CloudIoT paradigm acceptance for e-learning: analysis and future challenges

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ABSTRACT

E-learning is the theme interrelated to the virtualized distance learning with the help of electronic communication machines, certainly with the help of Internet. CloudIoT paradigm is the combination of cloud resource and internet of thing which become prevalent now days due to the flexibility and fast access for those reason different countries used CloudIoT paradigm different purposes. E-learning is one of the best examples where virtual environment provides cost-effective alternative to physical labs as well as to run scientific applications. The world order change in education sector due to Covid-19 all activity shift in to e-learning system. In this paper we present the review about CloudIoT paradigm and it usage in e-learning system as well as we extant taxonomy of CloudIoT paradigm for e-leaning purpose. In the related work section we present the existing contribution in the field of e-learning using CloudIoT paradigm are highlighted. We also contemporaneous the most standard framework which carried out for e-leaning using CloudIoT paradigm is discuss. The contribution section of the paper present the issue being faced by in adopting CloudIoT paradigm for e-learning are discussed along with recommendation and future work.

KEYWORDS
E-learning,
Teaching and learning strategies,
CloudIoT paradigm,
Adaptation, IoT, Cloud

1. Introduction

Education has important value for upward social and economic mobility of each country and individual it also responsible in offering competent human resource that they can use to day to day activity according to the standard set by the society. It breaks the bounds by different societies and encourages themto come together. All of these roles of education are sets in different educational institu tions [1], [2]. Technology has significantly improved education section due to the integral to achieving significant improvements in education sector. This was help full both case like teaching and learning system, technology also transfer a new model and style of teaching and learning system. Online learning opportunities and the use of open educational resources and other technologies can increase educational productivity by accelerating the rate of learning process [3].Internet of things consist of two words which are internet and thing, internet means the global connection of computer network with the help of different protocols and serve billions of user in the form of world wide web end user can get his entire requirement from different area. In modern world thing means those devices which human used for smart purpose with the help of internet. One of the most important roles of technology is process huge amount of data accurate and fast time. Cloud computing have the ability to increasing the storage capacity with dynamically without investing large expensive infrastructure through virtualizations[4]. Education is necessary element to change humanity and society in effective way. Now a day's traditional education system change in to e- learning system. It consists of virtualized distance learning system which used different electronic device and technology. E-learning is format learning system with the help of electronic recourses. Teaching activity is performed in class room or without class room but two important elements are required for learning system which is internet and electronic resources or we can say internet of thing [5].

According to [6],cloud computing is contemporary equipment which convenient on the demand network access for sharing and spooling of resources on the network like servers , storages, and different application services. It mentions both application and hardware. The application carried as facilities on the internet the hardware and system software work in the data centers for storage and other applications. People adopting new technology in order to achieve their required goals. Cloud computing is one of them people getting a huge amount of data in high speed and large memory storage. Cloud computing is new archetype that provide scalable on demand and virtualization for user. In this type of computing user can access and shared pool of computing resource which is provisioned with minimal management effort of user [7], [8]. Fig. 1 shows the structure of cloud computing.

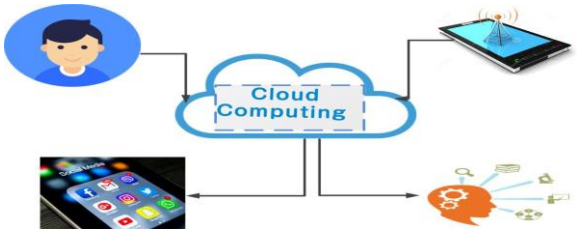

Fig.1.Structure of cloud computing

Cloud computing is the interconnection of different virtualization system they consist of parallel and distributed system. It consists of different level of architecture. Normally four type of cloud computing according to the user demand the cloud provider, provide these services, which are used in different field of life. Private cloud computing used for a solitary association and it may be accomplished by the association itself or third parity. It may be sited within the organization or out of organization. Public cloud is an infrastructure which own by an organization selling cloud service for user or any public user and public cloud can be used for public business and so many other activity [9], [10]. Hybrid cloud comprise of two or more cloud computing it's may be private or public and used for different reason and public cloud use for less sensitive data and private used for more sensitive data. Community cloud when numerous administrations cooperatively build and segment the same infrastructure and as well as their information and values are known as community cloud [11]. Fig. 2 shows the type of cloud computing.

