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Research Article

An Agriculture Application Research on Cloud Computing

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Abstract

Today's agriculture is embedded with advance services like GPS, sensors etc, that enable to communicate to each other, analyse the data and also exchange data among them. IT provides services in the form of cloud to agriculture. Agriculture-Cloud and IT offers expertise service to farmers regarding cultivation of crops, pricing, fertilizers, disease detail method of cure to be used etc. Scientists working at Agriculture research stations can add their discoveries, suggestions regarding modern techniques for cultivation, usage of fertilizers, can obtain cultivation history of the region etc. In this paper, our study was based on is to design and implement a simple Cloud based application on Agriculture System which is based on Agri-Cloud that enhance agriculture production and also enhance the availability of data related to research projects in field and also in lab. The impact of doing it would cut the cost, time, and make the communication system much faster and easier. We performed the simulation and experiments by using PHP server, mySQL database.

Keywords: *Agri-Cloud, GDP, SMI(service measurement index).*

1. Introduction

Cloud computing have five universal values:

- Reduction of initial cost.
- Allocation of resources on demand without limit.
- Maintenance and upgrades performed in the back-end.
- Easy rapid development including collaboration with other systems in the cloud.
- More possibilities for global service development.

Cloud computing is a tool to make IT related services available in a simplified manner hiding the complexities of those services, the users do not really need to know who is providing those services and the charm of cloud computing is that the services may be availed whenever and wherever needed. It also reduces the cost of availing those services drastically. It also offers maintenance of those services.

Agriculture-Cloud is one special type of Cloud, such cloud composed of different services which is based on MAD-Cloud Architecture. Services are:

- Data analyser services used by farmer, agri-expert, and officers in help centres like KISAN HELP CENTER etc.
- Data processing services like data sharing, data computing, data conversion, reporting and security etc.
- Data storage services in the database.

Most of the agriculture based developing countries as in INDIA, Agricultural sector contributes around 20% of the country's GDP and around 65% of the total population is employed by this sector. The optimal benefit and effect of cloud computing may be achieved if all the farmers can use it under a centralized control. The impact of doing it would cut the cost, time and make the communication system much faster and easier.

The objective of our work is to define land potential and explicitly and dynamically for unique and constantly changing soil and climate conditions. cloud applications helping the farmers to increase their agricultural yield. The work will also facilitate more rapid and complete integration and dissemination of local and scientific knowledge about sustainable land management.

With the deployment of this application, is a part of IT and Cloud, high quality service and efficient data can provide to user in anywhere anytime. It also provides wider coverage area.The scope of this paper concerns the characterization and analysis of agriculture data over cloud under varying climatic and soil conditions. For the implementation of this task, PHP language and mySQL database was used to run the application.

The rest of this paper is organised as follows. Section II gives brief background of framework and related work. Section III presents the summary of demonstration of application. Section IV evaluates and analyzes the result of different latitude and longitude and also of different crops. Finally, in section future scope of this paper is concluded.

