6CS007- Project and Professionalism

Assessment

Proposal Report

Full Name : Anita Waiba

Student Number : 2331409

Class Group : L6CG8

University Email : A.Waiba@wlv.ac.uk

Course : BSc (Hons) Computer Science

Supervisor : Niraj Singh

Reader : Yogesh Bikram Shah

Abstract

This project involves the creation of an online education application that will positively impact the learning progress of a learner, especially a starter in fields like computer literacy and interior design. As the learner achieved a level, the material presented was advanced or easier depending on the learning path thus making the application smart. Tasks in the form of quizzes, badges, and leaderboards were incorporated to increase interest while guaranteeing that users remain actively participating in their learning process. The web application has been created with the help of a frontend design pattern known as React.js and Node.js along with Express.js as the backend tools and MySQL as the database for the growth of the application.

The development process here involved the Scrum method which allowed iterative incremental deliveries with inherent customer feedback incorporated into the system continuously. The adaptive mode of learning is embraced in the application through ML algorithms because it can evaluate the learner's progress and make the necessary adjustments in the content presented to meet the level of the learner. This project accomplishes the goals of constructing an engaging, context-aware, and convenient learning environment necessary for the development of the e-learning spectrum.

Table of Contents

Table of Figures

1. Introduction

1.1. Project Title

"LearnIT"

1.2. Project Briefing

Computer fundamentals and programming are becoming significant essentialities in the present-day context. However, accessible and interesting material for learning these important skills remains limited for many people. So, the main purpose of this application is to provide a user-friendly entertaining, easy-to-learn experience for users who want to learn the fundamentals of a computer and basic programming but also include modules on practical computer shortcuts that are used daily. As a serious spinning game, the app offers lessons that break down difficult concepts into even simpler elements within the quiz, spin to learn achievements, and a spinning leader board respectively. These lessons will help the user to boost their productivity and confidence in using computers efficaciously.

1.3. Problem Statement

A significant knowledge gap exists for beginners learning about computers and programming. While resources exist, many are text-heavy, lack engagement, or require prior knowledge, which may deter beginners. Existing tools may not provide enough interactivity or gamified elements to motivate users. This project aims to bridge this gap by developing an app that provides an accessible and enjoyable way for users to acquire fundamental computer skills through structured, gamified lessons. Hence, this platform assists in simultaneously learning foundational and practical skills.

1.4. The Project as a Solution

This application provides a gamified learning experience where users can explore lessons on computer basics and introductory programming. The app engages users and encourages improvement by using interactive elements such as quizzes, matching games, and fill-in-the-blank exercises. Additionally, the app incorporates achievements and a leaderboard to motivate users and promote consistent learning. Security features protect user data, while regular content updates keep users engaged with fresh material.

2. Aims

- Create an application that offers lessons on computer fundamentals and elementary programming using learning games.
- Create a user-friendly UX that supports both the process of movement around the site, as well as the motivation to study the material offered.
- Various features give users feedback as to their advancement.
- Provide users with basic contexts about computing in a manner that inspires them to find out more all on their own.
- Also, it stimulates consistent learning and implementation of skills in day-to-day computer interaction.

3. Objectives

- Make engaging learning activities focusing on computers along with their shortcuts and programming basics.
- When creating an interface, implement the use of images, and buttons.
- An achievement system, a leaderboard, and badges should be introduced as fragments of the gameplay.
- Habits should be formed to go through day-to-day learning by embracing ways such as challenges, and streaks among others.

4. Artefact

This artefact is an online academic application designed to help users learn the fundamentals of computing and programming with entertainment-oriented content. There will be lessons, quizzes, and an interactive board where the user can see their progress. They are; computer orientation, computer typing, and an overview of programming.

The application will be built using:

- Frontend: Responsive for an interactive user interface
- Backend: Node.js to manage user's data and app's functionality.
- Database: MySQL to store user, statistics, and lesson details.

