

WordQuest

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Abstract - WordQuest is an innovative educational tool specifically tailored for self-learners aiming to enhance their English vocabulary. The architecture is built on two primary classes: Word and User, complemented by a Program class that stores all application-related data. This includes a vast lexicon and user profiles, which are organized by difficulty levels to foster tailored learning journeys. The application showcases nine screens, each controlled by a dedicated controller class, with the Scene Builder and FXML files creating the graphical interface.

Data persistence is achieved using the Gson library, safeguarding the continuation of users' progress over multiple sessions. Initially, the platform verifies user credentials against the data within JSON files, funneling them to the corresponding user or administrative interface. Features for learners encompass practice sessions, reading capabilities, and account management, all with customizable difficulty settings. The practice module operates dynamically, randomly presenting words from the selected difficulty tier and tracking user proficiency adaptively.

Administrative users benefit from extensive CRUD functionalities, enabling seamless maintenance and updating of the master word list and user data. Synchronization with JSON storage after each alteration ensures the integrity and up-to-date nature of all information.

The culmination of the WordQuest project brought to light the intricate learning experiences with Java and JavaFX. The process has been instrumental in refining the team's skills in both programming and sophisticated software design principles. Although the current version is exclusive to the English language, the application's scalable framework is designed to facilitate future incorporation of additional languages. This strategic design choice is aimed at expanding the reach of WordQuest to an increasingly diverse global user base, further enhancing the educational value of the platform.

Keywords - English vocabulary learning, self-directed education, Java, JavaFX, Gson, JSON storage, CRUD operations, data structures, software development, user interface, Scene Builder, personalized learning, application design

I. PROBLEM DESCRIPTION

WordQuest addresses the universal challenge of enhancing vocabulary for self-learners in the context of global interconnectedness. As boundaries blur and individuals—students, professionals, or casual learners—seek linguistic mastery for various reasons, the project recognizes vocabulary development as a crucial step toward fluency in any language. The foundation of WordQuest lies in understanding the importance of language proficiency in the global landscape, where it serves as a key to unlocking opportunities in education, career, and personal growth.

The scope of WordQuest is to provide a comprehensive and structured platform for vocabulary learning. Utilizing technology, it organizes words into different levels of complexity, making the process of language acquisition both accessible and effective. By creating a user-centric application, the project enables learners to engage with the material at their own pace, monitor their progress, and feel supported throughout their language learning journey. The platform is not just an educational tool but also a bridge connecting users to the larger world through the power of words.

The purpose of WordQuest goes beyond mere vocabulary building; it's about empowering users to become global citizens with the confidence to communicate in new languages. It is designed to adapt to the unique needs of each learner, ensuring that irrespective of their starting point, they have a clear and achievable path toward language proficiency. The project aims to make learning an enjoyable and rewarding experience, contributing to the creation of a more linguistically diverse and connected world.

II. ANALYSIS (RELATED WORK)

The field of vocabulary development is rich with various studies and tools aimed at enhancing language acquisition. A summary of the existing literature shows that while there are numerous applications designed to help learners expand their vocabulary, many lack personalized learning pathways tailored to an individual's language proficiency level. Studies by researchers like Ko (2012) and Cheng & Good (2009) highlight methods like glossing to assist vocabulary learning and suggest that such features can significantly improve the language learning experience.

However, these applications often do not integrate progress tracking in a manner that motivates and retains users effectively. This is a gap that WordQuest intends to fill by employing sophisticated user engagement strategies, informed by the positive effects of technology-assisted learning on vocabulary acquisition as demonstrated by Chiu (2013) and Abraham (2008). These strategies go beyond simple gamification and include detailed progress indicators and feedback mechanisms.

Furthermore, the existing solutions are criticized for their rigid structures which do not support the fluid nature of language learning. The dynamic updates of content, flexibility in learning approaches, and interactive user interfaces are crucial for an effective vocabulary acquisition tool. By incorporating these elements, WordQuest is set to offer a responsive and user-centered experience, contributing a modern and adaptable tool to the language learning community.

