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# Evaluating of Internet of things' effect on Smart Classes and Management System

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ABSTRACT

In the modern world, with the advent of new technologies in the field of education, there are significant advances. One of these technologies that seems to be more comprehensive and more influences the future of education is the Internet of things technology, as well as smart classroom and educational system. Many researchers have done a lot of work in this field and have achieved good results. In the meantime, each of these researchers has looked at this issue in a particular way. In this paper, we discuss the importance of the Internet of things and smart classes in the educational system. Subsequently, while expressing the importance of data mining in smart classes, we discuss cybercrime attacks and security risks in smart classes equipped with the Internet of things. In the end, we are considering ethical considerations in data collection and data mining. We also offer suggestions to improve this process.

## 1. Introduction

The paper Education is the process of facilitating learning, or the acquisition of knowledge, skills, values, beliefs, and habits. Educational methods include storytelling, discussion, teaching, training, and directed research. Education frequently takes place under the guidance of educator, but learners may also educate themselves. ( *Dewey,1944 ,1916*). Today, we face many problems in various aspects of education. There are useful tools available to mankind that can be used to train and solve educational problems. One of these tools is the Internet of Things (IOT). The Internet of things (I.O.T) is the network of physical devices, vehicles, home appliances, and otheritems embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to connect and exchange data.(*Brown,13 September 2016)*. One of the circumstances that (I.O.T) uses is in smart classes. The smart classroom concept has come into the literature as Internet based distance education system; or as smart environment issued with an assembly of many various types of hardware and software modules. In the process of everyday teaching, teachers or professors are usually trying to find out if the students (or more general the listeners) were satisfied with the lecture, which section of the lecture was interesting, which presentation techniques and methods were more effective and attractive than the others (Prof.Temkar et al., 2016). Previous studies have exhibited that student's attention begins to decrease approximately 10 min after the beginning of a lecture. At the end of a lecture, students remember 70% of the information presented in the first ten, and only 20% of the information presented during the last ten minutes of a lecture (Hartley & Davies, 1978). Although the application of this in educational systems and smart classes has attracted many researchers, the novelty and importance of this issue has made everyone look at this issue in their own eyes. In this research, we try to evaluate the results of the most important of these studies and the process of using data mining in smart classes and educational systems. Data mining involves discovering novel, interesting, and potentially useful patterns from large data sets and applying algorithms to the extraction of hidden information. (Chen et al., 2015). It seems that the results of these studies like the papers we are researching on, in the future, create a new generation of educational systems that can be a turning point for the education system, universities, knowledge-based companies and all the educational systems that benefit from it.

### *1.1. Previous works*

Several works have been done in relation to the use of the Internet of objects in smart classes and the educational system. Each of the researchers has looked at some aspect of it. Although this is a new subject, we have tried to gather some of the best and most recent research in this section.

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Svane et al. 2017 wrote a paper that this paper reports on work in progress between Belgium, Sweden and China. Students with different education backgrounds and levels hand over work (ideas) to others, to develop further. Currently, there are nine open-platform exercises to use as starting points for student work and discussions. Exercises are in English and free to download and use, as are some of the lectures related to them. So far, they are used in a digital service design class and in an introductory course in embedded systems. (Svane et al. 2017). Dickerson made a research in 2017, where a new and innovative course on IoT was presented. The pedagogical approach was to guide students in developing a conceptual "toolbox" of necessary IoT skills centered on the pillars of IoT systems: sensors, embedding computing, wireless networking and cloud-computing. He claimed that the results show that the course curriculum is effective in reaching the desired student outcomes and recommendations for improving future offerings are given. (Dickerson 2017). Bagheri and Movahed 2017 during a research which based on the recent IoT projects in education, categorized the application of IoT in education into four groups: energy management and real time ecosystem monitoring, monitoring student's healthcare, classroom access control and improving teaching and learning. They claim that, they investigated and analysed how this platform has changed the Education Business Model and added new value propositions in such organizations based on the Canvas Business Model. (Bagheri and Movahed 2017). Gul et al. 2017, during a paper discussed the usefulness and applications of IoT in the field of education. They claimed that it tries to present the recent research works, challenges and impact of IoT in future education.( Gul et al. 2017). Pishva 2017, during a paper claimed that he was going to show how previously forecasted security challenges of smart devices are becoming realities in the present day life. He shows its technical feasibility and demonstrates its partial materialization in proprietary manners. It then explains why and how numerous stake holders are needed to get together for its wide range commercial implementation. He claimed that some immediate necessary safeguard actions and intermediate schemes which include soft infrastructures are also presented for the purpose of risk reduction.( Pishva 2017). Veeramanickam and Mohanapriya 2017, during a paper focused on need of adopting IoT technology in campus using E-learning for academics. They claimed that in near future drastically make changes for students in highly enabled IoT: i-Campus environments. (Veeramanickam and Mohanapriya 2017). Uzelac et al. 2017 in the paper had presented a smart classroom system that is able to classify students' satisfaction with the lecture quality by examining parameters of the physical environment obtained using different smart devices. They claimed that the system accuracy was evaluated by comparing system outputs with the students' feedback and ranged from 70.7% to 83.9%. (Uzelac et al. 2017)

