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Original Article

Interactive E-Learning System Using Modern Web Technologies: Enhancing Student Engagement and Mentor Support

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Abstract

The fast pace of technological change has profoundly changed the depth of ways that education can be accessed, distributed, and delivered. Face-to-face, classroom-based systems have relatively difficult aspects to manage, such as educational access, rigid timelines for assignment deadlines, a rigid format for students to engage in courses, and systematic lack of student to student engagement/learning. In this paper, we discuss the development and delivery of an Online Learning Platform, which provides for centralized access to learning content and closes the gap of an instructor to student approach.The system has been built in such a way that allows instructors the ability to upload video courses, study material, and assignments and affords the ability for students to generate a student profile for course registration, to access learning materials, and to chat support for assistance as needed. In addition, there is a chatbot integrated in the platform to provide students some additional support if an instructor is not available. The system is built using react js in the frontend, spring boot in the backend, and MongoDB as the database engine. The system we propose removes the barrier to accessing learning experiences and improves flexibility to the learning experience and ultimately improves collaboration for a more engaging and inclusive learning experience.

Introduction

The rapid progress of digital technologies has changed how education is delivered and engaged in. Formal education can be effective in a school or classroom; it does, however, possess the limitations that an educational entity can only offer a limited number of learning opportunities, and learning access can be limited by geography, time, and by limited options for individual education.To address these limitations, online learning platforms offer an alternative for educational access and opportunities for flexibility, accessibility, and equity of access to education and interaction.

The Online Learning Platform recommended in this project delivers a complete service digital space for students and faculty to facilitate teaching and learning. Students will be able to register for courses, review video lectures, review supplementary materials for study, and take quizzes to test their knowledge of the course. Mentors will also have a place to provide links to external resources that student learners may need but may not have been covered in class and program a collection of all course content while also participating in real time support through the chat support to integrate within the product. Lastly, the product will have a chat bot that will support students in the absence of a mentor, allowing the learning process to continue to blossom. The platform has a front-end that is built in react js for reliability and a back end service that built in spring boot and uses MongoDB, therefore, it is a robust, scalable, user-friendly and efficient browser of materials. This product is innovative because it packages together functionalities that would generally be seen in a resource sharing application, an assessment component, and a way of communicating to support the student for self-paced study with a mentor, to increase the quality of education in the learning experience for them and the team of mentor educators.

Literature survey

E-learning refers to the effective use of advanced technologies and the Internet to facilitate the education process. In recent years, E-learning counts among the emerging trends in education. E-learning might be one of the major developments brought on by the internet. However, E-learning has many limitations regarding the extent to which it can replace the functions of the institution. For example, there may be courses that demand practical

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skills and supervision. Nonetheless, E-learning improves the interactions among the students and lecturers to create a strong learning environment for students based on their learning appeal and accessibility. E-learning is available anywhere and at any time.The paper was delivered by Florentina Magda Enescu, Gheorghe Șerban, Marshanna Jurian Romania 2019[1], at the Electronics, Computers and Artificial Intelligence (ECAI) International Conference 11th Edition 2019 published the year 2019. After reviewing all the modern, and most technically advanced web programming languages used to structure an application with an E-Learning module we opted for PHP as the programming language, and developed a framework based on PHP, specifically Laravel which was the most current version available when we developed the application. MySQL was selected as the application tool for the data storage related to the E-Learning unit, and the management system as the data storage aspect of the E-Learning application. The technical aspects of the elearning system were developed based on an indication from Vaishnavi Agarwal,Nanditha Pandey, Anjali, Anandhan K, and Damodharan D Noida 2021[2], International Conference on advance computing and Innovative Technologies in Engineering (ICACITE). They indicated that developing an e-learning site, in general, is cost effective for businesses, particularly providing we can demonstrate a good deal of functionality within the e-larning site to make it worthwhile.

