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The Growing Role of Cloud Computing Approaches in Providing Better Support for Medical Sector

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ABSTRACT
This study has focused on considering a survey process and the information is obtained from 50 different respondents who are managing activities in the medical sector. The study has also ensured that all the information is only related to the growing importance of cloud computing approaches within the medical sector. The main purpose of this research study is to illustrate a basic idea of cloud computing. Recent trends of a cloud computing system are going to be analyzed to derive the advantages and disadvantages of a cloud computing system. Open problems of the healthcare sector can get demolished by this emerging technology. Internet of things is considered one of the most effective outcomes of cloud computing in the medical sector. The entire healthcare sector is trying to act like a hybrid platform to provide quality services to patients and patient parties. Security and privacy-related challenges are going to be explained in the literature segment of this study. Machine learning technology is helpful for the emerging trend of cloud computing in the healthcare sector. In order to utilize a mobile cloud computing system, surveys are going to be conducted. The upper mentioned sections are going to help in predicting a profound conclusion.
Keywords: cloud computing systems, medical sector, cloud security alliance, scalability

INTRODUCTION

The main purpose of cloud computing and its various approaches are playing a great role in developing the healthcare sector positively. It is predicted that the cloud computing system is trying to help healthcare organizations by driving down excellent technological equipment. Cloud computing has a proper infrastructure that allows consumers to deploy and run its wide range of applications. Additionally, it can be said that cloud computing provides a very effective and highly scalable atmosphere. It is observed that some of the organizations are trying to make their cloud system leverage the entire infrastructure. On that note, it can be said that cloud computing plays an important role by absorbing the interest costs of healthcare organizations [1].

The recent trend of cloud computing tends to aim at accessing necessary information anywhere and anytime. The new delivery model provided by healthcare organizations is observed to be more effective and efficient. However, it brings a certain number of obstacles that are highly related to safeguarding confidential information provided by patients. Despite such risk factors healthcare organizations are trying to take the utmost advantage of cloud computing systems. By bringing a tremendous amount of benefits, quality service can be easily provided to patients by healthcare organizations. One of the core benefits provided by a cloud computing system is exchanging datasets between disparate systems.

Cloud computing systems are supporting healthcare organizations by sharing essential information such as *prescriptions, insurance information, references provided by doctors, EHR, test results* and *more*. This research study aims to illustrate the growth of cloud computing systems in providing better support in the healthcare sector [2]. Another issue that needs to be addressed is critical risk factors of cost-effective manners in healthcare organizations. Cloud computing systems have provided a huge amount of advantages for *hospitals, clinics, pharmacies, insurance organizations* and *other medical enterprises.*

Looking over the changes that occurred in the sector it can be said that cloud computing is going to be a **norm** in the healthcare sector.

The objectives related to the study are to derive centralized facilities provided by cloud computing systems, to address security issues in the healthcare sector with cloud computing and to understand different applications and approaches of cloud computing in the medical sector. In further sections, systematic evidence is going to be produced to derive the challenges and opportunities of cloud computing.

LITERATURE REVIEW

Medical-based organizations have been dealing with increasing rates of digital images and electronic medical records. Another reason to implicate cloud computing-based approaches in the medical sector is to maintain collaboration among remote and mobile workers [3]. Depending on the operational activities of the medical sector cloud computing systems can act as the main data center. This approach of cloud computing systems can reduce the requirements for IT staff in healthcare organizations. Most of the networks related to a cloud computing system are observed to be avoiding high network trafficking [4]. It maintains a reliable internet connection due to various redundancies and connections if the anchor carrier's connection collapses.

