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IOT in Advanced Education

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Abstract - Technology will influence the learning experience in many ways in the coming years. In the context of Information and Communication Technologies and the development of society, Internet of Things (IoT) sanction its important position. With the help of IoT, institutions can improve their learning outcomes by providing more comfortable learning experiences, improved operational efficiency, and by gaining real-time, actionable insight into student performance. The purpose of this study is to find out the potential of IoT in advanced education and how to maximize its benefits and reducing the risks involved with it. For releasing the full potential of IoT systems and technologies, more efforts are again necessary. Therefore, this paper presents a study about the influence of IoT on advanced education especially universities. IoT stands to change intensely the way universities work, and develop student learning in many disciplines. It has massive potential for universities or any other education all institutions; if well prepared to ensure widespread and success full implementation by leadership, staff, and students. IoT needs development where universities can lead. Researchers, academics and students are in a unique place to lead the development of IoT systems, applications, devices and services. Moreover, this paper provides an evidences about the future of IoT in the advanced education during the next few years, which have offered by a number of research organizations and enterprises. On the other hand, in advanced education, IoT also brings fabulous challenges. Hence, this paper presents the perception on the challenges of IoT in advanced education.

Index Terms - Internet of Things; education; smart gadgets, e-books.

I. Introduction

Internet of Things (IoT) is the change process in various parts of our day by day life. IoT technologies vary from past developments as they are universal, and encourage solutions to be intelligent and autonomous. Advances in the IoT area significant key innovation pattern. Universal sensors and the capacity to overcome any barrier between the actual world and the machine world were seen as the reasonable structure for the new learning model. The speculation behind this extraordinary change in outlook is the capacity to install sensors into any article and use Machine-to-Machine (M2M) correspondence to associate billions of gadgets to the current Internet foundation. The entirety of the physical world is coming online quickly. IoT is growing rapidly and turning into an increasingly growing topic that creates excitement and anxiety throughout the world. There are a lot of signs showing that the IoT will to change numerous areas, including advanced education organizations, particularly universities. Now, universities has a chance to lead the technical development and the developments models for the IoT, and to build the leaders of the IoT into the future, as well as to address the TIPPSS potentials for success which stands for Trust, Identity, Privacy, Protection, Safety, and Security related to the IoT.

The IoT is a worldwide physical network which connects gadgets, articles and things to the Internet framework to convey or connect with the inner and the outside environment as illustrated in Figure 1, and for the purpose of exchanging information through the information sensing devices according to specific protocols. Hence, IoT is empowering connectivity for anything and for anyone to be networked around the world anytime, and anywhere using any network or any

service to achieve the goal of intelligent identifying, tracking, and managing things. It is an augmentation and development of Internet-based network, which grows the communication between human to human(H2H), human to things(H2T) or things to things (T2T).

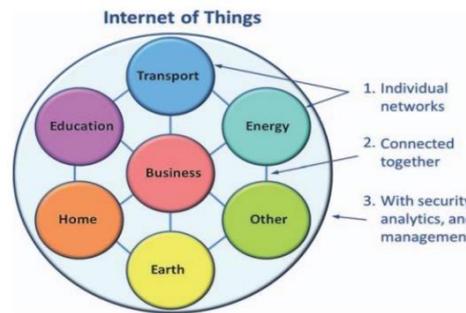


Figure 1. IoT view edasa global network.

The four pillars IoE network connection in higher education are - People, Process, Data, and Internet of Things (IoT)

IoE in higher education is in the incipient stages, but some institutions are leading the way in showing how IoE can be used effectively to transform pedagogy Fig.2 presents the four pillar structure of IoE and their impact on higher education and how some of the practices currently being planned or adopted need support, build and scale up.

