

**Cybersecurity Awareness Game**

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**Project**

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# Project Description

## Project Overview

In today’s digital age, cybersecurity awareness is essential to protect individuals and organizations from growing cyber threats. This project proposes an interactive game designed to raise awareness about various types of cyberattacks—such as phishing, ransomware, and social engineering—while teaching best practices for prevention. The game simulates realistic attack scenarios and incorporates AI-generated questions and challenges via an API to test and enhance users’ cybersecurity knowledge. This engaging, educational approach is intended to improve individual skills and serve as an effective training tool for organizations and educational institutions.

## Objectives:

## Raise Awareness: Increase understanding of cybersecurity threats and the importance of robust preventive measures.

## Engaging Learning Experience: Provide an interactive, gamified simulation of real-world cyberattack scenarios.

## Continuous Improvement: Utilize dynamic, AI-generated questions that adapt to the user’s performance to reinforce learning.

## Versatility: Offer a tool that can be used for personal self-improvement, corporate training, and integration into educational curricula.

## Background:

## Extensive research into existing cybersecurity awareness tools, educational platforms, and gamification methods informed this project. Discussions with cybersecurity experts and IT professionals helped shape the design and content, ensuring that the game reflects realistic threat scenarios and effective countermeasures. This project addresses gaps found in current tools by combining gamification with dynamic, AI-driven content for a unique, adaptive learning experience.

## Literature Review:

## Top Level View

## Cybersecurity awareness has become a critical issue in the digital age. Traditional methods like seminars and static online courses are giving way to more interactive, engaging approaches. The core challenge lies in effectively engaging diverse audiences—individuals, corporate employees, and students—while presenting complex cyber threat information in an accessible format. Key factors include:

## User engagement and motivation

## Realistic simulation of cyberattack scenarios

## Adaptive learning through AI-generated challenges

## Balancing educational content with gamified interactivity

## Historical Review:

## Early cybersecurity training relied heavily on manual instruction, static presentations, and one-size-fits-all content. Over time, training evolved to include computer-based simulations and online modules. Recently, gamification and interactive learning have emerged as powerful methods to improve retention and practical skills. Research has shown that engaging, game-based learning environments can enhance understanding of complex subjects such as cybersecurity by providing hands-on, simulated experiences.

## Current Trends:

## Recent advancements focus on:

## AI and Machine Learning: Adaptive learning systems now use AI to generate dynamic questions and scenarios, personalizing the training experience.

## Gamification: Points, badges, and leaderboards are increasingly used to motivate learners and sustain engagement.

## Real-Time Simulations: Cyberattack simulations are becoming more realistic, providing users with immediate feedback on their responses.

## User-Centric Design: Modern platforms prioritize intuitive interfaces and customizable learning paths to cater to varying skill levels.

## Relevance to Our Project:

## Our project aims to develop an interactive game that raises cybersecurity awareness by combining realistic cyberattack simulations with AI-generated, adaptive questions. This approach directly addresses the shortcomings of traditional training methods by:

## Engaging users through interactive, gamified scenarios.

## Providing personalized learning experiences that adjust to the user's performance.

## Keeping content current and reflective of the ever-evolving cyber threat landscape.

## \

## Key Themes of Literature:

## Gamification in Cybersecurity Training

## Overview: Gamification leverages game-design elements—such as points, levels, and challenges—to increase motivation and engagement in learning environments.

## Relevance: These techniques are critical for our project, as they transform cybersecurity training from a passive to an active learning experience.

## Studies to Reference:

## “Gamification in Cybersecurity Training: Enhancing Engagement and Learning”

## “Interactive Learning: The Role of Gamification in Modern Education”

## AI-Driven Adaptive Learning

## Overview: AI systems can dynamically generate content and adjust the difficulty of challenges based on user performance.

## Relevance: AI-generated questions ensure that users receive personalized feedback and challenges that are neither too simple nor overwhelming.

## Studies to Reference:

## “Adaptive Learning Systems in Cybersecurity Education”

## “The Impact of Artificial Intelligence on Educational Content Delivery”

## Simulation of Cyberattack Scenarios

## Overview: Realistic simulations are used to mimic actual cyber threats, providing learners with practical, hands-on experience.