Figure 1: Main applications of envisioned evolution of healthcare sector based on the cloud computing system [5]

Cloud computing systems appear to present various opportunities to present existing risk factors of healthcare organizations. Cloud providers need to be familiar with the security concerns of public clouds. Thus, it is going to help healthcare organizations comply with HIPAA Privacy Rules made by federal regulations. The security system of the healthcare sector needs to be guaranteed for storing necessary medical records [5]. Medical-based records need to be made centrally flexible and accessible while *maintaining basic* privacy guidelines. In 2010 Cloud Security Alliance was published with the best kinds of medical records. It needs to be implemented to achieve the maximum amount of security in the SaaS (Service as a Platform) and PaaS (Platform as a Service) model [6].
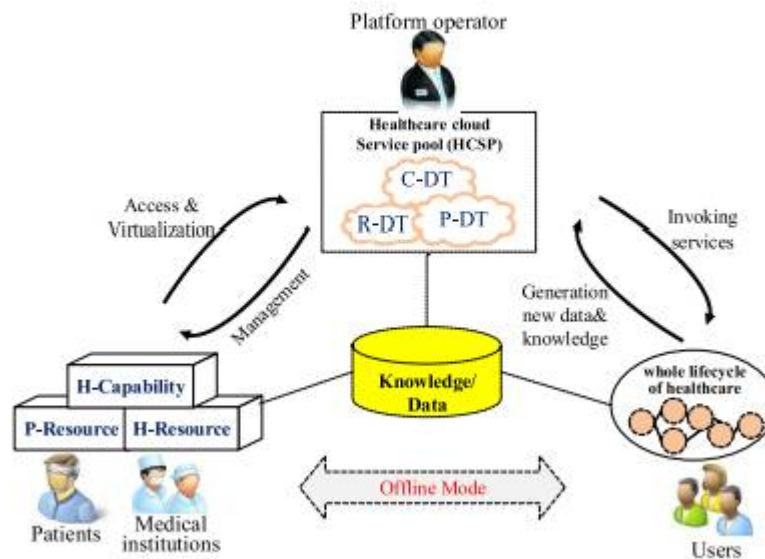
Figure 2: A conceptual model of the cloud computing system in the healthcare sector [7]

According to Aceto, Persico and Pescapé (2020, p. 100129), today's world is going through an enormous amount of transformation by the availability of anywhere-and-anytime connectivity. Cloud computing system is counted as a paradigm in the healthcare sector that unleash the effectiveness of computing resources. This way cloud computing system simplifies operational activities of the medicinal sector [7]. Cloud computing systems do not require a careful dimension and forecast of required resources. It allows consumers to enjoy pay-per-use billing based on short-term objectives. It allows customers to take advantage of the apparent infinite resources of the everything-as-a-service (EaaS) platform.

Figure 3: Different cloud computing models [8]

The most common services provided by cloud computing systems are IaaS, PaaS, and SaaS. On that note, it can be said that the cloud is necessary to satisfy the requirements of patients and patient parties [8]. Migration systems seem to be occurring in cloud computing systems as an emerging trend. However, several shortcomings are noticed in the cloud computing paradigm of the medical sector.

The cloud computing framework in healthcare is considered the most fundamental aspect [9]. The topological structure of cloud computing systems can outline some standard setups to present the main components of cloud computing in the medicinal area. According to previously done studies, a network based on connected networks can send necessary raw materials. Such raw materials are ECG (electrocardiogram), EMG (electromyography), BG (Blood Glucose) and Body temperature. When it

