International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 02 | Feb 2022 www.irjet.net p-ISSN: 2395-0072

Cloud Computing for Medical Application and Health Care

Rohit Raj[1], Shikha Priya Choudhary[2]

[1]*Student, Department of Computer Science and Engineering Amity University Jharkhand, Ranchi, India*
[2]*Student, Department of Computer Science and Engineering Amity University Jharkhand, Ranchi, India*

Abstract - *There is significant amount of medical data which is generated on the daily basis. The generated data is very much important for making the decision and delivering the best care to the patient. But somehow medical industry lags the technology due to the lack of IT infrastructure provided to the healthcare industry. In my term paper, I will study that what exactly is cloud computing and how this technology can be implemented in the healthcare industry. Cloud Computing is a cost-effective method that provides real time data collection, storage of data and exchange data between the medical organization. There are three types of cloud computing which includes private, public and hybrid cloud. Private cloud must be adopted by the healthcare industry as to provide the high data security to the patients. The privacy and security are two main major concerns for using the cloud-based healthcare services. Healthcare industry should have Electronic Medical Records in order the use the cloud-based services. Cloud computing has benefited the healthcare industry but there are many challenges that they faced. In this paper I will study that how some of the challenges can be overcome. I will also conduct survey as to analyse the current situation of medical industry and study that cloud computing can benefit the medical industry or not.*

1.INTRODUCTION

There are no secrets that healthcare industry lag behinds in terms of technology. They lag in implementing the IT infrastructure to the healthcare organization. Healthcare organization just invest 10% of revenue to the IT, whereas other industries regularly invest 25%. The healthcare industry must adopt the technology of Cloud Computing as to increase the quality of better treatment of the patient. In my project I am going to state briefly about the cloud computing and then I will study that how this technology can be implemented in healthcare module.

Cloud Computing may be defined as the delivery of the computing services which includes storages, servers, databases, networking, software, intelligence, etc which are stored over the internet or cloud to offer flexible resources , economies of scale and faster innovation.

In simple words it may be defined as pay on demand services which means paying for only that cloud services that we use.

Cloud Computing has many advantages, it lowers operating cost, run infrastructure more efficiently, flexible of work practices and many more.

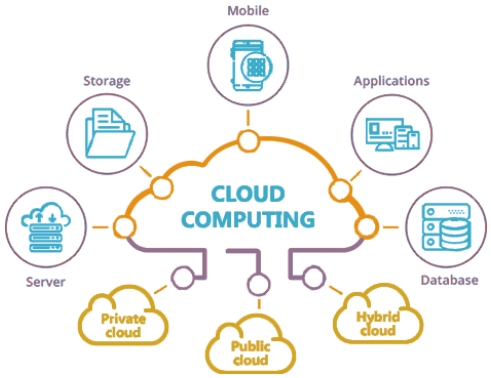

Figure 1

1.1 TYPES OF CLOUD COMPUTING

I)Public cloud-To offer the Cloud services whole computing services are located on the site of Cloud computing company.

II)Private cloud-The whole services of computing are confidential and not shared. This Cloud Computing provides highest data security.

III)Hybrid cloud-It is the combination of Public cloud and Private cloud, usage depends upon the purpose. We could keep the most important application as private and the other secondary application as public.

1.2 CLOUD SERVICES MODELS

I)Software as a Service-It is the licensing of software and delivering the model in which software is used on a subscription basis and it is also known as 'On Demand Software'.

II)Platform as a Service -It is the platform-based service that allows to develop, run and manage applications without the problem of building and maintaining infrastructure.

III)Infrastructure as a Service-It gives high-level (APIs) used to dereference various low- levels details of underlying network infrastructure.

1.3 BENEFITS OF CLOUD COMPUTING

I)Cost-Cloud Computing eliminates the high capital expense of buying software and hardware, in fact we just need a high-speed internet to access the cloud server.