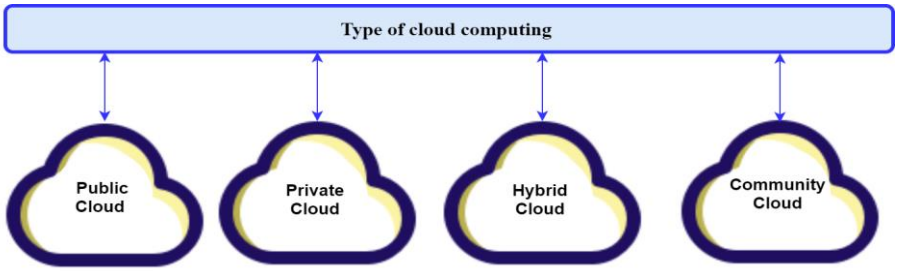

Fig. 2. Type Cloud computing

Cloud computing divided into four layers which are: Application layer the first layer of the model and it contains the actual cloud application. These are different from traditional applications. Platform layer the main role of platform layer is to control of operating system and solicitation frame work the persistence of stage layer is to diminish the burden of developing an application and also provide application process interface for storage [12], [13]. Infrastructure layer is used for dynamic resource management system along with for storage management making physical resources using virtualization. Hardware layer all the physical resources are managed by in this layer. Including switch power, router and cooling system normally the hardware layer implement in the data centre and contains thousands of servers and other devices are interconnected therefore there traffic management power and cooling system are also done in this layer [14].The main advantage of cloud computing are cost reduction, data security, scalability, mobility, disaster recovery, control and competitive edge. Due to this future it becomes more reliable technology. This is growing day by day with rich resource and service. It is also called as fifth generation of computing after mainframe, personal and client service [15].Internet of thing consists of self-configuration node they are connected with dynamic and with global network infrastructure. It comprises of small thing with limited storage and processing system internet of thing refers a broad vision. Thing such ways that every day object is place environment are interconnected with

each other with the help of internet. As we know that IoT is important source of big data. According to the process of data achievement and transmission in IoT the network architecture are divided in to three and five layers which are sensing layer, network layer and application layer [16] Fig. 3 show the layer of IoT but now a day's this layer increase in to 7 they increase according to demand of the environment.

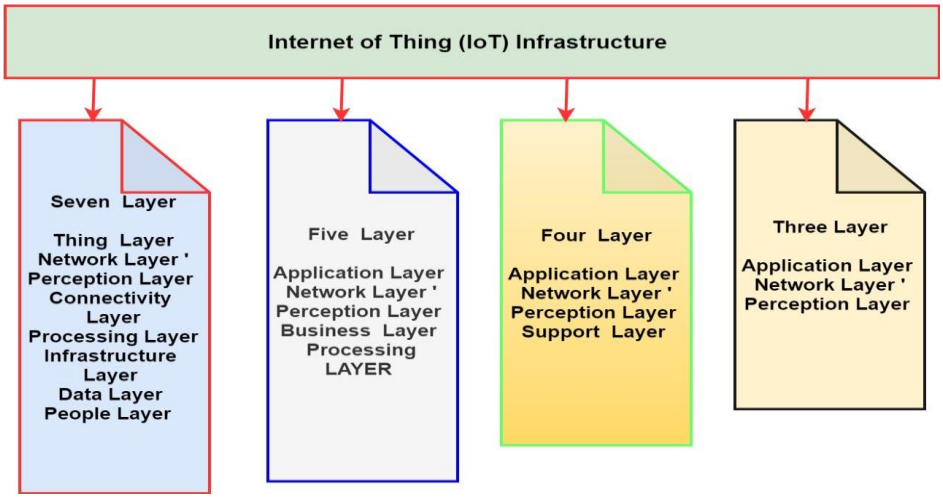

Fig .3.Layer of IoT

Cloud computing and internet of thing (IoT) are two different technology with different architecture and characteristics both are important part in our life. Cloud computing is new technology that has significantly changed over the last decade. The deliveries of virtualized IT resource over the internet are performed with the help of it. These services are delivered with the rule of pay and gain on demand with real time service. IoT become the next generation of technology it allow billions of internet device are connected and communicate with each other with specific rule and regulation it improves the quality of our daily life. Due to the modern world requirement these two technologies are merging together and know as CloudIoT paradigm. Cloud computing get more attraction and effectiveness due to the Integration with IoT in real world with distributed manner [17].Table 1 shows the difference of both technologies.

Table 1. Difference of two technologies

Cloud	IoT	Cloud	IoT
Virtual method used	Thing are passive	Virtual process have large store	Thing are real and on demand
Internet service delay	Limited storage capacity	Big data need to manage	Internet used for access coverage
Everyone can use resources	Big data store		

Table 1 shows the main difference of both technologies according to these differences they are managing to work together by developer and organization.

After the study of literature the integration of cloud computing with IoT consists of three steps which are minimal integration, partial integration and full integration. In Minimal integration strategy this layer provide different layer that produce connection with cloud Computing and IoT. It allows basic service like web, sensing storage and share these can be achieved with the help of these layers [18].Partial integration in this integration not only middleware layer or platform layer are developed it provide smart object service provider. It main role is to provide connection smart device connected with cloud computing and control them by multi-tenant approach. This layer provides virtualization for smart device. The final stage of level integration is known as full integration strategy. This process merge new service models that contain or conversional all cloud computing layer. Simple we can say all layer are working collectively in this section [19].Different heterogeneous network and framework and system with different patterns of communication like system to system, human to system and system to human. CloudIoT is new birth of technology which service with different application that can impact in different field of life [20].

