Collaborating Technologies for Evolution in Agriculture

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ABSTRACT

As India is rightly said "The land of Agriculture", the main part of income in India is agriculture. Ever since people learned to grow crops, harvest and sell them to market. But the farmers are not aware about the fact that changes in weather conditions, pests, soil fertility and diseases etc. affects the final outcome and they have grown the same crops for centuries. Now there is need to formulate techniques for smart and sustainable agriculture. Smart in sense, employment of technologies such as IoT, Cloud computing, Big data etc. In this proposed system, we emerge sensors into farmland and then Soil and environment properties are sensed, are periodically sent to cloud through IoT.The Cloud is used to store the details of farmers, periodic soil properties of farmlands, and current environmental conditions also information about crop diseases. The Big data analysis on data is done for fertilizer requirements, best crop sequence analysis, and for better cop production.

Keywords: Smart Agriculture, Internet of Things, Cloud Computing and Big data analysis.

I.   INTRODUCTION

Agriculture is the major source of income for the largest population in India and is major contributor to Indian economy. However, technological involvement and its usability still have to be grown and cultivated for agro sector in India. Although few initiatives have also been taken by the Indian Government for providing online and mobile messaging services to farmers related to agricultural queries, agro vendor's information to farmers, it provides static data related to soil quality at each region. The system, which utilizes real time data of soil quality based on its current properties for decision-making, has not been implemented. Soil properties determine the quality of soil. The soil pH value and amount of properties like Nitrate, Phosphate and Potassium in the soil is an important factor, which determines the soil quality and type of crop production.

Real time monitoring of these properties helps to maintain soil health intact by applying only required amount of fertilizers. Soil moisture analysis helps to apply the water whenever necessary avoiding wastage of water. In addition, environmental conditions such as temperature and moisture also affect the crop production and crop diseases. In this respect, we need a dynamic model, which collects such real time data. In support to this, all agriculture entities need to be connected to have decision-making system to increase the production and ease the distribution of agricultural products from farmers to marketing agencies and from vendors to farmers. Such system will also be responsible for controlling other parameters like agro product rates.

Smart mobile phones are available now days to many users including in the rural areas.

Pic controller, which can be interfaced to soil and environmental sensors to collect soil properties and current environmental conditions. This motivates to develop a cost effective and portable sensor kit for sensing the soil properties for current requirements

of fertilizers. The soil data from farmlands needs to be collected through sensor kit and sent to Agro Cloud storage for further processing. The collected big-data then can be analyzed for the required actions for production.

II. METHODS AND MATERIAL

A. Existing Work

We see farmers take crop in crop field without knowing the Fertility, nutrients and pH values of soil. Taking crop without understanding these all information could not make production well. Trying to grow crops without knowing the soil pH or fertility levels of each crop field is like driving a car with broken speedometer; eventually you are going get in trouble. Farmer takes crop without any information, which is related to the soil and use large amount of fertilizers, which are sometimes not required for the soil to grow crop. For these fertilizers farmers spend more money for. The centers for Agriculture, Food and Environment does the sampling of soil and most of the farmers rely on soil analysis results realizing this fact.

Soil sampling involves the analysis of a soil sample to give you clear information on the soil. This will include its nutrient content, composition and other characteristics that are important to plant health, such as acidity and pH level and detrimental contaminants. Limitations of existing work

- ✓ Time-consuming process
- ✓ Manual Process
- ✓ Inefficient
- ✓ Economical overhead
- ✓ Require more human interaction

B. Proposed Work

This proposed system explores the potential of Wireless Sensor Network (WSN) and Internet of Things in the area of agriculture in India. Farmers have already begun to employ high-tech farming techniques and technologies. With the evolution of precision agriculture wireless sensor networks era of great use in the field of agriculture for measuring temperature, humidity, soil PH, light intensity etc. With the emergence of Internet of things (IoT) farmers can use their smart phones or computers to remotely monitor their crops, and rewarded with information about possible diseases on crops. This paper conducts a survey on smart agriculture technologies in order to formulate an understanding of different techniques for smart and sustainable agriculture. Here it also addressed a simple conceptual model based on Cloud, Big data mining and analysis. In farming there farmer makes use of water without having knowledge about the requirement of water level to the particular soil. More use of water to the soil is harmful for the soil that is it reduces the productivity level of soil. Here in proposed system we will focus on water treatment to soil.

