

STUDY NOVA
A PROJECT REPORT

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Declaration by the student

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CERTIFICATE

This is to certify that the work titled “**StudyNova**”, submitted by “**Abhikant Kumar(211B408)**” in partial fulfillment for the award of the degree of Bachelor of Technology (Computer science Engineering) of Jaypee University of Engineering & Technology, Guna has been carried under my supervision. To per best of my knowledge and belief, there is no infringement of intellectual property rights and copyrights. Also, this work has not been submitted partially or whole to any other university or Institute for the award of this or any other degree or diploma. In case of any violation concern student will solely be responsible.

Dr. Prateek Pandey

Date:

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ABSTRACT

The objective of this website is to Enhance the quality of learning and teaching. Meet the learning style or needs of students. Improve efficiency and effectiveness. Improve user accessibility and time flexibility to engage learners in the learning process.

Our E-learning website **STUDYNOVA** will help you to learn online. And access courses from our website.

we believe that everyone must be equipped with basic knowledge in technology, as well as use it as a medium to reach a particular goal and aim. In the 20th century, we have moved from the Industrial Age through the Information Age and now to the Knowledge Age. Knowledge and its efficient management constitute the key to success and survival for organizations in the highly dynamic and competitive world of today. Efficient acquisition, storage, transfer, retrieval, application, and visualization of knowledge often distinguish successful organizations from unsuccessful ones.

It helps students learn efficiently by gaining resources and attending lectures online. It is deemed cheaper and reliable as students can learn and practice independently without pressure and stiff competition like in real classrooms.

NO peer pressure in E-learning Like school, where the teachers and other students are pressured to score well, this website helps students focus on themselves and do better. When competition isn't very stiff and healthy, the student can concentrate more and make the most out of their study time.

Through StudyNova you can learn the course of your choice through online resources. Lower costs than conventional teaching approaches are provided at StudyNova.

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1. INTRODUCTION

E-learning is an education via the Internet, network, or standalone computer. E-learning is basically the network-enabled convey of skills and knowledge. E-learning refers to using electronic applications and processes to learn. E-learning includes all forms of electronically supported learning and teaching.

The information and communication systems, whether networked learning or not, serve as specific media to implement the learning process. This often involves both out-of-classroom and in-classroom educational experiences via technology, even as advances continue in regard to devices and curriculum. E-learning is the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-based learning, computer-based learning, virtual education opportunities, and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM. That is to say, E-learning systems contain both a Learning Management System and a

Course management system. It can be self-paced or instructor-led and includes media in the form of text, image, animation, streaming video, and audio. It is commonly thought that new technologies can make a big difference in education. At young ages especially, children can use the huge interactivity of new media, and develop their skills, knowledge, and perception of the world, under their parents' monitoring, of course.

With the increasing adoption of the Internet and the rise in awareness about e-learning, the online education industry is expected to witness promising growth during the forecast period. Ease of learning, flexibility, and a wide range of study materials have influenced the overall growth of the industry. The online education market is segmented into primary and secondary supplemental education, test preparation, reskilling and certification, higher education language, and casual learning. The change in consumer behavior toward detailed learning and the surge in demand from tier II and tier III cities are driving the growth of this segment. The online test preparation market is expected to reach INR 94.75 Bn by 2024. This segment is expected to be the fastest-growing segment in the online education market.

E-learning is bridging the gap between learning and work. Workers can integrate learning into work more effectively because they use the same tools and technology for learning as they use for work. Both employers and employees recognize that e-learning will diminish the narrowing gap between work and home and between work and learning. E-learning is an option to any organization looking to improve the skills and capacity of its employees. With the rapid change in all types of working environments, especially medical and healthcare environments, there is a constant need to train and retrain people in new technologies, products, and services found within the environment. There is also a constant and unrelenting need for appropriate management and leveraging of the knowledge base so that it is readily available and accessible to all stakeholders within the workplace environment

1.1 ADVANTAGES OF E-LEARNING

Effectiveness: - E-learning offers teachers an efficient way to deliver lessons to students. Online learning has a number of tools such as videos, PDFs, and podcasts, and teachers can use all these tools as part of their lesson plans. By extending the lesson plan beyond traditional textbooks to include online resources, teachers are able to become more efficient educators.

Accessibility Of Time and Place: - Another advantage of online education is that it allows students to attend classes from any location of their choice. It also allows schools to reach out to a more extensive network of students, instead of being restricted by geographical boundaries. Additionally, online lectures can be recorded, archived, and shared for future reference. This allows students to access the learning material at a time of their comfort.

Affordability: - Another advantage of online learning is reduced financial costs. Online education is far more affordable as compared to physical learning. This is because online learning eliminates the cost points of student transportation, student meals, and most importantly, real estate. Additionally, all the course or study materials are available online, thus creating a paperless learning environment that is more affordable, while also being beneficial to the environment.

Suits a variety of learning styles: - Every student has a different learning journey and a different learning style. Some students are visual learners, while some students prefer to learn through audio. Similarly, some students thrive in the classroom, and other students are solo learners who get distracted by large groups. The online learning system, with its range of options and resources, can be personalized in many ways. It is the best way to create a perfect learning environment suited to the needs of each student.

1.2 INTRODUCTION TO PROJECT

StudyNova (website name) is the delivery of learning and training through digital resources. Although StudyNova is based on formalized learning, it is provided through electronic devices such as computers, tablets, and even cellular phones that are connected to the internet. This makes it easy for users to learn anytime, anywhere, with few, if any, restrictions. Basically, StudyNova is training, learning, or education delivered online through a computer or any other digital device. StudyNova is an online platform developed for the purpose of live coaching. The platform is also dedicated to training for several Courses such as Machine Learning, Programming Languages, Video Editing, etc. To offer its support to the 21st century's education system, the platform allows LIVE interactive online learning among pupils and teachers. It also offers individual as well as group classes. The platform makes use of two-way audio, video as well and whiteboarding tools which enables both the student as well as the teacher to view, listen, write as well as interact in real-time.

1.3 AIM AND OBJECTIVE OF THE PROJECT

E-learning represents an innovative shift in the field of learning, providing rapid access to specific knowledge and information. It offers online instruction that can be delivered anytime and anywhere through a wide range of electronic learning solutions such as Web-based courseware, online discussion groups, live virtual classes, video and audio streaming, Web chat, online simulations, and virtual mentoring. E-Learning enables organizations to transcend distance and other organizational gaps by providing a cohesive virtual learning environment.

Companies must educate and train vendors, employees, partners, and clients to stay competitive and E-Learning can provide such just-in-time training in a cost-effective way. Developing and deploying effective E-Learning programs may require products and services supplied by a variety of vendors, leaving one to connect the dots. One way to start is to define the goals of the desired learning solution. The definition of the goals of an E-Learning solution is driven by the following factors:

- Attracting and recruiting new students.
- Promoting our excellence in teaching and research. Providing consistent, up-to-date information.
- Attracting and recruiting people to study here. Provide our best faculty to students.
- Simple, easy-to-use platform for student and parent engagement. Can create classrooms, add students, and assign homework or activities.
- The Class Story feature helps parents remain updated on their child's progress and learning. Creates a competitive environment for students

1.4 PURPOSE OF THE PROJECT

1.4.1 CURRENT SYSTEM

The current situation is very limited to few resources, students are unable to get knowledge more than what the lecture provides to them. This in the end limits student's performances, because everything a student gets is collected from lectures in class. Here are some of the problems of the current system:

- Students submit assignments to lectures through hard copies or personal emails.
- Students only get help from lectures if the lectures are in their office.
- New lectures to a course have to get materials on their own.
- Students are required to physically be in the classroom in order to gain knowledge thereby sacrificing all other responsibilities.

