IT4010 – Research Project - 2024

Topic Assessment Form

Project ID: 24-25J-112

1. Topic (12 words max)

Adaptive Learner Centric LMS: Enhanced Student Engagement and Personalized Learning Experiences

2. Research group the project belongs to

Software Systems & Technologies (SST)

3. Research area the project belongs to

E-learning and Education (ELE)

4. If a continuation of a previous project:

Project ID	
Year	

5. Brief description of the research problem including references (200 – 500 words max) – references not included in word count.

Despite the widespread adoption of Learning Management Systems (LMS) in educational institutions, several recent studies and reports have shown that while LMS is highly successful in enabling the administrative of the learning, they are less helpful in enabling learning itself [14],[1],[2],[3]. These systems face significant challenges that hinder their effectiveness in enhancing student engagement and providing personalized learning experiences. The primary failure aspects identified in the current LMS implementations include:

1. **Communicative Feature Design -** According to many studies, the existing LMS designs are criticized for their inadequate communication features [4],[5], [6],[7]. Many studies have discussed this issue in terms of investigating why LMS is not effectively used for this purpose [8]. These systems often fail to facilitate effective two-way communication between students and instructors, leading to reduced interaction and engagement.
2. **Teacher-Centered Structure -** LMS is supposed to help facilitate moving learning toward a more learner-centered approach, innovating pedagogical practices [4]. LMS platforms are predominantly designed around a teacher-centered approach, which promotes passive learning environment [2], which limits student autonomy and active participation in the learning process. This overreliance on instructors to manage and coordinate all course activities stifles the potential for a more learner-centric environment.
3. **Learner Disengagement -** Student engagement is the measurement of learning quality at most education institutions [10]. It refers to "the amount of physical and psycho-logical energy that the student devotes to the academic experience"[10]. Hens one of the critical failure aspects is the inability of LMS to maintain student engagement [13]. The lack of interactive and stimulating content results in students feeling disconnected from the learning material.

4. **Inflexible Assessment -** The assessment tools within most LMS are rigid and do not align well with diverse learning outcomes and cognitive skill levels [11]. The prevalent use of multiple-choice questions and similar formats restricts comprehensive assessment of student understanding and skills [12].
5. **Confusing User Interface -** Many LMS platforms have cluttered and unintuitive user interfaces [14], making navigation and use difficult for students and instructors alike. This issue leads to frustration and decreased usage efficiency, as noted by several experts.
6. **Limited Mobile Features -** With the increasing reliance on mobile devices for accessing educational content, the lack of robust mobile-friendly features in many LMS platforms is a notable deficiency [14]. The limited support for mobile learning hampers the flexibility and accessibility of learning resources, which is critical for modern, on-the-go learners.

These identified failure aspects underscore the necessity for an Adaptive Learner-Centric LMS that prioritizes enhanced student engagement and personalized learning experiences. Addressing these shortcomings is crucial for developing an LMS that not only supports administrative functions but also truly facilitates effective and engaging learning environments.

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[4] A. K. Alhazmi and A. A. Rahman, "Why LMS failed to support student learning in higher education institutions," 2012, https://doi.org/10.1109/IS3e.2012.6414943
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[14] Alhazmi, A., Imtiaz, A., Alhammadi, F., & Kaed, E. (2021). Success and Failure Aspects of LMS in E-Learning Systems. International Journal of Interactive Mobile Technologies (iJIM), 15(11), pp. 133–147. https://doi.org/10.3991/ijim.v15i11.20805