comes to the implementation of a new cloud the first thing that needs to be addressed is portraying an understanding of complicated treatment procedures.
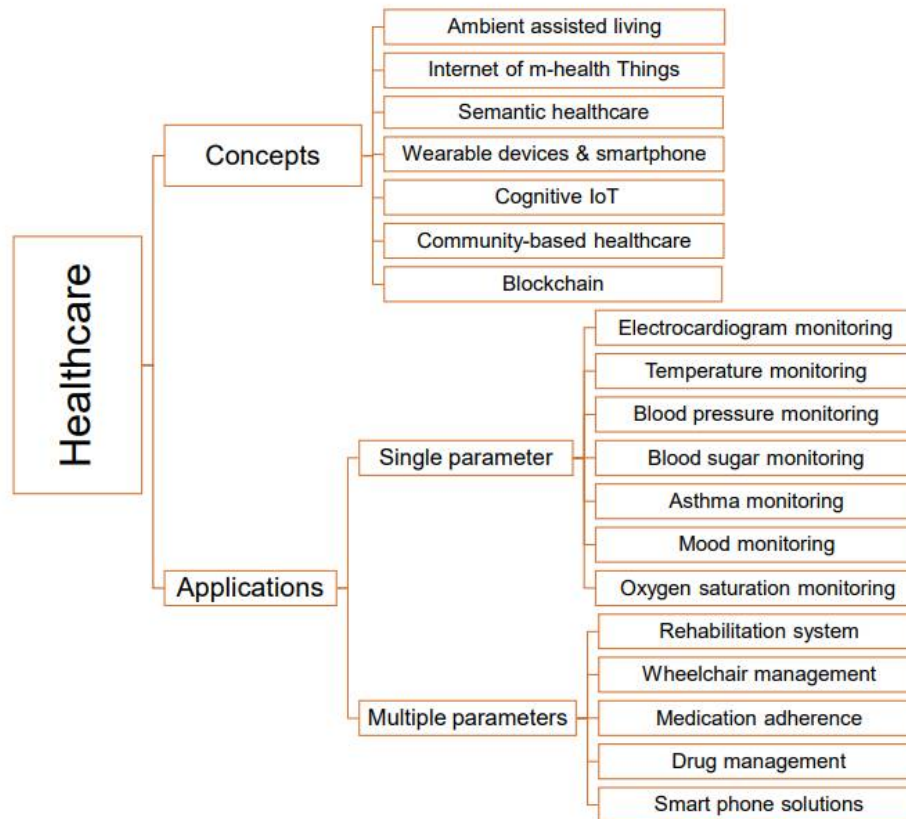

Figure 4: Cloud computing systems in the healthcare sector [10]

An introduction that is associated with cloud computing activities can change the contexts of remote monitoring systems and smart healthcare services. In recent years, the cloud computing paradigm has become the most important topic in information technology [11]. The best features of cloud computing systems are mobility, scalability and security benefits. According to research, healthcare services and their applications have been facilitated due to the development of technologies such as cloud computing and IoT. The cloud storage and its Multiple Tenants Access Control Layer is identified as the backbone of this system. It receives datasets from the healthcare sector through a sensor-based network [12].

The Healthcare Data Annotation Layer can resolve issues related to data heterogeneity that happens during data processing in the medicinal sector [13]. Another layer that is known as the Healthcare Data Analysis Layer analyses stored datasets in the healthcare sector. It assists in clinical decision-making procedures by analyzing similar historical medical records to create a treatment plan for similar cases [14]. Each of these mentioned layers is designed to handle predefined tasks in this sector. However, the majority of cloud computing datasets are centralized based on the geographical location of end-users. Therefore, for applications that require immediate real feedback such as telehealth, remote monitoring can face network congestions and other related issues.

CISCO is counted as a fog computing system that can easily extend the storage capacity and computing tenacity of a cloud [15]. In the further sections, a variety of methods is going to be discussed to display the effectiveness of a cloud computing system and its approaches.

MATERIAL AND METHODS

The entire research methodology section of this paper is going to be focused on interpreting the effectiveness of cloud computing systems gathered from various primary sources. A quantitative data collection method is going to be organized for conducting relevant surveys and questions for the participants. In order to understand the effectiveness of a cloud computing system and its approaches in the healthcare sector, the quantitative data collection method is going to be conducted. With the help of this data collection method, it becomes easier to gather authentic and relevant datasets [16]. Therefore, it needs to be stated that processing effective survey questions help in investigating gathered information.