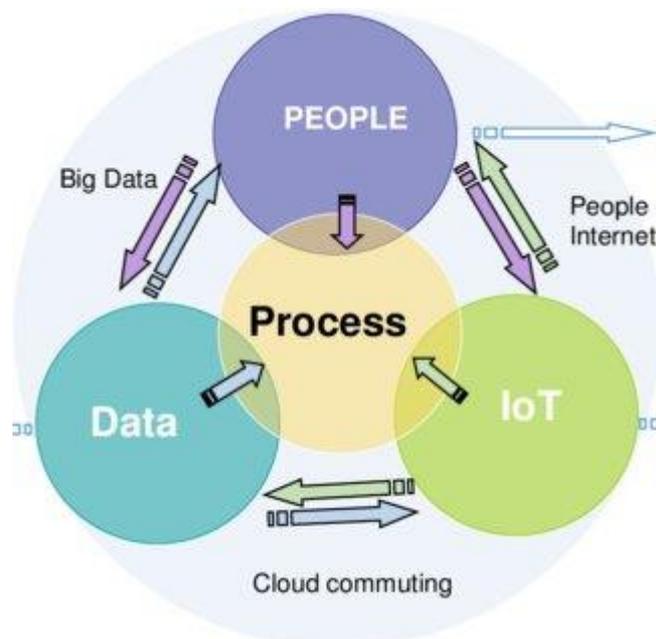


Figure 2: Four pillar network connection of Internet of Everything (IoE) in higher education system, Person to Person (P2P), Person to Machine (P2M) and machine to Machine (M2M).

A number of research organizations and experts have anticipated about the future of IoT and its possible effect on the Internet: billions of physical gadgets, all over the world, that have computerized sensors and are interrelated by utilizing any network. According to the research conducted by Juniper an estimated 13.4 billion gadgets were associated in 2015, which represent more than the total of population on the earth at the time, and this number is required to considerably increase to 38.5 billion gadgets by 2020. The opportunity of interacting with lots of regular articles connected to the Internet allows individual to access limitless data anytime and anywhere. This vision opens another skyline of thoughts and improvements that is as of now being considered by research scholars and academics.

The IoT vision is grounded in the conviction that the firmly fixed advances in microelectronics, communications and information technology we have witnessed in current years will suffer into the predictable future. Applications for the IoT are already being utilized in areas like medical care and client support. Now, universities and schools are joining the party. Some of the ways the IoT can benefit education may be obvious, while others are not as obvious. So this paper will present the greatest ramifications for associated gadgets in advanced education and how they could shape the learning for the future.

The future of universities is about how universities will adjust to the changing necessities of things to come information laborer, the future of work, and the economy. This paper presents an outline of IoT in advanced education organizations,

particularly in universities and takes a look at several emerging trends that are developing advanced education, and investigate the expected effect of IoT and the future of the IoT in advanced education. In addition, exploring one of IoT challenges regarding higher education sector.

II. Basic Components of IOT

The IoT is enabling innovation scientists to develop smaller and more affordable remote frameworks that consume less power and can be integrated into practically any kind of gadget [9]. There are three IoT parts which empower consistent connections which are: Hardware: made up of sensors, actuators and embedded communication hardware, Middleware: on request stockpiling and processing instruments for data analytics, and Presentation: novel easy to understand visualization and interpretation tools which can be broadly accessed on various platforms and which can be designed for various applications [10]. There are various expected methodologies for acquainting low-power communications to an IoT node, ranging from purpose-designed protocols like ZigBee to low-control variations of Bluetooth, Wi-Fi and NFC. In spite of the fact that Wi-Fi is the most well known type of integrated wireless technology and the best power-per-bit transmission efficiency, IoT improves different configurations including Radio Frequency Identification (RFID) innovation which is utilized all through business, industry and individual innovation frameworks and empowers plan of micro processors for wireless data communication [10]. A portion of this innovation can add wireless sensor capabilities (WSN) to any type of gadget, like Fit Bit wearable fitness trackers and books.

2.1 Concept of Digital Campus

Advanced Campus System is a significant stage for students to get all kinds of information. New technologies are also influencing different spaces of campus administration. There is an expanding interest for advanced education organizations, particularly, universities to digitize their substance and exercises, and adjust their strategies to permit scholastic and scientists to work effectually in a computerized environment. A well designed physical campus, completely integrating technology, is principal for building the brand of computerized university by improving the student experience, and providing the appropriate settings and facilities for educating, learning and exploration. It advances, supports and encourages lifelong learning. A digital university must have the innovation that empowered educating and learning, and enable shared exploration. All contemporary computerized dangers can be faced by universities if they contend, however few have the vision, adaptability, platforms, or appropriate leadership, set up the systems to guarantee that they can develop, or respond to commercial center conditions.