II)Speed-The vast amount of Computing resources can be delivered in minute giving business a lot of flexibility.

III)Global Scale-The right amount of IT resources are being delivered by Cloud Computing. This service can scale elasticity.

IV)Security-One of the top benefits of Cloud Computing is that it offers a broad set of policies which helps us to protect our data, apps from threats.

1.4 OBJECTIVES

→ My main objective of this project is to analyse that how the technology of Cloud Computing can be implemented in the healthcare industry. In my research paper I would like to-

a. To study Cloud Computing

b. To study technical problems faced by healthcare industry.

c. To study the benefits of Cloud Computing in healthcare industry.

d. To study certain cloud challenges faced by healthcare industry.

2. LITERATURE REVIEW

→In today's ruling era of Science and Technology, Cloud Computing has emerged as one of the most significant and trending technology. In the word Cloud Computing, Cloud is used as metaphor for internet but when computing is added the meaning gets more vast and unclear.

Today Cloud Computing is not only limited to confidential E-mails or for storage it is also used for testing and developing software. Cloud computing has also spread its roots in health care field and it has become a integral part. According to a report, global market for Cloud Computing in health industry is looking forward to grow by USD 25.54 billion during the time period of "2020-2024"

There are many experts who are coming up with technical proposals of cloud-based applications in health field (Kanagaraj and Sumathi, 2011; Karthikeyan and Sukanesh, 2012; Koufi etal., 2010; Rolim et al., 2010), the difficulty of management and investigation of large data amounts (Huang et al., 2011 as well as high costs and waste of resources for constructing an independent information system (He etal, 2010; Kanagaraj and Sumathi, 2011).

Health care is a field in which every single day significant amount of data is generated, this technology makes it patients accessible by cracking the geographical restrictions and this is the reason why Cloud Computing will be effective. The two most significant advantages it provides to health workers and patients are security and cheap price. Be it any field security is always a concern. Cloud Computing help to increase the security of health workers. It not only allows it users to access the information by breaking the geographical restrictions it also allows automation recovery option and creates disaster recovery option.

3. TECHNICAL PROBLEMS FACED BY HEALTHCARE INDUSTRY

→Healthcare is one of the largest sectors of India both in terms of revenue and employment. It comprises hospitals, medical devices, health insurance and many more. But traditionally in terms of technology the healthcare industry is lagging, in simple words it is not a faster adapter of technology. Some of the technical terms related to healthcare are as follows-

1. Hospital Information Management System (HIMS)
2. Picture Archival Communication System (PACS)
3. Laboratory Management System (LMS)
4. Inventory Management System (IMS)
5. Online Billing System (OBS)

The medical sector lags in implementing the above modules in the form of centralized system. Only partial digitalization is there due to the shortage of IT budgets and lack of infrastructure. If somehow technology is provided to the health workers than they must know how to operate and if not than they have to be taught which might be costly and lengthy process.

The four main technology challenges facing by the healthcare industry-

→Information and Service Integration

→Effective Payment Model Discovery and Implementation

→Protecting the Devices That Protect Public Health

→The Search for a Win-win Outcome with Pharmaceuticals

4. EVOLUTION OF CLOUD COMPUTING IN HEALTHCARE INDUSTRY

→ There has been a recent growth of Cloud Computing in Health Care Industry as it provides better data for storage and analysis. The on-demand access to the virtually endless resources in combination with a pay-per-use model allows us for the new way of developing and using these cloud services. Cloud Computing is often usen in OMICS- fields which is basically computing in genomics, proteomics and molecular medicine which generates the considerable amount of data to be processed and stored. The secondary use of the clinical data in data processing algorithm has also grown demand of dynamic and scalable resources. Often these resources are used in temporary basis so that the permanent infrastructure investments are very hard to justify.

