

Advanced Database System Design

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Final Project Submission

Instructor: Neha

neha@kent.edu

Group 16

Online Quiz Platform:

TYPEit

Submitted by-

Harini Padmaja Solleti

hsolleti@kent.edu

811288992

Geethika Vulli

gvulli@kent.edu

811290653

Abstract

The TYPEit Quiz Platform is an interactive and educational tool designed to provide high school students with a unique way of learning. The primary function of the platform is to involve students in playing the quizzes which are informative and fun. This project design provides simplicity in choosing topics, attempting quizzes and monitoring progress while the matters of content and users are with administrators. TYPEit stands out because of its real-time feedback mechanism where correct input lights the progress bar green, while incorrect input turns it red, guiding users intuitively. Furthermore, it offers a robust administrative dashboard for managing topics, user accounts, and quiz data. The project was built using Python's Flask framework, with SQLite managing the backend database and Bootstrap for responsive design. A timer adds a competitive edge, while the skip functionality ensures users remain engaged even when they are stuck. This documentation explores the project's technical design, methodology, challenges faced during implementation, and potential future enhancements to make TYPEit an indispensable tool in educational institutions.

GitHub Repository link:

https://github.com/hsolleti/ADSD_Final_Project

Demo Video Link:

https://video.kent.edu/media/ADSD+GROUP16+Demo+Video/1_725fyfgw

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Introduction

One of the biggest issues that has emerged in contemporary classroom learning environment is addressing students' interest in active involvement. While freewheeling tests and quizzes remain useful in learning to an extent, yet sometimes do not elicit students' interest or stimulate it for long. Such nonparticipation may hamper learning, especially for high school going learners who are at a prominent developmental period to acquire cognitive skills as well as content knowledge. Admittedly, there was a lack of such tools, due to which the TYPEit Quiz Platform was designed as a revolution in the definition of learning.

TYPEit is a creative and fun knowledge check that was developed particularly for students in the 9-12 grades range. The most important objective is to combine the processes of learning and having fun as to achieve the finest outcome – successful study – there is no need to suffer. The design of attracting students' attention and providing them with quizzes in the form of a game allow the platform to engage learners more actively and consolidate knowledge through the process of team performance and knowledge-based questioning. Thus, through having topic-based quizzes of various levels of difficulty, TYPEit increases competitiveness and reward and recognition rates among students.

In addition to satisfying students' needs, TYPEit is also an effective means of helping teachers and professors. This platform allows the administrators and teachers easily to create/quilt the quiz questions, moderate users' activities and review the students' performance effectively. That is why using such features as account creation and results analysis, educational professionals gain insights about their learners. Through this approach, the function of teaching and learning mechanisms become intertwined through which teachers and learners achieve common objectives.

In fact, from a technical aspect TYPEit utilizes modern reliable technologies to make it easy to use and efficient for the user. The backend has been developed using Python's Flask micro framework due to its advantages in being lightweight, highly modular, and easily scalable. SQLite is selected as the database solution to provide simple and stable tool to store quiz data and users' information. To achieve responsiveness which will allow the front end to work well in desktop and laptop, tablets and smartphones, the front end utilizes Bootstrap. Altogether, these technologies allow TYPEit to provide a seamless and good-looking user experience while performing all the challenging operations behind the scenes.

The innovation of TYPEit lies not just in its gamified approach but also in its real-time feedback mechanism. When students answer quiz questions, the platform provides instant visual feedback through a dynamic progress bar. Correct answers light up the bar in green, signaling success and encouraging confidence, while incorrect responses turn the bar red, prompting learners to review and improve. This feature enhances the learning process by guiding students intuitively, making the experience both interactive and impactful.

The TYPEit Quiz Platform addresses two primary problems in education:

- **Student Engagement:** By gamifying quizzes, it transforms learning into an enjoyable activity, increasing student participation and focus.
- **Educator Support:** It provides teachers and administrators with tools to effectively monitor and guide student progress, streamlining content management and performance analysis.

Without a doubt, TYPEit is the step forward in the sphere of educational technology as it suggests the environment manages most of the issues, associated with conventional learning processes. As designed and developed to suit the targeted high school learners, this platform redesigns learning into a meaningful and self-achieving approach to learning to help learners achieve their high academic goals.

