IOT IN MODERN DAY EDUCATION: A STUDY

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Abstract- Internet plays a great role in today's teaching and learning. There is no issue of time and distance, real or virtual and who and whom in the era of internet of things (IoT). IoT technology improves performance and automates different areas like city, home, agriculture, transportation, manufacturing etc and makes them smart. IoT technology also plays an important role to make a smart education system in modern day. In this paper we study and discuss some IoT based applications like, smart e-learning, smart classrooms, smart library etc in depth. We also discuss the technologies that are used and required to make IoT based education system available for urban and rural people. We try to address the gap and find new directions which will help to merge the knowledge of rural and urban pupil and make people empower by the power of IoT.
Keywords – Internet of things (IoT), RFID; Cloud storage, Smart classroom, Smart attendance system, Smart surveillance system, E-learning, Smart library

1. INTRODUCTION

Today's our daily life Internet is a big thing, and this is most important for everyone. We use internet for communicating and to getting information. The connected devices that are not directly controlled by human to the internet are called "things". Things may be laptop, mobile, fan, light, car, A.C, projector etc. When we connect things through internet and the things consist of sensor, software, electronics, actuators to collect and exchange data then whole system is called internet of things. IoT provides a bridge between virtual and physical world. Iot uses Radio Frequency Identification (RFID) and sensor network [1]. RFID systems identify and track data and other relevant information. We use a sensor for collecting and processing the data .By which we can find the changes in the physical status of things. In the next step we focus on to enhance the power of the network. We try to devolve processing capabilities to different part of the network. The final task will be to make the smaller and smallest things have the ability to connect and interact in the network. The term "internet of things" proposed by Kelvin Asthon in 1999 at Procter and Gamble (P&G) [2]. In modern day IoT uses in different domain that are Smart Home, Healthcare, smart city, agriculture, Mobile, Environment monitoring and Education [3]. In smart home we can control any kind of gadgets according to their status, if those devices are connected to the internet. In healthcare Iot plays very important role like glucose sensing, Blood pressure monitoring, rehabilitation system, body temperature monitoring etc [4]. The techniques like Noise monitoring, traffic congestion, city energy consumption and smart parking are used to make smart cities [5]. Today we use IoT technique in agriculture to improve agriculture process. We use different IoT techniques in agriculture that are poly House, control pumps and pH sensor etc [6]. Education is necessary for everyone. We can provide education for everyone through better technology. IoT is the better way. Now a day's IoT plays a vital role in education system. In education system IoT increases educational curiosity among teachers and students. Internet of things provides a new learning model that creates a bridge between physical world and virtual world [7]. Today IoT uses in higher education sector, especially universities. Some applications of IoT that are used in education system those are smart class room, smart e-learning, smart library and smart attendance system etc.

In section II we discussed different techniques which are used in modern day education system and the techniques are RFID, Smart classrooms, E-learning and smart library.

2. DIFFERENT TECHNIQUES USED IN MODERN DAY EDUCATION SYSTEM

In modern day we use some technologies and some applications. By using this technologies and applications, we make modern education system smarter. The technologies are RFID, cloud storage, NFC and cloud storage etc. The applications are smart classrooms, smart attendance system, smart surveillance system, E-learning and smart library. We are going to discuss some of the technologies and applications briefly.

2.1 RFID in Education System

RFID stands for Radio-frequency-identification is used to automatically identify and track tags attached to devices or objects. RFID has main three components those are the tag, the reader and the server. The tag is used to identify the item and the reader is used to collect information from the tag. And the server is used to communicating filtered event back to application

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[8]. RFID can be classified into three type based on power consumption those are passive RFID, active RFID and semi-active RFID. Passive and semi-active RFID can detect few range of meter where active RFID can detect hundreds of meters [9]. We use RFID in some application such that smart attendance system, smart library and smart classrooms.

