WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

CodeQuest: A Gamified Web-Based Platform for Coding Practice

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A B S T R A C T :

CodeQuest is a gamified web-based coding-learning platform that combines programming challenges with game-based progression. The project aims to make coding practice more engaging through experience points, achievements, a dashboard, and level unlocking after challenge completion. The prototype uses HTML, CSS, and JavaScript for its interface and interactions, with browser LocalStorage available for retaining selected progress data. It is intended for beginner programmers and engineering students and covers foundational programming concepts. Backend services, automated code execution, multiplayer features, and AI-assisted coaching are potential extensions that require further implementation and evaluation. The project establishes a foundation for combining structured coding practice with interactive game activities.

Keywords: CodeQuest; gamification; coding education; game-based learning; web application

Introduction

CodeQuest is a gamified web-based coding-learning platform designed to make programming practice more interactive and engaging for students. It connects coding challenges with browser-based game activities, encouraging learners to apply programming concepts before progressing to the next level. The platform uses game elements such as experience points (XP), achievements, badges, and progress indicators to make learning goals visible. The current project focuses on a frontend prototype developed with HTML, CSS, and JavaScript; AI assistance and advanced backend features are considered future enhancements.

Nomenclature

XP – Experience points
UI – User interface
AI – Artificial intelligence (planned future enhancement)

1.1. System overview

CodeQuest follows a challenge-based learning process. A user selects a programming challenge, reads its instructions, and attempts the task. When the configured completion conditions are satisfied, the system updates progress and can unlock the related game level. XP and achievements provide feedback on completed activities.

The project report describes a web interface with a home page, login and registration screens, a student dashboard, coding challenges, game-level pages, achievements, and a leaderboard. The initial prototype uses HTML to structure pages, CSS for presentation, and JavaScript for interactions and progression logic. LocalStorage can retain selected progress values in the browser.

1.2. Objectives

- To combine coding challenges with game-based activities.
- To encourage regular practice through XP, badges, achievements, and levels.
- To display challenge completion and learning progress in a dashboard.

The intended users are beginner programmers and engineering students. Challenges cover foundational concepts such as variables, conditional statements, loops, arrays, and functions. The project aims to provide a structured learning path rather than presenting coding exercises and games as separate activities.

The prototype should be understood according to the features actually implemented. Centralized accounts, secure server-side authentication, shared multiplayer sessions, automated code execution, and AI-based coaching require additional implementation and testing and are not claimed as validated results in this paper.

1.3. Key features

Table 1 summarizes the main features described for CodeQuest. Their availability may depend on the current prototype version.

Table 1 – Key features of CodeQuest

Feature	Purpose	Status / note
Coding challenges	Practise programming concepts	Core learning concept
XP and achievements	Reward completed activities	Prototype feature concept
Level unlocking	Connect challenge completion to game progress	Progression logic
Dashboard	Show progress information	Interface feature

1.4. Implementation

The frontend is built using HTML, CSS, and JavaScript. HTML defines the page structure, CSS controls layout and appearance, and JavaScript handles user interactions, challenge validation, XP updates, level progression, and display of progress information.

In the sample frontend logic described in the project report, LocalStorage stores the XP total and number of completed challenges, while sessionStorage helps prevent the same demonstration challenge from being rewarded repeatedly within a session. Node.js, Express.js, MongoDB, authentication, and REST APIs are identified as possible backend technologies where implemented; they should not be treated as completed functionality unless verified in the deployed application.