According to [21], e-learning means different thing are used for different section based on higher education refers that the use of both software and hardware for online learning process is know as e-

learning. These all researcher [22], [23], [24], [25], [26], [27] define e-learning that has evolved in different ways affecting business, education, training sector, and the military. Education is the process which change human lives in positive node or through the study change occur in human behavior is knows as education. Normally three main type of education which are formal education, primary education and active education, formal education or formal learning is the learning process which takes place in specific place like school, college and university. Non-formal education is the process in which the education are not get in proper school or college this kind of education can be get at certain environment like home ,any training section or environment. Informal education these kinds of education are can be get with family or friend by so some action. Or parent training their children this is know as informal education [28].When these type of education teach with the help of any technology that process is know as e-learning system. Fig. 4 shows the basic information about e-learning.

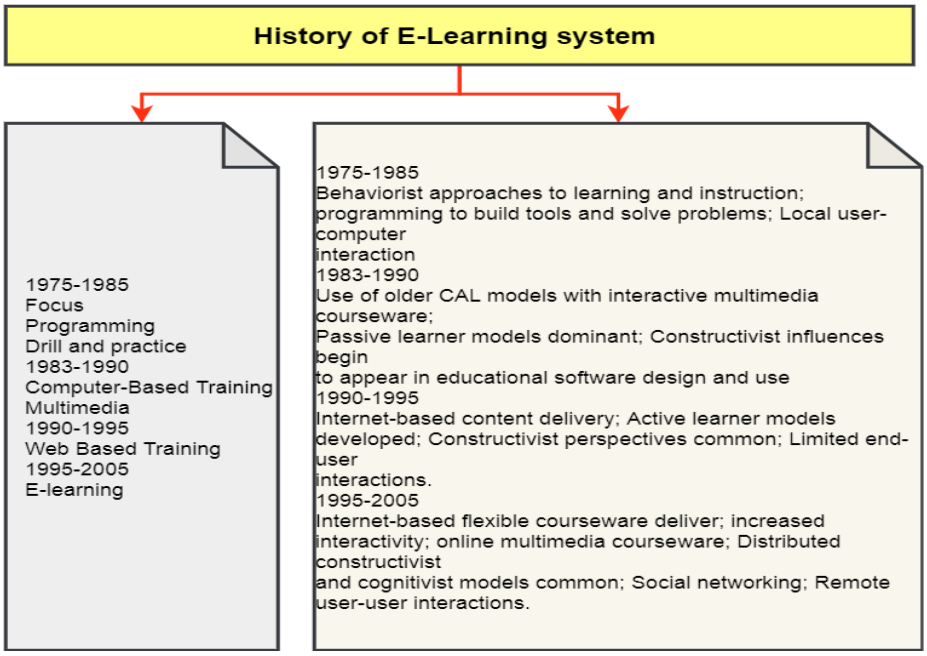

Fig .4.History of e-learning

According to [29] ,e- learning change for traditional system from last few years this system make more essay that different university school and colleges are online available any student from anywhere get admission and pursue in education system. This kind of education system needs more reliable network and device. Cloud computing and IoT are one of the important technologies of this system. Due to development in technology also affect the education system. Therefore the learning system shifts from traditional method in to internet based learning example are e-learning, m learning and u learning with the help of these technology cloud computing, IoT and mobile technologies. E-learning is the process in which all electronic element and device are used for teaching and learning processes. E-learning changes all the patterns of teaching across the world. Change traditional education system in to e- learning is difficult step but most of the people are ready to adopt the system. This system involves the use of computer and network and different application like as computer-based training (CBT), web-based training (WBT), virtual learning environments (VLEs) and digital collaborations. Main element of e-learning is that students are able to get easy learning environment according to their convenience. Different models are terms are used for e-learning systems [30],[31]. Fig. 5 show the taxonomy of different device that start using in e-learning environment. There two main terms are used which m-learning and d- are learning now a day which are main element of e-learning system. Mobile leaning is one of the main element in high education system properly it was used in 2011. Using m-learning learning setting is changing frequently because of the mobility of learners, learning technology, and learning contented-learning is perceived to be an educational tool that is capable to change the way higher education is delivered and it continues to getting wide spread and to gaining popularity day by day in the digital world. Deeper learning can promote three different ways to enhance the deeper learning such as personalized skill building, schools and tools, and the extended access [32], [33].E-learning become an imperative trends in education alteration because due to the information technologies learners can access teacher and other

resources with more accurate and given time. E-learning is one of the most well-known technologies revealed to make the traditional way of education change into software based and virtual learning environment [34], [35].