Cloud Computing is a viable solution to fulfil these demands. One of the main advantage of Cloud Computing is that their commercial providers like Amazon and Microsoft, provides

on demand services to the Health Care Industry and they only have to pay for the configurations, size and time they actually use.

The advantages of the cloud computing as mentioned is the main reason for adopting in the various business areas. In the resent years this technology has also been implemented in the healthcare domain.

Figure 2

5. BENEFITS OF CLOUD COMPUTING TECHNOLOGY IN HEALTHCARE INDUSTRY

→The technology of Cloud Computing has benefited the Healthcare Industry in many areas. But I would like to explain the benefits in three areas i.e. Business, Clinical and Operational areas. Today's market is the cost sensitive market. So, many facilities must show clinical benefits to justify the expenditures. Cloud technology has the exact potential tools to do that.

5.1 CLINICAL BENEFITS

→ The biggest Clinical Benefit of the Cloud Computing is that the technology has provided access to most of the applications that were previously unattainable. For example, implementing Digital pathology which can be managed through Cloud Computing Services, has huge clinical impact on an organization. The organization can roll out service that can cost a lot of amount, but now due to cloud technology the amount will only be paid for that service which is require, which simply means that no extra money is being payed. The patient care can be improved by providing the Cloud Computing services to them as they don't need to travel and thus waiting list are more easily managed as more patient can have the same test in more locations with larger availability of experts.

These experts can now access the patient data remotely and on demand through internet with a variety of connected devices. The diagnosis results can be reviewed by the physicians from home and due to this the patient can be discharged immediately. These were some of the Clinical Benefits of the Cloud Computing.

5.2 BUSINESS BENEFITS

→There must be some business benefit for a new technology to be adopted by any organization. The Cloud Computing technology provides benefits that contribute to the welfare of the organization.

- The experts can spend the time and effort to implement the best practices for each component, which will ultimately lead to the added benefit to both clinical users and patient.

For example, the organization add a new CT scanner and let the data storage be increased by 10%. Their current storge is not that capable to handle this volume, so this will reduce the storage faster than expected. In the Cloud model, the department has the access to the required capacity and performance to meet the new demand of the new CT scanner.

The consistent delivery of the IT services, hardware, and software on the basis of pay-per-user model provided by the Cloud services enables the healthcare industry to focus on the better treatment of the patient.

5.3 OPERATIONAL BENEFITS

→ The Cloud Services offer the scalability and the ability to adjust the demand rapidly that's why the services are more often cheaper. The Cloud services provides better security for the heath related data. The service providers are typically highly secure and protected to the several threats. The physical and technical methods are implemented and are maintained by the IT expert. Cloud Services offer the security control, data encryption. fine grained access control and access logging to the Healthcare industry. The Medical system which are built using the cloud services provides the web access to the data thus avoiding the need to store the information on the client devices. Cloud services providers operate on such a scale that they have all the necessary IT skills which are useful to the Healthcare Industry.

6. CLOUD CHALLENGES IN HEALTHCARE INDUSTRY

→As mentioned in the above section that Cloud Computing has certain benefits in implementing this technology in the Healthcare industry. But the Healthcare providers face many challenges in moving to a Cloud model. Two of them include privacy and security challenges which are explained below-

6.1 PRIVACY CHALLENGES

→The privacy concern ranks at the top of the reasons of slow adoption of the Cloud Computing in the Healthcare industry. The providers claim the high security of the medical data, but putting personal health in the 3rd party, remote data centre raises red flags where patient privacy laws are concerned. The possibility of losing misused or fall into the wrong hands of the medical records affects the adoption of Cloud Computing. The violation of the medical records of the patient carries heavy fines, including significant costs of recovery and patient recovery.

The solution to this challenge is to provide a private cloud model which is some more secure than any other model. In this model data resided at the customer data centre and a certain degree of control still exists for organization to manage the privacy of patient.

