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Cloud Computing Model for Agricultural Applications

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***Abstract:** There are major advancements in the technological fields, which include the smart farming with the IoT, Big-data, Cloud-service oriented architectures along with the internet etc. While considering the current situation in the field of agriculture, there are many issues being faced. Some of the major problems are climatic-changes, lack of the fresh-water availability, much barren lands and decrease in the farming lands, less power availability, etc. The agricultural architecture that are cloud-based or the cloud-service oriented architecture includes the monitoring of farming and the warehousing-information. In this paper, we provide a work on IoT, aerial images and SOA and how they can be applied on the large and the smart farming systems, which is scalable and that can be easily configured. An event-driven SOA is necessary to facilitate the flawless and significant information and integration of distributed and heterogeneous internet agricultural services to help real-time user preferences.*

***Keywords**— Internet-of-things (IoT), Service-Oriented Architecture (SoA), Cloud-service, Wireless Sensor Network (WSN)*

I. INTRODUCTION

The population of the globe now's roughly 7 billion. This is often aforementioned to extend by 2 billion in 40years down the lane. This population can reach nearly 9.0 billion by 2050. In this increasing population growth problem, the shortage of food is becoming the major issue world-wide. With the increase in the population, the demand in the production of food is also increasing in a higher rate. But due to the technological advancements, the production of these food materials is getting deteriorated and this gives rise to the question whether the growing population is will able to meet the demand on the food. The survey done in the farming and the food-production sector says it will be difficult to satisfy in line with the wants of the population increasing as there are many complex processes that has major advancements in the technological fields which include the smart farming with the Internet-of-things (IOT), Big-data, Cloud-service oriented architectures along with the internet etc. While considering the present situation in the field of agriculture, there are many issues being faced. Some of the major problems are climatic-changes, lack of the fresh-water availability, much barren lands and decrease in the farming –lands, less power availability [1]. There is a lot more shortage in the human-resources today especially the supply of labor. This is mainly due to the urbanization problem that even leads to the difficulty in the farming activities. The decline in the production of food is being observed. The reason for this could also be the youth of the nation trying to seek for the employment in the other fields rather than the farming. In order to address these problems in the agricultural activities, adopting the new agricultural technologies must be done to avoid the food production problems. Here the agriculture-IoT is proposed which is combined by several components that are connected by the Wireless-Sensor-Network using the sensors. The smart farming and the traditional farming has huge differences. Lot more advanced technologies are used in the smart farming [2] when compared to the traditional way of framing. The sensors used will be getting the data that are related to the monitoring of the crop. Without any manual intervention, the server will be implementing several actions. The actions include the watering of the pants whenever the soil moisture gets less than a particular value. The important among them are pesticides used to control the pest by drones, and modern machines for conventional works, soil and water management. The agricultural architecture that are cloud-based or the cloud-service oriented architecture includes the monitoring of farming, the warehousing-information, the farmers training on the information-services usage, fostering agri-business development service, market oriented service. All these will minimize the cost on the farming, minimizing of labor, time saving, improvisation in the yielding of crops, provision of the marketing information, data exchange based on this agriculture with different farmers, scientific advices for the pest controlling, identification of the crop for the particular soil type. This paper provides a survey on IoT, aerial images and SOA and how they can be applied on the large and the smart farming systems, which is scalable and that can be easily configured. It provides the design and the development of the multi-media platforms for the agricultural precession.

II. LITERATURE SURVEY

In earlier, the autonomous controller's irrigation was modelled through the analog methodology that based on timers and in several case of trivial, it was detected with alarm event and plastics bottles. If the selected bottle was fully fill by water, then irrigation scheme was working well and if the bottle is not fill (i.e., empty), then the system imperfectly working because of false positive.

