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Application of IOT Based System for Advance Agriculture in India

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ABSTRACT: Agriculture plays important role in India as large population of India lives in the villages and depend upon it. But agriculture in India is mostly depend upon natural resources and the weather condition plays important role. This paper suggest internet of things based sensor network for agriculture use. This sensor consist of Soil moisture sensor, soil temperature sensor, and ph sensor for soil. This all sensor connected to each other by wireless sensor network xbee and will convey data to a station pc in the control room. From control room it will be uploaded to website where farmers can access all the data on his smartphone and tablet. This system also control water requirement and fertilizers requirements from these sensor data for different type of crop in different time of year. The stored data of the sensors can be further analyzed and used for future uses such s in which condition we get maximum yield from crops so that farmer can plan according to it. Also this IOT based system provide atomized irrigation and fertilizer usage in real time to farmer which is very useful.

KEYWORDS: IOT, Cloud , Sensor, xbee

I.INTRODUCTION

Cloud computing and internet of things (IOT) are two new concepts emerged since the Computer era. They are the core of IT industry of the new generation. Not long after the Prime minister of the IndiaNarendraModi put forward the idea of "Digital India" in 2015PM raised the development idea of "Digital India", which mainly emphasized the development of IOT and strategic new industries [1]. IOT is closely related to cloud computing in a way that IOT as it is connected to internet. India is a typical agricultural country with productivity of rice, wheat, fruit, cotton . Agriculture, rural area and farmers are of particular important when it comes to socialist modernization of the India . Our ability to handle these three problems properly has a great bearing on India's development for the future.

II.CLOUD COMPUTING

Definition of cloud computing by wikipedia in this way: Cloud computing is a type of computing method based on the internet, which is used to share software and hardware information to be delivered to computers and other equipment on demand. The end users don't need to know about basics of the "cloud" or have professional knowledge concerning this, or control directly. They all need to know is what kind of resource they actually require and how to receive relevant service through the internet [2]. Cloud computing defines a new way of adding, using and exchanging IT service based on the internet which involves providing dynamic, expandable and most of the time virtualized resources by using the internet[3]. Generally speaking, cloud computing hasfive features as follows: on-demand service, internet access, resource polling, rapid elasticity and calculability.

III.IOT

Node Wikipedia defined IOT in this way: put sensors in electricity grid, railway, bridge, tunnel, road, building, water supply of system, dam, oil and gas pipes, appliance, etc., and connect the internet, so as to operate the certain programs and realize remote control. Central computer will realize concentrated management and control of machine, equipment

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and personnel based on internet and improve the production and life through more detailed and dynamic means. This is used for integration and harmony between the human society and the physical world and regarded as third wave of ITindustry development following the computer and internet [4]. The Major IOT technologies includesRF identification technology, new sensor technology, sensor network technology and internet work communication, which all have been involved in the links of IOT industrial chain, namely four identification, sensing, processing and information delivery[5]. IOT is nothing but an intelligent technology which includes identification, sensing and intelligence. Life and even intelligence of life itself can also be regarded as part of IOT technology. It get used for pattern identification fields such as measurement and computing also computer and communication fields like sensing, communication, information collection and processing[6-9]. The IOT definition changes as the time of cloud computing comes. Now it is defined as the IOT =cloud computing + intelligent sensing network+ubiquitous network. Cloud computing management is the "brain" of cloud computing and the relevant data. It involves the management of accession of cloud computing customization application by users of the IOT, computing and processing what is involved in customization service; organizing and coordinatingthe service nodes in the data center. Ubiquitous network includes the 3G, LTE, GSM, WLAN, WPAN, Wi Max, RFID, Zigbee, NFC, bluetooth and other wireless communication protocol technology. It also includes optical cable and other wire communication protocol and newtechnology. The principle of cloud computing for IOT is shown in fig 1.