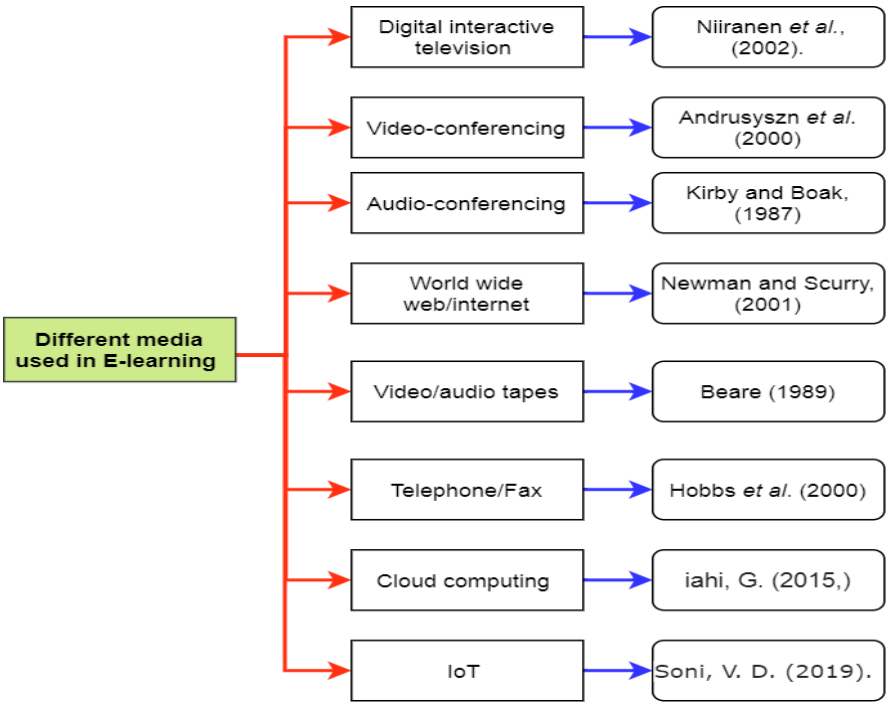

Fig. 5. Taxonomy of different device used in e-learning

E-learning system consist of different approach these approach are used to provided content but also on the way used to deliver this content thus the approach are important in e-learning system [36].Fig. 6 shows the main approaches which are apply with the help of CloudIoT Paradigm.

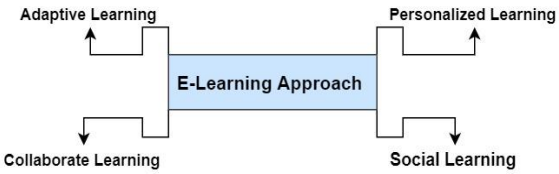

Fig. 6. Shows the e-learning approach

Collaborative e-Learning Approach: in this type of approach the learning adopts the notion the interaction of social and learning system interaction with each other. Where the learning process can attain high cognitive skills for information recipients. Collaborative learning is knowledge process through the process of negotiations and communications with others within the learning community. One of the main systems of collaboration learning system is to support the social interactions in order to enhance the collaborative environment [37]. According to [38], adaptive e-learning is the set of technique which offer online student a unique experience and improve the student performance. Adaptive e-learning system consists of unique identification of student and they consist of different background. It consists of different techniques which are user full for student during online system. Adaptive learning consists of content delivery system which is one of the main factors of improving the quality in education system. Social learning is one of the main elements of learning system it consist of two main types which are direct and indirect method. In social learning the education can be get able from social dimension. In direct learning a student can get the education face to face using technology and indirect leaning system the student can his required knowledge from different type of social media. There are different type of social learning system like Twitter, face book YouTube and many more it new technique different organization are implementing this technique due to covid- 19 this technique improve all over the world [39].Personalized e-Learning Approach: The transfer of traditional education system in to e-learning environment make big change in education system personal learning environment (PLE) is one of the main element of e-learning system where the e-learning parties (e.g. student, instructor, and the automated

system) the ability to customize their environment according to their needs and style and it have two main type which are self-regulated (student) and self-regulated and teacher-led customization [40], [41].

The collaborative learning model enhance by [42], using cloud and IoT infrastructure the proposed e-learning approach work on the base of knowledge based evaluation and reasoning for finding the supply and demand of the e-learning services. Virtualization concept was used in the e- learning service model and each model share knowledge, and service quality based on the pay and gain rule. The proposed model consists of payment system also where the user can pay and increase it service according to the demands.

For adaptive e-learning the [43], use mobile and cloud service on Amazon Web Services it was based on intelligent input the main aim of this study was organizing the contents and providing improved learning support system in e learning environment. Due to massive online data about e-learning these approaches handle the efficient and more accurate and also improve scalability of applications, fault tolerance, cost savings, and reliability. According to [44], design e-learning structure for data science using Jet stream cloud platform along with IoT. It consists of set of step where different software is the installation and configuration of Docker and create different github repository for course contents is performed. Different virtual machine and servicer are configure that can access by teacher and learning purpose in boot camp style.

A framework design by [45], for e-leaning environment with the help of private cloud along with IoT the frame work integrate with infrastructure, with a failover cluster. In this research the middle layer of cloud system tailored for e-learning environments where user can use for e-learning and management resource also. The researcher [46], proposed a model using different layer architecture for management and planning teaching resource section where different layer are mention for different tasks .Different layer of cloud are used for different propose where the high –level layer used for teaching and learning process. Where the intermediate layer focus on teaching and learning applications and low level used for data centre and other networking process along with security section. Fig. 7 show the Taxonomy of contributions with frameworks that present by different researcher based on CloudIoT paradigm for e-learning.