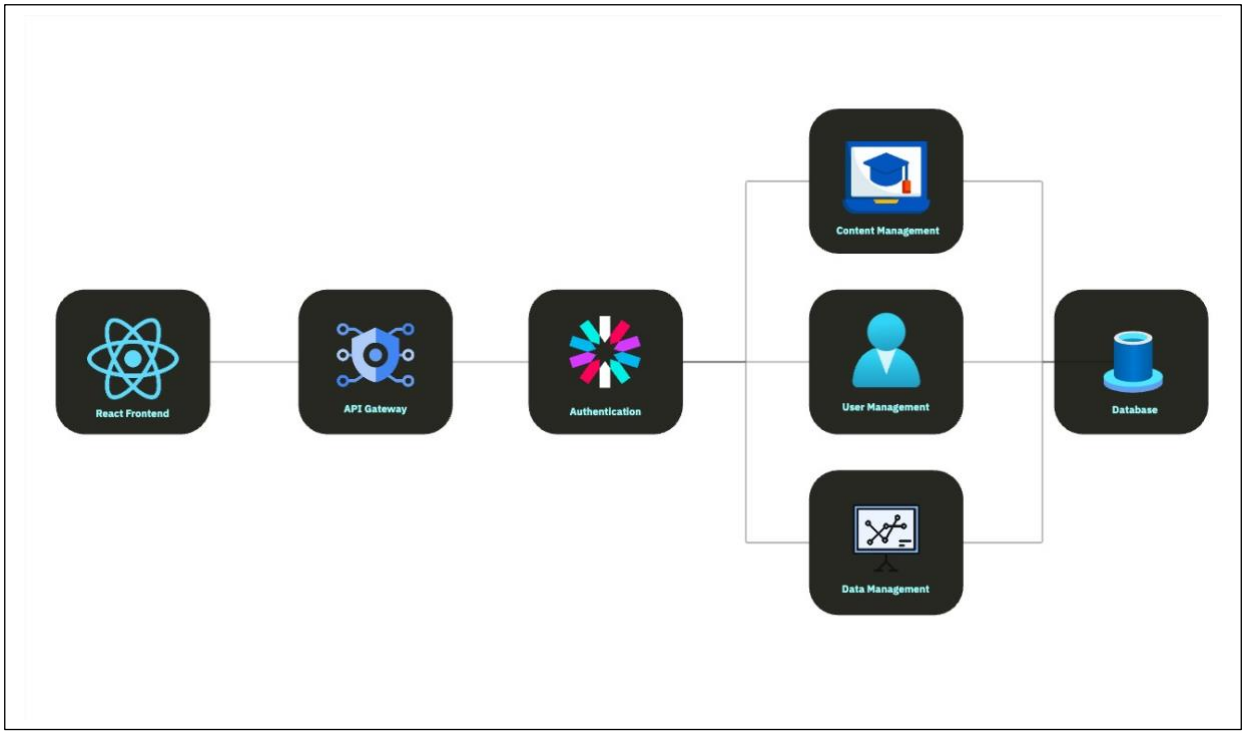
6. Brief description of the nature of the solution including a conceptual diagram (250 words max)

Our solution aims to enhance student engagement and personalize learning experiences by implementing an Adaptive Learner-Centric Learning Management System (LMS). This system is designed to address the limitations of current LMS implementations, particularly their inadequate communication features, teacher-centered structure, and inability to maintain student engagement.

The solution revolves around four main concepts

1. Keeping Students Engaged
    - **Friendly, Customizable Interface -** This includes options to adjust font type and size, switch to full-screen mode, use paper layouts, and modify brightness and color settings withing the system itself.
    - **Evidence-Based Study Techniques -** Incorporates techniques like progressive pomodoro, using timers and personalized motivations to promote effective study habits.
    - **Behavior Analysis and prediction system -** Utilizes algorithms to analyze user behavior, calculate reading speeds predict time to finish tasks, and determine active/inactive states based on time on screen and multiple other factors.
2. Content Creation and Note taking to the next level
    - **Mind Map Generation -** Automatically generates mind maps based on the content to enhance awareness and provide interactive tasks.
    - **Interactive Tools -** Includes notecards, bookmarks, highlighting, and note-keeping features to help students manage and organize their learning materials withing the system.
3. Personalized Exams and Assessments
    - **Adaptive Assessments -** Uses data to create personalized exams and assessments that match individual learning goals.
    - **Leaderboard -** Incorporates a pointing system to motivate students through a competitive and engaging environment.
4. AI Document Interaction
    - **AI Chatbot -** Facilitates student interaction with lecture content using an AI-driven chatbot, allowing for real-time assistance and clarification.
    - **Custom AI Responses -** AI-generated responses can be reviewed and published on the module forum with the approval of the Learning Interaction Coordinator (LIC).

