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A Survey on Soil Monitoring and Testing In Smart Farming Using IoT And Cloud Platform

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ABSTRACT
The perception of Smart Agriculture is flattering a truth as it evolves from intangible models for the development of crop at different stages. In traditional agriculture, cultivation of the plants will be used to sustain and enhance human life. The cultivation in our nation is much reduced due to lack of interest, scarcity of agriculture land and water and some farmers with their own interest they have been doing the cultivation at the present. But that also yields to very less production due to lack of awareness about the land dryness, no timely pesticide usage and suitable crops for the land. Hence now a days the Smart Agriculture has come into the depiction globally. It provides the key by means of placing the sensor in the cultivation land to determine the soil effectiveness. This paper surveys about the using of IoT sensors with the cloud environment to testing and monitoring the soil. Testing of soil type and quality consists of many tests, such as bulk density test, respiration test, moisture test and it also needs to check the water quality. In viewing of results obtained by the above tests the device suggests the crop for the farmer and it also helps him for the maintenance of the crop.
Keywords: Cloud, IoT, SmartPlanting, Moisture Sensor, Mobile Cloud.

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I. INTRODUCTION

Agriculture is considered as the basis of life for the human species and it is the main source of food grains and other raw materials. It had the least exposure to technology but with technology reaching every nook and corner of the globe, the agricultural landscape is also moving towards modernization. Technologies [1] like Cloud, Internet of Things (IoT), and Big Data are revolutionizing the global agricultural industry leading to an increase in crop productivity. In such a scenario, an Internet of Things system for agriculture is proving to be the latest technology trend within the industry. Indian agricultural sector is in a difficult phase due to the lack of mechanization and dearth of technological advances. In India, the agriculture technology are labor intensive, whereas the modern agriculture technology are mainly capital intensive. Climate change affects agriculture in a number of ways, including through changes in average temperatures, rainfall, carbon dioxide and ground-level ozone concentrations, changes in the nutritional quality of some foods; and etc. Experts says IoT could play a crucial role in meeting this need. Combined with big data and cloud, it can do so by improving the efficient use of inputs like soil, fertilizers and pesticides, monitoring the livestock, predicting diseases, scanning storage capacities like water tanks, and making sure that crops are fed and watered well. Farmers need variety of data and services to improve crop production based on land, crop, climate conditions, finance availability, irrigation facilities etc.. Cloud computing [4] has been used for storage of agriculture data by Government and private agencies.Cloud support various services to farmers to interact with cloud by using any cheaper ways like sensors, mobile devices, scannersetc,.

The query to the users can be asked via internet connection. The research application is completely based on MAD-cloud architecture, data are stored according to the co-ordinate and physical and chemical requirements of the crop. The data are stored in methodological form [5] and they are updated by admin and data are collected by sensor, GPS. The data also defines soil texture, humidity, wind speed, rain amount. The user can obtain detain information about related crop which is require to increase the production .the user can select the co-ordinate location and define personal detail like name, place, etc. It also describes crop disease and method to cure. Cloud provides objective way like required quality, reliability and security by using the cloud in agriculture helps the farmers and also used to increase our economic level. Use of IOT along with Cloud Computing can help a lot to Indian farmers to increase the production by providing the correct communication between objects and charging according to the usage of service. In this

paper it describes how the sensed data will be processed and stored in cloud and from cloud the data will be relayed to the registered farm owners through their pH one or device in user understandable form. Also if pH rate of the soil is low the application suggests the pesticides to be used to improve cultivation .This will be very helpful to the farmers who are away from the land, and improves the crop cultivation.

II. LITERATURE SURVEY

IoT [8] is a kind of intelligent technology, including identification, sensor and intelligence. IoT defines as the time changes of cloud computing. It is now defined as IoT with the combination of cloud computing + ubiquitous network + intelligent sensing network. Cloud computing management platform is the "brain" of cloud computing. IoT develops to an enormous number of smart tags interacting with and transmitting information to each other and with decentralized and central systems. Ubiquitous network including 3/4G, GSM, WLAN, LTE, RFID, ZigBee, NFC, blue tooth and other wireless communication. It also includes optical cable and other wire communication protocol and technology. Cloud computing is related with new pattern for the establishment of computinginfrastructure and big data processing method for various resources. The determination of cloudcomputing is to access large amounts of computing power, through the aggregation of resources,and to provide a single system view. Cloud computing is becoming a powerful architecture toperform large-scale and complex figuring, and has transfigured the way that computing infrastructure is vague and used. In addition, an important goal of these technologies is to deliver computing as a solution for tackling big data, such as large-scale, multi-media and high dimensional data sets [6].