For research philosophy positivism is going to be applied to collect necessary medicinal datasets for conducting surveys. As a research approach deductive research approach is going to be followed to gather desired and predicted information for this subject. It easily evaluates the specifications of the entire cloud computing system in the healthcare sector. On that note, the appropriate research design is going to be descriptive. This research design is counted as highly beneficial due to its ability to resolve different barriers [17]. In order to portray beneficial objectives provided by cloud computing systems in healthcare sectors, the surveys are conducted online due to the Covid-19 pandemic.

Various research methodologies are being undertaken based on contributions made by cloud computing systems. Responses were collected from different healthcare employees such as healthcare professionals, nurses, physicians, healthcare practitioners and other staff. For evaluating the significance of cloud computing systems, the research methodology section has to face many different stages. After analyzing four conducted survey questions the field of interests of participants can get properly analyzed. 50 participants are taken for a survey to estimate the effectiveness of cloud computing in healthcare sectors. Participants and their views are counted as necessary to illustrate future scopes of cloud computing systems.

The four questions are formed and conducted to get proper details of virtual binary options. On the other hand, this research study is trying to highlight the relevance of cloud computing systems in the medical sector [18]. Aspects of recent days are going to be applicable to display the positive effects of cloud computing in the healthcare sector. After all the surveys are conducted with directly linked healthcare employees for checking further modifications of cloud computing systems. The employees are taken by applying random sampling techniques for conducting this survey. Outcomes of the four conducted survey questions can provide relevant and useful knowledge of cloud computing systems in healthcare sectors.

Therefore, providing a comprehended understanding of the effectiveness of cloud computing systems help in analyzing transaction procedures in healthcare organizations. Moreover, after analyzing outcomes of the conducted survey questions the future scope of cloud computing systems can get easily understood.

RESULTD

The methodology section of the study has offered information regarding the selected approaches and primary data is to be gathered for managing healthcare sectors. His section is to obtain information by conducting a survey process from 50 different respondents who are working within the medical sector. This section is to analyse the different opportunities that individuals are likely to obtain within the healthcare sector. The researchers need to ensure that all the information is to be gathered based on different cloud computing approaches so that better medical support can be offered. Initial question ideas of the researcher in the survey process are:

- What are the reasons behind the growing role of Cloud computing approaches in the medical sector?
- What are the opportunities that cloud computing approaches are offering towards the medical sector?

Research survey questionnaires:

Question 1: Do you agree that cloud computing helps in lowering costs while developing patient care?

TABLE I: CLOUD COMPUTING IS REDUCING MEDICAL COSTS

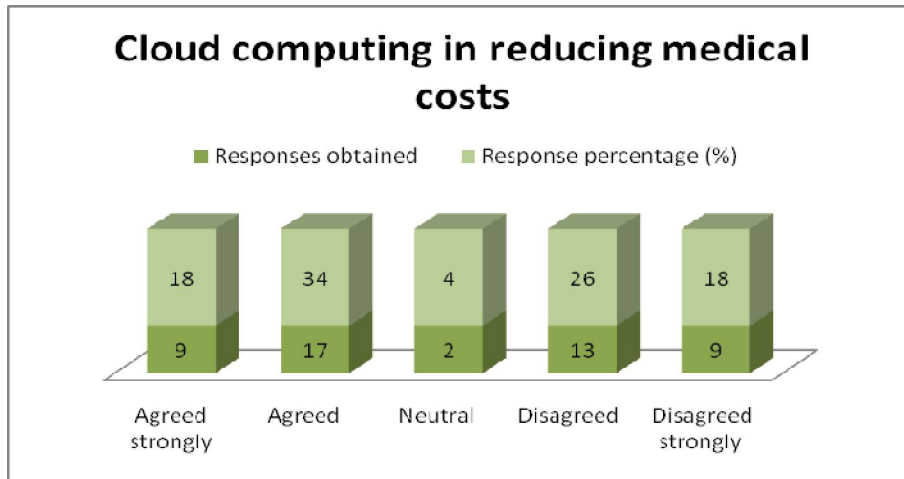| Determinants	Responses obtained	Response percentage (%)
Agreed strongly	9	18
Agreed	17	34
Neutral	2	4
Disagreed	13	26
Disagreed strongly	9	18

Figure 5: CLOUD COMPUTING IN REDUCING MEDICAL COSTS

This question of the survey process is related to managing activities in lower costing and along with that developing the overall satisfaction level of the customers. It was identified that cloud computing helps in better understanding of patients need and this statement has also been supported by the majority of the respondents.

