International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.06, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

Performance Evaluation of IOTinSmart Classroom Environment

Abhishek Kumar[1], Er. Meenakshi Mittal[2], Akshay Kumar[3]

[1,3]Research Scholar, Department of Computer Science and Technology,
Central University of Punjab,Bathinda (India)
[2]Assitant Professor, Department of Computer Science and Technology,
Central University of Punjab, Bathinda (India)

ABSTRACT

Internet of Things(IoT) is a paradigm which defines the technological and social advantages of interconnecting "Physical Objects embedded with electronics" and other electronic and computing resources like Sensors, Software Systems, Networking etc. The Internet of Things allows these objects to be connected over a network for controlled remote access via Internet/Intranet.Internet of Things follows the principle of Grid and Cloud Computing, where instead in place of resource/service sharing it share data for communication/command purpose. Computer Science education progresses very quickly over the time and need for appropriate learning aids requirement also increases. Smart classrooms must be equipped with advanced learning aids based on latest technology or smart things. Advancement of learning methods with Internet of Things model can fill the void between theoretical and practical education. The smart object provides ease and comfort for class management. Use of IoT in a classroom may help to provide a better control and management.

Keywords: *Computer Science, Cloud Computing, Data Communication, Internet of Things (IoT), Physical Objects, Sensors, Software Systems.*

1. INTRODUCTION

Internet of Things (IoT) is a newest paradigm that is gaining ground in the Computer Science field. The first Internet of Things appliance was a vending machine in early 1980s, which was developed at Carnegie Melon University. The machine was designed to report over the internet whether or not it had cold drinks available. In a broader sense IoT is interconnectivity of multiple devices that can report, monitor, or provide other value or services that are of value to end users. IoT can refer to devices from Smart Thermostats that allow homeowners control temperature over the internet to medical wearable devices that can alert emergency services of any abnormality in vital signs. There's little doubt that IoT has the potential to make people's everyday life easier, as interconnected devices become more and more ubiquitous. The term 'Internet of Things' describes an area with tremendous potential, where new sensing and communication technologies, along with their associated usage scenarios and applications, are driving many new research projects and business models. Three major themes pervade the technical discussions collected in this paper: novel sensing technologies to capture real-

International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.06, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

world phenomena; the evaluation of novel applications using both new and existing technologies; and the appropriate infrastructure to facilitate communication with billions of networked real-world objects. While all these technological developments are exciting, they also bear profound challenges from a social, legal, and economic perspective. [1]

The concept of connected devices or things has given a new rise of the Internet, anything, anywhere can get connected with the Internet and becomes 'Smart.' Connected devices can communicate with each other and share information which can then further be processed to take some decisions. This whole concept is named as 'Internet of Things.' According to Mark Weiser, "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it". Kevin Ashton first used the term Internet of Things in 1999. Since the beginning of Internet of Things (IoT) many researchers have tried to define IoT in various ways like Internet of Everything, Internet of Anything, Internet of People, Internet of Signs, Internet of Services, Internet of Data or Internet of Processes.

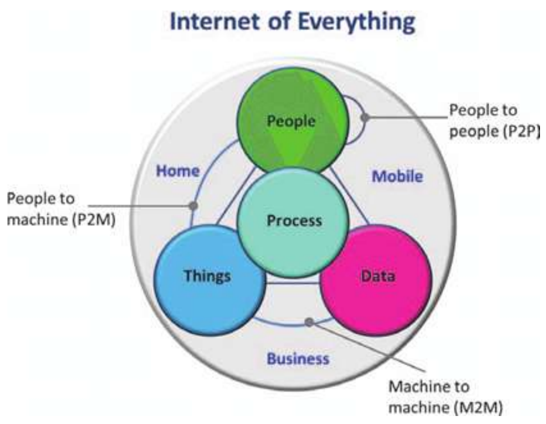

Figure1. Internet of Everything (Source: Cisco)

Cisco defines IoT as a network of connected physical objects. Cisco also uses the term Internet of Everything for both physical and virtual objects. Cisco states that "IoE brings together people, process, data, and things to make networked connections more relevant and valuable than ever before turning information into actions that create new capabilities, richer. [2]

The number of connected devices is increasing enormously, and many predictions have been made with this regard. According to Gartner's Forecast, 20.8 billion new things will be connected by 2020. According to Machina Research, the growth of IoT connections is Wonderful: from 6 billion in 2015 to 27 billion in 2025. The number of cellular IoT connections will be 2.2 billion, and 45% of these will be in connected cars.