4.1. FDD (Functional Decomposition Diagram)

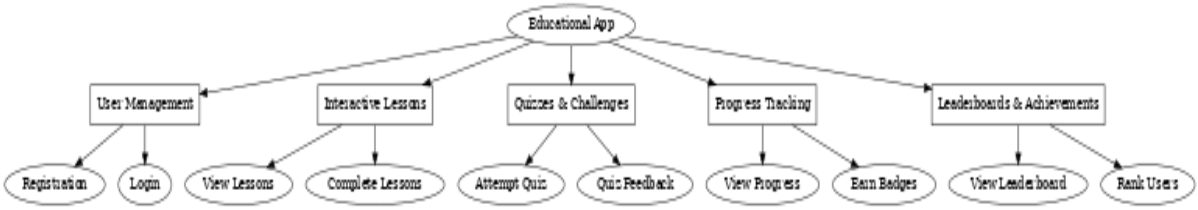

Figure 1: Functional Decomposition

This application is intended for any person willing to improve his/her digital competency entertainingly. Hence, the platform is divided into segmented subsystems, each having a distinct purpose to ensure smooth functionality and versatility.

4.2. Main System: Gamified Computer and Programming Teaching

The main system is the centralization of all functions that assist in providing easy and game-type learning. Lessons and quizzes can be easily observed along with rewards and progress of the users in a user-friendly mode.

4.3. Subsystems:

The main system is broken down into various subsystems:

i. User Management Subsystem

Purpose: Is responsible for user identity and his/her account settings as well as other preferences.

Features:

- New user registration and existing user login with secure credentials.
- Access control (e.g., admin for managing content).
- Dashboard visualizing the user's achievements and progress.

ii. Content Delivery Subsystem

Purpose: Teaches lessons, tutorials, and tips in a logical sequence.

Features:

- Lessons are broken down as either progressive or based on difficulty and include the basic, intermediate, and advanced levels.
- Lesson on daily-use computer shortcuts.
- Beginner-friendly and interactive tutorials for programming lessons.

iii. Gamification Subsystem

Purpose: Customer interaction: increases the interest in making the user's activity similar to a game.

Features:

- A system of scoring or gaining points for accomplishing lessons and quizzes.
- Different badges will be awarded depending on the level achieved.
- These include; Leader boards that are aimed to spark competition.

iv. Progress Tracking Subsystem

Purpose: Supervises the activity of users and shows statistics.

Features:

- An illustration of the completion of lessons and quiz performance.
- Patterns for keeping up continued learning regimes.
- To begin with, the new features came up as follows; Availability of downloadable progress reports. v.

v. Quiz Subsystem

Purpose: Contains quizzes that check users' comprehension through various activities.

Features:

- The exercise includes multiple choice and/or coding challenges besides match-the-pairs exercises.
- Opportunity to get results immediately with further clarification on incorrect responses.
- Integration with the reward system in the game.

vi. Notifications Subsystem

Purpose: Updates users on the current trends and or events.

Features:

- Notifications for incomplete lessons or a missed streak.
- Information on the current position in terms of the leaderboard and the badges which have been attained.

vii. Database Subsystem

Purpose: This means that data storage is carried out in a centralized manner for all the applications.

Features:

- User account information, content to be taught in lessons, quiz results, and the history of users' performance.
- Efficient ways of querying to access data as soon as possible.
- Synchronisation with information/data, which will allow the creation of backups for data integrity.

viii. Frontend Subsystem

Purpose: Highlights a friendly and useful interface used to interact with the users.

Features:

- Perceivable feedback for gamified features like progress bars and badges.
- Adaptive to the different computing and displaying devices.

5. Academic Questions

- What specific automated algorithms and structures are most effective when applying the concept of gamification to learning applications?
- How can programming and basic computer knowledge be simplified into small lessons that first-time learners understand?
- How can we ensure that users remain interested in the learning process while using educational applications?
- What is necessary to put into practice to ensure the user's learning progress and their personal information have a defense mechanism in the web app?

6. Scope

- Targeting users of all ages interested in engagingly learning computer basics and programming.
- Providing a user-friendly interface with gamification elements like a leaderboard and badges to motivate learners.
- Offering personalized lesson plans based on user progress and performance to tailor the learning experience.

7. Limitations

- Since user input may vary, it may be challenging to gauge the accuracy of each user's progress without additional assessment methods.
- Users need to engage with the app consistently to benefit fully from the learning experience, which relies on self-motivation.
- The app focuses on individual learning; its impact on formal education or broader educational systems may be limited.