Within a computerized campus, technology can reduce operational expenses, improve security, and offer instruments for scientists, academics, students and staff. These advantages offer genuine benefit to university activities and improvements, the experience of students, and analysts. The digital campus comprises two main components. Firstly, it reuses the IT Service Delivery Platform—end-to-end framework to give network availability, portability and security for all applications and administrations across the campus. Secondly, it includes a large number of Internet of Things (IoT) applications operating over the platform system to support the professional of the university, empower educating and learning exercises, and improve student's experience. According to Cisco- "Digitizing Higher Education To enhance experiences and improve outcomes"- IoT applications vary from traditional network applications as they support sensors and sensor data, rather than clients and client data. IoT applications for the digital campus include five main classifications: Building Control and Management; Security and Access Control; Video and Information Systems; Location and Attendance Systems; Energy Monitoring and Control. as shown in Figure 3: The wireless network has a fundamental task to carry out within the digital campus, thus must be designed to meet the high demands of a modern university.

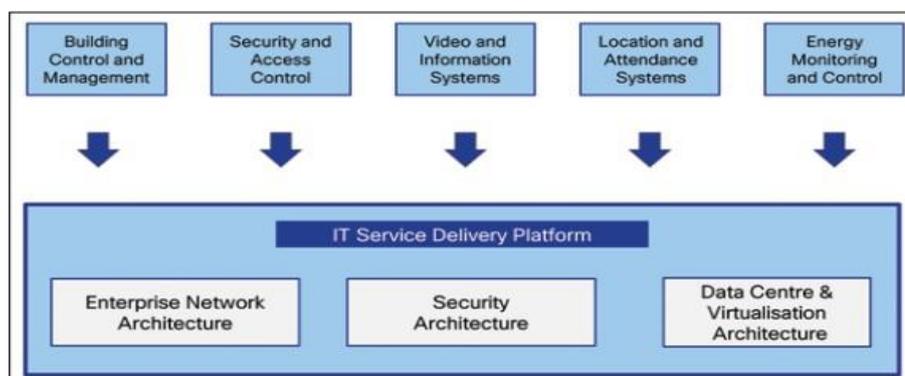


Figure 3: IoT Applications for the Digital Campus

Source: Cisco-Digitizing Higher Education To enhance experiences and improve outcomes.

The main role of the wireless network is to play within the digital campus, thus must be designed to meet the high demands of a modern university.

In addition, IoT change and change the educating and learning in the campus, for example, the IoT in the preparation of a similar sight, making the teaching space, training venues, sports venues, learning dormitories, restaurants and students across the campus of IoT, making the campus to train students anytime and anywhere, can become a physical, mental, and skills place to gain a full scope of learning and training. This will lead colleges to become omnipresent learning and training.

III. Impact of Internet of Things in Advance Education

The IoT will influence all aspects of society eventually soon. Advanced education foundations as a rule, and universities in particular, can work across disciplines and lead the advancement of the IoT innovations, plans of action, morals, and heads of the IoT empowered economy of the future the IoT innovations, plans of action, morals, and heads of the IoT empowered economy of things to come. For example, university teacher of computer science and engineering are directing IoT labs for the development of IoT technologies. In addition, Informatics College can instruct how to use the spans of IoT data, with TIPPSS. Also, they can work with business colleges to set and design IoT courses to create new business models. Medical colleges can empower the Internet of Medical Things also as, Law colleges can teach IoT morals, security, and strategy. According to Zebra technologies, as advanced education organizations initiate to create and use arrangements, for example, radio recurrence recognizable proof (RFID) and cloud computing through IoT technologies, they will be able to analyse and manage Big Data.

