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Review article

Collaborative Learning Platform for Academicians in Libya

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ABSTRACT

Higher education academicians face a variety of difficulties, such as the need for improved collaboration, streamlined communication, and effective resource management. In order to tackle these concerns, this study investigates the unique challenges that academicians in higher education face. The study emphasizes the need for integrated features and user interfaces that are simple to understand and customized for a particular requirement of higher education. Moreover, by exploring the recognition and understanding of these barriers, the study not only clarifies the complex terrain of difficulties but also establishes the foundation for the creation of a platform for collaborative learning. With a focus on the problems faced by academicians, this platform will include features like a forum that is easy to use, the ability to share resources, a powerful search engine, a section devoted to frequently asked questions, and a chatbot that can engage users. Together, these elements seek to offer a thorough resolution to the problems noted, promoting enhanced dialogue, information sharing, and instructional effectiveness among academicians.

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INTRODUCTION

In the realm of education, information technology has become a transformative force, evolving to support societal changes since its inception [4,11]. The influence of technology on teaching and learning in the new millennium has shifted the role of teachers to facilitators, with students actively engaging with information from diverse sources [3,10]. Effective knowledge management has emerged as a significant driver for improvement, particularly in project- oriented organizations, leveraging practical experience from past projects for efficiency and cost reduction [5]. The adoption of technology in education has led to the rapid growth of online learning platforms, such as learning management systems (LMSs) and content management systems (CMSs), supplementing traditional teaching methods with tools like forums, online assessments, and multimedia content.

The collaborative practices among academicians in Libya face challenges, primarily rooted in unstructured and inconsistent approaches, leading to perceived undervaluation of collaboration [1]. The concept of collaborative learning gained popularity in the 1980s, emphasizing better learning outcomes through collaborative, competitive, and individualized lessons [6]. In Computer-Supported Collaborative Learning (CSCL), technology is introduced to enhance collaborative learning processes, with advanced systems facilitating peer interaction to achieve learning outcomes [6]. Teacher collaboration research indicates positive outcomes, including improved attitudes towards teaching, teacher efficacy, and understanding of student learning [2].

Effective collaboration results in a shared sense of responsibility among teachers, contributing to increased student achievement [1,12]. Despite the proliferation of online learning platforms, there remains a need for a system specifically

designed for academicians to communicate, exchange information, and share instructional materials. This is crucial as academicians continually adapt their teaching strategies and materials to address the evolving complexity of the educational system. However, there's a notable lack of an interactive platform for academicians in Libya, hindering knowledge sharing and professional development opportunities.

Academicians, spanning various departments, lack a dedicated space to interact, resulting in limited sharing of experiences and knowledge. This isolation leads to missed opportunities for professional growth as academicians often work in silos. Moreover, traditional communication methods, such as mass emails, prove ineffective for sharing knowledge among a large group of academicians. While face-to-face communication holds value, technological advancements have rendered traditional methods inefficient. Direct messaging is highlighted as a more effective alternative, ensuring clearer and more complete information reaches the correct recipients. The project aims to enhance academicians' learning experiences by creating a comprehensive platform with key features like a user-friendly forum, resource-sharing capability, search function, FAQ section, and a chatbot. The first objective focuses on effortless interaction through a user-friendly forum, promoting real-time sharing of experiences. The second objective streamlines resource sharing, allowing academicians to upload and download instructional materials efficiently. The third objective emphasizes efficiency with a search function and a concise FAQ section. The fourth objective introduces a chatbot for automatic support, ensuring a user-friendly and personalized experience. Together, these objectives aim to create a tailored platform for academicians, fostering collaboration and improving their educational journey.

Related Systems

ResearchGate is a social networking site designed specifically for researchers and scientists. It provides a platform for researchers to share their work, collaborate with peers, and connect with other professionals in their field [17]. ResearchGate allows users to upload and share their publications, ask and answer questions, and participate in discussions related to various research topics. It aims to facilitate communication and collaboration among researchers worldwide. One of the cornerstone features is the Researcher Profiles, a digital haven for academics to showcase their professional identity. Upon signing up, researchers can craft comprehensive profiles encompassing essential details such as their name, affiliations, research interests, and a repository of their publications. These profiles not only serve as a virtual representation of a researcher's academic journey but also act as a networking hub within the ResearchGate community.