This holistic approach ensures that the LMS not only supports administrative tasks but also actively enhances learning and engagement.


Content Management
React Frontend
API Gateway
Authentication
User Management
Database
Data Management

7. Brief description of specialized domain expertise, knowledge, and data requirements (300 words max)

Educational Technology

- Knowledge of current pedagogical practices and how to integrate technology to support learner-centered education.
- Expertise in designing and developing interactive and adaptive learning tools that promote active participation and engagement.

Behavioral Psychology

- Understanding of student engagement metrics and how to analyze behavioral data to personalize learning experiences.
- Skills in developing motivational strategies and evidence-based study techniques to keep students engaged.

Data Science and Machine Learning

- Proficiency in creating algorithms that analyze user behavior, predict task completion times, and determine engagement levels based on screen time and other factors.
- Experience with adaptive learning technologies that use data to tailor content and assessments to individual needs.

Human-Computer Interaction (HCI)

- Expertise in designing user-friendly and customizable interfaces that enhance the learning experience.
- Knowledge of accessibility and usability standards to ensure the LMS is inclusive and effective for all students.

Artificial Intelligence

- Skills in developing AI-driven chatbots and natural language processing (NLP) tools to facilitate real-time interaction and support.
- Ability to create and manage AI systems that generate educational content and responses, ensuring accuracy and relevance.

Educational Data Requirements

- Collection and analysis of large datasets on student interactions, performance, and engagement to continuously improve and personalize the learning experience.
- Ensuring data privacy and security in compliance with educational regulations and standards.

8. Objectives and Novelty

Main Objective

The main objective of the proposed Adaptive Learner-Centric Learning Management System (LMS) is to enhance student engagement and personalize learning experiences by addressing the limitations of traditional LMS implementations. This includes improving communication features to facilitate effective two-way interaction, shifting from a teacher-centered to a learner-centric approach to promote student autonomy and active participation, and utilizing interactive, adaptive content and assessments to maintain and boost student engagement and motivation, ultimately creating a supportive and dynamic educational environment.

Member Name	Sub Objective	Tasks	Novelty
Rajapaksha R.M.S D	**Personalized, adaptive, customizable content viewing interface with built in learning techniques aiding tools** Enhance student engagement through a friendly, comfortable, and customizable interface, leveraging evidence-based study techniques to personalize the learning experience.	**Design and Develop a Customizable content viewing interface** • Implement features to adjust font type and size, switch to full-screen mode, use paper layouts, and modify brightness and color settings. • Ensure the interface is user-friendly and accessible, meeting usability and accessibility standards. **Incorporate Evidence-Based Study Techniques** • Integrate tools such as timers and personalized motivational prompts to encourage effective study habits.	**Personalized and Adaptive Learning Environment** • Incorporates tools such as timers and personalized motivational prompts to promote effective study habits, directly integrated into the LMS interface. • Optimize the components in the interface to make them adapt based on ongoing user interaction data.

		Client-Side Optimization • Managing the load of the client side by idling the unused features for better user experience.	
Sri Samadhi L.A.S.S	**Enhancing Learner Support and Motivation with Adaptive Features** Develop and integrate various adaptive features that support and motivate learners, including mind map generation, note-taking tools, and chat forum.	**Personalized Mind Map Generation** • Utilize grading from the initial assessments to tailor the mind map generation process. • Customize the appearance and structure of the mind maps to align with individualized learning progress. • Enable interactive features allowing users to expand or collapse nodes, focusing on specific areas of their learning journey. • Provide links to additional resources, such as articles, videos, and external websites, based on the mind map contents. • Include relevant references and further reading materials to enhance the learning experience. **Increase Awareness and Provide Interactive Learning Tools** • Develop a notecard system that allows students to create and manage digital notecards for key concepts and terms.	**Adaptive Learning with Interactive Mind Maps** • The mind map generation feature provides a unique way for students to visualize and understand complex information, enhancing their cognitive processing and retention. • By providing various tools and features aimed at supporting different aspects of learning, the LMS ensures that students have the resources they need to succeed, from visual aids to interactive engagement and social support.