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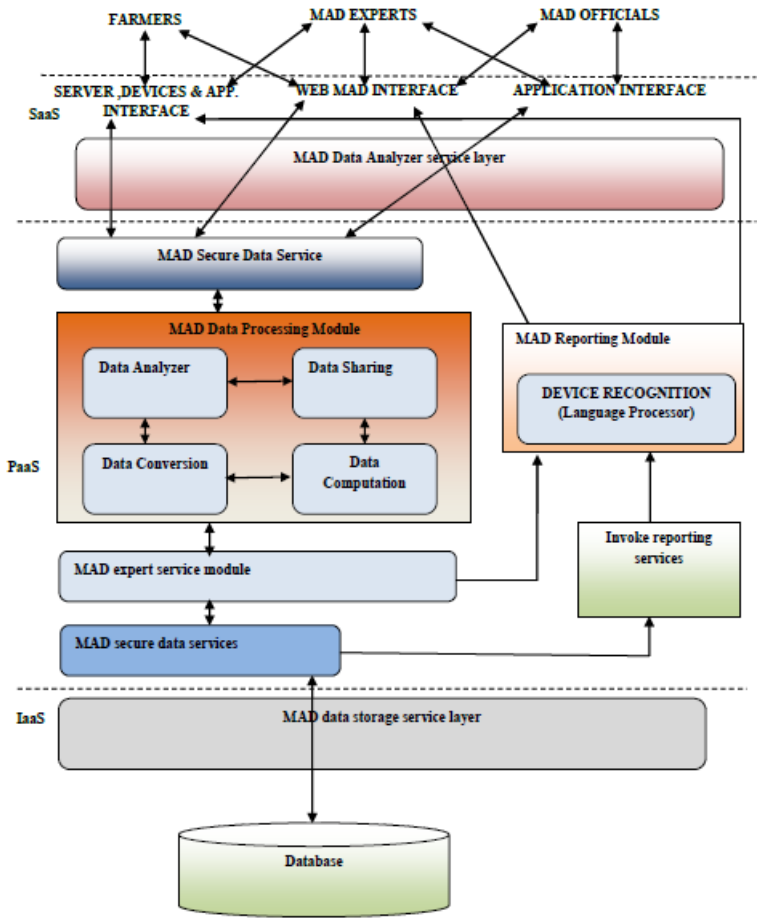


Fig.1 Architecture of MAD-framework

2. Applied Framework

In this section, we begin with a brief overview of framework, and also define short literature review.

Framework: framework of MAD-Cloud offers expertise service to farmers regarding cultivation of crops, pricing, and fertilizers to be used etc. Scientists working at Agriculture research stations can add their discoveries, suggestions regarding modern techniques for cultivation, usage of fertilizers, can obtain cultivation history of the region etc. MAD-Cloud framework at SaaS layer supports various services to Farmers to interact with cloud by using any cheaper ways or IOT such as Sensors, Mobile devices, Scanners etc. MAD-Cloud can use existing cloud infrastructures like networks, servers etc., other than the resources discussed below. MAD-cloud framework is a layered architecture contains layers like-

- MAD-Data Acquisition Layer (MDAL)
- MAD-Data Processing Layer(MDPL)
- MAD-Data Storage Service Layer(MDSSL)

1. MAD-Data Acquisition Layer(MDAL): MDAL is deployed as **SaaS** in Cloud which provides various interface services to be used by different types of consumers with different devices. It uses Internet and IOT which provides services to be used by farmers, agriculture experts or government officials to add or query data by using their applications service interfaces either through browsers, Tablet PC's, sensor(RFID) device or mobile devices.
2. MAD-Data Processing layer (MDPL): MDPL is a Data processing layer contains libraries which will accept data in various formats from various devices and converts into uniform format and performs computations on large data sets and reports to consumers of MAD-cloud. MDPL provides service contains libraries for Data security, Data Processing, Expert Decision making and Data Reporting. It is deployed as PaaS. MDPL provides service contains libraries for Data security, Data Processing, Expert Decision making and Data Reporting.

Further MDPL has divided into following modules:

a) MAD-Secure Data Service module
b) MAD-Data Processing service module
c) MAD-Expert Service Module
d) MAD-Solution reporting Service module.

3. MAD-Data Storage Service layer (MDSSL): MDSSL is data storage layer supports database infrastructure facilities to store large amounts of data which is required in agriculture sector for results to be accurate. MDSSL is deployed as **IaaS** in cloud which allows data sharing and usage.