- Students are unable to share resources effectively and hold group discussions that are monitored or supervised by lectures

1.4.2 THE FUTURE SYSTEM

The system will hopefully serve as a centralized database of syllabi for the courses offered at the university allowing students and faculties (current, past, and prospective), to view them. The system will end up bringing effective communication among students, lecturers, and the administration, by accessing information and other resources anytime, anywhere. Here are some expected results of the project:

- Lecturers to upload assignments and resources for their units.
- Students to download the resources and upload assignments.
- It provides an easy-to-use way to manage course websites that include schedule information, announcements, as well as course discussions.

1.5. SIGNIFICANCE OF E-LEARNING

Technology has the power to transform education. It is essential to bring it into the classroom to empower learning. Here are some of the reasons (significance/importance).

1. Students need to be engaged with what they are doing to improve learning outcomes
2. Enables students to become thinkers/learners/risk takers in a sheltered environment.
3. Learn not to rely on the teacher...be accountable themselves...become independent!
4. Broadens the horizons of many students as it exposes students to the world outside their city or country town.
5. Tech bridges rural education gaps, enabling virtual learning for diverse subjects, connecting small schools, overcoming distance, and fostering equal opportunities.
6. Allows a mobile learning environment– anywhere, anytime, anyhow.

2. LITERATURE REVIEW

2.1 Overview

E-learning, a key internet-driven transformation, enhances student-teacher interaction, providing flexibility but has limitations for hands-on courses. It utilizes various ICTs for content delivery, including feedback systems, networks, video/audio conferencing, and computer-assisted instruction. This approach, enabling learning anytime, anywhere, fosters lifelong learning with more advantages than limitations.

2.2 Introduction

Different authors use different terminologies including online learning, Internet learning, distributed learning, networked learning, tele-learning, virtual learning, computer-assisted learning, web-based learning, and distance learning interchangeably with the term e-learning, making it difficult to come up with a generic term to define e-learning. The common factor in all these terms is the use of technology in the delivery of teaching and learning. But one author by the name of Naidu breaks e-learning down into the following modalities:

1. Individualized self-paced online e-learning where an individual learner accesses learning material online.
2. Individualized self-paced offline e-learning where an individual learner accesses learning material offline.
3. Synchronous group-based e-learning where a group of learners work together in real time via the intranet or Internet.
4. Asynchronous group e-learning involves non-real-time online collaboration. This review covers offline peer learning, online LMS-based learning, various methods, and their pros/cons, excluding social networking interactions.

2.3 Outcome

E-learning platforms have revolutionized the way we learn, providing flexible and accessible educational opportunities for learners of all ages and backgrounds. Over the past few decades, there has been a burgeoning body of research investigating the effectiveness and outcomes of e-learning platforms. This literature review synthesizes the key findings from this research, focusing on the following aspects:

2.3.1 Effectiveness of E-Learning Platforms

- E-learning boosts knowledge and skills by offering personalized, self-paced access to abundant educational resources, fostering enhanced acquisition and development.
- E-learning boosts engagement and motivation through interactivity, gamification, and collaboration, enhancing the enjoyment and effectiveness of the learning experience.
- E-learning enhances accessibility, enabling learners to access education anytime, anywhere, overcoming geographical and time constraints, and benefiting non-traditional learners.

2.3.2 Factors Influencing E-Learning Outcomes

- Platform design and usability: E-learning platforms should be user-friendly and easy to navigate to ensure a positive learning experience.
- Course content quality: The quality of course content is crucial for effective learning. Content should be well-structured, engaging, and aligned with learning objectives.
- Instructor involvement: Instructor involvement can significantly impact student engagement and learning outcomes. Instructors should provide active support, guidance, and feedback to learners.
- Learner motivation and self-regulation: E-learners' success hinges on motivation and self-regulation skills, requiring self-discipline and effective time management to attain learning objectives.

2.3.3 Implications for E-Learning Platform Design and Implementation

- Focus on user-centered design: E-learning platforms should be designed with the user in mind, considering their needs, preferences, and learning styles.
- Ensure high-quality course content: Invest in developing well-structured, engaging, and relevant course content that aligns with learning objectives.
- Foster instructor involvement: Encourage instructor engagement by providing them with the necessary tools and support to effectively guide and support learners.
- Promote learner motivation and self-regulation: Provide strategies and resources to help learners develop self-motivation and self-regulation skills, which are essential for success in e-learning environments.

E-learning platforms have emerged as powerful tools for education, offering flexibility, accessibility, and personalized learning experiences. The research on e-learning outcomes consistently demonstrates the effectiveness of these platforms in enhancing knowledge and skills acquisition, increasing learner engagement, and providing accessible educational opportunities. However, the success of e-learning platforms depends on various factors, including platform design, course content quality, instructor involvement, and learner motivation. By considering these factors and implementing effective design and implementation strategies, e-learning platforms can continue to revolutionize education and provide learners with the tools they need to succeed.

3. SYSTEM ARCHITECTURE

The StudyNova ed-tech platform consists of three main components: the front end, the back end, and the database. The platform follows a client-server architecture [1], with the front end serving as the client and the back end and database serving as the server.

3.1 Front End:

The front end is part of the platform that the user interacts with. It's like the "face" of the platform that the user sees and interacts with. The front end of the platform is built using ReactJS [2], which is a popular JavaScript library for building user interfaces. ReactJS allows for the creation of dynamic and responsive user interfaces, which are critical for providing an engaging learning experience to the students. The front end communicates with the back end using API calls.

The front end of StudyNova has all the necessary pages that an ed-tech platform should have. Some of these pages are:

3.1.1 For Students:

- **Homepage:** This page will have a brief introduction to the platform, as well as links to the course list and user details.
- **Course List:** This page will have a list of all the courses available on the platform, along with their descriptions and ratings.
- **Wishlist:** This page will display all the courses that a student has added to their wishlist.
- **Cart Checkout:** This page will allow the user to complete the course purchase.
- **Course Content:** This page will have the course content for a particular course, including videos, and other related material.
- **User Details:** This page will have details about the student's account, including their name, email, and other relevant information.

3.1.2 For Instructors:

- **Dashboard:** This page will have an overview of the instructor's courses, as well as the ratings and feedback for each course.
- **Insights:** This page will have detailed insights into the instructor's courses, including the number of views, clicks, and other relevant metrics.
- **Course Management Pages:** These pages will allow the instructor to create, update, and delete courses, as well as manage the course content and pricing
- **View and Edit Profile Details:** These pages will allow the instructor to view and edit their account details.

3.1.3 For Admin:

- **Dashboard:** This page will have an overview of the platform's courses, instructors and students.
- **Insights:** This page will have detailed insights into the platform's metrics, including the number of registered users, courses, and revenue.
- **Instructor Management:** This page will allow the admin to manage the platform's instructors, including their account details, courses, and ratings.
- **Other Relevant Pages:** The admin will also have access to other relevant pages, such as user management and course management pages.

