Build EdTech platform using MERN Stack

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Abstract— The Department for Education in England has launched a comprehensive research program to investigate the effective implementation of educational technology (EdTech) in schools and colleges, with the aim of creating a robust evidence base for the successful integration of technology into the education system. This study critically assesses recent EdTech literature from 2020 and conducts in-depth qualitative research with 17 state schools and colleges in England to gain insight into the selection, implementation and impact of EdTech products. The research identifies key features common to successful case studies and highlights their importance in benchmarking and quality assurance. These findings contribute to ongoing efforts to improve the digital learning experience in educational environments, in line with EdTech360 developments. EdTech360 is a cutting-edge MERN stack project specifically designed to empower small institutes and universities in their transition to comprehensive online learning platforms, thereby facilitating greater student engagement and academic success in the digital age.

Index Terms- Learning platforms, Quality assurance frameworks, Digital learning experiences, Retention Spam, Methodology, Ed Tech 360, Mern Stack.

I. INTRODUCTION

The search for new mastering and cooperation in education brought about the creation of EdTech360. EdTech360 immerses college students in an interactive environment designed to improve engagement, know-how, and retention of dating content. studies show that knowledge acquisition, collaboration, and full problem-based learning regularly integrated into EdTech360 platforms are powerful.

EdTech360 provides a contextual framework that makes abstract concepts more tangible and relatable to students. In addition, this platform promotes social interdependence and collaborative learning, which is recognized as an effective pedagogical strategy. By encouraging collaboration and interaction among peers, EdTech360 enriches the overall educational experience and facilitates the exchange of knowledge and diverse perspectives.

In addition, the integration of modern backend technologies further enhances the potential of EdTech360. Technologies like Express and Node.js offer advantages in terms of performance, security, and a modern development experience. Known for its event-driven, non-blocking I/O model, Node.js exhibits excellent scalability and efficiency, especially when handling concurrent connections. This integration enhances the interactive and dynamic learning experience offered by the EdTech360 platform.[1]

In the context of EdTech360, an educational platform, implementation frameworks play a key role in planning and quality assurance. However, there are significant gaps in the empirical evidence base, such as:

1. The actual implementation process of EdTech in schools and colleges.
2. The extent to which educational institutions utilize digital technology frameworks to shape their EdTech strategies.
3. Empirically validated models for assessing digital maturity.
4. The implementation and impact of EdTech across different educational phases, with limited research in areas like further education.
5. The deployment of EdTech beyond pedagogy, such as school management information systems.

While there is evidence suggesting that increased technology support for teaching and learning does not automatically translate to improved learner outcomes, addressing these gaps is essential to inform schools and colleges on more effective EdTech strategies, leading to enhanced educational outcomes.

This research paper delves into the synergistic relationship between EdTech360. It explores how the integration of these elements can optimize the learning experience, improve student outcomes, and meet the evolving demands of education in the digital era. It also compares the results from a platform built using the MERN stack and from surveys conducted among different students from different parts of the country.[2]

II. THE EDTECH PLATFORM

The Edtech360 b platform design aims to enable students to learn from courses of their interests as well as improve their skills in other areas.

In general, the available e-learning platforms allow only registered teachers (teaching profession) to upload courses for students to learn from. However, this platform allows any logged-in user to upload their courses to help the student community. This can not only help them gain confidence and build interpersonal skills, but also motivate them to pursue and earn such a career.

- The new user can register and then subsequently login to his account.
- Existing user can log into his/her account.
- User can browse through the courses and find the courses wished to get enrolled in.
- User can access the contents of a free course directly.
- User can create courses for others to learn from.
- If a course charge some amount, then the user needs to pay as per use.
- User can post queries and get them resolved from peers or even the instructor of the course.
- User can log out from his account.

From security perspective, the databases are secured on multiple servers to avoid attacks from hackers/intruders of the systems.[3]

III. TECHNOLOGIES USED FOR THE PROPOSED ARCHITECTURE

Ed Connect 360 ed-tech platform consists of three main

components: front end, back end and database. The platform follows a client-server architecture, with the front-end serving as the client and the back end and database serving as the server.

