Adoption of Augmented Reality To Enhance Durban University of Technology's Learning Management System

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2022 International Conference on Engineering and Emerging Technologies (ICEET) | 978-1-6654-9106-8/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICEET56468.2022.10007142

***Abstract*—The Durban University of Technology's (DUT) e-learning system is used as a case study in the research as it investigates the various learning management systems in higher education. due to the expanding technological trends and the requirement to support students who belong to "Generation Z." This study examines how augmented reality can be used to transform the DUT E-learning system from a three-standalone system into a unified system. The study illustrates how the Business Analysis Core Concept Model, a conceptual framework for business analysis, would be employed to analyze the proposed augmented reality system and the current DUT e-learning model. Additionally, the use cases of the three standalone platforms that make up the current DUT E-learning are contrasted with a single augmented reality E-learning system.**

Keywords— Augmented reality, BACCM, E-learning, Learning management system

I. INTRODUCTION

In today's technology-driven society, the combination of education and the internet has created numerous options for students all over the world to develop new learning abilities, known as E-learning [1]. When compared to conventional methods of teaching and learning in organizations, the requirement for E-learning has shown to be crucial as knowledge is digitally changed. Many measures were made to tackle the severe impacts of the virus on economic events during the outbreak of the Covid-19 pandemic, which impacted education and the economy of many nations throughout the world. As a result, the postsecondary education sector has received less attention.

With the outbreak of Covid-19, this change has impacted the quality of education, as E-learning was immediately adopted in the educational environment and there was no time to adapt and organize new digitized teaching methods. Affected. Instructors and students were affected. Others are more adaptable than others who have better access to the tools needed for such learning [2]. According to Williams et al. in [3], with the rapid transition of pandemics to E-learning, many college students lack computer skills and lack computer labs, etc., to engage in an E-learning environment. There are technical issues, and certain students with (physical) disabilities do not have access to enough technical support to suit their needs. Though there are various obstacles connected with E-learning, the biggest issue affecting students is the inability of existing E-learning platforms to give practical experiences for students to embark on and improve the learning experience [4]. This has an impact on students' ability to participate in the E-learning experience and environment, restricting their potential, motivation, and excitement for learning.

To address accessibility issues for all students, many techniques and solutions have been developed and implemented. These include making systems like Moodle, VR/AR environments, and Blackboard available to all students to give the essential technical skills and information on how to use E-learning. Accessible computer laboratories with adequate material for studying and working using digital information, as well as training on various technical skills. The Covid-19 pandemic outbreak boosted E-learning reliance and made it more important for schools, colleges, and institutions. This means that additional strategies or procedures must be investigated and adopted topically to boost the accessibility of students learning online. This entails adjusting to ML (machine learning) and DL (deep learning) AI-based systems to improve the online learning experience while maintaining the same degree of engagement in hypothetical and, most importantly, practical work. This paper proposes the adoption of Augmented Reality (AR) natural frameworks to address E-failure figuring out how to give a common-sense contribution to all understudies to apply hypothetical information to genuine circumstances, as well as the comfort of utilizing a solitary stage, during the internet opportunity for growth.

II. RELATED WORKS

This study aims to assess current developments to demonstrate that there is still work to be done in terms of utilizing E-learning advances. Higher learning institutions have to undertake a quick shift from on-site to virtual classrooms in the context of COVID-19 However, articles dating back to the early 2000s document learning, the development and transition of E-learning, demonstrating its forecast potential. The present DUT E-learning system will

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be used as a reference for this study and throughout the paper.

Many LMS (Learning Management Systems) have been adopted in recent years with the potential of promoting and improving students' online learning experiences [5]. The Blackboard Learning System is the leading e-learning system introduced in recent years, with mentors tracking progress measured through student communication (online), publication use, course problem management, and flexible access [6].

In a study conducted by [7], Blackboard is a virtual web-based learning environment and learning management system developed by Blackboard Inc. Despite all the online features of the innovative pedagogy offered by the Blackboard system, this study found that the Blackboard software platform could not understand mathematical formulas and equations, mainly using the system in mathematics and physics. It shows that it is limited to the faculties that handle it. Providing a practical teaching method becomes incompetent. Other limitations of the system are its difficulty in use, and lack of flexibility compared to other forms of E-learning, especially when combined with tools that provide security for can systems, which are time consuming to use and costly to implement. The fact that it can take. This means that it can affect the quality of student learning in an E-learning environment.