The IoT is not just an innovation update and advancement inside the business, yet can prompt grow the change to the entire society including advanced education establishments. IoT will lead the change and reform the advanced education institutions. IoT will lead to changes in educational technology, reform the education, change in teaching, change in learning, management of change, experimental and practical changes, changes in campus, teaching resources changes and others.

With the improvement of IoT, the prospective application in advanced education lies in the three aspects: students' progressive evaluation, integration of current teaching platforms and development of educational middleware. This change gives expanded convenience for students, and makes the teaching process more effective for instructors and professors. The flow in connected gadgets and innovation that instructors and professors can focus on the actual learning that is more useful to the students rather than perform the routine task.

In addition, IoT has the ability to expand the learning experience by providing for real-time and significant bits of knowledge into student performance. Nowadays, students particularly in university are slowly moving away from textbooks to new technologies such as tablets and laptops. The advanced e-learning applications permit students to learn at their own pace and have an identical learning experience in classrooms and homes, which increases progression and satisfaction rates as well as instructors can deliver one-to-one instruction and persistent student assessments. Moreover, through IoT technology, professors can gather information about students' performance and then determine which ones need more care and attention. This information examination additionally assists instructors accurately change plans and methods for future classes. Additionally, connected devices can allow instructors with changing plans and techniques for future classes. Interventions as well as logging attendance will be simplified if students have a wearable gadget that tracks ECG patterns. Furthermore, these gadgets can redirect a student's attention by giving a warm up activity and exercise to do on their own gadgets. Also, EEG sensors can be used during courses to monitor students' cognitive activities.

This vision and understanding give partners with a perspective of students, association, and monetary resources. This resource intelligence empowers association to settle on educated choices to upgrade student knowledge and learning experiences, operational capability, and the security of campus. According to Zebra technologies (2015), by upgrading resource knowledge, instructive foundations can upgrade results by adding values in certain spaces include: Enhanced Learning Experiences and Outcomes, Improved Operational Efficiency, Safer Campus Designs. Also, outside of the classroom, universities can utilize associated gadgets to monitor their students, staff, resources and equipment at a reduced working expense. Furthermore, the development of mobile technology and the IoT empower universities to improve the security of campuses, upgrade admittance to data and applications at whenever from any place, and monitor. IoT is changing the student learning experience besides facilities management by connecting individual, data and things.

IV. Future of IoT in Advance Education

Universities have long realized the capacity of technology to disrupt teaching, learning, and evaluation. Moreover, technology disruption is basic if a modern university is to recognize its student offer, so increasing admissions, improving maintenance, and conveying wanted results. However, planning students to be sure for the universe of work is complex. It requires strong academic leadership, access to an excellent curriculum and content, and the exposure of students to the effective use of new technology. With the advancement of IoT, numerous establishment of advanced education have begun to focus on the related technology and application of the IoT [9]. This attempt is also utilized in college. The Internet has profoundly established itself into schools and colleges, and e-learning has become basic practice in many universities systems. Despite the fact that it's anything but a conspicuous utilization of the IoT, however, education is on that list [10] and the uses of the IoT in universities are various, and the implications for this are massive. IoT will take into account better operational proficiency in all learning environments. IoT can support classroom instruction by improving learning setting, enhance learning resources, improve methods and techniques of learning, raise management efficiency, and save management costs. The resources available for learning on gadgets, similar e-books are more engaging and interactive. However, there is consistent requirement for new innovations for learning process, for example, high-speed wireless networks with the bandwidth for streaming audio and video lessons.

According to the Citrix 2020 Technology Landscape Report (2015), in the next five years, IoT technology will upgrade the learning experience in an unexpected way. Learning experience will keep on getting more virtual, students will consume information and learning in new ways, and classrooms will be better prepared for learning. Eventually, learning will turn into an astonishing encounter for teachers and students with information speeding up while bringing new thoughts and solutions around the world. As well, students are ready for the future of work and assumptions at the working environment of the future.

