DESIGN AND IMPLEMENTATION OF AN ONLINE TEACHING AND LEARNING MANAGEMENT SYSTEM

*Adedoyin, A., Enebe, F. O., Oyekunle, R. A., and Balogun N. A.

Department of Information and Technology, University of Ilorin, Ilorin, Nigeria

*Corresponding authors' email: adedoyin.a@unilorin.edu.ng

ABSTRACT

The global education system was impacted by the coronavirus pandemic. To stop the coronavirus from spreading, all schools, colleges, and universities were closed. Students, instructors, and parents all experienced challenges while schools were closed. So, distance learning was a solution to continue the education system. Unfortunately, in a developing country, it was challenging to adopt distance learning due lack of network infrastructures, computers, epileptic power supply, and good internet access. In order to circumvent some of these challenges different online platforms were employed. However, they came with some limitations, for example, the freemium subscription scheme, which allows users to use basic features of the system but requires a certain amount on a predefined basis to access extra needed features. In addition, to use video conferencing in some of the existing LMS you are required to leave the app for another app, for example, to use video conferencing in google classroom you are required to use google meetings. This study aims to create an online E-Learning System that provides all in one tool for teachers to develop and administer courses online. The LMS comes with various functions such as creating learning plans, implementing learning processes, and assessing or evaluating learning processes. Our LMS presents instruction through content creation and storage, sees student participation, and assesses student performance online. The Online Learning System was designed using JavaScript (Vue), PHP (server-side programming Language), and NoSQL as the database. The developed system was evaluated by potential users and found to meet predefined user requirements.

Keywords: Learning management system, e-learning, open, distance learning

INTRODUCTION

As a result of the abrupt shutdown of educational facilities brought on by the COVID-19 outbreak, the authorities have advised adopting alternatives to conventional learning methods in times of crisis to make sure that students don't miss out on their studies and to stop the epidemic from spreading (Maatuk et al. 2022). Online learning has taken the place of traditional educational methods since the COVID-19 virus first surfaced because social gatherings at educational institutions are regarded to be opportunities for the virus to propagate. E-learning, which guarantees spatial separation, is the best option for halting the spread of infections (Lizcano et al. 2020).

E-learning is playing a crucial part in the current educational environment since it transforms the entire educational system and becomes one of the most popular academic topics (Samir et al. 2014). According to Gaebel et al. (2014), E-learning is defined as the usage of various ICT and electronic devices in the classroom. E-learning refers to internet-based education, digital learning, interactive learning, computer-assisted instruction, and other forms of web-based education (Aljawarneh, 2020; Lara et al. 2020; Maatuk et al. 2022). It is primarily a web-based educational system that uses technology to give students knowledge or skills. The cost of deploying web-based technologies has drastically decreased, which has led to a significant rise in their use for educational reasons. Nowadays, a lot of colleges have realized the value of e-learning as a foundational component of their educational system. E-learning utilizes a variety of information and communication technologies. These include digital television, cell phones, satellite communication, wireless networks, and the internet. Another name for e-learning is digital learning. Using personal computers or smartphones, e-learning allows you to learn at any time, any place, and multiple times. E-learning also enables the creation of digital content and the building of digital libraries so that both students and teachers can access course materials and research materials on any subject from anywhere at any time (Satinder & Monika Gupta, 2020).

There are numerous Learning Management Systems (LMSs) available, including Moodle, Sakai, and Blackboard, all of which include many helpful features. Organizations and institutions buy these LMS for registration and online training courses, but making customized LMS is crucial to satisfy the needs of most educators and students. The primary functions of an LMS are to support the consistency of course management delivery and to offer the educational institution strong tools for curriculum development, staff communication, collaboration, calendaring, and task management automation (Abdulazeez & Zeebaree, 2018). In addition, some of these off-the-shelf LMS still come with some limitations, for example, the freemium subscription scheme, which allows users to use basic features of the system but requires a certain amount on a predefined basis to access extra needed features. In addition, to use video conferencing in some of the existing LMS you are required to leave the app for another app, for example, to use video conferencing in google classroom you are required to use google meetings.

This study aims to create an online E-Learning System that provides all in one tool for teaching staff to develop and administer courses online. The LMS comes with various functions such as creating learning plans, implementing learning processes, and assessing or evaluating learning processes. The proposed LMS presents instruction through content creation and storage, sees student participation, and assesses student performance online. The remainder of this paper is organized as follows. Section 2 gives some background and related work about E-learning. Section 3 describes the methodology. System Implementation and evaluation are presented in Section 4. Section 5 discusses the conclusion of this work.