To build the front end, we use frameworks and libraries such as ReactJS [2], which is a popular JavaScript library for building user interfaces. We also use CSS and Tailwind [3], which are styling frameworks that help make the user interface look good and responsive. Additionally, we use some npm packages to add extra functionality to the front end. To manage the state of the application, we use Redux, which is a popular state management library for React. Finally, we use a development environment called VSCode, which is a popular code editor, to develop the front end.

3.2 Back End:

StudyNova uses a monolithic architecture, with the backend built using Node.js [4] and Express.js [5], and MongoDB [6] as the primary database. Monolithic architecture refers to a design approach where all the modules of the application are combined into a single large program, with a single codebase, to enable better control, security, and performance. Node.js [4] is a popular JavaScript runtime that allows us to run JavaScript code outside of the browser. Express.js is a web application framework that simplifies the process of building web applications in Node.js. MongoDB [6] is a popular NoSQL database that allows for flexible data storage and retrieval, making it a suitable choice for complex applications like StudyNova.

3.2.1 Features and Functionalities of the Back-end:

The back end of StudyNova provides a range of features and functionalities, including:

- User authentication and authorization: Students and instructors can sign up and log in to the platform using their email addresses and password. The platform also supports OTP (One-Time Password) verification and forgot password functionality for added security.
- Course management: Instructors can create, read, update, and delete courses, as well as manage course content and media. Students can view and rate courses.
- Payment Integration: Students will purchase and enroll on courses by completing the checkout flow that is followed by Razorpay [7] integration for payment handling.
- Cloud-based media management: StudyNova uses Cloudinary [8], a cloud-based media management service, to store and manage all media content, including images, videos, and documents.
- Markdown formatting: Course content in document format is stored in Markdown format, which allows for easier display and rendering on the front end.

3.2.2 Frameworks, Libraries, and Tools used:

The back end of StudyNova uses a range of frameworks, libraries, and tools to ensure its functionality and performance, including:

- Node.js: Node.js is used as the primary framework for the back end.
- MongoDB: MongoDB is used as the primary database, providing a flexible and scalable data storage solution.
- Express.js: Express.js is used as a web application framework, providing a range of features and tools for building web applications.
- JWT: JWT (JSON Web Tokens) are used for authentication and authorization, providing a secure and reliable way to manage user credentials.
- Bcrypt [9]: Bcrypt is used for password hashing, adding an extra layer of security to user data.
- 6. Mongoose: Mongoose is used as an Object Data Modeling (ODM) library, providing a way to interact with MongoDB using JavaScript.

3.3 Data Models and Database Schema:

In figure 3.1 the back end of StudyNova uses a range of data models and database schemas to manage data, including:

- Student schema: Includes fields such as name, email, password, and course details for each student.
- Instructor schema: Includes fields such as name, email, password, and course details for each instructor.
- Course schema: Includes fields such as course name, description, instructor details, and media content.

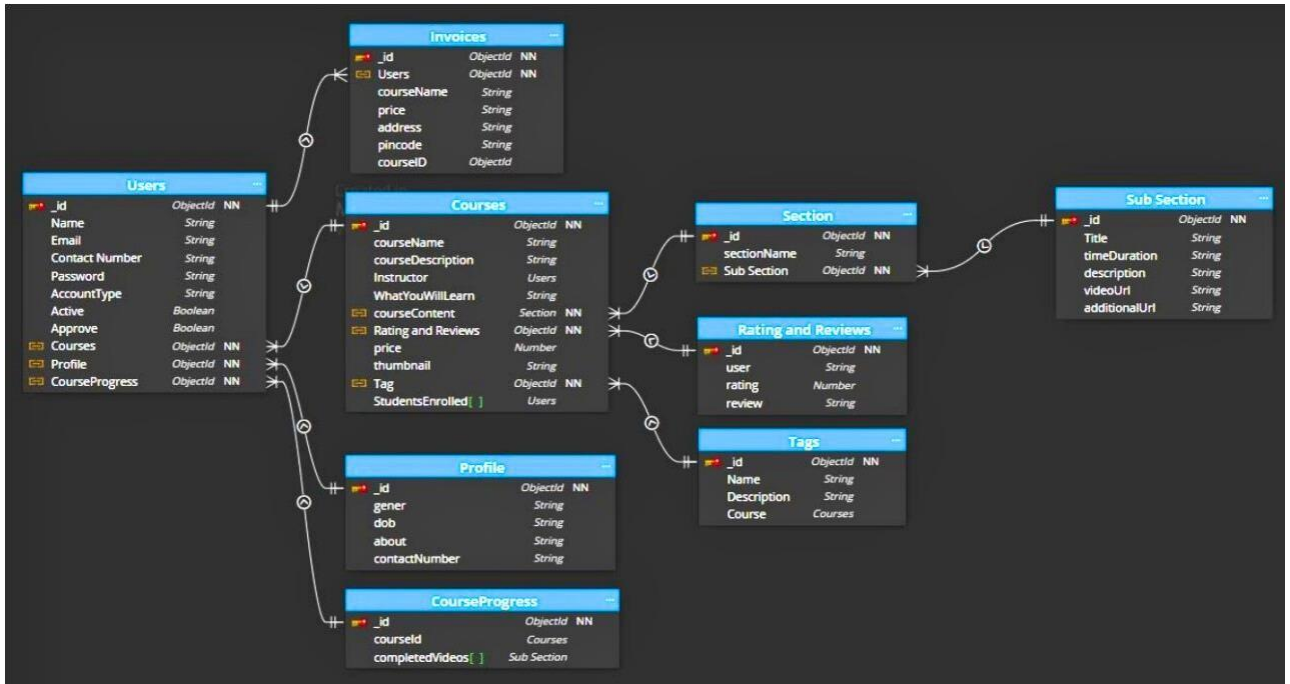


Figure 3.1 (class diagram of StudyNova application)

Overall, the back-end of StudyNova is designed to provide a robust and scalable solution for an ed-tech platform, with a focus on security, reliability, and ease of use. By using the right frameworks, libraries, and tools, we can ensure that the platform functions smoothly and provides an optimal user experience for all its users.

3.4 API Design:

The StudyNova platform's API is designed following the REST architectural style [10]. The API is implemented using Node.js and Express.js. It uses JSON for data exchange and follows standard HTTP request methods such as GET, POST, PUT, and DELETE.

3.4.1 Sample list of API endpoints and their functionalities:

1. /api/auth/signup (POST) - Create a new user (student or instructor) account.
2. /api/auth/login (POST) – Log in using existing credentials and generate a JWT token.
3. /api/auth/verify-otp (POST) - Verify the OTP sent to the user's registered email.

4. /api/auth/forgot-password (POST) - Send an email with a password reset link to the registered email.
5. /api/courses (GET) - Get a list of all available courses.
6. /api/courses/:id (GET) - Get details of a specific course by ID.
7. /api/courses (POST) - Create a new course.
8. /api/courses/:id (PUT) - Update an existing course by ID.
9. /api/courses/:id (DELETE) - Delete a course by ID.
10. /api/courses/:id/rate (POST) - Add a rating (out of 5) to a course.

