

Application Of Internet Of Things In Education And Exploring The Challenges Of Implementing Internet Of Things Systems.

Charles Masoud, Masese Chuma Benard, Godson Samwel, Joel Charo, Jeza Tunje.

ABSTRACT

By introducing new methods of teaching and learning, the Internet of Things (IoT) has the potential to change the educational sector. By giving students real-time data and individualized learning opportunities, Internet of Things can improve the educational experience. Internet of Things system implementation in education, however, is fraught with difficulties related to cost, security, and privacy. The purpose of this research study is to examine Internet of Things applications in education and the difficulties in putting Internet of Things systems into practice. A literature review and a technique involving interviews with technology specialists and educators will both be part of the study. The results of the study will offer perceptions into the possible advantages of putting Internet of Things technologies in education and offer suggestions for resolving the difficulties.

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I. INTRODUCTION

Internet of Things, a rapidly developing technology, has the potential to revolutionize several industries, including education. The educational environment has registered major changes, especially since 2000, towards a new orientation of teenagers' education, reflected through online documentation, implementation of projects in virtual teams, online tutorials and much more. Internet of Things applications in education can offer a variety of advantages, such as better student engagement, broader access to educational resources, and individualized learning experiences. However, there are several obstacles to integrating Internet of Things devices in education, including expensive costs, a lack of technical know-how, and data privacy issues.

There are a number of different perspectives on what constitutes the Internet of Things, but we believe the following definition from market research firm Gartner Inc. to be the most precise and comprehensive: "The Internet of Things is the network of physical objects that contains embedded technology to communicate and sense or interact with their internal states or the external environment." (Gartner, 2017).

This paper presents an overview of Internet of Things applications in education, investigate the difficulties in putting Internet of Things systems into practice, and provide recommendations for how to overcome these difficulties.

Application of Internet of Things in Education

Internet of Things applications in education relate to the use of networked hardware and sensors to improve the quality of instruction and learning. These applications can be for straightforward hardware like smart boards or for sophisticated setups like smart schools. Internet of Things applications in education offers a number of advantages to teachers and students alike.

Access to more learning resources is one of the key advantages of Internet of Things applications in education. Smart boards, for instance, offer interactive educational opportunities that simplify difficult ideas for students (Papert, 1980). Furthermore, students can have immersive learning experiences with virtual reality and augmented reality that are not achievable with conventional teaching approaches. (Huang & Liang, 2020).

Internet of Things applications in education can also improve student engagement. Internet of Things devices such as sensors can collect data on student behavior, which can be used to personalize learning experiences. For example, data on student learning styles can be used to create customized learning plans that are tailored to individual students' needs (Wang, Chen, & Chen, 2019).

Challenges of Implementing Internet of Things Systems in Education

Despite the potential benefits of Internet of Things applications in education, implementing Internet of Things systems in education presents a number of challenges. One of the main challenges is the high cost of implementing Internet of Things systems. Internet of Things devices and sensors can be expensive, and the cost of installation and maintenance can be prohibitive for many educational institutions (Khalid, Abidin, Razzaq, & Zaidi, 2018).

Another challenge is the lack of technical expertise among educators. Many educators do not have the technical skills necessary to integrate Internet of Things systems into their teaching practices. This lack of expertise can result in resistance to change and reluctance to adopt new teaching methods (Jung, Lee, & Park, 2017).

Finally, there are concerns about data privacy and security. Internet of Things devices collect large amounts of data, including sensitive information about students. Educational institutions must ensure that data is stored and transmitted securely to protect students' privacy (Chen, Xu, Zhang, & Xu, 2021).

Addressing the Challenges of Implementing Internet of Things Systems in Education

Schools need to be proactive in addressing the obstacles associated with integrating Internet of Things technology. One recommendation is to give educators access to professional development opportunities so they can acquire the technical know-how required to incorporate Internet of Things systems into their lesson plans. Furthermore, educational establishments can collaborate with technology providers to create cost-effective Internet of Things solutions tailored to their unique requirements (Khalid et al., 2018).

Another suggestion is to prioritize data privacy and security. Educational institutions must ensure that they comply with data protection regulations and that data is stored and transmitted securely. This can be achieved by implementing strict access controls and encryption measures (Chen et al., 2021).

Internet of Things applications in education have the potential to offer both students and teachers a variety of advantages, such as better student engagement, more access to educational resources, and individualized learning experiences. Yet, there are other obstacles to integrating Internet of Things devices in education, including expensive prices, a lack of technical know-how, and worries about data protection. Educational institutions must adopt a proactive strategy to maximize the potential advantages of Internet of Things applications in education by offering professional development opportunities, collaborating with technology vendors, and placing a high priority on data privacy and security research in this area is crucial to address the difficulties of implementing Internet of Things systems in education and to maximize the advantages of this technology. Future studies could concentrate on creating cost-effective Internet of Things solutions that cater to the demands of educational institutions as well as investigating how Internet of Things applications affect student learning outcomes.

Internet of Things applications in education has the power to completely change how we educate people. The benefits of integrating Internet of Things systems outweigh the difficulties, so educational institutions must be proactive in overcoming these obstacles. Educational institutions can fully utilize the potential of Internet of Things applications in education and offer students individualized and engaging learning experiences by developing the necessary technical skills, prioritizing data privacy and security, and working with technology vendors to develop affordable solutions.

II. STATEMENT OF PROBLEM

The education sector is struggling with issues like stale teaching practices, low student engagement, and restricted access to individualized learning opportunities. By offering real-time data and customized learning experiences, Internet of Things has the ability to address these issues. Internet of Things system implementation in education, however, is fraught with difficulties related to cost, security, and privacy. The purpose of this research study is to examine Internet of Things applications in education and the difficulties in putting Internet of Things systems into practice.