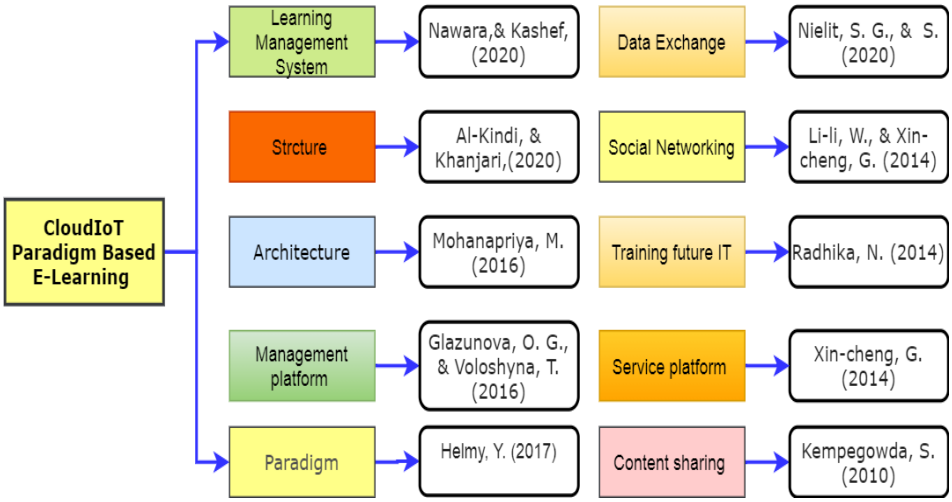

Fig.7. Taxonomy of contributions based on CloudIoT Paradigm for e-learning

According [47], present e-learning model based on cloud computing along with IoT where all layer and service like IaaS, PaaS, and SaaS used for social cloud activity (i-e) Google Apps, Course Builder, and Open Universal Desktop Services are used at the SaaS, PaaS, and IaaS layers, respectively.[48] , present cloud computing based curriculum design for English language course the system consist of models which managing service like curriculum resource and teaching learning course. These all activity is based on cloud computing based environments.

2. Method

Due to growth of technology and environment change it is necessary to redesign the virtual learning technique for student therefore in this paper we discuss the standard framework used for e-learning based

on CloudIoT Paradigm and details discuss about pros and cons. Two main section of the standard framework are used which are (a) integrating some of modern learning technique or structure section (b) Developing the e-learning environment or student section Fig. 8 show the CloudIoT Paradigm based e-Learning framework where we discuss about the pros , cons and recommendations.