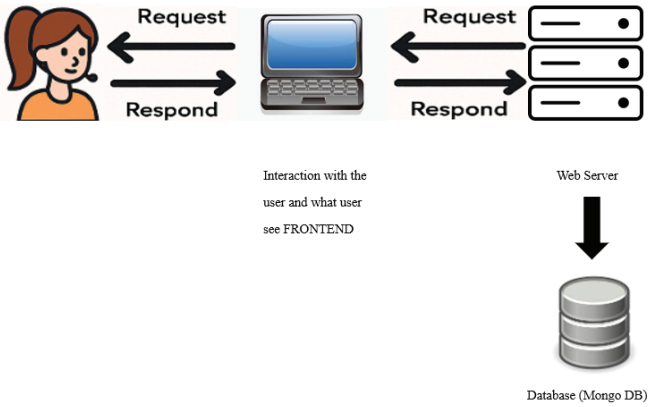
An educational based site again based on this research improved brand trust, again depended upon providing accurate and needed information.According to the research of Prof. Smita Deshmukh, Mr. Deepak Mane, Mr. Abhijeet Retawade Mumbai 2019[3], presented in the Proceedings of the Third International Conference on Computing Methodologies and Communication (ICCMC 2019), when it comes to technical considerations of Single Web Page Application, a single-page application is a web application or site that does not always reload the page from the server like a standard web page does, instead, after the first load, the user interaction with the page can be seen as being dynamically rewritten, so there is less disruption to user experience when going to the next page, and it makes the application behave like a desktop application.

According to the research by Mahani Hamdan, Jainatul Halida Jaidin Mia Fithriyah Begawan published in the 2020 [4] Sixth International Conference on e-Learning (e-conf), the problem for learning enthusiasts are, e-learning presents the best melding of teaching and learning practices at this time of crisis, but is very limited in the benefits and enjoyment of interacting socially on a face to face class.However, e-learning is the only advance we have to meet college, post-secondary and higher education standards. The use of Smart Mobile Devices (SMDs) and the Internet have also triggered education systems to adopt and enhance e-learning practices.

The research of Slavina Ivanova and Georgi Georgiev (2019 MIPRO) [7] indicated that as websites for e-learning are both learners and web designers, they confront quality issues of e-learning systems that correspond with deciding to the available and reliable content, consistency, interactivity, etc. Hence, there is a trend arising recently for multiple criteria decision making methods. Some of the new trends directly influence or introduce variability in our users experience as we became more reliant on web-based technologies, such as to replicate related computer systems in education systems.

Architecture

The proposed Online Learning Platform is going to be based on a three-tier architecture consisting of the frontend, backend, and database layers. The term "frontend" also referred to as the client layer is the part of the system that interacts directly with users. In this layer of the system, students and instructors can sign-in, view courses, upload learning contents and monitor progress, all while having a user-friendly experience. This layer will be developed by leveraging modern web technologies such as React, CSS are used to ensure responsiveness, as well as a good user experience.The backend is the layer that sits in between the frontend and the database. It is responsible for the user requests, managing the business logic, and interacting with the database to retrieve or save information. The backend was developed using Spring Boot, a security framework used for easily creating RESTful APIs that handled authentication, uploading courses, enrolling, and tracking. The database layer is implemented in MongoDB which is where we store all of the required information like user information, course information, shared materials and comments from students. The structure of NoSQL enables MongoDB to store both unstructured and structured data, which allows you to use a variety of educational content. The overall process of the system begins with a user request originating from the front end and will eventually the request...will reach the back end server, which will interface with the database to either retrieve or take an action on already existing data to be sent back to the front end. It will flow back ultimately to the front end in order to deliver the correct response back to the user. Overall, the system architecture provides a secure and seamless flow of information, leading to improved scalability, performance and user engagement in an online learning context.



Proposed system

The new system aims to develop a modern Online Learning Platform, with the purpose of connecting mentors and learners in an engaging and technologically rich space. The system addresses barriers to learning in a traditional classroom by providing accessible, flexible, and individualized online learning environments. The system enables/email and suggested both the learn and mentor are able to communicate, clarify questions, manage courses, and access course content any time and any place. This platform allows students to register for an account safely, sign in to the system, select courses, and access video lectures, materials, and quizzes about the course. Students can study at their own pace and communicate with mentors. Mentors can create and manage courses, upload video lectures and study notes.

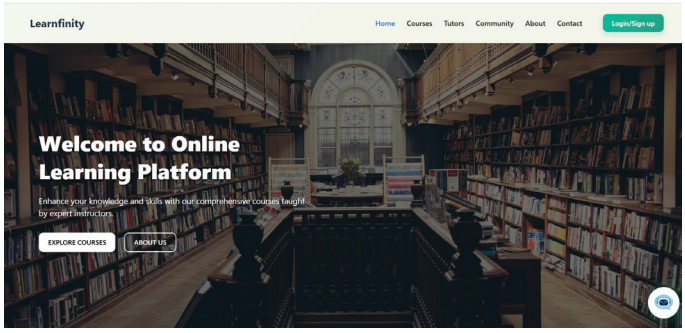
An important part of the system is the communication module that allows students and mentors to communicate synchronously, using an embedded chat feature. This fosters collaboration, allows questions to be answered immediately, and creates a more

dynamic experience in the online environment. Additionally, the system provides a chatbot assistant in the event that the mentors are unavailable to support the students. The chatbots can automate the responses to common questions, help navigate through the system, and direct students to specific resources if necessary so that the student can get back to learning without having a gap in responsiveness.

