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The Vital Role of Cloud Healthcare During COVID-19 Pandemic

Al Khafaji Amen A. Khabeer

[1]*University of Technology- Iraq*

**Corresponding Author: Al Khafaji Amen A. Khabeer*

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Abstract

The most sharable tag on social media was "stay at home". Where, the governments oblige their residents from physical meeting or traveling instead of this they have to stay at their home for controlling the wide speared of The novel Corina Virus (COIVD-19). Hence, many lives are being saved. Here, Cloud Computing act as a game changer in many institutions and countries demand particularly to healthcare organizations. This Paper will review cloud health applications such as Telehealth, Telemedicine supporting with mobile cloud health applications. And the important role of sharable the cloud informatics in health. Then it focuses on the role of cloud played in health care sector to saving life's during COIVED -19. Not only for people who have been infected but also for assisting other older people to get their treatment. Some concerns are existing to discuss related with security, outages, privacy and monitoring issues or when matter went wrong during the Telemedicine appointment with suggested solution for future matters.

Introduction

Information Communication Technologies (ICT) is an extended terminology than information Technology(IT) itself (Appiahene et al., 2016). ICT includes all technologies of communications which are servers, networking, devices, services as well as applications. It digitalizes the data over inerrant (Caicoya & Saury, 2011). Nowadays, ICT has compounded the power of VMs through Cloud Computing infrastructure (Cilliers, 2014). However, in the ear of COIVD-19, the employs are required to access their work through Gmail, video conferences, and other internet services (Abdulla & Alzobeer, 2014). Moreover, most people stay at home and plugging their commotions media most of the time (Chadwick et al., 2013). As a result, digitalization and comminution were suffering from payload during the quarantine. Cloud system has been played a important role in the era of COVID-19 ("Top Cloud Conferences & Events to Attend in 2020 | Gartner", 2022). One of cloud services is telehealth. Where telehealth assists doctors to treat patients remotely (Cheung et al., n.d.). emerging cloud with healthcare based on VMs or other services is not new technology. However, tele-system became relied on frequently in this period. Indeed, the paper reviews the previous studies to explain the relationship between could services and the health field. After that, the paper will list down cloud applications toward healthcare in this era. Finally, the future concerns related to telehealth in reality, and privacy will take into account.

Overview on Cloud Computing in the Medicine Industry

When the researchers tag to the quotes "Pay-As-You-Go", who are specialists in computing, they mostly referred to Cloud Computing where the paid cost relied on stakeholder's usages. The availability of computing on-demand defines as cloud computing where servers, platforms, applications, and storage are customizable (Hout Hangsea,2021). Due to the promises of cloud computing such as affordability, scalability, reliability, accessibility, and heterogeneity of

sharing resources. this leads to delivering the solutions for healthcare institutions (Linthicum, 2016). There are three major types of Cloud Computing as shown in figure1. categorized as the following: Public, where low cost with bounded services, Private, which is vs versa of public Cloud, and Hybrid Cloud Computing (Srinivasan, n.d.). They are classified based on privacy; ownership of stored resources on the cloud; security services besides their costs (Baun, 2011). Hybrid cloud computing is emerging between Public and Private once with more powerful technologies and reasonable cost (Hout Hangsea,2021). However, fig 2. Shown another classification for Cloud's type based on services those services could be catrized based on services level. Firstly, infrastructure as a Service (IaaS): In IaaS, a rentable computing Infrastructure are provided by cloud service vendor (Simpson & Collingwood, 2020). They adopted a virtual machines (VMs), include servers and operating systems as framework (Sosinsky, 2011). The virtualization of machines and OS are more flexible in term of management. VMs are running any OS with freedom of installing applications without aware of a storage or hardware limitations (Qarkaxhija, 2020). However, black chain as well as maintenance are accounting as a drawback in the cloud Infrastructure (Qarkaxhija, 2020). Secondly, Platform as a Service (PaaS): In PaaS, developing, managing, publishing software services are on-demand framework (Qarkaxhija, 2020). The developers are chargeable to coding their applications. However, deploying and running the applications rely on the PaaS vendor (Qarkaxhija, 2020). Indeed, in spite of, employing PaaS are more elasticity, cloud vendors are responsible on the management of the environment (Qarkaxhija, 2020). Moreover, Software as a Service (SaaS): in SaaS, software services are providing to the- end users. For example, Dropbox, ICloud, WHO interactive map, google cloud. In SaaS, the operational cost is minimized with maximum extension (Wang & Alexander, 2013). Finally, Data as a Servicee (Daas): is a management strategy for data where analysis, processing, handling data services through network connection (Dimitri, 2020). One thing to mention, (Daas) sometimes refers to Desktop as a services (Wang & Alexander, 2013).