He et al. in 2016 during a research, proposed to transform STEM core courses by integrating IoT-based learning framework into their corresponding lab projects. They proposed the effective learning approaches to address those challenges. They presented a case study by incorporating IoT-based learning framework into a Software Engineering (SWE) embedded system analysis & design course.They claimed that majority of the students provided positive feedback and enjoyed the IoT-based lab development kit.( He et al. in 2016). Atabekov et al., 2016, proposed IoT-based framework to facilitate education of indoor localization. The proposed framework employs Arduino microcontroller boards connected with XBee radio modules to perform indoor localization. (Atabekov et al., 2016). Rahman et al. 2016 during a research in education institutes in India, discussed about how academic learning can be made reachable and motivating for the students using ICT and IoT, besides introducing them to their core subjects with interactive ways of Smart learning. (Rahman et al. 2016). Uskov et al. 2016 during a research, presented the up-to-date findings and outcomes of research, design and development project aimed to identify the ontology of Internet-of-Things applications in smart engineering education - concepts, levels of "smartness", components, features, and functions. (Uskov et al. 2016). Lenz et al. 2016 during a concept paper claimed that the development of utilizing Big Data-based algorithms of the next internet generation, the so-called `Internet of Things', leads to a comprehensive approach of personalized learning for very different target groups. Their paper's goal was to overcome the severe gap between their existing intellectual potentials and their often unsuccessful learning biographies in schools and universities. (Lenz et al. 2016). Temkar et al. 2016, wrote a paper that consists of some practical scenarios of about how I.O.T can be implemented for a better classroom experience and how teachers can focus on student's skills and which will help to save the time of both. (Temkar et al. 2016). Gligoric et al. 2015 during a research, focused on a smart classroom system that enables a lecturer to monitor the current level of interest of the audience is presented. The system is based on the Adaboost M1 machine learning algorithm using a training dataset collected from 20 lectures. They claimed that the average accuracy of the system evaluated for three different groups of students was 81.9%; indicating that there is still room for improvement, but that it can be the basis of a novel approach for detecting the level of interest a lecture creates in a classroom environment. (Gligoric et al. 2015). Uzelac et al. 2015, during a paper they claimed that they analyzed the impact of different parameters of the physical environment on students' focus. The research is based on the dataset collected from 14 recorded lectures. After performing additional series of trials they identified three parameters that could be removed from the original dataset without changing classifier's accuracy, which left us five uncorrelated parameters that have shown to have significant impact on students' focus.( Uzelac et al. 2015). Palma et al. 2014 during a paper presented a way in which each classroom control wsa accessed through Near Field Communication (NFC) and the information was shared via radio frequency. They claimed that their application collected information from the classroom to create a control classroom tool that displayed access to and the status of all the classrooms graphically and also connected this data with social networks. (Palma et al. 2014). Gomez et al. 2013, in a paper focusing on education, offered a system that allowed students to interact with physical objects that are virtually linked to a learning subject. They performed an empirical validation of their approach, and provided evidence that their model improved student learning outcomes. ( Gomez et al. 2013).

### *1.2. The importance of smart classes in the educational system*

Today's traditional approach to educational systems has lost its effectiveness. According to a study conducted by International Data Corporation, 212 billion "things" will be installed based on IoT with an estimated market value of $8.9 trillion by 2020(ZDNet, 2017). Hence, students and teachers are trying to use new technologies. The use of new technologies as well as the Internet of objects in classrooms created a new generation of classes that are called smart classes. Combining the IoT technology with social and behavioral analysis, an ordinary classroom can be trans-formed into a smart classroom that actively observes the activities, listens and analyzes voices, conversations, movements, behavior, etc., in order to reach a conclusion about the quality of a lecturers' presentation and of the level of listeners' satisfaction. (Gligorica et al., 2013). Smart classrooms are the amalgamation of technology used at the teachers desk and in front of the classroom, technology in the hands of the student and a physical environment that allows the successful use of that

technology. (Block et al., 2015). But with the addition of these technological tools, we do not necessarily have a smart class, but it can be said that a smart class has the necessary productivity and the effectiveness of these tools in the performance of teachers and students and the overall system process Educational. Effective educational classes should be interconnected in the education system, and the overall process of data class results should be data mining and detailed analysis.