Moodle (Modular Object-Oriented Dynamic Learning Environment) is another Learning Management System designed to help students overcome the limitations of E-learning. However, Moodle does not allow students to work or complete their activities and courses offline [8]. This brought about virtual systems like Google Classroom, Microsoft Teams, and TalentLMS, which gave online connection among instructors and understudies, upgrading the E-growth opportunity; notwithstanding, these web-based frameworks share typical downsides, for example, failing during blackouts, downloading recordings is hampered because of unfortunate sign, and on the off chance that the speaker video is excessively lengthy, it is hard to download, influencing the availability of the planned administrations of the internet learning framework.

Regardless of these current frameworks being effective at connecting with students in advanced education hypothetical work and studies, they miss the mark concerning practical work that is relevant to their hypothetical studies. Beyond traditional learning methods, E-Learning strives to give 21st-century skills, critical thinking, creativity, teamwork, and communication [9]. In principle, E-learning enables students to acquire the necessary content and maintain the necessary skills and knowledge to use on online platforms and systems developed by institutions, whether for lockdowns or remote learning [10]. Even though there are several platforms with distinct learning characteristics to use, not all digital technologies are being used effectively to provide excellent learning experiences for students [11, 12].

Moodle, Microsoft Teams (MS Teams), and Self Help iEnabler are the three platforms that compose the present DUT E-learning system (ITS). Each platform functions as a granary, however, they are occasionally weakly connected, requiring students and lecturers to log in separately. Despite its shortcomings, it provides several tools for lecturers and students to employ. However, providing a ubiquitously available system through the accessibility of all devices, including the use of device internal features for AR [13] and making expansions in the framework to get to learning, for example, re-appropriating and leasing essentially VR headsets, guiding students to online resources, video-sharing stages and coordinated effort stages, across the board spot or framework to expand learning and showing experience [14].

The elements of employing AR/VR to encourage involvement were highlighted in publications. One study looks into the necessity for VR in medical studies, intending to give online medical students a "hands-on" experience [15]. Other articles [13, 16] employ a combination of AR and VR for realistic learning and reflective work as a method to recall what was learnt. AR is useful in STEM subjects because it makes use of mobile devices' applications, sensors, and hardware functionalities as measurement and data collecting tools Furthermore, VR technologies encourage students to be creative, which allows them to pursue other academic interests. In terms of E-Learning platforms, VR has certain limitations, including restricted mobility, the need for a specialized learning environment, and worries about online privacy [17].

Studies have given insight into the real-time collaboration capabilities of web platforms. This increases student engagement when they use video-sharing and voice-over platforms such as MS Teams, Zoom, and Discord, as well as interactive platforms and makerspaces dealing with 3D modelling, diagrams and drawings, planning, simulations in programming, electronics, and physics, which come with their communities, such as GitHub, Altium, Blender, Visual Studio, OneNote, Miro, and Trello [12, 16]. These improve the learning process and allow lecturers to provide explanations for students or student groups who are confused [9]. Consequently, socialization within AR rooms gives a virtual collaborative area for students to interact with other students, which may help to reduce the contact lost among students as a result of Covid-19

III. Methodology

With features that are rarely used, the present system consists of three different platforms. Integration and configuration are an ideal strategy to collect the best components and additional collaboration tools for each platform, combine them into one system, and inherit core and key functionality from each platform. Furthermore, productivity and engagement in the existing virtual classroom might be monotonous and quickly replaced by more interesting interactive platforms. The adopted business analysis framework can provide are the essential adjustments for students to interact and receive the lessons learned, while also delivering features that can be accessed and used to their maximum potential. The Business Analysis Core Concept Model (BACCM) approach was used to address the gap between the existing DUT learning management system and what was found in the literature analysis. BACCM is a conceptual framework for business analysis, according to the Business Analysis Body of Knowledge Guide [18].

A. Change

Making the use of existing digital technology to enhance E-learning. This gives students additional possibilities to improve their creativity, teamwork, and critical thinking

abilities by giving them access to tools and platforms that will help them study better.

