Internet of Things (IoT) application in the assessment of learning process

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Abstract. The spread of Coronavirus has changed the common life of students over the world. As a result of following international guidelines, all educational institutions are required to work remotely to reduce the contagion of the spread of Coronavirus. Web-based technologies and the Internet have become popular platforms for developing and introducing distance learning programs in the online classroom. Therefore, an application designed specifically to support e-Learning effectiveness named E-Learning Motivation Systems (E-LMS) changes in the teaching-learning process, monitoring and tracking of student performance. This article aims to identify and propose a low-cost, effective and flexible platform. This platform is designed to monitoring preliminary data on student access to, and participation in, virtual classroom environments and activities. In an initial case study conducted at the electrical engineering department at Wasit University. According to the evaluation results, E-LMS Motivation is an effective support tool for educators in pedagogical monitoring and student performance analysis, significantly contributing to improved student retention and promotion rates.

Keywords: Raspberry Pi, e-learning, Internet of things (IoT), an education platform

1. Introduction
Education is one of the most perceptible human activities affected by the Internet[1-3]. Distance education (DE) is being presented as a solution to meet the new educational demands arising from globalization, which is not only an economic phenomenon but also a transformation of space and time. The availability of technological resources alleviates the difficulties associated with the physical distance between students and teachers by allowing the creation of a virtual environment that promotes collaborative learning. As a result of the wide access to the Internet, online education enables professionals and students to study from a distance and keep contacting with the newest technologies and administrative changes[4-6]. E-learning has developed as one of the best moving trends in advanced learning, especially at present after the emergence of the Corona virus[7, 8]. Where now electronic teaching is taking place, in addition to providing thousands of training, technical and administrative courses, as well as degree and certificate programs by universities, professional development centers, and industrial training facilities all over the world[9, 10]. Smart learning is one of the main elements in the implementation of smart cities, and it is activated using virtual learning and digitalization[11-15]. This classification has led to many investigations by researchers. The Internet and Web-based technologies became a popular platform for developing and delivering distance learning (DL) programs in an online class setting in 2000. The E-LMS Motivation is viewed in this context as a method for monitoring students' success in the E-LMS Moodle[16, 17]. The aim is to help teachers, staff, and advisors with the role of advising students. Keeping track of distance learning students' progress. For this reason, Validation of the E-LMS Motivation program and student data.
2. Background about Internet of Things (IoT)

It mentions to networking technical innovations that allow real-world objects to join with one another by the internet. The devices that are linked are referred to as 'things'[13, 18-23]. The ability to send and receive information through the interconnection of various things via the internet has numerous applications in almost every field, including healthcare, business, transportation, agriculture, management, and education [24, 25]. These technologies provide a variety of e-learning technologies that can change the future of education systems[26]. The (IoT) in general, as well as some of its applications, will be discussed in this paper, with an emphasis on E-learning. Therefore, researchers Luvai Motiwalla and Steven Tello created a Web-based course model and analysed the results of an exploratory study to see how effective it was at increasing student satisfaction. The outcomes of their surveys presented that students were mostly gratified with the virtual education situation and demonstrated their appreciation for the suppleness of being able to access the course materials anytime and anywhere, and they were satisfied with the quality and content of the course[27]. Both researchers, Keenan A. Pituch and Yao-Kuei Lee (in 2006) suggested and tested alternative models aimed at explaining the student's intention to use the e-learning organization when using the system as a auxiliary educational tool within the traditional classroom or an independent method of distance education. The determinants of the established technology acceptance model, as well as the system and participant characteristics mentioned in the research literature, were incorporated into these models. Data were collected by 259 university students, to calculate the stage of presentation and use of the e-learning system. Structural equation modeling provided better support for a model that assumed stronger effects of system properties on the use of an e-learning system, in addition to discussing the implications for both researchers and practitioners[28]. In 2009, many universities were applying e-learning for various reasons. Based primarily on the technology acceptance model, Sung Youl Park proposed a comprehensive analytical foundation for university students' acceptance and intention to use e-learning (TAM). Huge enquiry efforts were devoted to developing e-learning systems, and several e-learning systems were suggested and used in practice, but the completion rate of e-learning was low in these systems at that time. Therefore, the author Masafumi Yamada et al in 2016 designed and tested Internet-based e-learning to improve the performance of the system by the researcher. Their proposed system can motivate the learner by using the smart implemented box, microwave sensor, and decision tree[29]. Some researcher indicated that the current semester's teaching absences exploration of students' information, which is incapable of evaluating students' mastery of knowledge points and locating students' learning paths in real-time, as well as effectively recommending the necessary achieve material for students. So, they proposed a personal familiarity point endorsement system based on the course data chart to solve these problems[30, 31]. Using their proposed system, they can first create evaluation equations to judge students' mastery of knowledge points, by using accuracy, response time, and answer types in the answer records. Secondly, they can extract the knowledge points in answer records and map them into the course knowledge graph. Finally, they can recommend knowledge points assigned to students using the semantic ordered association and the knowledge point sequence in the knowledge graph [18]. In this article, the focus was on the possibility of motivating students to pursue their studies by proposing a platform to monitor their school bikes and their daily attendance by the student himself and his parent. Where the teachers register this data on the platform on Raspberry Pi to be displayed to students and parents.