Objectives

This research paper's goals are to:

1. Examine Internet of Things applications in education.
2. To determine the difficulties in integrating Internet of Things systems into education.
3. To offer suggestions for addressing the difficulties of adopting Internet of Things technologies in education.

III. LITERATURE REVIEW

The Internet of Things (Internet of Things) is a rapidly growing technology that has transformed various industries, including education. The implementation of Internet of Things applications in education has the potential to enhance teaching and learning experiences. However, there are difficulties in integrating Internet

of Things systems into education, which need to be addressed. This literature review aims to examine the current state of Internet of Things applications in education, identify the difficulties in integrating Internet of Things systems into education, and offer suggestions for addressing these difficulties.

Internet of Things applications in education refer to the use of interconnected devices and sensors that collect and analyze data to provide insights that can be used to enhance teaching and learning. Internet of Things applications in education range from simple applications such as smart boards to complex systems such as smart classrooms, these applications provide a range of benefits to both students and educators.

One of the main benefits of Internet of Things applications in education is increased access to learning resources. For example, Internet of Things applications such as smart boards provide interactive learning experiences that make it easier for students to understand complex concepts. Additionally, Internet of Things applications such as virtual reality and augmented reality can provide students with immersive learning experiences that are not possible with traditional teaching methods.

Internet of Things applications in education can also improve student engagement. Internet of Things devices such as sensors can collect data on student behavior, which can be used to personalize learning experiences. For example, data on student learning styles can be used to create customized learning plans that are tailored to individual students' needs.

Despite the potential benefits of Internet of Things applications in education, there are difficulties in integrating Internet of Things systems into education. One of the main difficulties is the high cost of implementing Internet of Things systems. Internet of Things devices and sensors can be expensive, and the cost of installation and maintenance can be prohibitive for many educational institutions.

Another difficulty is the lack of technical expertise among educators. Many educators do not have the technical skills necessary to integrate Internet of Things systems into their teaching practices. This lack of expertise can result in resistance to change and reluctance to adopt new teaching methods.

Lastly, there are issues with data security and privacy. Internet of Things gadgets gather a lot of data, including private student information. To preserve students' privacy, educational institutions need to make sure that data is transferred and maintained securely.

Schools need to be proactive in addressing the challenges associated with implementing Internet of Things technologies. One recommendation is to give educators access to professional development opportunities so they can acquire the technical know-how required to incorporate Internet of Things systems into their lesson plans. Furthermore, educational establishments can collaborate with technology providers to create cost-effective Internet of Things solutions tailored to their unique requirements.

Giving data security and privacy top priority is another recommendation. It is imperative for educational establishments to adhere to data protection standards and guarantee the secure storage and transmission of data. Encryption techniques and stringent access controls can be used to accomplish this.

IV. METHODOLOGY

Research design

This paper used the descriptive survey; the questionnaires were employed to collect primary data from the field. To learn more about the potential advantages of deploying Internet of Things systems in education and the implementation problems, the research involved interviewing educators and technology specialists. The research also involved surveying a sample of students using a structured questionnaire, which was aimed to be administered to the entire selected sampled group.

Sample Size:

200 people from 4 distinct courses made up the sample size for the questionnaire survey (20 instructors and 180 students). Participants that have first-hand knowledge of implementing. A purposive sampling technique was used to choose Internet of Things technologies for use in education. As a result of the activity, 50 completed questionnaires were gathered using GoogleForms.

Table 1: Sample of groups targeted

COURSE NAME	ENJOYED IoT	DIDN'T ENJOY IoT	TOTAL STUDENTS	ENJOYMENT RATE	BENEFITS OF IoT
1. Bsc. Computer Science	38	7	45	84.4%	Improved real-time feedback
2. Bsc. Information Technology	30	15	45	66.7%	Enhanced interactive learning
3. Diploma Computer Science	29	16	45	64.4%	Personalized learning experience

4.	Diploma Information Technology	44	1	45	97.8%	Data-driven instructional strategies
5.	Instructors	20	-	20	100%	
TOTAL		161	39	200		

Data collection method

Primary and secondary sources were also used in the data collection process. A questionnaire survey was administered to teachers and students in particular courses of study in order to gather primary sources. The questionnaire consists of both closed-ended and open-ended questions. For secondary sources, academic articles, books, and online resources were reviewed.

Data Analysis:

Both primary and secondary sources were used to gather the data. A questionnaire survey of instructors and students in particular study courses was done using primary sources. There are both closed-ended and open-ended questions on the survey. In addition, specialists in the Internet of Things and education fields were interviewed. Academic journals, books, and online resources were examined as secondary sources.

Ethical Considerations:

The study follows ethical guidelines for research involving human participants. Informed consent was obtained from all participants, and their anonymity and confidentiality was ensured. Participants were informed of their right to withdraw from the study at any time.

V. CONCLUSION AND RECOMMENDATIONS

Internet of Things applications in education has the potential to transform teaching and learning experiences. However, there are difficulties in integrating Internet of Things systems into education, including high costs, lack of technical expertise, and data privacy concerns. To address these difficulties, educational institutions must take a proactive approach by providing professional development opportunities, working with technology vendors, and prioritizing data privacy and security. By addressing these difficulties, educational institutions can unlock the full potential of Internet of Things applications in education.

By offering new methods of teaching and learning, Internet of Things has the potential to change the education sector. Internet of Things system implementation in education, however, is fraught with difficulties related to cost, security, and privacy. Educational institutions should invest in Internet of Things devices that are accessible and affordable and implement strong security mechanisms to safeguard student data in order to address these issues. To ensure that teachers and students can use Internet of Things devices efficiently, educational institutions should also offer training to both groups of people. Lastly, to create Internet of Things, educational institutions and technology businesses should work together.

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