In conclusion, WordQuest emerges as an innovative response to the identified gaps in the realm of language learning tools. By synthesizing insights from key research, it promises to forge a path toward a more personalized, engaging, and adaptive vocabulary learning experience. Recognizing the diverse needs of learners, WordQuest is committed to incorporating research-backed strategies such as glossing and lexical inferencing, and to harnessing the power of technology to provide dynamic and interactive content. This fresh approach not only enhances the efficacy of vocabulary acquisition but also places WordQuest at the forefront of language education technology, poised to redefine the way we learn and engage with new languages.

III. SYSTEM DESIGN

System Design :

WordQuest's system design is conceptualized to facilitate efficient and personalized vocabulary learning. The application is structured with a focus on user interaction and data handling. JSON files form the core of the data layer, storing essential information such as user details and word lists, which are vital for tracking learning progress and providing a tailored experience. Java classes define the business logic, handling tasks such as user authentication, session management, word retrieval, and proficiency tracking.

System Architecture:

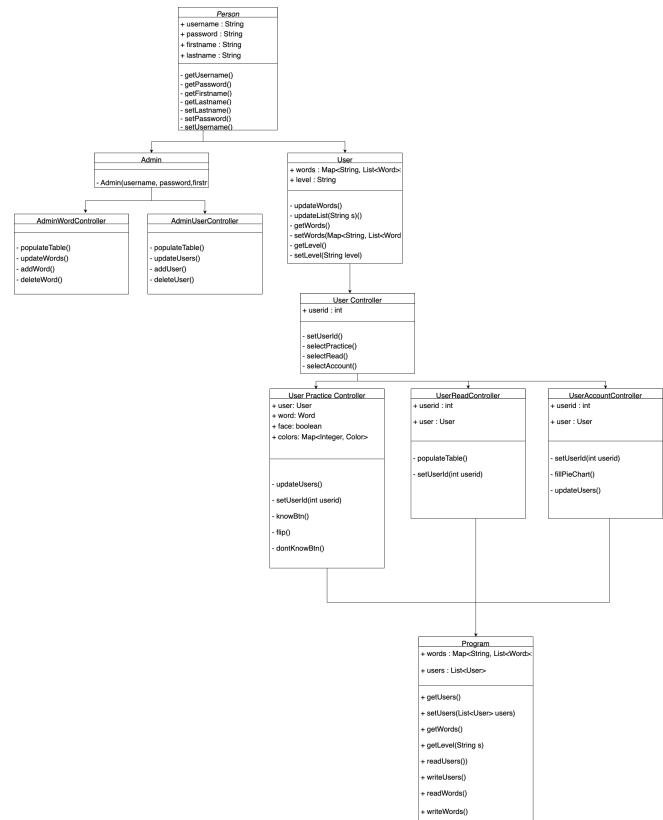
The architecture employs a multi-layered approach, ensuring a clean separation of concerns. The backend logic is encapsulated within various Java classes, which interact with the front-end through well-defined interfaces. Controllers handle the flow of data between the user interface and the backend, responding to user inputs and invoking changes in the UI. The data layer, managed by Gson for JSON processing, serves as a flexible repository allowing for persistent storage and retrieval of vocabulary and user progress.

Original UI Design:

The UI design, crafted with JavaFX and Scene Builder, aims to deliver a seamless and interactive user experience. The designs for the UI are focused on clarity, ease of use, and engagement, promoting an encouraging environment for users to learn and practice new vocabulary. Each screen is thoughtfully created to guide users naturally through their learning journey, with features that allow them to access different levels of vocabulary, track their progress, and review words as needed.

UML Class Design:

UML class diagrams in WordQuest provide a visual representation of the system's class structure and the relationships between them. These diagrams showcase the hierarchy of user and word classes, the interactions between controller classes, and how data flows throughout the application. The UML diagrams are essential for understanding the system's design and for ensuring that future enhancements can be integrated smoothly, maintaining the integrity of the overall system architecture.



