Manthano: An Online Course Platform

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Abstract

Manthano is a next-generation online course platform for revolutionizing the digital learning experience. By integrating advanced technologies and innovative pedagogical strategies, Manthano addresses the limitations of existing platforms and caters to the evolving needs of learners and educators. This proposal outlines the motivation behind Manthano, its key features, system requirements, architectural design, feasibility analysis, and the technologies employed in its development.

1. Motivation

The rapid rise of online education has dramatically expanded access to learning resources across the world, but it has also introduced a number of persistent challenges that undermine its effectiveness.

One of the major concerns is the lack of **personalization**. Many online platforms still rely on an one-size-fits-all model, delivering the same content to every learner, regardless of their individual needs. Research by Aljohani and Daud [1] highlights how adaptive e-learning systems, which adjust content based on learner preferences, can significantly improve engagement and learning outcomes, yet are not widely adopted. Moreover, an enormous number of online courses present information in a passive manner, limiting opportunities for interaction. As Bonk et al. [2] emphasize, such passive delivery can result in disengaged learners and high dropout rates.

Another major challenge is **feedback**. Many platforms offer feedback that is either delayed or generic, failing to provide learners with sufficient insights to improve. According to Hattie and Timperley [5], timely and specific feedback is a key driver of effective learning, and without it, learners may struggle to make progress.

Accessibility is also a critical issue. Laubsch [6] points out that not all online platforms are designed with inclusivity in mind, which creates barriers for learners with disabilities or those accessing content on mobile devices. Finally, the lack of robust community features can leave learners feeling isolated. Garrison's work [7] demonstrates the importance of social presence in online education, noting that meaningful interaction with peers and instructors plays a vital role in sustaining motivation and deepening understanding.

To address these issues, Manthano aims to create a more personalized and engaging learning experience. By incorporating adaptive learning paths based on AI algorithms, the platform tailors content to accommodate learners' pace and style, enhancing both engagement and outcomes [9]. Interactivity is significantly improved by integrating multimedia, simulations, and gamified elements, which research by Dichev and Dicheva [3] suggests can make learning more engaging and immersive.

Additionally, Manthano focuses on giving instant, personalized feedback, fostering continuous improvement and deeper understanding [8]. It also adheres to Web Content Accessibility Guidelines (WCAG) to ensure full access for all learners to its features [10]. Finally, Manthano strengthens the sense of community by offering collaborative tools such as forums and group projects, which, as Garrison [4] observes, are critical for fostering a supportive and interactive learning environment.