Front-end
The front-end of the platform is built using ReactJS, a popular JavaScript library for building user interfaces. ReactJS enables the creation of dynamic and responsive user interfaces that are critical to providing an engaging learning experience for students. The frontend communicates with the backend using RESTful API calls.[4]

Back-end
The backend of the platform is built using NodeJS and Express JS, which are popular frameworks for building scalable and robust server-side applications. The backend provides an API for the frontend to use, which includes functions such as user authentication, course creation, and course consumption. The back end also handles the logic for processing and storing course content and user data.[5]

Database
The table for the floor is built utilizing MongoDB, a NoSQL table that provides a adaptable and ascendable data conversion solution. MongoDB allows storage of unstructured and semi- structured data, which is useful for storing course content such as videos, images, and PDF files. The database stores course content, user data and other relevant information related to the platform.

Architecture Diagram
Here is a high-level diagram that illustrates the architecture of the Ed Connect 360 ed-tech platform:

A. Frontend
Front-end A component of the platform that the user interacts with is the frontend. It resembles the "face" that users view and engage with on the platform. A well-liked design tool called

Figma, which lets you make a simple and uncluttered user interface, was used to construct the front end of Ed Connect 360. Every element that an ed-tech platform ought to have is present in the Ed Connect 360 frontend. Among these websites are:

Regarding Students:

- Home page: Links to the course catalog and user information are included here, along with a quick overview of the platform.
- Course List: All of the courses that are offered on the platform will be included here, along with a description and rating. → desire List: Every course that the student has added to their desire list is shown on this page.
- Cart Checkout: The user can finish purchasing the course on this page.
- Course Content: Videos and other relevant materials will be included in the course content section of this website for a particular course.
- User details: Name, email address, and other pertinent data pertaining to the student's account will be included on this page.
- User Edit Details: The student can make changes to their account details on this page.

Regarding Instructors:

- Dashboard: This webpage will include a summary of the classes taught by the instructor, along with evaluations and comments for every course.
- Statistics: Comprehensive data regarding the instructor's courses, including as views, clicks, and other pertinent metrics, will be available on this page.
- Course Management Pages: These pages give the instructor the ability to add, edit, and remove courses in addition to controlling the cost and syllabus.
- View and modify profile info: The educator can access and modify their account details on these sites.

Regarding Admin (this is for future scope):

- Dashboard: This page will provide a summary of the platform's courses, teachers, and students.
- Statistics: Comprehensive data regarding the platform's metrics, such as the quantity of users who have registered, their rates, and their income, will be available on this page.
- Instructor Management: An administrator can oversee platform teachers' account information, courses, and ratings from this page.
- More pertinent pages: The administrator will also possess entry to more pertinent pages, like those

pertaining to user management and course management.

To build the frontend, we use frameworks and libraries like ReactJS, which is a popular JavaScript library for building user interfaces. We also use CSS and Tailwind, which are styling frameworks that help make the UI look good and responsive. Additionally, we use some npm packages to add more functionality to the frontend. To manage application state, we use Redux, which is a popular state management library for React. Finally, we use a development environment called VS Code, which is a popular code editor, to develop the frontend.[6]

B. Backend

Description of the Back-end Architecture:
Ed Connect 360 uses a monolithic architecture with a backend built using Node.js and Express.js and MongoDB as the primary database. Monolithic architecture refers to a design approach where all application modules are combined into one large program with a single code base for better control, security, and performance.

Node.js is a popular JavaScript runtime that allows us to run JavaScript code outside the browser. MongoDB is a popular NoSQL database that makes it easy to transfer and store data; This makes it a good choice for complex applications like Ed Connect 360.

Features and Functionalities of the Backend:
The back end of Ed Connect 360 provides a range of features and functionalities, including:

1. User Authentication and Authorization: Students and tutors can log in and log in to the platform using their email addresses and passwords. The platform also supports OTP (One-Time Password) authentication and a forgotten password feature for added security.
2. Course Management: Instructors can create, read, update and delete courses as well as manage course content and media. Students can view and rate courses.
3. Payment Integration: Students purchase and enroll in courses by completing the checkout process, followed by Razorpay integration for payment processing.

