New Era in Agriculture:
Cloud Computing and its Services

Mr. Santhosh Chandu Pawar[1]

Assistant Professor of Computer Science, College of Agriculture, Kalaburagi, UAS Raichur, India[1]

Abstract: Use of Cloud computing in Indian agriculture field is one of the challenging and has greater possibilities in general development in the field of agriculture. Cloud computing is a model for on-demand, convenient, and ubiquitous network access to a shared pool of configurable computing resources that can be quickly provisioned and freed with minimal management effort [1]. The India produces 11 precent of total world agriculture product, while agriculture provides the livelihoods of around half of India's population, most of whom are small farmers [2]. Cloud computing is one of the most cost effective technology and useful to maintain the centralized database for agriculture related data, centralized agriculture database may contain the data related to the information of Crop, information of Seed in terms of quality and variety, Soil health information, Agriculture product and marketing, agriculture research, information related to fertilizers and pesticide used to the field etc, in this paper , also discuss the Cloud Computing service models, Characteristics, Deployment models of cloud computing and also Challenges and benefits of Cloud computing in agriculture.

Keywords: Cloud Computing, Crop information, Soil data, SaaS, PaaS, IaaS, Agriculture.

I.   INTRODUCTION

Cloud Computing facilitates computing infrastructure, IT resources and Services over internet as and when required by the user and it is the one of the most cost-effective technology to the user and start-up. In this technology instead of buying, owning and maintaining the physical data servers we can access technology in the form of services like storage, computing power & databases as we require from Cloud provider, and you pay as you use for all the type of resources [3]. India is one of the largest producers of food, cereals and other agriculture products, but agriculture and its production processes are still decentralized and farmers are subject to unsophisticated and out-dated methods and constraints. As a result, there is a clear gap between the agricultural supply chain and the demand chain. This has a negative impact on farmers' economic status and national income, This type challenges can be resolved by the implementation of Cloud computing technology in agriculture field, all the agriculture related data has to be stored at the central database and access has to provide to the all researcher, ,scientists, faculty members, students, farmers , policy makers etc and it can be helpful for the users for further development activities in the field of agriculture.

Fig 1: Cloud Computing in Agriculture [4]

It's time for agriculture, one of the old and traditional professions on earth, to work with one of the latest technologies like cloud computing. You may be wondering how it may help, but the truth is that cloud computing applications are

being applied in multiple ways in the agricultural sector to help and grow this field. Cloud computing companies have the expertise in their field so they can work faster and are better managed. It is also much better suited to meet fluctuating and unpredictable demand. Cloud computing service providers typically work on a pay-as-you-go model. Alternatively, the user can also select options such as Software as a Service (SAAS), Platform as a Service (PAAS), and Infrastructure as a Service (IaaS). IaaS is one of the most commonly used services because it helps organizations eliminate infrastructure costs [4].

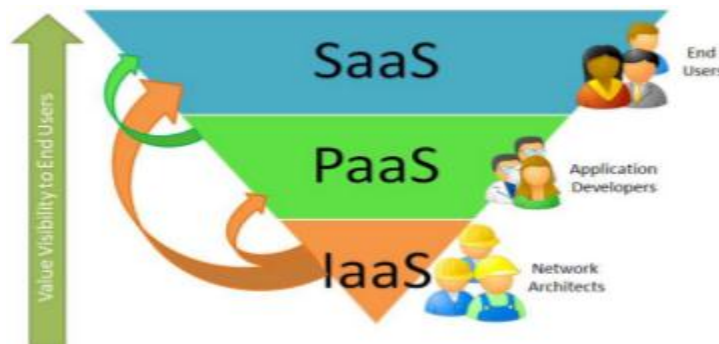## II.   CLOUD COMPUTING SERVICES

Fig 2: Cloud Computing Services
http://nolegendhere.blogspot.com/2012/06/presentation-4-5-7.html

SaaS:

Software as a service (also known as SaaS) is a cloud-based service that accesses applications via a web browser instead of downloading software to run and update your desktop PC or business network. Software applications can be anything from office applications to unified communication between different available business apps.This offers a variety of advantages and disadvantages. Key advantages of SaaS include accessibility, compatibility, and operational management. Additionally, SaaS models offer lower upfront costs than traditional software download and installation, making them more available to a wider range of businesses, making it easier for smaller companies to disrupt existing markets while empowering suppliers [5].