In the Fig. 1 it is shown that with the help of IoE People can connect to their homes and control their home appliances via Internet. Machine to Machine connectivity under IoE achieve to support many Business Operations like Remote Control, Connecting Sub-Branches of Companies, maintain resources including people's efficiently. IoE follows Data Driven process and it acts on data received by any mobile/non-mobile devices.[1]

1.1 Characteristics of IoT

1.1.1 Interconnectivity: With IoT many types of Interconnectivity can be achieved both simple and complex. Like, People can control temperature of their home by turning on/off or adjusting speeds of their Air-Conditioners while present at any other location far from home. People can link their offices to their home or vice-versa to gain an advantage of being at two place simultaneously. [3]

1.1.2 Automated services: The IoT is capable of providing automated services with ensuring necessary constraint like, privacy, protection and systematic consistency between hardware and software. Automation of any device/service which is non-automated by nature are extremely fragile when using them via any automaton source/technology but this problem resolve by IoT very efficiently because it follows standard networking protocols for data transmission between devices. [3]

1.1.3 Heterogeneity: The devices connected under IoT are heterogeneous because they are based on different hardware architecture and runs different platform oriented software's. These different types of device with different compatibility requirements can communicate over IoT. This scales up the heterogeneity integration onto next level. [3]

1.1.4 Dynamic changes**:** Integration/Updating of devices/appliances is a continued process. This led to take advantage of IoT Dynamic change adaptability. As all connected devices work under network with standard protocols, it is easy to add another device or update existing device without any data loss or hardware failure. The state of devices change dynamically, e.g., sleeping and waking up, connected and/or disconnected as well as the location and speed. Moreover, the number of connecting devices can change dynamically ([3]

1.2Applications of IoT

The IoT application covers smart environments/spaces in domains such as: Transportation, Building, City, Lifestyle, Retail, Agriculture, Factory, Supply chain, Emergency, Healthcare, User interaction, Culture and tourism, Environment and Energy. Below are some of the IOT applications.

1.2.1 Remote Control Appliances: Switching on and off appliances remotely to save energy and reduce over usage. Remote access over appliances gives user liberty to use in instructive manner. [3]

1.2.2Smart Home Appliances: Refrigerators with LCD screen telling what's inside, food that's about to expire, ingredients need to buy and with all the information available on an Internet. Washing machines connected to network allow to monitor the laundry remotely. [3]

1.2.3Safety Monitoring: Alarm system setup with biometric or RFID system to ensure that authorized person only enter in home/office else alarm triggers. Motion sensors can also be helpful while securing home/office. To get information of all people who visited nearby, camera's setup with storage setup either in the inner facility or in cloud for saving the recordings capture by camera. ([3]

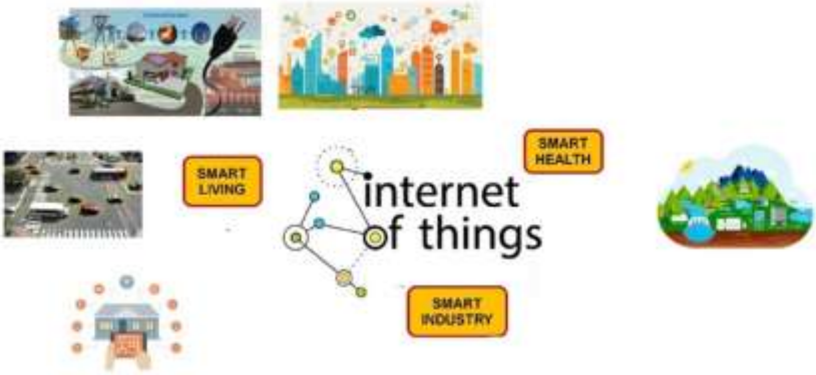

Figure 2. Area of IoT Applications

1.2.5Medical Emergency**:** With the help of some wearable electronic devices some basic health component can be monitored. Which help when emergency strikes. Any reading from sensor which person wearing indicate to any fore coming health hazard will inform to patient and doctor (if registered) automatically[3]

1.3IoT in Education

Technology in education has played a significant role in connecting and educating the students. IoT has an important impact on education field. IoT brought changes in the infrastructure of educational institutions. The term Internet of Things in Education is considered two faced because of its use as a technological tool to enhance academic infrastructure and as a subject or course to teach fundamental concepts of computer science. IoT technology is playing a key role for the improvement of education at all levels including school, college and university teaching. From student to teacher, classroom to campus, everything can get benefited with this technology.