4. Cloud-based media management: Ed Connect 360 uses Cloudinary, a cloud-based media management service, to store and manage all media content, including images, videos and documents.
5. Markdown formatting: Course content in document format is stored in Markdown format, which allows for easier front-end display and rendering.[7]

Frameworks, Libraries, and Tools used:
The back end of Ed Connect 360 uses a range of frameworks, libraries, and tools to ensure its functionality and performance, including:
1. Node.js: Node.js is used as the primary back-end framework.
2. MongoDB: MongoDB is used as the primary database to provide a flexible and scalable data storage solution.
3. Express.js: Express.js is used as a web application framework that provides a number of features and tools for building web applications.
4. JWT: JWTs (JSON Web Tokens) are used for authentication and authorization and provide a secure and reliable way to manage user credentials.
5. Bcrypt: Bcrypt is used for hashing passwords and adds another layer of security to user data.
6. Mongoose: Mongoose is used as an Object Data Modeling (ODM) library that provides a way to interact with MongoDB using JavaScript.[8]

C. Data Models and Database Schema:
To handle data, the Ed Connect 360 back-end makes use of a number of data models and database schemas, such as:

1. Schema for Students: includes sections for each student's name, email address, password, and course information.
2. Instructor Schema: This includes each instructor's name, email address, password, and course information.
3. Course Schema: Consists of fields for media content, instructor information, course title, and description.

The overall goal of the Ed Connect 360 back-end is to offer a stable and expandable ed-tech platform solution with an emphasis on security, dependability,

and user-friendliness. By using the appropriate frameworks, libraries, and tools, we can guarantee that the platform functions flawlessly and offers each customer the best possible experience.[9]

D. API Design
The REST architectural approach was used in the development of the Ed Connect 360 platform's API. Express.js and Node.js are used to implement the API. It exchanges data using JSON and make use of the common HTTP request methods (GET, POST, PUT and DELETE).

An example of an API endpoint's functionality is provided here:
1. /api/auth/signup (POST) - Register as a new user (teacher or student).
2. /api/auth/login (POST) – Create a JWT token and log in with your current credentials.
3. Check the OTP that was provided to the user's registered email at /api/auth/verify-otp (POST).
4. /api/auth/forgot-password (POST) - Send the registered email address an email including a password reset link.
5. /api/courses (GET) - Retrieve a list of every course that is offered.
6. /api/courses/:id (GET) - Retrieve information about a particular course by ID.
7. /api/courses (POST): Add a new course to the system.
8. Update an already-existing course by ID using /api/courses/:id (PUT).
9. /api/courses/:id (DELETE) - Use the ID to remove a course.
10. /api/courses/:id/rate (POST) - Give a course a rating (out of 5).

Sample queries and answers sent to an API:
1. To obtain a list of all courses in the database, use the GET /api/courses request.
2. Get a single course by ID with the GET /api/courses/:id method.
● Response: The course with the given ID
3. POST /api/courses: Establish a new course
●Request: The body of the request contains the course data
● Reaction: The recently developed course
4. PUT /api/courses/:id: Modify a current course using its ID

- Request: The request body contains the updated course data
- Response: The updated course
5. DELETE /api/courses/:id: To remove a course based on its ID
- Response: The course has been erased, as indicated by the success message.

In summary, a crucial component of the project is designing the REST API for the Ed Connect 360 ed-tech platform. The purpose of API endpoints and their features is to guarantee smooth communication

between an application's front end and back end. An API that adheres to RESTful principles will be scalable, dependable, and maintainable. The aforementioned sample API queries and answers show how each endpoint functions and what kind of data it can receive or return. Ed Connect 360 will be able to offer a seamless user experience while guaranteeing security and stability with this API design.[10]

E. Implementation
The process of deploying the Ed Connect 360 ed-tech platform will entail hosting the application on a number of cloud providers. Vercel, a well-liked hosting provider for static React websites, will be used to deploy the frontend. The back end will be housed on one of two cloud hosting services—Render or Railway—for Node.js and MongoDB apps. The database will be hosted on MongoDB Atlas, a fully managed cloud database service, and the media files on Cloudinary, a cloud media management platform.