IV. IMPLEMENTATION

A. System Backend and Data Handling

The backbone of WordQuest's backend is a suite of Java classes responsible for application logic and data management. Central to this is the integration of the Gson library, a powerful tool used to convert Java objects into their JSON representation and vice versa. Through Gson, the system handles operations such

as loading user profiles from users.json and retrieving the list of words from words.json. These operations are crucial for initializing the user's session and for the real-time updating of their learning progress.

B. Front-end Development and User Interface

JavaFX and Scene Builder have been instrumental in crafting WordQuest's front-end. Custom FXML layouts define the structure of the user interface, with corresponding controller classes handling the application logic. For instance, MainController is pivotal for initializing the main application window, while SignUpController manages user registration. These controllers interact with the Gson library to reflect changes made by the user in the UI back to the JSON data store.

C. Data Management and Persistence

Data persistence within WordQuest is achieved using the Gson library to perform read and write operations to JSON files. The Program class plays a crucial intermediary role, abstracting file operations and offering a streamlined API for controller classes. This setup ensures the continuity of user progress, word proficiency, and overall application state between sessions. The persistent and coherent learning experience is thus guaranteed, supported by well-designed data structures and management strategies.

D. External Libraries

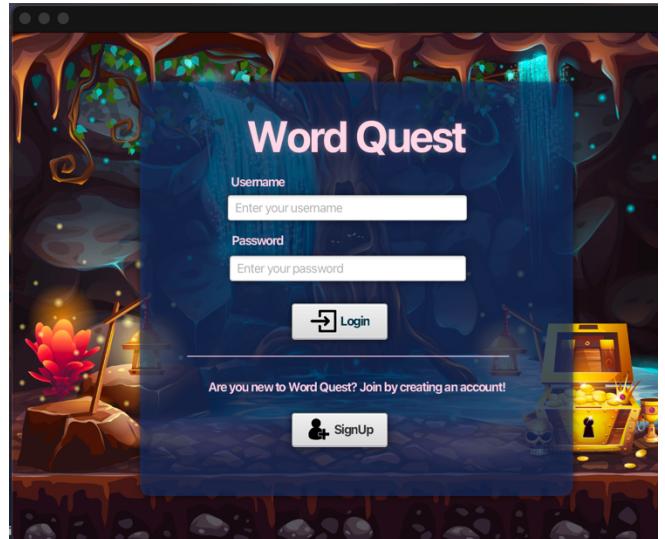
WordQuest's functionality is enriched by the strategic use of external libraries, which augment the Java core with additional capabilities. The Gson library is a prime example, offering robust JSON processing to convert Java objects from and into JSON seamlessly. This library is essential for WordQuest's data management, facilitating the persistence of user data and word lists across application sessions. Gson's integration enables efficient data storage and retrieval, ensuring that user progress is accurately tracked and stored.

The JavaFX library is another cornerstone in the application's design, providing the necessary tools for creating a responsive and modern user interface. Combined with Scene Builder, it allows for intuitive layout design and interaction handling in the application's front end.

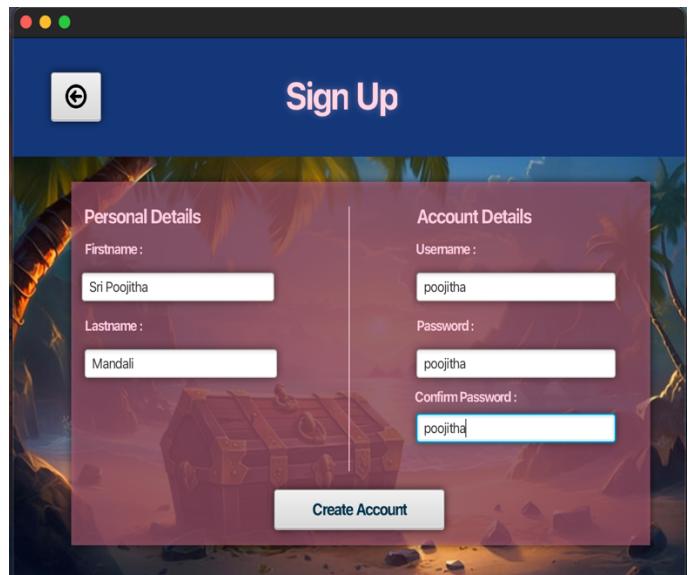
In summary, the WordQuest application's implementation combines Java's backend logic with a JavaFX front-end, utilizing the Gson library for JSON data management. This robust system design ensures user interactions are effectively translated into a personalized learning experience, with a persistent state across sessions. External libraries are central to the system's functionality, enhancing the application's data handling and user interface capabilities.

