

Big Data Analysis with AgroCloud in IoT for Smart Agriculture

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ABSTRACT

The most difficult task for the farmers to protect his farm and monitor it throughout the growth of the crops. The process has the main priority that the human presence is required all the time in the field. Although precision agriculture has been adopted in few countries; the agriculture industry in India still needs to be modernized with the involvement of technologies for the better production, distribution and cost control. Thus to avoid this a multidisciplinary model for smart agriculture has been proposed using key technologies: IoT, sensors, Mobile computing, Data analysis is used. Farmers, Agro marketing agencies and agro vendors need to register to the farmers GSM module. Agro storage is used to store the details of the farmer, periodic soil properties of farmlands, Agro vendors and agro marketing agencies and current environmental conditions. Soil and environment properties are periodically sensed and send to Agro storage through IOT. Data analysis on Agro data is done for fertilizers requirements, best crop sequence analysis, total production, and current stock and market requirement. Proposed model is beneficial for increase agricultural production and for cost control of agro products

Keywords: *Internet of things, Sensor technology, Cloud Computing, Big data analysis, Smart agriculture, mobile computing*

1. INTRODUCTION

Internet of-Things and Big-Data examination are late advancements from most recent couple of years and applications are being produced in different areas utilizing these as key advances. Sensor innovation has likewise been progressed and numerous sorts of sensors like ecological sensors, gas sensors are created and utilized as a part of uses according to the need. Distributed computing and Mobile-Computing are develop innovations and applications exists in relatively every field utilizing those advances. Employments of these innovations in the field of horticulture are likewise presented and are utilized for development in this division.

1.1 INTERNET OF THINGS (IOT), WIRELESS SENSOR NETWORKS AND SENSORS

Internet of Things is an innovation which has a tendency to interfaces every one of the articles on the planet to the Internet. It includes the utilization of RFID, remote and different sensors with Internet stack inbuilt into the gadget. Applications are created in light of IoT empowered gadgets for checking and control in different areas including modern procedures, home machines, wellbeing observing applications, savvy homes, brilliant urban areas. In agribusiness space couple of scientists have proposed models in light of IoT to screen inventory network administration of farming items. Wireless Sensor Networks is said to be develop innovation and parcel of work has been improved the situation horticulture area. Sensors are accessible for detecting and examining the different parameters that are required in farming space. Numerous applications are being used which uses sensors in farming WSN structures were proposed, executed and tried for observing the dirt properties.

1.2 MOBILE COMPUTING

Versatile figuring has influenced parts in number in our everyday life because of its accessibility and has a less expensive cost of correspondence. It is being used in relatively every field including farming part. Framework in view of portable figuring has been proposed for sending every day, occasional messages to agriculturists in regards to the item data and climate data.

1.3 BIG-DATA AND BIG-DATA ANALYTICS

Enormous information is a gigantic measure of information gathered from various sources and for longer period like sensor information, person to person communication information, and business information. The real test is catch, stockpiling, investigation, .It is being used for business information preparing alongside huge information examination to scan for shrouded designs in the information. Enormous information in horticulture area is utilized for inventory

network administration of agro items, to limit the creation cost [2].

1.4 DATA MINING, ANALYSIS AND KNOWLEDGE BUILDING

Information mining is procedure of breaking down information to discover a few examples covered up in the information. Information digging for farming area have been the subject of research for a long time[1]. Information mining have been utilized for analyzing the dirt kinds and properties to order them. Additionally soil information digging is valuable for edit expectation and choosing the better harvest arrangement in light of past yield groupings in a similar farmland with the present soil supplement data.