Scalability, security, and dependability will be guaranteed by the Ed Connect 360 platform's infrastructure and hosting environment. Render or Railway offers a dependable and scalable backend infrastructure, whereas Vercel offers a quick and scalable frontend hosting environment. While MongoDB Atlas offers a highly available and secure database environment with capabilities like automated scaling and disaster recovery, Cloudinary offers dependable storage for media assets with features like automatic picture optimization and transformation.

All things considered, Ed Connect 360's implementation procedure will guarantee a dependable and expandable hosting environment for

the program, enabling users to easily access the platform from any location in the globe.
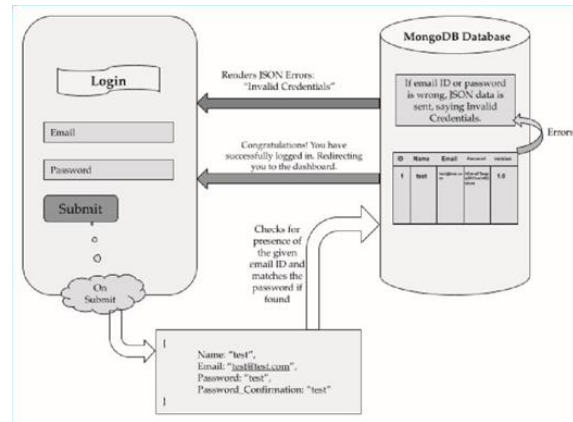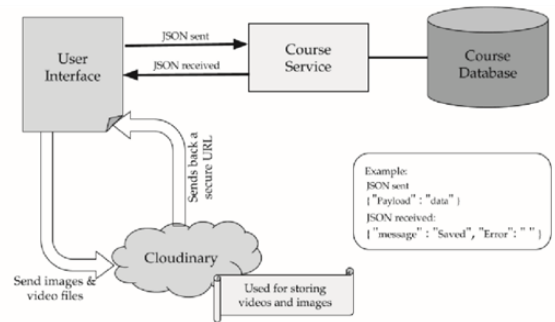

Fig. 5

Fig. 6

CONCLUSION

In conclusion, this document outlines the architecture, features and functionality of the Ed Connect 360 ed-tech platform. It highlights the use of MERN stack technologies and REST API design and outlines the deployment process using free hosting services, Vercel for the front-end, Render.com or Railway for the backend, and MongoDB Atlas for the database. In addition, it lists potential future improvements that could be implemented to improve the platform, along with their estimated timeline and priorities.

Throughout the development of the project, various achievements will be made in terms of implementing the desired functionalities and creating a user-friendly interface. However, skilled will be challenges to be confronted all the while the development process, to a degree merging different electronics and troubleshooting errors.

FUTURE ENHANCEMENT

This section discusses future improvements to the Ed Connect 360 platform. These add-ons are listed with a description of how they will improve the platform and implementation priorities.

1. Game features: Adding game features like badges, points, and leaderboards can increase user engagement and motivation. This will be moderate incremental development.
2. Personalized Learning Path: Creating a personalized learning path for each student based on their interests and learning style can increase student satisfaction and success. This will be a priority contribution.
3. Social learning features: Incorporating social learning features such as group discussions, peer feedback, and collaborative projects can increase engagement and student engagement. This will be a medium priority contribution.
4. Mobile Application: Creating a mobile application for the platform will allow more convenient access to certain content and features and increase the accessibility of the platform. This will be a priority contribution.
5. Machine Learning Powered Recommendations: Using machine learning algorithms to provide personalized course recommendations can increase student engagement and satisfaction. This will be a medium for high priority development.
6. Virtual Reality/Augmented Reality Integration: Adding virtual reality or augmented reality components to some courses can improve and deepen the learning experience. It will grow low to medium. [11]

Overall, these enhancements would significantly improve the Ed Connect 360 platform and its offerings to students, instructors, and administrators. The implementation timeline and priority would depend on various factors such as the resources available and the specific needs and goals of the platform.

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