Question 2:Do you believe that cloud computing is associated with offering real-time clinical data?

TABLE II: CLOUD COMPUTING IN MANAGING REAL-TIME CLINICAL DATA

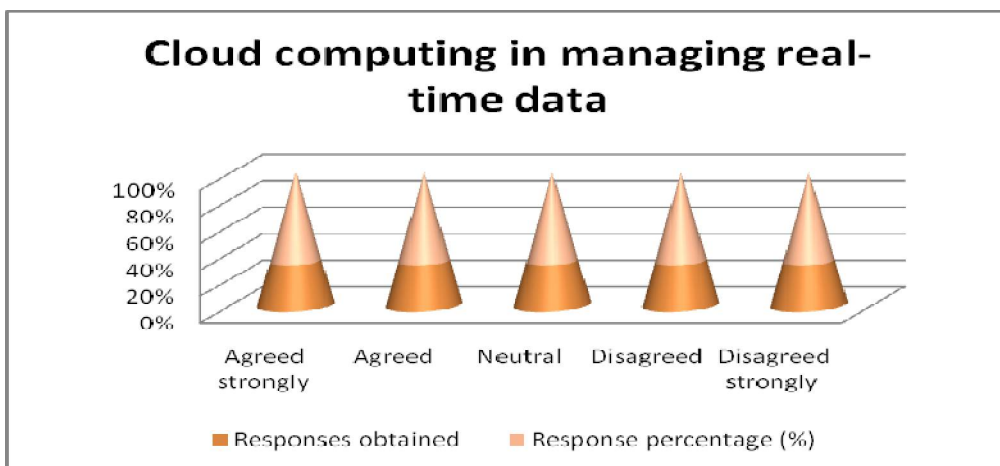| Determinants	Responses obtained	Response percentage (%)
Agreed strongly	10	20
Agreed	18	36
Neutral	1	2
Disagreed	14	28
Disagreed strongly	7	14

Figure 6: CLOUD COMPUTING IN MANAGING REAL-TIME CLINICAL DATA

Real-time clinical data is to be offered to the patients with the use of the cloud computing process, as it is required for offering better health services that are likely to observe faster development in the health outcome of the individuals. Cloud computing is likely to offer a platform for real-time activities of managing clinical operations.

Question 3: How far do you agree that cloud computing is related to data protection activities?

TABLE III: CLOUD COMPUTING IN MANAGING DATA PROTECTION ACTIVITIES

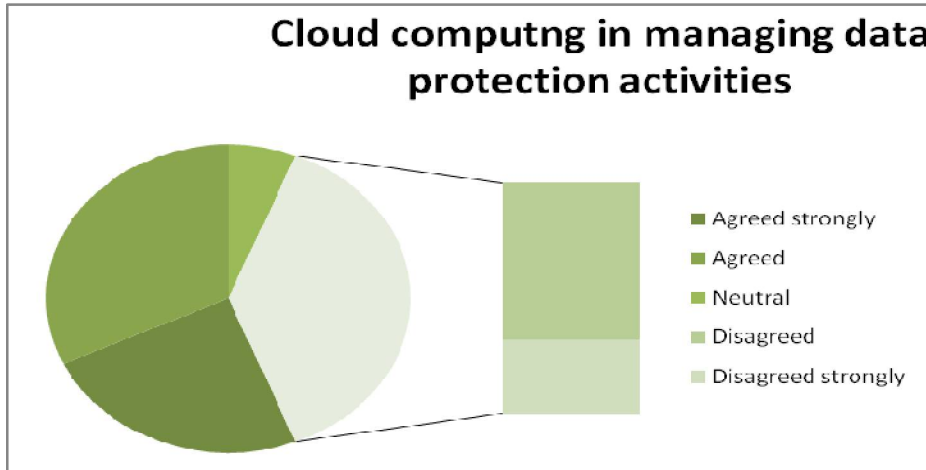| Determinants	Responses obtained	Response percentage (%)
Agreed strongly	12	24
Agreed	16	32
Neutral	3	6
Disagreed	13	26
Disagreed strongly	6	12