Another way to understand the impact of IoT on education is through the use of sensors. According to integrating "IoT as a new actor in educational environments can facilitate the interaction of people (students and teachers) and objects (physical and virtual) in the academic environment"[4]. As a subject, IoT is a highly exciting and stimulating topic to attract students and an ideal platform for teaching computer science concepts. Realizing the importance of IoT as an active subject, in the UK, the Open University introduced a new course, My Digital Life, based on IoT concepts for undergraduate computer science students. My Digital Life assists students to use IoT as a tool to understand and question the world around them and know their role in understanding IoT. An IoT-based interactive model is built to teach the English language. To correct the pronunciation and the shape of English learners' mouth, this model uses voice and visual sensors. IoT is also used to teach fundamental concepts of Programming language to students. Another system uses objects with tags and Learning Management System to collect data and analyse students' learning method using learning analytics techniques.[5]

2. PROPOSED SYSTEM

2.1 Existing Work

The smart classroom concept introduced as Internet based distance education system; or as intelligent environment equipped with an assembly of many different types of hardware and software modules. In the process of everyday teaching, lecturers are usually trying to find out if the students were satisfied with the lecture, which part of a lecture was interesting, which presentation techniques and approaches were more attractive and effective than the others.[6]

Bernabas Amare Has set to investigate the concept of Internet of Things and its applicability in campus context. The fundamental idea of Internet of things innovation is devices are coordinated with the virtual universe of the web and collaborate with it by tracking, sensing and monitoring objects. In this paper, we have shown how to successfully build a smart campus that will embrace progressed ICT'S to consequently screen and control each activity and events inside a campus using IoT. In order to show the feasibility of the system a simulation is prepared and implemented.[7]

Daniel Palma Proposed Arduino hardware has provided enormous simplicity in the development of the prototype. The different modules and shields are successfully integrated. This work has shown an example of integrating different technologies by using the basic principles of the Internet of Things. The result is that a thing, the classroom, registers information in the cloud via a sensor network created with Arduino components. Different applications that make use of data by integrating them into an application that uses Google Maps to produce information published on Twitter has been developed. This not only shows the possibilities of the Internet of Things but also scalability and reuse of data that can be generated. Also NFC, RF, Arduino, Xively, Google Maps and Zapier technologies are combined in the same project with a successful result that tests the power of the Internet of Things for managing and sharing data.[8]

Zhen Ling Proposed the security problems of Edimax plug system and hope that Edimax plug and other IoT device manufacturers enhance the security of their systems. They study the vulnerabilities of smart plug system by reverse engineering its communication protocols. After he obtain the details of its communication protocols, he are able to identify several security vulnerabilities, including insecure communication protocols, lack of device authentication, and a weak password policy. he propose four attacks, device scanning attack, brute force attack, device spoofing attack, and firmware attack, to demonstrate the severity of these security risks. He has implemented these attacks and performed real-world experiments. They analysis and experimental results show that an attacker is able to control these smart plugs completely. The device scanning attack can find all online plugs. The brute force attack and device spoofing attack can obtain the device password whatever it is. The firmware attack can obtain the root access on the plug system. To thwart these serious threats, we present the guidelines for Corresponding countermeasures.[9]

2.2 Working of Purposed System

In Proposed system all electrical equipment’s are controlled through a computer system by a user wirelessly. Microcontroller interfaced with different Modules and Sensors and further interfaced with equipment’s. By this semi-automation achieved. Providing connectivity with Computer with required application installed, a complete automation can achieved.

IJARSE
ISSN: 2319-8354

2.2.1 Introduction

Installation of required Software like Operating System (Windows), Proteus Simulator, Programming languages (Java, C) and Hardware like Arduino are performed. In the proposed technique, Proteus tool has been used. The tool is designed by Lab centre Electronics Ltd. The software was initially designed only for electronics purposes but later with the development of new microcontroller boards like Arduino, it is now also used with computer language. Proteus consolidates usability with intense highlights to enable you to configure, test and design PCB more professionally. The Proteus suite is basically a windows software for simulation, PCB layout design and schematic capture. Schematic capture is the simulation of PCB layout. It is a core component of Proteus.