Literature Review

In the area of education and technology, much of the information delivery involves quizzes but these do not provide immediate feedback and very few, if any, provide the element of controls for administrators. Many of the current quiz systems, such as Kahoot, or Quizlet, are based on group or ready-made quizzes rather than providing individual building options for teachers or students. Furthermore, most of these platforms do not possess components such as the live feedback, the challenges based on selected topics, the individual performance history, etc. TYPEit overcomes these drawbacks by providing administrators of the tool with a great deal of flexibility whereby different topics can be turned on or off, users can be regulated, and the data, which measures the performance of the tool, is provided to the administrators. Moreover, the use of TYPEit has an easy graphical user interface and, hence, the real-time response also improves the learning

section. This section also lists the tools and frameworks used; it evaluates them against the others; and finally, explains why Flask was chosen for its simplicity and scalability.

Over the years there has been a rapid advancement change in educational technology especially the technology applied in assessment through quizzes online. These tools have been especially useful for creating the interactivity in the learning-teaching process and facilitating the assessment. However, there are problems with scalability, authentication, and the lack of highly individualized platforms. This review compiles literature findings to highlight the possibilities and inform the creation of the TYPEit Quiz Platform.

Online Quiz Platforms: Current Landscape and Limitations

Butler-Henderson and Crawford (2020) emphasize the importance of scalable online examination systems in maintaining integrity and authentication, especially in high-stakes educational settings. However, many platforms designed for such purposes lack features that engage students actively during the learning process. In the same way, Salas-Morera et al (2012) offered a research on the use of online quizzes as tool in teaching-learning process, and emphasized that to improve the learning interest and knowledge of the learner, the feedback is vital and must be given instantly. Despite their pedagogical value, traditional systems often fail to provide immediate feedback mechanisms, limiting their potential to guide students effectively during assessments.

Platforms like Kahoot and Quizlet, widely recognized in the domain of gamified learning, focus on pre-made quizzes and group participation. While effective for collaborative learning, they are often criticized for their lack of customization and individual progress tracking (Degirmenci, n.d.). Additionally, Castro and Tumibay (2019) conducted a meta-analysis on the efficacy of online learning courses, noting that the inclusion of interactive and adaptive features, such as live feedback, significantly enhances the overall learning outcomes. This highlights a gap in existing platforms, which TYPEit aims to address through its unique features.

Real-Time Feedback and Adaptive Learning

A key capability of real-time is important since its implementation has been proven to enhance the performance of a learner and make corrections on their assessments as soon as possible. In a work that considers the challenge of designing online quiz systems for feedback during the COVID-19 crisis, Iqbal et al. (2021) intend to focus on feedback mechanisms during the COVID-19 pandemic. That is why their study points to such systems' effectiveness in increasing activity and decreasing cognitive load. TYPEit integrates this feature through a dynamic progress bar, which changes color based on the

correctness of answers, offering a visually intuitive way for students to gauge their performance. This aligns with the findings of Niek and Abdul Aziz (2022), who advocate for the inclusion of interactive and adaptive elements in online teaching and learning assessments to foster deeper student engagement.

Administrative Controls and Customization

While most existing platforms provide limited administrative functionalities, the ability to manage content and monitor user activity is increasingly recognized as essential for educators. Degirmenci (n.d.) highlights the importance of customization in language learning tools, where the ability to tailor content to specific learning objectives enhances effectiveness. TYPEit builds on this principle by offering administrators robust control over quiz topics, user accounts, and performance metrics. This level of customization empowers educators to design assessments that align with curriculum goals and individual learning needs.

Technological Frameworks: A Comparative Perspective

The choice of frameworks and tools significantly influences the scalability and usability of online quiz platforms. Iqbal et al. (2021) highlight the role of lightweight and modular frameworks like Flask in developing efficient online assessment systems. Flask's simplicity and scalability make it an ideal choice for TYPEit, especially when combined with SQLite for backend data management. Bootstrap's responsive design capabilities ensure that the platform remains accessible across devices, addressing accessibility concerns noted in previous studies.