3. Proposed work

This paper proposes an easy, simple, and reliable online method for monitoring the student’s study status by the student himself and his parent. The E-LMS Motivation tool was created as a Moodle E-LMS plugin, and it looks like a block with options inserted in a virtual space. This is done by designing and implementing an educational platform in which the student’s academic grades and daily attendance are written by the responsible teacher. This platform is built on the server is the Raspberry Pi shown in figure (1)
The Raspberry Pi: It's a tiny computer board with a CPU, GPU, USB ports, Wi-Fi, Bluetooth, and a set of GPIO (general purpose input/output) pins for controlling electronic components for physical computing and experimenting with the Internet of Things (IoT). The server (Raspberry Pi) is built using the things board application. Thingsboard is an open-source Internet of things (IoT) platform that enables rapid development, management, and expansion of IoT projects. Figure (2) illustrates the E-LMS Motivation consists of the following process worked on this online platform.

**Figure 1.** The Raspberry Pi 3.

**Figure 2.** A flowchart of how the proposed E-LMS motivation platform would work.
4. Results and Discussion

For this project, the design of the E-LMS Motivation was defined. The tool aims to collect and track students’ performance to provide a visual overview of the relationship between the interaction and the student’s performance on the E-LMS, assisting professors or tutors in tracking distance learning students’ performance. Eight accredited subjects were selected that were taught in the electrical engineering department at Wasit University and 20 students per professor. A special interface has been created for each professor and student, to be accessed via email and a special password for each one. Figure (3) shows the private e-mail addresses and initial passwords for each professor and student.

![Figure 3. private e-mail addresses.](image)

When opening his destination, the teacher can enter the grades of the subject for which he is responsible. Figure (4) shows the interface for the teacher of the control system, where the name of the subject was written on the upper left side of the interface for each professor.

![Figure 4. the private interface for each teacher.](image)

As for the student’s interface, his academic results that were recorded by the responsible teacher are displayed, as in Figure (5).
In Figure (5), the interface of each student is divided into two halves. The upper half shows the last grade obtained by the student in each lesson in the form of a graph, while the lower half shows the student’s academic results with the date on which the exam was taken. Once the student’s guardian obtains the student’s e-mail and password, he can see the student’s academic level.

5. Conclusion
The Internet of Things (IoT) will grow at a breakneck pace, bringing massive advances in every field with it. When it comes to learning, IoT will carry E-learning to the next level. We can use this to our advantage. IoT’s ability to incorporate smart learning, a setting that encourages better learning and increased productivity. Retention rates are important. This innovation in education is significant to develop better people in terms of abilities and knowledge understanding. Distance learning depends on the Internet, so information and communication technologies are used in the e-learning process. E-learning permits students to achieve their classes over a computer network by merging teaching theory and computer network skills. In this study, it was proposed to design an electronic platform in which students’ test scores are recorded, as well as their daily attendance by the faculty responsible for them. Where it can clarify the possibility of providing a link between the student and his guardian via the Internet. As a result, parents can play a fundamental role in learning practices by stimulating and improving the student’s state of study after monitoring their academic level remotely using a mobile phone, laptop, etc.

