Usability of "iCollege" Learning Management System in University Environment

K.H. Wijesinghe[1], Dilshan.U.K.T[2], Dilshan.K.B.G.L[3], Tharupathi.M.A.U[4], D. I. De Silva[5] and R.R.P. De Zoysa[6]

[1]Faculty of Computing, Sri Lanka Institute of Information Technology, New Kandy RD, Malabe, SRI LANKA
[2]Faculty of Computing, Sri Lanka Institute of Information Technology, New Kandy RD, Malabe, SRI LANKA
[3]Faculty of Computing, Sri Lanka Institute of Information Technology, New Kandy RD, Malabe, SRI LANKA
[4]Faculty of Computing, Sri Lanka Institute of Information Technology, New Kandy RD, Malabe, SRI LANKA
[5]Faculty of Computing, Sri Lanka Institute of Information Technology, New Kandy RD, Malabe, SRI LANKA
[6]Faculty of Computing, Sri Lanka Institute of Information Technology, New Kandy RD, Malabe, SRI LANKA

[1]Corresponding Author: hasarangawije2345@gmail.com

ABSTRACT

In recent years, there has been an increasing demand in integrating new technologies into educational procedures. The Learning Management System (LMS), a web-based educational technology, helps teachers meet their pedagogical objectives, organize course materials, and support students. Learning Management Software (LMS) has been implemented in many universities across the world to assist link faculty and students outside of the classroom setting. It is a digital environment that allows the efficient distribution of academic materials, Easy access to information, instant access to up-to-date content, maintain a library virtually and enhanced communication through a single location. The main scope of developing this Learning Management System is to resolve above-described features and address many issues in the Academic process and content deliverables. The software solution has been implemented by addressing each requirement of administrators, Students, and Lecturers following each phase of the software life cycle in order to provide real time operations and advanced functions for the web based LMS system.

Keywords— Learning Management System, Academic, User Management, Announcement Management, Library Management, Lecture Schedule

I. INTRODUCTION

Learning management System or (LMS) is an online porta; that links professors and students as it is often called in the world of colleges and universities. It provides a means for the simple sharing of educational materials or activities. Additionally, it serves as a platform for interaction between students and educators outside the classroom. In this era of information technology, the internet is easily available and accessible by urban areas so online learning resources are now available for anybody to access whenever and wherever they want.

As students Handover lecture materials, Publish Timetables, publish announcements and notices, having an E-Library and capability of managing each student's profile are major functionalities that educational institutes face. To make sure Institute's academic programs run efficiently these functionalities should be maintained and updated as one functioning system.

If students want to get Study materials, including lab sheets, lecture notes, and tutorials, they must go to the university, and lecturers have manually handed over the papers. With the rise of the Covid-19 pandemic Continues to pose a danger to everybody. Institutions throughout the world have temporarily shuttered to protect students, lecturers, and staff from potential illness. A study by UNESCO [1] says that almost 1.2 billion students in 143 countries are affected by the pandemic. This is the main reason why a Learning Management System must be implemented and designed.

Teaching and learning processes have developed in parallel with technological advancements. Similarly, the fast growth of information and communication technology has transformed traditional classrooms into smart learning environments. According to a recent report [2], By 2025, educational institutions are prepared to change to educational technology.

Because of these reasons, learning management system is a must for the education industry of these days. Thought out this paper the implementation of the learning management system is discussed according to different functionalities and operations of LMS users.
In Our LMS system Provide unlimited access to Learning materials get effective management between learning and teaching, the interaction between learners and instructors plays an important role in reaching students' satisfaction. user has unlimited access to the information they need.

II. RELATED WORK REVIEW

A. Announcement Management

Manage Announcements is one of key part in our project it aims to publish relevant announcements to the students quickly and easily. The Announcement decisions should encourage effective communication between faculty management and students

According to [3] Science the Announcements are published on digital platform students can now read any of them on the LMS that makes reachability of the announcements very high

B. Library Management

Libraries are one of the essential parts of the LMS. A library management system, also known as an automated library system, is software designed to handle the basic functions of a library and to provide a complete solution for the administration of a library's technical functions and public services. It can keep track of the library's assets and help with day-to-day operations. Digital Library System is an Advance Library Software that helps in the fast and effortless gathering of all information in the library. A digital library, also known as an online library, an internet library, or a digital collection, is an online database of digital objects such as text, still images, audio, video, digital documents, or other digital media formats.

