Enhancing Teaching Learning Processes by using Internet of Things

Naeem Ullah

Department of Computer Science, University of Swabi, Pakistan.

Abstract: *The core objective of this paper is to present the concept of Internet of Things (IoT) in Information Technology and Communications (IT & C). The effect of Internet of Things has been revolutionary in all field of life and significant in education. New technologies in the context of education are used to improve the teaching learning processes. IoT is also one of those technologies which facilitate the educators to communicate with the learners through suitable IoT enabled applications. A study is conducted to introduce the capacity of IoT in teaching and learning process. Although IoT is becoming more popular in the context of education but still some clarification is required that how IoT can be used for education purposes. The focus of this paper is to investigate the recent applications of IoT in the field of education and to expose the benefits and accompanied issues of those applications.*

1.   Introduction

As now a days Internet is becoming ubiquitous, which affects the world and human life through any angle. Now, on the basis of Internet, a new era is in development phases where a range of appliances will be controlled through web. That era is called as "Internet of Things" (IoT). The concept of IoT was first introduced by Kevin Ashton in 1999. He made a research to capable the real-world objects communicating with each other through internet. As internet changed our lifestyle like that; the IoT will also take us to the new environment to make our life simpler and more comfortable [1].

 The term IoT is defined in different ways by different authors. Some most popular definitions are:

1) Internet of Things (IoT) is a network of things which are embedded with software,electronics, sensors and connected to the internet [2].
2) Internet of Things is a model in which networking and computing features are fixed in certain suitable objects [3].

It is the ability of objects residing around us to communicate with each other through internet. It experiencing the objects to make it able to communicate with computer or other objects. Objects which are making the IoT system are ranging from laptops, smart phone, smart watches, cars, refrigerators, vending machines and sensors connected to the internet to assist user [4].

This research paper is organized in such a way that Literature study is described next to the first part of the paper which is introduction. In applications of IoT in education section certain applications like Attendance Monitoring System, Wearable Technology, Personalisation through feedback, Smart Classrooms and Education through Gamification are briefly discussed. At the end of this paper some conclusion for the betterment and implementation of the IoT in education are proposed.

2. Literature Study

The progress in Information and Communication technology leads to an era where objects are interconnected, which is called as the Internet of Things (IoT).

The main feature of this technology to link every day objects with the internet which are inspiring the social & economic fields, as well as the environment monitoring, healthcare management, education system, smart cities and smart houses.

As every technology implies both positive and negative impact on environment, social and economical fields, IoT also does not indicates only positive aspects but some security issues are also created by a number of inter connected objects [5].

In education IoT systems are used in many areas of education like attendance management system, personalisation through learning analytics, environment monitoring, security and others [6].

The characteristics of IoT in teaching learning environment is motivational and allowing the teacher to teach according to student ability. A teacher choose suitable materials according to the student mentality and student can learn at their own way [7].

In the aspects of education; IoT technologies are influencing student engagement in learning and facilitating teachers to provide their own contents to improve students consequences.

There are seven innovative technologies and strategies which driving modernization in education. " visualization technology like Virtual reality, Audio & video aids, Social media technology, Consumer technology, Learning technology, Internet technology, Digital strategies and Enabling technologies".

IoT is subsection of Internet technology which asses the teaching learning process. The educational institutes collect a huge amount of data from IoT devices and perform significant analysis based on these data. IoT enabled systems facilitate both the students and teachers, as students can discover through sensor and QR codes and access study material regardless of place and time. A teacher can also use smartphone applications and other wearable gadgets to improve teaching process [8].

Internet of Things have no incorporated architectures like the internet which have a standard architecture. IoT architecture have other attributes like networking, coding, security and information services which make it more complex [9].

A simple IoT architecture in education is depicted in the below figure 01 [10].
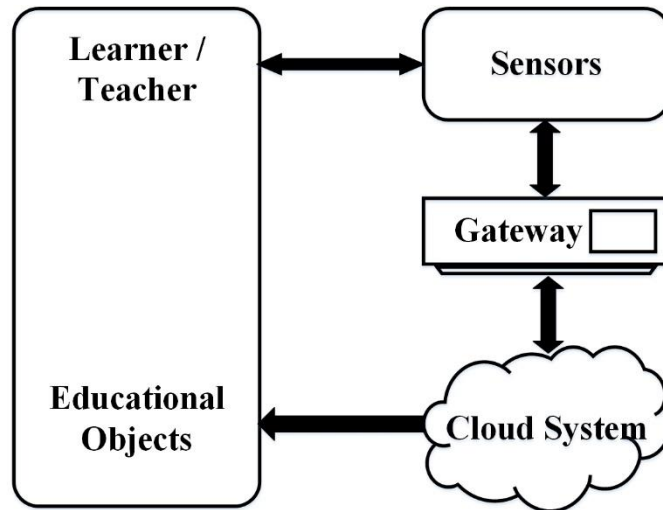

Figure 01. Simple Architecture of IoT in Education

The list of research papers which were selected and studied for the proposed research to enhance the Internet of Things in teaching learning processes are listed in the below table 01.