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In general, mostly of the high irrigation controllers have able to programmed manually thru Smartphone applications and mobile messaging. Considering the high performance computers that include some additional features such as; irrigation alarm detection in a real time and irrigation schedule in according to environment data 'or' 'indexed vegetation data'. In paper [3], they have described the irrigation controller's development that based on the model of simulation. Moreover, they got two prototypes such as sprinkle irrigation approach that is based upon a ballistic approach. The sprinkler guides the water to drops, which subjected to a wind vector, velocity vector, and also the force resistance. The different type of crop prototype, which associate with the crop yield, soil water balance, and crop growth are modelled using the mathematical equations that applied at a software application. These type of proposal in a real time analysis of image that include corn crops through the tablets 'or' Smartphone to handle the irrigation model. However, sometime the water quality is changing with the clay and grit, which is not captured through the irrigation filter model, which may cause the several drawbacks in the summer time production and can suffer deficiency in warm-days. In paper [4], they proposed the architectural view by using IoT depends upon the heterogeneous data sensor. They have designed the agriculture based cloud computing for implementing IoT and the modelling is depend on the structure of two-tier storage of HBase that is nothing but a distributed database under high scalability model. Thus the database access through map reduce approach is performed at distributed framework. Therefore, the efficient data access and scalable storage model facilitated the different tasks of data processing. Moreover, the captured image is being used to predict the parameters that generally measured via sensors. The quality dependency of video stream is depends upon the algorithms, and the model can be easily classify the lane changes, vehicles, also recognize the license plates. Generally, a system needs only one camera as per the monitored area location and; the environment data, aerial image and ground data should be segmented and changed into objects. Therefore, this kind of performance is tracked and recognized for further data process, this kind of example is given in [5], where the highly multi-spectral cameras is used to display the vegetarian directory through the band reflection process. In this paper [6], it presented the analysis to regulate requirement of bandwidth to transmit the video in system and can be applied to investigate the problem in an irrigation coefficient model. They also investigated weeds on maize crop and the main aim of their effort was to increase the monitoring process with sensors 'or' adding all the sensor networks, where the airborne sensors functionality is just a type of sensors. In first level nodes, the physical sensors are directly connected to their location and the nodes created a classified structure. Therefore, according to SOA process, the software can be delivering as likely coupled services that can be published, described and easily revealed. In that kind of environment, novel application is said to business prototype that can created though configuring of existing facilities. The mesh network has a potential of a smart irrigation process to accumulate the irrigation period in order to provide the best agronomy result system, which can also save the resources and improve the efficiency. Moreover, the smart channel assignment topology is considered to avoid the interferences [7]. The controllers at irrigation process consists a mesh network, which can operate at 868MHz frequency band ISM [8] as the SIGFOX [10] 'or' LR-WAN [9]. The 868MHz communication approach and irrigation controller are modelled in such a way that energy consumption becomes very low, which can work throughout a year and can transmit the data up-to 15km. The adaptation of IoT can support several kind of industrial applications, the coordination and cooperation of 'smart-things' is the major promising factor to fulfil all requirements, which are very far from the capacity of single 'smart-things'. In order to address this type of challenges, a 2-tier IoT framework is come in to picture, where the functionality given through smart things can be encapsulated at the IoT services and categorized under a service classes. That service network can be built through considering supplication option in between the service classes, these service chains are created by using web service composition process, which includes the certain requirements of functional specification. Here, the considered factors like as; IoT configuration services, energy efficiency, and spatial-constraints, selection of IoT services at instant of service classes arranged in chains that decrease a multi-constrained and multi-objective optimization difficulty [11]. Whenever the clients interact with service cloud, they generally anticipate definite degree of QoS (Quality of Service) assurances and these can be articulated as privacy and security policies, service presentation policies and interaction approval policies among others. The major challenge is security in an environment of cloud-based service, usually modelled as SOA, in that it is very problematic to trust all the services at a provision composition. Moreover, the service details involved an end-to-end facility to arrange chain, which are frequently not expose at client's side. The SOA complexity services also the multi-tenancy in considered cloud environment enables a large surface for attack. In this paper [12], they proposed a novel approach to provide end-to-end security as well as privacy in cloud-based environment, which generally uses a service monitor activity to inspect the service activities in a particular domain. These service monitor intercepts provide interactions to client and services, also among the services. Therefore, provides an interface for several different components in order to analyse interaction services and make dynamic based decisions on the security programs. The major challenge in SOA is security, in that we cannot just allow the participants to provide service configuration all over the expected time. However, the service of chain includes an end-to-end supplication that may not be observable to the several clients. Therefore, any kind of client violation policies may stay undetected and to address these type of challenges in SOA, in paper [13] they provided several contributions. Primary, they proposed a novel end-to-end architectural security for the SOA based combined dynamic trust model, and in order to continue the dynamic trust, they designed a third party trusted service that called as the component of trust manager, which generally collects the data and processes the acquired feedbacks from the authentic service execution. Secondly, they advanced an inter-service policy of end-to-end monitoring with the enforcement framework, which are able to intercept dynamically under the interactions between run-time services and respond to mischievous activities in accordance to the policies of client's.