A library management system helps maintain records for all library items. It also tracks any information at any time, maintains a large database, and reduces operating costs. It reduces the staff workload and increases the efficiency of the library. It encompasses the process of replacing traditional, paper-based systems with computers and software. It makes information more available and accessible in an easier manner. [4]

C. User Management

User management is an administrative task that gives users access to and control over digital assets such networks, devices, apps, and cloud services. Today, businesses are looking at even more cutting-edge solutions. The full administration of user accounts, including user registration, login, and authentication, single sign-on, and permissions management, is offered by modern user management systems. Identity and access management is a system that is frequently used to implement user management. Administrators may control who has access to the system, including both internal and external users, thanks to identity and access management. A user directory service, which holds login credentials and other information for all users, is either included in or integrated into identity and access management. The directory service authenticates, authorizes, and monitors user access to enforce access constraints.

In the past, LMS handled user management and authentication using identity providers that were installed on their own premises, such Microsoft Active Directory. User administration, authentication, and authorization for the local network were handled by the identity provider server located on-site. Identity and access management has gone to the cloud recently. Cloud-based identity and authorization management is designed for secure remote access, which is more scalable and versatile, and allows admins greater control.

Many organizations recognize that on-premise IdP solutions are insufficient for the modern IT environment. Users increasingly rely on cloud services and access corporate systems remotely, often via personal devices. Organizations must find a way to manage secure access for a distributed environment. These challenges are making user management more important and more complex than ever before. [5]

D. Lecture Schedule Management

LMSs are multi-faceted learning environments that can adapt to several instructional methods while utilizing the wide range of available technologies. It is a teaching tool that let professors reach students online, provide online tasks, and even mark and comment on students' reports. Due to its ideal features, which include the following, LMS may be considered as a beneficial helper to both instructors and pupils as technology advances, including:

- Multiple learning styles: Learning management systems support a variety of content forms, including image, PowerPoint, Word, Excel, picture, video, and others, which enable lecturers to diversify the contents they share with students.
- Assignments: Both lecturers and students may construct individual assignments with specific sub-actions, a start date, and a deadline date.
- Class Scheduling: By using this feature, lectures can schedule the class with information such as time, date, details about lecture and lecture materials, students can join classes using provided details and according to time table.
- Results: Students can quickly view their results for a previously completed activity or submission.

To satisfy pupils, there needs to be contact between lectures and students. exchanges between students and lecturers, such as two-way complementarity discussions between the lectures and students. An efficient and active LMS is a learning environment where lecturers play the role of a friendly adviser to students, make a tremendous effort to interact with them, and provide a safe area for them to address any questions or issues they may have regarding the lectures. [6]

III. METHODOLOGY

Tools and Technologies
- **Frontend: ReactJs**
- **Backend: NodeJs, ExpressJs, Mongoose**

- **SonarQube** is a self-managed automatic code review tool that systematically helps you deliver Clean Code [7]. It's a web-based tool that stores historical data for a variety of indicators. The application evaluates more than 30 different programming languages and interfaces with any CI pipeline and DevOps platform to guarantee the code adheres to high standards. Sonar cube can also spot coding convention violation. And also it can reduce complexity of the code, time of maintenance and make readable code
- **Git** is a website and cloud-based service that helps developers store and manage their code, as well as track and control changes to their code [8]. it was developed to facilitate collaboration among developers. Git includes all the version management features that the majority of development teams require.
- **Selenium** is a free (open-source) automated testing framework used to validate web applications across different browsers and platforms. It enables programmers to write and reuse scripts to support automation.
- **ReactsJs -** It is a free and open-source toolkit for creating user interfaces based on UI components that can be used in front-end JavaScript applications. It is maintained by Meta, an independent developer group, as well as by other organizations.
- **NodeJs -** Designed to assist in the creation of scalable network applications, NodeJs is an open-source, cross-platform, back-end JavaScript runtime environment that executes JavaScript code outside of a web browser.

A. Announcement Management

The Announcement Management function handled by the system Administrator when he navigates into the interface through the dashboard notice management function can be viewed. And also these Announcements can be viewed by students. Implementation of this function done by using NodeJs and ExpressJs framework. Then the system administrator can easily interact with the functions which are in the Announcement management. Admin can click Add Notice button and add new Announcement including the details such as Faculty, date, topic and the Announcement itself, with adding those details they will pass to the database. These details can be updated and deleted as per requirement of the system Admin. Changes made to the data from the frontend will simultaneously change in the database.