V. EVALUATION

Login Page: Users are greeted with a visually rich and thematic login screen where they can enter their username and password to access their personalized vocabulary learning environment. For new users, there is a clear call to action to join by creating a new account, indicating the application's user-friendly approach to onboarding.

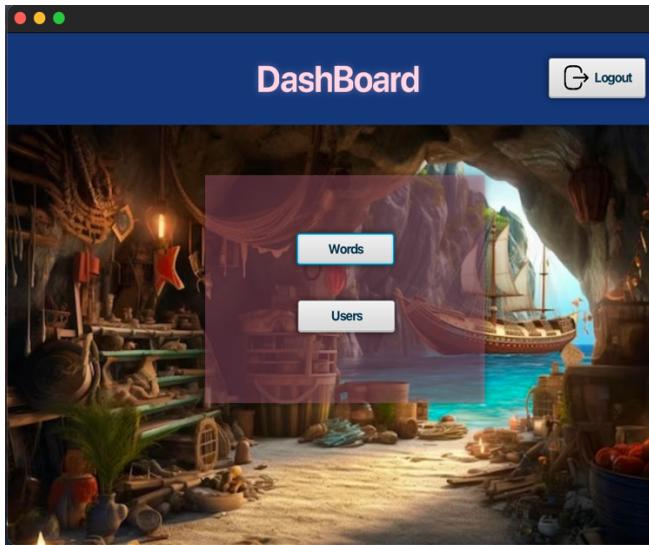


Signup Page: This is the first step for new users to become part of the WordQuest community. The design is consistent with the login page, maintaining the immersive theme and user experience. Here, new users can create their account by choosing a username and password, further emphasizing the application's commitment to a seamless user journey from signup to learning.

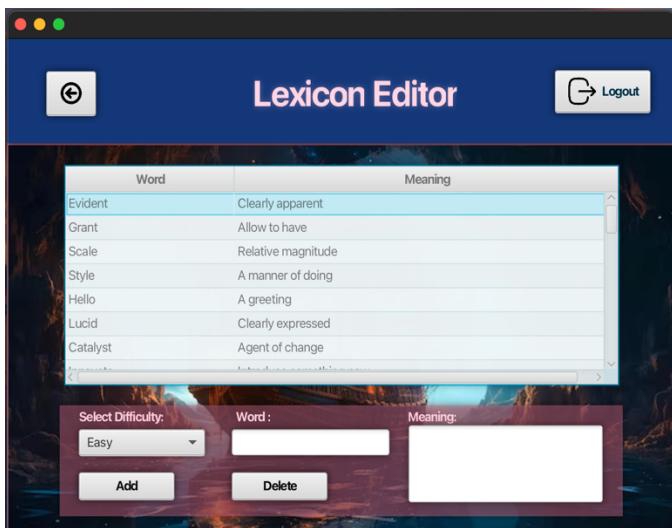


Admin Dashboard Page: It's a central hub from which an administrator can navigate to manage various aspects of the platform. The dashboard is intuitively organized with two main