Technology will consistently have a place in all educational disciplines. IoT additionally has numerous chances for Science, Technology, Engineering, and Mathematics (STEM) disciplines, such as computer programming and physical computing. It is not difficult to anticipate how IoT abilities can be utilized in STEM disciplines, robotics, and anything having to do with gathering explicit information. It is all in the capability of the IoT. However, ultimately the educationists need to be able to identify the correct innovation and incorporate it appropriately in the classroom for learning to evolve. Although principle IoT advancements are so far not clear, the point certainly is that a lot of contents are the result of new development phase. Considering the demand of more professional research, setting the IoT major is relative easy and applicable for graduate students. However, for undergraduate students, they actually need a wide scope of essential courses, so it is difficult to set IoT major autonomously like different majors as of now. New training techniques will be investigated for undergraduate students. Different colleges need to investigate the proper methodology as indicated by their own qualities. The system approach and courses content need to be progressively established and improved. Since IoT is accomplishing the unity of the virtual world and the actual world, numerous new training methods and cross-cutting regions will be produced later on.

Moreover, the future IoT economy can be formed by specialists and leaders in advanced education area and by educating the students. The advancement inside advanced education frameworks will visualize, improve, and lead the new innovation developments. Therefore, advanced education area must work with business and industrial sectors to shape and assemble the future of an IoT-enabled economy. Moreover, advanced education area, particularly universities, have the chance to lead the future of IoT technologies by planning courses for specialized and business leaders and by facilitating students and researchers work to build new business strategies that influence IoT innovations in a multidisciplinary way.

In 2016, a workshop conducted by IEEE, National Science Foundation (NSF), and Internet2, entitled "End to End Trust and Security for the Internet of Things", and followed by an IEEE Experts in Technology and Policy Forum, the specialists and members affirmed that the IoT needs advancement and improvement which the IoT needs innovation and development which researchers, professors, academics, and students in universities and advanced education area are in a unique place to lead the development and improvement of IoT gadgets, systems, applications, and services. Also, they emphasized that new platforms thoughts across disciplines should be created and found to take care of numerous issues and issues that we are confronting these days. In addition, IoT and data analytics tools can be utilized to create and improve to develop and improve effectiveness and competences on campus and across societies, to improve information capture, to address security and privacy issues, to minimize the energy use, and to analyze data and provide actionable insights and understanding to develop and enhance health sector. To build this system sight, working across skillsets and disciplines are required. Furthermore, academics and research scholars can build end-to-end TIPPSS solutions for the IoT as well as they can build IoT gadgets, and administrations with a "defense in depth" strategy, adding in security at the equipment, programming, firmware, and administration levels.

V. Benefits of IoT in Education

The implementation of technology gives education professionals new tools to optimize classwork, improve the efficiency of the training process, connect with students better, and ensure on-site safety. Here are welfare of putting sake of Things and education into a unified framework:

5.1. Improved school management efficiency - Managing an education institution requires filling during a lot of paperwork, keeping track of supply management, and distributing funds properly. IoT solutions lay the groundwork for faster, risk-free, and interconnected decision-making framework where all the stakeholders (teachers, students, parents, public officials) are engaged in improving the state of the facility.

5.2. Real-time data collection - IoT allows processing terabytes of knowledge simultaneously, opening tons of applications for schools and colleges — safety tracking, student progress monitoring, overseeing the professional training of teaching specialists, and many more. Ministries and principals could use real-time data to enhance the efficiency of testing and grading or when trying to find new ways to enhance classroom engagement.

5.3. Improved resource management IoT - Education helps establishments run more efficiently, reducing operating and storage costs within the end of the day. Additionally, facility managers can employ connected IoT devices for education to make sure energy or water consumption efficiency.

5.4. Global interconnectedness - The global nature of IoT helps education professionals create uniform teaching standards and ensure equally efficient school and college training worldwide. The Internet of Things can support global peer-to-peer professional training tools, where educators everywhere the planet can exchange tips and best practices. Students, on the opposite hand, are going to be ready to share learning materials internationally, improving the accessibility of education everywhere the planet.

5.5. Addressed safety concerns - The Internet of Things has an array of security applications schools, colleges, and pre-schools may benefit. Among them are on-demand video-monitoring tools, student escort drones, smoke and vaping

sensors, etc. These platforms bring parents and students more confidence within the safety of their learning environment, help promote positive habits and make it easier for facility managers to stay the institution in order.