The system admin could also generate report and perform the search operation to search any announcements by the faculty, Date or the topic.
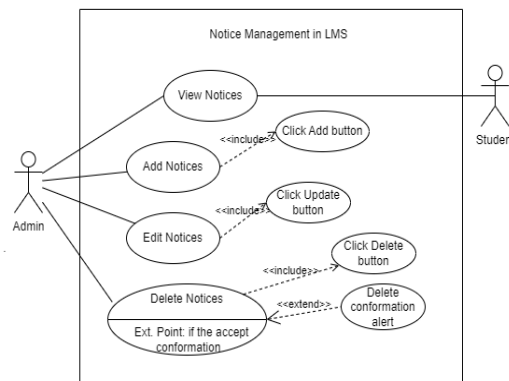

Figure 1: Announcement Management functionality use case diagram

B. Library Management

The library management section of the learning management system used react js for frontend development, express js for the backend, and MongoDB for the database, making it very easy to exchange data between other parts of the system. This is because all frameworks, including react js, express js, and MongoDB, are based on JavaScript. REST API is used for CRUD operations. The admin adds library items to the system by using the POST method. The PUT method is responsible for updating the library resources. When an administrator wishes to delete library items, the DELETE method is invoked. The GET method is used to retrieve all library resources. Uploading files is done through Cloudinary. It is a third-party cloud storage provider.
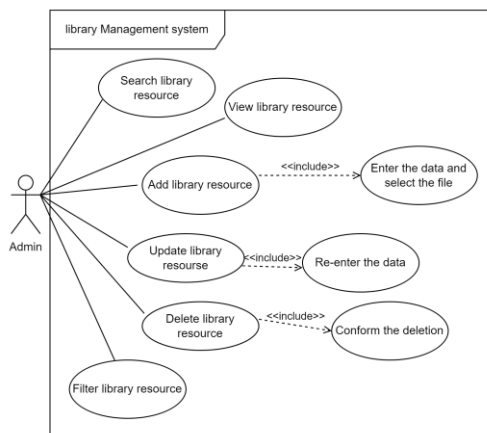

Figure 2: Library Management functionality use case diagram

C. User Management

As for the using of technologies in the user management part of the learning management system, it used ReactJs for the frontend development, expressJs for backend and mongodb for database, so it was very easy to exchange data between other parts of the system. This is because all frameworks such as ReactJs, expressJs, mongo dB are generally built on java script. Also, the use of context variables and session storage is very easy in ReactJs, so the complete project was done using those frameworks.
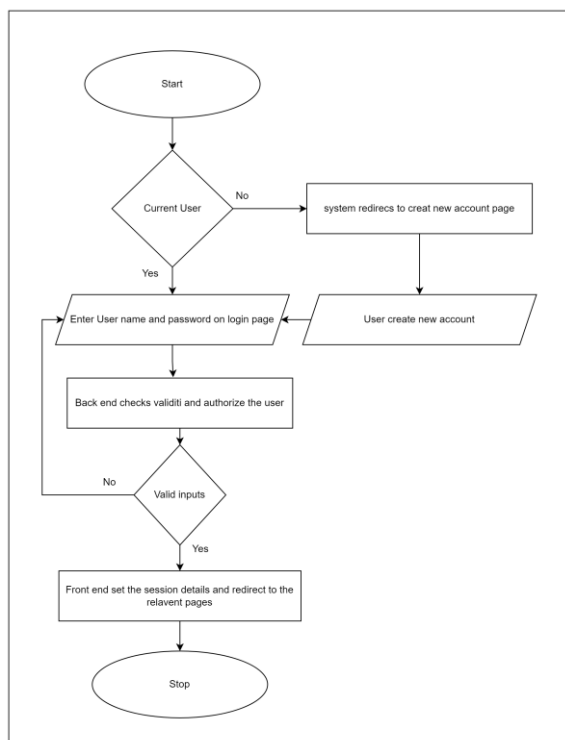
Figure 3: User flow of user management functionality