Central to ResearchGate's functionality is the Publications feature, empowering researchers to share their scholarly works effortlessly. From research papers to preprints, conference presentations, and book chapters, this platform acts as a repository for the diverse outputs of academic endeavors. Beyond mere sharing, ResearchGate provides detailed usage statistics for each publication, offering insights into their reach, downloads, and citation impact. Facilitating professional connections is the Networking and Collaboration feature, allowing researchers to forge meaningful relationships within their field. Through the platform, users can follow peers, stay updated on their latest work, and establish connections that transcend geographical boundaries.

ResearchGate’s algorithm further aids in suggesting potential collaborators based on shared research interests and existing connections. The Questions and Answers section provides a valuable space for researchers to seek guidance and expertise from the ResearchGate community. Scholars can pose queries related to their research or broader scientific topics, inviting responses and insights from fellow users. This interactive feature fosters a collaborative environment where knowledge-sharing becomes a communal effort. Diving into the heart of intellectual discourse, ResearchGate houses Discussions and Groups. This feature allows researchers to engage in topic-specific discussions and create or join groups dedicated to particular fields, disciplines, or research interests. These virtual forums serve as fertile grounds for scientific discourse, resource-sharing, and collaboration among like-minded researchers. For those seeking a quantitative understanding of their scholarly impact, ResearchGate offers Metrics and Research Impact features. Researchers can track the citations garnered by their publications, monitor the Altmetric score reflecting online attention, and delve into various engagement statistics. These metrics collectively provide a panoramic view of the influence and visibility of a researcher's body of work.

Quora is another online platform that serves as a question-and-answer community, enabling users to ask questions on a wide range of topics and receive answers from a diverse user base. Users can follow specific topics, answer questions based on their knowledge or expertise, and engage in discussions [18]. The platform is known for its question-driven content, where answers are upvoted or downvoted by the community, helping to surface the most helpful responses [19]. Quora aims to create a knowledge- sharing ecosystem, allowing individuals to both seek and contribute information in a collaborative and community- driven manner. A fundamental aspect of Quora is its reliance on User- Generated Content. This cornerstone feature empowers users to pose questions across a vast spectrum of topics, fostering a diverse

and extensive repository of information. The platform thrives on the collective wisdom of its user base, creating a knowledge hub that spans a multitude of subjects. Quora's organizational structure revolves around Community and Topics. Users can tailor their experience by following specific topics or joining communities aligned with their interests. This strategic organization ensures that content is curated to meet individual preferences, enhancing the relevance of the information users encounter.

Central to the Quora experience is its distinctive Question and Answer Format. Users engage in a continuous exchange where questions are posed, and answers are provided by the community. The democratic nature of the platform allows answers to be upvoted or downvoted, elevating the most helpful and pertinent responses for users. Quora has evolved into a platform where Professional and Expertise Networks converge. Users often showcase their professional backgrounds or areas of expertise in their profiles, lending credibility to their responses. This has transformed Quora into a go-to destination for accessing insights from professionals, experts, and enthusiasts alike. To maintain a positive and informative environment, Quora adheres to Community Guidelines. These guidelines encourage users to contribute accurate and helpful information while discouraging spam, hate speech, and inappropriate content. This commitment to fostering a constructive space enhances the overall user experience.

In its journey of expansion, Quora introduced features such as Blogging and Spaces. The blogging platform allows users to delve into longer-form content, while Spaces function as communities centered around specific topics or themes. These additions enrich the diversity of content and engagement on the platform.

The personalized experience on Quora is amplified through Notifications and Feeds. Users receive real-time updates related to their questions, answers, and the topics they follow. The personalized feed further curates content based on individual interests and activity, ensuring that users stay informed and engaged. Quora has ventured into Monetization and Partnerships to sustain its growth. The introduction of the Quora Partner Program (QPP) exemplifies this, enabling users to earn money by posing compelling questions. These innovative revenue models contribute to the platform's sustainability and continuous evolution. With a Global User Base, Quora thrives on diversity, both in perspectives and expertise. Users from around the world converge on the platform, fostering a rich tapestry of insights and knowledge. This global community aspect amplifies the depth and breadth of information available on Quora, making it a dynamic hub for collaborative learning and information exchange.