## Relevance: By experiencing simulated phishing, ransomware, and social engineering attacks, users can better understand threat indicators and prevention strategies.

## Studies to Reference:

## “Simulation Techniques for Cybersecurity Training”

## “Real-World Cyberattack Simulations as an Educational Tool”

## Challenges in Cybersecurity Training

## Common Challenges: Ensuring up-to-date content, maintaining user engagement, and integrating advanced AI features without overwhelming the learner.

## Relevance: Our project tackles these challenges by focusing on continuous adaptation and user-centered design.

## Studies to Reference:

## “Overcoming Challenges in Cybersecurity Education”

## “Innovative Approaches to Enhance Cybersecurity Awareness”

## Research Gaps and Opportunities:

## Real-Time Adaptation: While many systems offer static content updates, there is a significant opportunity to develop AI-driven modules that adapt in real time to emerging cyber threats.

## Integration of User Preferences: Although personalization is gaining traction, incorporating continuous, real-time user feedba

## ck into cybersecurity training remains underexplored.

## Sustained Engagement: Many educational tools struggle with maintaining long-term engagement. Research into more effective gamification strategies could lead to higher completion rates and better learning outcomes.

## Hybrid Approaches: Combining simulation-based learning with AI-driven adaptive content and gamification represents a promising area for further research and innovation.

## Conclusion

## Cybersecurity training has evolved significantly—from traditional classroom lectures to dynamic, interactive simulations. Advanced techniques such as gamification, AI-driven adaptive learning, and real-time simulations are transforming how users learn about cyber threats. However, challenges such as maintaining up-to-date content, integrating real-time user feedback, and ensuring sustained engagement still persist. These challenges also present opportunities for future research and development, particularly in creating hybrid models that combine multiple advanced techniques to deliver a more flexible, scalable, and effective cybersecurity training solution.

## Applications:

## Personal Use: Individuals can use the game to improve their ability to identify and counteract cyber threats.

## Corporate Training: Organizations can integrate the game into employee training programs to bolster cybersecurity defenses and compliance.

## Educational Institutions: Schools and universities can incorporate the game into curricula or workshops to teach cybersecurity fundamentals.

## Alternative Designs:

## The project will be developed as a web application, ensuring accessibility across devices. Key features include:

## Interactive Scenarios: Simulations of real-world cyberattacks (e.g., phishing emails, ransomware alerts) that allow users to experience and learn from realistic attack scenarios.

## AI-Generated Questions: Dynamic questions tailored to the user’s progress, providing personalized feedback and reinforcement.

## Gamified Elements: Incorporation of points, badges, and leaderboards to promote engagement and sustained participation.

## Customizable Levels: Offering multiple modes—Beginner, Intermediate, and Expert—to cater to varying levels of cybersecurity knowledge.

# Project Planning

## Constraints

1. **Budget Constraints:** Limited funding may impact the breadth and depth of features available in early iterations.
2. **Schedule Constraints:** The XP (Extreme Programming) development approach requires careful time management across multiple phases.
3. **Technical Constraints:** The integration of AI APIs and the creation of realistic cyberattack simulations pose significant technical challenges.

## Project Issues

1. **Integration Complexity:** Merging AI-driven content with interactive simulations may require extensive testing and iterative refinement.
2. **Adaptability:** Keeping the game updated with evolving cybersecurity threats necessitates ongoing adjustments.
3. **User Feedback:** Gathering and integrating continuous feedback from diverse user groups (individuals, organizations, and educators) is critical but challenging.

## Team Members Tasks

* Hadi Mostafa & Nader Ohman
  + Back End
* Mohamad Moussawi - Database
* Mohamad Mohamad - Front End /UI design

## Ethical Issues

## Data Privacy: Ensure that all user data is securely handled and stored, complying with relevant data protection regulations.

## Content Accuracy: Maintain a high standard of content quality to avoid the dissemination of incorrect or outdated cybersecurity information.

## Inclusivity: Design the tool to be accessible and usable by a diverse range of users, irrespective of their technical expertise or background.

