

IoT devices: Use in Higher Education and Future

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Abstract- Education has reached to newer heights with the inclusion of digital technologies. Despite the traditional classroom based education being profuse across the globe, several online tools have attributed significantly towards an efficient supportive medium in education. The concept of connected devices or things has given a new rise of the Internet. This has led to an efficient network system for information exchange. The information exchange through internet has led to develop a smart system so that students can survive in the competitive world. This whole concept is named as 'Internet of Things' IoTs.

Key words- Internet of Things(IoT), connected devices, smart system

Objective

The aim of the research is to study the various IoT devices used in higher education and their applications in future.

Research Methodology

Extensive literature review and secondary data research has been conducted to explore the various IOT devices and their applications in future in several higher education institutes. The study has been conducted to explore the future of Internet of Things in higher education.

Findings

The study has come out with the scope and application of several IoT devices used in higher education institutes. The role of IoT in building up the future of the students in higher education has been discussed in the study.

Managerial Implications

The study is beneficial for sustaining a better future for the upcoming generation to compete for their career.

Originality

The study can bring up a wide change in shaping the students with critical thinking and innovative skills.

Introduction

Technology is covering education just as a part of its inevitable influence in every sector. The optimal combination of several new technologies in teaching has given good learning outcomes (Abedodun et al., 2014). The information communication and technology have a broad impact in the

present education system. Education sector has created enough stir to make the business community rethink its prospects in global scenario. To shape education in a smarter way the aspiring education institutes are striving hard to make the best out of the technologies. Recent technology has put more emphasis on active learning by more engaging and direct procedures, which is also endorsed beneficial by several research initiatives. Education merged with technology has engaged students in learning and broadening their skills. This has overall prepared the students to meet the challenges and create a place for themselves in the competitive world (Abedodun et al., 2014).

The boom in social networking has also contributed to this active as well as collaborated learning, promoting a newer approach towards education. Web learning paradigms getting more profuse also confirms the fact that the modern learning community has been relying upon Internet and connected technologies a lot. The interaction with learning materials has also seen its newer approach from technology where classrooms are getting open and education is reaching beyond barriers. However adopting newer technologies though opened up the global space of learning has still several bars towards its full spread. Despite the increasing connectivity, newer leap of innovation, it is inevitable to make the most out of the connection and collaborations. To survive in the edge of competition, the IoT is essential. The main objective of this paper is to study different IoT devices and their applications which can be used to impart quality knowledge in higher education institutes. The paper discussed the scope of Internet of Things in education.

Literature Review

Education has reached its new height with the inclusion of digital technologies in it. Despite the traditional classroom-based education being profuse across the globe, several online tools have attributed a lot towards acting as efficient supportive medium in education. The concept of connected devices or things has given a new rise of the Internet. This has led to an efficient network system for information exchange. The information exchange through internet has led to develop a smart system so that students can survive in the competitive world. This whole concept is named as 'Internet of Things' IoTs.

IoT devices have been currently used in higher education to increase the engagement of the students in the classroom. The IoT devices in education system includes Attendance tracking systems, Temperature sensors, Advanced Security Measures, Wireless door locks, eBooks providing a better way to Learn, Mobile Devices and Tablets, IoT enabled board, Wearable Tech, Video Recorders for Lecture Capture, Sensors in Parking lot, Sensors track buses, Laser Trimmers, Mobile-based learning, Video-based learning, SMART, Idea-paint, GPS-enabled bus system, IPEVO and several others. IoT devices used in higher education encourage students to learn with technology. Learning algorithms, programming skills, teaching through online courses have their own challenges but they make students smart. It has been found in reports that more than 80 percent of students using IoT are adult learners. This leads to several challenges as the students using the IoT devices rarely are slow in their work. Thus, it is required to make the students aware about the IoT devices in higher education institutes. China has focus on the application of IoT on agriculture, logistics, transport, electricity, health and others (http://news.xinhuanet.com/english/china/2012P02/14/c_131410233.htm). Technology adoption in agriculture has led to sustain the system (Kumari, 2017).

Research Methodology

Literature review and secondary data research was conducted to explore the various IoT devices and their applications in future in several higher education institutes. The study has been conducted to explore the future of Internet of Things in higher education institutes. Around fifty research articles have been reviewed from quality journals and Secondary data has been collected from the database of several higher education institutes. The several IoT devices and their applications have been reported in the paper.

Results and Discussion

Internet of Things is the technology to connect things to build up an interaction between people and things. In a learning society it is essential to increase student's knowledge and increase their skills. Students should absorb the contents by utilizing the online resources and e-books. Latest educational trends include Flipped Classroom and Massive Open online courses. Kamar et al., 2016 has explored various IoT platforms in their research. Microsoft Azure Iot enables the use of advanced data analytic to transform business.