From the literature, there are the following crucial features of the online quiz platforms: The provision of the real-time feedback feature, the need for the administrative control options, and the possibility for enhancing the customization of the learning experience. There are current platforms like Kahoot and Quizlet; however, these lack full functionality for such purposes as both for the learners and tutors. By addressing these limitations through its unique features and robust technical framework, TYPEit emerges as a promising tool in the realm of educational technology. The findings from prior research provide a sturdy foundation for the design choices in TYPEit, ensuring that the platform is pedagogically sound and technologically robust.

Methodology

The development of TYPEit followed an iterative and collaborative approach. The first activity involved community assessment in which pupils and other stakeholders in high schools discussed their needs and requirements. Using the information gathered by the team, the project was divided into essential tasks using Trello, designing the schema of the database, the creation of the user interface, and integration of real-time feedback. To implement the backend application, the Flask tool was used as the primary framework since it is lightweight and highly modular. The database used in the application and the recommendation system is SQLite since it is simple and compatible with Flask applications. Bootstrap and jQuery were employed to ensure the platform is responsive and interactive. The project was developed in three phases: planning, implementation, and testing. During the planning phase, the database schema and routes were mapped out. The implementation phase focused on coding the login system, dashboards, and quiz mechanics. Finally, the testing phase involved both manual and automated tests using tools like Selenium and unit test. This approach ensured a robust and user-friendly application.

The TYPEit Quiz Platform was created based on the prototype design approach where the final product was adjusted to fit high school students and teachers. The aim of this methodology was to ensure an optimum blend of technical progression and usability characteristics with the employment of contemporary tools and approaches the application that should be convenient, stable, and receptive.

Requirement Analysis and Planning

An extensive need analysis of the project has been envisioned with ideas contributions from the educators and high school students. These sessions were conducted with an attempt to define issues that arise with currently existing quiz systems and to collect information about users' preferences. Teachers reported the importance of enabling administrative control features, receiving feedback with scores instantly, and monitoring the progress, at the same time students focused on the aspects of games and tasks associated with certain topics.

Therefore, the project team decided to organize the development process in a project management tool called Trello. This environment was helpful in reducing the project into sub-tasks such as creating database schema, building up the user interface, and

incorporating the ability to interact. Each task was assigned to team members with specific deadlines, ensuring systematic progress.

Technology Stack Selection

The decision about what technology should be used or which stack to go with was a key part of the method described. There are a lot of toolkits available in today's world, but Flask was selected as the backend framework because of its simplicity, scalability, and compatibility with other tools. It can be scaled to support other layers, like user authentication, broadcast routing and real time user interactions which are essential for a platform such as TYPEit.

SQLite was used for database management because of its simplicity and the ability to implement Flask applications. Due to its lightweight characteristic, it was easy to build quickly and use during the development phase for data processing. For the front end, Bootstrap and jQuery were used in pulling off the responsiveness and the interactivity of the website, respectively. Bootstrap gave the UI and design variations equal and responsive across different devices, and jQuery offered dynamic interactivity that made users' creativity enjoyable.

Development Phases

The development process was divided into three distinct phases: planning, implementation, and testing.

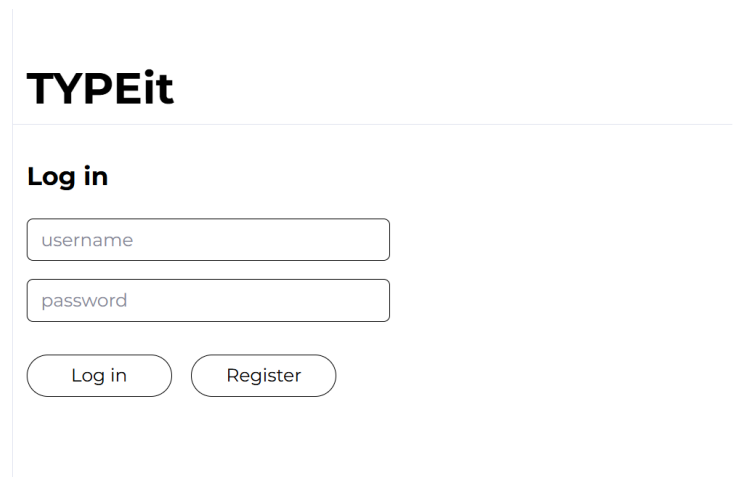
1. Planning Phase:

During this phase, the project team focused on designing the database schema, mapping out application routes, and defining key functionalities. The database scheme was structured to store user profiles, quiz data, and performance metrics efficiently. The routes were carefully planned to ensure seamless navigation, covering areas like user registration, login, quiz participation, and administrative dashboards. Wireframes and mockups were also created to visualize the user interface and gather feedback before development.