Frog VLE -Virtual Learning Environment is a learning platform that provides educational resources and tools for teachers, students, and parents. It is designed to facilitate online learning and collaboration within schools and educational institutions. Frog VLE offers features such as lesson planning, content sharing, assignment management, communication tools, and assessment capabilities. It aims to enhance the teaching and learning experience by providing a centralized platform for educational activities. Frog VLE is widely used in schools and educational institutions in various countries [16]. Frog VLE stands as a comprehensive educational platform equipped with a range of features designed to enhance the teaching and learning experience. At the core of its capabilities is content management, providing teachers with a versatile toolset for creating and organizing digital content. From lesson materials to multimedia resources, quizzes, and assessments, Frog VLE serves as a centralized repository, streamlining the storage and sharing of educational materials Facilitating Collaboration and Communication, Frog VLE transforms the virtual space into an interactive hub where teachers and students can engage in discussions, share ideas, and collaborate on projects. With features like forums, messaging, and real-time chat, the platform fosters seamless communication among users, fostering a collaborative learning environment. For educators, Frog VLE offers robust Lesson Planning and Delivery tools. Teachers can meticulously plan their lessons, set objectives, and attach resources to support their teaching objectives. The platform accommodates various formats for lesson delivery, including videos, presentations, and interactive activities, providing flexibility in instructional approaches.

In the realm of Assessment and Feedback, Frog VLE empowers teachers with tools for creating diverse assessments, quizzes, and assignments. From design to distribution and feedback provision, the platform supports both formative and summative assessment practices, catering to the varied needs of educators Parental Engagement is a distinctive feature of Frog VLE, recognizing the importance of involving parents in the educational journey. Parents gain access to valuable insights into their child's progress, can view assignments, and communicate with teachers through the platform, fostering a collaborative partnership between home and school. To harness the power of data, Frog VLE incorporates Analytics and Reporting functionalities. This feature enables teachers and administrators to gather insights into student performance, engagement, and progress. The data-driven approach facilitates the identification of areas for improvement, informing strategic instructional decisions

Research and system development methodology

Requirement data gathering method

To capture requirement data, a questionnaire was used in this research. Capturing accurate requirement data is a key to the successful development of a new system [13]. The nature of difficulties and issues currently faced by academicians analyzed using the questionnaire. Questionnaires play a crucial role in systematically gathering data and opinions from academicians, helping to understand the challenges they face and their expectations for an improved system. The process begins by clearly defining research objectives and structuring the questionnaire logically. It incorporated a mix of closed-ended and open-ended questions while ensuring clarity and avoiding bias. Demographic questions are included for relevant background information. The questionnaire delved into current teaching methods, exploring existing approaches used by academicians. It also sought opinions on potential areas of improvement, addressing features like centralized resource repositories and real-time communication. Encouraging detailed responses aids in understanding their needs.

Software development methodology

The software development methodology employed in this project is the Agile software development methodology. This approach proves well-suited for projects where requirements are anticipated to evolve or change over time, promoting adaptive planning, iterative development, and continuous collaboration with customers, which in this case involves academicians [14]. Salza et al., [15] recommended the use of agile methodology of software development for educational related systems. In the planning phase, as the software developer, researchers conducted a comprehensive review of the background study to gain a deep understanding of existing solutions, technologies, and relevant research. This knowledge forms the basis for effective development process planning.