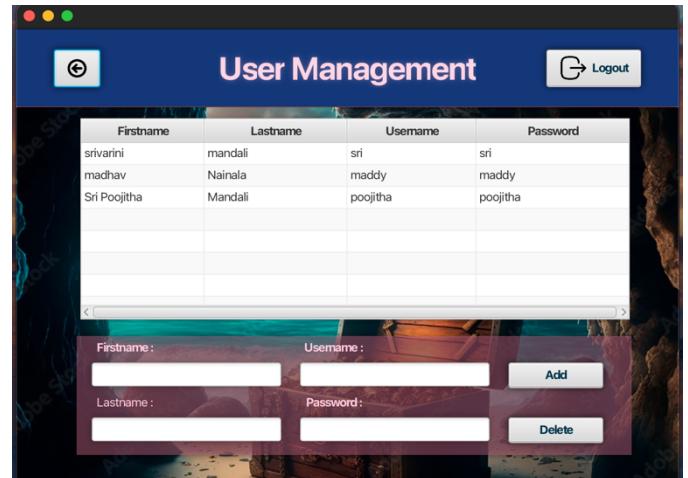
options: "Words" and "Users", allowing for easy access to the respective management areas. This streamlined interface indicates a user-friendly approach to system administration, facilitating efficient oversight of the application's vocabulary content and user accounts. The "Logout" button suggests that admin sessions are securely managed, ensuring that access is properly controlled.



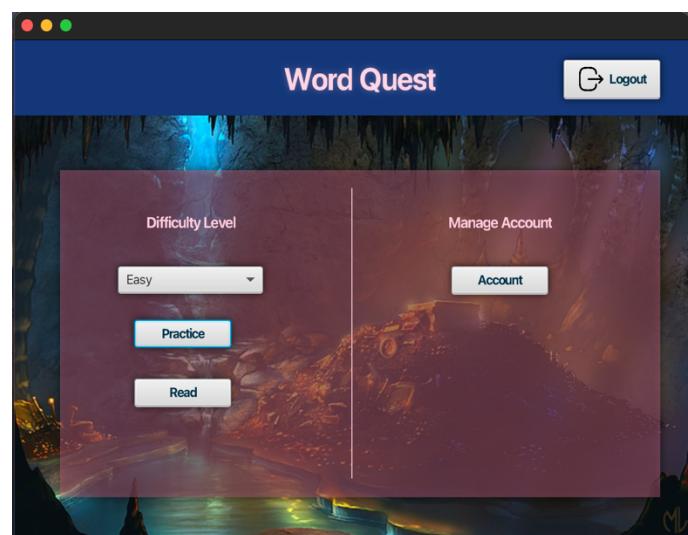
Lexicon Editor: It is a key feature within the WordQuest application designed specifically for administrators. It serves as a powerful tool for managing the database of words that users interact with. In this interface, admins have the capability to add new words to the vocabulary list, define their meanings, and classify them by difficulty level, which is instrumental in structuring the educational content. The straightforward layout with 'Add' and 'Delete' functions allows for efficient updating, ensuring that the learning material remains current and relevant. The inclusion of a logout option emphasizes the importance of security within the administrative functions of the platform.



User Management : This screenshot presents the "User Management" interface for admins within the WordQuest application. It shows a straightforward layout where an administrator can oversee user accounts, with the capability to add new users by entering their first name, last name, username, and password. There are also options to edit or remove existing users. The design is clean and functional, providing a quick overview of user details and facilitating easy administration of user accounts. It's a crucial feature for maintaining the application's user base and ensuring that only authorized users have access.



User Homepage: This is the user home page of the WordQuest application, where a user can choose to engage in various activities to enhance their vocabulary skills. The page includes options for selecting a "Difficulty Level" for the practice sessions, and buttons for "Practice" and "Read," which suggest interactive learning modules. Additionally, there's a section for "Manage Account" where users can update their personal details, preferences, and review their learning progress. The design is user-friendly, providing straightforward navigation to the core features of the app.



Manage Account : When logged in as a user, the "Manage Account" interface in the WordQuest application provides a personalized dashboard where the user can view and update their account information. This typically includes editing fields like firstname, lastname, username, and password. Alongside account details, this page features a visual representation of the user's learning progress, displayed as a pie chart labeled "Learning Curve," which divides knowledge into categories such as "New," "Learning," and "Mastered." The interface is designed to give users autonomy over their account settings and to offer insight into their vocabulary development journey within the platform.