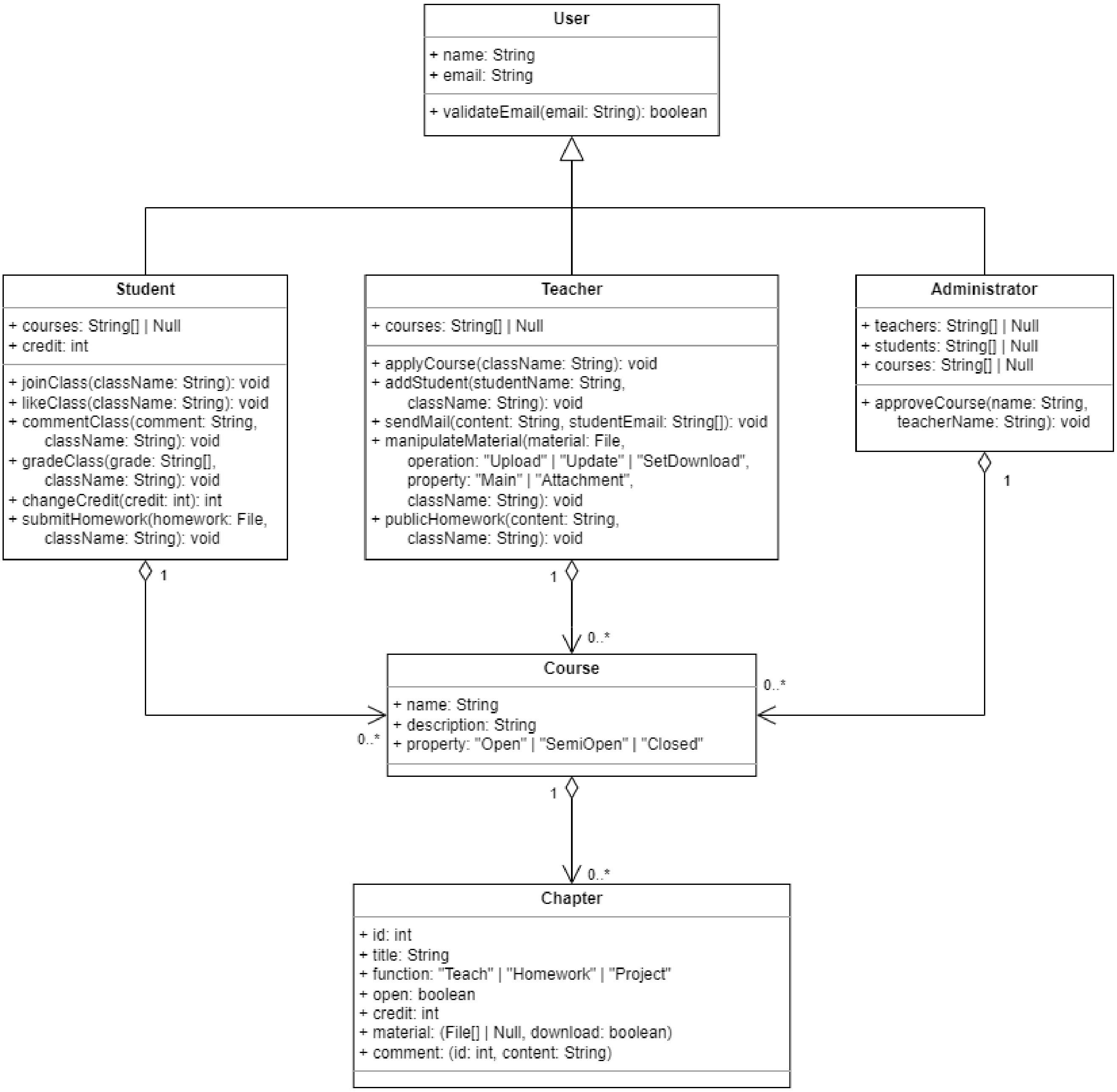
By addressing these challenges, Manthano seeks to improve the quality, accessibility, and overall effectiveness of online education for a global audience.

2. Features

2.1. User Stories

The user stories for the Manthano platform are shown in the Appendix A, including the primary actions and expectations from different types of users (teachers, students, and administrators).

[*] These authors contributed equally to this work.


User
+ name: String
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Student
+ courses: String[] | Null
+ credit: int
+ joinClass(className: String): void
+ likeClass(className: String): void
+ commentClass(comment: String, className: String): void
+ gradeClass(grade: String[], className: String): void
+ changeCredit(credit: int): int
+ submitHomework(homework: File, className: String): void
Teacher
+ courses: String[] | Null
+ applyCourse(className: String): void
+ addStudent(studentName: String, className: String): void
+ sendMail(content: String, studentEmail: String[]): void
+ manipulateMaterial(material: File, operation: "Upload" | "Update" | "SetDownload", property: "Main" | "Attachment", className: String): void
+ publicHomework(content: String, className: String): void
Administrator
+ teachers: String[] | Null
+ students: String[] | Null
+ courses: String[] | Null
+ approveCourse(name: String, teacherName: String): void
1
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Course
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+ description: String
+ property: "Open" | "SemiOpen" | "Closed"
1
0..*
Chapter
+ id: int
+ title: String
+ function: "Teach" | "Homework" | "Project"
+ open: boolean
+ credit: int
+ material: (File[] | Null, download: boolean)
+ comment: (id: int, content: String)

Figure 1. UML Class Diagram for Manthano Platform

2.2. UML

The Unified Modeling Language (UML) diagram for Manthano is shown in Fig. 1. Note that it's not a complete version of our entire design, but only provides an highly abstract view of the core system components and their interactions.

2.3. Mockups

See Appendix B.

3. Requirements

Manthano is a comprehensive online learning platform with ease of use and powerful functionality. The requirements are split into two categories: functional ones, which define the core operations and features, and non-functional ones, which ensure performance, security, and scalability.

