

Integration of IoT, Cloud and E- Learning In Education

Vijay B. Mohite¹, Sonali G. Gaikwad², Renuka R. Gavli³

^{1,2,3}Dept of Computer Engineering

^{1,2,3}JSPM's BHIVRABAI SAWANT POLYTECHNIC, PUNE- 412 207

Abstract- *Internet of Things (IOT) is the networked link of physical objects. The IOT's major and significant development is the explosive growth of devices connected and controlled by the Internet. It is an increasingly growing topic of dialogue both in the place of work and outside of it. It's a concept that not only has the prospective to impact how we live but also how we work.*

IOT and Cloud are two very different technologies and are both already part of our life. Cloud and IOT combined together is foreseen as troublesome and as an enabler of a large number of application request scenarios.

Education has been progressively expanded, and each of a module of the education has changed slowly. It is becoming completely associated with the Information Technology on the data exchange, communication and alliance. The education based on cloud computing provides a new solution to set up an unified, open and flexible network teaching stage and reduce the hardware input. Cloud computing as an exciting development in Educational Institutes and it is the delivery of on-demand computing resources everything from applications to data centers over the Internet.

In this paper, we will discuss how Cloud computing will have a significant impact on the educational environment in the future and what can be done to increase the benefits for students and teachers. This paper focuses on the integration of Cloud and IOT for education system.

Keywords- IoT, Cloud computing, E-learning, IaaS, ICT, PaaS, SaaS.

I. INTRODUCTION

The Internet has emerged from the idea of connecting people and later sharing videos, photos, and text to more recently physical objects. As things and people turn into more connected, such objects also become part of social networks. In this way, the value of such objects enhance for both research and education. Students and organizations have the prospect to quickly and economically access a variety of

application platforms and resources through the web pages on-demand. Regardless of the fact that the IOT[1] is above all else about creativity, the common suggestions do not do it justice. A new way to realize the impact of IOT in education is through the use of sensors. Even people without acquaintance of software coding can receive text and email updates on what items or environments the box is sensing.

One of the most capable paradigms for education is e-learning. E-learning is usually referred to the deliberate use of networked information and communications technology (ICT) in teaching and learning. Online learning, virtual learning, distributed learning, network and web-based learning are the other terms used to describe this mode of teaching and learning. The development of e-learning is directly related to the rising access to ICT, as well as its declining cost. The competence of ICT to support multimedia resource-based learning and teaching is pertinent to the growing importance in e-learning. However, in conventional web-based e-learning mode, system construction and maintenance are located in inside of educational institutions. Cloud computing has many advantages such as estimated performance, reduced investment, high accessibility, reduced launch time, infinite scalability, remarkable fault-tolerance capability, and accessibility, enhanced collaboration, and mobility, allow users to make use of any device, such as a mobile phone, personal computer (PC) etc. The benefits of cloud computing maintain education institutions to determine some of the frequent challenges of e- learning such as cost decrease, efficient communication, security, privacy, flexibility and accessibility. Due to its dynamic scalability and effective usage of the resources Cloud computing is fitting a smart technology; which can be utilized under conditions where the availability of resources is limited. This paper presents the impact of using IOT and cloud computing upon e-learning solutions development.

II. INTEGRATING IOT AND CLOUD COMPUTING

The two technologies of IOT[1] and Cloud[9] have been an independent evolution. On the other hand, a lot of common advantages are the result of their integration [8] identified in literature, predicting the future. On one side, the

Internet of things can help cloud almost unlimited capacity and resources to make up for the technical limitations. In particular, cloud computing provides an effective solution to realize managing of Internet services and composition and use of things or data applications. The other way; Cloud computing can benefit from the Internet of things, by enhancing its scope to deal with things in the real world in distributed and dynamic way, and provide new services on a large number of real life scenario. The four pillars [2] of IOT insist a call for an education system that allows digital society who understands the technologies that strengthen IOT, the societal impact of widespread adoption, with the right application of the information that is captured. In the area of computer science, the challenge is in budding new forms of scalable education that have room for large numbers of students around the world, attract prospective students with various interests, and carry an innovative curriculum that reflects the essential changes in computing technology. IOT and Cloud computing technologies help to provide solutions for the aforementioned problems in education system. Cloud computing helps users to organize and access data via the Internet. The main users of a typical education cloud include students, Faculty, administrative staff, Examination Branch and Admission Branch. All the important users of the institutional organization are connected to the cloud. All the users are provided with separate login for their assigned work. Teachers can upload assignments, and tests on the cloud server. Students will be able to access those via Internet using computers and other electronic devices both at home and college and 24X7. The education system helps teachers to identify problem areas in which students tend to make mistakes, by analyzing and assessing students' study records. With this, it will also allow teachers to improve teaching resources, materials and methods. These will not only help students to use online teaching materials and resources during class but they will also be able to access these materials at home, using them to prepare for and review lessons. The cost of operation will be reduced with utilization of cloud computing systems because servers and learning materials can be shared with other colleges also. Many features and functions of these services and tools may be uploaded to the cloud and consumed directly over the Internet either as fully or partially.