S.No	Ref#	Author	Year
1	[9]	Ning et al.	2012
2	[11]	Tianbo et al.	2012
3	[7]	Gómez et al.	2013
4	[2]	Charmonman et al.	2015
5	[12]	Hussein et al.	2015
6	[13]	Elyamany et al.	2015
7	[8]	Bagheri et al.	2016
8	[4]	Barakat et al.	2016
9	[14]	Marquez et al.	2016
10	[3]	Sethi et al.	2017
11	[15]	Aldowah et al.	2017
12	[10]	Bayani et al.	2017
13	[5]	Banica et al.	2017
14	[16]	Johri et al.	2017
15	[17]	AjazMoharkan et al.	2017
16	[18]	Attallah et al.	2018
17	[6]	Meacham et al.	2018
18	[1]	Nagakannan et al.	2018
19	[19]	Kumar et al.	2018

| 20 | [20] | Bakla, Arif et al. | 2019 |
| 21 | [21] | Abdel- Basset et al. | 2019 |

3. Applications of IoT in Education

Although IoT development is in initial stages but its applications are growing in many organizations like healthcare system, entertainment, energy conservation, education, social life, home automation, transport system and environment monitoring system.

There are several IoT applications in education like attendance management system, personalization through learning analysis, security, environment monitoring system etc.

- **Attendance Monitoring System**

In the field of education several IoT applications have been implemented, Attendance Monitoring System is one of those applications. This application uses RFID tags to monitor student attendance. As a student enters to the classroom, their attendance could be automatically logged by using IoT devices like smart band which uses the ECG pattern of the user to authenticate their identity [6].

- **Wearable Technology**

Wearable technology can be defined as those digital wearable gadgets which are remotely connected to provide and exchange seamless information. Wearable devices are hands-free technology which facilitate students and other users to free-up their hands to interact with the real-world environment. The wearable device which are beneficial in teaching learning are: Muse headband, Virtual Reality (VR) and Google Glass.

Muse headband is a wearable technology which sense and measure brain activities through electroencephalography (EEG) sensors and sends the produced data to smartphone through wireless connectivity. It facilitates an educator to monitor that how the students are engaged and focused on study.

One of the most popular Virtual Reality (VR) system is Oculus Rift, which fully engulf a user. The impact of VR in the field of teaching learning processes is significant. It allows a user to experience learning without risk. It takes a user to the places which are difficult to access in real life. Medical education, space studies, archaeology courses are more difficult in real time but VR made it easy to learn.

"Google Glass" an important gadget used for teaching learning process which enables students to remotely listen and watch a lecture without physical presence. It also facilitates medical students to watch a surgery process. It has the functionality of receiving notifications and alerts related to their studies [18].

- **Personalisation through feedback**

Personalization through feedback is an IoT characteristic which involve mobile technology to acquire real-time feedback. A mobile application "*Socrative*" is used to receive real-time feedback from a huge number of students [6].

- **Smart Classrooms**

An application of IoT in teaching learning environment is the Smart classroom System. These are technology enhanced environment equipped with specialized softwares, computers, audience response technology and Audio/Visual capablities. Such systems also determine if the available environment is conducive for learning and monitor some parameters like temperature, oxygen, CO_2 level in air, odour, noise and other eco-friendly conditions [6].

- **Education through Gamification**

As Gamification engage a user while getting entertainment and increase their concentration towards the game. A player can also experience learning while playing which is a better learning exercise. Gamification motivates the user to play more and more which makes a user addictive! Applying gamification techniques to the Internet of Things will make the

education system smart. A smart education system has three important fundaments which are: Smart Learners, Smart Pedagogies and Smart Learning Environments [17].
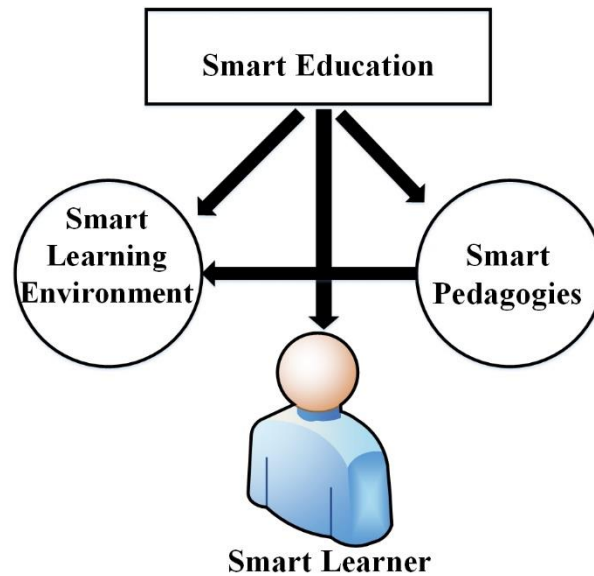

Figure 2. Smart Education System

4.   Conclusion

The main purpose of this article is to investigate that how the internet of things is benificial in the education environment. This research focused to introduce those IoT applications which are facilitating students, teachers and also generating benefits for the educational organization.