B. Need

The current system is divided into three apps, which might be inconvenient for students and professors. Furthermore, students and lecturers must use tools and platforms outside of the system to perform work and monitor, which necessitates signing up and coordinating to keep the class together rather than spreading out. Furthermore, there is a shortage of practical studies as a result of multi-modal learning, which results in students having largely hypothetical information but not understanding how to apply it.

C. Solution

Given the potential of many apps and platforms, as well as the necessity to offer ease so that students and lecturers do not have to sign into several platforms, the solution is a complement system. A proposed solution in which the previous three systems, are combined into a single application, that serves as the foundation that is reinforced with extensions from various platforms and apps that serve as features for collaboration spaces and AR application spaces.

D. Stakeholder

The stakeholders are the persons who will be involved in the new system's development process. Gaining comments and recommendations builds trust and allows the development's conclusion to be adjusted to stakeholder expectations, which is like design thinking. Students (users), lecturers (users), and administrators are all involved.

E. Value

The tangible would be a rise in attendance, system use, and student grades, which might raise the university's rating. The intangible would be increasingly critical skill acquisition, innovation, creativity, teamwork, and communication.

F. Context

The setting for this proposed change may be to gain by and coordinate computerized innovation to advance E-learning and give greater openness for understudies to have a superior opportunity for growth that incorporates both functional and hypothetical learning. This proposed change may be to gain by and coordinate computerized innovation to advance E-learning and give greater openness for understudies to have a superior growth opportunity that incorporates both practical and hypothetical learning.

IV. Analysis

The DUT learning management system comprises three standalone systems which are Moodle, Microsoft Teams and DUT Self Help iEnabler. Figure 1 displays DUT's Moodle LMS, which allows instructors to produce online coursework, provide exams, and track a student's progress. Students may use Moodle to obtain course materials, submit assignments, take exams, and evaluate test results. Lecturers may access their course modules and post-class content, as well as add assignment submissions and class examinations. Moodle needs users to input their credentials to validate the user before gaining access to the system.