The problem statement plays a pivotal role during this phase, defining the specific challenges that need addressing and guiding the understanding of the problem domain. Furthermore, the project's aim and objectives outline desired outcomes and deliverables, setting clear goals and defining the scope of work for the development phase. Moving on to the design phase, considerations involve the synthesis of the background study from the requirement that was gathered, problem statement, and project aim to architect the software system. This includes determining system components, database design, and the layout of the user interface. The design phase facilitates the creation of a blueprint aligned with project objectives, aiding informed decisions about technologies, frameworks, and programming languages. Next, the development phase involves the translation of design into functional components and features through writing code. Throughout this phase, the focus remains on the project aim and objectives, ensuring code alignment with desired outcomes. Regular reference to the problem statement guarantees that the software effectively addresses the identified issues. Furthermore, testing is vital in the software development process, with various types of testing, such as unit testing, integration testing, and system testing, being performed to verify functionality and reliability. This phase ensures that the software meets project objectives and resolves identified issues, allowing for the identification and resolution of any bugs or problems before the software is released. Then, the release phase involves preparing the software for release, including packaging, creation of installation files, and documentation of necessary instructions or release notes. This phase underscores the project's significance, representing its importance and potential impact on users or stakeholders. Proper release planning and execution are essential to maximize the software's reach and value.

Finally, in the feedback phase, active solicitation of feedback from users or stakeholders who interact with the released software is conducted. Their insights into usability, performance, and areas requiring improvement provide valuable input. This phase is instrumental in understanding how well the software aligns with the project's aim and objectives, allowing for refinement and enhancement based on real-world usage and user feedback. Throughout the software development process, the overarching goal is to ensure that the software effectively addresses identified problems, aligns with project aim and objectives, and delivers significant value to users or stakeholders.

RESULTS

In crafting the collaborative learning platform, a combination of robust applications and tools was employed to ensure a seamless and efficient system. The server-side of the platform was developed using Java, specifically leveraging the Spring Boot framework (Figure 1).

This choice was driven by Java's versatility, and the capabilities offered by Spring Boot facilitated the creation of a powerful and scalable server. This server handles a myriad of functionalities, ensuring smooth communication and efficient processing of data, thereby contributing to the overall effectiveness of the collaborative learning experience.

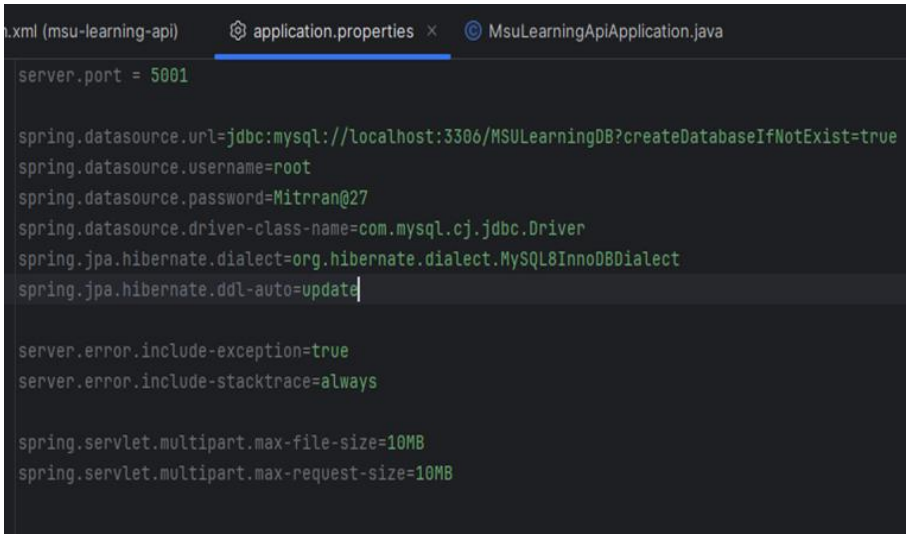

Figure 1. Java Spring Boot Code for System's Server

For the client-side development of the platform, Angular emerged as the framework of choice. Angular's structured approach and dynamic capabilities played a crucial role in shaping an interactive and user-friendly front- end. This decision was made with the intent of providing academicians with an engaging interface that seamlessly integrates with the collaborative learning features, fostering an intuitive and efficient user experience. The implementation of the chatbot functionality was realized through the utilization of Python, specifically incorporating the Flask API. Python's inherent flexibility and the simplicity offered by Flask were key factors in developing an intelligent chatbot. This component adds real- time support to the platform, enhancing user interaction and providing valuable assistance to academicians throughout their engagement with the collaborative learning features.