2. Implementation Phase:

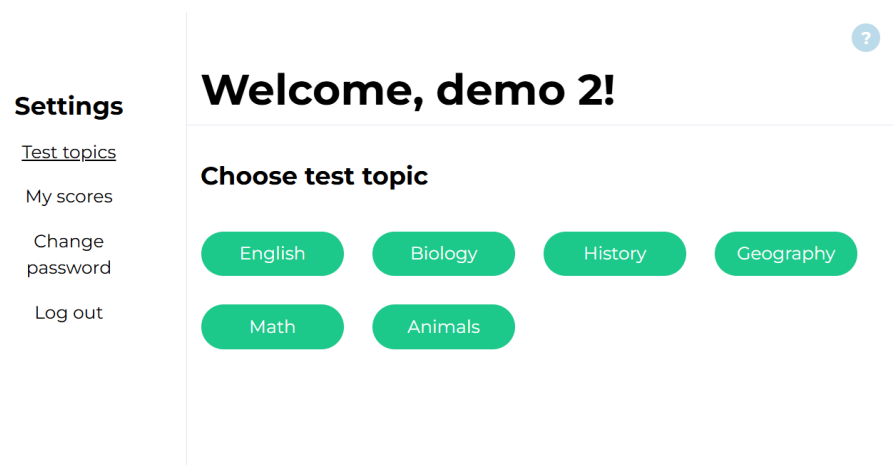
This phase marked the core development of the TYPEit platform. Key components were developed iteratively, allowing for continuous improvement and integration.

- **Login System:** A secure authentication system was implemented using Flask's built-in functionalities. Passwords were hashed using industry-standard libraries to ensure data security.



The screenshot shows the login interface for 'TYPEit'. It features a header with the 'TYPEit' logo. Below the header is a 'Log in' section containing two input fields: 'username' and 'password'. At the bottom of the login section are two buttons: 'Log in' and 'Register'.

- **Dashboards:** Separate dashboards were created for students and administrators. Students could view their progress, participate in quizzes, and track achievements, while administrators could manage content, users, and performance metrics.



The screenshot displays a user dashboard for 'demo 2!'. On the left is a 'Settings' sidebar with links for 'Test topics', 'My scores', 'Change password', and 'Log out'. The main content area is titled 'Welcome, demo 2!' and includes a 'Choose test topic' section with six green buttons: 'English', 'Biology', 'History', 'Geography', 'Math', and 'Animals'. A help icon (?) is visible in the top right corner.

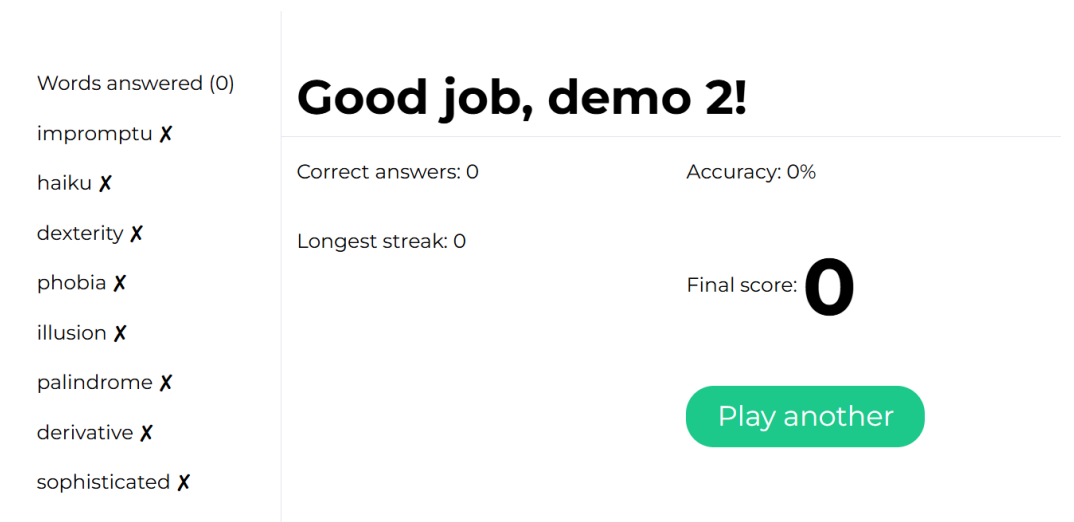
- **Quiz Mechanics:** The core feature of TYPEit, the quiz functionality, was designed to be dynamic and customizable. Quizzes could be tailored by topic and difficulty level, with a progress bar providing real-time feedback on performance.