D. Lecture Schedule Management

As for the using of technology in the lecture management part of the LMS system, manly this system based on MERN stack framework. We used React JS for the frontend development except for the designing frameworks. In this function includes all POST, GET,PUT and DELETE methods which are handle by the backend for user convenience. We used Node JS and Express JS (Node JS web framework) for server-side development and MongoDB for database in our system. To use the cloudinary cloud service for file upload functionality, we are required to store lecture materials (e.g., lecture slides, instructional sheets, and lab sheets) as PDFs. The cloudinary service is quite simple to build using Java Script.
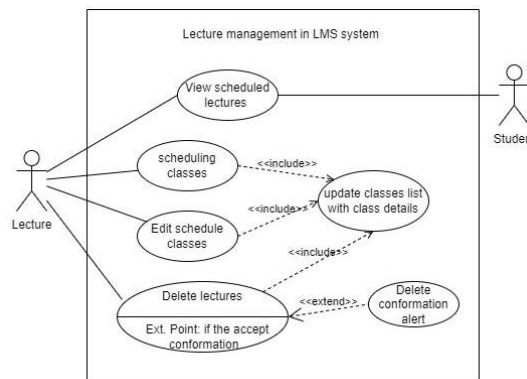

Figure 4: Use case Diagram of Lecture Management System

IV.   PROPOSED SYSTEM

A. Announcement Management

Under this function admin can publish Announcements for students (Figure2.1) first admin can see all the announcements then in the table. After clicking 'Add announcement' Button admin will be redirected to the form (Figure 2.2). in here necessary details can be added. Also Admin can update, delete the announcements that already published, also able to generate report and able to search notices.

In the students Homepage students can view all the notices and also they can filter Announcements by Topic, date and the faculty

B. Library Management

In this function, the admin and students can view all the library items. They can search for library resources by entering the title of the library item and filtering the results by faculty, year, and subject. They can also print the complete record details of library items.

The admin can add library items by clicking Add library resource button. Then select the faculty, year, subject and upload the file, and press submits button. After that display the success message and redirect to, the view library item page.

The admin can update the library items by clicking the update button and entering the details. Also, the admin can delete library items by clicking the delete button and confirming the deletion.

C. User Management

In this function, three users are initially identified, they are admins, lecturers, and students. First, all users are entered into the system through the create new user page, and according to the registration number they enter, the system understands what his or her user role is and assigns the correct role.

When the registered user logs in through the login page, the data is authorized by the backend. After that, the backend replies what is needed for the session storage in the front end. Then the front end saves them in the session directory and redirects them to the relevant pages for the respective user. In addition, if the logged in user is an admin, he can access the user management function through the admin dashboard. It can manage all the users in the system.

D. Lecture Schedule Management

All users must be registered to our LMS system. This function most important part in our LMS project and this is mostly interacting with student and lectures, the lectures can schedule their classes(lectures) according to the timetables and display all scheduled classes, they can filter lectures from entering date or year/semester also can download lecture materials. they have own permission to edit or delete their scheduled lectures. When the lectures want to add new classes to system according to their timetables, must enter class scheduling date and time, lectures meeting links, lecture material (e.g., lecture slide, tutorial sheets, lab sheets) upload as pdfs, lecture topics and description.

The registered student can display lecture inside the grid view with all information about classes. They not allowed to edit or delete lectures, but they allowed to download lecture materials from the system, students can filter the lectures from entering date or year/semester. Because of that students can join classes from given meeting link according to the scheduled time and date

V. DISCUSSION

Students and lecturers will benefit enormously from this proposed Learning Management system. In this system, four main functions have been implemented, which are User Management, Announcement, Lecture, and E-library management. The system is designed to generate four reports for each area.

Selenium and Sonarqube, two testing tools, have been utilized to test the Learning Management System. In

To test our system, we used 2 testing tools, Sonarqube, and selenium. We analyzed the total system with Sonarqube and increased the quality of the LMS. We also automated our testing using selenium

This learning management tool will provide a suitable solution to manage academic content and its related activities.

To back up the statement we collected data from students. We let students use each function of the system and collected their feedback

We asked how likely they recommend this software to use in a University as the figure says most users recommend this tool use for university
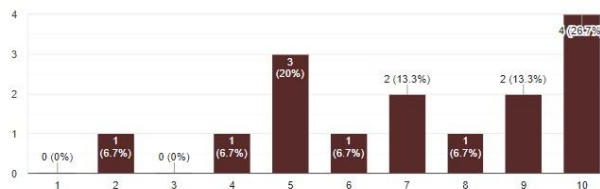

Figure 6: User Feedback how likely they recommend this tool for University use in 1-10 Scale (1-Not Likely, 10-Extremely likely)

We also asked how satisfied users were with the reliability of this software. And most users are happy with the reliability of this software
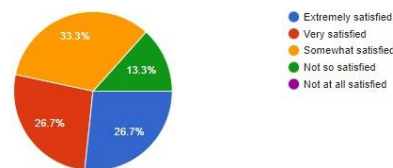

Figure 5: Users' response to their satisfaction with the reliability of the software.