The core structure and styling of the collaborative learning platform were built using HTML, Typescript, and SASS (Figure 2). These web development technologies played a pivotal role in creating a responsive, visually appealing, and intuitive system. By leveraging HTML for structure, Typescript for dynamic functionality, and SASS for enhanced styling, the collaborative learning platform was tailored to meet the specific requirements of academicians in higher education. Together, these technologies underpin the platform's user-centric design and contribute to its overall success in addressing the unique challenges faced by academicians.

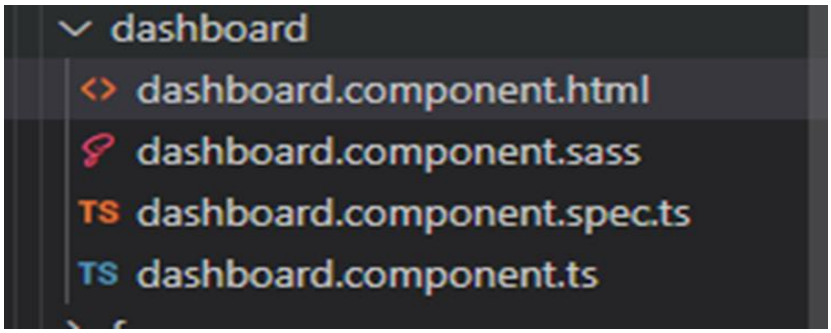

Figure 2. Styling of System's Dashboard

To save and manage the databases, MySQL (Figure 3) was employed as the relational database management system (RDBMS). MySQL added robustness to the platform's data storage and retrieval mechanisms, ensuring the secure and efficient handling of user-related information, forum posts, comments, likes, educational resources, and announcements. information about platform users, including user.

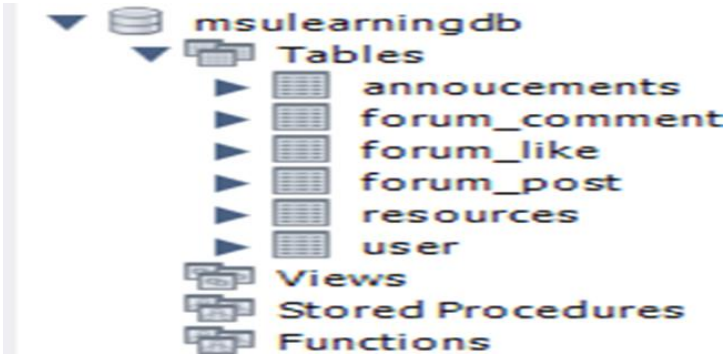

Figure 3. The Proposed system's Database in MySQL

The MySQL database is administered through robust management practices to ensure data integrity, security, and optimal performance. Regular backups are scheduled to prevent data loss in the event of unforeseen circumstances. Indexing is implemented strategically to enhance query performance, and normalization principles are applied to eliminate redundancy and maintain data consistency. Security measures, including user authentication and authorization protocols, are enforced to safeguard sensitive user information. Regular monitoring and performance tuning are conducted to address potential bottlenecks and ensure the platform's responsiveness.

Proposed System Performance and Interface Testing

Performance Testing: The performance testing conducted for the collaborative learning platform, several key metrics were assessed using Lighthouse, a tool designed to evaluate web page performance. The overall performance score obtained was 53 (Figure 4), indicating a moderate level of performance. Various important metrics contribute to this score.