Radio Frequency Identification and Wireless sensor networks technologies are the innovative features used in education system. Machine to machine, machine to object and object to object interactive implies a complex typology between devices. The RFID readers collect the sensory data and sends information to a private cloud system for decision making. Wireless Sensor Network constitutes of a group of tiny sensors. There are few components in education which can be managed. Home smart backpack, classroom check in, smart desk and whiteboard. The home smart backpack is designed to track the backpack through fingerprint. Classroom check in services helps to provide the email service for the students and teachers. Smart desk is used to receive instructor's writing on the white board. They can easily see it on their laptop. Smart whiteboard is another component where the students receive and sends messages, questions, images, text and lectures. IoT includes objects, smart devices, sensors etc. to create value added applications. GPS and wireless network make the vehicle and transportation system smart. Traffic and video sensors can be detected through GPS. This leads to better transportation in higher education. IoT can be used to access medical history, electronic patient records and e-health (Mahalle and Railker, 2015). The application of IoT and their impact in health in industries has also been discussed by Kumari et al., 2017.

IoT constitutes of IoT enabling technology, marketplace and application desirable to users (Friess, 2013). IoT is not a single technique but it is a concept to connect things (Vermesan et al., 2013).

Table 1: List of IoT devices, it's features and role in higher education

S.No.	IoT devices	Features and Role in Higher Education
1	Amazon AWS IoT	Manages cloud platform supporting several messages Connects the application and devices, collects IoT data and manages services. Such devices provide open source to create and receive data. It focuses on data management. Few IoT devices are an open source to store and retrieve data over the internet. It allows to connect device for sharing information Allows retrieving data from different sources. IoT devices Offers search tools for public sensors. It allows for easy sharing of data. Monitors and control devices. Is a cloud service which interacts with devices and sensors Retrieves large amount of data from devices Provides infrastructure for connecting things
2	IBM IoT	
3	Xively	
4	Thingworx	
5	Thingspeak	
6	Pariampu	
7	Open Source	
8	WoT kit	
9	Every Thing	
10	Smart Things	
11	Isobridge	
12	Nimbeta	
13	Thinger	
14	Sensor Networks	
15	M2M	
16	Mobile Internet	
17	Semantic data Integration	
18	IPv6	
19	3G	
20	LTE release 8	
21	LTE release 10	
22	Cloud Computing	
23	Overlay network	
24	Green Networking Technology	
25	Virtual Sensors	
26	Bluetooth low Energy	
27	Ultra-Width Bandwidth Technology	
28	NFC	
29	Smart metre	
30	Biometric Strap	
31	Wireless Sensor Network	
32	Bluetooth Interface	
33	CASAGRAS2	
34	Ebbits	
35	Elliot	

RFID (Radio Frequency Identification)

It is a wireless identification technology that uses tags carrying electronically stored information, which is detected by the nearest RFID Reader. These readers work on radio frequency also called as radio transmitter-receivers or interrogators send out a signal to the tag and read its response. The receiver reads the response in electronically stored information inside the tag. The tags are attached to clothing, automobiles, pets, and pharmaceuticals, for tracking the progress through the assembly line in car manufacturing. The reader and the attached tag need not to be in line of sight like the Barcode system. Unlike barcode, this identification system has a far range of identification from 100 meters away. The concept being simple, this is detection of the tags by sending out far strong signals in all directions (Figure 1).



Figure 1: Application of RFID in School Attendance Management

Wireless Sensor Network

The wireless network consists of small sensors distributed over a field building a network of multiple sensors. They're called sensors as they sense and detect events and send the absorbed data to a sink point. This sink point is a gateway having a specific sensor node called mote, which can perform some processing and carries sensory information and communicates with other nodes in the network. This node gathers information from all other sensor in the network and sends it through the

gateway for further analysis related to the events captured. Sensor node is a sensor in a sensor network (Figure 2).

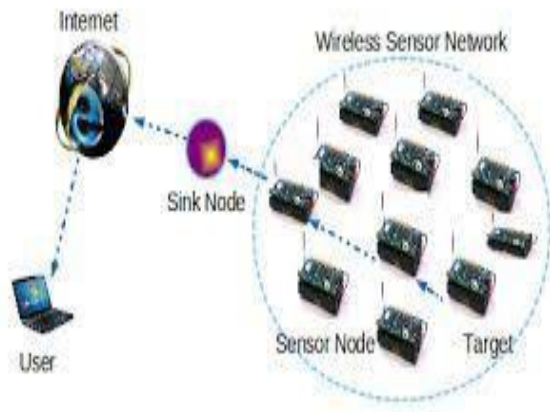


Figure 2: Wireless Sensor Network Smart Desk

This desk is equipped with IoT sensor detection; it uses RFID system for authentication of its user. Each Student has a preconfigured smart desk. The users are authenticated as this desk checks fingerprint, RFID Card or a cell-phone interaction, and once everything is verified user can use the facilities of smart desks. This desk can connect via wired or wireless connection, once the user gets the required authority, SMART desks services and facilities like Smart Whiteboard can be used. Users can assess the main system to pull every service offered. Since this desk is connected with other desks as well, a student can receive what is written on the whiteboard and see it on its laptop, a part of the desk. With authorization permissions the users can interrupt and teaching by asking questions via the laptop screens or the whiteboard. As this desk technology has a mini cloud system, every information received or sent are recorded on the cloud. The list of IOT desks also recorded is in the cloud, which can be used for attendance.