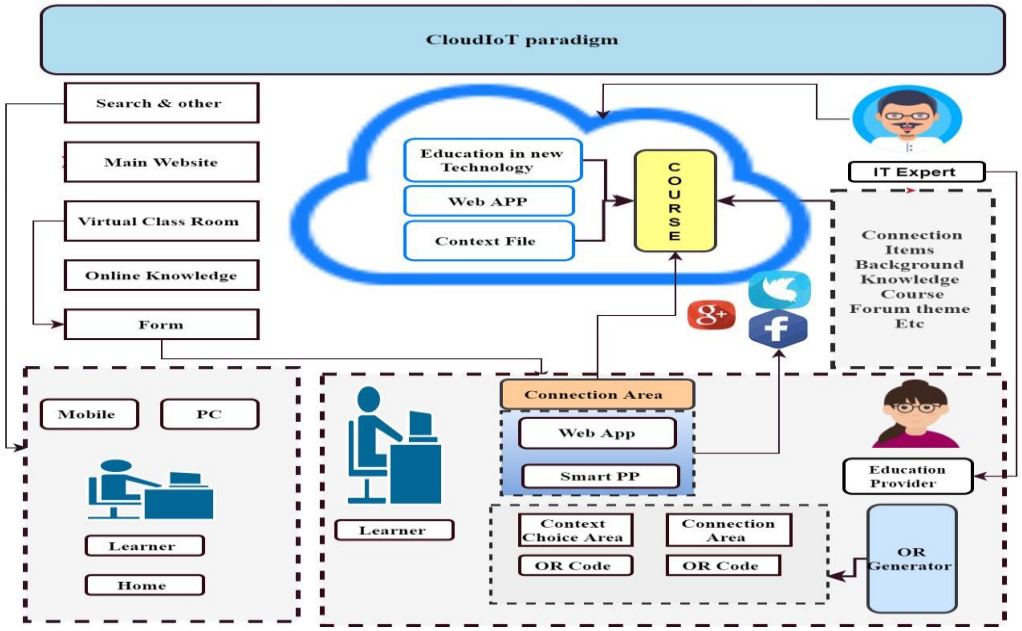

Fig 8. Framework of e –learning based on CloudIoT Paradigm

The architecture of a CloudIoT Paradigm platform as portrayed in Fig. 8 which is common to the most e-learning approach on CloudIoT Paradigm. As mention the first layer can used for interface with CloudIoT Paradigm environment, that consist of several management subsystems for determining the current necessities of the user in terms of computational resources, and storage services. The management's service used to distribute the execution of load among the virtual machine and the system administrator used to monitor and initiate activities of each layer. And security components their privacy, recovery and integrity for user and data also control in this layer. The second layer has the responsibilities to mention virtual machine or other virtual activity this section some of IoT device used to share information as virtual section (i-e) different connection section, authentications and presentation section. Third layer is service (adaptively/personalization manager) which is responsible for loading the personal learning environment for each student and consist of load personal environment, track user and maintain user profile, customize the content sequence and presentation, generate exams and assessments depending on the student's level and result. The fourth layer of the framework which consists of different service and management according to the requirement it mentions different service. Normally three main type of manger are used in this layer which are transaction manager, these all are resource control different service which are authentication and authorization service, generate and edit profile service, upload resources service , find and retrieve service , Mail/IM management service, Posts management service, Blog entry management service, Load personal environment, customize the content sequence and presentation. Physical layer this layer deals with the student sections which are. Self-monitoring system : In this section the student can get and access their progress in graphic virtualization form which present the student strength and weakness point and the system recommended resource and data to overcome these issues normally it called Student's performance using progress report. System feedback: This section consist of social media and collaborative with different tool then after the student get different response from these medium. This section is important for student because with the help of these it get different information using internet. Services for Instructor: Instructors are the most important facilitators of the learning process within the system where the instructors are the responsible for uploading of course, content and material, creating measurable questions, helping students in clarifying some points, and monitoring student's activities. This progress reports are tracked and monitored by course instructor to identify and address student's difficulties, and refine the content published by students. The tracking and monitoring also can be performed comprehensively based on class-level to measure and develop courses offered through the system, enriching online content. The last layer is data layer where all the data are store and give excess the student layer in the CB-SALF is the data layer which is responsible for storing

all of the educational process data such as user profiles, preferences, personal usage data, blogs and social activities. It is also responsible for storing the courses learning materials on the database, with the user's files, assignments, and assessments reports. In this layer IoT share most of the data to main center of CloudIoT Paradigm for different sources.

CloudIoT paradigm can improve teaching and learning process in future in term of different aspect. It can be predicted that IoT tools will provide a more appealing, flexible, engaging and quantifiable system of education that fulfills the different needs of a vast number of students. Normally in developed country student spent 1025 hours spent in class room and out of these 308 hours spent in setting char and other in relevant things in class room or waiting for teacher [49],[50]. Education section is one of the best examples of changes in the world due to the covid-19. All activity of education system change in e-learning system where all teaching activates were transferred in to online communications and learning platform. In this platform both teacher and student have interaction while using different app and application for teaching method. This is not the first time the conventional education system were stopped in 2009 due to H1N1 Flu outbreak also impact on education system. After the Covid-19 face to face learning system changed in distance learning or simple way change in to e-learning system. Most governments played catch-up to the exponential spread of Covid-19, so institutions had very little time to prepare for a remote-teaching regime. Where possible, preparations could have included [51], [52]. Fig. 9 shows those app and software which are used during Covid-19 by different organization and universes around the worldwide.

