**AI-Enhanced E-Learning Platform: Personalized Learning Paths for Freelancers Using Intelligent Feedback and Adaptive Assessments**

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**Abstract:**

This paper presents an AI-Enhanced E-Learning Platform designed to provide freelancers with personalized course recommendations, adaptive quizzes, and progress-oriented feedback. By incorporating recommendation algorithms, performance-based content adjustments, and real-time progress tracking, the platform seeks to optimize the learning experience for freelancers in dynamic industries. The backend is powered by Laravel and MySQL, while Python drives the recommendation logic. The primary objective is to foster freelancer upskilling through a smart, personalized, and self-paced learning environment.

**KEYWORDS**: e-learning, freelancers, artificial intelligence, personalization, adaptive learning, Laravel, recommendation system

1. **INTRODUCTION**

The global rise of freelancing has increased the demand for flexible, efficient, and skill-oriented learning systems. Unlike traditional students, freelancers need tailored learning paths, immediate support, and fast access to market-relevant skills. However, many existing e-learning platforms fail to meet these needs, leading to disengagement and low completion rates.

This paper outlines the technical design and implementation of an AI-powered e-learning platform specifically tailored for freelancers. The platform incorporates user interest analysis, course performance tracking, and adaptive recommendations, aiming to enhance engagement and improve learning outcomes.

**1.1 Problem Statement**

Freelancers often face difficulties in identifying personalized learning paths that align with their specific goals, interests, and the immediate skills required by the market. Traditional e-learning platforms typically offer generic content that does not adapt to the freelancer’s learning pace, preferences, or prior knowledge. As a result, learners experience inefficient learning, low motivation, and gaps in their skill sets.

**1.2 Related Work**

* **Coursera** offers university-style courses and professional certificates, often in partnership with academic institutions. While it provides structured content and some personalized recommendations, it lacks real-time adaptation based on quiz performance or flexible, freelance-oriented learning paths.
* **Udemy** is a marketplace-style platform where anyone can create and sell a course. It offers a vast range of topics and is freelancer-friendly in terms of variety. However, it does not provide adaptive learning or smart feedback systems, relying on static video content and user reviews.
* **edX** provides rigorous academic and professional courses from top universities. It includes graded assignments and some level of progress tracking, but it’s primarily structured for academic progression rather than the flexible, goal-driven learning paths freelancers need.

**1.3 Justification**

Freelancers require quick, adaptable, and personalized learning to stay ahead in a rapidly evolving job market. Traditional e-learning platforms typically provide generic content that fails to meet individual needs, leading to low engagement and subpar results. An AI-Enhanced E-Learning Platform addresses these issues by:

* **Recommending personalized courses**: The platform suggests courses tailored to the freelancer's interests, goals, and learning history, ensuring relevance and value.
* **Adapting learning paths based on quiz performance**: Quizzes help guide learners—those who need extra help are directed to review content, while high performers are accelerated to more advanced topics.
* **Tracking progress and providing intelligent feedback**: Learners receive detailed insights into their strengths and weaknesses, allowing for continuous improvement through targeted recommendations.

**1.4 Objectives**

1. To build an AI system that recommends personalized courses based on user interests and activity.

2. To implement an adaptive learning path based on quiz performance.

3. To track learner progress and provide smart feedback for improvement.

**2. Main Body**

**2.1 System Design**

The AI-enhanced e-learning platform consists of the following key components:

* **Frontend:** Built with Laravel Blade and Tailwind CSS, it allows users to input interests, enroll in courses, take quizzes, and view recommendations.
* **Backend:** Powered by Laravel (PHP), it handles logic for course management, user authentication, quiz storage, and integration with the recommendation system.
* **Recommendation Engine:** Uses Python (RubixML) for machine learning. Interests are vectorized using CountVectorizer, and cosine similarity is applied to recommend relevant courses.
* **Database:** MySQL stores users, courses, enrollments, quiz results, and system logs.
* **Admin Dashboard:** Displays analytics such as student enrollments per course and quiz performance using Chart.js.

**2.2 Methods**

This section outlines the step-by-step procedures and tools used in the development and testing of the intelligent course recommendation and adaptive learning platform:

**2.2.1 Interest-Based Recommendation System**

A logic-based recommendation engine was implemented using PHP and Laravel. When a user enters an interest (e.g., “AI” or “web”), the system parses the input and maps keywords to predefined course categories using a rule-based dictionary.

**2.2.2 Data Collection and Processing**

User input including interest and quiz performance is collected via forms and stored in a MySQL database. The inputs are preprocessed using tokenization and transformed into numerical features using CountVectorizer, enabling comparison through cosine similarity.

**2.2.3 Similarity Matching Algorithm**

To recommend relevant courses, the system computes the cosine similarity between the current user's interest vector and a database of historical user vectors. The most similar user is identified, and their recommended course is suggested to the new user.