2.2.2 Architecture of Purposed system

2.2.2.1 Virtual Scenario

Simulating the Arduino and Sensors on Proteus Simulator Software. Bluetooth (part value BLUETOOTH HC-05, part reference HC1), Servo motor (220v; part value FANDC), led lights (according to given temperature sensors) and LCD1 (part value LM016L and part reference LCD1) to show the current temperature and sensor values are the three principal components in the circuit. Apart from these, the circuit contains a temperature sensor (part value LM35 & part reference U1) and Arduino UNO R3 (part value ARDUINO UNO R3 and part reference DUINO1) for controlling all devices like servo motor, buzzer and led lights. A buzzer is connected to Arduino and the resistor. LED lights (part value LED-BLUE and part reference D) are connected to Arduino, that blink at 2.2v. This circuit is further controlled by 3 resistors of 220 ohms.

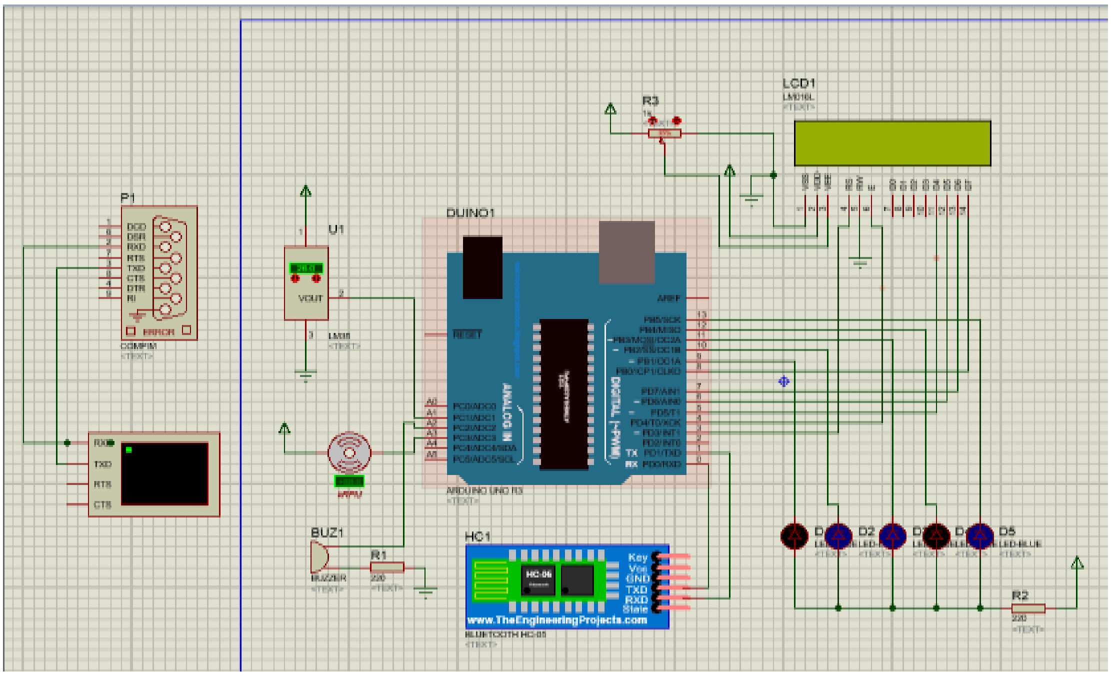

Figure 3.Circuit diagram

2.2.2.2 Real Scenario

In Real Scenario Proposed System is capable of processing the data acquired by Sensors using Arduino. Led lights, Fans, Projector and Projector Screen and Biometric Sensor is connected to same Arduino. Arduino in proposed system interfaced with Bluetooth module for providing wireless connectivity. Arduino get power supply from computer system to which it connected and controlled via commands. To get more objective measurements, training conditions must be as similar as possible to the conditions in a prototype environment. Since IOT needs a faster and reliable communication, thus data is determined while simulating.