3.4.2 Sample API requests and responses:

1. GET /api/courses: Get all courses.
2. GET /api/courses/:id: Get a single course by ID
3. POST /api/courses: Create a new course
4. PUT /api/courses/:id: Update an existing course by ID
5. DELETE /api/courses/:id: Delete a course by ID

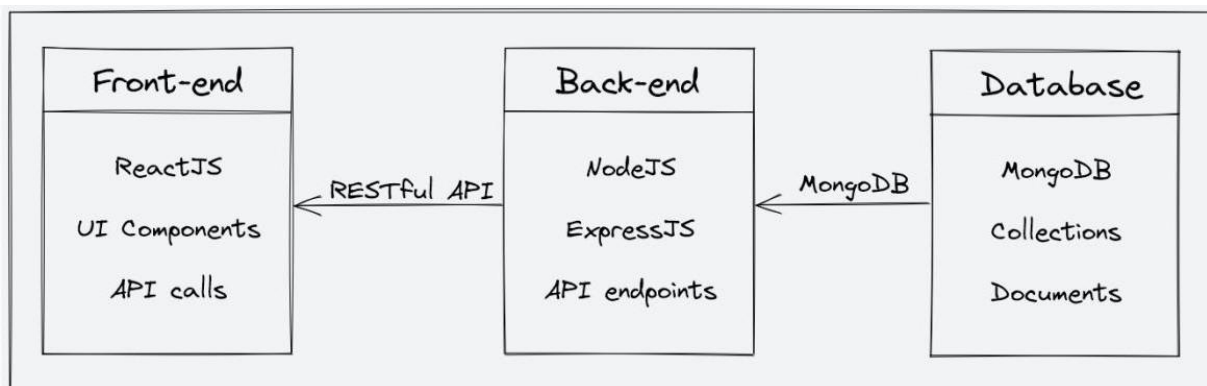


Figure 3.2 (hierarchical structure of a web application)

In conclusion, the REST API design for the StudyNova ed-tech platform is a crucial part of the project. The API endpoints and their functionalities are designed to ensure seamless communication between the front-end and back-end of the application. By following RESTful principles, the API will be scalable, maintainable, and reliable. The sample API requests and

responses provided above illustrate how each endpoint will function and what kind of data it will accept or return. With this API design, StudyNova will be able to provide a smooth user experience while ensuring security and stability.

3.5 Use Case Diagram

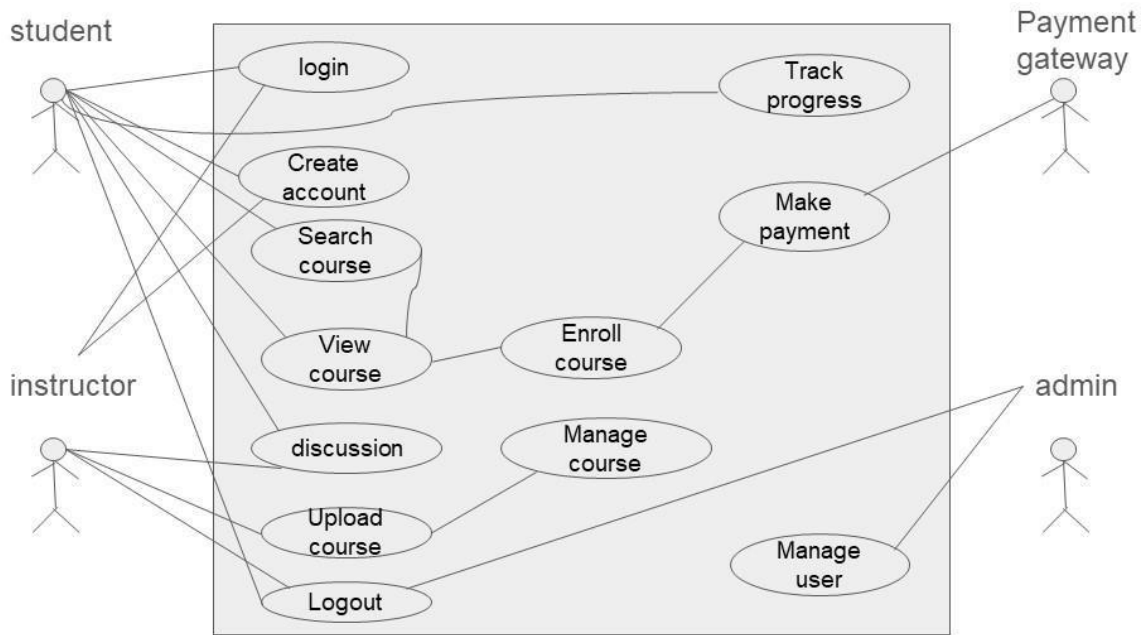


Figure 3.3 (Use case diagram)

The e-learning platform provides a centralized platform for students, teachers, and administrators to interact and collaborate. It allows students to access high-quality educational resources, teachers to deliver their courses effectively, and administrators to manage the platform efficiently.

Here is a more detailed explanation of the different interactions in the diagram:

- **Student-Teacher:** Students can interact with teachers by asking questions, submitting assignments, and participating in discussions. Teachers can provide feedback to students on their assignments and answer their questions.
- **Student-Administrator:** Students can interact with administrators to report technical issues, request assistance with their accounts, and inquire about

administrative matters. Administrators can provide technical support to students and help them resolve any issues they may be facing.

- **Teacher-Administrator:** Teachers can interact with administrators to upload their courses, get feedback on their courses, and request assistance with managing their courses. Administrators can review teachers' courses and provide feedback. They can also help teachers manage their courses and students.

The e-learning platform provides a variety of features and tools to support these interactions, such as discussion forums, messaging systems, and gradebooks. These features help to create a collaborative and engaging learning environment for students, teachers, and administrators.

3.6 System Required:

System requirements are what is necessary for a client to install the web application in their system and be used hopefully without any difficulties. The aim of this is to help clients make sure they have all required tools or equipment. With analysis there are some objectives for hardware, software and any other thing that would be the minimum requirements to install the system. The minimum requirements are as follows-

3.6.1 Hardware Requirements

intel Pentium: 600 MHz or above.

RAM (SD/DDR): 512MB

Hard Disc: 30GB or above

System bus: 32 bits

RAM: 256MB of RAM

3.6.2 Software Requirements

Web Technology: Visual studio

Database: MongoDB

Language and Frameworks: JavaScript, Html, CSS, Ajax, Mongo DB, NodeJS

3.7 Deployment:

The deployment process for the StudyNova ed-tech platform will utilize various cloud-based services to ensure scalability, security, and reliability. Vercel [11] will host the front end, while Render [12] will handle the back end. Cloudinary will store media files, and MongoDB Atlas will manage the database.

Overall, the deployment process for StudyNova will ensure a stable and scalable hosting environment for the application, allowing users to access the platform seamlessly from anywhere in the world.

4. WORKING

4.1 HOME PAGE OF WEBSITE:

The page typically encountered first on a website that usually contains links to the other pages of the site. When we open website (Figure 4.1), we get to see a join class and view course buttons. And in the navbar, we can see different page buttons like Home, Login, Course, Contact, and About Us.



Figure 4.1 (Home Page)

4.2 COURSE PAGE OF WEBSITE:

If you click on Course button you reach to course page (Figure 4.2) where we have different types of courses. Here you can find our professional and popular courses. If you are interested in any course, then you can click on that course and you can about that course like course duration, syllabus, cost, etc.