3.1. Functional Requirements

The core functionalities of Manthano aims to guide user interactions and enable a smooth learning experience for both parties.

Course Creation and Management. Only teachers are capable to request for new courses, which must be approved by the system administrator for creation. Teachers have complete control over course visibility. In private courses, teachers personally select the students into them, tailoring for specialized needs.

Student Enrollment and Engagement. Students are free to browse and enroll in public courses, creating a self-driven learning atmosphere. By the collection and engagement, the recommendation system generates similar choices to raise Daily Active Users (DAU).

Rich Course Content. Teachers can upload materials to enrich their courses—chapter courseware, relevant videos, and downloadable attachments. Each piece of courseware is accompanied by a dedicated comment section, where students can ask questions and teachers can provide clarifications. This interactive layer transforms static content into a living, breathing dialogue.

Student Feedback and Evaluation. Students can evaluate courses by assigning scores and giving detailed comments. The evaluation contains various indicators, including course clarity, instructor engagement, and content relevance. This feedback not only guides future students but also helps teachers continually refine their teaching materials.

Interactive Resource Sharing. The platform fosters a collaborative learning community by allowing students to share learning resources. They can upload files directly in the comment sections, creating a rich repository of student-generated content. This feature adds value to each course as students collectively contribute to the learning experience.

Assignments Module. Teachers have the ability to post assignments, and students can submit their completed work directly through the platform. Teachers can then review and grade these submissions, ensuring that the learning process remains interactive and results-oriented.

Popular Courses and Teachers. Manthano showcases popular courses and top-rated teachers, making it easier for students to discover high-quality content. This feature drives both engagement and competition, encouraging continuous boost from instructors and enhancing the learning experience for students.

3.2. Non-Functional Requirements.

Beyond its core functionalities, Manthano must adhere to strict standards in terms of performance, security, and accessibility, ensuring a robust experience across the board.

Data Protection and Privacy. In a world where user privacy is paramount, Manthano adheres strictly to data protection regulations, including compliance with *GDPR* and other relevant standards. User data is encrypted, and sensitive information is handled with the utmost care to prevent unauthorized access.

Access Control and User Roles. Manthano ensures that only authorized users can access certain features. For instance, students cannot view pages reserved for teachers, and teachers cannot access administrative panels unless given explicit permissions. This role-based access control ensures that users interact with the platform within their assigned boundaries.

Lightning-Fast Response Time. Speed is crucial in keeping users engaged. Manthano guarantees an average response time of less than 1 second across all platforms, ensuring that students and teachers enjoy a smooth and responsive experience. Whether it's loading course materials or submitting assignments, the platform's performance remains consistent and swift.

Language and Platform Support. Manthano is truly global, offering multi-language support to accommodate users from diverse linguistic backgrounds. Additionally, the platform is designed to be accessible across multiple devices and operating systems, ensuring seamless transitions between desktop, tablet, and mobile environments.

High Availability and Scalability. Manthano is designed with reliability in mind. Built on cloud infrastructure, it scales dynamically to meet spikes in user activity without compromising performance. Whether handling a handful of students or thousands, the platform's architecture ensures that the learning experience is uninterrupted and smooth.

Security and Backup Protocols. Robust security protocols ensure that Manthano is protected from data breaches and unauthorized intrusions. The platform runs routine security audits and employs measures like *SSL encryption*, *multi-factor authentication*, and *regular backups* to safeguard both user data and system integrity.

Usability and Accessibility Standards. Usability is at the core of the platform's design. Adhering to *WCAG* accessibility guidelines, Manthano ensures that students with disabilities or special needs can interact with the platform effortlessly. Keyboard navigation, screen reader compatibility, and customizable user interfaces make the platform inclusive for all.

Extensibility for Future Growth. Manthano's architecture is modular, allowing for easy addition of new features and tools as the platform grows. Whether it's integrating with external learning management systems or introducing AI-driven features in the future, the system's design is ready to evolve with the needs of its users.

Monitoring and Analytics. Administrators and instructors have access to detailed analytics regarding course engagement, completion rates, and user behavior patterns. These insights are valuable for improving the learning experience, identifying potential areas for course enhancement, and ensuring that the platform remains responsive to its user base.