6.2 SECURITY CHALLENGES

→ One of the main advantages of Cloud Computing is the ability to access the resources. The security experts should deploy the latest security patches and software to its data centre as to provide protection against the threats so that access to the physical property will be well guarded and many polices, processes and mechanisms will be on place to ensure the data security. Any application operating through cloud will store all their data in cloud, which means that there is no PHI (Protected Health Information) residing on the hospital computer which is more secure than today's current environment.

In the study It was found that The PHI violation came from theft of the computers taken form facilities and loading docks. These thefts have found to be more for the computers and less for PHI.

7. HEALTH BASED APPLICATION IN CLOUD COMPUTING

7.1 TELEMEDICINE

→Cloud Computing provides data storage service that is used for storing or sharing the data of patient through tele-consultation, tele-follow up and tele-education programme. The telemedicine system mainly consists of video conferencing, medical consultation software called telemedicine software and medical attachments which facilitate to record heartbeat, ECG, pulse rate, SPO2, Blood Glucose, NIBP, Pathological Slides, X-Ray Scanner and Dermatology camera. The software which is deployed in the Cloud provides real time collaboration via software during virtual OPD or Tele-OPD. Remote telemedicine centre which is present at the remote location can connect to the server which is deployed in a cloud data centre which is accessible through internet like high speed broadband or 4G Data Card. Data which is present at remote centre is transferred to the cloud database along with the relevant patient health record. The specialist Doctors can connect to cloud database after providing user-id and password and gave consultation using telemedicine software.

7.2 CLOUD BASED 12 LEAD ECG FOR TELE-CARDIOLOGY

→ The Cloud based 12 Lead ECG is based on telemedicine service. It can enhance the convenience of ECG interpretation and the efficiency of tele-consultation, as it can enable the cardiologists to interpret ECG ubiquitously, to access patients' current and past ECG records across the various hospitals via cloud database, and it can provide pre-hospital diagnosis in time. This service advances the clinical work and research on 12-lead ECG telemedicine with ECG interoperability, as it can establish an open tele-consultation platform from clinic to person and from hospital to hospital which makes the day to day work more easy.

7.3 VIDEO CLOUD SERVICES FOR TELEMEDICINE & TELEHEALTH SERVICES

→This Cloud service enables video conferencing from a device, location and network of our choice and It also avoids the investment in additional infrastructure through the existing telemedicine cart, Smartphone, tablet, PC or Mac. The Cloud-based video can be accessed from any device with a data connection and video can be shared throughout the organization in just a few minutes on HIPAA compliant privacy and security.

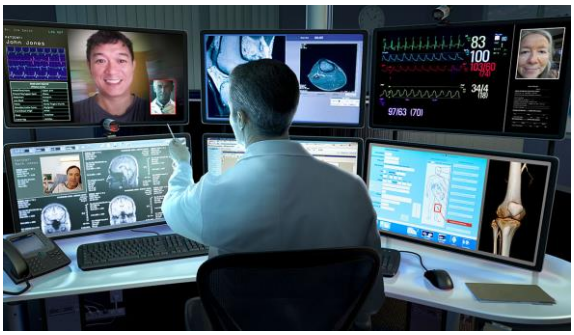

Figure 3

7.4 CLINICAL RESEARCH

→The medical research is based on the data which is collected from the patient time to time. These data can be stored in any cloud-based application software with database software. The data can be made available to the researcher for clinical research any time from the centralized cloud sever.

7.5 ELECTRONIC MEDICAL RECORD

→The hospitals and physicians believe that the medical image and cloud based medical records and are more convenient for them to access. Hospitals and IT department should focus on supporting imperatives such as EMR adoption and improving the clinical support systems.

Figure 4

7.6 MEDICAL IMAGING

→Medical Imaging includes sharing, storage and computation of images related to medical records. It also provides flexible radiology round the clock. Medical imaging in the cloud computing assist the patient to share the information to group of doctor for expert opinions.