III. IOT AND CLOUD COMPUTING

In Soil testing [11],the combination of IoT and cloud computing is very much familiar to applied with it.How means, with the global increase in population, the need for increase in food production is raised. The Food and Agricultural Organization of the UN (FAO) survey predicted that increase in world population will further create poor circumstances in future with the simultaneous increase in price of food products if proper measures will not be taken. This will result in starvation to the people who fall below the poverty line. Use of technology is constantly increasing to improve food production and commercial activities. Fig 1 explains that,basically IOT can be used to connect the world's objects in both a sensory and intelligent manner through combining technological developments in item identification ("tagging things"), sensors and wireless sensor networks ("feeling things"), embedded systems ("thinking things") and nanotechnology ("shrinking things"). Farmers need variety of data and services to improve crop production based on land, crop, climate conditions, finance availability, irrigation facilities etc. Cloud computing [1] is required in agriculture as it is not possible for farmers to deal with service providers on an individual basis. They need comprehensive and cost effective service providers with multiple services. In this case cloud computing may offer data as a service (DaaS), it costs less as compared to the fixed services which are charging on a fixed basis irrespective of utilization of service. Cloud computing provides sharing of resources with cheap cost. Cloud computing service provider may also offer services like Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) with affordable cost. Cloud computing has been used for storage of agriculture data by Government and private agencies. Use of IOT along with Cloud Computing can help a IoT to Indian farmers to increase the production by providing the correct communication between objects and charging according to the usage of service.

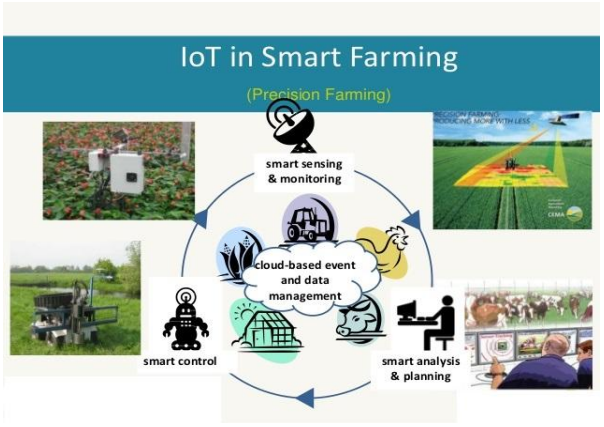

Fig 1:IoT in Smart Farming

IV. SMART SYSTEM MONITORING ON SOIL

Monitoring of soil is very much important due to climate change affection. Monitoring the soil using IoT sensors [5] in that, by using the same existing soils pH rate, Temperature, water level can be monitored using the wireless sensors. Soil can monitor their pH rate, temperature regularly .The monitored report of their land can access this information from their mobiles via wireless network and can check their pH rate at their own time. If they notice abnormalities, they can immediately notice their land and use pesticides to overcome the abnormalities. The remote monitoring of the soil pH

rate and its temperature rate has been done with the very minimal cost. The values can be viewed by the farmer's anywhere in the world at any time. Hence this system gives more accurate pH rate and temperature rate of the soil which play vital role in the agriculture. The temperature sensor, Humidity sensor and soil moisture sensor can be interfaced to the microcontroller to assess any further data. A reliable and continuous vital sign monitoring system targeted towards the each farmer's land has been successfully built. The resulting system was also low in power and cost, non invasive and provisional real time monitoring on the agriculture. It is also easy to use and provide accurate measurements.Gather data from pH, humidity and temperature sensors at regular intervals with a microcontroller and forward that data via Wi-Fi connection to the MongoDB database residing on the cloud. On the cloud, a server side application will then crunch the stored values to provide a customized feedback tailored to each user via a web.

V. SOIL TESTING

In paper[4] there are three different methods has been carried to test the soil, they are moisture test, respiration test and bulk density test.Soil moisture test is to be performed first because it plays a key role in exchange of water and heat energy between the land surface and the atmosphere, through evaporation and plant transpiration. By considering the soil moisture test results we can perform the further tests like soil respiration test.Soil breathes! Soil respiration is an indicator of biological activity or soil life. This activity is as important to the soil ecosystem as healthy lungs are to us. However, more activity is not always better; it may indicate an unstable system (i.e., after tillage). For efficient sampling, the soil respiration test is performed. The best time to run the soil respiration test is when soil moisture is at field capacity.

The bulk density measurement should be performed at the soil surface and/or in a compacted zone. Measure the bulk density near the site of the respiration tests. Bulk density is the weight of soil for a given volume. The greater the density, the less pore space for water movement, root growth and penetration and seedling germination. After the completion of the three tests on the soil the results obtained by them are used to decide which crop is suitable for that particular soil. This can be done by using decision tree algorithms. After sowing the seeds it regularly checks the soil moisture levels and if moisture levels decreases we need to supply fresh water to the field in required quantity. If water is not supplied to the field the moisture levels of the soil decreases, due to this seed germination cannot be done properly.

During the growth of the crop at different stages we need to give the pesticides according to its level of growth so that healthy crop can be maintained. The pesticides which we give to the crop should be given at minimum level because if we give a high level of the pesticide the crop may damage and it also effects the soil nutrients. By using the Soil Quality Testing using Sensors in Smart Agriculture for Crop Production and Maintenance we can have an effective growth of the crop and the crop health can also be maintained. As we use less quantity of the pesticides the soil will not be affected and this also lowers cost in the crop production.