1.5 CLOUD COMPUTING

Distributed computing gives sharing of assets shoddy cost Distributed computing specialist co-op offers administrations like Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) with modest cost[5]. Distributed computing has been utilized for capacity of agribusiness information. It has been utilized as a part of horticulture area alongside IoT Agriculture Industry in India

Agribusiness is the significant wellspring of wage for the biggest populace in India and is real supporter of Indian economy. However mechanical association and its convenience still must be developed and developed for agro segment in India. Albeit couple of activities have likewise been taken by the Indian Government for giving on the web and versatile informing administrations to ranchers identified with horticultural questions, agro merchant's data to agriculturists, it gives static information identified with soil quality at every district. The framework which uses continuous information of soil quality in view of its present properties for basic leadership has not been actualized. Soil properties decide the nature of soil. The dirt pH esteem and measure of properties like Nitrate, Phosphate and Potassium in the dirt is an imperative factor which decides the dirt quality and kind of yield generation[4]. Continuous checking of these properties keeps up soil wellbeing in place by applying just required measure of manures. Soil dampness investigation applies the water at whatever point vital keeping away from wastage of water. Additionally natural conditions, for example, temperature and dampness likewise influence the harvest generation and yield maladies. In this regard we require a dynamic model which gathers such constant information. In help to this; all agribusiness substances should be associated with have basic leadership framework to expand the generation and facilitate the conveyance of agrarian items

from ranchers to advertising organizations and from merchants to agriculturists. Such framework will likewise be in charge of controlling different parameters like agro item rates. Smart cell phones are accessible now days to numerous clients incorporating into the rustic zones. Beagle dark bone is a shabby IoT gadget which can be interfaced to soil and natural sensors to gather soil properties and current ecological conditions. This persuades to build up a financially savvy and compact sensor unit for detecting the dirt properties for current necessities of composts. The dirt information from farmlands should be gathered through sensor unit and sent to Agro Cloud stockpiling for facilitate processing. The gathered enormous information then can be dissected for the required activities for creation.

2. RELATED WORK

Utilization of IoT has been proposed in agribusiness space. The creators have depicted FMS engineering which uses Future Internet attributes. The agriculturists will get Easy access to data and guidance through this engineering. In IoT has been utilized for item store network business process. In IoT and Cloud figuring have been utilized for agribusiness area. In creators have clarified this with regards to specialist co-ops and production network for practical administrations for agriculturists[6]. In creators have depicted controlled engineering of brilliant horticulture in view of IoT and Cloud Computing. Utilization of distributed computing for agribusiness area for putting away subtle elements of horticulture data has been clarified in Distributed storage stores work history data, manures conveyance, development pictures through camera and condition data gathered through sensors, accumulation and recording data. Creators have examined the gathered information for relationship between's condition, work and yield for standard work demonstrate development. Observing for antagonistic signs and blame discovery. In creators have utilized picture preparing on trim pictures for edit malady recognition and picture information is put away on the Cloud. In an approach is proposed in view of simulated neural systems to foresee trim yield by detecting soil properties and environmental parameters. Huge information innovation in horticulture space and how it will influence the cost diminishment and advantages is clarified Difficulties in horticulture part and remote detecting applications are talked about in which incorporate yield estimation and cropland mapping. In creators have outlined and executed a wsn in view of soil temperature, stickiness observing framework for farming utilizing ZigBee and GPS advancements for the task[7]. In creators have proposed advancement of rice trimming observing framework for continuous checking to expand rice generation. This framework makes utilize bits with outside sensors for leaf wetness, soil dampness, soil pH, air weight sensors connected to it[4]. PH esteems are sent to the rancher from base station by means of GSM modem in the SMS shape. Utilizing the pH esteems agriculturist can choose

