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Internet of Things (IoT) in Education: A Review

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ABSTRACT: The Internet of Things (IoT) has become one of the most significant technologies in this innovating world. Education is the part which leads to actual development of the nation. IoT based Smart computers, Sensors and many such paraphernalia help in developing the educational arena for better education to the generation. The IoT system benefits in Evolving Methodologies, Automated Attendance Recording, Safety in premises, Distance learning and administrators can monitor and manage facilities like classrooms, laboratories more efficiently. Thus, IoT in education is a key to abundant progress in every field of success. This paper stretches on IoT applications in modern education system.

KEYWORDS: IoT, Education, Technology

I. INTRODUCTION

The Internet of Things (IoT) is an emerging paradigm that enables the communication between electronic devices and sensors through the internet in order to facilitate our lives. IoT use smart devices and internet to provide innovative solutions to various challenges and issues related to various business, governmental and public/private industries across the world [1] A great transformation can be observed in our daily routine life along with the increasing involvement of IoT devices and technology. One such development of IoT is the concept of Smart Home Systems (SHS) and appliances that consist of internet based devices, automation system for homes and reliable energy management system [2]. The Internet of Things (IoT) is gradually but surely trespassing on many sides of peoples everyday lives. Kelvin Ashton first used the phrase “The Internet of Things (IoT)” in 1999. The term has, however, including services, medical care, transportation, etc. [3] The Internet of Things put classrooms and campus devices on the local area network (LAN). This connectivity brings teachers and students closer by sharing the infrastructure and data in a smart way [4]. Information and Communication Technology (ICT) is regarded as the best technology used for handling information, including multimedia, the internet, and devices such as video, cameras and mobile telephones, with the use of personal computer (PC) or laptop, Smart phones, when attached to the internet can provide access to large quantity of information [5]. A student can have great freedom to pick up his or her subjects or documents. This could be used by a biometric attendance program to track student attendance. It could later be linked to scholarships, mobile phones for parents, etc. Student wellbeing and hostel inmates may be tracked via the adoption of fitness apps. Automatic monitoring of temperatures may be done in laboratories and laboratory equipment. You could do interactive projectors, touchscreens, automatic reading capture [6] Industry leaders such as: Cisco, Microsoft and many others have already added IoT, Cloud Computing & Virtualization in their current academic curricula to train the future engineers and IT experts. Educational institutes on the other hand not only teach computer science concepts but also encourage critical thinking and innovation. The June 2017 issue of Computing Now from IEEE Computer Society [7] elaborates how technology can be effectively utilized by teachers in the IoT era.

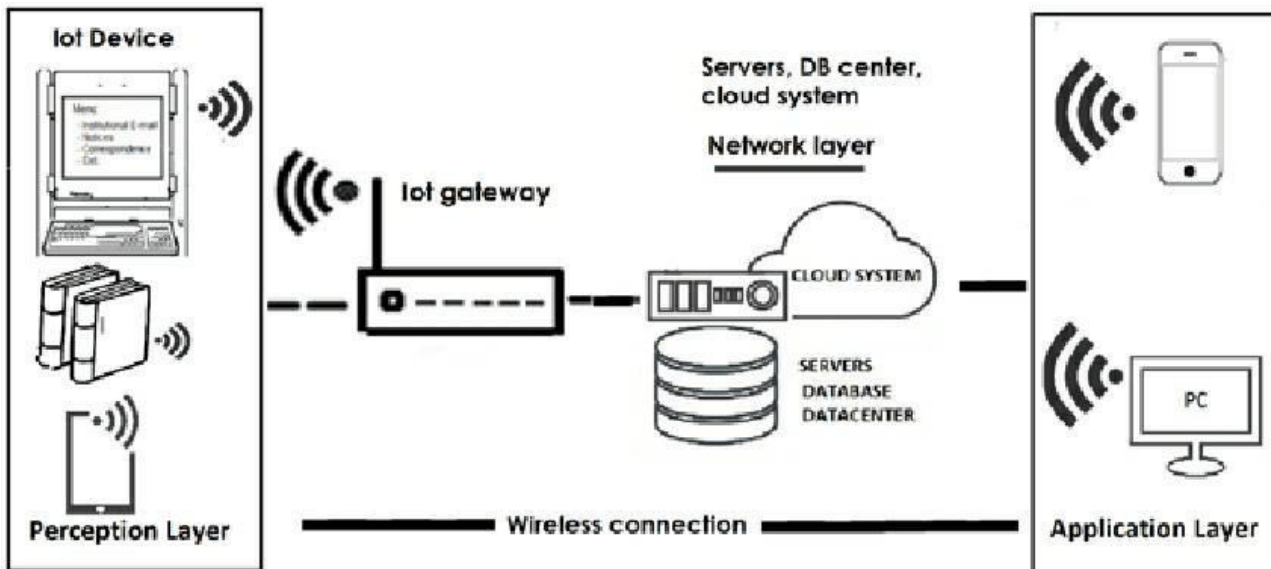


Fig.1- Basic Architecture of IoT in Education [8]

II. EDUCATIONAL TOOL FOR IOT

The purpose of this study was to develop a hardware board that enables learners to overcome the difficulties of IoT programming and to implement an IoT system quickly. The three most widely used tools for IoT education for learners are Arduino, Raspberry Pi and Micro:bit. First, Arduino is a popular microcontroller-based prototype platform [9]. The Arduino board provides a library that makes it possible for learners to write programs without needing in depth knowledge of electronic parts and electric circuits. Second, Raspberry Pi is a single-board computer developed for education. It is a palmsized computer board in which either the Linux or Windows operating system can be installed [10]. Third, Micro:bit is the hardware for physical computing education that was developed by the BBC (the public broadcasting corporation of the UK) [11]. Kits are designed by interviewing teachers and students from different schools for their choice of kits given the list of kits. Preliminary projects are designed to learn the basic function of IoT devices. Some of such projects are: [12] a) Led Blinking