4. Design

4.1. Architecture

Manthano's design features seamless interactions between its core components: the frontend, main backend, recommendation system backend, and the database (see Fig. 2). Each component plays a vital role in providing a smooth learning experience.

The **frontend** is the user interface where learners and educators interact—browsing courses, watching videos, submitting assignments, and leaving comments. User actions prompt immediate communication with the **main backend**, which processes requests, updates the database, and provides *real-time updates* to the frontend for instant user engagement.

Non-urgent data, such as analytics, are handled via *lazy updates*, optimizing performance by updating the database in batches. The **recommendation system backend** processes user data to generate personalized course recommendations, interacting continuously with the database and updating the frontend with tailored suggestions.

The **database** serves as the central repository, storing all platform information. Its structure supports frequent reads and writes, enabling efficient access and updates by the backends.

This integrated architecture ensures a fluid and adaptive learning environment, combining real-time engagement with personalized experiences.

4.2. Timeline

The Manthano platform project is structured around four key tasks, developed in parallel to ensure timely delivery. The estimated total effort is 182 hours, distributed over 9 weeks, with each developer working approximately 7 hours per week.

4.2.1 Effort Breakdown

With parallel development, the total estimated effort per person is distributed as follows, which is specified in Fig. 3:

$$\text{Per-person effort} = \frac{182\,\text{h}}{3\,\text{p}} \approx 60\,\text{hours / person}$$

4.2.2 Task Descriptions

Each task is outlined in detail below, specifying the goals and expected effort for completion:

Task A: Login & Registration System (2 hours) This initial setup involves the design and implementation of a secure login and registration system. It is critical for establishing user authentication, including form validations and password security. Task A is a relatively short task and can be completed within the first few weeks.

Task B: Course Learning Functionalities (60 hours) Assigned to Qiwen Xiao, this task encompasses the development of the core learning components. It involves building the interface and backend systems to manage course content, including video streaming, assignment submissions, and quizzes. This functionality will be crucial for the platform's core operations.

Task C: Course Exploration & Recommendation System (60 hours) Handled by Haodong He, Task C focuses on developing a robust recommendation system that allows students to explore courses based on their interests and learning preferences. This system leverages user data to provide personalized course suggestions.

Task D: Course Evaluation & Community (60 hours) Qingwen Deng is responsible for this task, which aims to foster community engagement. This includes features like course evaluations, peer reviews, and discussion forums to enable student interaction and feedback.

5. Technologies

Manthano's architecture relies on two core technologies: Vue3 + TypeScript for the frontend and Tornado for the backend, specified in Tab. 1. These frameworks were carefully selected to ensure scalability, low bug density, maintainability, and an engaging user experience.

6. Feasibility

6.1. Technical Feasibility

The platform is technically feasible due to the team's expertise and the use of modern frameworks like Vue3 with TypeScript and Tornado. These open-source technologies ensure scalability, compatibility across environments, and flexibility to accommodate a growing user base.

6.2. Operational Feasibility

Operationally, Manthano is designed for minimal downtime and efficient user interactions. Tornado's asynchronous architecture allows it to handle multiple requests simultaneously without performance issues. Its modular design enables easy updates and maintenance, with new features integrated seamlessly. A DevOps workflow with CI/CD pipelines ensures rapid deployment of updates and fixes.

6.3. Economic Feasibility

Economically, Manthano is feasible due to low initial costs from using open-source technologies and cost-effective cloud services like Tencent Cloud. Revenue can be generated through subscriptions, educational partnerships, and in-app purchases, aligning with the growing demand for online education platforms.