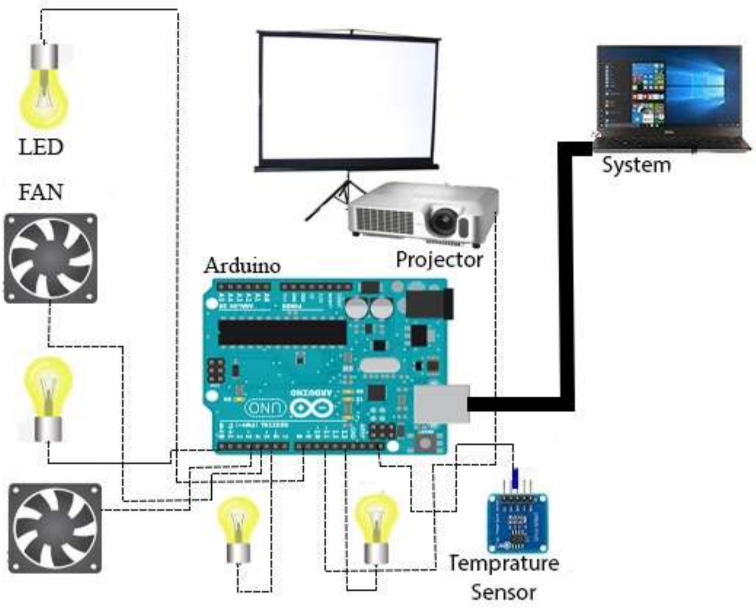

Figure 4. Prototype scenario

2.2.3 Working of Purposed System

2.2.3.1 Virtual Scenario

At first, the program is developed according to circuit diagram on Arduino IDE. All pins are to be set for desired inputs and outputs. Set all connectivity for Bluetooth device. Run the whole circuit. Established connection between mobile and circuit diagram via Bluetooth. Take output as per input command.

2.2.3.2 Real Scenario

With the help of simulation of virtual environment, connectivity of different sensors and devices are performed, which used in creating Smart Classroom Scenario. Setup the Arduino and other sensors. Each fan,led light, Projector and projector screen connected to Arduino's different pins, as describe in Virtual Scenario Simulation.

Test the Setup by turning on equipment's with automated shutdown timings. Evaluation and Analysis of parameters like Packet Delivery ratio, End to End delay, Throughput, Packet loss.

3. RESULTS

3.1 Simulation Results

3.1.1 Measuring and analysingthe End to End delay (Figure 5), Packet Loss between devices (Figure 6). Packet delivery ratio (Figure 7), Throughput ratio (Figure 8) between devices (mobile &laptop) while simulating the smart class room via Bluetooth.

Figure 5

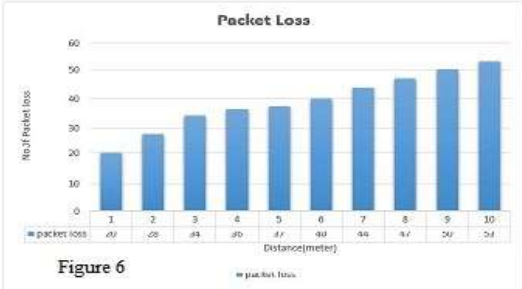

Figure 6

Figure 7

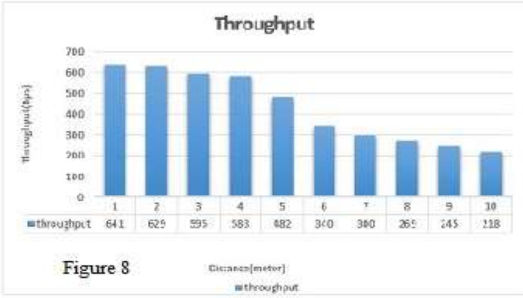

Figure 8

3.2 Implementation Results

3.2.1 Measuring and analysing the End to End delay (Figure 5), Packet Loss between devices (Figure 6). Packet delivery ratio (Figure 7), Throughput ratio (Figure 8) between devices (mobile &laptop) while implementing the smart class room via Bluetooth.