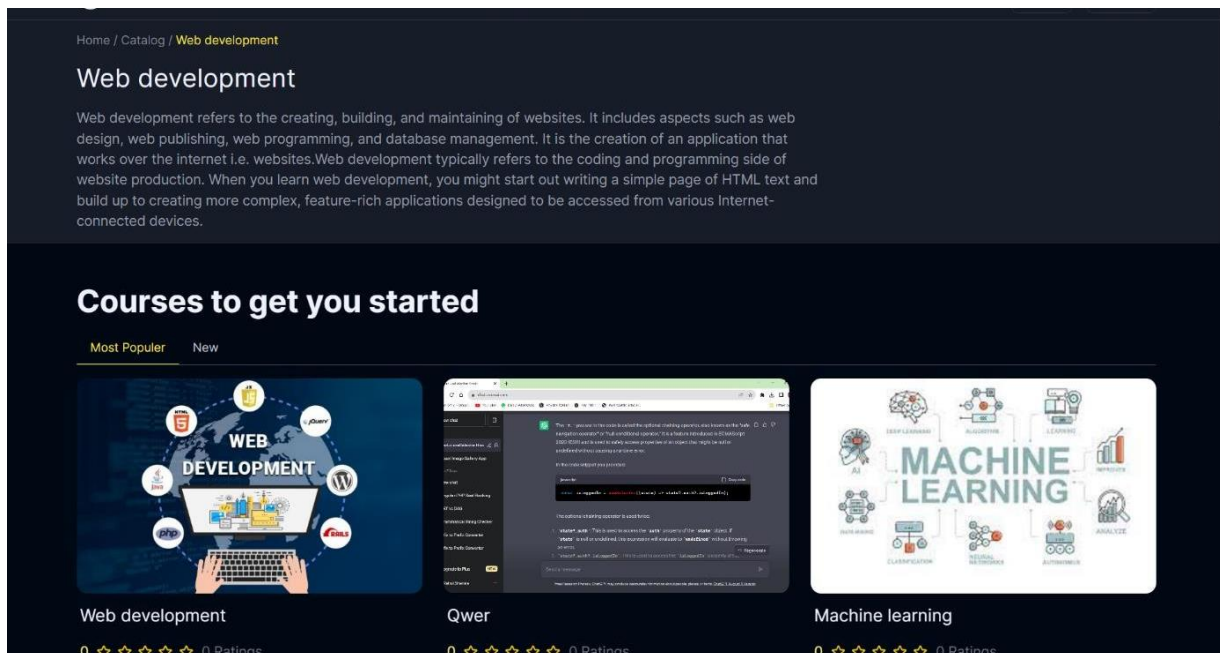


Figure 4.2 (Course Page)

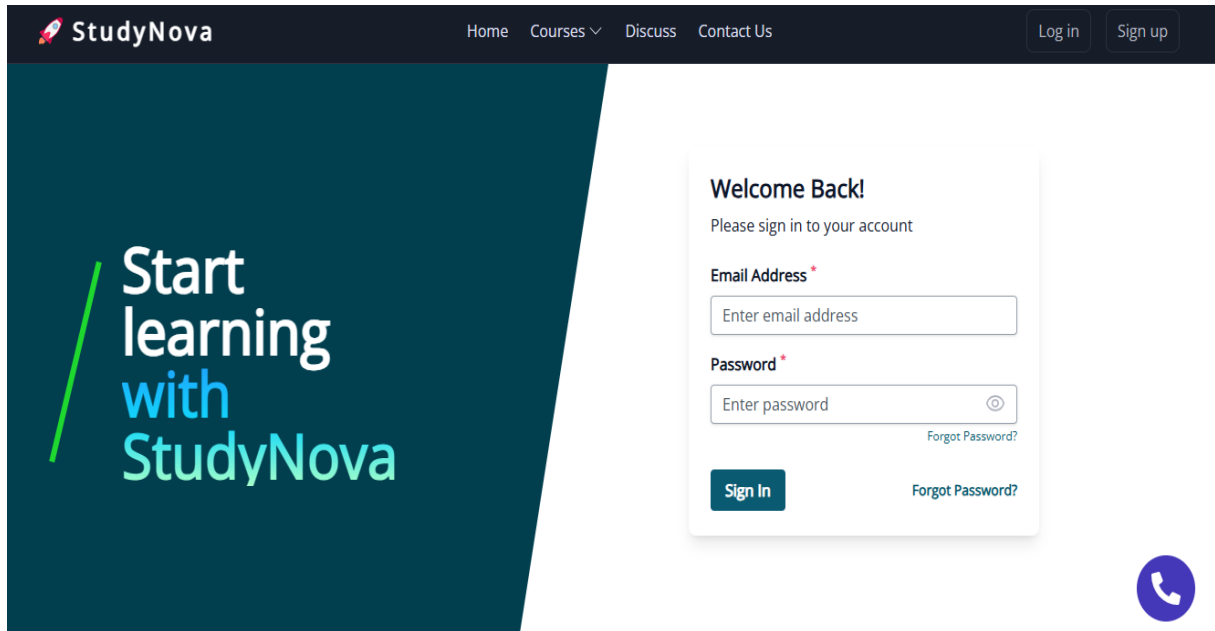
4.3 CONTACT US:

We can access the contact us page (Figure 4.3) from the navbar of the home page. Where we have kept our contacts, social media account.

Figure 4.3 (Contact Us page)

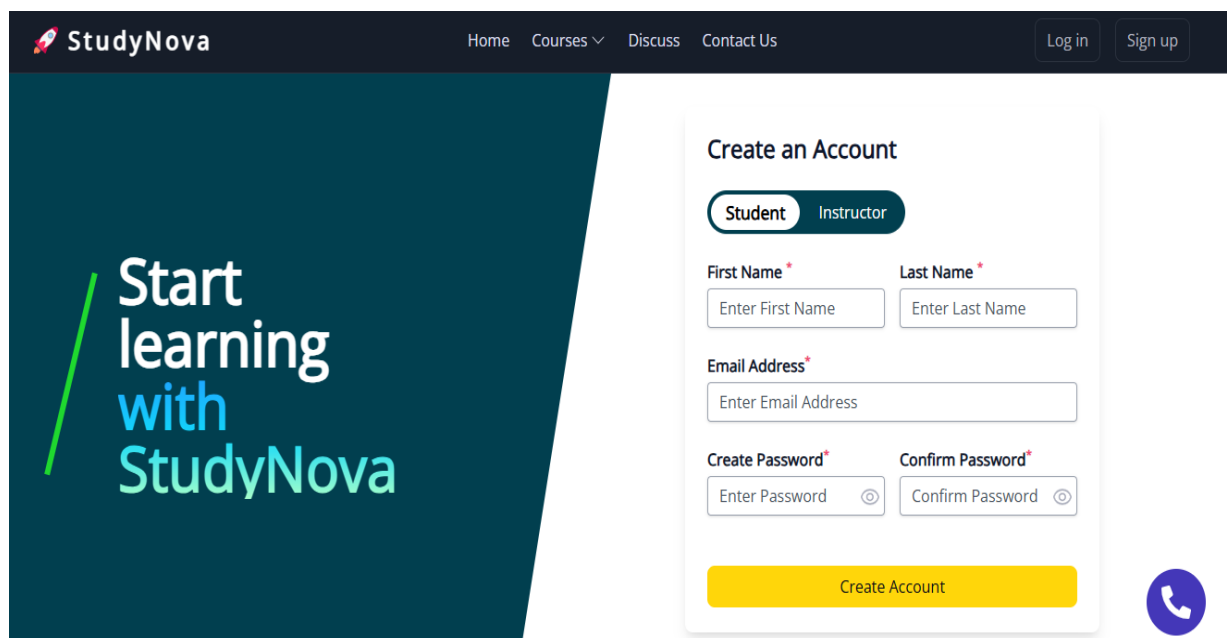
4.4 LOGIN AND SIGNUP PAGE:

An existing user or a new user can login and login or signup to the website using the login page (Figure 4.4) or signup page (Figure 4.5).