## 2. Data mining of IOT system in smart classroom

The Internet of Things (IoT) and its relevant technologies can seamlessly integrate classical networks with networked instruments and devices. IoT has been playing an essential role ever since it appeared, which covers from traditional equipment to general household objects. (Jing et al., 2014).There is a great vision that all things can be easily controlled and monitored, can be identified automatically by other things, can communicate with each other through internet, and can even make decisions by themselves. (Tsai et al., 2014). In order to make IoT smarter, lots of analysis technologies are introduced into IoT; one of the most valuable technologies is data mining. Data mining involves discovering novel, interesting, and potentially useful patterns from large data sets and applying algorithms to the extraction of hidden information. (Chen et al., 2015). Many other terms are used for data mining, for example, knowledge discovery (mining) in databases (KDD), knowledge extraction, data/pattern analysis, data archeology, data dredging, and information harvesting.( Jiawei and Kamber, 2011). The objective of any data mining process is to build an efficient predictive or descriptive model of a large amount of data that not only best fits or explains it, but is also able to generalize to new data. (Mukhopadhyay et al., 2014). Data mining involves information analysis tools in order to discover valid and unknown patterns among a bunch of data. When we examine the information process of a smart class in general, it seems to be a better result, but when several smart classes equipped with the Internet of things, are interconnected and analyze the process of all of them, we get more results. We find that these results are far more helpless than small data mining, but each one is valuable in their own place. Even when we have all the campus equipped with the Internet of things and we start analyzing and data mining, different results are obtained. This applies to the entire educational system as well. So, it seems that data mining is the result of wisdom, and macro data mining brings massive results. In fact, data mining in the Internet of Things will show when its power is right enough to be the subject of the big data analysis. Big data is data sets that are so voluminous and complex that traditional data processing application software are inadequate to deal with them. Big data challenges include capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating and information privacy. There are three dimensions to big data known as Volume, Variety and Velocity. Lately, the term "big data" tends to refer to the use of predictive analytics, user behavior analytics, or certain other advanced data analytics methods that extract value from data, and seldom to a particular size of data set.( wikipedia) "There is little doubt that the quantities of data now available are indeed large, but that's not the most relevant characteristic of this new data ecosystem.( Boyd and Crawford, 2011).

Data mining shows significant progress in the type of analysis tools available, but it also has some limitations. One of these limitations is that, although it helps to reveal patterns and relationships, it does not provide information about the value or importance of them. The second limitation is that, in spite of the ability to identify relationships between behaviors or variables, it is not necessarily able to detect cause-and-effect relationships. The success of data mining depends on the use of technical experts and test analysts who have the ability to classify analyzes and change them. Technological abilities in data mining are important, but other factors, such as how to implement and monitor in intelligent classes and educational environments, may affect the outcome. One of these factors is the quality of data, which implies the accuracy and completeness of it. The second factor is the degree of compatibility of data mining software with databases provided by different companies. The third factor to be mentioned is to go beyond data mining and data mining for a purpose that has not been initially collected with this intention. Privacy is another factor that should be taken into consideration.

### *2.1. Security Risk in Educational center*

The era of Collaborative Internet of Things (C-IoT) is approaching wherein improvement of life quality will have a direct impact on business efficiency enhancement. (Pishva, 2017). When data collection and data mining from educational centers, such as smart classrooms, campuses, libraries, etc. are big enough, perhaps one of the most important concerns of individuals is how to secure data? Many tools are used in these centers. Smart boards, sensors, cameras, microphones, or even some students and teachers, want to connect their personal belongings, such as tablets and smartphones, to improve the learning process based on Internet to things.

As you know, on the Internet of things all devices are connected to the Internet. And anything connected to the Internet is at risk of penetration and hacking. One of the most important incidents in this case is Dyn cyberattack that took place on October 21, 2016, and involved multiple distributed denial-of-service attacks (DDoS attacks) targeting systems operated by Domain Name System (DNS) provider Dyn, which caused major Internet platforms and services to be unavailable to large swathes of users in Europe and North America. (Etherington et al., 2016).The groups Anonymous and New World Hackers claimed responsibility for the attack, but scant evidence was provided. (Romm et al., 2016). As a DNS provider, Dyn provides to end-users the service of mapping an Internet domain name—when, for instance, entered into a web browser—to its corresponding IP address. The distributed denial-of-service (DDoS) attack was accomplished through a large number of DNS lookup requests from tens of millions of IP addresses. (Newman and Hay, 2016). Activity is believed to be implemented through a botnet that includes a large number of Internet-connected devices, such as printers, IP cameras, residential gateways and baby monitors - infected with Mirai's malware. This indicates that a large network of devices of Internet of things was in danger of DDS attacks. The first large scale thingbot based attack was discovered by security researchers from Proofpoint in early 2014. It consisted of more than 750,000 phishing and spam emails which were launched from thingbot. The network contained more than 100,000 hacked IoT devices, ranging from smart TVs, refrigerators and other smart household appliances. (Cyber Defense Magazine, 2017).

