

## Internet of Things and its Applications to Progress the Industry of E-Learning

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**Abstract:** Internet of Things (IoT) briefs the idea of technological innovation in the digital world of networking. That networking further helps practical world matters of machinery to connect and communicate with each other. Internet of Things has spread its wings in all the fields of work, which include business, healthcare, education, agriculture, transportation, management etc. Almost a dozen of appliances in a person's life are claimed to be part of the Internet of Things. This includes smart phones, smart watches, cars, and home appliances. The technology of the Internet of Things is tirelessly working and evolving to bring the essence of smartness into the lives of people and their homes. Without a doubt, IoT has made life easier for people across the world. This paper will discuss about the innovations that helped to progress the industry of e learning pertinent to the Internet of Things (IoT).

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## Introduction

As the world started to face revolution, everything became digital and innovated with lots and many amendments. Similarly, many years ago the first machine-to-machine conversation was exchanged via excess of Internet after with several communication links were invented. This M2M communication started making things easily accessible in the world. The biggest example of this innovation is worldwide web, commonly known as (WWW). After several advancements that occurred in the world of Internet, revolutionised technological innovation was brought into action, which is known as Internet of Things (IoT). Internet of Things is responsible for converting the ordinary things into smart ones. When one machine starts to communicate with the other it is known as a part of the Internet of Things, for example, the air conditioner is operated with its remote with the involvement and help of Internet of Things (IoT). To put the idea of IoT into basic concept, it is the connection of things through the Internet. Internet of Things (IoT) is a concept of all rounder activities, as it is found in every field of work such as health care, agriculture, education, management, business, finance,

education etc. Internet of Things (IoT) has made lives easier for people living in the contemporary world where digitalisation has become the part of their lives. This paper will discuss about the technological advancements towards the Internet of Things (IoT) and progress that it has made in the industry of E-learning along with some technicalities that are required to be addressed.

### Uses of Internet of Things

Being deeply blended in our lives, Internet of Things (IoT) has taken over every action and activity of the day to day tasks. Below discussed are few ways in which we use Internet of Things in our daily life, they also helps to progress the e-learning industry.

- **Mobile learning**

Mobiles have become the most common devices to exist, in the academic courses, almost half of the students excess their classes and the lecture notes through their mobile phones. They also enhance the industry of e learning by making the mobile phone accessibility an easier way on the journey of higher education. Mobile phone has made the availability of e learning easier and quicker at any place and anytime.

- **Push Notifications**

Push notifications are the features of the electronic devices which give alarms and the notifications which reminds the students about the classes that are scheduled or the lecture that an individual has to listen. This makes it convenient for the students to learn and do not skip any lectures in classes.

- **Overview of Relationship Between Internet of Things and E-learning**

E-learning is the electronic learning mode which has made the lives of students and teachers easier by making everything handy and quick. The e-learning was limited to the video lectures prior to the incorporation of Internet of Things (IoT). However, after the incorporation of Internet of Things, e-learning industry has progressed in an enormous manner. All these progressions are shown in the table below:

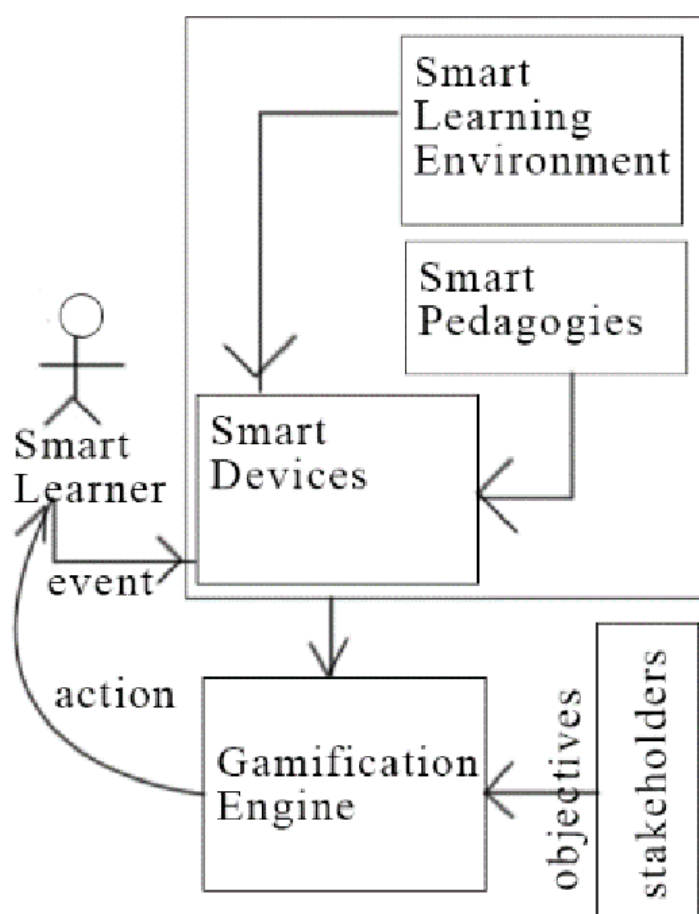
Table 1. Advancements of E Learning [2]