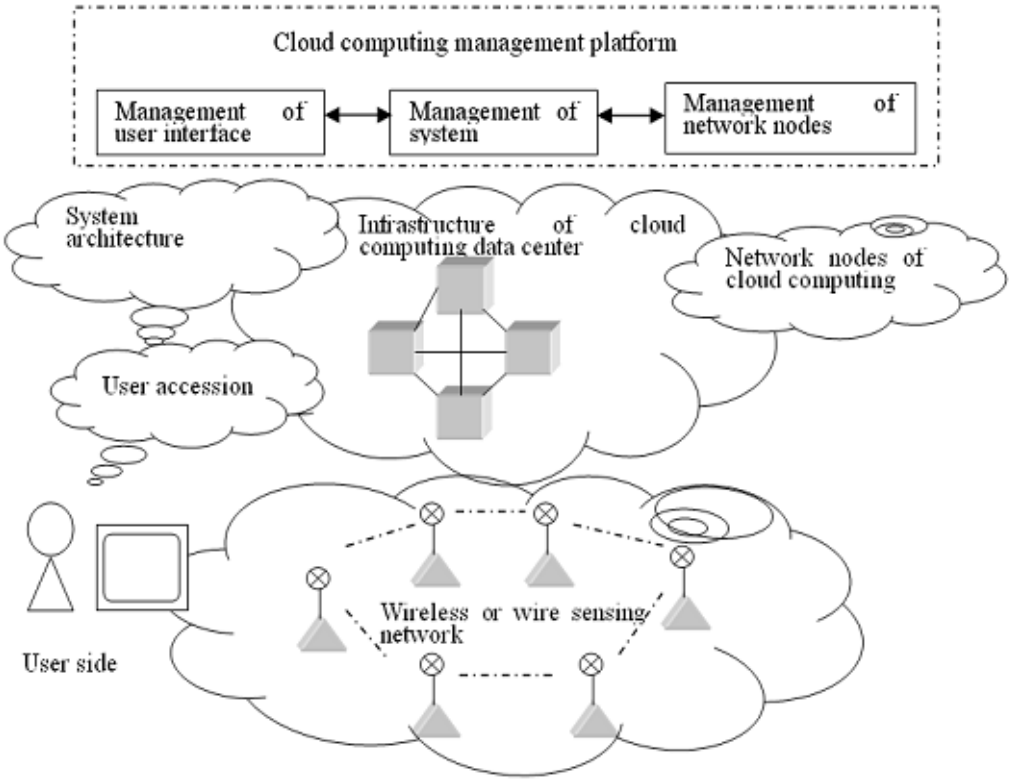

Figure.1The principle of cloud computing for IOT

IV.SMART AGRICULTER

1 Agricultural informationization

The world agriculture is undergoing industrialization, it is important to develope agricultural informationizationat same time. The Agricultural informationization has become the trend of development for the world agriculture. As far as Idea's agricultural development is concerned with, the agricultural informationization is a major force promoting the agricultural development and transformation and a corner stone for maintaining sound and sustaining economic development. In a past few years , we have been focusing on agricultural information service and infrastructure

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development. After many years of hard efforts, remarkable results had seen in agricultural infrastructure development. These infrastructure provided to foundation for agricultural information service. However, the problems still exist in India's agricultural information. For an example, we put more emphasis on hardware than software and could not provide high quality information to meet the production needs of farmers. Moreover, information is not sufficiently used by farmers and the effect of information on agriculture, farmers and rural area is not that notable. To change this situation and promote fast development of agricultural informationization, it is now necessary to use the cloud computing and visualization technology to constructs "agricultural information cloud"[11],which combines the IOT technology and RFID technology, so we have to realize smart agriculture.

V.SIMULATION RESULTS

The Construction of agricultural information cloud based on cloud computing

4.1 Architecture of agricultural information cloud:

The architecture of an agricultural information cloud technology consists of four layers: physical resource layer, resource pool layer, management of middleware layer and SOA[12] i.econstruction layer, as shown in Fig.1. The physical resource layer includes various kinds of resource servers, memories, internet facilities, database and software in relation to agricultural information; the resource pool layer builds a large amount of resources of the same kind into isomorphic or the approximate isomorphic resource pools, like computing resource pool and data resource pool. The construction of resource pool can be regarded as integration and the management of physical resource, the main purpose of which to integrate isomeric agricultural information resources into the resource pools of same kind, so as to create a basis for synergy. Management of the middleware layer is the core for agricultural information cloud. It's responsible for management of cloud computing resources and dispatching the various kinds of tasks, so that resources can serve application with higher efficiency and security; SOA construction layer encapsulates cloud computing capacity into standard Web Services and incorporate them into the SOA system for management and using it, including service registration, searching, visiting and constructing workflow for services. Management of middleware layer and resource pool are the key parts of cloud computing technology. The function of SOA construction layer, to a large extent, relies on external facilities[13].