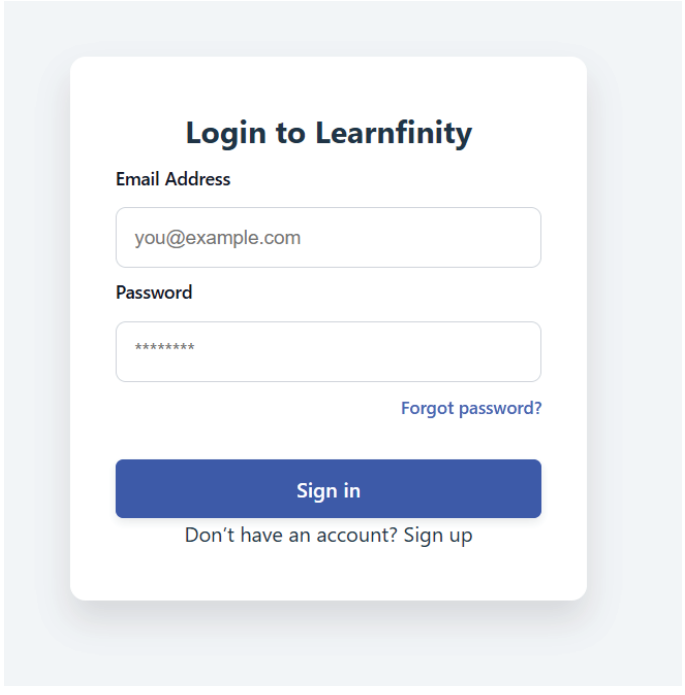
From a technical point of view, the system is running React. js on the front-end, which allows for an ease-of-use and responsive user experience. The back-end of the system is using Spring Boot, which is reliable, secure, and scalable to reliably and efficiently handle user interactions and requests -- potentially from multiple users at the same time. A MongoDB database is being used as a flexible data solution, allowing easy management of user information, course data, video files, and quiz results. All together, these technologies provided a reliable and scalable solution that can reliably support many users at the same time.

The interactive design of the platform encourages learners to be active participants in their educational experience.

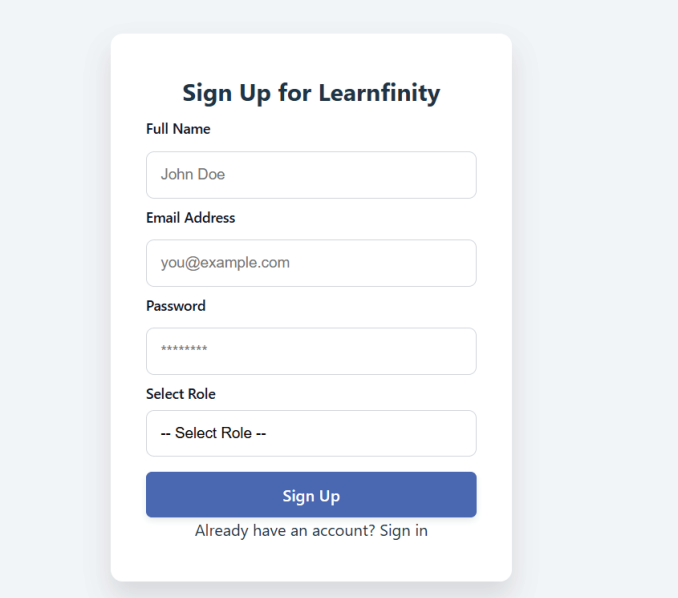
Results



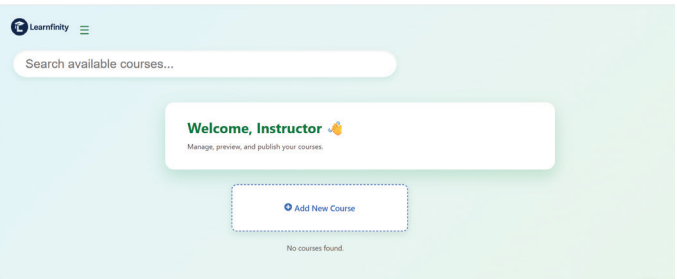
The figure above illustrates the Home Page of the Online Learning Platform with an ease of use application that allows various access points to information for students and mentors. This serves as the main entry point for students and mentors to use the various modules.