A screenshot of a typing test interface. On the left, there are two large '0' characters representing 'Points' and 'Streak'. Below them is the text 'Words answered (0)'. In the center, a timer shows '19:59' in a rounded rectangle. To the right of the timer is a blue circle with a white question mark. Below the timer, the word 'Starts with I' is displayed in a large, bold font. To the right of the word is a rounded rectangle containing the text 'Skip'. At the bottom, the text 'Done without being planned or rehearsed.' is visible.

3. Testing Phase:

To ensure the platform was robust and user-friendly, a combination of manual and automated testing was conducted. Manual tests involved simulating user interactions to identify bugs and usability issues. Automated tests were performed using tools like Selenium for end-to-end testing and unit test for unit testing. Key areas of focus included functionality, security, and performance. Multiple iterations of testing and refinement were conducted to ensure a seamless user experience.

A screenshot of the TYPEit login page. The page has a white background with a dark gray header containing the 'TYPEit' logo. Below the logo, there is a yellow error message box that says 'Invalid credentials, please try again.' Below this, the text 'Log in' is displayed in a bold font. Underneath, there are two input fields: one for 'username' and one for 'password'. At the bottom, there are two rounded buttons: 'Log in' and 'Register'. A vertical scrollbar is visible on the right side of the page.



Iterative Development and Collaboration

Feedback from the participants was gathered at every phase of the project, and the methodology followed was therefore an iterative one. Conveying and code scrums provided the means for teammates to collaborate towards the project's objectives vocally and visually. Trello was used to track progress, manage dependencies, and address roadblocks effectively.

By combining user insights with a structured development approach and leveraging modern technologies, the TYPEit platform was designed to meet the dual objectives of engaging students and empowering educators. This methodology ensured the creation of a scalable, secure, and user-friendly application, poised to revolutionize quiz-based learning for high school students.

Implementation Details

The implementation of TYPEit involved both backend and frontend development, with a focus on user experience and functionality. The login and registration system ensures secure authentication, with student accounts being enabled or disabled by administrators. After the login, the student can select topics out of the given list and try quizzes on these topics. The actual quiz itself has a graphical component in the form of an underline beneath the answer input field which changes color depending on how good the user was. Using a timer has a positive effect because it creates a sense of time constraint, and the skip button helps learners to progress through a set of questions which they find difficult to solve. On the admin side, features include managing topics, enabling, or disabling user accounts, and viewing class scores. The backend uses SQLAlchemy to manage database

interactions, while the frontend employs Bootstrap for responsive design. Jinja2 templating facilitates dynamic content rendering. The database structure consists of three tables: Users, Topics, and Results, ensuring efficient data storage and retrieval.

The database structure consists of three tables: To collect, store, and index documents, Users, Topics, and Results, were established. TYPEit is a quiz platform that has been developed which aimed at combining the powerful back-end capabilities with a simple and visually appealing front-end. This was mostly facilitated in the context of student use while also integrating aspects that envisage making the platform easier to be used, engaged as well as managed by the administrators.

Backend Development

The backend of TYPEit was developed using Flask, supported by SQLAlchemy for database management and Jinja2 for dynamic content rendering. Key aspects of the backend include:

1. Authentication System:

- An account authentication and user account creation mechanism ensures proper protection of user accounts.
- It means the accounts belonging to students can be allowed or prohibited by administrating authorities, offering more control of free access to the platform.
- Passwords are encrypted enough to combat any attempts from third parties to gain access to the applications.