4.2 Application of agricultural information cloud:

(1) Cloud computing in plant management By using cloud computing database, information management of specific processes of plant production becomes possible and allows cloud computing management of relevant records and storing of data related to the production performance shown by individual plant and plant groups, analyze and compute, make production plans, etc. This includes automatic analysis of key problems occur in specific process of production, like analysis of potential management defects, measurement and the analysis of productivity and the property based on productivity curve.

(2) Cloud computing in the estimation of productivity effect and the management measures Cloud computing estimatesproductivity effect of plants with the production function constructed by using computer simulation and mathematic modeling. For example, scientists uses random model and computer simulation technologies to estimate the benefit of various management strategies accepted in different growing processes of key plants.

(3) Cloud computing in tracing and control of farm produce security by using information technology of computer network and cloud computing is being able to build a tracing system for regional farm produce, increases security monitoring of farm produces "from farm to dining table" and realize certification of pollution-free farm produce and the place of origin.

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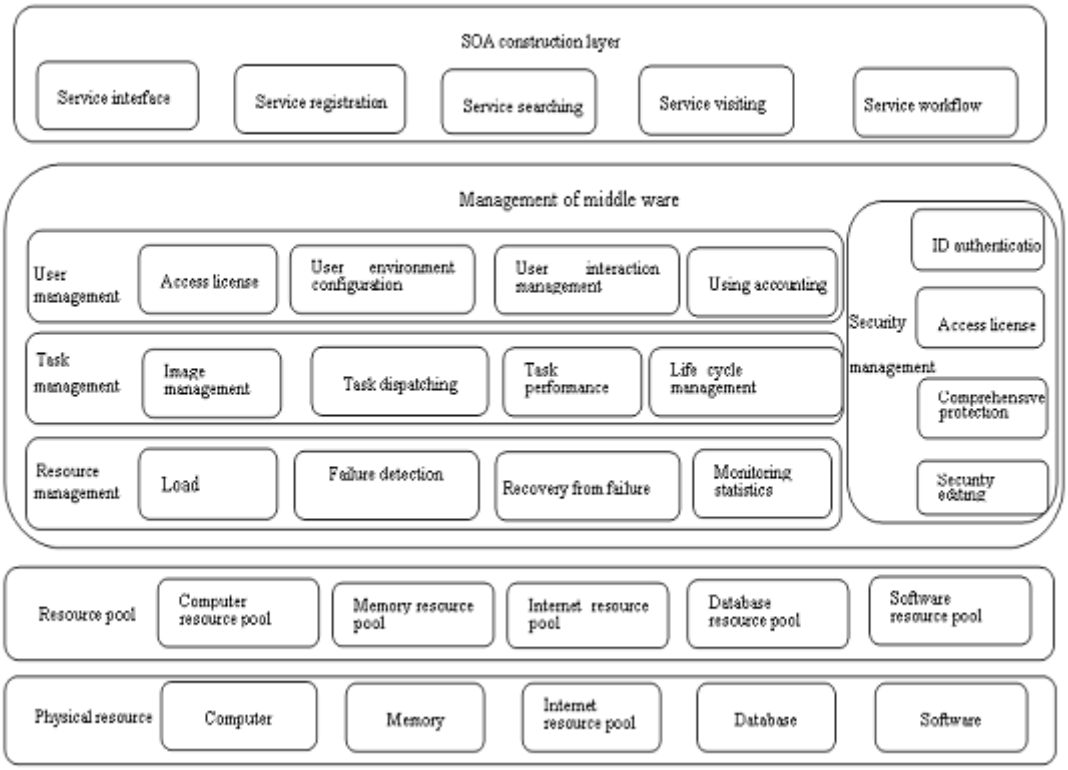