The previous figure depicts the Login Page of the Online Learning Platform. Using this page, users are able to safely access their accounts. The Login Page includes an authentication functionality for both students and mentors, with a focus on privacy and security of data as well as role-based access to the platform. Also, the Login Page of the Online Learning Platform has a simple design features and easy user experience throughout the login functionality.

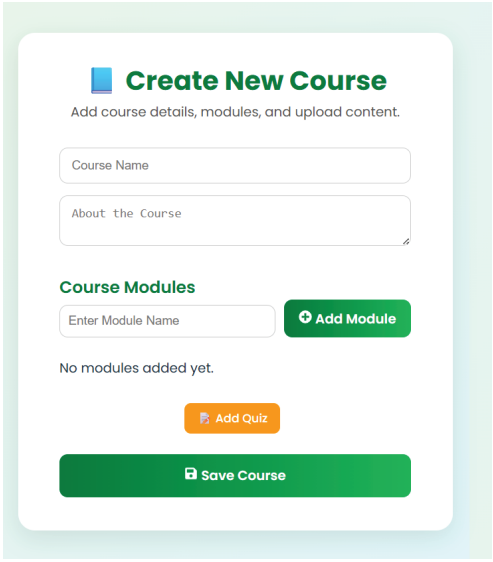


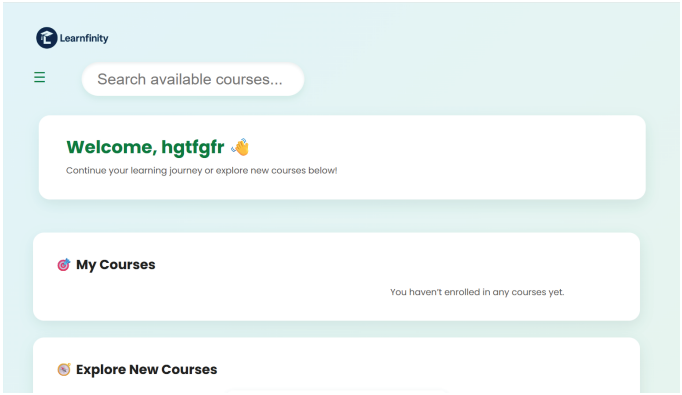
The Registration Page of the Online Learning Platform demonstrated above provides new users to register for an account with confidence and essential information is asked for both students and mentors, providing the system respective role access. The appearance of the user interface is created to be as user-friendly as possible to enhance the onboarding experience for all users.



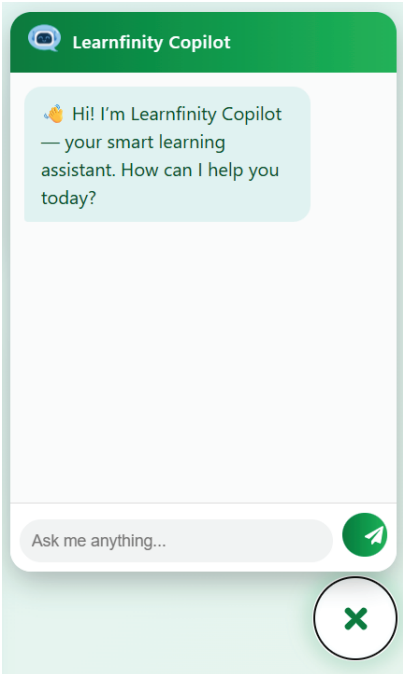
The above image shows the Instructor Dashboard which provides an organized interface for the instructors to manage the courses. Here it shows the courses that instructor uploaded, and the dashboard is built for clarity, accessibility, and real-time engagement with students.

The below image illustrates the Add Course and Quiz Page, which allows instructors to develop new courses and design quizzes. It allows instructors to upload learning materials, generate quizzes, and create a coherent content structure in an organized manner. This page was designed to provide a manageable way for instructors to utilize course materials and assess learning.



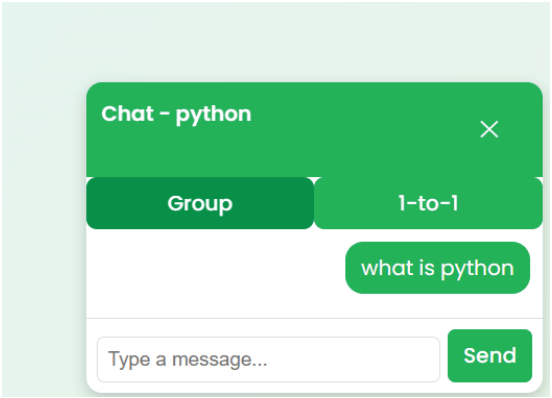


The Student Dashboard featured in the above figure allows students to search for, register for, and access any courses that are currently offered. It shows the courses the student is registered.