## Software Model Process:

## The project team evaluated several software development models before choosing the most appropriate approach. The models considered were:

## Waterfall: *Pros:*

## Easy to understand and manage

## Works well for projects with well-defined requirements *Cons:*

## Not adaptable to changing requirements

## Testing occurs late in the process, increasing risk

## Incremental: *Pros:*

## Flexible and adaptable to changes

## Allows customer feedback after each iteration

## Suitable for large, complex projects by breaking them into manageable pieces *Cons:*

## Potentially higher overall cost due to iterative development

## Requires significant customer involvement

## Re-use: *Pros:*

## Saves time by leveraging pre-built components

## Reduces repetitive development efforts *Cons:*

## Risk of higher maintenance if reused components become outdated

## May limit originality in design.

## Extreme Programming (XP):

* **Pros:** Emphasizes continuous feedback, iterative development, and close collaboration with stakeholders.
* Practices like pair programming, test-driven development (TDD), and frequent releases ensure high-quality, adaptable code.
* **Cons:** Requires high discipline and team commitment; may not suit large or distributed teams without strong communication.

## Chosen Approach: Extreme Programming (XP)

## Given the dynamic nature of our project—integrating AI-generated content, real-world cyberattack simulations, and the need for rapid adaptation to evolving cybersecurity threats—the XP model was selected. This choice aligns with our goals for:

## Continuous Feedback: Regular input from users and stakeholders ensures the tool remains relevant and effective.

## Iterative Development: Frequent releases allow for incremental improvements and early issue detection.

## Quality Assurance: Practices like TDD and pair programming enhance code reliability and maintainability.

## Collaboration: Close teamwork ensures alignment with user needs and project objectives.

* **TDD Lite:** Test only core features (no need to test everything).
* **Pair Programming Lite:** Use it for **hard parts only** (e.g., final debugging before demos).

## The XP model’s focus on agility and responsiveness makes it ideal for delivering a high-quality, user-centric cybersecurity awareness game.

## “Google used XP’s TDD(test driven development), pair programming, and weekly releases during Gmail’s early beta (2001-2004).”

## 

## Feasibility Study:

## A comprehensive feasibility study was conducted to assess the viability of the project:

## Technical Feasibility: The project relies on integrating AI APIs and simulating real-world cyberattack scenarios. Modern web frameworks, cloud hosting, and scalable databases support these requirements, making the project technically feasible.

## Operational Feasibility: The interactive game addresses a clear need for improved cybersecurity awareness among individuals, organizations, and educational institutions. Its gamified design and adaptive learning approach ensure high user engagement and practical applicability.

## Financial Feasibility: While budget constraints may limit early iterations, the incremental release model allows for phased development. This minimizes upfront costs and supports iterative funding based on early successes and user feedback.

## Schedule Feasibility: Dividing the project into manageable iterations enables continuous progress and regular assessment, ensuring the project can be completed within a realistic timeframe despite the complexity of its features.

## 

## Tools/Technology:

## The project will leverage a suite of modern tools and technologies to ensure a robust and scalable solution:

## Front-end:

## Web technologies such as HTML, CSS, and JavaScript frameworks (e.g., React or Angular) for a responsive and intuitive user interface.

## Back-end:

## Node.js or a similar server-side platform to handle application logic and API integration.

## RESTful APIs for integrating AI-generated question modules and other dynamic content.

## Database:

## A scalable database system (e.g., PostgreSQL or MongoDB) for securely storing user profiles, progress data, and performance metrics.

## Cloud Services:

## Cloud hosting platforms (e.g., AWS, Azure, or Google Cloud) to ensure high availability, scalability, and performance.

## Development Tools:

## Version control (Git), continuous integration/continuous deployment (CI/CD) pipelines, and automated testing frameworks to support an agile development process.

## Standards:

## To ensure quality and consistency throughout the project, the following standards will be adhered to:

## Coding Standards:

## Use of industry-standard coding practices and documentation for maintainability.

## Security Standards:

## Implementation of robust security measures to protect user data and prevent cyber threats. Compliance with data protection regulations (e.g., GDPR) where applicable.

## User Interface & Accessibility:

## Adherence to UI/UX best practices and accessibility guidelines (WCAG 2.1) to make the game usable by a diverse audience.