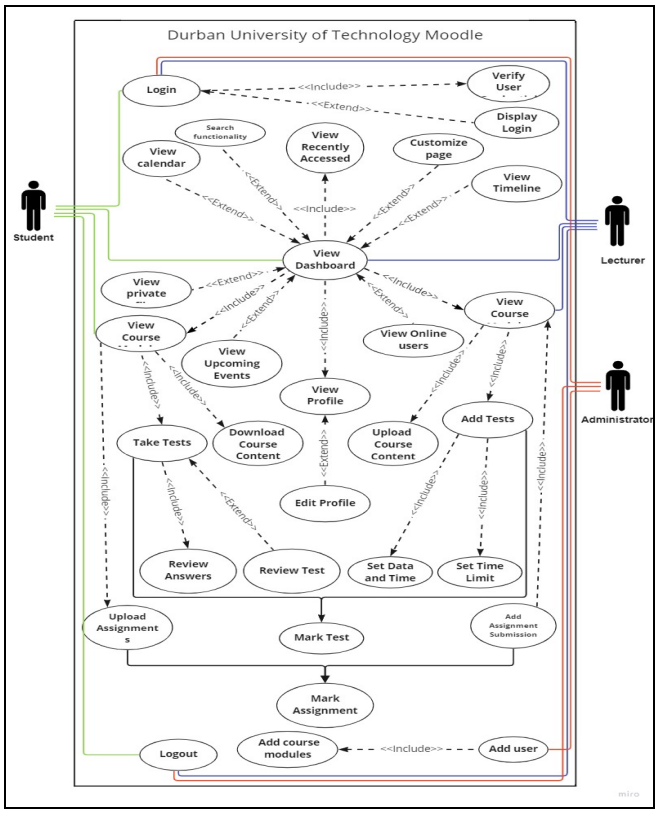

Figure 1. Use Case Diagram for Durban University of Technology Moodle System

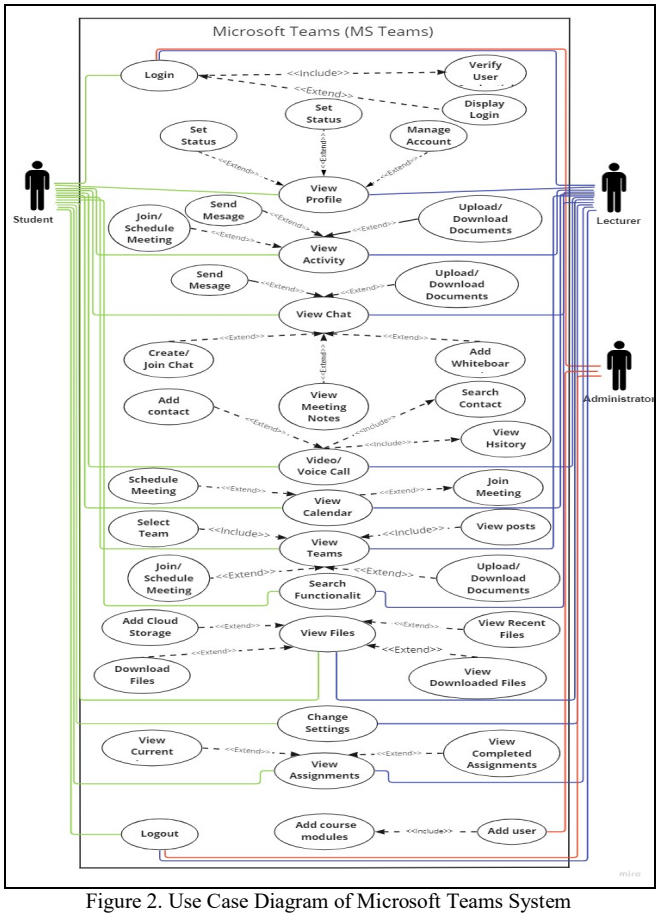

Figure 2. Use Case Diagram of Microsoft Teams System

The Microsoft Teams (MS Teams) system is depicted in Figure 2. MS Teams is a Microsoft collaborative workspace designed for collaborative working, video conferences, and file sharing. Users must login before they may use the system; if they input the wrong credentials, they will be prompted to try again. Students and lecturers can participate in or initiate video/voice calls, view call logs, search for a contact to call and upload class materials.

The DUT Self Help iEnabler as shown in Figure 3 is a platform for administrative purposes. Students and lecturers will be added as users to the system by administrators, who will prohibit them from signing up on their own. Students may access their personal information, financial information, school-leaving information, and, if relevant, their residential information through the dashboard. Students can also use the student enquiry option to get information for themselves. Students may access their academic records and progress reports via student inquiry, which can be posted by both the administrator and the lecturers. Only if a student receives financial help may they examine their financial aid information. Students who do not get financial help must finance themselves, and they manage their accounts by visiting to keep track of their banking information. If students owe money to the university, they must go to student finance and pick debt recognition.