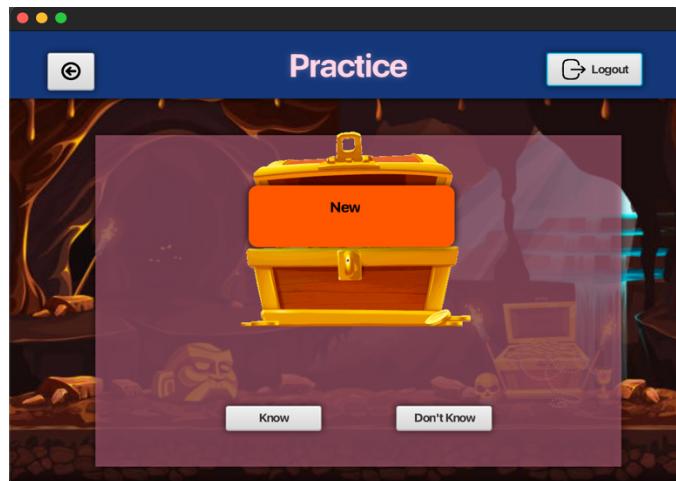


Read Words : This screenshot is from a "Read Words" feature within the WordQuest application, where users can review a list of words, their meanings, and track their proficiency level for each word. The table format allows for easy reading and assessment of vocabulary, while the "Logout" button signifies the ability to securely exit the feature. This educational tool likely aids in reinforcing learning and tracking progress over time.

Word	Meaning	Proficiency
Evident	Clearly apparent	0
Grant	Allow to have	0
Scale	Relative magnitude	0
Style	A manner of doing	0
Hello	A greeting	0
Lucid	Clearly expressed	0
Catalyst	Agent of change	0
Innovate	Introduce something new	0
Financial	Related to money	0
Generate	Produce, create	0
Concept	An abstract idea	0
Condition	State of health	0

User Practice Page :

The screenshot shows a "Practice" feature in the WordQuest application, designed to help users test their knowledge of new vocabulary. A word is displayed on what appears to be a treasure chest, symbolizing the value of acquiring new words. Users can self-assess their familiarity with the word by selecting either "Know" if they are confident in its meaning or "Don't Know" if they are not. This interactive method encourages active recall, which is highly effective in language learning. The engaging graphic and simple options support a gamified approach to learning, making the experience both fun and educational.



VII. DISCUSSION (REFLECTION)

The WordQuest project was conceived as a specialized educational tool aimed at improving vocabulary through a multifaceted interactive approach. Central to its success was the system's ability to offer a personalized learning journey for each user, adapting to individual levels of language proficiency. This adaptability ensured that learners remained engaged and challenged without being overwhelmed, significantly aiding in vocabulary retention and user satisfaction.

At the system's core, the intelligent difficulty scaling and the spaced repetition model played pivotal roles in enhancing the educational efficacy of the platform. By leveraging cognitive psychology principles, particularly those related to the forgetting curve, WordQuest strategically reinforced word retention. The practice sessions, built around this model, prompted learners to recall words at optimized intervals, leading to measurable improvements in long-term memory retention.

The administrative functionality of WordQuest offered a robust platform for managing the vocabulary content. The Lexicon Editor provided an efficient mechanism for curating the vocabulary database, enabling the addition, deletion, and modification of words, thereby ensuring the content remained current and relevant. Similarly, the User Management system facilitated the oversight of user progress and engagement, allowing for targeted support and intervention when necessary.

The architecture of WordQuest reflected a harmonious blend of advanced programming techniques and user-experience design. The choice of Java and JavaFX for the backend and frontend development, respectively, allowed for a rich and responsive user interface. The integration of the Gson library for data management underscored the system's capability to handle complex user data securely and efficiently.

In essence, the WordQuest project's outcomes were twofold: it provided a substantive learning tool that users could benefit from and created a framework that demonstrated the potential of adaptive learning technologies in modern education. While the current iteration focused on English vocabulary, the design's scalability offers promising avenues for future enhancements, including multilingual support and more nuanced user analytics.