Related Study

Hazem and Nikos (2009) designed an integrated intelligent E-Learning system. The system uses an open, adaptive, and multi-subject E-learning system. Through the use of a number of intelligent agents who carry out learning tasks on behalf of teachers, students, and administrators, this system enables students to engage in interactive tasks and create open channels of communication with their teachers. This concept was used to create a learning platform for an online university. The proposed system has also been created with business continuity management and learning management in mind. In addition, security in E-Learning has been discussed.

Sam K. P. and Rung-Tsong (2009) designed a Virtual Learning Environment in which both learners and instructors do not need to be familiar with the high technology, while they can still communicate with each other effectively, using advanced Internet technology. Moreover, the Virtual Learning Environment provides its users with appropriate guidance and support, which helps the learners to achieve overall progress across all courses and study programs. In short, the Virtual Learning Environment allows an interactive, and dynamic educational center to be developed and fulfilled in a modern studying environment.

Ekwonwune and Edebatu (2019) developed an adaptive e-Learning Software to enable the learner to answer questions or solve problems based on his/her ability. Their work was motivated by the need to address the deep concern and awareness of how learners learn best. They developed an adaptive e-learning platform where the learner is allowed to answer questions or solve problems based on his/her ability or pace. It also provides an online classroom that will run alongside the traditional classroom. The LMS software was designed using the waterfall model, VB.NET (an Object Oriented Programming Language), AJAX, and JAVASCRIPT web development tools. Furthermore, they recommended new strategies & technologies to improve safety, quality, and overall standard of learning amongst learners in educational institutions.

Rabiman et. al (2020) created an LMS-based E-Learning system that will be tested in a Mechanical Engineering Education class using Microteaching. The Hannafin and Peck approach paradigm was used in their work, with specified phases (needs analysis, design, development, and implementation). The created LMS was then tested by media and material specialists to ensure that it meets their requirements. The participants in the study were 15 college students between the ages of 22 and 25 (adults). Questionnaires and direct observation were two methods for gathering data. The findings of an LMS-based E-Learning development study are "extremely viable" to implement. The LMS usability, LMS functionalities, visual communication, learning design, material contents, as well as language and communication, are all factors in the evaluation. The findings in this study are that utilizing a learning management system (LMS) improves satisfaction and quality of learning.

According to Capterra (2021), a global software evaluation and selection portal, there are currently 561 LMSs accessible for academic and educational applications. Edmodo, Moodle, MOOC, and Google Classroom were the learning systems that were most commonly utilized and explored between 2015 and 2020 (Setiadi et al., 2021). Although there is little literature on LMS comparisons, several comparisons between LMSs like Moodle, Sakai, SumTotal, Blackboard, Canvas, and ATutor do exist (Shkoukani, 2019; Xin et al., 2021). Moodle is the most used and favored open-source LMS, according to a recent systematic review of trends in the use of LMSs (Altinpulluk & Kesim, 2021). Moodle is widely used in the community and by many institutions. It includes a huge selection of ongoing courses and is available in numerous languages (Al-Ajlan & Zedan, 2008; Sergis et al., 2017). However, they all come with some cons, for example, Canva site can be a bit buggy and it is not easy to find online information on how to use the platform (Littlefield, 2019), Moodle has technical-related issues that cause its instability (Zharova et. al. 2020).

METHODOLOGY

This section discusses the system design and modeling of the proposed LMS application. In modeling the proposed system, a use case diagram and a class diagram are presented.

Web Application Architecture

To guarantee that many applications can operate together, web application architecture describes the relationships between apps, middleware systems, and databases. The system architecture for the proposed web-based system contains three necessary components: (i) Client and client Application, the user can view the user interface via the web browser (ii) Data server for the data base (iii) Web server where the application is hosted as shown in Figure 1.
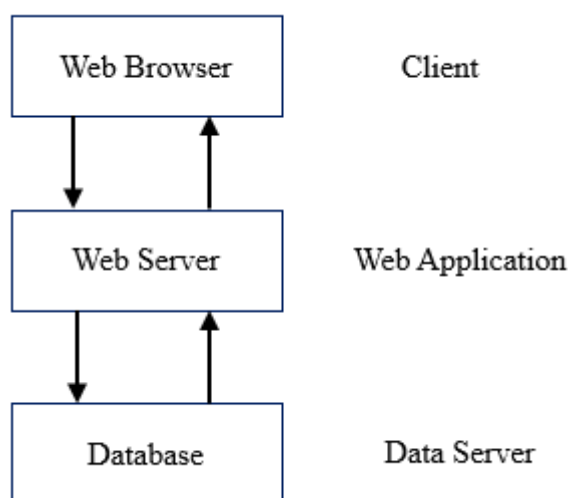

Figure 1: Web-based Software Architecture

System Design

The system design step converts functional requirements into diagrams that are both structural and behavioral components of the proposed system. This section examines the proposed system's many components and how they interact with one another and the environment. To achieve this, the Use Case diagram was used to graphically depict the various components of the proposed system as presented in the next subsections.