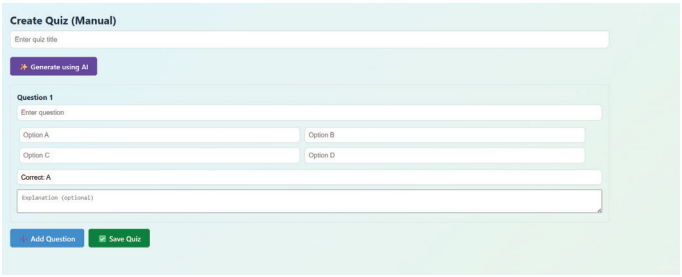


The figure above depicts the Chatbot, which is represented by an interactive icon across each dashboard for instant support for students and mentors, answering questions and walking users through the platform. The Chatbot provides support at any moment and enhances the user experience in general.

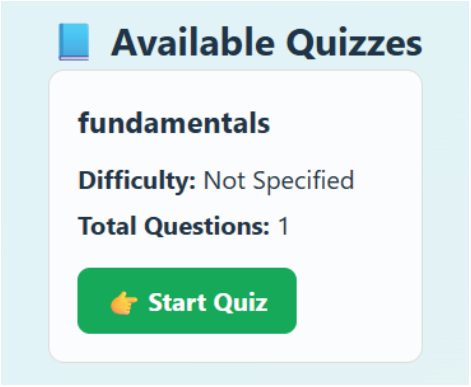
The previously mentioned outcome shows that learners and



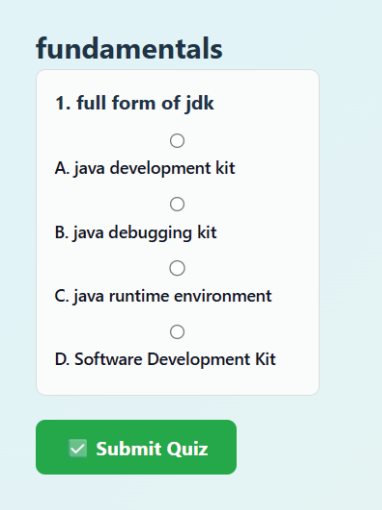
mentors can communicate through a jointly integrated, real-time chat system, students can ask for notice of confusion and not understandings, engage in topics with others, and receive feedback in real-time, while mentors can monitor the incidents of dialogue and provide instantaneous responses to students.



The illustration above depicts the page where a mentor is able to create quiz. The mentor can include questions, assign options, and save them for students to take and complete at a later date.

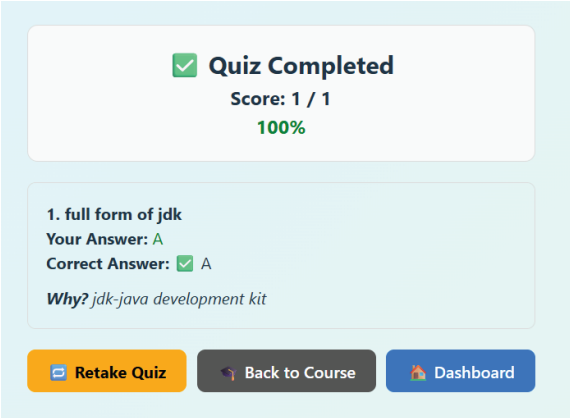


The figure above shows the page where students will see a list of available quizzes for their registered courses. There will be a button that says "Start Quiz" that allows students to begin the assessment. This page will allow students to access and complete quizzes.



The figure presented above illustrates the page where students answer question for the quiz. At the conclusion of the quiz, a "Submit" button is available for submitting their answer.

The below output is the location where students can view their quiz results and where their question is further explained in detail. The results page would include their overall score, as well as which responses were correct and incorrect.



Conclusion

The proposed Online Learning Platform successfully addresses the limitations of traditional pedagogical strategies by establishing a flexible, interactive, and technology-driven context. Students can take classes, consult teaching materials, and quizzes on their own schedule, while instructors can organize course content seamlessly. The capability of real-time chat, a chatbot, and a role-based dashboard will allow for easy interaction with instructors and students, as well as provide support when needed, making learning personalized for every student. The platform incorporates modern technology -- React. js, Spring Boot, and MongoDB -- to deliver a customized platform that easy and scalable, while being secure for today's educational environment. In summary, the platform furthers digital learning, collaborative learning, and competition within the digital academic world..

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