3.1. The four Pillars of IOT in e-learning/ Education

This section describes the impact each pillar of IOT on education and what is required to maintain, develop the practices currently being planned or adopted.

i. People: Using multiple devices and social networks most people are connected to the Internet. The education sector

must realize how people connect to the Internet to increase their learning and as a result relate their knowledge. Author Alvin Toffler, says there will be those who know how to “learn, unlearn, and relearn.” Identifying the right people with and from whom to learn will be decisive: each individual becomes a “node” on the network; people will need to know how to connect, not just to the effort of leading experts, but to peers who have similar passions and interests. Thus, people will exchange ideas, talk about research and latest developments in their area of study, and develop connected communities of practice. Experts in a specific area will be required to teach classes, and exchanging information through streaming or live video.

ii. Process: People, data, and things work together to deliver value in the connected world of IOT with proper Process definition. Connections become relevant with the correct process, and value is added as right information is delivered to right person, at the right time. The process could get rid of examinations used to measure and compare learners' performance. The measurement model could be precise at any moment in time, providing targeted, and personalized feedback on what a learner need to improve his or her understanding and performance.

iii. Data: By providing more useful information things connected to the Internet evolve more intelligent. Rather than reporting just raw data, connected things send higher-level information back to machines, computers, and people for further evaluation and faster decision making. It results into enormous implications in education. The accuracy of such data will have a massive impact on learners' benefit. Additionally, remote data collection will also assist people reduce their redundant efforts. Exchanging datasets with others around the world will improve and expand students' learning experience, authorizing their research through active commitment with other researchers.

iv. Things: Physical items that can be connected to both the Internet and people via sensors are referred as to Things. A “voice” is given to things through sensors: by capturing data. Sensors enable things to become context-aware, and provide more experimental information to help people and machines make relevant decisions.

3.2. Key Factors supporting Successful Implementation of IOT in e- Learning: As discussed earlier, IOT has huge prospective in education. Here, three main factors are addressed that ensures widespread and unbeaten adoption of IOT in education.

a. Security: IOT security may become an vast issue in education. Without affirmation, persistent development of IOT will not happen across educational institutions. Information must be accessible—yet not to be disclosed—when required, with the owner of the information deciding which people, groups, or organizations may have access to it. Both educators and learners will need to have a better understanding of ethical issues and the risks of IoE, as well as ways to mitigate those risks. Personal and communal data will need to be treated differently, and the individual's privacy will have to be respected.

b. Data Integrity: Data integrity must be ensured, along with its accuracy and completeness.

c. Education Policies: Education policies for adoption of technology in the classroom and its effective integration into syllabi are vital.

III. E- LEARNING

E-learning consists of all forms of electronic means learning and teaching. The information and communication Technology systems, may it be a networked learning or not, serve as explicit media to employ the learning process. This a lot involves both out-of-classroom and in-classroom educational experiences through technology, even as developments continue in view of devices and curriculum. CBT (Computer-Based Training), IBT (Internet-Based Training) or WBT (Web-Based Training) have been used as synonyms to e-learning. E-learning is the computer and network-enabled shift of skills and knowledge. Via Internet, audio or video tape, satellite TV, and CD-ROM content is delivered which can be instructor-led and includes media in the form of text, image, animation, streaming video and audio. It is commonly approved that new technologies can make a big difference in education. Especially, in young ages children can exercise huge interactivity of new media, and develop their skills and knowledge under their parents' observation. Many aspects of e-learning believe that everyone must be equipped with basic knowledge in technology, as well as use it as a means to attain a particular goal. E-learning is extensively used today on different levels: continuous education, industrial trainings, academic courses, etc. At least two entities are involved in an e-learning system: the students and the trainers/teachers.

IV. CLOUD COMPUTING IN EDUCATION

Cloud computing technology uses the internet and central remote servers to manage data and applications. Cloud computing is the exercise of computing resources that are

deployed as a service over internet network. Cloud computing permits users and organizations to use applications with no installation and access their personal files at any terminal with internet access. This technology helps for much more efficient computing by centralizing data storage, processing and bandwidth. Cloud computing ensures remote services with a user's data, software and computation.

Cloud offers following services:

A. Infrastructure as a service (IaaS): Hardware resources and computing power are offered as services to customers. This enables organizations to lease these resources rather than spending money to buy dedicated servers and networking equipment.