		• Integrate a note-taking tool within the LMS, enabling students to keep notes directly linked to specific lecture content. • Ensure that notes can be easily accessed, edited, and organized. **Forum Between Student Groups and Lecturers for Each Subject** • Implement a forum feature that allows students to form groups and communicate with each other and with lecturers. • Ensure that forum threads are organized by subject and topic to facilitate focused discussions.	
PEIRIS A.R.D	**AI-Driven Document Interaction Using an LLM API** Implement an AI-driven document interaction feature using a LLM API, enabling students to interact with lecture PDFs through a chatbot.	**Chatbot Integration** • Integrate a suitable LLM API to create a chatbot that can interact with PDFs. • Ensure the chatbot can understand and respond to queries related to the content of the selected lecture PDFs. **PDF Content Extraction and Processing** • Implement functionality to load and extract text from lecture PDFs. • Format extracted text for processing by the LLM API.	**Lecture content based chatbot** • The chatbot will be fed with the extracted text of the lecture PDF on button click allowing the students to interact with the lecture content.

Monali G.M.N.	**Enhanced Personalized Learning Experience** Create a dynamic and supportive learning environment by utilizing adaptive content, real-time progress tracking, flexible assessments, and proactive support to meet each student's unique needs and preferences.	**Create Adaptive Learning Paths** • Develop initial assessments to determine students' knowledge levels. • Implement algorithms to personalize learning paths based on assessment results. **Develop Real-Time Progress Tracking and Support System** • Create a dashboard with visual progress indicators like graphs and charts. • Design an alert system to notify instructors when students need extra help. • Enable students to schedule one-on-one tutoring sessions through the chat forum. **Provide Flexible Assessments and Personalized Feedback** • Develop various assessment tools such as quizzes and project-based assignments (Formative assessment). • Implement grading systems for quick responses (Summative assessment). • Enable instructors to give personalized feedback.	**Adaptive Learning Technology** • Continuously adjusting learning paths based on real-time student performance and interactions, while utilizing diverse assessment methods, including quizzes and assignments, to align with different learning objectives and styles, promoting a deeper understanding of the material and ensuring each student receives a tailored educational experience.

9. Supervisor checklist

a) Does the chosen research topic possess a comprehensive scope suitable for a final-year project?

Yes	✓	No	

b) Does the proposed topic exhibit novelty?

Yes	✓	No	

c) Do you believe they have the capability to successfully execute the proposed project?

Yes	✓	No	

d) Do the proposed sub-objectives reflect the students' areas of specialization?

Yes	✓	No	

e) Supervisor's Evaluation and Recommendation for the Research topic:

The scope and the project idea is good.

10. Supervisor details

	Title	First Name	Last Name	Signature
Supervisor	Dr.	Kalpani	Manathunga	24/06
Co-Supervisor	Ms.	Thilini	Jayalath	24/06
External Supervisor				
Summary of external supervisor's (if any) experience and expertise				

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Topic Assessment Form

This part is to be filled by the Topic Screening Panel members.

Acceptable: Mark/Select as necessary

Topic Assessment Accepted	
Topic Assessment Accepted with minor changes (should be followed up by the supervisor)*	✓
Topic Assessment to be Resubmitted with major changes*	
Topic Assessment Rejected. Topic must be changed	

* Detailed comments given below

Comments

- Component 1 - Persuasive.
- Component 2 - Should persuasive. May lack sufficient scop
- Component 3 - Building LLM API is not sufficient. Have to clearly the topic or define the contribution
- Comp 4 - Persuasive & augmentation the contribution

The Review Panel Details

Member's Name	Signature
Dharsha Kuruppu	
Thilini Jayalath	
Rivoni De Zoysa	

*__Important__:

1. According to the comments given by the panel, make the necessary modifications and get the approval by the **Supervisor** or the **Same Panel**.
2. If the project topic is rejected, identify a new topic, and follow the same procedure until the topic is approved by the assessment panel.