Use Case Diagram

A Use Case Diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. In this case, as shown in Figures 2 and 3, the users are the students and lecturers/administrators in a tertiary institution. The administrator/teacher is in charge of administering the courses and the students, doing activities such as adding and deleting, posting assignments, videos, courseware, assessments, and more. Students can enroll in courses, turn in homework, participate in forums, etc. Figure 2, depicts how creating a class requires that teachers register on the application by providing some relevant details like their name and email address. After class creation, students can be added to the created class space. Lectures can also be scheduled to hold for registered students. Resources can be uploaded, and coursework can be assigned and evaluated. Reports on student involvement in class can also be measured and generated on the application. The most important of all possible functions is the teacher being able to create a class.
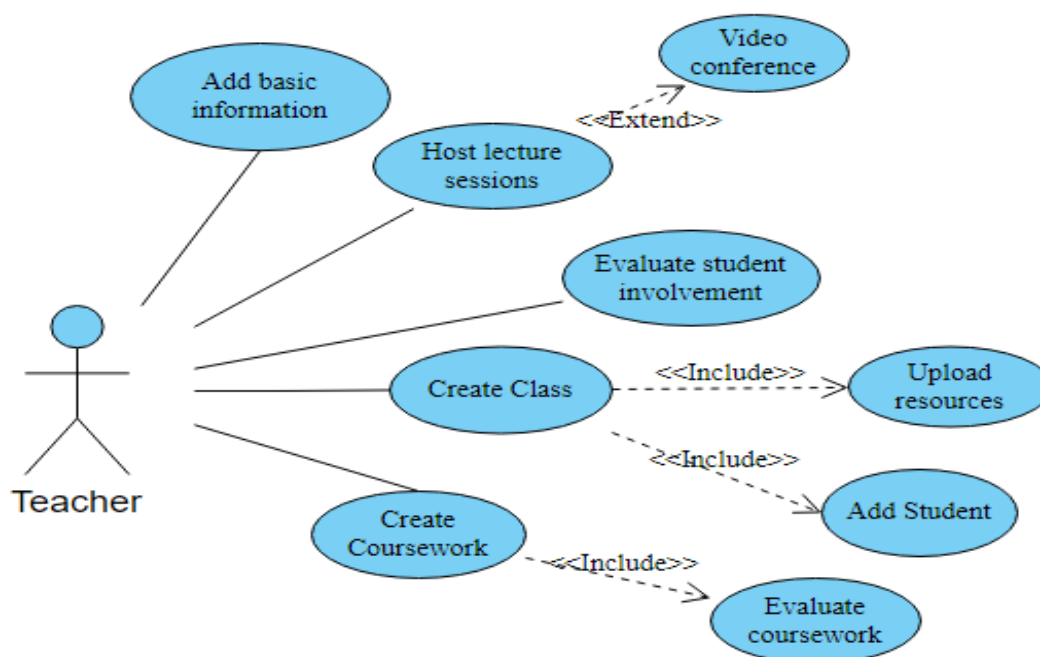

Figure 2: Use case diagram for teachers

Figure 3 shows students' possible interactions with the platform. On their first visit, they're first required to register on the platform by providing basic information about themselves. Details provided can be used for authentication and personalization on subsequent visits. After signing on, students can proceed to join any class they're granted access to on the platform. They'll also be able to join a class lecture session once they get approval for the class. Students will also be able to relate with fellow learners and when they have any coursework, they'll be alerted and prompted to submit it to the teacher.
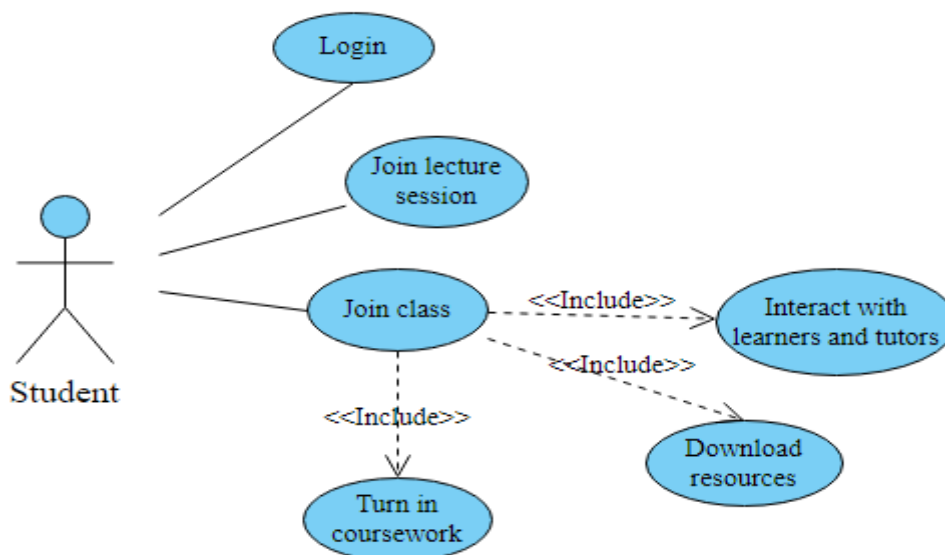
Figure 3: Use case diagram for student