8. Initial Review

a. Tailored Gamification in Education

Source: (Wilk Oliveira, 2023)

Description: Gamification has surfaced as an efficient method to engage learners in educational applications. However, if the effectiveness of the platform is to be properly harnessed, such a framework must be adapted to individual learners. As this paper points out, the learners could benefit from adaptive gamification in terms of challenges, rewards, and performance tracking that are in a way designed per learner. Hence, the goal of delivering personalized learning experiences, ensures learners stay motivated and engaged through interactive and tailored features.

Evaluation: This also corresponds with the requirement of my project as analysis of users learning outcomes entails a process of creating interesting, effective, and individual-oriented tools and activities for the learning process which will keep the learners motivated.

b. Between Level Up and Game Over: A Systematic Literature Review of Gamification in Education

Source: (Ana Manzano-León, 2021)

Description: Gamification has proven to remarkably enhance both motivation and academic performance, especially when users are rewarded for their efforts and can track their progress. This review shows that game-like components, such as points, badges, and leaderboards, are highly effective in driving learners' engagement, but they also caution that the learning outcomes should remain the focus.

Evaluation: In the context of my project, finding the right mix of such elements will avoid overshadowing the educational objectives and keep users interested.

c. Importance of User Privacy and Data Protection in Educational Mobile Apps

Source: (Team, 2024)

Description: Education apps offer important functionality, yet these apps also gather significant amounts of information about the users, so security issues have to be addressed. According to (Team, 2024), the latter systems describe the need to implement corporate safeguards such as encryption and secure authentication procedures. This is so because in learning platforms data including learners' performance and other data is likely to be stored there.

Evaluation: The above practices are very significant for my app since they must demonstrate compliance with data protection regulations to protect and secure the customers using my app.

d. Impact of online learning on student's performance and engagement: a systematic review

Source: (Catherine Nabiem Akpen, 2024)

Description: Proper development of online learning platforms includes the provision of features that enhance the participation of learners. Real-time feedback, quizzes, and other types of interacting lessons enhance the users' participation and performance as explained by (Catherine Nabiem Akpen, 2024). They conclude that in the use of social media to achieve learner engagement it was established that the more engaging or active the platform, the better positioned it was at ensuring that users stay and also get better results.

Evaluation: This insight is useful to advance your app and where elements such as quizzes, progress bars, and instant feedback contribute much to interest.

9. Project Methodology

9.1. Scrum Methodology

Scrum Methodology will be implemented to ensure the seamless and efficient development of the project. Scrum is suitable for creating a system that needs to be changing all the time, adding or removing features, depending on the client's feedback. Presented below are critical arguments why Scrum is particularly appropriate for this project anchored on empirical literature and best practices.

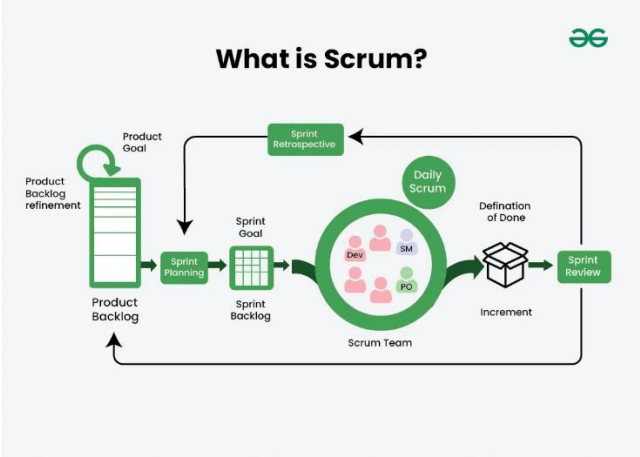

Figure 2: Scrum

9.2. Features:

i. Adaptability and Flexibility

The application should be in a constant state of evolution, primarily because users will be shaping the tool's subsequent iterations based on their feedback, and new technologies may affect the app. Due to the iterative nature of Scrums, it is very easy to respond to changes in the requirements, feedback, or scope of a project. (Permana, 2015) Noted the flexibility of scrum to estimate that it affords the various teams the prompt opportunity to adapt to various changes and hence recommend it where frequent change is needed say where the education app changes their user needs frequently.