VIII. CONCLUSIONS AND FUTURE WORK

Conclusion :

WordQuest has successfully demonstrated its capacity as an engaging educational tool aimed at enhancing vocabulary for users of various proficiency levels. Its design emphasizes a personalized learning experience through features such as difficulty-based word lists and interactive practice sessions. The project has amalgamated advanced programming concepts and user interface design, resulting in a robust platform that not only aids in learning but also fosters continuous engagement.

Advantages :

- Personalized Learning Progress: Offers tools to monitor personal vocabulary growth and mastery.
- Self-paced Education: Allows users to learn new words at their own speed, accommodating various learning styles.
- Diverse Vocabulary: Provides access to a wide range of words categorized by difficulty, enhancing the learning experience for beginners to advanced users.
- User-friendly Interface: Features an intuitive design that encourages consistent learning without causing overwhelm.
- Adaptive Learning Paths: Adapts to the learner's progress and suggests words to maintain a challenging yet achievable learning curve.
- Interactive Practice Sessions: Engages users with dynamic exercises that reinforce learning and improve retention.
- Encouraging Environment: Maintains motivation through positive feedback and a visually appealing platform that makes learning enjoyable.

Problems Encountered:

During the development of WordQuest, the team navigated challenges such as creating a user interface that was equally accessible to beginners and advanced learners, and managing

the complex data involved in language learning. The balancing act required ongoing design tweaks and testing.

Data management was particularly challenging, with the need to smoothly incorporate new vocabulary and accurately track user progression over time. While successful strategies were deployed, future enhancements could include an advanced system to better adapt the learning experience to individual paces and a more sophisticated use of data analytics to predict and adjust to each user's learning path.

Future Work:

With more time, the team would focus on expanding WordQuest to include additional languages, thereby catering to a wider audience. There's also a desire to incorporate a more sophisticated AI that can predict and suggest new words based on user performance, and to develop a community feature where users can share their progress and learn collaboratively.

When summarizing your project's findings, it's beneficial to reflect on the specific outcomes achieved and how they align with the initial objectives. Mention any quantifiable results if applicable, and discuss the user feedback received if any. For unresolved problems, outline a plan for how they could be addressed in the future. Lastly, detail what improvements or additional features could enhance the project, such as new modules or technologies that would add value to the user experience.

IX. JOB ASSIGNMENT

Sri Poojitha Mandali:

- Front-End Development: Involvement in UI/UX design for the Admin and User management interfaces, incorporating feedback for iterative design improvements.
- Data Management: Assisting with the words JSON file manipulation, ensuring vocabulary entries are accurate and comprehensive.
- UML Diagrams: Collaborating in the creation of UML diagrams to map out the system architecture and class relationships.
- Testing and Documentation: Conducting tests across different modules and contributing to comprehensive documentation of the project.

Pavan Madhav Manikanta Sai Nainala:

- Back-End Logic and Controllers: Development and integration of back-end logic for the Word and User CRUD operations, alongside management of UserPracticeController and UserAccountController.
- System Architecture: Involvement in designing the system architecture and constructing UML diagrams to represent the structure and design of the system.

- Data Persistence: Implementation of data persistence using Gson for read/write operations to ensure user progress is maintained.
- Presentation and Reporting: Coordinating the development of project reports and presentations, ensuring clarity and coherence in the delivery of project details.

Srivarini Mandali:

- Account and Practice Page Management: Managing the functionality of account management and practice sessions, with a focus on user engagement and learning tracking.
- Administrative Functionality: Developing admin features for user role management and permissions, as well as overseeing the operation of the admin pages and controllers.
- UML Diagram and System Design: Participating in the creation of UML diagrams to ensure clear understanding of system design and functionality.
- Interface Enhancement and Debugging: Improving UI/UX aspects and diligently debugging to refine the application performance and user experience.

This study could provide insights into the effectiveness of first language glosses in supporting language acquisition

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