2. Database Structure:

SQLAlchemy, ensuring efficient storage and retrieval of data helps in managing the database. It consists of three primary tables:

- **Users Table:** Stores user information, including usernames, hashed passwords, roles (student/admin), and account status (enabled/disabled).
- **Topics Table:** Maintains details of available quiz topics, including their difficulty level and status (active/inactive).
- **Results Table:** Records quiz results, storing user IDs, topic IDs, scores, and timestamps for progress tracking and performance analysis.

3. Real-Time Feedback and Timer:

- Logic for evaluating quiz answers and providing instant feedback was implemented in the backend.
- A countdown timer is incorporated to add urgency and simulate test-like conditions.

4. Administrative Features:

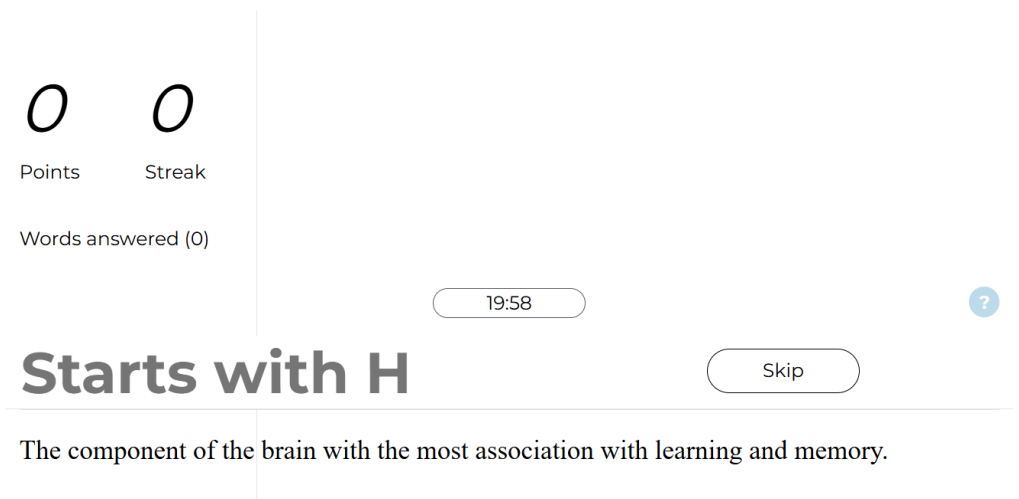
- Administrators can add, edit, or remove quiz topics.
- They can enable or disable user accounts and monitor class scores through a dashboard.

Frontend Development

Bootstrap was implemented for the frontend to support the feature of responsiveness and jQuery was integrated for functionality. This enabled the program to use Jinja2 templating to make it easier to produce content that was both as logical and visually coherent as possible.

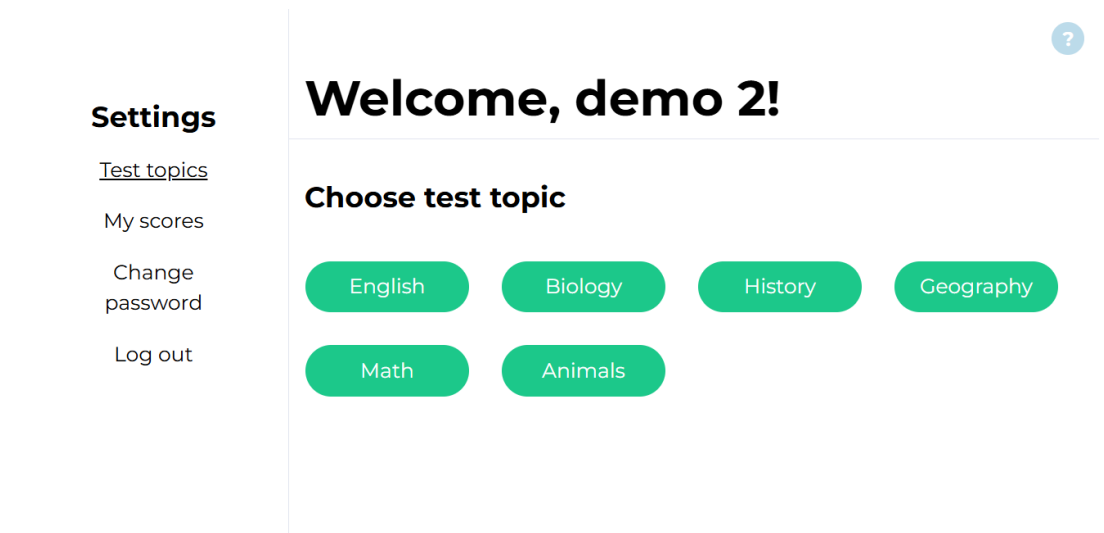
1. Student Interface:

- Students are greeted with a user-friendly dashboard displaying available quiz topics.
- The quiz interface includes:
 - A **progress bar** that changes color based on the correctness of the user's responses, providing immediate feedback.
 - A **timer** that counts down for each question, adding an element of urgency.
 - A **skip button** enabling students to move past challenging questions and revisit them later.



2. Admin Dashboard:

- The admin interface provides tools for managing topics, users, and scores.
- Class scores are displayed in an organized manner, helping educators track student performance.



3. Responsive Design:

- Bootstrap guarantees that the platform works and runs in all devices be it, desktops, tablets, and smartphones.
- The elements arrange on the screen proportional to the screen size of the device, keeping the uniformity of a program.

Integration of Key Features

1. **Dynamic Content Rendering:** Jinja2 templates are used to render dynamic content, such as personalized greetings, topic lists, and quiz questions, based on user roles and actions.
2. **Quiz Mechanics:** The quiz logic includes question randomization and result calculation, ensuring variety and fairness in assessments.
3. **Progress and Performance Tracking:**
 - Scores and progress are stored in the database, enabling detailed analysis of student performance over time.
 - The platform provides visual representations of scores, helping students and administrators assess improvement areas.

Testing and Refinement

The implementation process included rigorous testing of all features:

- **Manual Testing:** Each functionality was tested manually to ensure smooth operation and identify usability issues.
- **Automated Testing:** Backend logic along with the database response was tested by unit and Integration testing methodologies using the Python language unit test function.

By building up a strong backend with the simple and creative frontend, TYPEit guarantees a highly enjoyable and efficient learning process. This thoughtful implementation equips students with an interactive learning tool while giving educators powerful features to monitor and guide progress.

Results and Discussion

The development and deployment of the TYPEit platform successfully achieved its primary objectives: creating an engaging, interactive quiz environment for students and providing educators with a comprehensive tool for user and content management. The outcomes of testing and feedback from initial users underscore the platform's strengths and highlight areas for potential enhancement.

Key Achievements

1. Engaging Student Experience:

- The color-coded feedback system was a standout feature, offering students immediate guidance on their performance.
- They both enhanced the challenging atmosphere to the quizzes: the presence of the progress bar made the quizzes more interesting, and the presence of the timer contributed a lot to the quizzes' interactivity.
- Test users responded positively to the fact that they could easily 'pass' tough questions to the next section and revisit those in the next section later as time allowed them to catch up.

2. Administrative Efficiency:

- The admin dashboard enabled educators to easily manage topics, monitor user accounts, and review class performance.
- The ability to activate or deactivate topics and student accounts provided flexibility in tailoring the platform to meet the needs of specific classes or groups.
- Simplified score tracking and performance metrics allowed educators to focus on identifying areas where students needed additional support.

3. System Stability:

- Rigorous testing revealed that the platform was robust, with no significant bugs affecting functionality.
- The combination of Flask, SQLAlchemy, and Bootstrap ensured reliable performance and a seamless user experience across devices.

User Feedback

Feedback from both students and educators highlighted several aspects of the platform that enhanced its usability:

- The real-time feedback was cited as such because it allows students to know when they are wrong and correct it on the same instance.
- The responsive design ensured accessibility, with users reporting consistent experiences on desktops, tablets, and smartphones.