Figure. 2Architecture of agricultural information cloud

Cloud computing takes records of quality and the security related information in selling and logistics processes, like freezing and delivery, going to market and being put on the super market shelves, then uploads such information onto the internet server. Cloud computing takes records of the security-related factors in the process of plants production, like information concerns the grower and the field, fertilization, management and environment of planting, disease prevention, etc. and produces an electronic files of them. Cloud computing enables the consumers to find out the information in upper reach to the products through the computer network and enterprises to know where the products have gone to by using the tracing system. This is the great significance in plant disease prevention, emergency response to food safety events and increasing competitiveness of farm produce. (4) Cloud computing in monitor of plant growing Cloud computing is being able to identify the growing of plants by using pattern identification technology and perform dynamic monitor of plant growing with the help of other sensing equipment.

VI. CONSTRUCT PLANT FACTORY BASED ON IOT

IOT technology in terms of modern farms produce mainly consists of soilless culture and culture solution control technology, the artificial photosynthesis technology, growing environment controltechnology (carbon dioxide density, humidity, wind pressure and the speed), intelligent irrigation technology, etc. IOT technology and method is used in farm produces the production with plant factory technology as an integration. The plant factory is a highly efficient agricultural system achieves the continuous production of crops around the year through highly accurate to control environment within the facility. It is used by computer to automatically control the temperature, humidity, carbon dioxide concentration and the culture solution of crops in farms, so we achieve labor-saving production of crops which are subject to know or little natural condition limitation[14]. In the production of plant factory, IOT serves the plant factory through “comprehensive sensing, to give reliable delivery and intelligent handling”, which corresponds to the three layers of IOT, namely sensing layer, delivery layer and control layer[5].

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(1) The layer of sensing mainly consists of environment testing sensor, biosensor, GPS and RFID, which works together for sensing the information in the production process of crops. For instance, lighting sensor can show distribution of intensity of the light in real time and video sensor can monitor the size of the plant, from which we can know the stage of growing, whether it is germination period or not, growth period or other growing periods. With the spectralanalysis of plant photos, we will get to know health condition of the plants in real time;

(2) The delivery layer is responsible for reliable delivery to the customers and the sensing layer collects information and delivers it to control layer and display terminal through delivery layer. In the process of delivery, 2G GPRS, 2.5G CDMA and 3G wireless broadband as well as multi-media techniques are used to achieve the remote connection. For short-distance delivery, wireless communication techniques developed from the combination of non-contacting identification and various kinds of network techniques can be used. These techniques will achieve fast and convenient wireless connection of equipment within a shortdistance. LAN802.11 and Bluetooth have been successfully used for such purpose. ZigBee technique fits small-size and low-cost wireless network, like wireless sensing network.

(3) The intelligent control layer consists of PDA's, controller, regulation equipment and the operating terminal. This layer achieves the automatic of equipment in plant factory through comprehensively analyzing information like intelligent irrigation system. The system can be obtain and analyze weather information from the internet, including weather forecast in previous days. After comprehensive analysis of such information, an irrigation parameter for irrigation plan can be obtained. Meanwhile, another irrigation parameter can be given according to the ability of the soil in keeping water and soil after analyzing soil constitution. What's more, the system is being able to collecting and analyzing temperature data obtain from the air and conduct systematic analysis on various conditions that might impact the growth of plants before giving parameters. Finally, an irrigation plan of a specific day is made based on these parameters. This can guarantee that the right quantity of water needed by the plant and at the same time avoid too much water which might drown the plant and cause waste.

VII. SMART AGRICULTURE

The control architecture of smart agriculture based on the cloud computing and IOT is shown in Fig. 3. This data center[15] consists of control platform and the database, and the platform further consists of such subsystems as agroecological environment control, agricultural resource control, production process control, farm produces and food safety, agricultural equipments and facility. Data center is a set of complex facilities. It includes not only computer system and the other facilities go with it (like communication and memory system) but also the redundant data communication links, environment control facility, monitor facility and various kinds of security devices. Data center architecture based on cloud network is shown in fig 4. Numbers in this diagram stands for flow of resource accession. Unitary and highly extendible data center network is good for concentrated servers and memory resources and can achieve better load balance and efficiency of use.