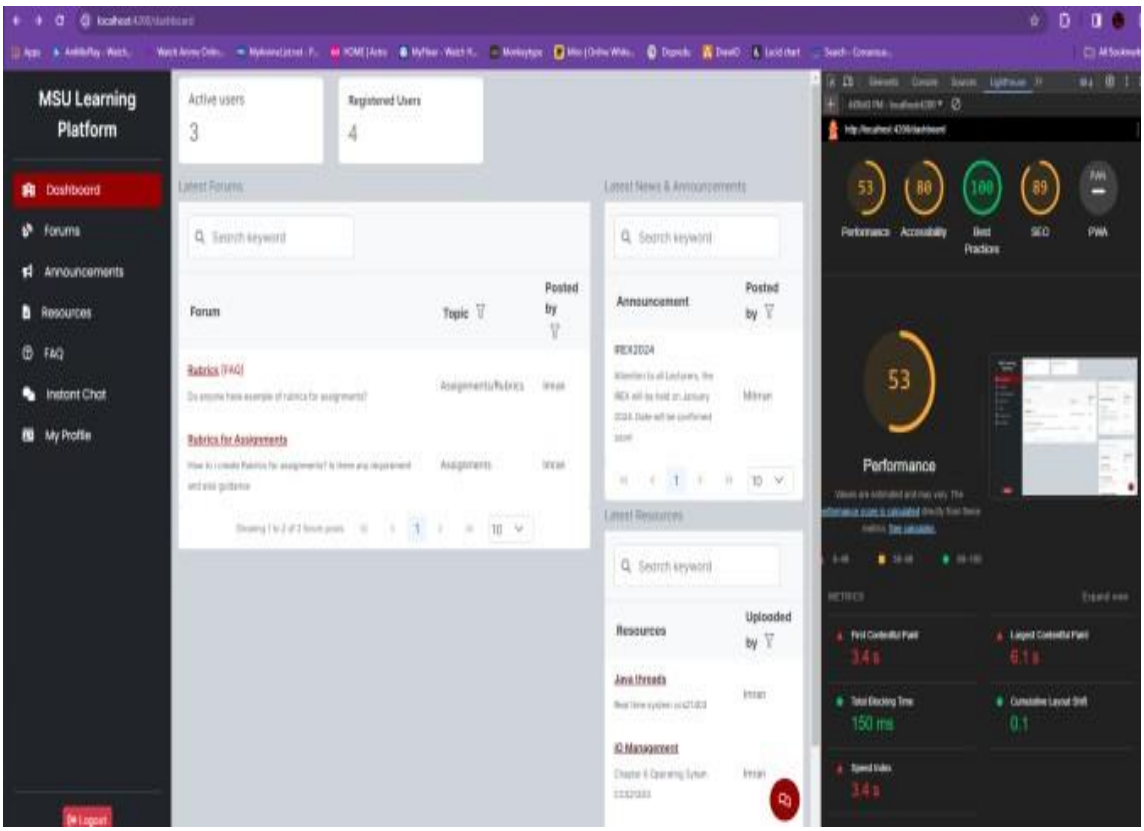

Figure 4. Performance Testing results

First Contentful Paint (FCP): This metric measures how quickly the browser renders the first piece of content on the screen. In this case, the platform achieved a First Contentful Paint time of 3.4 seconds, reflecting a reasonable speed for users to perceive initial visual feedback.

Total Blocking Time (TBT): TBT gauges the time during which the main thread is blocked, hindering user interactions. A Total Blocking Time of 150 milliseconds suggests that the platform's responsiveness is generally good, minimizing delays in user interaction.

Speed Index: The Speed Index reflects how quickly content is visually displayed during page load. With a Speed Index of 3.4 seconds, the platform demonstrates a relatively efficient loading process, contributing to a positive user experience.

Largest Contentful Paint (LCP): LCP measures the rendering time of the largest content element on the page. The platform achieved a Largest Contentful Paint time of
6.1 seconds, indicating a reasonable loading speed for significant content.

Cumulative Layout Shift (CLS): CLS assesses the visual stability of the page, considering unexpected layout shifts during load. A low Cumulative Layout Shift of 0.1 suggests that the platform maintains a stable layout, preventing abrupt shifts that may disrupt user interactions.

Accessibility Testing: The accessibility testing conducted for the collaborative learning platform has yielded a score of 80 (Figure 5), indicating a good level of accessibility.