2.2. Cloud storage in IoT based education system

Cloud storage is a data storage model which connects multiple storage devices to achieve resource shearing and it provides certain storage facility and it accessed by the combination of software and hardware. Basically, cloud storage are two parts first one is individual user which provides the online storage space for data uploading, downloading, sharing and multi-device data synchronization. Second one is application user which is comprehensive and efficient storage space. It provides the services that will access all digital campus related application. In application user cloud storage one resource can share multiple application which means many users can access after uploading only once. In our IoT based education system, RFID (Radio frequency identification), NFC (Near field communication) and LPS (Local positioning system) etc collects real time and continuous data from smart library system, smart classrooms, E-learning system and smart library system. And those data are store in cloud for access and control devices from anywhere existing in our proposed system [10].
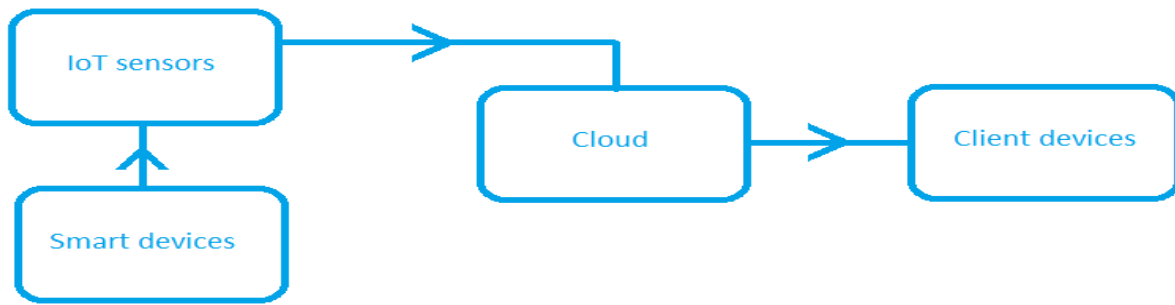
Fig. 1. Application of cloud storage in IoT

2.3. Smart Classrooms

Smart classrooms are consisting of various type of hardware and software module. The modules are Projector, laptop, smart phone, wall screen, smart board, Document camera, VCR and DVD etc [11]. Students can more satisfy from lecture, presentation and conversation by smart classroom. Not only the student helps from smart classrooms and also teachers can get a platform to presents their lecture or presentation in a batter way. IoT can transform standard classrooms to smart classrooms with better voice, conversation, movements, behavior etc. It provides the teachers to presents their lecture, presentation with better impact and student also get the opportunity to learn effectively, a shorter process, more planets, more interesting and also entertains [12]. We discuss two applications in below.

1) Smart surveillance system

A smart surveillance system has microphone, camera, sound sensor and PIR sensor to collect information in every class in the form of video. Where raspberry pi operates and control motion detection [13]. And camera is uses to surveillance. Collected data from smart classrooms are stored in cloud for future playback. When a student absents to attend their class then they can easily collect information regarding the classes through his/her smartphone. We discuss different type of sensor in table I that are used to make a smart surveillance system.

3. DIFFERENT TYPES OF SENSORS

Sensor	Parameter	Output
Microphone	Noise	Noise Existence
Camera	Fidgeting	Motion level
Sound Sensor	Sound level	Sound level
PIR Sensor	Fidgeting	Motion Existence

2) Smart Attendance System

 Roll call system is the most important in our school, college or university to identify the student's problem or they are interested or not in their classrooms. We can improve attendance system using IoT technology to provide more effectively and more efficiently. Comparatively less time required to collect attendance than standard classroom. We discuss two type of

IoT based attendance system firstly, if each student has a RFID attached student ID card. Each classroom contains a RFID reader which reads each student ID cards for update their attendance which makes a smart classroom roll call system [24]. Secondly, using NFC (Near Field Communication) based attendance system where each student has NFC embedded smartphone and a NFC scanner is placed in the front of the class. The NFC reader read each student ID card through his/her smartphone and it store information in the server [22].

4. E-LEARNING

E-learning stands for electronics learning and it involves use of internet. E-learning makes learning process more efficient for both student and teacher. Maximum places use standard e-learning system but if we include IoT technology in standard e-learning system then it will improve educational process in better way. IoT based e-learning systems help to collect data from the devices connected in the smart campus and share it to each other for convenient and also effective manner [22]. Importance of IoT based e-learning applications are we can share class notes to outside of the classrooms using IoT based e-learning system. It creates a virtual classroom where many student of different classroom in different region can learn easily [23]. IoT based e-learning system can create a competiveness between local and international students. And also it will create a blended classrooms environment. This system provides course content, user interface design, digital libraries, e-learning classrooms notes, compressing note's image and it will also provide any time anywhere access class notes opportunity. We can implement this thing by a mobile app [15]. According to Zhu's smart education research framework and smart learning environment, smart pedagogies and smart learners are the elements of this framework [16]. Smart learning environment consists of software tools i.e. online resources, messaging, blog resources, social network, and analytical and virtualization tools and hardware i.e. interactive whiteboard, smart phone, tablet and smart object like smart table and e-bag etc. It helps students to learn any time at anywhere. The knowledge-pull approach enhances the learning capability and personal knowledge. This approach facilitates the learner with adequate implicit and explicit knowledge. It improves their intra and inter personal knowledge network by using variety nodes/devices/things in the network. This will give researcher to develop new method and educator can learn and more effectively and more efficiently. A learner is called smart learner when he/she interact with the system by smart devices [17,18].