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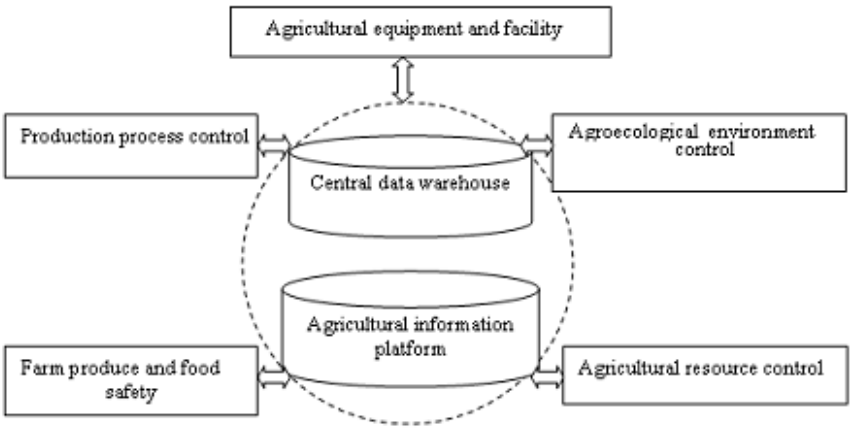

Figure. 3 Control architecture of smart agriculture based on cloud computing and IOT

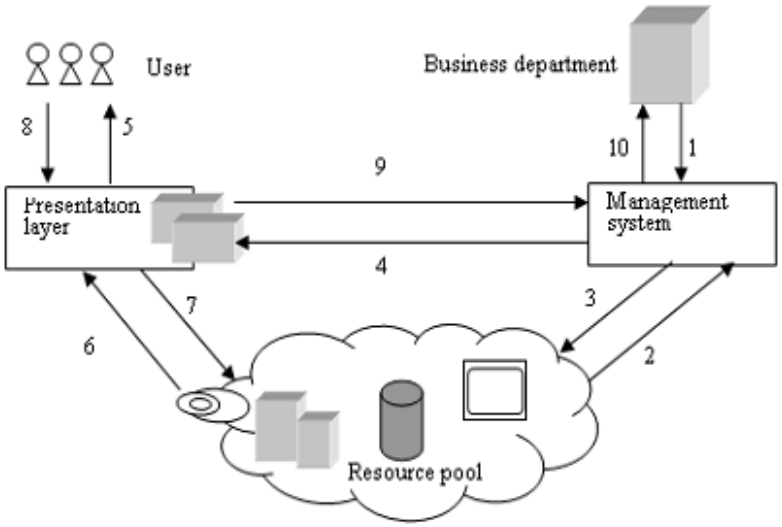

Figure. 4 Data center architecture based on cloud network

The agroecological environment control subsystem includes:
(1) Water quality monitoring, automatic improvement of water quality
(2) Accurate fertilization saves fertilizer
(3) Monitor soil constituent, soil humidity, light, wind, air, etc.

The agricultural resource control subsystem includes:
(1) Intelligent greenhouse that allows automatic adjustment of temperature
(2) Water irrigation that can automatically control flow and save water
(3) Scientific disease and pest monitoring

The production process control subsystem includes:
(1) Identification of individual animals allows healthy cultivation
(2) Monitoring of animal and plant growth
(3) Product sorting guarantees quality

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Farm produce and food safety subsystem includes:
(1) Get informed of the entire logistics process
(2) Rationally arrange storage in warehouse
(3) Traceability system of farm produce supply chain

Agricultural equipment and facility system includes:
(1) Diagnosis of farm machinery breakdown
(2) Remote control of farm machinery
(3) Operation monitoring of farm machinery.

VIII. CONCLUSION AND FUTURE WORK

The IOT is related to cloud computing in a way that IOT obtains powerful computing tools through cloud computing and it finds the best practicing channel based on IOT. Agricultural information cloud is constructed based on cloud computing and smart agriculture is constructed with combination of IOT and RFID. Hardware resources in agricultural information network are integrated into resource pool by using vitalization technology, achieving dynamic distribution of resource and balance of load, significantly improve efficiency of resource using. Large amount of data obtained by using radio frequency identification, wireless communication, automatic control, information sensing techniques of IOT are handled with agricultural information cloud, truly realizing smart agriculture.

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