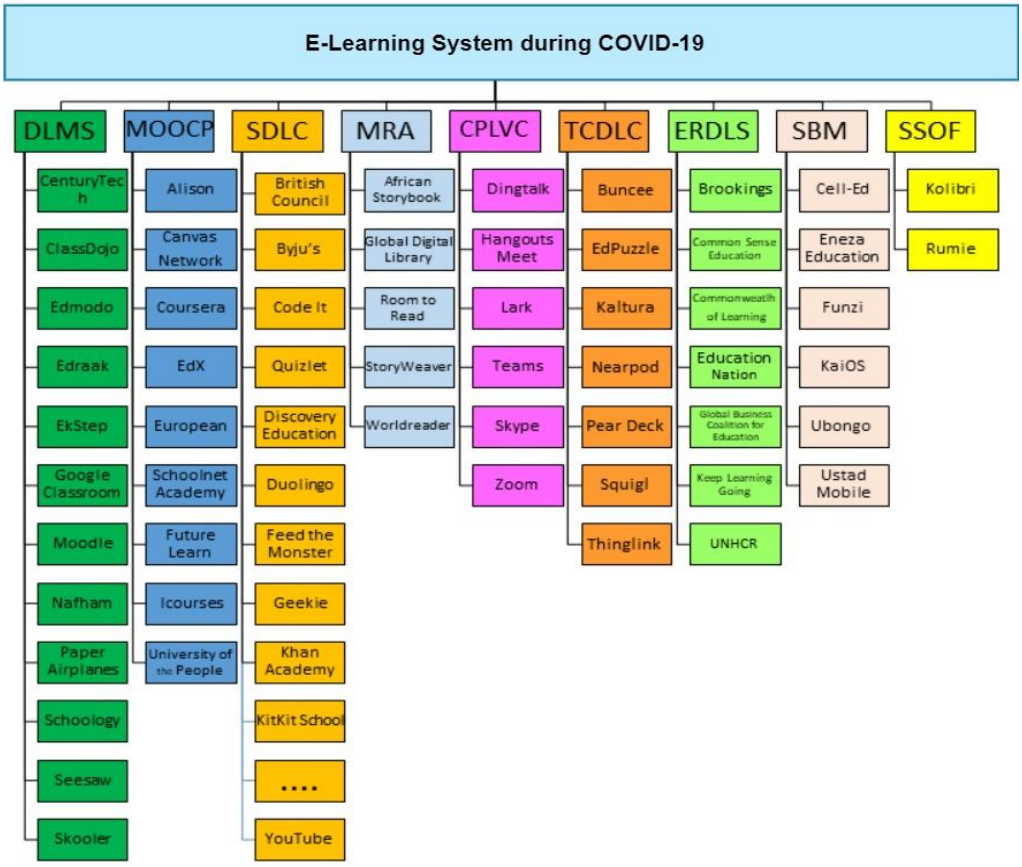

Fig. 9. Taxonomy of e-learning solution by UNESCO,[53].

Fig. 9 show the Taxonomy of e-learning solution by UNESCO, due to Covid -19 and the rapid adaption of the e-leaning paradigm also increase due to Covid-19.

3. Results and Discusion

3.1. Challenges and Possible Solution For Using Cloudiot Paradigm For E-Learning

From last few years e-learning changes in to industry especially after Covid-19 therefore the role of CloudIoT Paradigm is important for the massive support to overcome the traditional local physical labs and computational environments. However, there are visibly main challenges and barriers that need to be

overcome in order for the cloud to gain wider use and adoption in facilitating and sustaining e-learning system. These challenges and suggestion are mention below.

3.2. Familiarity with CloudIoT Paradigm

In e-learning environment both instructor and student must be aware form the different resource utilization which is providing by as services, by third-party. As we know that different IoT device are connected with cloud and used for specific purpose therefore the instructor need to aware from the use of these device before presenting the lesion. School or university management system must need a pre session with instructors about all these activity and device. As we know that all student are not familiar with CloudIoT Paradigm and those backgrounds are in computer science or related fields may find it much easier to acclimatize, understand about CloudIoT Paradigm otherwise other student need proper training. Fig. 10 shows the structure of e-learning when it shifts from traditional system in to e-learning system.

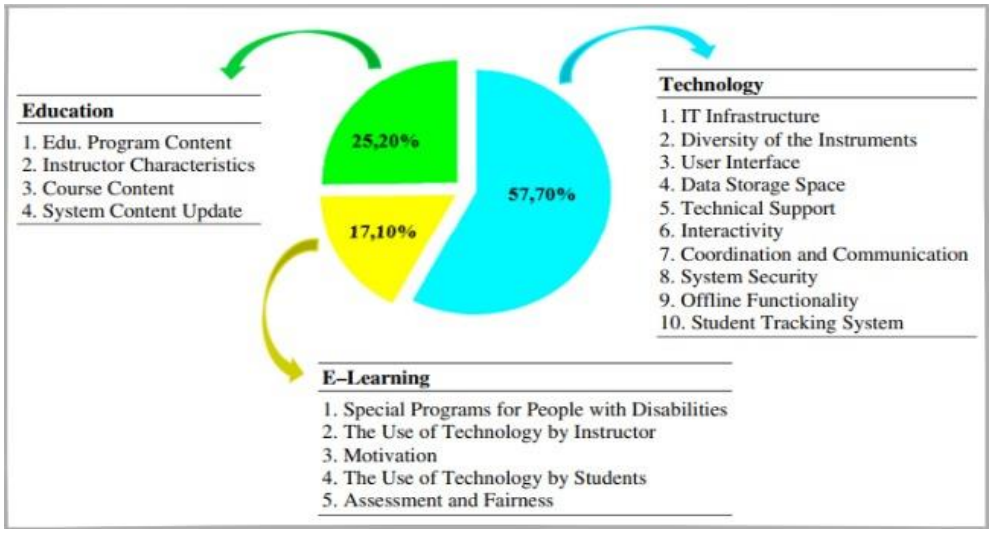

Fig. 10. Shfiting process from learning to e-leaning [54].

Fig. 10 show the e-learning system where we can see 57% technology device are involve it means when learning system shifted in to e-learning we must be familiar with different technology this is one of the main issue.

3.3. Using the CloudIoT Paradigm service with the help of pay and gain role

CloudIoT Paradigm service based on (IaaS) layer which allows to access different resource like hardware, software and operating system for any university or school based on pay and gain role. After getting different resource an organization get application with the help of (PaaS) layer in CloudIoT Paradigm. After getting these resources universities or schools customized e-learning application and launch architectures e-learning system. These architectures of e-learning system host by CloudIoT Paradigm any user (i-e) student, management system and stuff accessed for e-learning via web browsers or any other desktop client software [55].

3.4. Using offline service of CloudIoT Paradigm

Different offline service of CloudIoT Paradigm are in used in different universities and schools with the help of different device and software but they are inter organization service normally we called them privet CloudIoT Paradigm. The e-learning structure can be bee shifted to this type of CloudIoT Paradigm but as we know that this type of learning system must be privet and limit number of access. Therefore these types of e-learning have restriction and not available to access at any other location [56], [57].