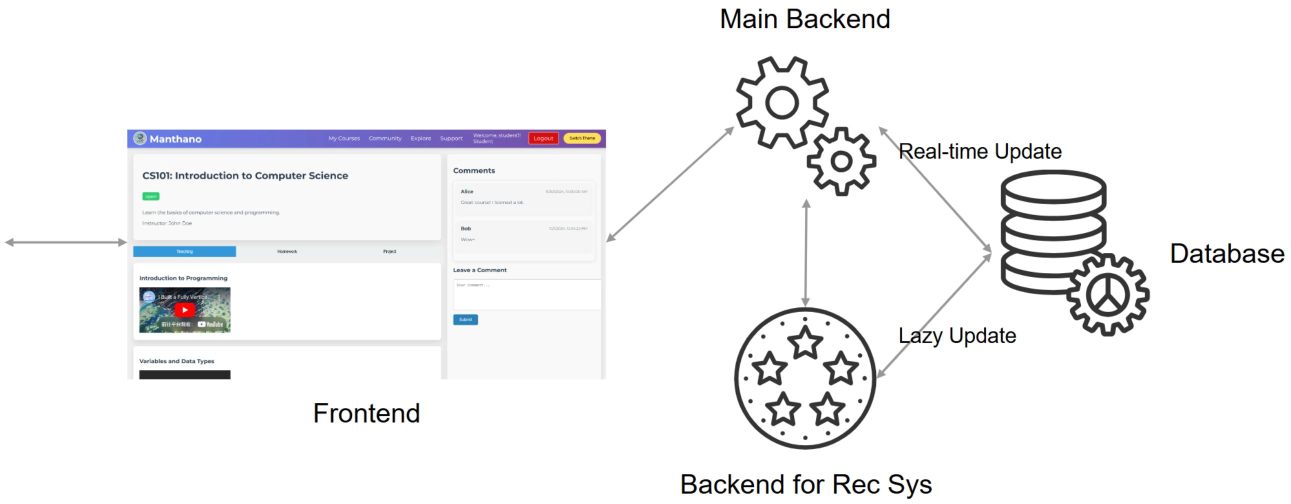

Figure 2. Architecture of Manthano

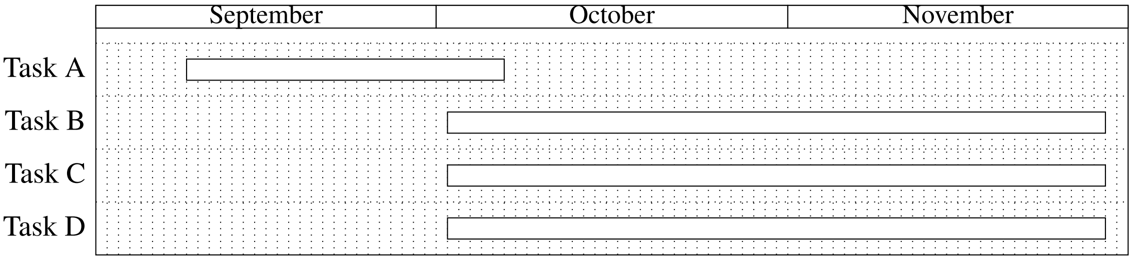

Figure 3. Gantt Chart of the Project Timeline

6.4. Schedule Feasibility

The development timeline is covered above, which is reasonable. Distributed tasks are to prevent stalls, and integrated testing ensures ongoing quality assurance. The team's familiarity with the technologies and modular development reduce the risk of delays.

In summary, Manthano is highly feasible across all dimensions—technical, operational, economic, and schedule—positioning it for success in the competitive online education market.

Acknowledgements

This work is the project proposal of the course Object Oriented Analysis and Design, Fall 2024 delivered by Prof. Yuqun Zhang at Southern University of Science and Technology.

Note: This work is not funded by any external sources.

References

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Frontend	**Vue3 + TypeScript**
Vue3 provides reactive data binding and component-based architecture, allowing for the development of highly interactive user interfaces. TypeScript enhances this with static type-checking, improving code readability, and catching errors early in development. The combination of these two technologies ensures a robust, maintainable front-end architecture.	
Relevant Packages	• `vue-router`: Dynamic routing for page navigation. • `pinia`: State management for synchronized global state. • `axios`: Frontend-backend HTTP communication. • `Vuetify`: UI component libraries for building responsive, user-friendly interfaces.

Backend	**Tornado**
Tornado, with its asynchronous, non-blocking architecture, is ideal for handling high concurrency, making it well-suited for real-time applications. Its event-driven design enables efficient handling of multiple requests simultaneously, such as processing course enrollments or fetching content. Tornado's support for WebSockets also facilitates real-time interactions, enhancing user engagement.	
Relevant Packages	• `tornado.web`: For building HTTP APIs that handle user requests. • `tornado.websocket`: For real-time communication, like instant messaging and live notifications. • `tornado.ioloop`: Asynchronous operations for handling non-blocking tasks.