Major features of SaaS:
1. SaaS providers provide users with software and applications on a subscription basis.
2. Users do not need to manage, install or update software. The SaaS provider controls this.
3. Data in the cloud is protected. No data is lost due to hardware failure.
4. Resource utilization can be scaled based on service needs.
5. Application can be accessed from almost any device connected to the Internet, from almost anywhere in the world [7]

PaaS:

Platform as a Service (PaaS) is a cloud computing model in which third-party vendors provide hardware and software tools to users over the Internet. These tools are usually required for application development. PaaS vendors host their hardware and software on their own infrastructure. As a result, PaaS eliminates the need for developers to install hardware and software internally to develop or launch new applications [6]. PaaS is a set of services designed for developers to develop and test their applications without having to worry about the underlying infrastructure. Developers don't have to worry about server provisioning, storage, and backup related to application development and execution. They want to be able to write code, test the application, run the application, and make on going changes to fix bugs. All internal server setup work should be done automatically and transparently in the background. This is the PaaS promise.

Major features of PaaS:
1. PaaS provides a platform with tools for testing, developing and hosting applications in one environment.
2. Allows the organization to focus on development without worrying about the underlying infrastructure.
3. The provider manages security, operating system, server software, and backups.
4. Facilitates collaboration, even when teams are working remotely [7].

IaaS:

Infrastructure as a service (IaaS) is a cloud computing offering in which a vendor provides users access to computing resources such as servers, storage and networking. Organizations use their own platforms and applications within a service provider's infrastructure.

Major features of IaaS:
1. Instead of buying the full hardware, the user pays for IaaS on demand.
2. Infrastructure is expandable in support of processing and storage needs.
3. Saves companies the cost of purchasing and maintaining their hardware.
4. Because your data is in the cloud, there is no single point of failure.
5. Allow virtualization of management tasks, and free up time for other tasks [7].

III.   APPLICATIONS OF CLOUD COMPUTING IN AGRICULTURE

Harvest or Crop Data:
It can store Information on all crops grown in the past can be gathered to help farmers decide what to grow next. Weather Information: The cloud can store weather information for a specific area or weather forecast for a specific time period. Again, this helps farmers make crop-related decisions.

Soil related Data:
Crop decisions also rely heavily on soil information. In addition to the soil profile, past soil trends can also be provided to help predict future trends. For example, does the soil become acidic / alkaline, or what other changes do you see besides the nature and composition of the soil.

Crop growth monitoring:
The growth of various crops can be monitored in different regions, and at regular intervals. This enables growth patterns to be compared with past growth patterns.

Region wise farming data:
You can collect and track local agricultural data and investigate the participation of local farmers. This will help policy makers identify key agricultural areas that will help them develop their strategies.

Agri Marketing:
Village farmers cannot sell their products directly on the market. Many middlemen appear at the end of retail and manufacturing, which ultimately leads to the exploitation of farmers. Through cloud computing, farm management information systems, farmers can sell their products directly to end users / retailers [8].

IV. CONCLUSION

Agriculture is backbone of India and it plays very important role in Indian economy, to balance the demand and supply of food required to feed the Indian population, The Cloud computing is a game changing technology solutions in agriculture field, Cloud Computing provides computing infrastructure, IT resources and Services over internet as and when required to farmer for storage, maintenance and access of data that is not only impacting the way computing services are delivered but also the way in which farmers will use technologies in agriculture. The Cloud Computing promises several benefits but also many challenges are there those needs to be considered while using Cloud computing technologies in agricultural sector.

REFERENCES

[1]. https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf.
[2]. https://www.mckinsey.com/industries/agriculture/our-insights/how-digital-innovation-is-transforming-agriculture-lessons-from-india.
[3]. https://aws.amazon.com/what-is-cloud-computing/
[4]. https://www.sourcetrace.com/blog/cloud-computing-agriculture/
[5]. https://www.techradar.com/news/what-is-saas
[6]. https://searchcloudcomputing.techtarget.com/definition/Platform-as-a-Service-PaaS.
[7]. https://www.ibm.com/in-en/cloud/learn/iaas-paas-saas#:~:text=Infrastructure%20as%20a%20service%20(IaaS)%20is%20a%20cloud%20computing%20offering,as%20servers%2C%20storage%20and%20networking.&text=Instead%20of%20purchasing%20hardware%20outright, on%20processing%20and%20storage%20needs.
[8]. https://www.sourcetrace.com/blog/cloud-computing-agriculture/