3.5. Adaptation of architecture through mapping

As we discuss in pervious section about offline service of CloudIoT Paradigm which consist of e learning structure where we can change the role and make it public. When we change the role from private into public configuration on existing hardware, setting up operating system & middleware layers change this process feasibility shift in to e- learning system. These all activity performed with the help of optimal mapping process normally it is called mapping conversation. When All the structure of e- learning shift

in to CloudIoT Paradigm then virtualization process start working for more improvement in service and avoid underutilization of resources [58].

3.6. Transfer of existing e-learning infrastructure to CloudIoT Paradigm

The infrastructure of e-leaning needs satisfactory planning prior to implementation in CloudIoT Paradigm. This process consist of different technique an organization can adopt any of the following strategies for transferring existing e-learning system into CloudIoT Paradigm e-learning system [59].

3.7. Study resource and lab materials

Up to day CloudIoT Paradigm service and resource are not ready to integrate with e-learning systems. Due to Covid-19 up to some extend resource of e-learning shift in to CloudIoT Paradigm system. Different organization and universities are still lacking the necessary online CloudIoT Paradigm based course and exercises that are designed for a specific subject of study. The integration of online lecture and lab materials can improve the student learning experience and improve the academic institutions e-learning systems.

3.8. Security and privacy

As we know that CloudIoT paradigm is internet based technology data are store in different serves and data base system. IoT device are connected with different e-Learning system student connect with these device to get their requirements data and some of the data are personal and need more security. Therefore security is very important in new technology as compare to other technology is more secure but need more step because it user increase day by day along with data size [60].

3.9. Reliable Wi-Fi Connection

For the connection purpose different kinds of connection technology are need they connected different device and system together for share and processing purpose. WI-FI is one of them main technology that connected different kind of technology and network together. Therefore proper speed and bandwidth and reliable with high speed WI-FI need because in the E-learning system audio and video streaming of lessons and presentation are present [61].

3.10. Management

As we know that new technology CloudIoT paradigm consist of two main technology which are IoT and CC therefore different device are connect they have different configuration and setup. If the configuration and standardization of this technology are not making simple and reliable then it make difficulties of e –Learning environment. Therefore compatible and can hinder the organization's ability to build a CloudIoT paradigm setup for education system [62], [63].

3.11. Cost

The whole setup of a CloudIoT paradigm based educational institution can be expensive. Therefore the cost of devices and equipment is another challenge. Therefore need more and comfortable that developing country can also able to change able traditional education system in to E-Learning [64].

3.12. Connectivity and network delays

While Internet connectivity and speed have improved significantly over the last decade to an acceptable level in many places around the world, slow Internet speed can be a major inhibitor for cloud-based education and e-learning. The problem is exacerbated if users need to access data and services hosted in remote non-regional cloud datacenters. In this situation, cloud users and students can experience unacceptable delays in using and accessing cloud-based e-learning systems [65].

4. Future Trends in E- Online Learning Services

Information and communication technologies (ICT) have, in a short time, become one of the pillars of modern society. Today, many countries consider understanding these technologies and mastering their main concepts and skills to be an integral part of basic education, along with reading, writing, and arithmetic. So that, the education informatization has become a new paradigm of online education, called smart or e-learning that permits to insert the theory of modern education, based on educational data and used supporting technologies to realize better exploits of intelligent e-learning services. There is an urgent need to create a ubiquitous learning environment by incorporating hybrid human intelligence into the loop to create safe, intelligent, and engaging online learning environments to promote performance and

experience with learning services personalized as well as a huge online learning service, especially when they first appeared in the world. Some infectious diseases (Covid-19) develop. For this reason, future work will be as follows. The intelligent knowledge service, without a doubt, online learning enabling e-learners to learn and learn knowledge. There is an urgent need to transfer numbers of educational resources into well-planned structure knowledge system and service that cans any country can adopt. One of the main issues in e-learning is that under developed countries cannot access these services due to different reason which are discussed as above [66], [67].

5. Conclusions

In this paper we have termed about cloud computing and their interrogation rule with internet of thing how they substantially upkeep and facilitate teaching and e-learning environment. While the new technology is known as CloudIoT paradigm and his adoption enactments by get from the lecture as well as the standard frameworks are discussed during this paper. During the paper we present the broad survey and taxonomy about CloudIoT paradigm usage for e-learning process are discuss along with attitudes, main apparatuses, and relevant features are discuss in this paper. Due to Covid-19 CloudIoT paradigm user increase enormously in education system of the entire world. However, there still residues further interesting work and efforts to be exerted on forming the next-generation CloudIoT paradigm platform for e-leaning environments. Future work Privacy services and the protection of digital property remains a hot topic in online learning there is no exception to e-learning and its services. Certain tasks need to be performed to prevent leaked confidentiality disclosure, including for recommendations and sharing of educational resources or facial identification. Some privacy-related tasks are to ensure that there is no illegal leakage and modification of student personal files on the Internet. Therefore research need to interest in this section for upcoming period.

Declarations

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