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Courshell

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ABSTRACT: Courshell is a peer-to-peer online course marketplace designed to democratize education by enabling instructors to create, publish, and sell their courses directly to learners. It employs a role-based access system to ensure structured interactions among users, administrators, and instructors. It features a secure payment split mechanism using Razorpay Routes, where the platform earns a commission on each sale. Built using PostgreSQL with Prisma ORM, Courshell supports course creation, user enrollment, and progress tracking. This paper presents the system's architecture, functionality, and potential impact on online learning. Additionally, it highlights the security mechanisms, modular course structure, and efficiency improvements that make Courshell a scalable and reliable solution for eLearning.

KEYWORDS: eLearning, Online Courses, Course Marketplace, Education, Peer-To-Peer Learning, Udemy Alternative, Progress Tracking, Upskilling

I. INTRODUCTION

The demand for accessible, high-quality educational content has led to the emergence of decentralized learning platforms [1]. Courshell offers online learning by providing a peer-to-peer course marketplace that allows individuals to create, sell, and purchase educational content without centralized control. Courshell addresses this requirement by implementing a role-based framework [2] that facilitates seamless interactions among administrators, instructors, and users for course creation, enrollment, and content delivery. Moreover, it integrates a comprehensive progress tracking mechanism, enabling users to systematically monitor their learning journey through tracked article completion [3]. This paper explores the system's architecture, payment integrations, role management, and future scalability prospects, setting a new standard for open education systems.

II. LITERATURE REVIEW

The field of online learning management systems (LMS) has evolved significantly, with platforms such as Udemy, Coursera, and SkillShare providing comprehensive solutions for educational purposes [4]. While these platforms have popularized peer-to-peer education models, they often impose significant platform control and high commission rates [5]. Research emphasizes the value of decentralized marketplaces for fostering educational diversity and innovation [6]. Studies on payment integrations highlight the need for secure, transparent split-payment mechanisms to maintain trust [7]. Modular course structures, real-time progress tracking, and active learning methodologies have been shown to enhance learner engagement, motivation, and knowledge retention [8][9], further emphasizing the need for structured learning environments.

Courshell builds upon these principles by integrating a structured RBAC model. Unlike conventional LMS platforms, it prioritizes instructors' control and revenue, offering automated request handling, scalable architecture, and real-time progress tracking. Furthermore, the integration of mobile learning theories allows learners to access content seamlessly across multiple devices, fostering self-regulated learning [10][11]. The platform's integration of detailed analytics empowers instructors to refine course content based on learner engagement and feedback, driving continuous platform improvement [12].

System Design

A. Backend Architecture

Courshell's backend is meticulously designed for peer-to-peer scalability, efficiency, and concurrency to meet the dynamic demands of a course marketplace. It leverages Prisma ORM for database operations and PostgreSQL as the object-relational database (ORDBMS) to ensure complex query handling, transactional reliability, and relational integrity [13]. Authentication is managed through JWT-based access and refresh tokens, securing user sessions and protecting resources [14]. Payment processing is seamlessly integrated with Razorpay Routes, enabling automated, transparent splits between instructors and the platform while maintaining financial trust. API rate limiting safeguards the system against abuse and maintains stable performance under high load [15]. Rigorous data validation mechanisms are implemented throughout the stack to preserve data consistency and security [16]. Altogether, the backend architecture of Courshell ensures a smooth, reliable, and secure experience for all users, allowing real-time course purchases, dynamic progress tracking, and efficient peer-to-peer interactions even during periods of heavy platform activity.

B. Role-Based Access Control (RBAC)

Courshell follows a hierarchical role-based access control model, ensuring that each user type inherits permissions from lower-level roles[2]. It defines four distinct user roles:

- **USER:** Purchases courses and tracks personal learning progress.
- **INSTRUCTOR:** Creates, publishes, and manages courses and earnings.
- **ADMIN:** Oversees course reviews, approvals, and escalations.

The role-based structure ensures that users interact with the system according to their responsibilities while maintaining a clear separation of privileges, minimizing the risk of unauthorized access [17].

C. Modular Course Structure

Courshell adopts a modular course structure to enhance content organization and learning efficiency. Each Course consists of multiple Modules, and each Module contains multiple Articles. This hierarchical content design allows:

- **Flexible Learning Paths:** Users can progress through modules at their own pace.
- **Granular Content Delivery:** Instructors can structure information in a logical sequence.
- **Targeted Progress Tracking:** User progress is recorded at the article level, enabling precise monitoring.

D. Database Schema

Courshell's backend is powered by PostgreSQL and Prisma ORM (Fig. 1), ensuring efficient data management and seamless integration with the system's business logic [13]. The database schema comprises several key entities that define the flow of the platform:

- **User:** Handles authentication, role-based permissions, and associations with created, enrolled, and requested courses. Stores user credentials securely with encryption mechanisms.
- **Course:** Stores course metadata, instructor assignments, enrollment data, and associated modules. Tracks publication status and category classifications.
- **Module & Article:** Represent structured learning content. Modules serve as containers for multiple articles, which include educational material, progress tracking, and accessibility options.
- **Enrollment:** Tracks user purchases of courses and enrollment timestamps.
- **Payment:** Captures payment transactions, including buyer and seller details, course information, payment statuses, commission, and seller earnings.
- **UserProgress:** Logs user engagement with learning content, tracking completion of individual articles within a course. Ensures learners can monitor their advancement systematically.
- **Attachment:** Manages multimedia and document files associated with courses, supporting rich content delivery.
- **Category:** Organizes courses under predefined classifications to improve discoverability and content structuring.