The screenshot shows the StudyNova login page. The header includes the StudyNova logo, navigation links (Home, Courses, Discuss, Contact Us), and buttons for Log in and Sign up. The main content area features a large teal banner with the text "Start learning with StudyNova". To the right, a white login form titled "Welcome Back!" prompts the user to sign in. It includes fields for Email Address and Password, both marked with an asterisk. Below the password field is a "Forgot Password?" link. A "Sign In" button is at the bottom left of the form. A purple circular chat icon is visible in the bottom right corner.

Figure-4.4 (Login Page)



The screenshot shows the StudyNova sign-up page. The header is identical to the login page. The main content area features the same teal banner. To the right, a white sign-up form titled "Create an Account" is displayed. It includes radio buttons for "Student" (selected) and "Instructor". Below these are fields for First Name, Last Name, Email Address, Create Password, and Confirm Password, all marked with an asterisk. A "Create Account" button is at the bottom of the form. A purple circular chat icon is visible in the bottom right corner.

Figure 4.5 (Sign Up page)

4.5 DASHBOARD:

The dashboard page (figure 4.6) provides a centralized and visual overview of key information and features. It typically displays relevant metrics, analytics, and quick access to essential tools, allowing users to monitor and manage various aspects of the site efficiently.

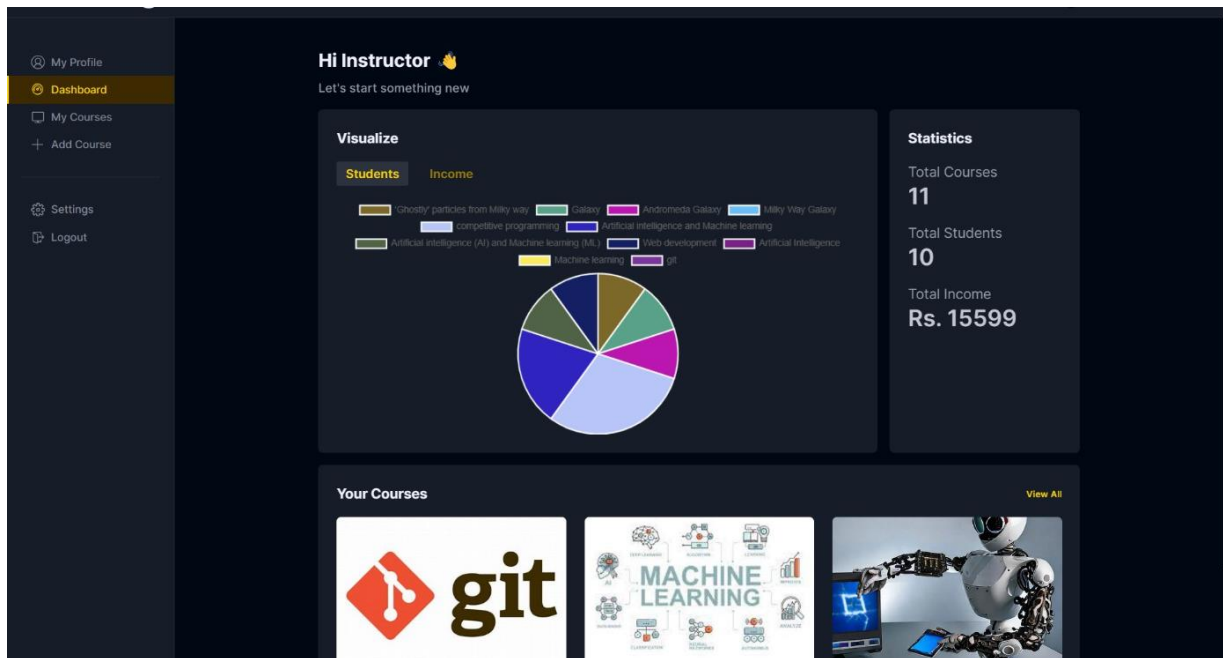


Figure 4.6 (dashboard page)

4.6 DISCUSSION PAGE:

The Discussion Forum (Figure 4.7) serves as an interactive space for students to engage in academic discourse, seek clarification, and share knowledge. It allows users to **post questions** related to specific courses or topics, ensuring a focused and collaborative learning environment. Each post can be **answered** by peers or educators, creating a dynamic thread-based structure for ongoing discussions. Users can also **like** responses they find helpful and **bookmark** important threads for quick access in the future. The interface is designed with usability in mind, featuring filters for sorting questions by popularity, recency, or course relevance. This forum promotes peer-to-peer learning and helps build a strong student community around the platform.

Figure 4.7 (discussion page)

4.7 VIRTUAL ROOM DASHBOARD:

The Virtual Room Dashboard (Figure 4.8) is a central hub for remote collaboration and real-time communication among users. It allows users to **create** or **join virtual rooms** for live sessions, discussions, or collaborative study. Upon entering a room, participants can access a suite of tools including:

- **Video/Voice Calling:** Powered by WebRTC, users can interact in real-time with minimal latency and high-quality audio/video.
- **Screen Sharing:** Facilitates effective presentations, demonstrations, or troubleshooting during live interactions.
- **Collaborative Whiteboard:** A shared canvas where users can draw, write, and brainstorm ideas simultaneously.
- **Real-Time Chat:** An integrated text-based chat system built using Socket.IO for exchanging messages without leaving the video session.

The dashboard also includes controls for **muting/unmuting**, **turning the camera on/off**, and

ending the session, providing users with a seamless and controlled collaboration experience. This feature makes the platform ideal for virtual classrooms, study groups, or even one-on-one mentorship sessions.