Several electronic products have made the e-learning easier and more innovative, such as the digital highlighters and digital smart boards. For example, Apple pencil and Scan marker. Scan marker is a digital marker that highlights the notes from the traditional books and transfer them into the electronic device.
Another Phenomenal invention in the world of Internet of Things is the RFID chip Which is used to track the physical objects, such as, plants, animals, books etc. So that the information about these objects can be gathered for the research purposes and study material.
Another popular Type of hero in the world of Internet of Things is the QR code They are used to scan the Quotes available in the books which students can transfer on the Internet devices To learn further information about them.

Devices in relationship to the Internet of Things are on their journey of enormous creativity and innovation, hence, it is recommended to every student to add Internet of Things in their lives to make their educational life effective and simple. All these innovations in Internet of Things are also helping the e-learning industry to progress on an enormous scale.

### Progress in the E learning Department

Several progresses have been made in the e-learning industry with various techniques and technologies. Firstly, the communication technologies such as Emails and SMS have been introduced to make e-learning easier for the students. Secondly, some softwares are developed for the teachers and students to communicate easily and to enhance the experience of e-learning, these include, backboards, LMS portal, CMS portal etc. These let teachers and students share assignments, quizzes, lecture notes and videos with each other. Thirdly, the database is also used frequently in the process of e-learning. Despite all of these techniques discussed in relationship to the e learning. The most appropriate and efficient way of e-learning is gamification. It is not the process of gaming but it is the process of implementing the gaming designs on the non-gaming applications to gather information and enhance the learning of the students. This technique makes it sufficient for the students to grasp knowledge. This technological innovation has made knowledge learning easier and efficient.



**Figure1** Platform of Internet of Thing [3].

E-learning also focuses on ICT infrastructure to provide higher education with efficiency and smartness. ICT helps in delivering the web based instructions (WBI) to the students and worked through the cloud networks of computer. There are several foundations and objectives of ICT in relationship to the e-learning which are as followed [4]:

- ICT consists of innovative pedagogical strategies that are needed for the engagement of society in e-learning.
- ICT helps instructors and teachers to build their knowledge, technological skills and expertise of pedagogical methods.
- It also has the power of digital automation and computation which helps in e-learning.
- ICT also provides a baseline for adjustment of digital technology and accuracy in the informational technology processes.
- ICT also offers knowledge in an interactive manner between the teachers and students.
- ICT acts as a catalyst for thematic integrative methodology in order to train and develop knowledge discovery habit within students.
- ICT in all works for the establishment of the schools, universities and other educational institutes that focus on high level of e-learning education system, so that the world gets used of the smarter education system.

**Table 2.** ICT infrastructure Development & Cloud Technology in E-Learning Education Sustainability [Field Survey, 2019]

<b>Federal Tertiary Institution</b>	<b>No. of Questionnaires Distributed</b>	<b>No. Questionnaires Retrieved</b>	<b>Percentage of Questionnaires Retrieved</b>
<b>UNN</b>	140	125	89.3%
<b>NAU</b>	122	105	86.1%
<b>FUTO</b>	123	100	81.3%
<b>NEKEDE</b>	115	90	78.3%
<b>TOTAL</b>	500	420	84%

### Smart Learning

The concept of smart learning is totally opposite of what conventional learning offers. Smart learning believes in the accessibility of educational resources at any place and at any time with just one click of the button. It has all become possible with the help of Internet of Things. Smart learning makes the learning experience more knowledge gaining and highly engaging which also improves the understanding of the students. Smart learning requires some devices, which are laptops, mobile phones, tablets, iPads etc. For software requirements, it requires the softwares of connections, such as, zoom, FaceTime, blackboard, and other analytical and visual tools [5].