1.5. Results and discussion

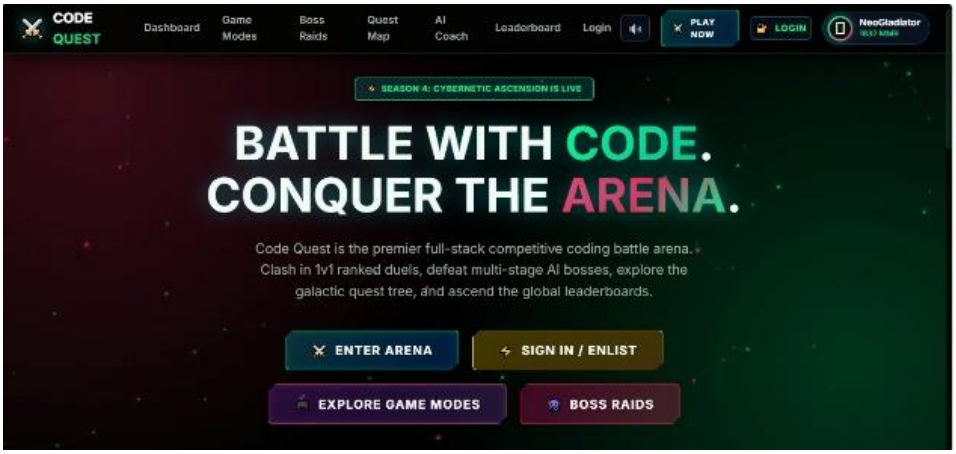
The project demonstrates the design of a web-based learning interface that links coding practice to game progression. The interface and JavaScript prototype provide a basis for showing challenge completion, XP rewards, and progress updates. These features illustrate how game mechanics can be incorporated into a programming-learning workflow.

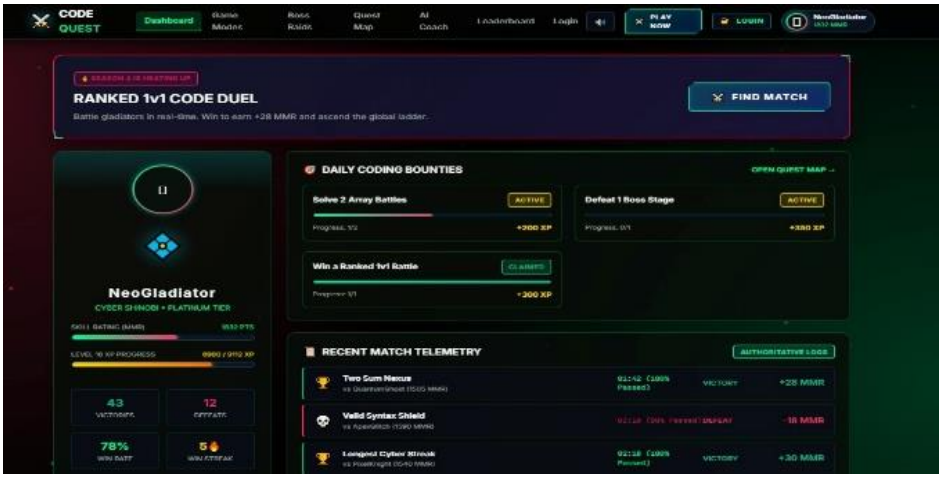
1.6. Limitations and future work

The project report does not provide a quantitative user study or measured learning-outcome results. Further evaluation is needed to determine whether CodeQuest improves engagement or programming performance. Future work may include secure account management, database integration, automated code evaluation, multiplayer competitions, AI-generated hints, adaptive difficulty, and testing with students.

2.Illustration

All figures used in the CodeQuest system are numbered with Arabic numerals (1, 2, 3, …) and provided with captions. The figures represent the main interfaces and features of the proposed CodeQuest gamified coding-learning platform, including the login page, dashboard, coding challenges, multiplayer coding competition, and user progress tracking. All figures are embedded within the paper and placed close to their first mention in the text.





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Conclusion

CodeQuest presents a gamified approach to programming practice by connecting coding challenges with game-level progression and rewards. Its HTML, CSS, and JavaScript prototype provides a foundation for interactive learning activities and progress tracking. Additional implementation and user evaluation are required before making claims about AI functionality or improvements in learning outcomes.

Acknowledgements

The authors thank their project guide and the Department of Computer Science and Engineering at Sri Shakthi Institute of Engineering and Technology for their guidance and support during the project.

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