Lastly, they modelled a monitoring intra-service policy, where the enforcement framework has based on 'fault-analysis' mechanism in order to supervise the information flow within the services, which also identify and block the information from the attackers. In general, the current solution of integrated cloud-sensor do not providing platforms 'or' tools for the effective data management, also the standardized interface which is for the WSN dependent application in a cloud shared infrastructure. In this paper [14], they proposed a novel architecture that based on SOA computing and sensors virtualization for the efficient management of data at heterogeneous WSNs. In this paper [15], they proposed an optimal and dynamic valuing approach for provisioning SaaS (Sensors-as-a-Service) in a cloud-sensor environment but the present cloud models are inadequate in terms of service type homogeneity. Therefore, they proposed a novel pricing prototype for the comparison of both component that is appropriate for SaaS architecture; pricing attributed to the Infrastructure (PAI) and, pricing attributed to the Hardware (PAH). PAH addresses the pricing difficulty at physical sensor nodes, which is subjected to end user utility and dynamic demand, moreover, it increases the acquired profit through each sensor owner with keeping the end-user utility. PAI mainly aim on the incurred pricing because of the resources virtualization and consider the cost usage function for the infrastructural resources. The cost inclusive for continuing virtualization also within the cloud sensor, therefore, the PAI can increase the income of the cloud sensor service provider with the user satisfaction.

III. RESULTS AND DISCUSSION

In this paper, the results can are drawn based on the existing works done so far in the role of cloud computing in agriculture sector and discussion on how the existing methodology used for agriculture related applications and what are the drawbacks of the existing works, so that the results can be drawn by comparing new proposed technique with existing works. Few of the important methods and their drawbacks discussed below which will be helpful in drawing the results for proposed cloud model in agriculture related application Monitoring of agricultural produce and regulation of parameters that affect their yield and quality has been approached using IOT including a number of services integrated together that work on the backbone of Internet. From registration of the land to marketing and consultancy for farming, separate services comprised the IOT architecture. The systems provide timely information services to the end users, but the regulation or corrective measure implementation is not accounted for. Using big data and cloud computing along with IOT was another approach attempted, wherein the sensor data processing using Map-Reduce incorporated and a scalable, distributed database service for much easier as well as faster information transferred to the farmers.

Table 1: Parameter taken in different works

Paper	Cost-Effective	Efficiency	Scalability	Security
[3]	✓	✓		
[4]	✓		✓	
[7]		✓		
[12]	✓			✓
[13]	✓			✓

Information services using data virtualization in WSNs used as a strategy to overcome the temporal difference in sensor data capture and user retrieval for cloud sensor architecture is able to access the information collected anytime and anywhere. PaaS service combined with it, provides implementation tools that are later evaluated to gauge real system performance. The pricing of the cloud service model subject to heterogeneous architectures in sensor clouds is also studied. The existing works offer pricing models based on similarity in services offered thus in yet another work, pricing based on two physical sensor nodes and infrastructure is presented. In sensor cloud network, price of information services is utmost important. Since the major problem with cloud service is security, an SOA architecture that is capable of providing assurances in QoS and end-to-end control of sensor information, SOA was used as an alternative for agriculture monitoring and advancement but drawback of limited visibility of participants and trust issues are present. This survey on various methods that can be used in the development of agricultural applications deployed over the cloud which can be used further to improve the effective utilization of the resources and improving the accuracy existing methods for the productivity of the crops in agriculture. The existing works still have lack in effective utilization of the cloud resources and deployed for the different regions in identifying suitable crops for that region can be improved by proposing new techniques of cloud resource allocation techniques and the security algorithm can be incorporated to the proposed cloud model, so that the proposed model can be used over all the agriculture related application in the cloud.

IV. CONCLUSION

A Wireless Sensor Network (WSN) is a global distributed network and it comprises a large number of distributed, low powered and self-directed devices. Which include several characteristics; heterogeneousness of nodes, provide scalability at large scale deployment, ability to resist at harsh environmental conditions, power consumption constraints for nodes using energy harvesting, and etc. The mesh network have a potential under a smart irrigation process to accumulate the irrigation period in order to give the best agronomy result system, which can also save the resources and improve efficiency. Moreover, the smart channel assignment topology can be considered to avoid the interferences. Through information and communication topologies, we can improve the efficiency, effectiveness and productivity of the crop.
For that, a new agricultural monitoring system is required which will based upon Cloud Computing and SOA.

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