ii. User-Centered Development

The key factor of the success of the app lies in the fact that there is a focus on its relevance to the needs of its users. Within Scrum, there is a focus on a Sprint Review where functional increments of the app are shown to stakeholders. This feedback frequency is in concordance with (Catherine Nabiem Akpen, 2024) Proposal on how engagement and satisfaction are increased especially when the development loop includes user feedback. In the case of the educational app, it denotes the process of fine-tuning the aspects like the lessons, modules, quizzes, or progress bar that enhances the results of the user's constant feedback.

iii. Iterative and Incremental Progress

The arrangement of the project is done more flexibly by Scrum which divides the project into smaller easier chunks of work called sprints that should not exceed 2 weeks, and by the end of this sprint, it is possible to be delivering a product increment. This makes it possible for functional enhancements such as the lesson content, quizzes, and

tracking of the user's system to be enhanced continuously. (Monika Yadav, 2015) Have pointed out that Scrum's iterative structure increases the chances of identifying the problem, which if uncovered, will be resolved as the project's many components are important for an educational platform.

iv. Collaboration and Communication

Scrum Framework involves iterative cycles which can effectively help in identifying risks and issues early hence enabling them to correct the entire project. According to (Permana, 2015), Scrum approves the integrating and testing processes to be run continuously in the development process to reach high qualities. Attempting to solve such challenges during the Scrum process means that the development of the educational app won't get off track and avoid significant issues.

v. Repetitive Improvement and Risk Management

Scrum's Product Backlog creates a priority to guarantee that what needs to be developed comes first. That is why the decision-making of choosing high-priority tasks for each sprint helps the development team to continue delivering value from the very beginning of the project, wherein it's critical to have fully functional templates such as interactive lessons, quizzes, and progress tracking no later than at the beginning of the second sprint. This is in line with the objective of the project – the creation of an educational application that would offer the best return on investment for the target consumers.

10. Gantt Chart

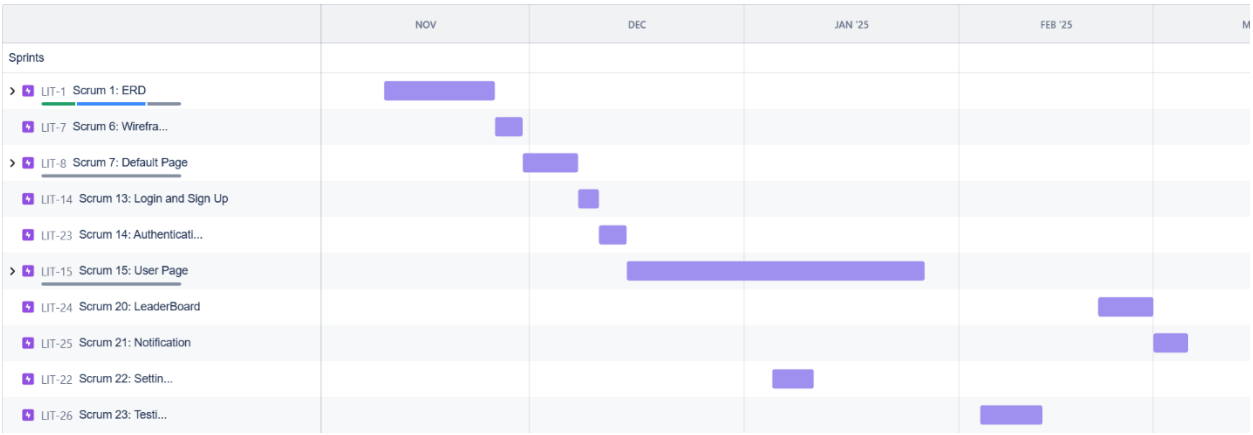

Figure 3: Gantt Chart

Link:
https://tinytalker.atlassian.net/jira/software/projects/LIT/boards/2/timeline?shared=&atlOrigin=eyJpIjoiNTg4MDljMzk5NjUyNDA1MjgyZTM3Zjk5NDExNTExMWIiLCJwIjoiaiJ9

11. Technology and Tools

In my project, to attain the aforementioned goals while creating the web-based educational application, several tools and technologies have been chosen to support the project's goals and ensure a convenient, progressively incremental course of development. Here's a breakdown of the key tools and technologies used:

i. React.js (Frontend):

Why: React.js allows us to have a flexible, adaptive user interface that can accordingly engage with other back-end services. React's component-basing allows one to use the elements within the framework repeatedly, making it easier to modify and improve as time passes. Moreover, using React developers are provided with a wide array of solutions for effective and scalable development including React Router for routing, Redux for state management, and a huge community of developers.