References

[1] Faiola A and Matei S A J J o c-m c 2005 Cultural cognitive style and web design: Beyond a behavioral inquiry into computer-mediated communication 11 375-94
[2] Chen S-Y and Fu Y-C J A 2009 Internet use and academic achievement: Gender differences in early adolescence 44
[3] Kranz M, Roalter L and Michahelles F 2010 Things that twitter: social networks and the internet of things. In: What can the Internet of Things do for the Citizen (CloT) Workshop at The Eighth International Conference on Pervasive Computing (Pervasive 2010), pp 1-10
[4] Childs S, Blenkinsopp E, Hall A, Walton G J H I and Journal L 2005 Effective e-learning for health professionals and students—barriers and their solutions. A systematic review of the literature—findings from the HeXL project 22 20-32
[5] Bates A W and Bates T 2005 Technology, e-learning and distance education: Psychology Press)
[6] Desai M S, Hart J and Richards T C J E 2008 E-learning: Paradigm shift in education 129
[7] Mohmmed A O, Khidhir B A, Nazeer A and Vijayan V J J I I S 2020 Emergency remote teaching during Coronavirus pandemic: the current trend and future directive at Middle East College Oman 5 1-11
[8] Ban Hassan Majeed L F J, Haider Th.Salim Alrikabi 2021 Tactical Thinking and its Relationship with Solving Mathematical Problems Among Mathematics Department Students International Journal of Emerging Technologies in Learning (iJET) 16
[9] Rhema A, Miliszewska I J I i I S and Technology I 2010 Towards e-learning in higher education in Libya 7 423-37
[10] Duha Khalid Abdul-Rahman Al-Malah H H K J, Haider Th. Salim ALRikabi 2020 Enhancement of educational services by using the internet of things applications for talent and intelligent schools Periodicals of Engineering and Natural Sciences (PEN) 8 2358-66
[11] Chamoso P, González-Briones A, Rodriguez S, Corchado J M J W C and Computing M 2018 Tendencies of technologies and platforms in smart cities: a state-of-the-art review 2018
[12] Duha Khalid Abdul-Rahman Al-Malah I A A, Haider Th Salim Alrikabi,and Hussain Ali Muter 2021 Cloud Computing and its Impact on Online Education IOP Conference Series: Materials Science and Engineering 1094 012024
[13] Zubaidi S L, Abdulkareem I H, Hashim K S, Al-Bugharbee H, Ridha H M, Gharghan S K, Al-Qaim F F, Muradov M, Kot P and Al-Khaddar R J W 2020 Hybridised Artificial Neural Network Model with Slime Mould Algorithm: A Novel Methodology for Prediction of Stochastic Water Demand 12 2692
[14] Zubaidi S L, Al-Bugharbee H, Muhsin Y R, Hashim K and Alkhaddar R 2020 Forecasting of monthly stochastic signal of urban water demand: Baghdad as a case study. In: IOP Conference Series: Materials Science and Engineering: IOP Publishing) p 012018
[15] Alaidi A, Yahya O and Alrikabi H 2020 Using Modern Education Technique in Wasit University International Journal of Interactive Mobile Technologies 14 82-94
[16] Alaidi A H M, Yahya O H and AlRikabi H T S 2020 Using modern education technique in Wasit university International Journal of Interactive Mobile Technologies 14 82-94
[17] Shaame A A 2020 Effectiveness of Moodle learning management system for fostering teaching and learning mathematics in secondary schools in Zanzibar. The University of Dodoma)
[18] Madakam S, Lake V, Lake V, Lake V J J o C and Communications 2015 Internet of Things (IoT): A literature review 3 164
[19] Alselawi N S, Adnan E K, Hazim H T, Alrikabi H T S and Nasser K W 2020 Design and implementation of an e-learning platform using N-tier architecture International Journal of Interactive Mobile Technologies 14 171-84
[20] Kahrilas G A, Wally L M, Fredrick S J, Hiskey M, Prieto A L, Owens J E J A S C and Engineering 2014 Microwave-assisted green synthesis of silver nanoparticles using orange peel extract 2 367-76
[21] Al-dabag M, ALRikabi H S and Al-Nima R 2021 Anticipating Atrial Fibrillation Signal Using Efficient Algorithm International Journal of Online and Biomedical Engineering (iJOE) 17 106-20
[22] Mohammed B K, Mortatha M B, Abdalrada A S, ALRikabi H T S J P o E and Sciences N 2021 A comprehensive system for detection of flammable and toxic gases using IoT 9 702-11
[23] Naseer Ali Hussien A A D A, Haider Th.Salim Alrikabi, Faisal Theyab Abed 2021 Monitoring the Consumption of Electrical Energy Based on the Internet of Things Applications International Journal of Interactive Mobile Technologies (iJIM) 15
[24] AjazMoharkan Z, Choudhury T, Gupta S C and Raj G 2017 Internet of Things and its applications in E-learning. In: 2017 3rd International Conference on Computational Intelligence & Communication Technology (CICT): IEEE) pp 1-5
[25] Duha Khalid Abdul-Rahman Al-Malah S I H, Haider TH. Salim ALRikabi 2020 The Interactive Role Using the Mozabook Digital Education Application and its Effect on
Enhancing the Performance of eLearning *International Journal of Emerging Technologies in Learning (iJET)* 15 21-41

[26] Rihab Salah Khairy A S H, Haider TH. Salim ALRikabi2 2021 The Detection of Counterfeit Banknotes Using Ensemble Learning Techniques of AdaBoost and Voting *International Journal of Intelligent Engineering and Systems* 14 326-39

[27] Motiwalla L, Tello S J T i and education h 2000 Distance learning on the Internet: An exploratory study 2 253-64

[28] Pituch K A, Lee Y-k J C and Education 2006 The influence of system characteristics on e-learning use 47 222-44

[29] Yamada M, Oda T, Matsuo K and Barolli L 2016 Design of an IoT-based e-learning testbed. In: 2016 30th International Conference on Advanced Information Networking and Applications Workshops (WAINA); IEEE pp 720-4

[30] Woolf B P 2010 *Building intelligent interactive tutors: Student-centered strategies for revolutionizing e-learning*: Morgan Kaufmann)

[31] Schumacher C, Ifenthaler D J T I and Education H 2021 Investigating prompts for supporting students' self-regulation–A remaining challenge for learning analytics approaches? 49 100791