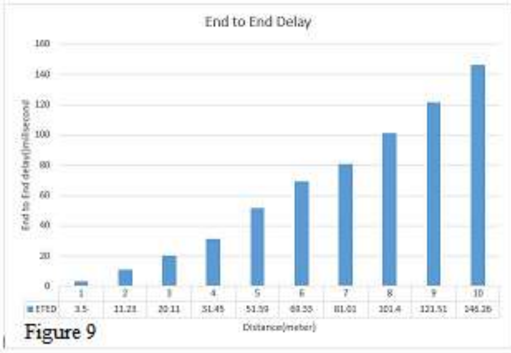

Figure 9

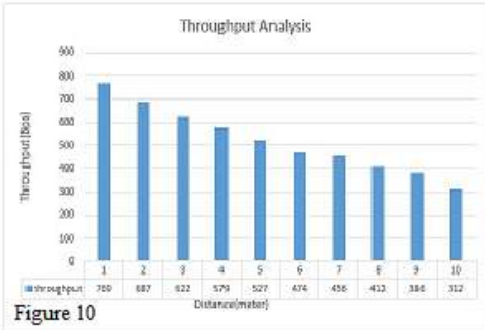

Figure 10

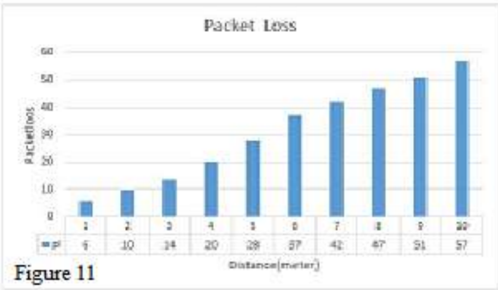

Figure 11

Figure 12

4. OBSERVATIONS

4.1 End to End Delay

In both virtual and real scenario End to End delay increases with distance increased. But ETD more increases in real scenario, which means there are more data loss compared to virtual scenario.

4.2 Packet Loss

In both virtual and real scenario packet loss increases with distance increased. But packet loss is much higher in real scenario compared to virtual scenario.

4.3 Packet Delivery Ratio

In both virtual and real scenario Packet delivery ratio decreases with distance increased. But PDR more decreases in real scenario, which means there are more data loss compared to virtual scenario.

4.4 Throughput

In both virtual and real scenario Throughput decreases with distance increased. But Throughput more decreases in real scenario, which means efficiency of data transmission is decreases compared to virtual scenario.

5. CONCLUSION

Internet of Things allows data transfer over a network without human-human or human-computer interaction. In this paper, we discuss the tangible IoT Model usage for traditional classrooms and convert it into Smart Classrooms, which are helpful in academic development of educational institutes. The term “Classroom Management” means a way or approach a teacher uses to control/manage classroom. The use of IoT devices for teaching and learning purposes is a hot trend among institutions across the world which provides a new and innovative approach to education and classroom management. Combining the IoT technology with social and behavioural analysis, an ordinary classroom can be transformed into a smart classroom.Potential applications of the IoT are numerous and diverse, permeating into practically all areas of every-day life of individuals, enterprises, and society as a whole. The programming of the device was not complicated as the Arduino developer community is large and there are many tutorials that can be accessed via the net.

References

[1] M. A. M. Y. S. A. M. Shahla Gul, "A Survey on Role of Internet of Things in Education," *IJCSNS International Journal of Computer Science and Network Security,* vol. VOL.17 No.5, pp. 159-165, 2017.

[2] P. Constantin-Eugen CORNEL, "The Role of Internet of Things for a Continuous Improvement in," *Hyperion Economic Journal* , vol. vol. 2, pp. 24-31, 2015.

[3] S. M. P. Keyur K Patel, "Internet of Things-IOT: Definition, Characteristics, Architecture, Enabling Technologies, Application & Future Challenges," *International Journal of Engineering Science and Computing,* vol. 6, no. 5, pp. 6122-6131, May 2016.

[4] V. L. U. A. P. a. A. D. Jeffrey P Bakken1*, "Smart Universities and their Impact on Students with

Disabilities," *EC OPHTHALMOLOGY,* pp. 42-52, 30 june 2017.

[5] A. U. K. Nenad Gligori, "Smart Classroom: Real-Time Feedback on Lecture Quality," *IEEE,* pp. 391-394, 2012.

[6] N. D. V. M. V. Hemanthraj, "IOT Based College Automation with Smart Classroom Integration Using Raspberry Pi," *International Journal for Research in Applied Science & Engineering Technology (IJRASET),* vol. 5, no. VI, pp. 2120-2125, june 2017.

[7] J. S. Bernabas Amare, "Internet of Things (IoT) Driven Design and Implementation of smart Classroom," *International Journal of Computer Science Trends and Technology (IJCST),* vol. 5, no. 4, pp. 32-38, 2017.

[8] J. E. A. *. H. S. a. M. M. M. Daniel Palma, "An Internet of Things Example: Classrooms Access Control over Near Field Communication," *open access sensors,* pp. 6998-7012, 2014.

[9] Z. L. L. X. G. K. W. X. Fu†, "Security Vulnerabilities of Internet of Things: A Case Study of the Smart Plug System," *IEEE Internet of Things,* pp. 1-11, 2017.

[10] S. M. P. Keyur K Patel, "Internet of Things-IOT: Definition, Characteristics, Architecture, Enabling Technologies, Application & Future Challenges," *International Journal of Engineering Science and Computing,* pp. 6122-6131, 2016.