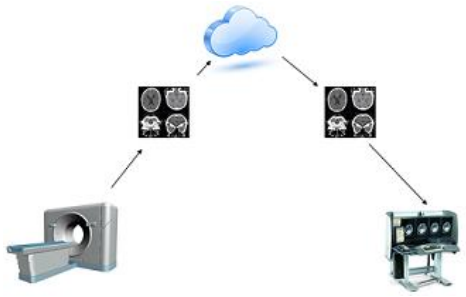

Figure 5

7.7 MOBILE CLOUD COMPUTING

→Mobile Cloud Computing allows cloud computing to the mobile environment which overcomes mobile devices limitations such as storage, security, and privacy issues. The limitations and challenges are overcome by advanced technologies like high speed broadband like 4G and WIFI connectivity and can be used in improving the patient outcomes through providing the quality services.

8. SURVEY REPORT

→ The objective of my research paper was to show that how the technology of the Cloud Computing can be used in the Medical Sector to improve the quality of treatment. The research is based on the primary data for which I conducted survey from around 110 respondents and secondary data.

The survey was conducted among 110 respondents of all the ages and gender. The survey results showed that yes in terms of technology, Medical Healthcare is lagging.

8.1 ANALYSIS AND INTERPRETATION

→ Results from my survey shows that 83.6 % respondent visit to hospital which shows why Healthcare Industry is one of the largest sectors.

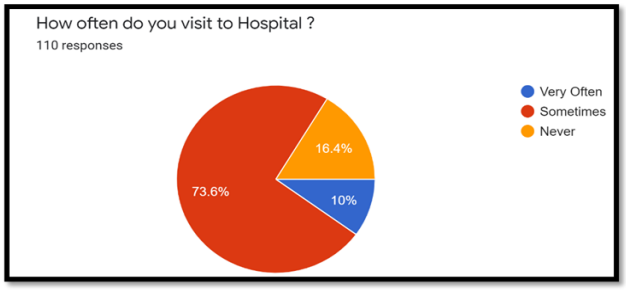

Figure 6

→ 86.4 % respondents agreed that Yes Healthcare industry is lagging in terms of technology.

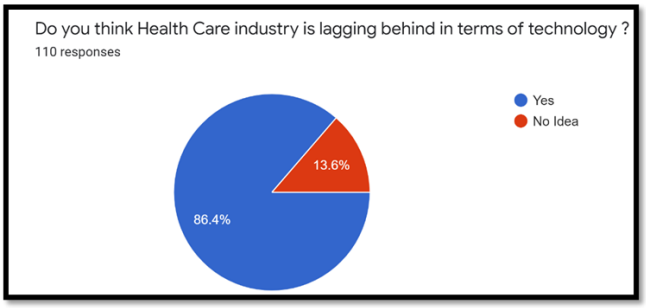

Figure 7

→ 80.8% respondent are familiar to the technology of Cloud Computing. So, it is very easy for the healthcare industry to adopt this technology.

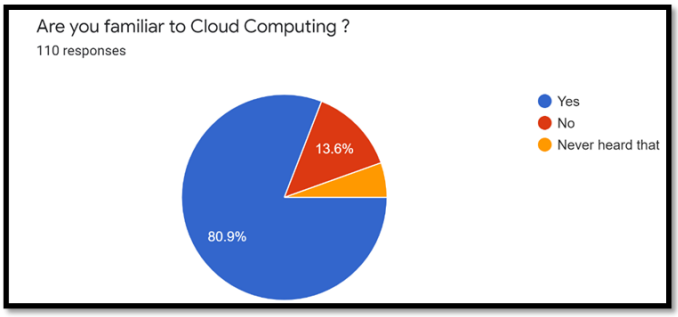

Figure 8

→ 96.4% respondent agreed to the fact that advancement of technology can lead to the better treatment of the patient.