There are a number of devices on the Internet of Things, some of which are weak in security. Many of them are also in the smart learning system, which makes them attractive for DDoS attacks. Therefore, it seems that we need to strengthen the hardware and software infrastructure when developing and creating the educational environments and connecting them to the Internet, reducing the risk of cybercrime attacks and increasing our network security. It

is therefore essential to consider security in their design process, development cycle and in the effective usage of their information systems. (Pishva, 2016).

### *2.2. Ethical considerations in smart classes*

One of the problems that we have seen in most of the papers we have seen so far today is that these papers either directly emphasized that students should not be aware of the sensors and the process of collecting information, or have passed the problem indifferently. Some papers have also given poor solutions. The reason for some of these papers is that once students know that they are controlled by sensors and their data is gathering and data mining, they may show less realistic behaviors. Temkar et al. 2016 claimed that from the sociological perspective, the students' unawareness of sensors presence is advised: the sensors can be located anywhere inside the classroom, but preferably not worn by the students. (Temkar et al., 2016). They also claimed that it is important not to affect the social interaction integrity of the students as they may not behave naturally when they are known that they are being observed. They thought an approach with less invasive sensors is mandatory. (Temkar et al., 2016). From a glance, this is probably true, but from another point of view, it's not professional in terms of ethics that we collect and then data mining information without informing people, On the other hand, the students of today's generation who are studying in smart classes are so knowledgeable about the mechanism of these classes, so it seems that this thinking is a rude and contrary to professional ethics because students know that Their information is under review, now whether these sensors are hidden, obviously, it does not differ in their performance. In principle, the following questions about data mining should be answered:

Who are the data mining providers to what extent are they allowed to use data?

Does the data be used in an unconventional framework?

Which privacy laws may apply to data mining? (wikipedia).

We have two suggestions for improving this problem that may be worth considering. First, we should at least inform the parents and legal guardians of the students, and the second is to give students confidence that the information is collected to improve the training process and data mining, and the particular person is not highlighted in this regard. When individuals are assured that a particular person is not highlighted and that information is generally and completely data-mining, the probability of fear decreases, and thus the likelihood of occurrence of actual behavior increases. Let me explain this with an example. One of the things that companies managing virtual networks on the Internet are collecting information from users, storing user information, data mining, and then using them to benefit the company. Many users know this, however, in which virtual networks themselves show real behaviors. For example, they put their real photos or write their real names and so on. Because they assume that the information of a person is not relevant to those companies, and the information is supposed to be comprehensive and comprehensive in data mining, and what the company does is data mining is the general information process. Perhaps the user's idea is wrong, but users rely on their beliefs in these social networks to behave normally. So it seems that when we are assured that smart class users are not supposed to highlight specific information or that that information is abused the likelihood of reducing fear and actual activity increases. Of course, doing these strategies differs depending on the culture of the people of each country.

## 3. Conclusion

This paper explores the effects of the Internet of Things on smart classes and the educational system. Initially, we paid attention to the importance of equipping the classes and the entire educational system with the Internet of things, and then we became familiar with the use of data mining in the Internet of things. It seems that the importance of data mining on the Internet of things is more in the general trend analysis, especially in big data. Therefore, the higher relationship between the components of the educational system and the more general data mining can more help the planning of the educational systems. In fact, micro data mining contributes to micro-planning, and large-scale data mining contributes to large-scale planning. In the next section, we proposed to strengthen the hardware and software infrastructure, to ensure the security of the Internet of things' network and to prevent cybercrime attacks such as DDoS. In the last section, we also addressed the ethical considerations within the smart education system and suggested that students and audiences should not be involved in the process of collecting information by sensors and other objects on the Internet of things, and to ensure that they do not abuse their information and care about them carefully. We would like to say that this information is intended to improve the educational process of the data mining, and that most of the general data process is important and that no specific information is considered. At last the probability of occurrence of real behaviors among people increases, and professional ethics is also observed.

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