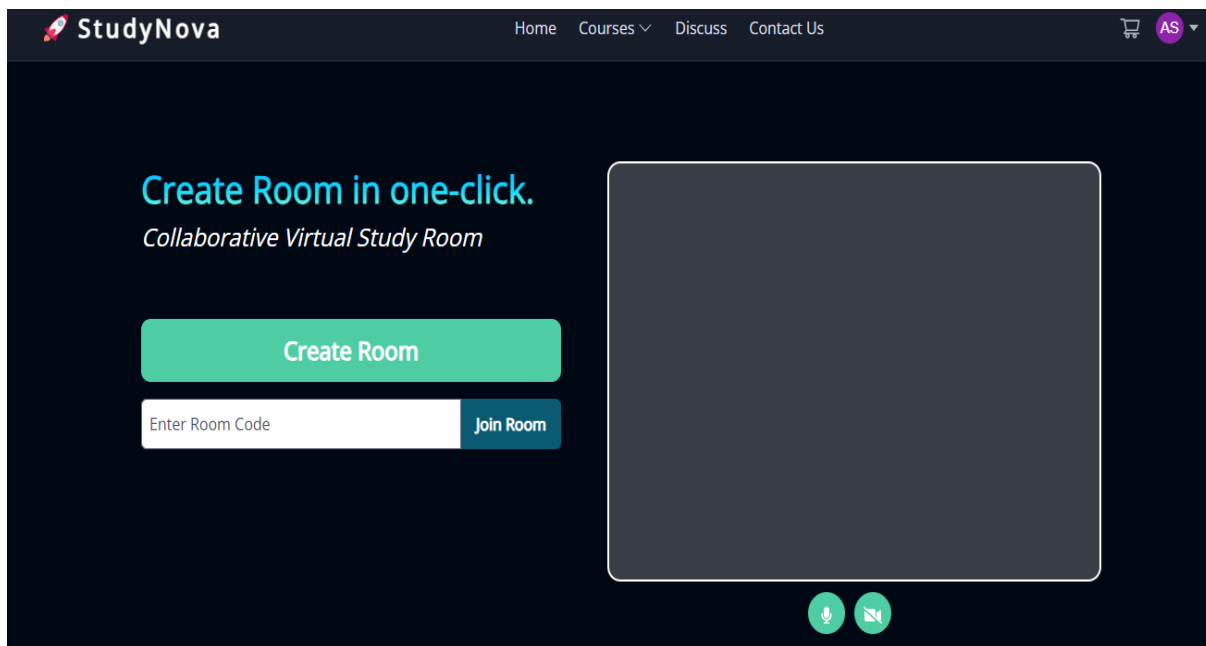


Figure 4.8 (virtual room dashboard)

4.8 COLLABORATIVE WHITEBOARD:

The Collaborative Whiteboard (Figure 4.9) is an essential interactive feature integrated within the virtual room. It provides a **real-time shared drawing space** that allows all participants to visualize ideas, solve problems, or take notes simultaneously. Users can draw shapes, write text, and use different colors to highlight important points. The whiteboard is synchronized using WebSockets (via Socket.IO), ensuring that any change made by one participant is instantly reflected for others. This tool is especially beneficial during brainstorming sessions, mathematical problem-solving, or diagrammatic explanations. It enhances the collaborative learning experience by enabling active participation and collective visualization of concepts.

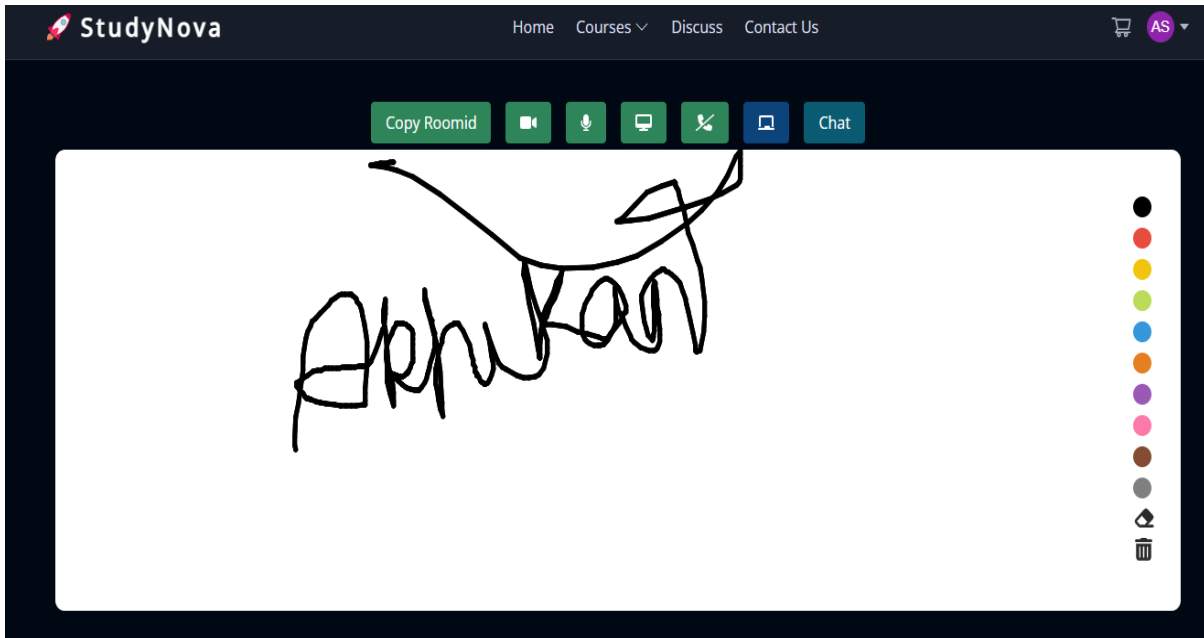


Figure 4.9 (collaborative whiteboard)

4.9 CHATTING ROOM (REAL-TIME CHAT):

The Real-Time Chat Room (Figure 4.10) is seamlessly embedded within the virtual room to facilitate continuous text-based communication alongside video or audio calls. It supports **instant messaging**, including emojis and system notifications (e.g., user joined or left). Messages are broadcasted using Socket.IO, ensuring ultra-low-latency communication between participants. The chat room is designed with a clean and responsive UI, supporting both individual and group interactions. Users can scroll through past messages and refer to shared information during or after the session. This feature is particularly useful when participants prefer silent communication or need to share quick links, notes, or brief explanations during discussions.