5. SMART LIBRARY

In our traditional library system's books are arranged in shelves based on their subjective classification. There are lot of possibility to get misplaced these books for the reason is everyday many books are in and out of the library therefor lot of movements are performed. We can improve our library system using Wi-Fi based Local Positioning System (LPS) and Near Field Communication tag for easily identify the current position of the books. Generally, a library system performs four facilities like authentication, query and reply, locating the books and issue and return policy.

Authentication: Authentication is very important to protest for entering unauthorized person in library. In smart library each user has user-ID card through his/her NFC embedded smart phone and also his/her fingerprint through biometric fingerprint reader to allow access in library WLAN and also library OPAC system.

Locating the book: In smart library NFC tag are attached to every books of the library. Each rack has NFC tag reader included rack monitor that are connected to the library's WLAN. When some action is performed like book in and out of the library the rack monitor gets information about the book and it store to the library database.

Query and reply: In our smart library each rack contain a rack monitor which store all information about each books. When user queries for a book the rack monitor provide all information regarding the books using NFC tags and local positioning system.

Issue and Return: Every user has a separate account in smart library. Where user can get all information regarding the transaction and it will maintain by the library server. NFC scanners are placed at the entrance and exit of a library. During issues a book at first read NFC tag through his/her smart phone after checking the book are issued in his/her account. During returning a book at first read NFC tag using his/her smartphone after checking condition the book is taken out in the library. Fines are automatically calculated and user can pay through his/her smart phone [21], [19].

IoT based smart library system provides the luxury of fetching a book from its own place. User can connect to the library server through his/her smart phone so, no required of separate RFID reader and also no required of librarian. Smart library reduces manual error in libraries and it is more reliable.

6. DISCUSSION

From the study we found that IoT technology plays an important role to improve our education system. Here we discuss different technologies which mostly use in IoT technology, for example RFID, NFC and LPS. RFID (Radio-frequency-identification) is used to uniquely identify and collect information about the perspective devices or objects. NFC stand for Near Field Communication is the set of communication rules that enables two devices for communication between the ranges of 10cm. And LPS stand for Local Positioning system. It is basically a navigation system that gives location information in all the weathers irrespective of places but importantly within the network coverage area. Then we discuss cloud storage model which provides certain storage facility and it access by the combination of hardware and software and it provides online storage space for uploading, downloading, sharing and multi-devices data synchronizations. And also we discuss two

parts of the cloud storage one is individual user and second one is application user, which access multiple storage devices to achieve resource sharing. After that we discuss digital campus, using campus network, internet of things mobile network by adopting many things like cloud computing, data exchange in application layer and application integration frame to make a digital campus, which make easier to manage or control the campus. Then we discuss smart classrooms consisting various type of hardware and software module and it will change traditional classrooms to smart classrooms where students can learn in shorter process, efficiently, planets and more interesting and also entertains. And then we discuss e-learning, IoT based e-learning is intended for collecting data that are exists in smart campus and also share it to other devices for effective e-learning and also it will provide anytime anywhere access class notes. Then we discuss smart roll call system using IoT based technology and also we discuss two type of attendance system first one is RFID based attendance system and second one is NFC based roll call system both are the reducing time and more reliable. After that we discuss smart library system which are consisting of Wi-Fi based local positioning system (LPS) and near field communication (NFC) for easily locate the current position of the books. And user can access OPAC system through his/her smartphone. And also we discuss some different types of network protocol in table II.