We asked users how liked and feel about the LMS system, and most of the users were satisfied with the current UI and feel of the software.
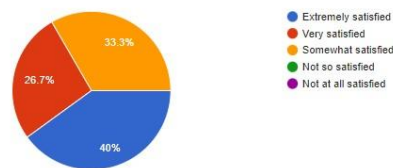

Figure 7: Users feedback of Software UI

We specifically asked users to Sign in, log in to the LMS system, edit their profile details, and ask their opinion of the process.

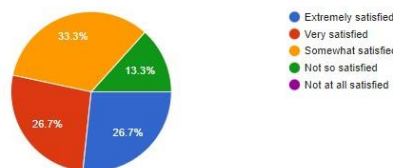33.3% of users are somewhat satisfied with this function, so we have to improve the UI of this functionality

Figure 8: Users response of their account setup experience

We asked users whether is it useful the way of displaying Announcements and searching for notices. Most users are satisfied with the way LMS displays announcements.
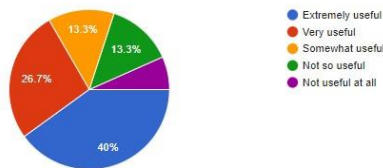
Figure 9: Users response of Usefulness of Announcement publishing functionality

In the survey, we asked how useful will it be if we include E-library functionality in the system and we let them use it, and We got very positive feedback as most users think E-Library functionality will be very useful for this software.
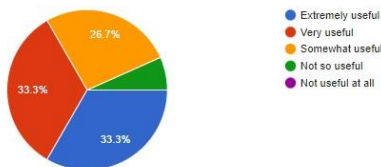

Figure 10: User's response of Usefulness of E-Library functionality of the system

We also asked how satisfied they are with the Lecture Material functionality. As their response, most of them are very satisfied with the way we implemented the Lecture martial functionality.
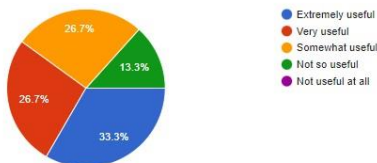

Figure 11: User's response of Usefulness of Lecture Material functionality of the system

VI.   CONCLUSION

In this research paper, we address the key functions available in this Learning management system, including Lecture management, User management, E-library management, and notice management. Each function has a sub-function of report generation.

The lecture management function focuses on Student's flexibility to get lecture materials such as Lecture slides, Tutorials, and assignments lecturers can post online class links and timetables too. Notice management function handle all the faculty announcements. So it will be easy for faculty to publish faculty notices. It will be convenient for students to get all the Notices in one place. Another function that plays a significant role in this system is Library management which is a function under E-Library.

In this function system, the administrator can add, edit or remove e-books from the E-library database. Students and lecturers can access E-library materials too. The other function is the User Management function which is responsible for handling user roles and each user profile details.

Since this Learning management system is a combination of all these functions it contains all the requirements that a Learning Management system should have. In terms of further research, more external functions could be considered

REFERENCES

[1] www.unesco.org, "school closure to recovery | UNESCO," [Online]. Available: https://www.unesco.org/en/covid-19/education-response.

[2] R. Markets, " GlobeNewswire News Room," 2019. [Online]. Available: https://www.globenewswire.com/news-release/2019/12/17/1961785/0/en/Online-Education-Market-Study-2019-World-Market-Projected-to-Reach-350-Billion-by-2025-Dominated-by-the-United-States-and-China.html.

[3] S. ,. M. S. ,. I. Sumair Hamza, "research gate," 2020. [Online]. Available: https://www.researchgate.net/publication/323292627_E-_Notice_board_Dynamic_Information_Processing_Application.

[4] R. (n.d.), "Library Management System," 2022.

[5] J. R. S. G. P. M. T. a. W. C. Rhode, "Understanding faculty use of the learning management system," 2017.

[6] N.-T. Nguyen, "A study on satisfaction of users towards learning management system at International University – Vietnam National University HCMC. Asia Pacific Management Review," 2021.

[7] "https://docs.sonarqube.org/latest/," [Online].

[8] [Online]. Available: https://kinsta.com/knowledgebase/what-is-github/.

[9] c. D. systems, "Crest data systems," 2022. [Online]. Available: https://www.crestdatasys.com/blogs/an-introduction-on-using-sonarqube/.