector will be predicted.

Fertilizer System- The fertilizer module is used to identify the name and amount of fertilizer to be used on a specific crop at a specific stage of development. Crop history will be saved in the data set. The type of fertilizer used is determined by micronutrients (Nitrogen, Potassium, Phosphorus) and macronutrients (Calcium, Magnesium, Sulphur) [6-7]. If the pH level is 7, the soil is alkaline; if the pH level is greater than 7, the soil is saline. Because of illiteracy, farmers apply fertiliser without first testing the soil, which reduces crop yield. As a result, soil testing is required. Soil testing is required in the proposed system to determine the appropriate amount of fertilizer to use based on available nutrients, crop stage, and so on. The fertilizer system is depicted in a block diagram.

Fertilizer module takes crop name, crop stage, soil chemical condition, and growing period as input and outputs fertilizer name and quantity after preprocessing or clustering.



Pesticide- The pesticide module is critical for quality control and disease prevention. Excessive or incorrect pesticide use has negative effects on crops, so the proper amount of pesticide must be applied. A variety of factors must be considered when deciding which pesticide to use, for example. Humidity, temperature, abrupt environmental change, and excess Water use, water pollution, air pollution, soil pollution (due to industries near the farm), and so on. Humidity and temperature will be retrieved from satellite and online sources, and all other factors, including disease symptoms such as holes in leaves, insect attack on crop, and so on, will be chosen by the farmer. A cluster will be formed based on all of this data, and then the pesticide name and amount of pesticide will be determined. The number of days to apply fertilizer based on the stages will be provided as an output. Here, clusters can be formed based on temperature and humidity, and after preprocessing, the relevant pesticide will be recommended to the farmer, along with the amount and per day use. The following is a block diagram of a pesticide system.The pesticide system is depicted in a block diagram. It takes the crop name, crop stage, disease symptoms, and temperature as input and outputs the pesticide to use and its amount.

CONCLUSION

In this paper, we introduced smart farming system approaches that will result in maximum crop yield. This system is very noticeable in terms of results because it is more advanced than previously developed approaches. The clustering algorithms used in this system for computing are logics written for pattern matching that elegantly returns the perfect outputs based on the input parameters passed, using data mining. This results in a proactive approach to providing outputs by smartly tracking future conditions that may arise.Because it is autonomous, this system will not require any possible interventions or data handling or changing on a regular basis. It will precisely focus on crop growth and cultivation, increasing productivity through the use of its tactics. The smart farming system will also notify farmers of critical weather conditions, allowing any anomaly to be sustained. Water is a limited resource, and its conservation is the most pressing issue today; however, using this system will aid in proper water utilization, with no waste or oversupply. To summarise, the smart farming system is a godsend solution for future farming.

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