- b) Dimming LEDs
- c) Temperature and humidity reading
- d) Activating/Deactivating relay switches

III. IOT FOR STUDENTS

1. Smart Classrooms - This is a place of learning and teaching. It's the place of overall educational activities. Here the learning, teaching, assessment happens very differently and effectively. Usually, smart classrooms consist of the e-gadgets, such as a digital screen, projector, Internet-enabled devices [13].
2. Distance Learning - Distance learning has emerged as a solution in the pandemic era, when contact learning was impossible. Distance learning or online learning can be enhanced effectively by IoT [14]. IoT tools can benefit distance learning and help in uplifting student performance and efficiency by up to 20 percent, as reported in [15]. IoT sensors measured the brain activity during learning sessions and recorded the feedback. In this research [15], IoT sensors measured level of tiredness and keep brain active by sending signals.

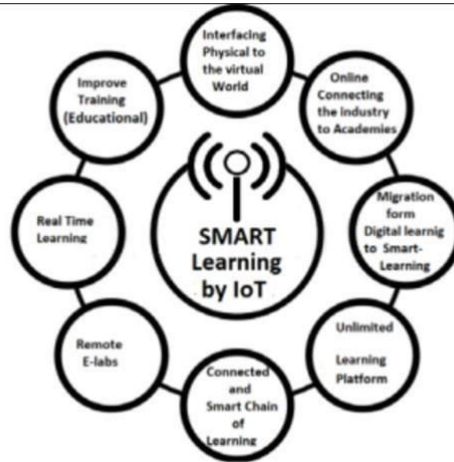


Fig.2- Smart Learning by IoT [22]

- Enhanced Productivity and Interaction – Smartphone based online classes, virtual classes, or e-classes develop more interactivity in students. This interaction-based learning develops students’ interest in being involved in different tasks and participating actively in the feedback and assessment processes. Therefore, IoT-based learning environments enhance students productivity and interaction. For example, e-books with barcodes help students to read in an interactive environment. Scan maker is an IoT device which can quickly scan editable text from books, papers, and other documents directly into a phone, tablet, or computer. The device has the ability to translate text in 40 languages [16].

IV. IOT AND THE FUTURE OF EDUCATION

In the nearest future, education will be more user friendly when IoT is introduce to the sector [17]. Reviewed and predicted that classroom will be at everyone’s convenience; there will be sharp contrast between what is obtainable now and what to be expected [18]. Table 1 below show the difference between the current classroom practice and what to expect in the nearest future.

CURRENT PRACTICE	NEAREST FUTURE WITH IoT
Physical attendance with teachers.	Scale teachers and best quality of instruction-any device. Anywhere.
One-time instruction in one location	Scale content recordable and replicable instruction, any time, any venue
Static, linear content with low control	Learn at your own pace, focus on relevant content only, richer, interactive content
Costly instructional resources, "one size fits all" Ad hoc decision making	Access to crowd-sourced content, ability to customize curriculum Data-driven decision

TABLE 1. Changes in Education through IoT [18].

V. ROLE OF IOT IN SOLVING EDUCATION PROBLEMS

1. Availability in Wide Geographical Coverage: Wired and wireless networks now cover most of the population, creating unlimited platforms that increase availability. Here, the Internet of Things helps learners globally to make available locally and globally, whether with the appropriate content or by choosing teachers anywhere. The solutions offered by the Internet of Things allow a large number of learners in China, for example, to learn English through text messages and audio lessons, despite the scarcity of specialized and qualified local teachers.

2. Timely Availability, Autonomy: The Internet of Things offers educational alternatives anytime and anywhere, unlike traditional classrooms. For example, in some isolated villages, some university professors deliver lessons through podcasts that allow learners to access them anytime and anywhere and learners interact with them through text messages in an independent way for each learner in the learning process [19,20].

VI. THE ROLE OF IOT IN EDUCATION

A very smart component of today's universities and classrooms is that IoT improves schools and improves fees for physical services and systems. An elusive university has the advantage that it can easily provide a better level of knowledge at the individual level. Smart gadgets are used throughout campus to employ the Wi-Fi community to transmit information and receive orders [21].

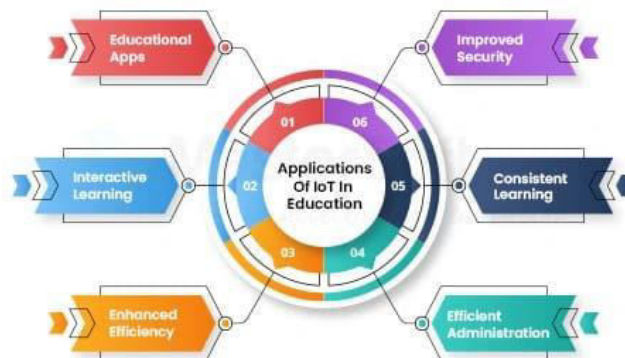


Fig.3: IoT's Application in Education[23]

VII. CONCLUSION

As we know about the rapid growth of Internet of Things (IoT) in education sector. IoT devices attracts students, teachers as it has innovative teaching methods, E-Learning facility etc. These device has intense the nature of IoT devices. IoT has brought lots of changes in education system gradually. This involves integration of intelligence system such as Learning Kits, Smart Classrooms, Digital Learning, Productivity etc. In this paper we had reviewed many concepts of IoT in Education which made student-teacher life much easier and more interesting. Hope this paper will help researchers to gather knowledge about IoT in education and supports such useful technology.

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