System Development and Evaluation

The development of this new system entails using a PHP Framework, JavaScript for the front end, and then hosting it on a web server. In order to create the database for our proposed system, MySQL database management system was adopted. Figure 4 below shows the entities, attributes with their assigned data types, and entity relationship descriptions for our database system.
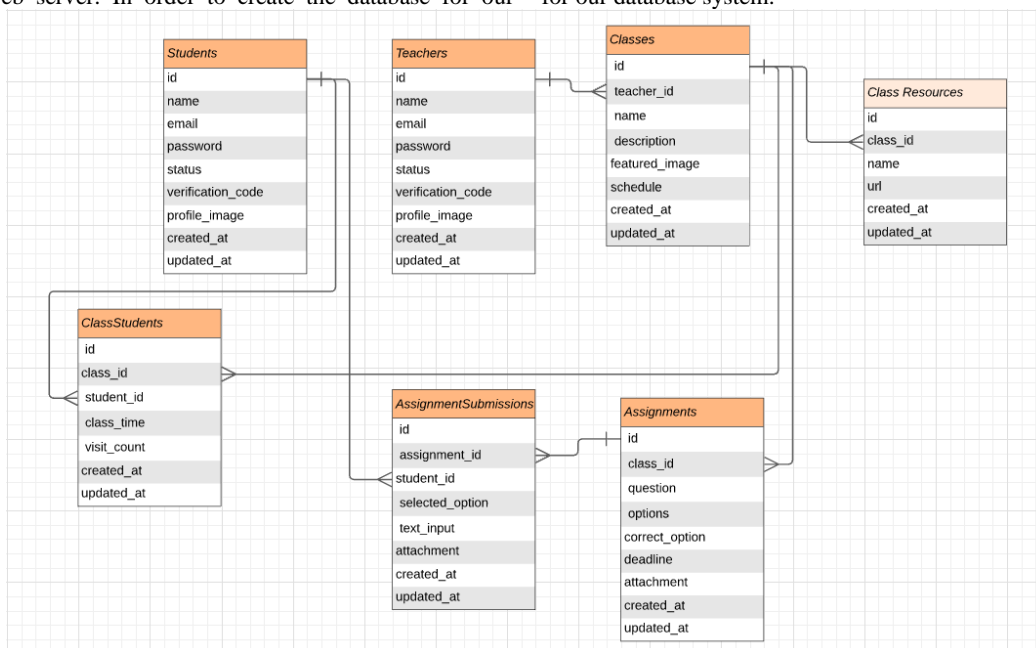

Figure 4: Entity Relationship Diagram of online learning application

Application Development

The application was developed using PHP, and HTML 5 and deployed on Heroku, a cloud-hosting platform. The developed system is available at https://tutorme.software. Figure 5 shows the home page for the developed system. It has features such as; create an account link for new users and a signing-in link for returning users. After signing in, you are directed to the dashboard page where classes, modules, discussions, assignments, etc. can be created.