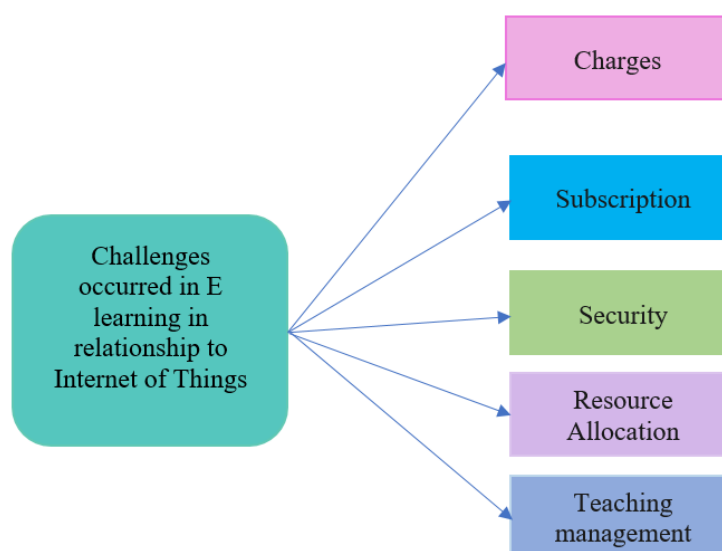
The whole world is occupied with the advancements and involvement of Internet of Things but it is predicted to be a beginning fog this tech savvy world. There is more that Internet of Things has to offer to this world. Internet of Things and cloud computing has brought world together and has reduced distances among the communicative services. There have been several technological developments brought by Internet of Things in terms of economic, social and political enhancements in today's world. To be specific, in educational sectors e-learning has brought dramatic change in making educational sector prosperous and further help the teachers to improve their teaching methods in relationship to the competitive world and new technologies. Along with benefits to the instructors, it also helps learners to gain analytical skill and instructors to have face detection feature to keep learners intact during the lectures. Higher education institutions suffer from the lack of connectivity, research gaps and lack of efficiency

due to the obsolete technology and lack of resources available in the institutions. Henceforth, the implementation of e-learning knowledge via Internet of Things has brought huge progress in the educational sector.

Internet of Things has affected learning outcomes and learning styles in some positive manners. There is a vital relationship between learning outcomes and learning styles with Internet of things. All of these are interconnected and are interdependent for the good quality of education. In order to improve the educational quality at higher education institutes, instructors are required to design the curriculum in accordance to the Internet of Things, so that the students are able to get hands on the teaching objectives in a handy manner. These learning styles can be incorporated and amended according to the requirements of the students so that, students are able to learn in their desired environment and grasp the concept in a better way.

### **Challenges occurred in E learning in relationship to Internet of Things**

Even after having enormous advancements and improvements of Internet of Things in the e-learning sector, it still faced some challenges to execute the system in e-learning sector. The first and foremost challenge that Internet of Things face is the charges of the cloud services as it being expensive is not possible for everyone to afford it. Secondly, the concern of security as Internet asks for the identification of the users so it is necessary for data to be confidential and encrypted to make sure that customers are satisfied with the usage and security. The third challenge that occurs is the challenge of competency. The technology related to Internet of Things keeps evolving so the frequent and regular amendments are required in order to compete with the innovative market of e-learning. Educational management strategies and allocation of resources also play a part in creating hurdles in the way of e-learning. As both these factors demand for the amalgamation of the stakeholders for the development activities. They are also considered as the requirement criteria of good strategies in terms of Internet of Things that teachers are able to provide the optimum amount of information to the students within the boundaries of these strategies. The combination of all these factors created hindrances for the e-learning industry in relationship with the Internet of Things.



**Figure2** Challenges for E-Learning Cloud [6].

The higher education enhances the phenomenal model for development and movement through a computerised/versatile model of progress. The scholarly examination local area has culminated a cycle that cultivates the creation and improvement of information, and that is compelling to such an extent that its fundamental qualities are normal to all disciplines. I think

any reasonable person would agree that all scholastic disciplines share a crucial arrangement of necessities for great and thorough exploration. The scholarly expert as analyst is [7]:

- High knowledge in specific areas.
- License to practice the E learning details.
- Working with the peers.
- Seek new and innovative insights.
- Peer review.

Late years have seen a sensational expansion in both the take-up of e advancing inside advanced education and investigation into its effect for foundations, specialists, and understudies [8]. Considering such a development of exploration, there are presently a few endeavours in progress to survey the current examination and feature regions deserving of future examination. In the UK this year, the Association for Learning Technology (ALT) have distributed their examination technique and the Joint Information Systems Committee (JISC) has been taken part in a conversation to decide research inquiries for future undertakings [9]. Beetham's survey distinguishes a wide scope of inquiries rising up out of past JISC subsidised projects, remembering a hole for the examination investigating the encounters of e-students [10].

## Conclusion

The deep roots of internet in education are further expected to be creating more and more changes in the sector. Internet of Things has proven to be an ultimate solution to the problems occurring in the educational institutes. For instance, it has helped in developing the softwares helpful for students, creating smarter learning plans, linking lectures to the internet connection. The Internet of Things has also worked to bring high values into the education system by providing engagement learning and educational advancements. This research was concluded by developing an insight for the challenges that the sector of e-learning has faced in relationship to the Internet of Things. The further studies required the deep analytics and evaluation of how to solve these problems and make internet of Things more efficient for e-learning industry.

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