the measure of composts to be utilized. IoT with information mining is talked about in the information produced from IoT and applying different information mining techniques on this information. Creators have additionally examined changes required for information mining in IoT point of view alongside issues and future trends. WSN based nursery condition observing framework is clarified in which makes utilization of temperature, dampness, CO2 and light identification modules. This joined WSN innovation and nursery control innovation gives programmed alteration of greenhouse [3]. Big data applications in information mining are clarified. In creators have reviewed information mining strategies to discover best systems to separate new learning and data from existing soil profile information contained inside soil informational collection. They have portrayed information digging strategies reasonable for various expectation in horticulture. Harvest yield estimation utilizing existing information through information mining is proposed For this they have used four properties to be specific year, precipitation, territory of sowing and generation. In creators have dissected information mining calculations to anticipate edit yield with more exactness and sweeping statement utilizing existing information. E-horticulture data framework for agriculturists to give data of current plans to agribusiness and data with respect to the manor is propose. creators have checked on WSN innovation and applications in agribusiness space. Creators have additionally examined existing structures in farming area. The utilization of WEKA-based information mining and investigation demonstrate is talked about in Creators have talked about utilization of machine learning calculations through a contextual analysis in rural area for mushroom evaluating process[10]. In creators have clarified the utilization of spatial information mining in horticultural space. They have utilized K-implies calculation alongside streamlining strategy dynamic refinement for spatial affiliation examination. Temperature and precipitation is given as introductory spatial information and dissecting it for the enhancing the product yield and to decrease the harvest losses. Although scientists have proposed few models in agribusiness space utilizing at least one of the advances said; the dynamic model is required that gives a coordinated way to deal with: (1) Monitor different soil properties from every farmland and natural conditions occasionally through convenient practical IoT gadget and usable by various clients, enquires about yield creation points of interest to the ranchers after harvest collecting and stores these subtle elements at the focal place as in the distributed storage. This in result creating Big-information over the time and will be examined for manure prerequisites for current yield, mapping of harvest generation to soil properties. at that time, next product to be developed and so on. This will be useful for increment in production[2]. (2) Connect every single horticultural substance together including ranchers, agro showcasing organizations, agro item merchants and Ministry of agribusiness and

AgroBanks. This will encourage dissemination of items from ranchers to purchasers and from agro merchants to agriculturists[9]. Through the Ministry of agribusiness ranchers will have the capacity to get notices about new plans reported by the administration for farming segment.

3. PROPOSED MULTIDISCIPLINARY MODEL FOR SMART AGRICULTURE

The proposed engineering of multidisciplinary display as appeared in figure 1 comprises of the five modules:

- 1) Sensor Kit Module
- 2) Mobile App Module
- 3) Agro Cloud Module
- 4) Big-Data Mining, Analysis and Knowledge Building Engine Module.
- 5) Government & Agro Banks UI.

SensorKit module is convenient IoT gadget with soil and condition sensors. MobileApp module gives interface to the clients. AgroCloud Module comprises of capacity, Big-Data mining, investigation and learning building motor and application module to speak with the clients. Government and AgroBanks UI is a web interface for data identified with farming plans and credits.

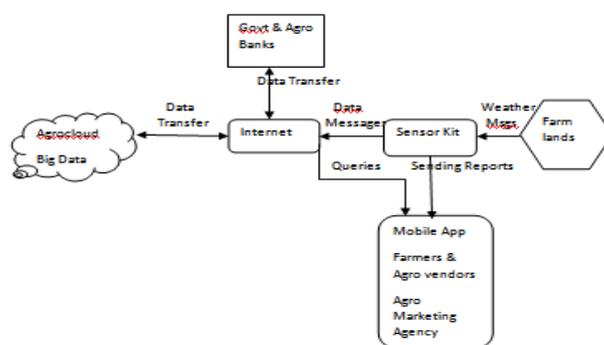


Figure 1. Model for smart Agriculture.

3.1 SENSORKIT MODULE

This module is an imperative piece of this engineering and is in charge of soil testing at intermittent interims to get soil property estimations.

Sensor Kit module. SensorKit is a practical and versatile pack in which we have considered the utilization of beagle dark bone which is IoT empowered gadget with memory and handling capacity, GPS sensor to recognize the positional data[8]. The significant parts of this unit are soil supplement sensor gadgets associated with it. Soil qualities

sensors we have considered for this model are soil pH sensor, soil dampness sensor, Phosphorus (P), Potassium (K), Nitrate (N) sensors which are interfaced to the IoT gadget.3.2 Mobile App Module

Versatile applications should be introduced on the end clients cell phone. It has three sections like,

- a. UI for rancher
- b. UI for agro promoting organization
- c. UI

for agro merchants including fertilizer, pesticide suppliers and seed suppliers. At first the end client needs to enroll to the mobile app with couple of qualifications including personality data, client write, address, geological areas and other essential points of interest. On the off chance that end client is rancher at that point needs to send couple of certifications in regards to the farmland data comprising of surmised area and aggregate region for every farmland[3]. The soil information per farmland is assembled through SensorKit. SensorKit gets the required directions from Mobile App. The data will be sent and put away on AgroCloud Big-Data stockpiling. SensorKit likewise gathers and sends the dirt data to distributed storage when the product development is in advance. Through these application agriculturists get recommendations in regards to the manures required and its sum for better harvest results and cost reserve funds. This application is additionally utilized for sending the warnings to the clients. At the point when the yield is collected, the aggregate generation data for each harvest will be sent to the distributed storage from the agriculturist alongside current soil qualities after development of that product. This data is put away in the distributed storage alongside the time-stamp points of interest[7].