Entry

The entry section includes all authentication pages ranging from the login to the registration screens. Creating an account on the admin end of the system implies signing up to own and host classes. The registration page is kept very simple to ensure ease in signing up and logging in as shown in Figure 5 where users' credentials are verified before letting them proceed to use the application.
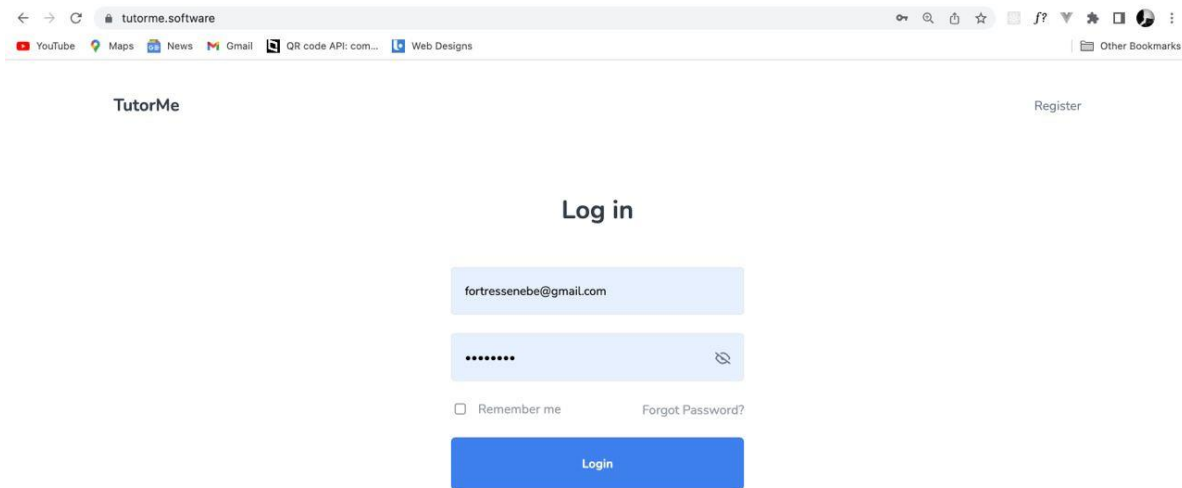
Figure 5: Login Screen

Dashboard

The dashboard screen basically helps to display major reports to the tutors at a glance. Instead of having tutors navigate through different pages in search of information such as the number of students added to the class, pending class entry requests, number of assignments given, the total number of modules in the class, and other recent activities, they are presented with these summaries on the dashboard once they sign in as shown in Figure 6.
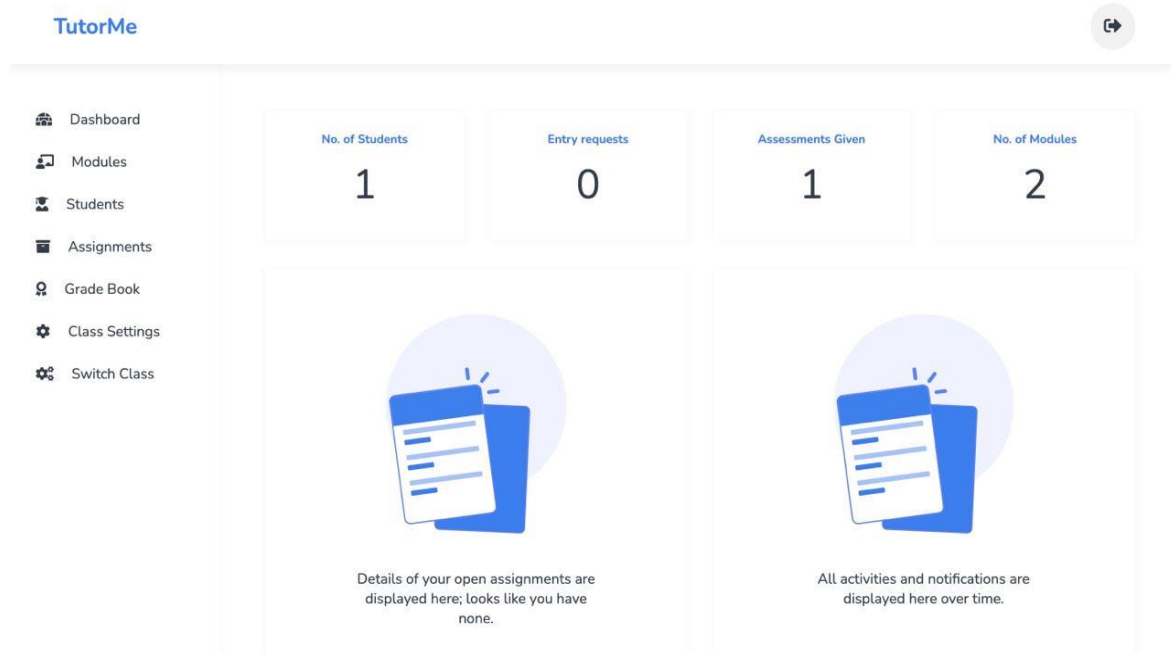