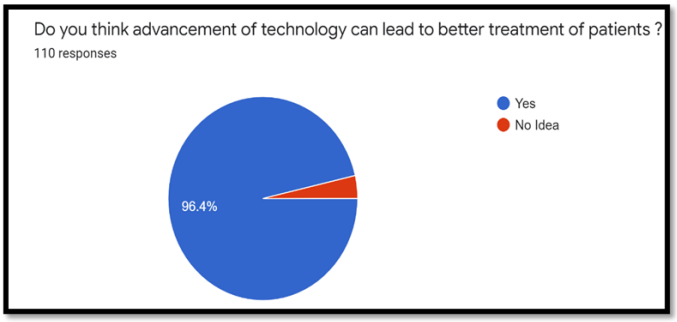

Figure 9

→82.7% agreed that their medical data is safe in the cloud server which shows that Cloud server in somehow secure.

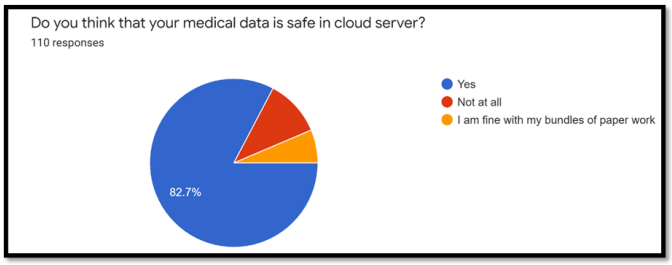

Figure 10

9. CONCLUSION AND FUTURE SCOPE OF CLOUD COMPUTING IN HEALTHCARE INDUSTRY

→ After working on my research paper and conducting the survey I came to a final conclusion that Medical sector is lagging behind in terms of technology and Cloud Computing must be adopted by Medical sector as to be technically strong which will lead to better treatment and better management of data related to the patient.

But here the question is that What will the healthcare industry look like in the upcoming 10 years? Healthcare will be adopting Cloud computing or will fade away as application service providers model did? The demand for improving the technical infrastructure will continue to increase and are not likely to slow down, with the current condition of healthcare and adoption challenges it is logical to conclude that Cloud computing will be at the forefront of healthcare innovation. The adoption of Health record, digitalization and lowering costs will require the technology of the cloud computing. The cloud providers are very much aware of the obstacles to the adoption and will work on these challenges through education and proof of concepts.

The perceptions that exist today will be changed for the better. Another question arises that What will be done for patient care? A system will be made via Cloud computing so that the information of patient will be accessible from any device in a secure and private manner. The entire patient record will be consolidated into a single view from any number of different applications which will give accurate and up-to-date information, so that physicians can make a better-informed decision. Clinics and hospitals will be able to access the relevant information as needed.

The healthcare providers and IT departments will be able to afford the burden of managing the infrastructure and mainly focus on supporting the patient care related activities. Ultimately patient care will improve which in turn will cut the costs and will improve efficiencies.

REFERENCES

[1] Qian, Ling & Luo, Zhiguo & Du, Yujian & Guo, Leitao. (2009). Cloud Computing: An Overview. 5931. 626-631. 10.1007/978-3-642-10665-1_63.

[2] Birje, Mahantesh & Challagidad, Praveen & Goudar, R.H. & Tapale, Manisha. (2017). Cloud computing review: Concepts, technology, challenges and security. International Journal of Cloud Computing. 6. 32. 10.1504/IJCC.2017.083905.

[3] Kayte, Sangramsing. (2015). Review and Classification of Cloud Computing Research. Journal of VLSI Signal Processing. 5. 5.

[4] Kumar, Amit & Kumar, Amit. (2013). Cloud computing for improved healthcare: Techniques, potential and challenges. 2013 E-Health and Bioengineering Conference, EHB 2013. 1-4. 10.1109/EHB.2013.6707234.

[5] Mahandule, Vikas & Chandgude, Vidya. (2019). Impact of Cloud Computing on Health Services.