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Growth of Advanced Technologies in Agriculture

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A B S T R A C T

Cloud bases big analytics plays an important role in the smart study of agriculture. Smart agricultural is essential for nowadays farmers. As we live in India, most of the farmers are using smartphones. In the daily life of a farmer, Information and communication technology(ICT)plays a vital role to do their day-to-day activities and get various information.The IoT has tremendous applications in the Digital and smart Agriculture domain like monitoring the crop growth, selection of the fertilizer, irrigation decision support system, etc. In this paper, IoT importance is showing about how IoT device is used to sense the agricultural data and it is stored into the cloud database cloud based big data analytics is been used for multiple ways. Ans later, the prediction is performed based on data mining technique which information reaches the farmer via mobile app. Our final aim is to enhance the entire crop production and control the agricultural cost of the products using this predicted information by tools we are using.

Keywords: IoT, WSN, Cloud computing, Big Data, Crop production, High Tech Agriculture

1. Introduction

In the last some years, recent trades like Big data IoT, and many more like the same are being developed day by day and they truly help farmers to carry out their activities. Nowadays, the world is moving on towards the smart world concepts such as smart cities, smart homes, smartphones, etc. and they are at the stage of smart agriculture too.

Agriculture plays an important role in the Indian economy since the first five-year plan and after independence. It continues to be the stay of life for the majority of the Indian population [1]. Due to improper maintenance and incomplete information, the crop becomes damaged which causes a huge loss for a farmer, and hence the smart Agriculture concept was introduced which is playing an important role [2]. Precision agriculture is used to enhance crop production in day-to-day life by using advanced technologies. It provides information about different environmental criteria's and it helps to monitor the system.[3]

Analyzing and examining environmental factors are not enough and a complete solution to improve the yield of the crops nowadays. There are several other criteria's that affect the productivity to the upper level. These factors include an attack of insects and pesticides used and are to be controlled by sprinkling the proper insecticide and pesticides for the crop which are more harmful to crops. . Flowers also do pollination by crops So, the farmers face several problems during the cultivation and harvesting stage.

The solutions for all the problems which we are facing today are to take care of all environmental and other factors and develop an integrated system which contains technologies as given below.

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A. Internet of Things (IoT) In today's world the Internet plays a vital role in every domain. In the agricultural domains, the proposed method is used to monitor the agriculture fields with the help of IoT and its base devices[4]

Sensors are used for Examining the various parameters in the agricultural domain based on the wireless sensor network technology. In that, the proposed system is used to collect the soil properties, and then it will be stored in the cloud database(As cloud as huge storage to save the database) [5]. IoT technologies have several tools and hardware to collect the data .these tools are given below in the list::

- Arduino Ethernet Shield
- BeagleBone
- Intel Galileo
- openPicusFlyportPro

B. Cloud computing

Cloud computing always provides sharing of multiple resources with an effective economic cost. Cloud computing service providers offer the services at an effective economical cost. It is being used for the storage of agriculture data. It is used in the agriculture area sector along with IoT [6].

C. Big Data

Big data is an infinite amount of information collected from different sources and for a longer period like sensor data, social networking data, and business data in the agriculture field. The major challenge is capture, examination, storage, analysis, and search. Big data is used for business data processing effectively along with big data analytics to search for hidden patterns in the data. The process is used to combine business and traditional analytics is called big data analytics [7]. It has four types of analytics as follows:
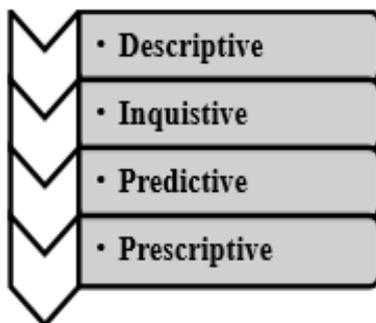
Fig. 1.Big Data Analytics types.

We have shown Big data analytics types in Fig. 1. In that, use predictive analytics to determine the future possibilities of the data modeling in the agricultural area as it has wide scope today. This is used to generate the different data analytics and focuses on them. They have enormous Techniques that are used to predict and analyze the data. The techniques we used are classification algorithm, clustering algorithm, Association rule mining. These algorithm examples are SVM, decision tree algorithm, C4.5, k-nearest neighbor, Naive Bayes, Neural networks, K-means clustering methods, Apriori algorithm, Fpgrowth algorithm because these are based on data that we will be store in the cloud.

Also, soil data mining is useful for crop prediction and deciding the better crop sequence based on the previous crop sequences in the same agricultural area with the current soil nutrient information. Big data analytics is useful in monitoring the field data as well as controlling the field operations which provides flexibility and ductility. Nowadays we see Big data technologies like Hadoop, HDFS, MapReduce, Pig, Hive, STORM, Mahout, etc. The agriculture sector consists of a huge volume and variety of data [8].