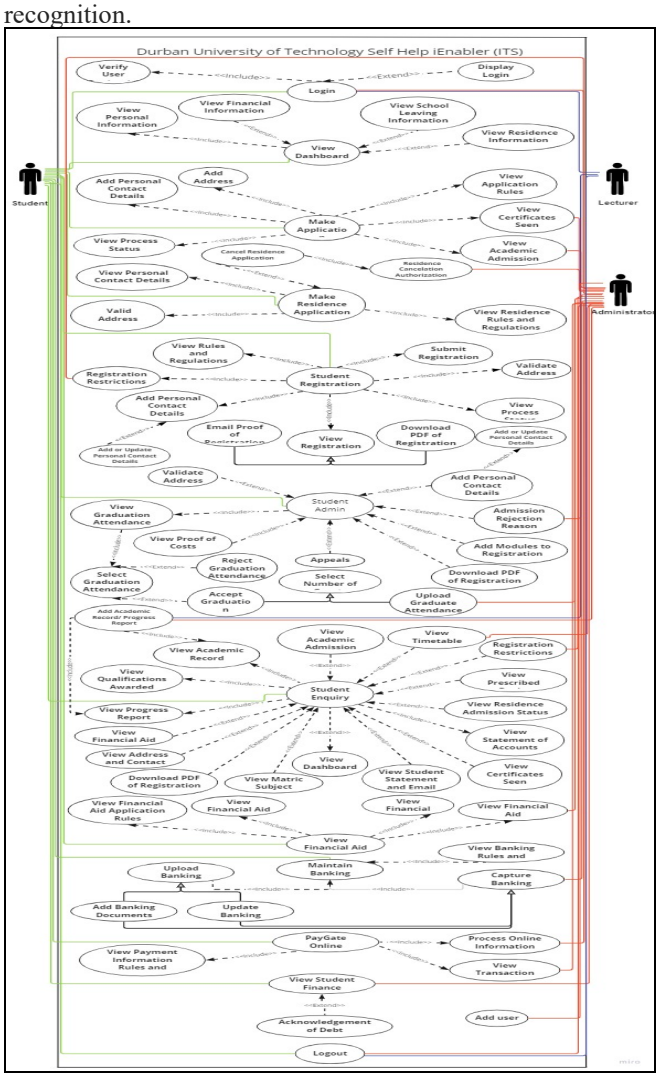

Figure 3. Use Case Diagram of The Durban University of Technology Self Help iEnabler

The proposed approach is depicted in Figure 4. The suggested system combines the use cases of Moodle, MS Teams, and ITS, with the addition of AR immersive technology features and functionality. When a student or lecturer signs in, they are directed to the dashboard, where they may examine the chat, the calendar, alerts, and personal information, which are all focused on the AR collaboration tools. When a student or lecturer enters the chat, they have the option of sending direct messages, creating or joining a virtual room with other students' AR technologies. They can also listen to recordings and look up student and lecturer contact information. The student has access to his personal information and can see or change it. When a student goes to their calendar, they may plan a meeting if the other student(s) agrees, as well as change the time of the appointment.

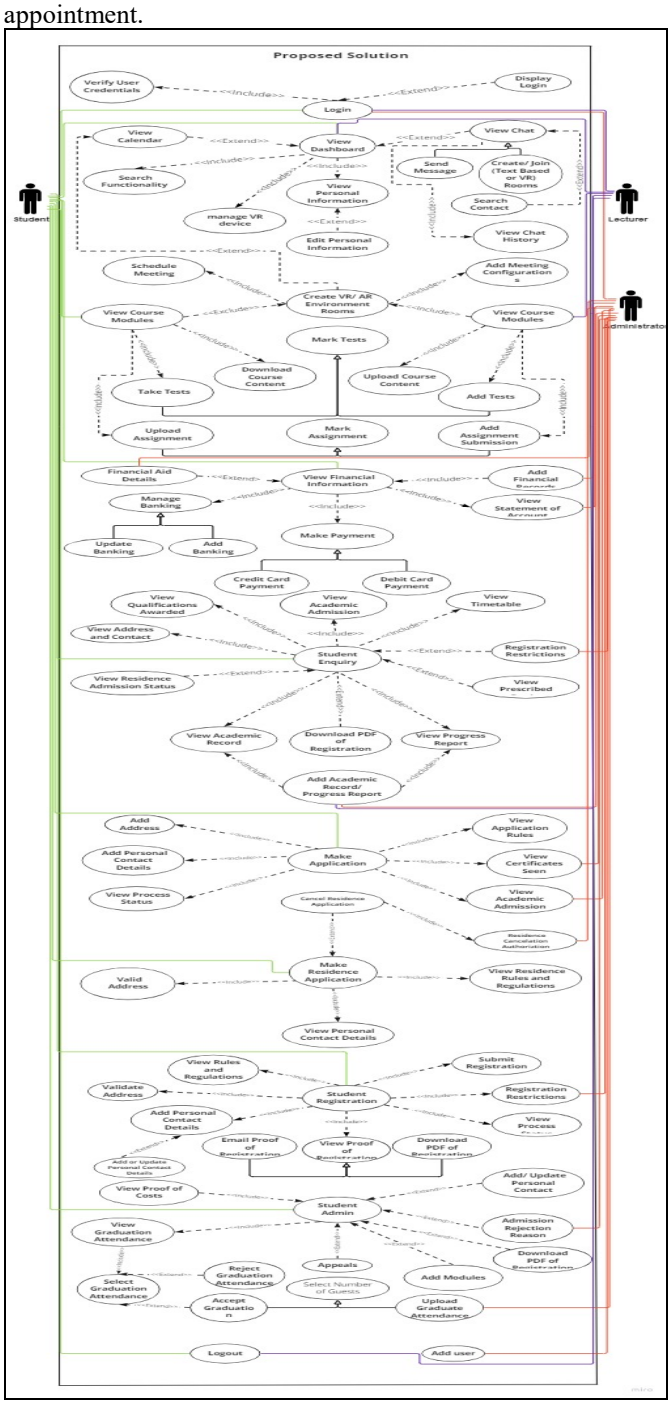

Figure 4. Use Case Diagram for The Proposed System.