Agro advertising offices in charge of obtaining collected harvests from agriculturists needs to send the intermittent updates identified with changes in cost and their buy necessities. Agro item merchants are in charge of offering compost, seed, and pesticide and rural equipment's. Agro merchants need to send refreshes identified with items and cost changes occasionally.

3.3 AGRO CLOUD MODULE

Every one of the clients of agribusiness area should be enlisted to Agro Cloud through Mobile App. Agro Cloud stockpiling comprising of Big-Data stockpiling will store every one of the subtle elements of rancher, agro promoting specialist points of interest, and agro sellers and specialist organizations (compost/pesticide/seed and agro hardware suppliers subtle elements and government plans for horticulture division including bank advances for agriculturists and concessions given on seed and additionally manures[5].

This module likewise stores occasional information gathered through soil and condition testing. As bigger and bigger number of end clients gets associated with this administration and the information estimate becomes quickly finished the time coming about into the Big-Data.

3.4 BIG-DATA MINING, ANALYSIS AND KNOWLEDGE BUILDING ENGINE

This module dwells at Agro Cloud and as appeared in figure 4 assumes vital part in basic leadership for the manure prerequisites for ebb and flow edit in view of ebb and flow soil properties for better yields, trim illness expectation in view of momentum soil properties and ebb and flow climate conditions, edit yield forecast, best harvest grouping examination from the information gathered over the period, best product for comparing soil properties, watering required in light of soil dampness level[8]. This database likewise gives data of locale astute harvest generation subtle elements for each yield, add up to edit creation for each harvest in the state, in view of this and current prerequisites for the customers will be useful to control the expenses for each agro item.

As this database gathers data throughout the years for soil properties and yield data points of interest with its generation sum for every farmland, induction comes about with information digging can be figured for better harvest successions to be conveyed for best creation and to protect great soil wellbeing. And additionally this database can give proposals to the agriculturists to harvests to be gone up against the farmland with impossible to miss soil properties in light of past supply of agro items and current prerequisites in the market. Big data investigation can be completed to assess future creation of every item in view of past learning base.

Application module at the distributed storage is utilized for sending the notices to the clients, recommendations in view of investigation, edit illness notices in view of current climate conditions and past knowledgebase.

3.5 GOVERNMENT AND AGROBANKS UI

Through the UI of this module service of horticulture will have the capacity to give the subtle elements of late plans and endowments for ranchers and farming part. Agrarian banks additionally give the points of interest of advance plans through the UI.

4. CONCLUSION AND FUTURE WORK

In this paper we have proposed a multidisciplinary approach for shrewd farming utilizing five key innovations: Internet of Things, Sensors, Cloud Computing, Mobile Computing and Big-Data Analysis. Through ongoing testing of soil rancher will have the capacity to get present compost prerequisites for the yield. This is a fundamental prerequisite towards

agribusiness area in India to get enhanced harvest generation with decrease in cost of manure necessities keeping soil wellbeing in place. As the information is gathered throughout the years for edit subtle elements and soil conditions, this model gives Big-Data investigation to best harvest arrangement, next yield to be developed for better creation, add up to trim generation in the territory of premium, add up to manure necessities, and other information of premium can be broke down. As all the agribusiness related substances are associated together, this will likewise encourage the conveyance of gathered harvests to the agro advertising offices and ranchers will likewise have the capacity to get required horticulture items and administrations from agro merchants. This model likewise encourages the evaluations of aggregate generation per trim district shrewd and state savvy, add up to compost prerequisites. This will be useful to keep the cost of agrarian items in charge. Through notices ranchers will likewise educated about current plans for farming.

Our future work will be focusing on interfacing distinctive soil supplement sensors with beagle dark bone and breaking down the outcomes to improve comes about, executing this model and gathering information from different farmlands, investigating information digging calculations appropriate for rural Big-Data examination for getting the coveted result.

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