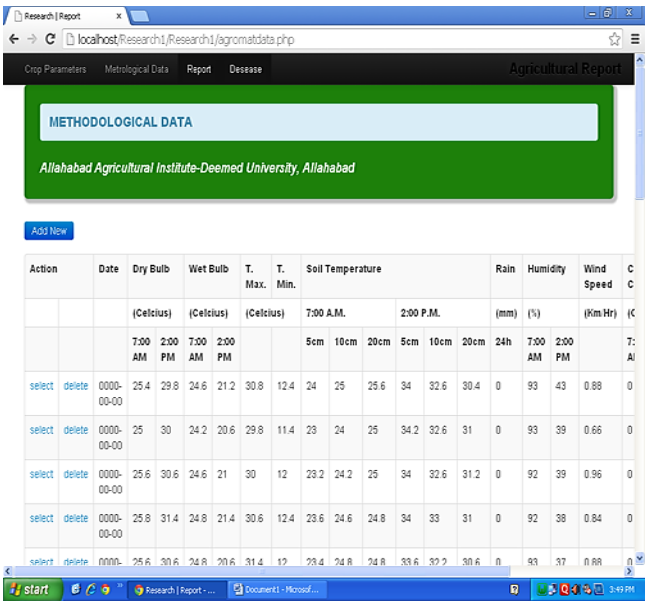
3. Summary of Application

Application Detail: our research application is completely based on MAD-Cloud architecture, here data is stored according to the coordinate(latitude and longitude), then on physical and chemical requirement related to particular crop. Data is stored as in the form of methodological data, and it is updated by the admin and data collected from reliable resources like sensors, and GPS etc.

Action	Crop Type	Month	Crop	Soil Texture	Soil Moisture	Particle Density	Bulk Density	Pore Space	pH	EC	Organic Carbon	Temperature
select	RABI	November to February	Wheat	Loamy	50 - 75	2 - 3	1 - 1.5	50 - 60	6 - 7.5	0.1 - 0.2	0.35 - 0.45	20 - 30
select	RABI	November to February	Maize	Light Loamy	50 - 75	2 - 3	1 - 1.5	50 - 60	7.5 - 8.5	0.1 - 0.2	0.35 - 0.45	20 - 30
select	RABI	November to February	Mustard	Light Loamy	50 - 75	2 - 3	1 - 1.5	50 - 60	5.5 - 8.3	0.1 - 0.2	0.35 - 0.45	20 - 30

Fig.2 Methodological Data(Snapshot)

Data also define soil texture, humidity, wind speed, and rain amount in m/m. This data is defined in the data base as metrological data. Both data are relate with coordinates.



Action		Date	Dry Bulb		Wet Bulb		T. Max.	T. Min.	Soil Temperature						Rain	Humidity		Wind Speed	C C
			(Celcius)		(Celcius)		(Celcius)		7:00 A.M.			2:00 P.M.			(mm)	(%)		(Km Hr)	(C
			7:00 AM	2:00 PM	7:00 AM	2:00 PM			5cm	10cm	20cm	5cm	10cm	20cm	24h	7:00 AM	2:00 PM		7: Al
select	delete	0000-00-00	25.4	29.8	24.6	21.2	30.8	12.4	24	25	25.6	34	32.6	30.4	0	93	43	0.88	0
select	delete	0000-00-00	25	30	24.2	20.6	29.8	11.4	23	24	25	34.2	32.6	31	0	93	39	0.66	0
select	delete	0000-00-00	25.6	30.6	24.6	21	30	12	23.2	24.2	25	34	32.6	31.2	0	92	39	0.96	0
select	delete	0000-00-00	25.8	31.4	24.8	21.4	30.6	12.4	23.6	24.6	24.8	34	33	31	0	92	38	0.84	0
select	delete	0000-	25.6	30.6	24.8	20.6	31.4	12	23.4	24.8	24.8	33.6	32.2	30.6	0	93	37	0.88	0

Fig.3 Metrological Data(Snapshot)

User can access detail information related to crop which is required to increase the production like farmer want to know about the quantity of physical requirement as well as chemical requirement, everything is available here.

The collection of data is not the part of farmers, they can only use it. User can select the coordinate location and also define their personal detail which is required in the form like name, place etc, and get the response. This cloud-application also describes crop disease and method of cure from the disease.