Like other technologies, the application of IoT in education has several advantages but some limitations may be also accompanied. The concept of IoT has the capability to eliminate the obstacles faced in the field of education. The use of technology in education leads to a simple way of learning, improves quality of knowledge and indirectly the excellence of students as well.
Although the revolution predicted by IoT, the educational sectors are still not ready to accept such changes and implement IoT technology. The teachers should use the modern technologies, communication methods and implement them in the existing work. It seems that soon IoT will replace the existing traditional system.

5.   Acknowledgement

References

[1]   M. Nagakannan, C. J. Inbaraj, K. M. Kannan, and S. Ramkumar, "A RECENT REVIEW ON IOT BASED TECHNIQUES AND APPLICATIONS," in *2018 2nd*

International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC), 2018 2nd International Conference on, 2018, pp. 70-75.

[2] S. Charmonman, P. Mongkhonvanit, V. N. Dieu, and N. Linden, "Applications of internet of things in e-learning," *International Journal of the Computer, the Internet and Management,* vol. 23, pp. 1-4, 2015.

[3] P. Sethi and S. R. Sarangi, "Internet of things: architectures, protocols, and applications," *Journal of Electrical and Computer Engineering,* vol. 2017, 2017.

[4] S. Barakat, "Education and the Internet of Everything," *International Business Management,* vol. 10, pp. 4301-4303, 2016.

[5] L. Banica, E. Burtescu, and F. Enescu, "The impact of internet-of-things in higher education," *Scientific Bulletin-Economic Sciences,* vol. 16, pp. 53-59, 2017.

[6] S. Meacham, A. Stefanidis, L. Gritt, and K. T. Phalp, "Internet of Things for Education: Facilitating Personalised Education from a University's Perspective," 2018.

[7] J. Gómez, J. F. Huete, O. Hoyos, L. Perez, and D. Grigori, "Interaction system based on internet of things as support for education," *Procedia Computer Science,* vol. 21, pp. 132-139, 2013.

[8] M. Bagheri and S. H. Movahed, "The effect of the Internet of Things (IoT) on education business model," in *2016 12th International Conference on Signal-Image Technology & Internet-Based Systems (SITIS)*, 2016, pp. 435-441.

[9] H. Ning and S. Hu, "Technology classification, industry, and education for Future Internet of Things," *International Journal of Communication Systems,* vol. 25, pp. 1230-1241, 2012.

[10] M. Bayani, K. Leiton, and M. Loaiza, "Internet of things (IoT) advantages on E-learning in the smart cities," *Int. J. of Development Research,* vol. 7, pp. 17747-17753, 2017.

[11] Z. Tianbo, "The internet of things promoting higher education revolution," in *2012 Fourth International Conference on Multimedia Information Networking and Security*, 2012, pp. 790-793.

[12] M. Hussein and C. Nätterdal, "The benefits of virtual reality in education-A comparision Study," 2015.

[13] H. F. Elyamany and A. H. AlKhairi, "IoT-academia architecture: A profound approach," in *2015 IEEE/ACIS 16th International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD)*, 2015, pp. 1-5.

[14] J. Marquez, J. Villanueva, Z. Solarte, and A. Garcia, "IoT in education: Integration of objects with virtual academic communities," in *New Advances in Information Systems and Technologies*, ed: Springer, 2016, pp. 201-212.

[15] H. Aldowah, S. U. Rehman, S. Ghazal, and I. N. Umar, "Internet of Things in higher education: a study on future learning," in *Journal of Physics: Conference Series*, 2017, p. 012017.

[16] P. Johri and A. Misra, "Digital technology in classroom: Changing the face of education infographic," in *2017 International Conference On Smart Technologies For Smart Nation (SmartTechCon)*, 2017, pp. 405-406.

[17] Z. AjazMoharkan, T. Choudhury, S. C. Gupta, and G. Raj, "Internet of Things and its applications in E-learning," in *2017 3rd International Conference on Computational Intelligence & Communication Technology (CICT)*, 2017, pp. 1-5.

[18]   B. Attallah and Z. Ilagure, "Wearable technology: Facilitating or complexing education," *International Journal of Information and Education Technology,* vol. 8, pp. 433-436, 2018.

[19]   N. M. Kumar, P. R. Krishna, P. K. Pagadala, and N. S. Kumar, "Use of Smart Glasses in Education-A Study," in *2018 2nd International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC), 2018 2nd International Conference on*, 2018, pp. 56-59.

[20]   A. Bakla, "A CRITICAL OVERVIEW OF INTERNET OF THINGS IN EDUCATION," *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi,* pp. 302-327, 2019.

[21]   M. Abdel- Basset, G. Manogaran, M. Mohamed, and E. Rushdy, "Internet of things in smart education environment: Supportive framework in the decision- making process," *Concurrency and Computation: Practice and Experience,* vol. 31, p. e4515, 2019.