Table 1. Services used in Manthano

Appendix A: User Stories

As a Teacher, I Want to Create a New Course

Title: Course Creation
As a teacher, **I want to** submit a course creation request to the system administrator, **so that** I can start offering my course to selected students.
Acceptance Criteria:

- The system allows teachers to fill out a form with the course title, description, and other details.
- The system sends a notification to the administrator for approval.
- Once approved, I can set the course to public or private and choose the students who can join.

As a Student, I Want to Enroll in a Public Course

Title: Course Enrollment
As a student, **I want to** browse available public courses and enroll in those that interest me, **so that** I can access the course materials and start learning immediately.
Acceptance Criteria:

- I can browse a list of all public courses.
- I can click ”Enroll” and immediately gain access to the course content.
- I can mark a course as “Liked” to help me find it later in my favorites list.

As a Teacher, I Want to Upload Course Materials

Title: Course Material Upload
As a teacher, **I want to** upload chapter courseware, videos, and additional resources **so that** my students can access all necessary learning materials in one place.
Acceptance Criteria:

- I can upload multiple types of files, including PDFs, videos, and attachments.
- Each courseware item owns its comment section where students can ask questions and I can reply.

As a Student, I Want to Leave Feedback on a Course

Title: Course Evaluation
As a student, **I want to** evaluate the quality of a course

by leaving a rating and detailed comments **so that** I can share my learning experience and help improve future courses.
Acceptance Criteria:

- I can rate the course based on specific criteria like content quality, instructor engagement, and clarity.
- I can submit a detailed review of my learning experience.
- The course ratings and reviews are visible to future students.

As a Teacher, I Want to Post Assignments

Title: Assignment Posting
As a teacher, **I want to** post assignments for my students, **so that** they can submit their work through the platform.
Acceptance Criteria:

- I can post an assignment with instructions and attach any necessary documents.
- Students receive notifications about the new assignment.
- I can view student submissions and provide feedback.

As a Student, I Want to Upload and Share Learning Resources

Title: Resource Sharing
As a student, **I want to** upload learning resources in the comment section of a course **so that** I can share additional materials with my classmates.
Acceptance Criteria:

- I can attach files such as PDFs or presentations to a comment.
- Other students can view and download the resources I upload.
- Teachers can moderate or highlight shared resources as valuable.

As a Student, I Want to Browse Popular Courses and Teachers

Title: Discovering Popular Courses
As a student, **I want to** see a list of the most popular courses and highly-rated teachers **so that** I can easily find high-quality content to enroll in.
Acceptance Criteria:

- A ”Popular Courses” section is visible on the homepage, showing trending or top-rated courses.
- Teachers with the highest ratings or most enrollments are highlighted.
- I can click on a course to view its details and enroll directly from this list.

As a System Administrator, I Want to Approve Course Creation Requests

Title: Course Approval
As a system administrator, **I want to** review and approve or reject course creation requests from teachers **so that** I can ensure all courses meet the platform's standards.
Acceptance Criteria:

- I receive notifications when a teacher submits a course creation request.
- I can review the course details before approving or rejecting.
- Upon approval, the teacher is notified, and the course is published.

As a Student, I Want to Receive Real-Time Feedback from Teachers

Title: Real-Time Feedback
As a student, **I want to** receive real-time feedback on my questions in the comment sections **so that** I can better understand the course materials and improve my learning experience.
Acceptance Criteria:

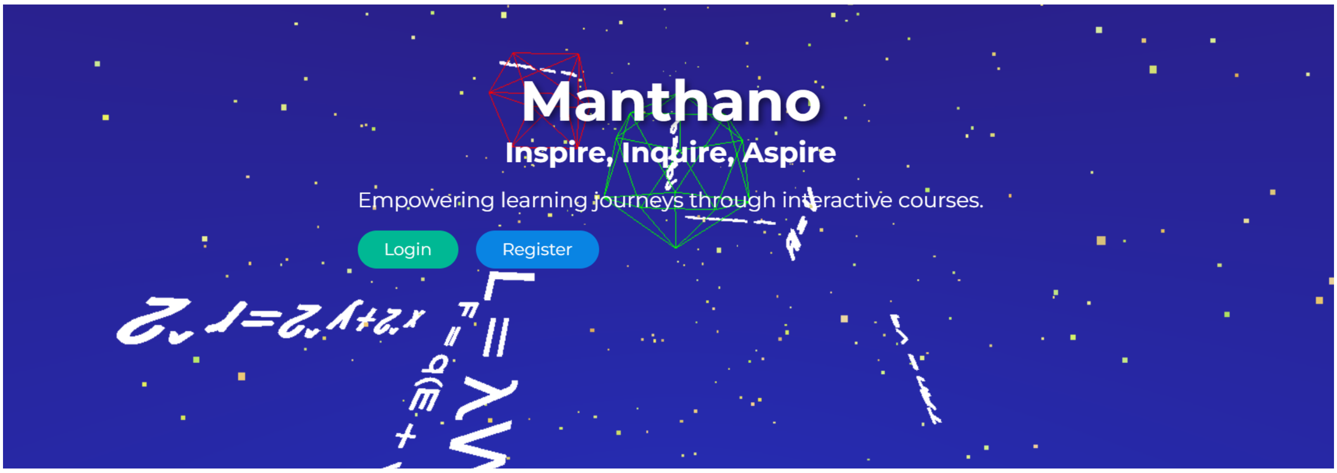
- Teachers can reply to my comments in real-time or near real-time.
- I receive notifications when a teacher replies to my question.
- The feedback is visible to other students as well, fostering a collaborative learning environment.

As a Teacher, I Want to See Course Engagement Analytics

Title: Engagement Analytics
As a teacher, **I want to** view detailed analytics on how students are engaging with my course materials **so that** I can adjust my teaching methods and materials to better suit their needs.
Acceptance Criteria:

- I can view statistics on course views, assignment submissions, and student participation in discussions.
- I receive visual reports showing engagement trends over time.
- I can export the data for further analysis or reporting.