VI. Challenges of IoT in Higher Education

IoT carries enormous difficulties and opportunities to advanced education. The unique growth of ubiquitous computing, developing IoT technologies for example, cloud computing, and big data and analytics are useful not just in improving the fundamental beliefs of teaching and quality of research but also developing an IoT society and encouraging a new digital culture. With expanding the online degree openings and consistent access to instructional content in both structured and unstructured formats, the IoT leads digital momentum into advanced education institutions. IoT is a dramatic change in the conventional educational paradigm while integrating broader disciplines, including social science, to enrich the value of huge information accessible from social media. Some of the IoT challenges in advanced education area include:

6.1 Cloud Computing

Many universities are using hybrid cloud as their enterprise architecture for hosting IoT applications. The combination of millennials, the most tech-savvy students in the universities, as well as the rise of tablet and mobile technology, has opened new methods to increase the effectiveness of enterprise architecture, instructional technologies, research and learning environments. With ubiquitous computing, the cloud provides seamless connections and services to information technology services. Presently, enterprise architecture in many higher education institutions depends on hybrid cloud infrastructures with computing platform on private clouds, while enterprise and instructional applications gradually move to public clouds. Enterprise architecture in these institutions need reduce latency time due to the demand for content in instructional technologies, the large increase in audio and videos for instructions, and the need for active enterprise networks.

6.2 Instructional Technologies

The growing use of learning management systems LMS like Moodle and Blackboard is creating massive amount of structured and unstructured data such as audio and video content. Sophisticated electronic classrooms equipped with lecture capture systems and web streaming provide an opportunity for students to access instructional contents on demand at anytime [9].

6.3 Mobile Applications

IoT applications are by and large progressively used to incorporate portable learning applications and for evaluation and reviewing frameworks. The ideal application can help understudies to profit by learning assets, oversee tasks, and work on errands. Educators additionally utilize a portion of these applications to show profoundly specific ideas, complex physical, logical reproductions, and social subjects.

6.4 Security and Privacy Concerns

Collecting and processing various sorts of digital data will put educational institutions on the map for hacking threats. Before deploying an IoT solution, project stakeholders got to build a contingency plan for data breaches, security attacks, and other threats. Increasing awareness regarding the importance of data security among students is an essential part of the innovation implementation process will be required to develop solutions in effective and appropriate way to face IoT security challenges. Furthermore, the complete potential of the IoT depends on strategies that consider people's privacy. Therefore, to satisfy these opportunities, there is need to develop new strategies that consider an individual's privacy choices and expectations, whilst still promote innovation in new technologies and services [8].

6.5 Quality and Ethics

The quality of learning both online and on campus and the rising cost of advanced education has been intensely debated in latest years. The IoT offers unique opportunities to deliver digital courses. However, it also introduces challenges to maintain the quality of instruction and evaluation of students' work. IoT educational applications need tools and technologies for instructors, professors and the scientific community to improve the quality of research and address ethics issues within higher education.

6.6 High Implementation Cost

The cost of information technologies keeps on expanding each year as content and an application. These applications tacks keep on becoming both on a level plane and in an upward direction on instructional technologies, research computing and enterprise technologies. Alongside the knowledge technology and laboratory fees, most universities don't have a technique for sharing costs and identifying the total cost of ownership for an IoT infrastructure. Advanced education should think with new plans to fund an information technology infrastructure and services.

VII. CONCLUSION

With the progression in technology for example Internet of Things, universities can resolve numerous difficulties, for example, monitoring fundamental assets, develop access to information, assemble more astute plans, and plan more secure campuses. IoT systems have tremendous potential to bring significant values to advanced education by engaging and motivating the students and staff, and to increase speed of learning. The motivation behind this examination was to discover the capability of IoT in advanced education and how to expand its advantages while tending to its difficulties and decreasing the risks involved with it. Therefore, our future work will be to focus on IoT implementation in advanced education.

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