Figure 6: LMS Dashboard Screen

Modules

The modules section helps to keep things organized. A list of all modules associated with a class is usually presented to the user. Once a module is selected, the app proceeds to display all files, assignments, and conversations associated with that module as shown in Figure 7.
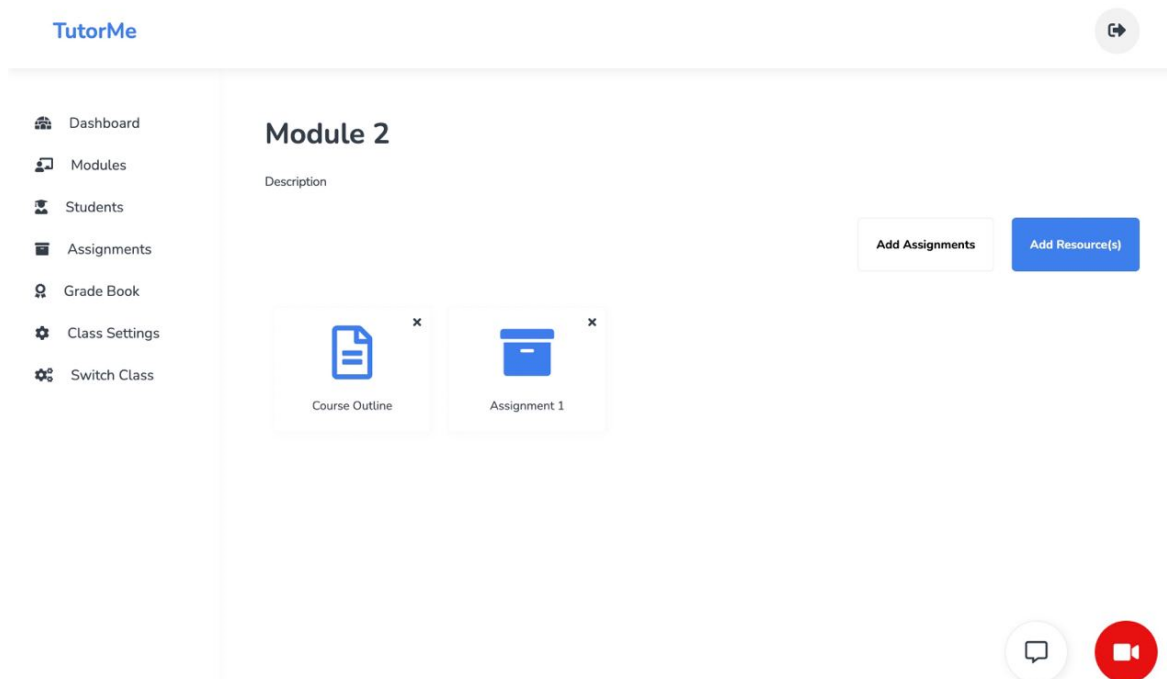
Figure 7: Single module screen

In addition, the modules section has video conference features. I virtual class can be scheduled or created instantly for a class. Figure 8 shows video conferencing activation on the LMS.
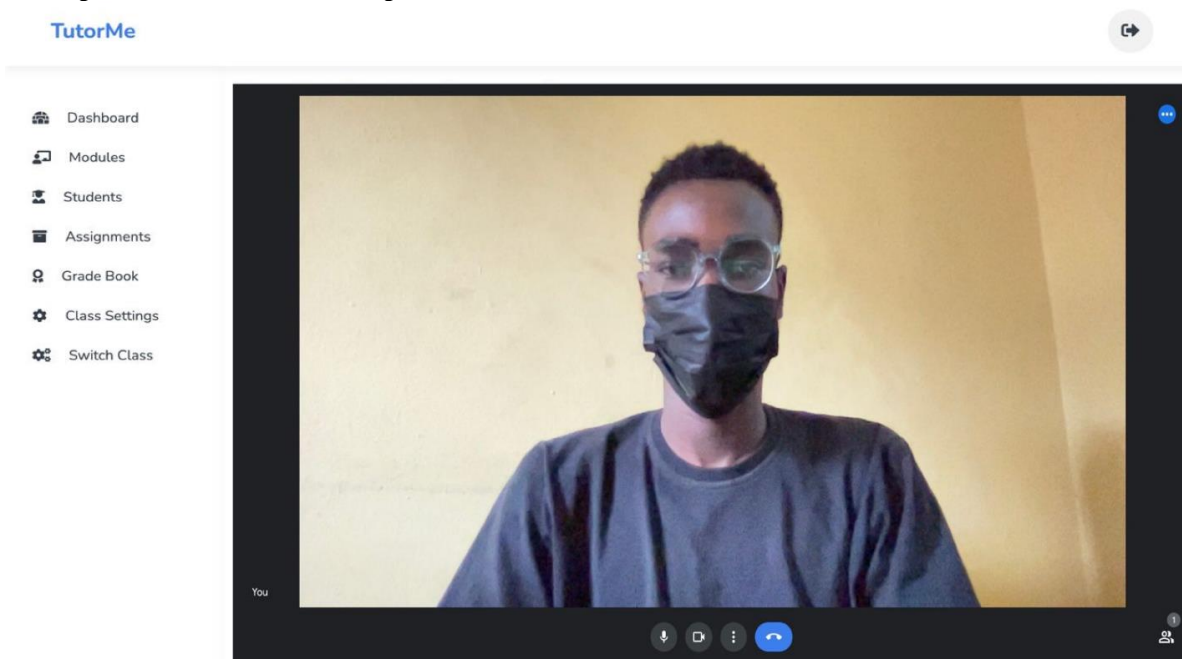