All type of data sends to user in the form of reports.

It is a simple agriculture service cloud application to define MAD framework. Data is collected from different resources and updated. It provides security to the data by reducing the users interference directly and indirectly. It can easily expand and provide other services

4. Performance Analysis of Application based on Framework

Cloud computing aims to deliver a network of virtual services so that users can access them from anywhere in the world on subscription at competitive costs depending on their Quality of Service (QoS), in other words, cloud computing offers significant benefits to users by freeing them from the low-level task of setting up IT infrastructure and thus enabling more focus on innovation and creating value for their services. Cloud providers an objective way, such that the required quality, reliability and security of an application can be ensured. Therefore, it is not sufficient to just discover multiple Cloud services but it is also important to evaluate which is the most suitable Cloud service. Cloud characteristics like on-demand self-service, resource pooling, rapid elasticity, updated data and measured service ensures in the application satisfies consumer demand while maximizing resource utilization. Application is divided into modules such that the expansion of application services is easy.

SMI attributes are designed based on the International Organization for Standardization (ISO) standards by the CSMIC consortium. It consists of a set of business-relevant Key Performance Indicators (KPIs) that provide a standardized method for measuring cloud services. There are currently no publicly available metrics or methods which define KPIs and compare Cloud providers. The following defines these high level attributes:

- Accountability
- Cost: cost is the most important factor arises in the mind which switching the application.
- Performance: performance in terms of functionality, service response time and accuracy.
- Agility: The organization can expand and change quickly without much expenditure
- Assurance: performing as expected or promised in the organisation
- Usability: for the rapid adoption of Application, the usability plays an important role. The easier to use and learn an application is, the faster an organization can switch to it.
- Suitability=

$$\frac{number\ of\ non-essential\ features\ \ provided\ by\ service}{number\ of\ non-essential\ features\ required\ by\ the\ customer}$$

if only essential requirements are satisfied
= 1 if all features are satisfied
= 0 otherwise.

- **Availability—**The availability is the percentage of time a customer can access the service. It is given by

$$\frac{(total\ service\ time)-(total\ time\ for\ which\ service\ was\ not\ available)}{total\ service\ time}$$

- Elasticity: easy to expand.
- Throughput and efficiency: Throughput and efficiency are important measures to evaluate the performance of services provided by an application. Throughput is the number of tasks completed by the application per unit of time. It is slightly different from the Service Response Time metric, which measures how fast the service is provided. Throughput depends on several factors that can affect execution of a task.

5. Result and discussion

The tables show the experimental result on two Platforms MAD-Agri and Local Server.

Table1 Result of application on local server

SMI Criteria	Platform	Mean	Std. Deviation
Accountability	Local Server	3.58	1.53
Agility	Local Server	3.22	1.40
Cost	Local Server	3.26	1.23
Performance	Local Server	3.31	1.31
Assurance	Local Server	3.38	1.35
Usability	Local Server	3.05	1.33
Availability	Local Server	3.43	1.41
Elasticity	Local Server	3.22	1.32
Throughput and efficiency	Local Server	3.58	1.53

Table 2 Results of Application on MAD-framework

SMI Criteria	Platform	Mean	Std.
Accountability	MAD-Agri	4. 8	1.02
Agility	MAD-Agri	3.39	1.05
Cost	MAD-Agri	3.75	1.20
Performance	MAD-Agri	4.01	1.12
Assurance	MAD-Agri	4.46	1.04
Usability	MAD-Agri	4.22	1.11
Availability	MAD-Agri	3.86	1.06
Elasticity	MAD-Agri	3.92	1.08
Throughput and efficiency	MAD-Agri	4.63	1.31

Conclusion

Conclusion: After evaluating the results of all designed scenarios accountability, agility, cost, performance, assurance, usability, availability, elasticity, throughput and efficiency have been measured in terms of Service Measurement Index. The results thus experimentally evaluated show encouraging results and application expansion

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