Figure 7: CLOUD COMPUTING IN MANAGING DATA PROTECTION ACTIVITIES

Cloud computing helps in managing sensitive patient information, and it is also related to understanding compliance standards. Cloud computing activities are related to managing automation and healthcare expertise activities. Cloud computing in the medical sector is also important for detecting changes in cloud accounts, and it is also related to understanding cloud accounts.

Question 4: Do you support that cloud computing is associated with managing automated operations?

TABLE IV: CLOUD COMPUTING IN MANAGING AUTOMATED OPERATIONS

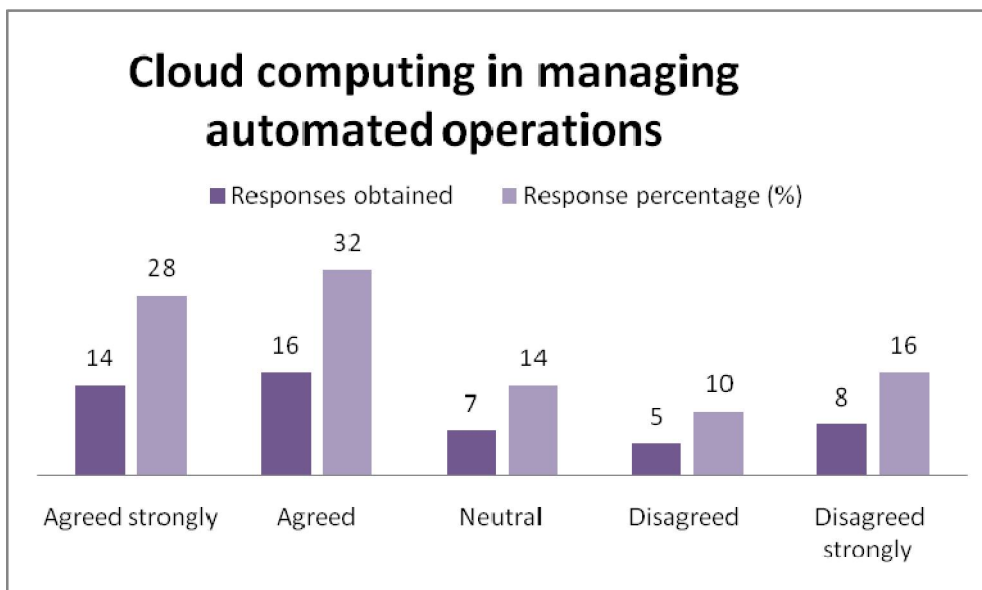| Determinants	Responses obtained	Response percentage (%)
Agreed strongly	14	28
Agreed	16	32
Neutral	7	14
Disagreed	5	10
Disagreed strongly	8	16

Figure 8: CLOUD COMPUTING IN MANAGING AUTOMATED OPERATIONS

Cloud computing is associated with understanding automated operations, and it is related to managing documentation and streamlining the medical process. Cloud computing is related to developing patient experience, and it also offers individuals with medical and pharmaceutical devices.