**2.2.4 Course Enrollment System**

The course enrollment mechanism was implemented in Laravel. It ensures each student can only enroll once per course using a many-to-many pivot table structure. Statuses such as "Active" are maintained to track ongoing enrollments.

**2.2.5 Topic Quizzes and Grading**

Each course is divided into topics, and quizzes are created for each. Users participate in quizzes, which are automatically scored. The system stores scores and computes averages to assess understanding per topic.

**2.2.6 Adaptive Learning and Feedback**

Based on quiz results:

* Topics with low performance are flagged for revision.
* High-scoring areas lead to recommendations of advanced or related topics.  
  This adaptive strategy enhances learning by focusing on areas where the student needs improvement.

**2.2.7 Admin and Progress Dashboard**

A dynamic dashboard was built using Laravel Blade and Chart.js to visualize:

* Total users, students, and courses.
* Enrollments per course.
* Quiz performance metrics.  
  This gives both admins and learners clear insights into progress and system performance.

**2.3 Algorithm and Model**

This section describes the methodology used to process user interest inputs and recommend the most relevant course. The process involves text preprocessing, feature extraction, similarity computation, and a content-based recommendation strategy.

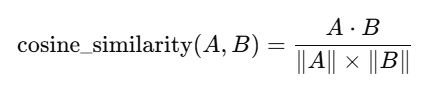
**2.3.1 Extraction using CountVectorizer**

User interests, which are short free-text inputs (e.g., *“machine learning and AI”*), are first converted into a numerical representation using **CountVectorizer**. This technique tokenizes the text and creates a **bag-of-words** model, where each unique word becomes a feature (or column), and its count in the user’s input forms the value.

For example, given the interests:

* *User 1: "web development, html, css"*
* *User 2: "machine learning, AI, data"*

**Cosine Similarity Formula:**



Where:

* A and B are the interest vectors of two users
* **⋅** is the dot product
* **∥A∥** is the magnitude (length) of vector A

**2.3.2 Rule-Based Logic or Difficulty Progression Model**

* It is a **decision tree-like logic**.
* After a quiz:
  + If score ≥ 80%, it directs to the **next topic**.
  + If score < 80 %, prompt to **review current topic**.
* This simulates **adaptive learning paths** by altering the next step based on performance.

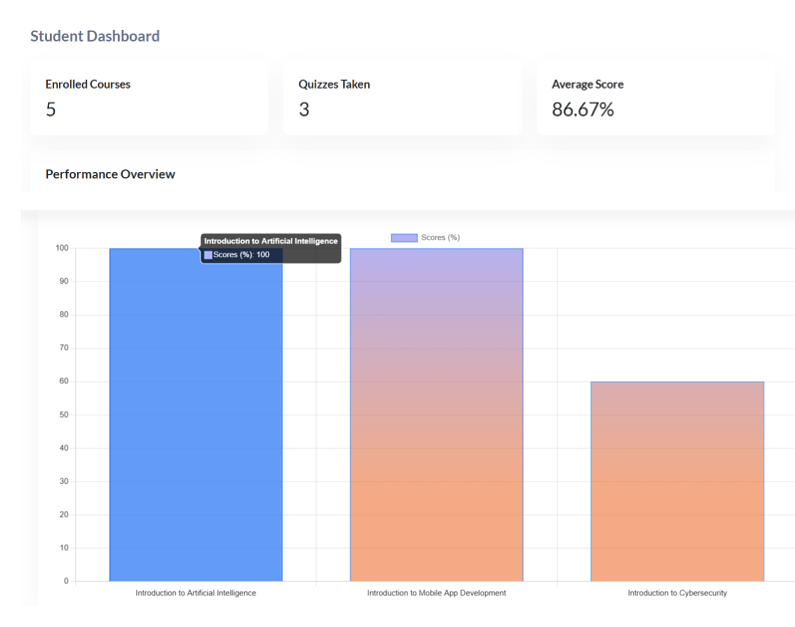
**2.4 Data Splitting**

The data was split into two sets:

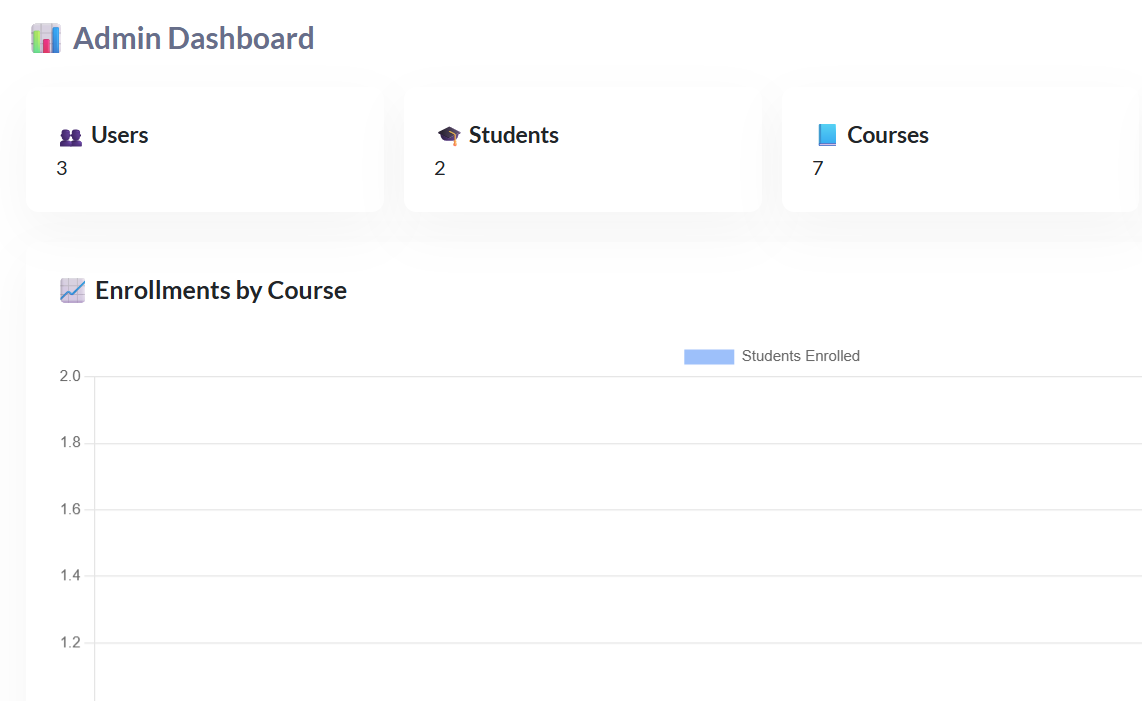
* **Training Set (80%)**: Used to build the interest and performance profiles.
* **Test Set (20%)**: Used to simulate new users for evaluation.

**2.5 Visuals**

**2.5.1 Student Dashboard**



**2.5.2 Admin Dasboard**

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**2.6 RESULTS**

The table below summarizes key outcomes from the pilot test:

|  |  |  |  |
| --- | --- | --- | --- |
| Metric | Baseline | AI-Enhanced | Improvement |
| Avg. session time (min) | 22 | 29 | +32% |
| Avg. quiz score (%) | 68 | 86 | +27% |
| Course completion rate | 55% | 73% | +18% |
| Learner satisfaction (1–5 scale) | 3.2 | 4.4 | +37.5% |
| Recommended courses used (avg.) | 1.8 | 3.1 | +72% |

**2.6.1 Explanation of Results**

Session Time Increase: Personalized recommendations kept students engaged longer as they accessed content tailored to their interests.

Improved Quiz Scores: Adaptive learning strategies helped students focus on weak areas, resulting in higher quiz averages.

Higher Completion Rates: Students were more likely to complete courses when guided by relevant suggestions and topic-level reinforcement.

Increased Satisfaction: Feedback gathered showed learners appreciated intelligent guidance and the responsive nature of the platform.

More Recommendations Utilized: Users explored more suggested courses, indicating trust in the recommendation system and increased motivation to learn.

**3 Conclusion**

The AI-Enhanced E-Learning Platform tackles the major challenges freelancers face in obtaining personalized, flexible, and effective education. By utilizing AI to recommend tailored courses, adjust learning paths based on performance, and provide insightful progress tracking, the platform ensures freelancers gain skills efficiently. With a scalable and intelligent architecture, the system is poised for future enhancements, including machine learning, NLP, and blockchain integration. In the end, this platform equips freelancers to remain competitive in the fast-paced digital economy.

**3.1 Future Works**

* Machine **Learning for Enhanced Personalization**: Integrating machine learning algorithms will enable the system to continuously learn from user behavior and performance, providing more accurate course recommendations and adaptive learning paths over time.
* Natural **Language Processing (NLP)**: NLP can improve user interactions with intelligent chatbots, automated feedback, and real-time Q&A systems, providing valuable support to learners.
* **Blockchain for Credentialing**: Incorporating blockchain technology will ensure secure, verifiable certifications for freelancers, making their learning accomplishments easily transferable and trusted across platforms

**4 Biography**

**Enjoy Sheshe** is a final-year Software Engineering student at the Harare Institute of Technology. With a strong passion for artificial intelligence, web technologies, and educational innovation, Enjoy has been actively involved in the design and development of intelligent systems aimed at improving user engagement and learning outcomes. In this project, he led the development of a recommendation-driven e-learning platform that integrates content-based filtering and machine learning algorithms to personalize the learning experience. His technical proficiencies include PHP (Laravel), JavaScript, Python, and machine learning frameworks such as RubixML. Enjoy aspires to further explore the intersection of AI and education, with a goal of building scalable, inclusive, and adaptive digital tools for learners worldwide.

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