Members of an AR environment will be shown as avatars with their names displayed above their heads. Members can communicate with one another in the VR conversations to collaborate. Users will, however, require a suitable VR headset to use VR conversations. The AR environment will create a suitable environment that can be used for practical learning. When a student chooses a module, they can see the time and date for the module's online lecturers. The lecturers offered e-books, required chapters, and other pertinent documents also available for them to browse or download. Furthermore, students will be able to view lecture sessions using an augmented reality system as shown in Figure 5.

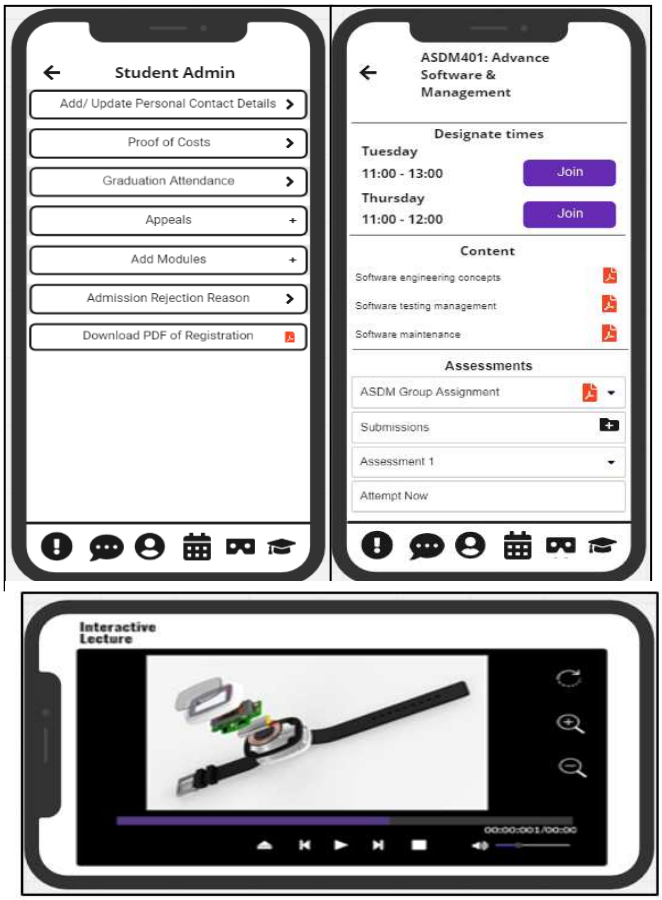

Figure 5 shows the wireframe diagram for the augmented reality eLearning system.

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V. Conclusion

Many instantaneous developments in Information and Communication Technology play a critical role in the progression of e-learning by changing the process of education directly. With such interaction, education has improved significantly, giving rise to new dimensions of methods for students to access their education such as mobile learning, accessibility of information via the electronic environment, virtual learning environment, and internet-based e-learning. Currently, technology-assisted education has become unavoidable for effective and better learning, this dependency was exposed during the outburst of the Covid-19 pandemic. Many virtual software systems specifically designed to provide access or enhance the e-learning experience and engagement for students provided crucial support in the continuation of learning during the pandemic since all education institutions (specifically higher education institutions) postponed all face-to-face teaching and learning methods. However, these enhancements came with challenges for both students and teachers for many specified reasons, specifically in terms of accessibility of the services provided by these systems to students to engage based on theoretical and practical learning efficiently. The dependency on technology-driven education is rapidly increasing as traditional ways of teaching and learning are proven to be unreliable due to the increased volumes of data and information required, and the rate at which this data and information are to be processed and accessed by both students and teachers. E-learning proved to be suitable for these conditions, especially during and after the Covid-19 pandemic, which rapidly increased the dependency on e-learning. Thus, this dependency signifies those improved methods or techniques are required to be thematically researched and implemented to enhance the advancement of online learning technology, improving the accessibility for students to embark on the e-learning experience under these current intense conditions of big data and vast information. Finally, the adoption of the augmented reality eLearning system would help DUT enhance its current system and better engage the technologically savvy (Generation Z) students in achieving adaptive and innovative teaching and learning processes.

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