DISCUSSION

Cloud computing within the medical sector, is known for offering support and empowerment towards both the practitioners and the patients, along with developing data management activities. It is to offer realization regarding different data management activities. The above sector has offered information regarding different cloud computing benefits that are offered in the medical sector[20]. It was identified that cloud computing is related to managing a different form of automated operations, and it also helps in developing a network of healthcare professionals operating in the medical sector. It was identified that cloud computing is further known for managing data protection, and it is highly important for ensuring privacy towards the patients. It was identified that it helps in protecting the sensitive information of the individuals, along with managing compliance safeguards[21]. Healthcare professionals are also known for detecting changes, along with observing changes in real-time clinical data activities. Moreover, patients in the medical sector are also known for conducting faster operations, and it is also related to managing EHR latency, along with managing restoration and streamlining of data management activities[22]. Cloud computing also helps in reducing the workload of the individuals, and it is also known for developing patient care by reducing individual business costs.

TABLE V: PREDICTED OUTCOMES OF SURVEYS TO DISPLAY THE GROWTH OF CLOUD COMPUTING TECHNOLOGY IN THE MEDICAL SECTOR

The topic of discussion	Supported	Neutral	Disagreed
(a) Cloud computing systems help in lowering expenses while developing quality services of patient care.	52%	4%	44%
(b) The cloud computing system is highly associated with real-time medical datasets.	56%	2%	42%
© Data protection activities and cloud computing systems are directly interconnected with each other.	56%	6%	38%
(d) In order to manage automated operating activities, cloud computing systems are interlinked.	60%	14%	26%

From the above-displayed table it can be said that participants tend to possess their opinions based on the questions related to a cloud computing system. The first question is related to the cost-effectiveness of a cloud computing system to provide better patient care. For developing better quality services cloud computing can lower extra expenses for patients. After conducting the first question a total of 52% of participants supported, 4% stayed neutral. On the other hand, 44% of participants disagreed with the question. The second question related to this study is estimating the effectiveness of both cloud computing systems and real-time medical datasets [23].

The interconnection between the mentioned aspects in the second question has positive effects in the medical sector. 56% of participants agreed to the second question while 42% of participants disagreed with it. The third question is conducted to depict necessary data protection activities for illustrating the effects of cloud computing systems in the medical sector. The collaborative nature of the medicinal network is observed to be properly uplifted by data protection activities [24]. It helps in reducing risk factors related to data management in hospitals. Control in the healthcare system is highly related to further enhancements in healthcare organizations.

Data protection activities help in maintaining the privacy of a wide range of networks in healthcare organizations. It helps in developing easy accessibility and flexibility for the business procedures in healthcare organizations [25]. The last conducted survey question defines that those automated activities are interlinked with a cloud computing system. It is said because it is related to developing a medical chain platform. It is conducted to understand the empowerment provided by a cloud computing system to healthcare organizations. The cloud layer of a cloud computing system is responsible for maintaining extended computational analysis of medical datasets [26]. It is accessed by healthcare practitioners to efficiently utilize available resources to display practitioner manners.

CONCLUSION

From the above discussion it can be concluded that administrations of healthcare organizations are closely cooperating to ensure a seamless transformation of a cloud computing system. During this integration procedure of cloud computing in healthcare, many approaches are appended. A comprehensive survey is being conducted that exists in healthcare applications. This research paper also considers the vulnerabilities and threats of cloud computing systems. Investigating hospital health professionals to access EHR can unleash mistakes and omissions [27]. Moreover, the disadvantages are highlighted to appreciate unanimous findings based on opinions provided by participants. This work is intended as a reference that aims to help medical providers and practitioners to understand the constitutions of envisioned HC 4.0 (Healthcare 4.0). Cloud computing system is counted as one of the finest applications that improve traditional systems and procedures of the healthcare industry. New unforeseen approaches are going to be attached to inspire medicinal intakes for patients [28]. Technical benefits such as predictive maintenance, development of open standards, closed-loop design and advanced service lines are provided by cloud computing systems. The opacity of the entire infrastructure needs further monitoring as it is counted as a challenge of this topic.

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