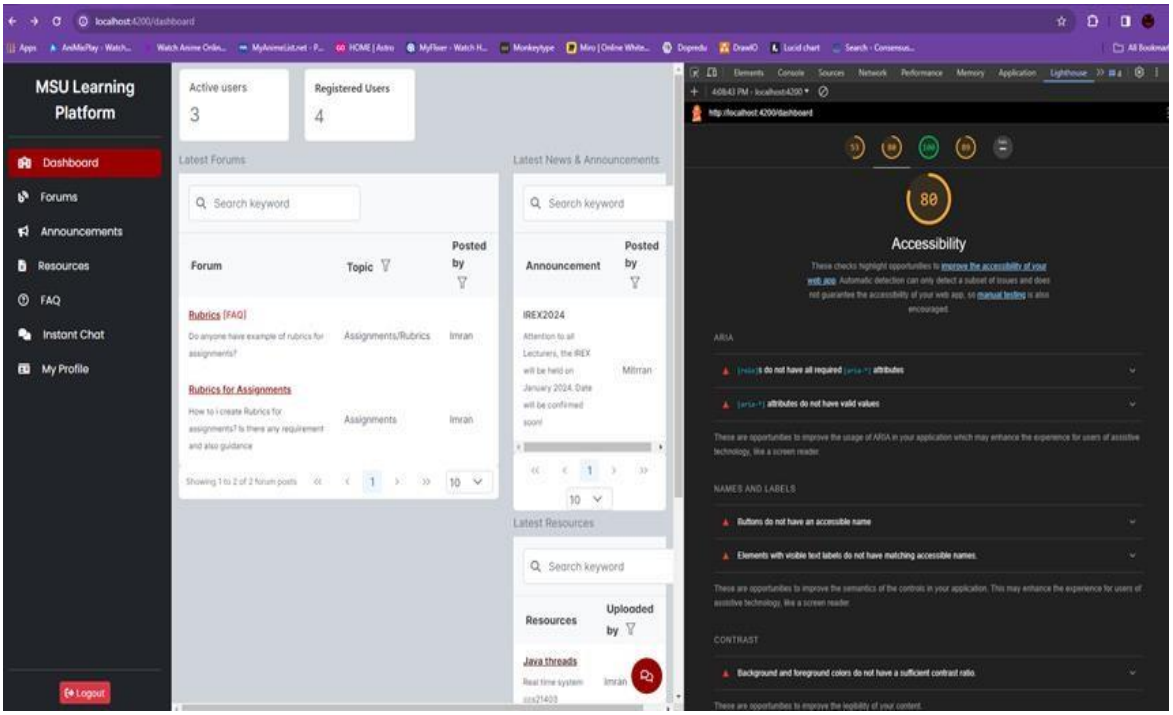

Figure 5. Accessibility Testing results

Aria Attributes: The Aria (Accessible Rich Internet Applications) attributes play a crucial role in enhancing the accessibility of web content for users with disabilities. The testing identified instances where elements with Aria roles lacked some of the required Aria attributes. Additionally, some Aria attributes did not have valid values, potentially impacting the accurate interpretation of these elements by assistive technologies.

Names and Labels: Accessibility guidelines emphasize the importance of providing accessible names for interactive elements. The testing revealed that certain buttons lacked an accessible name, making it challenging for users relying on screen readers or other assistive technologies to understand the functionality associated with these buttons. Furthermore, there were instances where elements with visible text labels did not have corresponding accessible names, potentially causing confusion for users with disabilities.

Contrast Ratio: Achieving an adequate contrast ratio between background and foreground colors is essential for users with visual impairments. The testing identified areas where the platform's color combinations did not meet the recommended contrast standards. This can affect the readability of text and the visibility of interface elements, particularly for users with low vision.

DISCUSSION

Even though the prototype was meticulously planned and developed, there were some limitations and challenges throughout the development lifecycle. During the development of the system, the performance of the collaborative learning platform may exhibit variations due to different factors, such as users' network conditions, device specifications,

and overall internet connectivity. While efforts have been made to optimize platform performance, external factors beyond the system's control can influence the user experience. Users may experience differences in loading times and responsiveness based on their individual circumstances. Additionally, the chatbot integrated into the platform has undergone basic training and currently possesses the capability to respond to greetings and provide simple answers to specific questions. However, it is essential to note that the chatbot's training is not exhaustive, and its responses are limited in complexity. Future iterations may involve further training to enhance the chatbot's understanding and responsiveness, covering a broader range of user inquiries and interactions.