Areas for Improvement

While the platform met its primary objectives, certain areas for improvement were identified during the testing phase:

- **Password Reset Functionality:** The current password reset process was noted to be cumbersome, requiring enhancements to improve user convenience.
- **Variety in Question Types:** Now, the platform has the ability only to create multiple choice questions. Its addition in other formats which includes true/false, short answer and drag-and-drop will increase the variety of the learning activity.
- **Quiz Analytics:** Additional metrics, as time spent on each of the questions, and performance trends by topics, would help both students and teachers even further.
- **User Interface Enhancements:** While effective, some of the users mentioned that they envision small changes which would enhance the look of the skylight and make its use even easier.

Discussion

Accordingly, the results show that TYPEit can be a fair value for educational institutions, enhancing interactions and other learning, as well as easing organizational challenges. The platform successfully bridges the gap between traditional quizzes and modern, gamified learning solutions, aligning with contemporary educational trends.

The implementation of features like the admin dashboard and real-time feedback system positions TYPEit as a versatile tool that caters to the needs of both students and educators. However, continuous iteration and the incorporation of user feedback are critical to keeping the platform relevant and effective.

Future Scope

- **Scalability:** Introducing new security measures as well as improvements in handling profile data files based on cloud-based solutions with increased performance to store more users and quizzes.
- **Gamification:** Implementing badges that would query unique identifiers as a way of attempting further participation, display of top performers and provision of incentives.
- **Integration:** That led to considerations to explore its integration with Learning Management Systems (LMS) to expand its range of use and service offerings.

These findings will show that TYPEit has the potential to be a useful solution within the practice of educational technology and has the capacity to grow and change as the technology industry does.

Challenges and Solutions

The development of TYPEit encountered several challenges, each of which was addressed with thoughtful solutions:

1. Secure and Scalable Login System:

- **Challenge:** Implementing a robust authentication system to ensure user data security.
- **Solution:** Solution: Managing user sessions, Flask-Login was used, while crypt was implemented to support password hashing securely.

2. Responsive and Intuitive Interface:

- **Challenge:** User Interface: the goal of designing an interface that is usable in any form of device.
- **Solution:** Bootstrap was used to ensure that the design was responsive while multiple iterations of the user interface were tested with end users to make them more usable.

3. Database Integrity:

- **Challenge:** Maintaining consistency and reliability in the database structure.
- **Solution:** Proper key foreign constraints were implemented, accompanied by rigorous testing to prevent data anomalies.

These solutions ensured that the platform was secure, user-friendly, and dependable, laying a solid foundation for its functionality and scalability.

Conclusion and Future Work

The TYPEit Quiz Platform effectively bridges the gap between education and entertainment, providing an engaging learning experience for students and robust management tools for educators. The platform achieves its goal of making learning enjoyable while offering valuable feedback and administrative insights. Peculiarities of LMS's structure, its feedback feature, and the opportunity to adapt to the needs of the educational institution make this tool perspective.

Promising future advancements in carrying out its stocks further which include developing other areas of the platform:

- **New Question Types:** Using pill questions which utilize images, videos, etc., to make the test more engaging.
- **Password Recovery Options:** Encrypting the website for better security and adding easy means for password reset.
- **Advanced Analytics:** Developing detailed performance metrics and insights for educators to better track student progress and engagement.

With these improvements, TYPEit can become an all-in-one solution for today's education requirements, which would cement its place in the future of learning technologies perspective.

Team Members Contribution

Harini Padmaja Solleti – 811288992

- I have developed the required code to develop our online quiz platform which is TYPEit and executed the code using Visual Studio Code. The documentation/project report was done by me which included all the required information or mentioned points in the instructions.
- The challenges that I have faced while doing this project are as we are not professionals; I encountered many errors where I had to look up everything and change it several times to get the desired output.

Geethika Vulli –

- I have contributed by doing a demo video on how to implement the code and use the online quiz platform where it can be easily understood whoever sees it. I have prepared the power point presentation and included all the required information.
- The only challenge was to complete this entire project successfully and as I am the one who is preparing the power point presentation, I have to take extra care as that is the one which we showcase our project in front of everyone and as the slides should not contain so much matter and yet should convey all the necessary information, I had to be conscious.

We both, as a team, had a wonderful experience working together on this project. We shared works and kept updated about the progress from start to finish.

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