Figure 8: Video conferencing

Evaluation

System evaluation is the process of reviewing a planned program to ensure that it is standard and reliable enough to satisfy all expectations. The goal of assessing the developed system is to detect mistakes, weaknesses, and restrictions so that changes and adjustments may be made to assure the application's stability and effectiveness. This testing was performed on the proposed system to determine whether or not the implemented system fits the specifications provided prior to creation. The figure below shows the result of a user performance test that was carried out by twenty-five students and five lecturers.
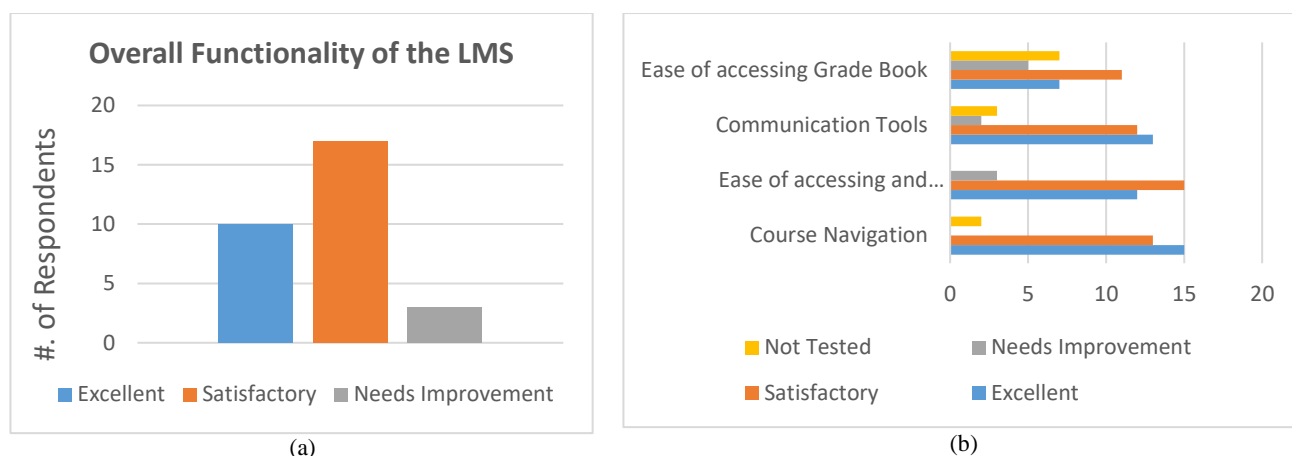
(a)   (b)

Figure 8: Showing results from the evaluation of the system by respondents

Figure 8(a) shows the overall rating of the functionality of the LMS, about 90% confirmed the functionality of the LMS was excellent and were satisfied with it. Figure 8(b) shows the result for rating the functionality of (i) the quality of the grade book based on ease of access, appearance, and organization. (ii) ease of access and use of other communication tools, including the syllabus, announcements, calendar, Email/messaging, and personal notification settings. (iii) ease of accessing and completing coursework, including tests or quizzes, assignments, and discussion boards. (iv) navigating through the course, locating and accessing course materials.

CONCLUSION

This paper proposes an online learning system that basically meets the needs of students' online learning. The designed LMS provides all in one tool for teachers to develop and administer courses online. In addition, the LMS comes with various functions such as creating learning plans, implementing learning processes, and assessing or evaluating learning processes. The system was developed using PHP and NoSQL, MongoDB for the database query. The developed system was evaluated by potential users and found to meet predefined user requirements. As further work, the system can be improved by adding more features that will further improve its use and meet user needs. Some of the features that were recommended are: support exporting grade books into CSV files, support collective teaching (more than one tutor performing admin roles in the same class), and optimize for mobile to support on-the-go learning.

REFERENCES

Abdulazeez, A. M., & Zeebaree, S. R. M. (2018). Design and Implementation of Electronic Learning System for Duhok Polytechnic University. Academic Journal of Nawroz University, 7(3), 249–258.