Appendix B: Mockups

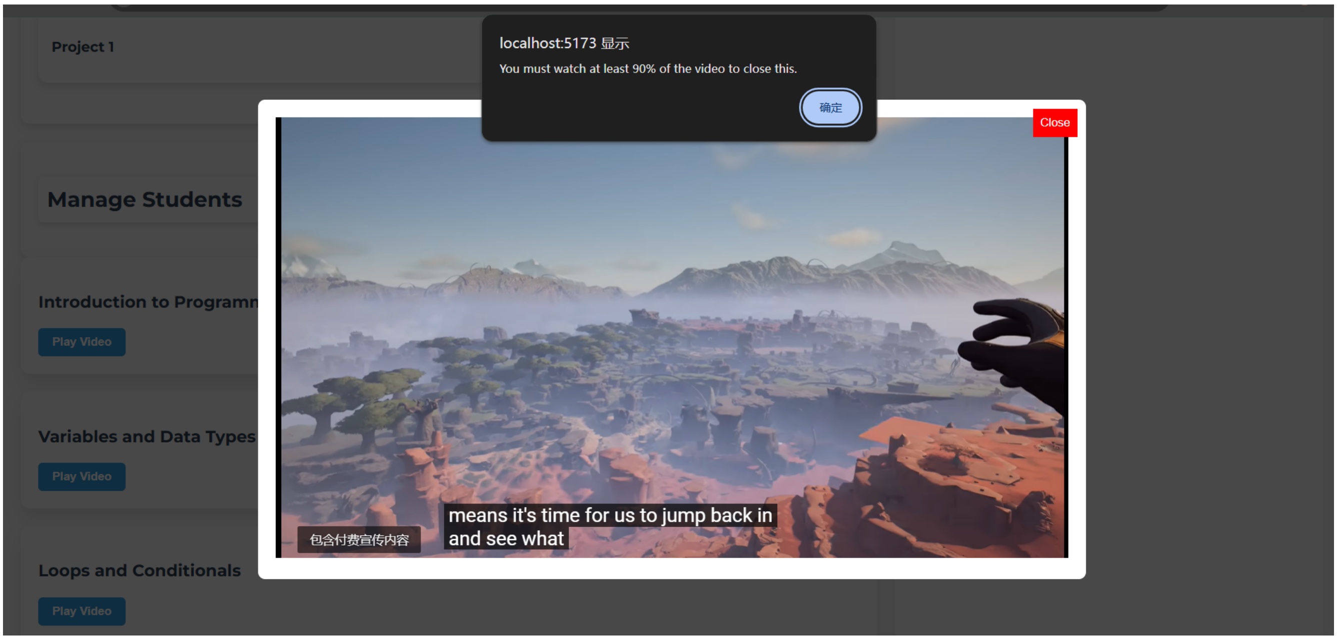


Manthano

Inspire, Inquire, Aspire

Empowering learning journeys through interactive courses.

Figure 4. Main Page



localhost:5173 显示

You must watch at least 90% of the video to close this.

Project 1

Manage Students

Introduction to Programm

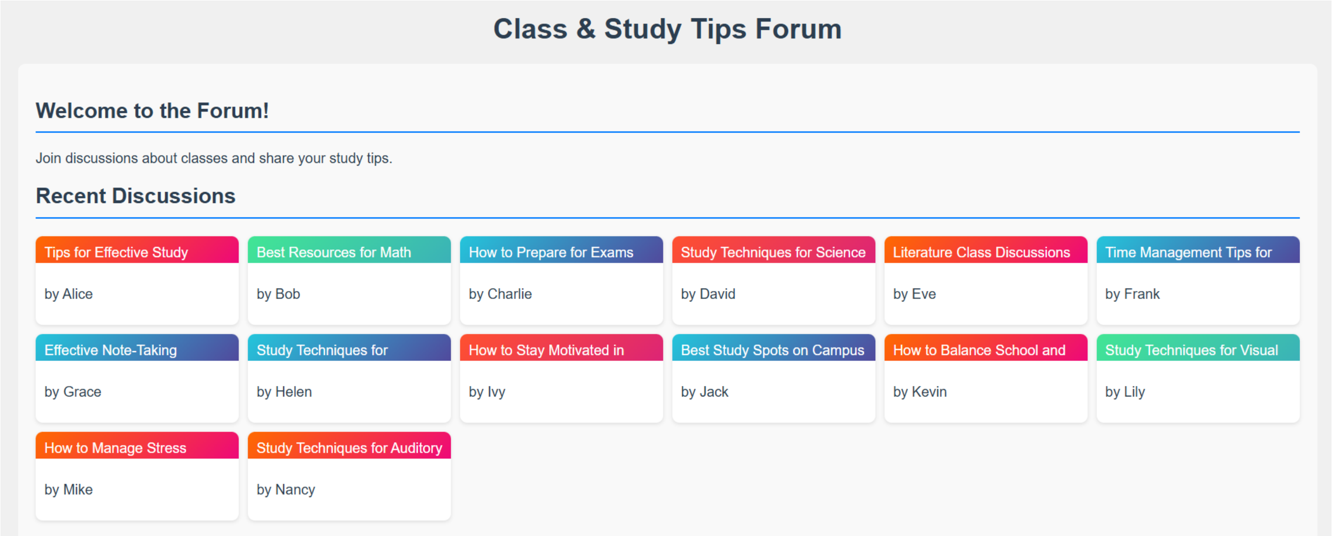
Variables and Data Types

Loops and Conditionals

means it's time for us to jump back in
and see what

包含付费宣传内容

Figure 5. Anti-cheat Function



Class & Study Tips Forum

Welcome to the Forum!

Join discussions about classes and share your study tips.

Recent Discussions

Tips for Effective Study
by Alice

Best Resources for Math
by Bob

How to Prepare for Exams
by Charlie

Study Techniques for Science
by David

Literature Class Discussions
by Eve

Time Management Tips for
by Frank

Effective Note-Taking
by Grace

Study Techniques for
by Helen

How to Stay Motivated in
by Ivy

Best Study Spots on Campus
by Jack

How to Balance School and
by Kevin

Study Techniques for Visual
by Lily

How to Manage Stress
by Mike

Study Techniques for Auditory
by Nancy

Figure 6. Community