Biometric Strap

The present application relates to a portable biometric monitor strap and to a portable biometric monitor comprising said strap. More particularly the present application relates to a wearable biometric monitor, such as a heart rate monitor for attaching to a wrist of a user. Physiological data can be measured from a user by using portable biometric monitors, which may be attached to the user, for example to the wrist, forearm, or arm of the user. The physiological data may include for example heart rate. Traditional monitors usually contain a separate sensor, which is attached for example to the user's chest with a strap, and which communicates wirelessly with the wrist device. The use of separate sensors

complicates the use of a portable biometric monitor, and therefore there is a need to develop solutions embedded to the wrist- attached or other extremity attached device.

Smart Meters

These are next generation meters for gas and electricity, replacing today's standard meters that use technology created years ago. This network automatically sends the actual electricity usage to the supplier, so the need of tracking household bills and following up to places for bill payment is totally erased. It helps in more accurate bills: There is no need of estimation. No more strange people coming at your house to take a reading from your readings.

Parking Sensors

It becomes difficult to find a parking space the city center, but can also waste time, cost money and result in needless pollution. Bosch came up with a system where the parking spaces used are to inform drivers where they can park. It is a reverse method of using free space, since instead of the user searching for parking space, the parking space itself is notifying the coming vehicle of its availability. It can be used for daily management and long-term planning.

Network Application Analytics

Learning Management System: LMS

In this technological era training needs to be simple and accessible. LMS allows creating, distributing and tracking training anywhere, on any device. With LMS its possible for anyone to create, track, manage and distribute learning materials of any kind. Nearly a ten billion-dollar industry, this system allows any organization to develop electronic courses to work on, deliver it with flexibility. Some common components or features that can be found in many eLearning platforms include rosters, registration control, document Management, Multiple device access, Distributed instructor and student base, Course calendars, Student Engagement, Assessment and testing: Creation of knowledge retention exercises such as quizzes and comprehensive examinations, Grading and Scoring.

Content Management System

It provides competences for several users manage content, data or information of a website project, or internet/intranet application.

Sensors on Trash Receptacles

The automatic Motion-Sensing Touchless Infrared Trashcan eliminates spreading of infectious diseases and food impurities. Germs such as E. coli, staph and salmonella can survive on the surface of a trashcan for several weeks. This trashcan looks like a sleek, that has stainless steel as exterior complementing the decor style, the motion-sensing technology is a hands-free design allowing the lid to open when any object approaches the sensor range. As object is moved away, it closes automatically to avoid the smell from escaping, and since there is no direct contact with the can or lid, ones' hands are germ free and eliminates the spread of germs.

Wearable for Health Fitness

IoT-enabled wearable healthcare devices provide individuals with the information they need to gain better control over their health outcomes. There is high demand of Wearable devices are since they offer individuals greater visibility and analysis into their health position, letting them to make more informed choices about their health and well prepared for the outcomes with neither less expectation or high expectations.

- Individuals can observe various fitness, health, and wellness factors to track progress toward health objectives.
- People having health concerns which requires close monitoring can use a wearable device to track day-to-day basis the important health parameters.
- Patients can share data from their wearable devices with their healthcare monitors to provide physicians and other medical staff. Using precise health measuring devices like such helps detecting even minor health issues that may not come in notice if not equipped with such technologies.
- User can also connect their devices to other social networks.

5. Conclusion and Future Directions of Research

There are various ways by which internet can become a boon for young generation. Internet of Things helps in transforming students to meet the critical challenges of the society (Kortuem et al., 2013). Internet of Things helps students to see the emerging new jobs. They can match their skills with the job and meet the self as well as industrial needs (Rifkin, 2011). There have been increases in the number of people who are demanding IoT in their education. The reason being today the consumers want to be the producers so that they can meet their needs through technology (Mille, 2011; Topscott and Williams, 2008). This has led to the requirement of IoT education right from the schools.

The study is limited to several IoT devices used to build up higher education in institutes. The research is a desk-based research discussing only about the IoT devices and their applications. However, the researchers feel that the research can be extended by surveying Indian higher education institutes and the enablers as well as barriers in application of IoT devices. The students can also be surveyed to find out the IoT application in their education.

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