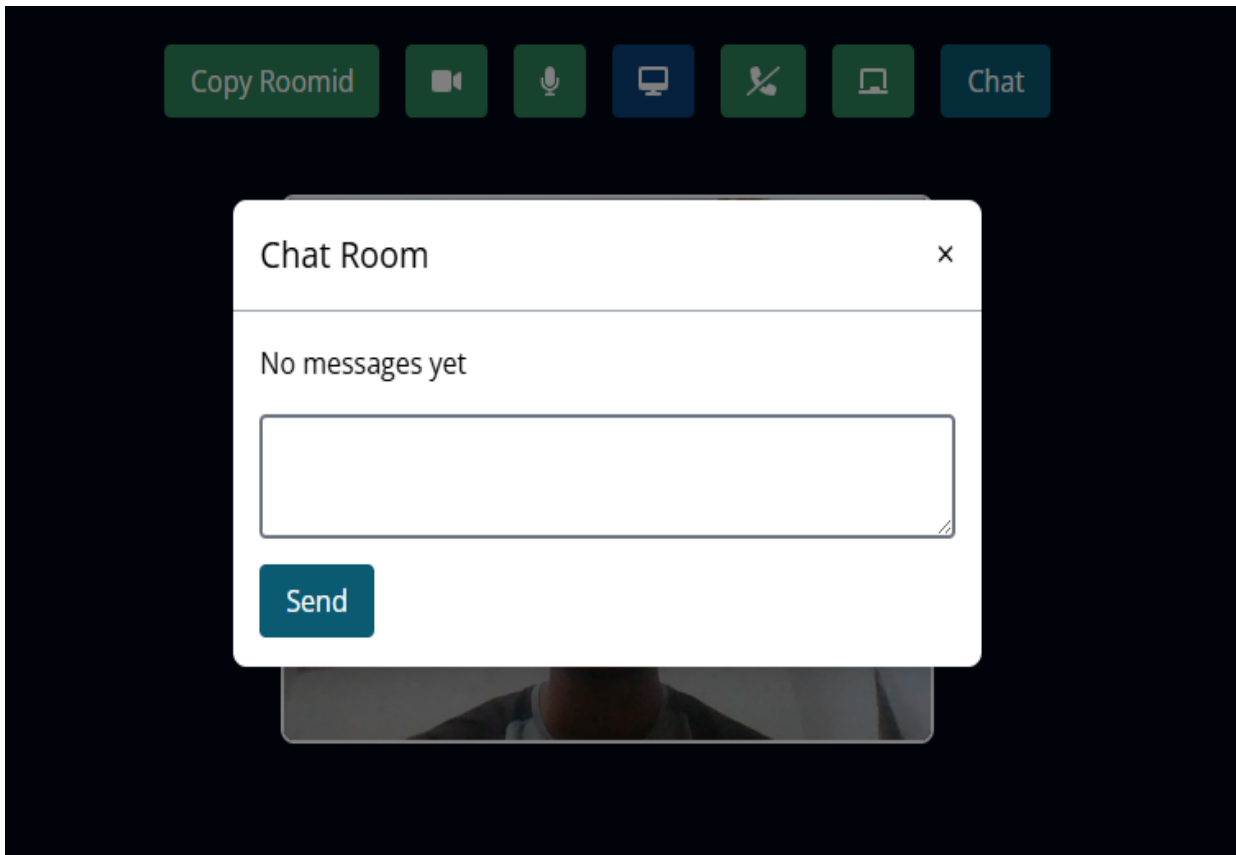


Figure 4.10 (Real-Time Chat Room)

4.10 SCREEN SHARING:

The Screen Sharing feature (Figure 4.11) allows a user to **share their entire screen, specific application window, or browser tab** with all other participants in the virtual room. This feature is vital for demonstrations, presentations, or collaborative walkthroughs. Built using the **WebRTC getDisplayMedia API**, the screen sharing function ensures a high-quality, low-latency streaming experience. The presenter can toggle screen sharing on or off during the session, and other participants can continue to interact through chat, voice, or whiteboard tools simultaneously. This multi-functional integration ensures a smooth and productive virtual collaboration environment, simulating real classroom or meeting scenarios.

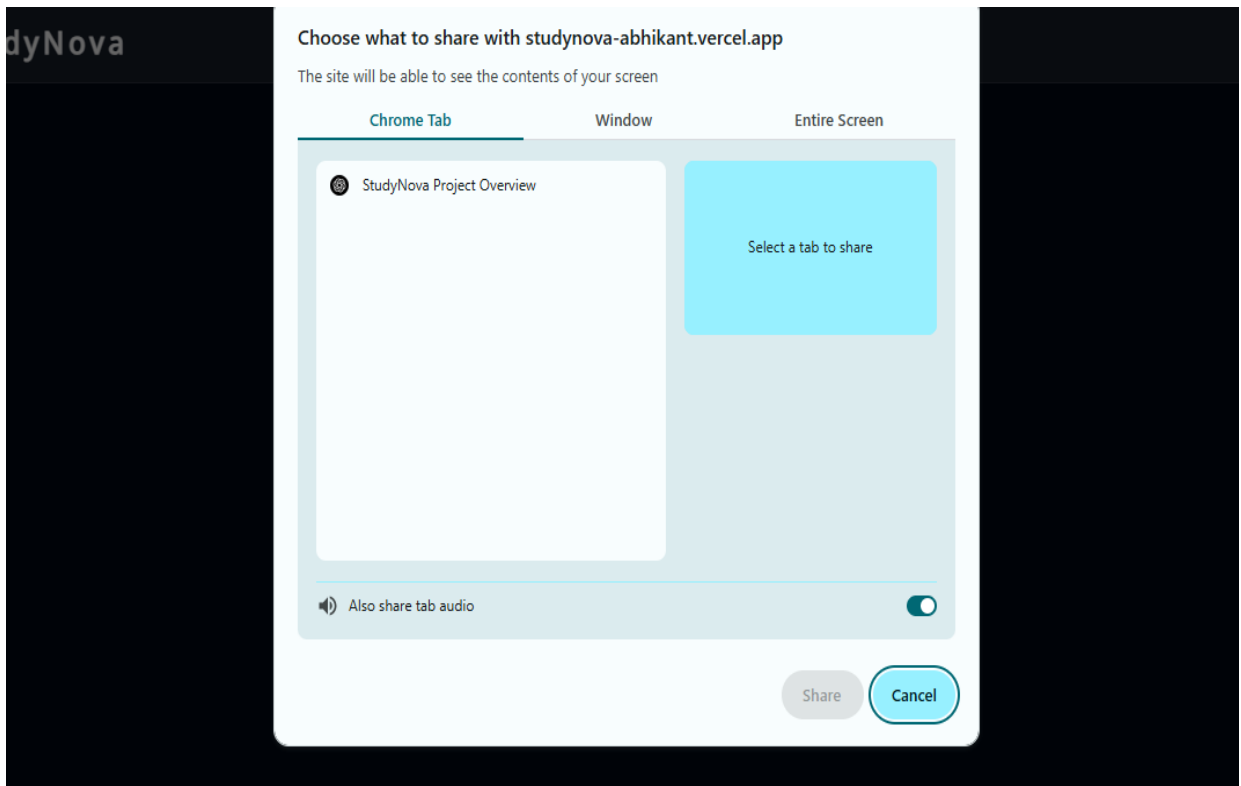


Figure 4.11 (Screen Sharing)

The StudyNova website is live at: [StudyNova \(https://studynova-abhikant.vercel.app/\)](https://studynova-abhikant.vercel.app/)

6. FUTURE ENHANCEMENTS

This section discusses potential future improvements to the StudyNova platform. These enhancements are listed along with an explanation of how they would improve the platform and priority for implementation.

- **Gamification features:** Adding gamification features such as badges, points, and leaderboards can increase user engagement and motivation. This would be a medium-priority enhancement.
- **Personalized learning paths:** Creating personalized learning paths for each student based on their interests and learning style can increase student satisfaction and success. This would be a high-priority enhancement.
- **Social learning features:** Adding social learning features such as group discussions, peer-to-peer feedback, and collaborative projects can increase student engagement and interaction. This would be a medium-priority enhancement.
- **Mobile app:** Creating a mobile app for the platform would allow for more convenient access to course content and features, and would increase the platform's reach. This would be a high-priority enhancement.
- **Machine learning-powered recommendations:** Using machine learning algorithms to provide personalized course recommendations can improve student engagement and satisfaction. This would be a medium to high-priority enhancement.
- **Virtual reality/augmented reality integration:** Adding virtual reality or augmented reality components to certain courses can enhance the learning experience and make it more immersive. This would be low to medium-priority enhancement.

Overall, these enhancements would significantly improve the StudyNova 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.

7. CONCLUSION

It has been a great pleasure for us to work on this exciting and challenging project. This project proved good for us as it provided practical knowledge of not only in HTML, CSS and JavaScript web-based application and no some extent Windows Application and MongoDB Server, but also about backend and APIs. It also provides knowledge about the latest technology used in developing web enabled application. This will provide better opportunities and guidance in future in developing projects independently.

In conclusion, this document outlines the architecture, features, and functionalities of the StudyNova ed-tech platform. It highlights the use of MERN [13] stack technologies and REST API design and outlines the deployment process using free hosting services, Vercel for the front-end, Render.com for the backend, and MongoDB Atlas for the database. Additionally, it lists potential future enhancements that could be implemented to improve the platform, along with their estimated timelines and priorities. Throughout the development of the project, various achievements were made in terms of implementing the desired functionalities and creating a user-friendly interface.

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