7. DIFFERENT NETWORK PROTOCOLS USED IN IOT

Network Name	Range	Data Rate	Frequency
Bluetooth	50-100 m	1 MBPS	2.4 GHz
Zig-bee	10-100 m	250 Kbps	2.4 GHz
Wi-Fi	Approximately 50m	2.4 GHz and 5 GHz bands	150-200 Mbps typically
Cellular	35 Km max for GSM 200 KM max for HPSA	35-170 Kb(GPRS),120-384 Kb(EDGE),384-2 Mbps(UMTS),600 Kb-10 Mb(HPSA),3-10 Mb(LTE)	900/1800/1900/2100 MHz
Z-wave	30 m	9.6/40/100 Kbps	900 MHz(ISM)

Now a day, IoT technology is used in different domains. Basically it is used in smart city, home automation, agriculture, transportation etc. But in our education system, IoT technology are comparatively less uses then other domains. In this paper we discuss some applications of IoT based education system like, smart classrooms, smart attendance system and smart library. In India, few colleges and universities are uses this IoT based application. In future we have to focus on implementation of IoT technology in education system. We discuss different IoT techniques and applications which are required to make a IoT based education system shown in table III, IV and table V.

8. COMPARISON OF THE TECHNIQUES

Techniques	Requirements	Cost per unit	Advantage	Disadvantage
RFID	RFID reader, RFID tag, connecting cable	INR 2400	Automatically track, capture data.	Expensive and a software is needed
Cloud storage	Smartphone, computer, laptop, network(Wired wireless)	Price varies from company to company policy (Amazon, google etc.) and data usage	Remotely maintained and manage data from anywhere	Required Internet connection for accessing cloud services
NFC	NFC reader, NFC tag connecting cable	INR 1500	Convenience, safety and versatility	NFC does not work in long distance(larger than 10cm)

9. COMPARISON AMONG THE APPLICATIONS(1)

Applications	Requirements	Cost(Minimum approximate)
Smart classrooms	PIR Sensor, Microphone, Camera, Sound Sensor, interactive whiteboard, Projector, Laptop, smart phone, tablet, smart table, e-bag, Network	INR 42,131 per classroom
E-learning	interactive whiteboard, smart phone, tablet, smart table, e-bag, online resources, messaging, blog resources, social network, and analytical and virtualization tools	INR 28,720 per unit
Smart library	LPS, NFC embedded smartphone, Fingerprint reader, NFC tag, Rack monitor, network	INR 17650 per unit
Smart attendance system	RFID attached ID card, RFID reader, Display monitor, NFC embedded smartphone, NFC scanner	Using RFID: INR 16650 per unit Using NFC: INR 9000 per unit

10. COMPARISON AMONG THE APPLICATIONS(2)

Applications	Urban	Rural	Online/Offline	Advantages	Disadvantages
Smart classrooms	Applicable	Be applicable	Online/Offline	Better voice conversation	Too much expensive
E-learning	Applicable	In rural areas E-learning system is not accessible due to Internet speed	Online	Easy to learn from anywhere anytime	Required Internet connection and smart device
Smart library	Applicable	Be applicable	Online	Luxury of fetching a book from its place	Each user must be needed a NFC embedded smartphone.
Smart attendance system	Applicable	If we use RFID then it is possible but if we use NFC then we face some problem	Online/Offline	Comparatively less time required to collect attendance	Using NFC, each student must be needed a NFC embedded smartphone

From the above table we get the information about few IoT techniques and applications. The information are checked like requirement, minimum cost from renowned websites and service providers like amazon, ebay etc. We try to focus on the advantages and disadvantages of those techniques and their applications. We have also shown the application which are possible to implement in online or offline mode.

The maximum area (72%) of India is rural and the internet facility did not reach there. There are also some other problems for which the IoT based education system is hard to implement in rural area. Those problems are poor internet connectivity, economical problem and lake of smart devices etc. 650 million users use mobile phone but among them only 300 million users use smartphone according to "IFAD, UNITED NATIONS". But now a days India has 391,292,635 users use Internet and India is the second in rank of data usage in 2017 [25]. Education and health care are the most priority issues in every society. In this paper we try to make a survey of IoT based education system feasibility in not only urban but rural areas. We live in a society where education is the basic right. This survey helps to understand the IoT based education systems and think about the new techniques which will meet all the challenges especially in the rural areas.

11. CONCLUSION

From the study we got the clear idea that IoT can change the orthodox education system and it will help to make the education system smart. In modern day IoT based education system we have the facility of smart classrooms, smart attendance system, smart library etc. From this study we tried to summarize different IoT based applications that are used to implement a smart education system. This work provides important applications and technology which are required to make a smart education system and it will help the researchers to think new IoT based applications and new technology.

12. ACKNOWLEDGMENT

We are very thankful to Mr. Rahul Karmakar for his support, motivation and useful guidance during this work.

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