Aljawarneh, S. A. (2020). Reviewing and exploring innovative ubiquitous learning tools in higher education. Journal of Computing in Higher Education, 32, 57–73. https://doi.org/10.1007/s12528-019-09207-0.

Altinpulluk, H., & Kesim, M. (2021). A systematic review of the tendencies in the use of learning management systems. The Turkish Online Journal of Distance Education, 22(3), 40–54. https://doi.org/10.17718/tojde.961812

Al-Ajlan, A., & Zedan, H. (2008). Why Moodle?. Paper presented at the 12th IEEE International workshop on future trends of distributed computing systems. 2008. doi: https://doi.org/10.1109/ftdcs13956.2008.

Capterra (2021). LMS software. https://www.capterra.com/learning-management-system-software/?feature=%5B38347%5D&sortOrder=sponsored. Accessed 27 Nov 2021

Ekwonwune, E. and Edebatu, D. (2019). Design and Implementation of an Online Course Management System. Journal of Software Engineering and Applications, 12, 21-33.

Gaebel, M., Kupriyanova, V., Morais, R. and Colucci, E. 2014. E-learning in European Higher Education Institutions November 2014 Results of a mapping survey conducted in October–December 2013 Michael Gaebel, Veronika Kupriyanova, Rita Morais, Elizabeth Colucci.

Hazem M. El-Bakry, Nikos Mastorakis, "Realization of E-University for Distance Learning", Wseas Transactions on Computers, Issue 1, Volume 8, pp 48 – 62.

Lara, J. A., Aljawarneh, S., & Pamplona, S. (2020). Special issue on the current trends in E-learning Assessment. Journal of Computing in Higher Education, 32, 1–8. https://doi.org/10.1007/s12528-019-09235-w.
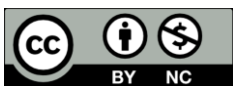
Littlefield, J. (2019). Review of Online Learning Platform Instructure Canvas. ThoughtCo. https://www.thoughtco.com/canvas-instructure-review-1098196. Accessed 5 December 2022.

Lizcano, D., Lara, J. A., White, B., et al. (2020). Blockchain-based approach to create a model of trust in open and ubiquitous higher education. Journal of Computing in Higher Education, 32, 109–134. https://doi.org/10.1007/s12528-019-09209-y

Maatuk, A.M., Elberkawi, E.K., Aljawarneh, S. et al (2022). The COVID-19 pandemic and E-learning: challenges and opportunities from the perspective of students and instructors. J Comput High Educ 34, 21–38. https://doi.org/10.1007/s12528-021-09274-2

Rabiman, R., Nurtanto, M. and Kholifah, N. (2020). Design And Development E-Learning System By Learning Management System (LMS) In Vocational Education. International Journal of Scientific & Technology Research, 9(01), pp. 1059 – 1063.

Satinder Bal Gupta, Monika Gupta (2020). Technology and E-Learning in Higher Education. International Journal of Advanced Science and Technology Vol. 29, No. 4, pp. 1320 – 1325

Shkoukani, M. (2019). Explore the major characteristics of learning management systems and their impact on e-learning success. International Journal of Advanced Computer Science and Applications, 10(1), 296–301.

Samir, M., El-Seoud, A., Taj-Eddin, I. A. T. F., Seddiek, N., El-Khouly, M. M., & Nosseir, A. (2014). E-learning and Students' Motivation: A Research Study on the Efect of E-learning on Higher Education. International Journal of Emerging Technologies in Learning. 9(4), 20–26. https://doi.org/10.3991/ijet.v9i4.3465.

Sergis, S., Vlachopoulos, P., Sampson, D. G., & Pelliccione, L. (2017). Implementing teaching model templates for supporting flipped classroom-enhanced STEM education in Moodle. In A. Marcus-Quinn & T. Hourigan (Eds.), Handbook on Digital Learning for K-12 Schools (pp. 191–215). Springer International Publishing.

Sam K. P. and Rung-Tsong, M. (2009). A Web-based Customized Virtual Learning Environment, Computers, ISSN: 1109-2750 50, 8(1).

Xin, N. S., Shibghatullah, A. S., Subaramaniam, K. A. P., & Wahab, M. H. A. (2021). A systematic review for online learning management system. Journal of Physics. Conference Series, 1874(1), 12030. https://doi.org/10.1088/1742-6596/1874/1/012030

Zharova, M.V., Trapitsin, S.Y., Timchenko, V.V., and Skurihina, A.I., (2020). Problems and Opportunities of Using LMS Moodle before and during COVID-19 Quarantine: Opinion of Teachers and Students. International Conference Quality Management, Transport and Information Security, Information Technologies (IT&QM&IS), Yaroslavl, Russia, 2020, pp. 554-557.