In the platform's resources and forum features, a limitation exists concerning timestamp visibility. Specifically, the date information is not displayed directly on the features page; instead, users are required to click on the forum topic to access detailed timestamp information. This design choice aims to maintain a clean and uncluttered interface on the main features page. However, it is acknowledged that this approach may require users to take an additional step to view timestamp details, impacting the immediacy of date information accessibility. This limitation is considered in balancing user interface simplicity with the need for timestamp visibility.

As for the challenges faced during the development of the system, time constraint poses a challenge for comprehensive training of the chatbot. Due to the limited time available, the chatbot may not be fully equipped to handle a wide range of user queries. Its responses are confined to basic interactions and may lack the depth required for more intricate or specialized questions. This limitation underscores the importance of ongoing development and training for chatbots, acknowledging that their effectiveness grows with continuous learning.

Next, the challenge in exploring database connectivity issues arises from encountering unfamiliar variables or components. The complexity of database systems, especially when dealing with various tables such as user data, forum posts, and educational resources, may introduce variables that weren't anticipated during the initial development phase. This challenge highlights the need for a robust understanding of database management systems and the importance of thorough testing to ensure seamless connectivity and data retrieval.

CONCLUSION

In conclusion, the development of the collaborative learning platform marks a significant advancement in tackling the diverse and complex challenges faced by educators in higher education. By thoughtfully incorporating innovative features such as an intuitive forum, robust resource-sharing capabilities, an intelligent chatbot, and a comprehensive FAQ section, the platform emerges as a holistic and versatile solution, meticulously designed to meet the unique needs of academicians. While acknowledging the limitations and challenges encountered during the development process, the creativity and foresight embedded in this solution position it as a powerful catalyst for positive change within the educational landscape. The survey results underscore the platform’s substantial value, revealing its practical utility and potential to reshape the dynamics of academic collaboration and information sharing. As we look forward to future enhancements, the project’s dedication and commitment not only showcase a profound engagement with the needs of the academic community but also reflect a broader commitment to advancing educational technology. The platform’s greatest strength lies in its capacity to address real-world issues faced by educators, fostering enhanced collaboration, and ultimately contributing to the elevation of educational standards and practices.

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Conflicts of Interest

The authors declare no conflicts of interest in this study.

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منصة التعلم التعاوني للأكاديميين في ليبيا

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المستخلص

يواجه الأكاديميون في التعليم العالي مجموعة من الصعوبات، مثل الحاجة إلى تحسين التعاون، وسهولة الاتصالات، وإدارة االمصادرالموثوقة الفعّالة. ومن أجل معالجة هذه المخاوف، تبحث هذه الدراسة في التحديات التي يواجهها الأكاديميون في التعليم العالي. وتؤكد الدراسة على الحاجة إلى ميزات متكاملة وواجهات مستخدم تكون سهلة الفهم ومصممة خصيصًا لمتطلبات معينة للتعليم العالي. وعلاوة على ذلك، من خلال استكشاف التعرف على هذه العوائق وفهمها، فان هده الدراسة لا توضح الصعوبات المعقدة فحسب، بل تضع أيضًا الأساس لإنشاء منصة للتعلم التعاوني. مع التركيز على المشاكل التي يواجهها الأكاديميون، ستشمل هذه المنصة ميزات مثل منتدى سهل الاستخدام، والقدرة على مشاركة مصادر المعلومات، ومحرك بحث قوي، وقسم مخصص للأسئلة الشائعة، وبرنامج محادثة آلي يمكنه إشراك المستخدمين. وتسعى هذه العوامل معًا إلى تقديم حل شامل للمشاكل المذكورة، وتعزيز الحوار المعزز، وتبادل المعلومات، وفعالية التعلم والاستفادة بين الأكاديميين.

الكلمات المفتاحية: الأكاديميون، التعليم العالي، التعاون، التواصل، إدارة المصادر، منصة التعلم التعاوني.