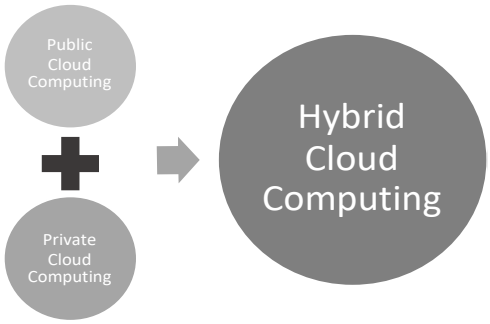

Figure 1. Cloud Computing Types

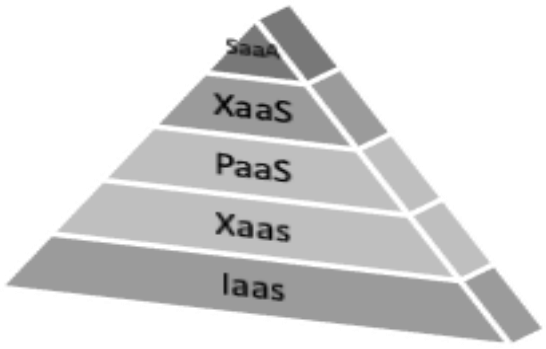

Figure2. Cloud Computing Types Based on services where XaaS refers to Daas or another new services which listed as secondary services

Cloud-HealthCare facing COIVD-19

In the era of COIVD-19, cloud computing has played an increasingly important role for providing acre services. In conjunction with both Internet of Things(IoT) for managing big data and Artificial intelligence in term of Machine learning (ML) and Deep Learning (DL) to serve healthcare requirements (Mumay & Mutlu, 2021). More efforts introduced by developers to provide enhancements in the medical sciences. This created a new trendy application that named "cloud health care". cloud health care defines as employ the power of cloud system in health sector through utilizing medical resources to enhance the level of diagnosis and treatment (Fong & Chung, 2013).

To explore cloud health care more closely, at the beginning, this paper will review many studies that relies on cloud system. (Fong & Chung, 2013) adopted cloud computing in Telemedicine by using mobile cloud computing. Here, mobile devices operate by both professionals and patients to access easily to medical data. (He et al,2017), built an efficient cloud infrastructure that can response to synchronized requests from ubiquitous health care services. That's because the nature of cloud system as on-demand and service-oriented. Cheung, (2013) patients who participated in the National Health and Nutrition Survey get their data analyzed via mobile medical centers.

Despite the limitation in of literature on cloud health care, little effort has been made to curate and refine the knowledge from the literature. this because of the mysteries way that cloud framework related with security level and ownership of resources from both doctors and developers. In the next section will deal with application of this study aimed to identify the role that taken by cloud health care during the novel virus these days.

Applications of Could Computing in Health Sciences

In this section, the study will list the most cloud services in health sector and then will complain some issues for future studies attention to tackles those disadvantages. Before exploring the services of cloud computing, there is a necessity to mention cloud services providers. the most known providers for cloud services are Amazon Web Services (AWS). Microsoft Azure, Google Cloud besides other companies (Dignan, 2022). From this point of view, the current study will review cloud applications in health filed as following.

Application of Cloud Healthcare in COVID-19 Era

Cloud Medical Informatics

Interactive Map with statistical news reports for the Plants: Through the wide spread for novel-coronavirus, World Health Organization(WHO) had raised the need for publish the global number of infected people and report the results of infection rate daily (WHO, 2022). Additionally, they aim to educate people about the essential of first aided instructions against the virus (WHO, 2022). From this point of view. Both AWS and WHO worked together for deploying an informative site that provide a feedback for up to date number of positive cases (WHO, 2022), ("Coronavirus disease (COVID-19) – World Health Organization", 2022).

Secondly, they provide another services with interactive Map, which captured from the original website of WHO as shown in Fig3, that could feed people who want to travel for a specific location with statistical of infected cases in particular location. Thus, they could have a second thought toward traveling of flight distance as kind of awareness.

Figure 4. Interactive map for the total infection cases in 9th of February in 2022 recording to WHO supported by AWS