Use: React is used for the development of the interactive front end of the proposed educational app. The user interaction interface (UI) of the lesson modules, quizzes, user progress, and dynamic content will use React.js.

ii. Node.js and Express.js (Backend):

Why: It is based on the Chrome JavaScript runtime and is capable of processing backend requests much more efficiently while they are still asynchronous. Express.js is a tiny and highly adaptable Node.js web application framework that offers many important features for web and mobile application development. If you're creating a web application that has to be as scalable and as fast as possible while processing real-time data then you surely need Node.js and Express.js as your backbone solution, which is rather important for the educational platform.

Use: Node.js will take on functions such as user session control, MySQL DB manipulation, and REST API servicing roles. Express.js will be used to set up the application routes, as well as to handle the server-side computations including users' data, lessons' content, and results of the quizzes.

iii. MySQL (Database):

Why: MySQL is a reliable and fast-working relational DBMS, which possesses all the features required for productive work. It supports SQL-based queries for structured data and provides interfaces for inserting and querying data on tables such as user profiles, lessons, quizzes, and progress data. Considering the educational application that requires stable and relational data, MySQL provides the best optimization for big data and its safety.

Use: MySQL will be used for storing user data, lesson completed status, quiz results, and all information relevant to this app's functionalities. Due to the relational structure of MySQL, it is easy to perform some complex queries like features of recommending the lesson according to the users and their progress over time.

iv. Git and GitHub (Version Control):

Why Chosen: Git is a distributed version control application that can help developers manage code both in terms of version and cooperative changes. GitHub is used as the cloud storage platform of the project and it provides strategic aspects such as branches, pull requests, and issues. Use in the Project: Git and GitHub will be used for version control throughout the development process. Everyone will share the project within their team and GitHub will be used to track the changes to the codes and also the history of the changes.

12. Architecture Design

12.1. High-Level Diagram:

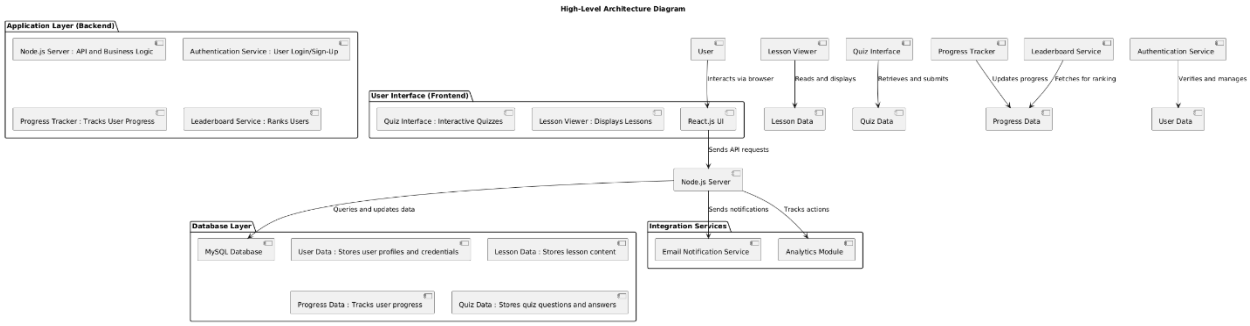

Figure 4: Architecture Diagram

12.2. Low-Level Diagram:

i. Use case Diagram:

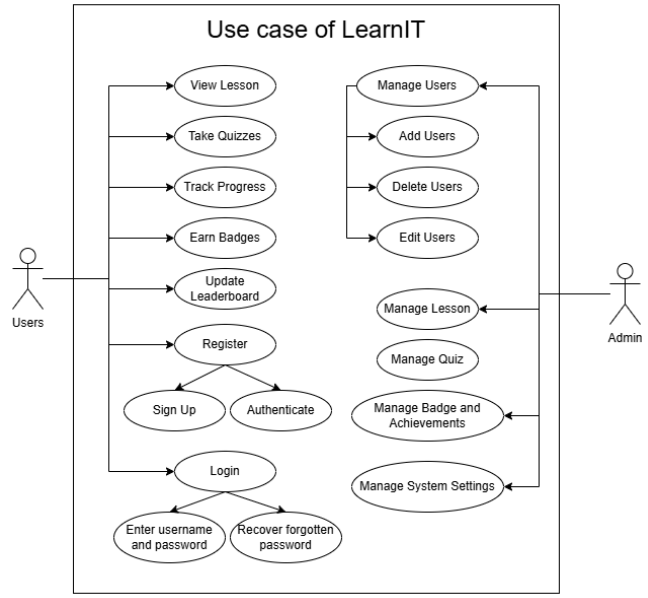

Figure 5: Use case Diagram

ii. Activity Diagram:

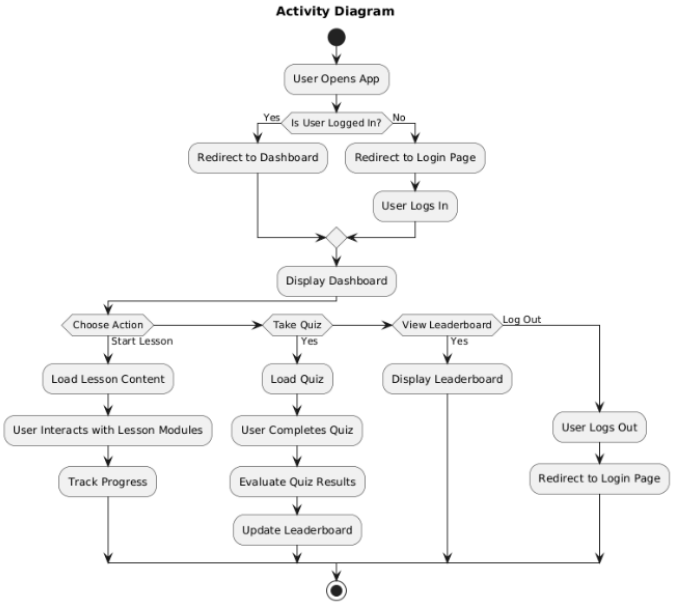

Figure 6: Activity Diagram

iii. Sequential Diagram:

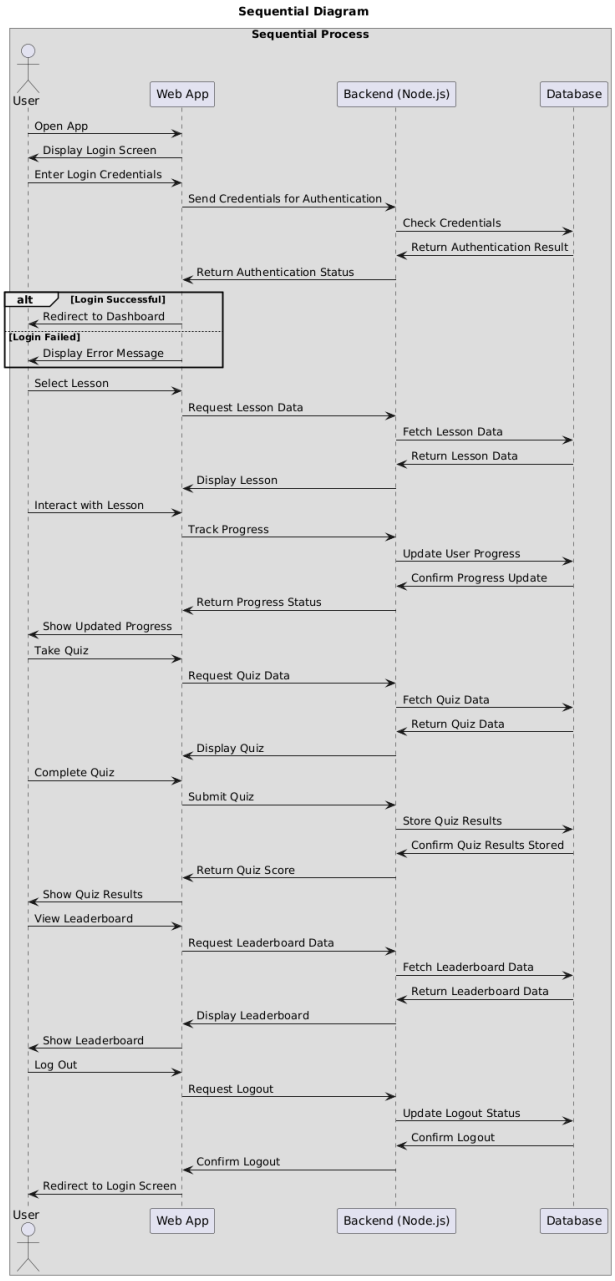

Figure 7: Sequential Diagram

13. Testing

13.1. White Box Testing:

i. Unit Testing:

This comes under white box test and implies testing of functional parts such as functions, methods, classes etc. Implementers are able to understand the relationships and patterns of the embedded algorithms in order to check on the functionality of each segment of the application. Incorporating the analysis of the application's source codes, the problematic areas in development are identified well in advanced for the solution of bugs' initiation.

ii. Integration Testing:

Another type of white box test is integration testing, in which the work is carried out based on the analysis of communication between interacting system elements, for example, frontend, backend, and database. When inspecting the internal organizational structure and require communication with other modules, this testing type will ensure the integrated components require work appropriately underway.

13.2. Black Box Testing:

iii. Usability Testing:

Usability testing falls in the category of black box testing whereby, the testers does not focus on the internal structure of the application/program but rather on the justification that has been developed to support the program. Testers assess if it is easy to navigate, if the looks and feels fit expectations, and if the features perform as expected, based only on a user's mode of thinking. Performance Testing: The other black box approach is the performance testing, which can be used with a

purpose of determining possible performance under various loads. It involves checking whether the application is responsive, stable, and scaleable particularly under load of high traffic and large amounts of data. It makes sure that the software in use is offer seamless experience regardless the state of the affairs.

iv. User Acceptance Testing (UAT):

UAT is one of the traditional black box testing techniques where actual users make the assessment on the system. Testing phase gives a feedback on the level of satisfaction, ease of use and perform relative to expectation to enable iteration in the final deployment phase.

14. Conclusion

Thus, the creation of the web-based educational app has met its objectives of designing an individualized platform enhancing educational engaging features like combining gaming aspects and learning paths. Through the utilization of machine learning to adapt content depending on user performance, the system has greatly improved the level of training offered to the users The addition of progress levels and the inclusion of quizzes has made the user more enthusiastic to complete the training. Other factors such as the consideration of user interface styles have also achieved favorable outcomes because the app is easy to navigate and use by learners at different classes.

Therefore, the project can claim that the main difficulties of educational app development have been resolved concerning the project goals and objectives, such as the development of a compelling, individualized, and safe learning application. The integration of data privacy factors has made it easy to protect user data thus enhancing the trust of users in the educational platforms. As a next step to enhance the app, designers can refine the existing algorithms of machine learning and develop even higher levels of personalization for each of the users of this app Besides they can broaden the coverage of content provided by this app so that more and different types of materials can be covered for learning purposes.

15. References

Ana Manzano-León, P. C.-L. A. A. M. A. G. L. G.-P. J. M. A.-P. R. T., 2021. Between Level Up and Game Over: A Systematic Literature Review of Gamification in Education. *Sustainability.*

Catherine Nabiem Akpen, S. A. S. A. H. O. &. S. S., 2024. Impact of online learning on student's performance and engagement: a systematic review. *Discover Education.*

Monika Yadav, N. G. J. Y., 2015. Agile Methodology over the iterative approach of Software Development -A review. *IEEE International Conference on Computer and Information Technology (ICCI-T).*

Permana, P. A. G., 2015. Scrum Method Implementation in a Software Development Project Management. *International Journal of Advanced Computer Science and Applications (IJACSA).*

Team, V. C. a. M. R., 2024. Importance of User Privacy and Data Protection in Educational Mobile Apps. *IT practices.*

Wilk Oliveira, J. H. L. S. A. M. T. L. R. P. T. P. &. S. I., 2023. Tailored gamification in education: A literature review and future agendaTailored gamification in education: A literature review and future agenda. *Education and Information Technologies,* pp. 373-406.