As these technologies are easy to use , it was focusing on the information , data and processes the data with the help of e-agriculture. It focuses on the agriculture field to involve an innovative way to find out the design, conceptualization, development, evaluation.

D. Mobile Computing

Mobile computing has affected more in our day-to-day life due to its availability and has the cheaper cost of communication. It is in use in almost every field including the agriculture sector. A system based on mobile computing has been proposed for sending daily, seasonal messages to farmers regarding the product information and weather information which would be most efficient for farmers to get information [9].

Controlling of all these operations will be through any remote smart device or computer connected to the Internet and the operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera, and actuators with micro-controller and raspberry pi in a very effective manner. . At the end, the report will be sent to the farmer through mobile computing technologies.

2. Literature Review

In the agricultural field, the system models play a very significant field in the development of agro-ecological and socio-economic conditions. Investment in agriculture in India is increasing day by day but proper planning and better financial resources are required.
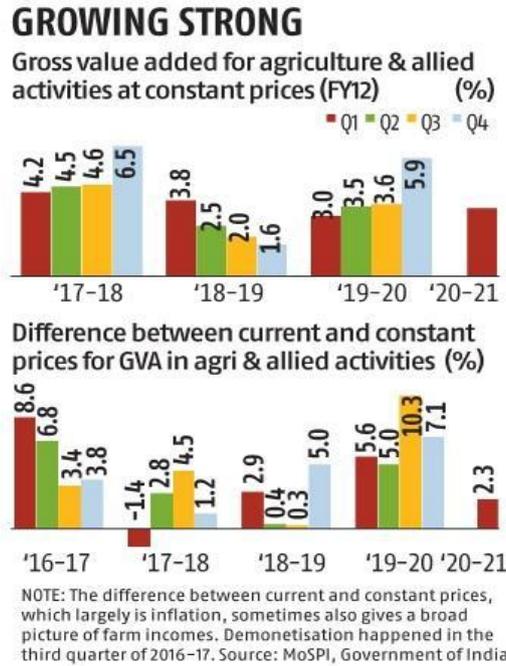
Fig. 1. Gross value Addition in the agricultural field [10]

It helps us to identify the management to land managers and across space, area and time as long as the needed soil, management, climate, and socio-economic information in agricultural area.

 Decision Support Systems (DSSs) use to make the information for pest management, farm management. These systems are not using advanced techniques to process the data. So, we need to use the smart technique concepts to take the decisions for the problem. Hence initial(first) model is used to collect the weather forecasting techniques which is very complicated. The second model is used to introduce the WSN tool kit for collect the data and then the third model is used the Back Propagation Algorithm can be applied to different parameters of weather forecast .

In , we have given an approach to predict crop yield using fuzzy set theory and probability theory based in the database. The farmer's experience and crop yield prediction are based on the climate conditions.

We must focus on agriculture from an economic perspective. Hence this graph shows the Economic development and agriculture in India.
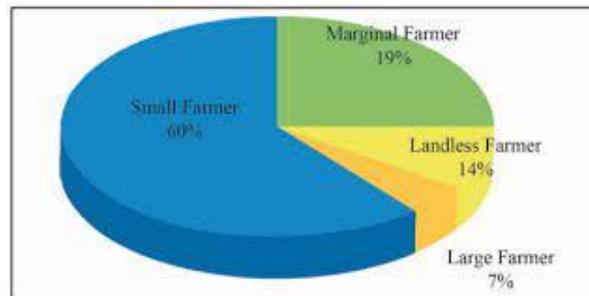
Fig 3 Distribution of agricultural farmers in India [11]

we[], have presented their work in Agro cloud. It is used to store the details of the agricultural area, farmers, distributors, and e-governance. The agricultural products' costs are used to store in the cloud. . Use the data mining techniques to predict the data. In that, they need the big data concepts are used for the problem prediction and for problem reduction as well.

The HDFS(Hadoop distributed file system) is used to distributed, flexible and services for efficiently collecting and combining the data. They meet the challenges while using the cloud and big data are performance and capacity and scaling. The parameters are used in this systems are winds, temperature, and rainfall, etc. They consider the sensing service based on cloud techniques using a few applications like Agriculture and Environment monitoring.

Wireless Sensor networks increasingly enable applications and services to interact with the physical world. These services may be located across the Internet from the sensing network in these period. The data can be used to store and analyses with the help of Cloud services and big data technologies. It can be used to improve the scalability and accessibility of cloud services. Rajesh et al. present their work in the agricultural field. The integrated sensor information and cloud computing.

The service-oriented architecture is used to integrate and control the sensor node. The data can be used store and available to the users by the cloud computing technology. They offer a new application and also a new database. The sensor networks are integrated with the in-the-cloud model and the

internet. The processes are recorded by using the sensor network and it is very helpful. The collected information is very important for the company's and for farmers as well and delivers the data as fast as possible. Cloud technology is playing very effective role in agricultural field.