III. SYSTEM ARCHITECTURE
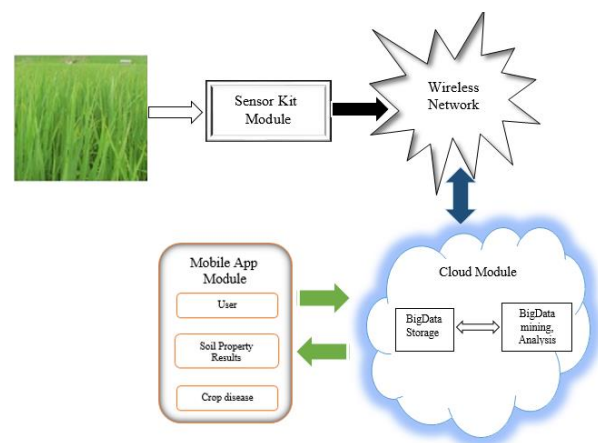
Figure 1. System architecture

System architecture delivers the knowledgeable elements, relationships among those elements, and the rules governing those relationships comprises a system. The architectural components and set of relationships between these components that an architecture description may consist of hardware, software, documentation, facilities, manual procedures, or roles played by organizations or people.

A. System Analysis

System analysis is the process of gathering and interpreting facts, diagnosing problems and using the facts to improve the system. System specifies what system should do.

A system is a set of components that interact to accomplish some purpose.

- ✓ Identifying the drawback of the existing system
- ✓ Identify the need for conversion
- ✓ Perform feasibility study

IV. METHODOLOGY

The proposed architecture of multidisciplinary model for agriculture is as shown in figure 1 consists of the four modules:

- A. Sensor Kit Module
- B. Cloud Module
- C. Big-Data Analysis and mining
- D. Android App Module

Sensor Kit module is portable IoT device with soil and environment sensors. Cloud Module consists of storage, Big-Data mining, analysis and knowledge building engine and application module to communicate with the users. Android App module provides interface to the users.

A. Sensor Kit Module

This module is important part of this architecture and is responsible for soil sampling at periodic intervals to get soil property values.

Sensor Kit is a cost effective and portable kit in which we have considered the use of pic controller which is IoT enabled device with memory and processing capability. The major components of this kit are soil nutrient sensor and environment sensor devices connected to it. Soil attributes sensors we have considered for this model are soil pH sensor, light sensor ,soil humidity sensor, rainfall sensor, water-level sensor which are interfaced to the IoT device.

B. Agro Cloud Module

All the users of agriculture sector needs to be registered to Agro Cloud through Android App. Agro Cloud storage consisting of Big-Data storage will store all the details of farmer, agro marketing agent details, and agro vendors and service providers details and government schemes for agriculture sector including bank loans for farmers and concessions given on seed and/or fertilizers. This module also stores periodic data collected through soil and environment sampling. As larger and larger number of end users are get connected to this service and the data size grows rapidly over the time resulting into the Big-Data.

C. Big-Data Analysis and mining

This module resides at Agro Cloud and as it plays important role in decision making for the fertilizer requirements for current crop based on current soil properties for better yields, crop disease prediction based on current soil properties and current weather conditions, crop yield prediction, best crop sequence analysis from the data collected over the period, best crop for corresponding soil properties, watering required based on soil moisture level. This database also provides information of region wise crop production details for each crop, total crop production for each crop in the state, based on this and current requirements for the consumers will be helpful to control the costs for each agro product.

As this database collects information over the years for soil properties and crop information details with its production amount for each farmland, inference results with data mining can be calculated for better crop sequences to be carried for best production and to preserve good soil health. As well as this database can provide suggestions to the farmers for crops to be taken on the farmland with peculiar soil properties based on previous stock of agro products and current requirements in the market. Big data analysis can be carried out to estimate future production of each product based on previous knowledge base.

Application module at the cloud storage is used for sending the notifications to the users, suggestions

based on analysis, crop disease notifications based on current weather conditions and previous knowledgebase.

D. Android App Module

New user has to register with all of his details to access the data. User can registered through Android application. User who has already registered , he can login with authorized username and password. After getting log on to application , he will be able to access data for cloud. Mobile application will give current properties of soil. Also it will be responsible to give suggestions about the production rate, Fertilizers, Future Diseases etc.

V. CONCLUSION

In this paper, we have proposed a collaborative approach for smart agriculture using key technologies :Internet of Things, Sensors, Cloud Computing, Mobile Computing and Big-Data Analysis. The system designed will be able to make agriculture automated, simple and effective. It will address an essential requirement towards agriculture sector in India is to get improved crop production with reduction in cost of fertilizer. It will also be good enough at keeping soil health intact.The farmer will be given information at every processing stage. He will be able to take decision even when he is far apart from the field.

VI. REFERENCES

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