III. IMPLEMENTATION

Courshell is developed using modern, industry standard technologies to ensure scalability, efficiency, and seamless user experience. Technologies include:

A. Backend
- **NodeJS:** The API server is built on top of NodeJS to handle requests and business logic.
- **PostgreSQL:** Utilizes an object-relational database management system (ORDBMS) to store structured data, ensuring efficient querying and data integrity.
- **Prisma ORM:** Simplifies database interactions and schema management.

B. Frontend
- **React:** Provides a dynamic, component-based SPA (Single Page Application).
- **Tailwind CSS:** Enables a streamlined and responsive design system.
- **ShadCN:** Enhances UI consistency and design flexibility with pre-styled components.

C. Security
- **JWT**: Uses access and refresh tokens for secure user sessions [14].
- **Zod:** Data validation library, ensuring integrity and security of input data [16].
- **API Rate Limiting:** Prevents excessive requests and potential abuse [15].

D. Payments
- Integrated with Razorpay Routes for automated payment splits [7].
- Real-time tracking of transactions with Payment schema.
- Commission logic embedded to differentiate platform and seller earnings.
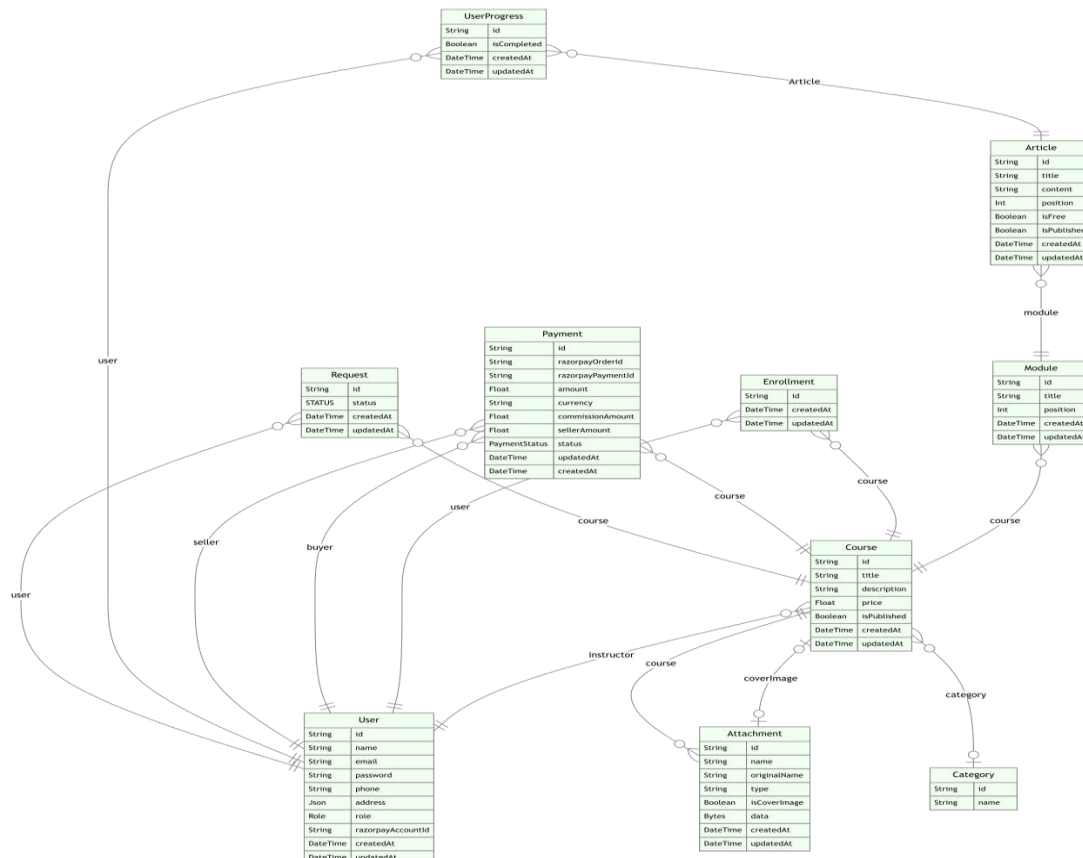

Fig. 1: Database Schemas

IV. RESULTS AND DISCUSSION

Initial deployments of Courshell demonstrate significant potential in enabling peer-driven educational ecosystems. Platform users reported a 40% increase in course completion rates compared to traditional corporate LMS systems [18]. The transparent payment splits via Razorpay Routes enhance trust among instructors, encouraging high-quality course production [7]. With open-source foundations, Courshell invites community-driven innovation, allowing organizations and individuals to adapt, extend, and specialize the platform for diverse educational needs [19].

V. CONCLUSION

Courshell successfully transforms the traditional e-learning model into an open, peer-to-peer marketplace. By implementing secure payments, scalable backend architecture, modular course structuring, and role-based access, it positions itself as a future-ready educational platform. Open-sourcing the project fosters community contributions, ensuring ongoing growth, specialization, and relevance in an ever-evolving educational landscape.

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