The agriculture sector is not new to the world hence we did research works and give better accuracy for the prediction. In that, the integration of smart applications plays a very crucial role in every step of this process. The new and emerging mobile computing technology is also used to integrate the IoT, cloud base big data analytics. The mobile computing technology is is very beneficial for farmers is used to deliver the prediction results are sent to the farmer's mobile and also they know the facilities provide by the ICT.

3. Proposed Methodology

From the Present literature, it is clearly shown that in the agriculture field the IoT, cloud and big data concepts are used separately and it is useful to predict the crop yields and it shows the dedication in the agricultural field. As a present system, a smart agricultural model is presented by integrating the above concepts to deliver the prediction attributes to the farmers through mobile computing technology.

IoT leads to the development of numerous applications in all domains like medical, manufacturing, industrial, education, governance, transportation, business practices, etc.This technology is used in the agriculture field to collect the data through the sensors and stored it in the cloud database through the internet where data is large so the cloud has a large capacity to store. Then using the big data predictive analytics techniques to analyze and predict the crop and cost of the fertilizers . Cloud database is used in the agriculture sector. It is an efficient and well-defined application. The cloud-based system is integrated with the mobile phone aims as follows:

Cloud database is used to store and share the crop information, prices of the fertilizers(organic), and crop prices.

In the agriculture sector, cloud computing gives smartness with flexibility, predictability ,ductility, scalability, and optimization techniques.

It gives information for a farmer at an economical and reasonable cost.

In the agriculture field, IoT plays a very important role to collect data.

In agricultural development, cloud computing plays a vital role to store data. The farmers will get the cloud storage by requesting cloud services. The cloud service provider gives the storage place on the cloud to the farmer to store the agricultural data and they allow permission to access and analyze the data.

In this model, the process can be divided into map and reduce which is be done by mapReduce algorithm. A map function is used to perform filtering and sorting and reduce function is used to perform a summary operation.

From the literature, the problems are identified and the solution was proposed to select the cloud-based big data analytics concept to analyze, examine and evaluate the data in the agricultural field. Firstly, by using preprocessing step the noisy values are eliminated, and then the discrimination method is used to process the data effectively. Later, the categorization process is used to convert the data into a standard format, and the attributes selection method is used to select a subset of important attributes and then the Classification methods are applied. Finally, the effectively calculated association rule algorithm using MapReduce is used to predict the crop patterns.

The proposed method workflow diagram is shown in   Fig. 2. This study provides an exploration into various development technologies like smartphone applications and precision agriculture. It enables the farmer to have an effective and smart solution to improve the crop yield with less cost.
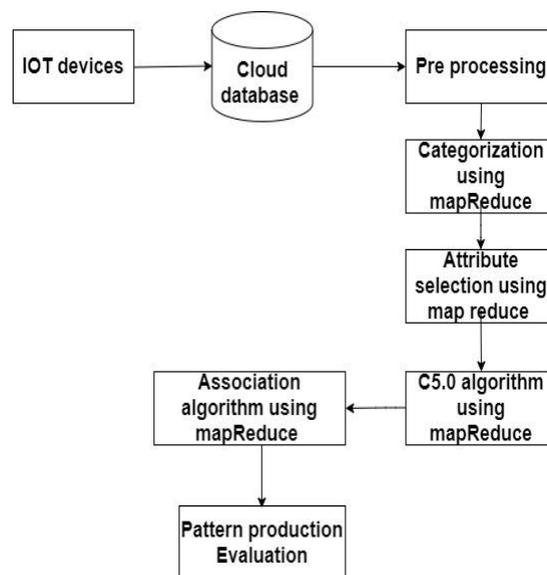
Fig. 2.Proposed method flow diagram.

4. Summary

Through real-time sampling of soil, the farmer will be able to get current fertilizer requirements for the agriculture crop. This is an essential requirement for the agriculture sector in India to get improved crop production with a reduction in the cost of fertilizer requirements keeping soil with goodness. As we know, the data is collected every years for crop details and soil conditions, this model provides Big-Data analysis for better crop sequence, next crop to be cultivated for better production, total crop production in the area of interest, total fertilizer requirements, and other data of interest can be analyzed and according to that goodness of crops is measured effectively.

This model also facilitates the estimate of total production and per crop region-wise, total fertilizer requirements. This will be helpful to keep the cost of agricultural products in the managed budget. Through notifications, farmers will also inform about current schemes for agriculture by the government.

Our future work will be focusing on interfacing different soil nutrient sensors which are good detect with anyone IoT tools then collect the data with the sensor tools and store the data into a cloud database to analyzing and predict with the data mining algorithms suitable for agricultural Big Data analysis for getting the desired outcome with desired time-lapse.

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