In paper[5] ,a successful attempt has undergone to measure the soil moisture with respect to time and uploaded the data to the Cloud.Today Wi-Fi is available in most business, industrial and public sites with high-speed internet connection. Data in real-time from sensors and translates to meaningful information. For sustainable development in field of agriculture continuous cropping must be accompanied with constant check of fertility value of soil. Soil nutrient measurement is very necessary for proper plant growth and effective fertilization. For this the soil samples are sent to the soil testing labs for test. In these labs the nutrient proportion is determined by mere observation of the colour of the soil solution on reaction with the reagent. Hence leading into inaccurate results. In this paper[3] a standalone device is proposed that follows same procedure for measuring the Soil Macronutrients as that carried out in these laboratories but the colour is detected precisely using Photodiodes, Light Emitting Diodes, analog-to-digital converter (ADC) and FPGA. This will result into more accurate proportion of Macronutrients.

VI. SMART FRMING-IOT AND MOBILE CLOUD

As we all known, smart agriculture solution refers to precision farming, greenhouse automation and environment monitoring & control. In many sectors farmers, researchers or greenhouse owners need to measure the degree and extent of certain aspects of environment. As shown in Fig.2, they can also be used on smart planting. Smart Sensors for forestry and agriculture play an important role today. The need for increasing the production and simultaneously the efforts for minimizing the environmental impact and for saving costs make the sensor systems be the best allied tool. The use of sensors helps to exploit all available resources appropriately and to apply hazardous products moderately. When nutrients in the soil, solar radiation, humidity, density of weeds and all factors affecting the production are known, this gets better

and the use of chemical products such as fertilizers, herbicides and other pollution products can be reduced considerably.

Smart Farming [8]IoT interconnects the information sensing devices such as RFID, sensors, GPS system, and two dimensional codes according to pre-determined protocol. It exchanges information and communicates through wired or wireless network. The IoT can achieve functions such as intelligent recognition, data acquisition, intelligent control, location tracing, tracking, monitoring and management. The proposed architecture of public information service system for smart planting IoT is shown in Fig 2, which is beneficial in any definition of three layers. Smart planting IoT systems are able to execute processes and communicate using a standard communication interface; in the coordination layer, it can be useful to design new coordination applications, with the purpose to orchestrate the management and exploitation layer with the subsystem layers; and finally, in the management and exploitation layer, IoT identification capabilities contribute to provide tailored information services for a specific plant distribution network community. (1) The sensor layer is responsible for numerical sensor of physical values in agricultural production, relying on the ubiquitous sensor deployment. (2) The cloud storage summarizes the collected data from sensors, using internet technology and integration of geographic information collection point. (3) The smart farm net gateway display and expresses of specific business logic agriculture through interactive interface.

Mobile Cloud Computing Platform It is the key step for implementing precision planting to collect timely the spatial-temporal variant information that influences plant production. In order to intelligent monitor the situation of the large scale planting, the precise environment surveillance and the early warning analysis are necessary.

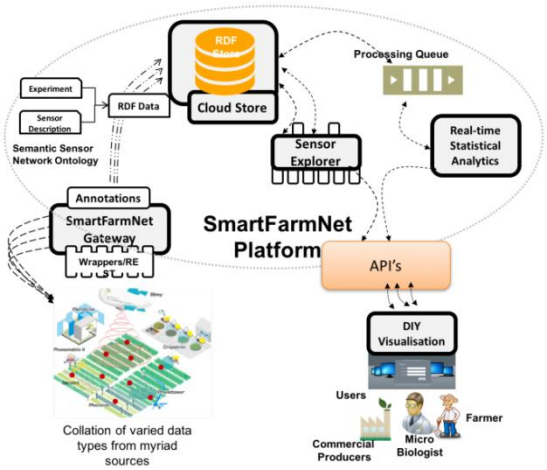

Fig 2: Smart Farming

Thus from the paper [8], analyzed the study and application of Mobile cloud computing and the IoT on smart planting. First of all, we need continuous data and information gathering, including the environment temperature, concentration of carbon dioxide, air humidity, soil moisture and content of soil NPK etc. We index these data so that the results can be rapidly accessed by mobile user query application. Secondly, we start to compress all the data sets and upload them to the cloud computing center. By using cloud computing database, cloud computing management of relevant record and storing of data related to production performance shown by individual plant and plant groups, analyze and compute, make production plans, etc. Cloud computing is also able to identify the growth of plants by using pattern identification technology and perform dynamic monitor of plant growing with help of other sensing equipment [5]. Finally, front-end mobile service that serves users' online requests for queries. Farm workers can grasp the accurate, real-time state of planting by using mobile device. This mobile system gives researchers a precise view of the growth of plants, effectively reduce the harmful factors such as natural disasters, diseases and insect pests on crop yield, the quality of agricultural products and the influence of soil quality.

VII. CONCLUSION

In this paper we obtained a survey about the applications of IoT and cloud in soil monitoring and soil testing in smart agriculture. In addition to that how the smart planting is the put into action based on integrating IoT capabilities especially with the mobile cloud to achieve a scalable and feasible industrial system.

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