B. Software as a service (SaaS): In this model, software applications are offered as services on the Internet rather than as software packages to be purchased by individual customers.

C. Platform as a service (PaaS): This refers to providing facilities to support the entire application development lifecycle including design, implementation, debugging, testing, deployment, operation and support of rich Web applications and services on the Internet.

A. Cloud computing for E-learning: E-learning is an Internet-based learning process, using internet technology which is used to design, execute, Manage, support and enhance learning. E-learning does not replace conventional education methods, but improves the effectiveness of education. E-learning is extensively used today on different levels: continuous education, industrial trainings, academic courses, etc. Various e-learning solutions from open source to commercial are available. At least two entities are involved in an e-learning system: the students and the trainers/teachers.

The students: • Attend online course • Give exams • propel feedback • complete homework, projects

The teachers: • Design and deliver content • Prepare tests • Assess tests, homework, projects taken by students • Send feedback • Communicate with students (forums).

Generally, e-learning systems are constructed as distributed applications. The structural design of a distributed e-learning system includes software components, like application on client side, an application server and a database server and the necessary hardware components like client computer, network infrastructure and servers.

Connecting to the cloud and with “hidden” resources enables exchange of information all the time and universally, huge application scalability, anytime and anywhere availability of services, data security, storage, backup copies and many more. Adopting cloud computing is beneficial in both the financial savings and resource management viewpoint. Public cloud stores many public education resources that are built for students who learn to search for basic knowledge of that field. And private/ internal cloud is a promotion term for a proprietary computing structural design that provides hosted services to a limited number of people behind a firewall. Primary reason for implementing private cloud is to make the most of and make use of existing in-house resources. Secondary reasons consist of the data privacy and trust for security. In the last, data exchange cost have full control over mission-critical activities behind the firewalls. It combines more resources both physical and virtual. It also provides an academic platform for teachers. Throughout all stages, the private or the community cloud, they all can build up a hybrid cloud called as “educational cloud”, in which all the resources from the various organizations can be shared. Private cloud uses the local network whereas the educational cloud makes use of public network to access the services provided by the cloud.

4.1. Advantages of Cloud Computing In E-Learning: The educational cloud computing focuses on the power of number of computers on one problem, allowing learners learn and find models and solutions faster. The organizations can also release their technology infrastructures to private, public sectors for learning purpose and research advancements. The effectiveness of cloud computing can help organizations keep competence with growing resource requirements and energy costs. Students look forward to use their personal mobile devices to connect to campus services for education. Faculty members ask for well-organized access and flexibility when integrating technology into their classes. Learners/ Researchers cover immediate access to high performance computing services, without managing a large server. Generally, e-learning systems are constructed as distributed applications. The structural design of a distributed e-learning system includes software components, like application on client side, an application server and a database server and the necessary hardware components like client computer, network infrastructure and servers.

There are various advantages of cloud computing with e-learning, they are:

i. Low cost: As the data is created, managed and accessed in the cloud, the user does not require to spend more money for

large memory for data storage in local machines. Organizations also need to pay for the space they need .

ii. Improved performance: As the cloud based e-learning applications have most of the applications and processes in cloud, client machines do not create problems on performance when they are working.

iii. Instant software updates: The software’s are automatically updated in cloud source. So, always e-learners get updates instantly.

iv. Improved document format compatibility: As the cloud based e-learning applications open the file from cloud problems related to file formats and fonts are eliminated.

v. Benefits for students: Students can take online courses, attend the online exams, get feedback about the courses from instructors, and send their projects and assignments through online to their teachers.

vi. Benefits for teachers: Teachers prepare online tests for students, create and manage better content resources for students through content management, assess the tests, homework, projects taken by students, send the feedback and communicate with students through online forums.

vii. Data security: Though it seems not very reasonable, the cloud computing provides major security benefits for individuals and organizations that develop e-learning solutions.

V. CONCLUSION

As a conclusion IOT and Cloud Computing is a stimulating development that provides a significant alternative in today’s educational perspective. Students and teachers have the opportunity to quickly access various application stages and resources through the web pages on-demand. There is remarkable value for connecting the unconnected with intelligent networks across education. This paper describes the integration of IOT and Cloud and the potential impact on making education more relevant, engaging and motivating learners, and enabling faster time to mastery. Additionally for IOT to be accepted, both policymakers and educators must be well-prepared not only to exploit, but also to understand potential risks.

This paper discusses a cloud based e-learning in education, describe its definition and some benefits. Cloud based education will assist the students, Teachers, organizations and also the learners to a very high extent and

essentially students from rural parts of the world will get an opportunity to get the knowledge shared by the experts.

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