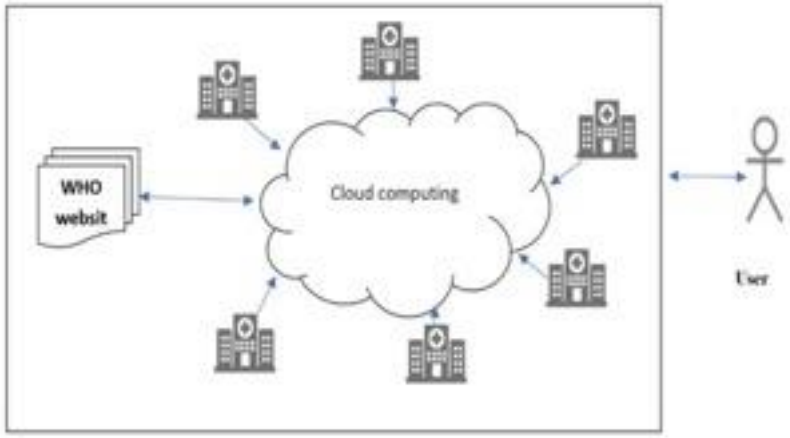

Figure 5. UML1: Unit Model For Who Website

Lunit's technology cloud-based: Lunit's technology developed by both WS and South Korean radiologist ("Lunit ", 2022). This technology operates AI and ML for published dataset of X-Ray that shared via Cloud for diagnosis infected lungs by the virus. Many Cases are positively detected via Luint's where radiologist failed to noticed. This because of, the area that damaged through novel-coronavirus usually marks as black and white point Ruther than grey where most radiologist used to clarify the damages level in the lungs ("Lunit ", 2022).

GenBank of Omics, that provide by NCIB, studies, protein functions are delivered via could as a sharable resource to define the path deadly pathogen in SARS and the evaluonrionry mutation that sanely habind in the DNA sequences for COIVD-19 to understand the germ behavior then prevent those kind of developing in germ gens in the future those studies were used from both doctors and biologists research's ("CNGBdb-China National GeneBank DataBase", 2022).

Mobile Cloud Infrastructure applied in Telehealth and Telemedicine

Delivering healthcare services by using the technologies of telecommunication have been declared as Telehealth. In 1940s, where the first prototype of transferring medical data in Pennsylvania. They used telephone for sending radiology pictures over two cities (He et al., 2013). After ten years, A Canadian doctor had operated the of tele-radiology system for

reaching his patients. Later on, those practices were adopted to apply widely specialty in suburban city. Another successful project on telehealth is NASA project with their partnership with Indian Health Services. In that project, they transmit X-ray images and other medical records to public hospital (Aggarwal, 2022). Additional example, India was one of those countries that applied telehealth technology. Where the common people are suffering from poverty and paucity of hospital existing in the countryside. Therefore, telehealth was a key solution for Indian to save their lives, costs and efforts (Aggarwal, 2022).

Indeed, telehealth like an umbrella that includes another health services depends on the specialist who deliver health medical assistance for instance, Telemedicine, Telenursing, Tele clinic (evist,2022). Usually, Telemedicine refers to the delivering health servers between group of doctors and sharing a medical record and it refers also a schedule appointment between a doctor and a patient (He et al., 2013). While employing telehealth for therapy by nurses called telenursing (evist,2022). Indeed, the necessity of applying quarantine conditions in the era of pandemic reinforced the role of telecommunication in health. Mostly medical aid were delivered remotely via telemedicine applications for an infected individual unless their deterioration of vital signs then moving to a hospital for acre [34]. Mentoring and reversing this previews records are required. Here, cloud play as game changer to recall those records that have been recorded and uploaded on cloud during the virtual meetings. Hence, most of telehealth applications that dismissing documentations were inefficient from point of view for doctors therefore, cloud cooperate with ICT through the pandemic for saving lives (He et al,2017).

Cloud Healthcare Concerns

Despite of leading health services technologies was being supported by cloud computing systems. Overcame the drawbacks of cloud in medical industry are required. As listed here, obstacles of cloud in health sector as follows: Monitoring and Control limitations counted as one of mean disadvantages in cloud. Indeed, all services are being controlled and mongered by the providers belong third- part side. However, Part of health instituioions are signed contracts toward this consideration (Limor Wainstein, 2018). Secondly, due to network traffic in the parodic, cloud healthcare faced outages and dropdown system. This because providing multithreading of client's requests simultaneously or most of openness nature of cloud platforms for developers who deploy unreliable health application. Seriously, system failure ultimately effect on the organizations of healthcare performance ((Kuo, 2011). Finally, The Most important issue related with cloud's disadvantage is security of cloud data besides privacy. Although private cloud computing granted high level of security with assigned contracts and certifications (Kuo, 2011). Public type provides publish access for published health records with main information of related with the patients of patients. Here, loopholes, a third party or external server triggers risks, unrealizable application from untheorized developers effected negatively on security matters of cloud system (Gonul Kochan et al., 2018). Hence, ingrate cloud with other technologies are required at this level. Include Blockchain-Based Encryption technology in cloud health care attacked these drawbacks in mean matter (Gonul Kochan et al., 2018).

Conclusion

In conclusion, Style lives and occupations of people are being effected by the novel coronavirus. Which leads to employing ICT's to keep people connected. Empower ICT with cloud computing lead to handle connection problems. One of these occupation that employed cloud in its in facture is health filed. The treatment and care were serviced remotely by doctors through cloud healthcare applications. Cloud offers an open ensoulment for doctors to share health records not only between them and their patients but also between a doctor and another one. However, this openness lads to negatively effect on the privacy of patients as well as

security issues. For future studying, employ hybrid cloud computing could enhance the level of security. Additionally, applying black chain during the appointment and data exchange could be taken in accountable.

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