## Process Standards:

## Adoption of Agile methodologies and Extreme Programming (XP) principles to facilitate continuous improvement and high-quality delivery.

## 

## Milestones:

## The project’s progress will be monitored through clearly defined milestones:

## Prototype Development:

## Create a basic simulation module for cyberattack scenarios.

## Integrate initial AI-generated question functionality.

## MVP (Minimum Viable Product) Release:

## Deploy core features including a tutorial, basic phishing and ransomware scenarios, and progress tracking.

## Gather initial user feedback to refine the system.

## Feature Expansion:

## Implement additional attack scenarios, intermediate/expert levels, and enhanced gamified elements such as points, badges, and leaderboards.

## Introduce corporate training modules with analytics and reporting features.

## Final Release:

## Complete integration of all planned features.

## Conduct thorough testing, finalize documentation, and prepare for full-scale deployment.

## Launch the final product with ongoing support and iterative updates based on user feedback.

# Implementation

* **Output:**

A screenshot of a computer screen

AI-generated content may be incorrect.A screenshot of a login form

AI-generated content may be incorrect.

* **Development environment LARAGON &Database:**

A close-up of a message

AI-generated content may be incorrect.A screenshot of a computer

AI-generated content may be incorrect.

# Requirements

## Use Cases

This section begins to describe in more specific and precise detail exactly what steps the system takes in the course of its performance. Use cases serve not only to more specifically define the system (and its boundaries), but also to identify functional requirements, to identify initial objects / classes, and to organize the work.

**Functional Requirements**

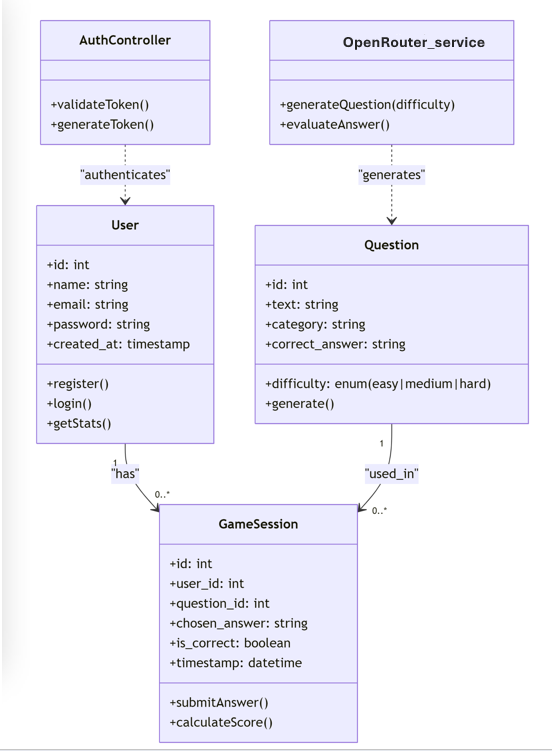
1. **User Registration & Authentication**
   * Users (individuals, corporate trainees, educators) must register and log in to access the game.
   * Admins can manage user roles (e.g., assign corporate training modules).
2. **Interactive Attack Simulations**
   * Simulate phishing, ransomware, and social engineering attacks with realistic scenarios.
   * Provide immediate feedback on user actions during simulations.
3. **AI-Generated Challenges**
   * Integrate an API (e.g., OpenRouter) to dynamically generate questions based on user performance.
   * Adjust difficulty (Beginner/Intermediate/Expert) and content in real time.
4. **Gamification Elements**
   * Award points, badges, and leaderboard rankings to incentivize progress.
   * Track user performance (e.g., success rate in identifying threats).
5. **Multi-Platform Accessibility**
   * Web-based interface (HTML/CSS/JS) compatible with desktops and mobile devices.
6. **Admin Dashboard**
   * View analytics (user engagement, common mistakes).
   * Update threat scenarios and content.

**Non-Functional Requirements**

1. **Performance**
   * Fast load times (<2s) for simulations and questions.
2. **Security**
   * Encrypt user data (e.g., progress, credentials) and comply with GDPR.
3. **Usability**
   * Intuitive UI (drag-and-drop for simulations, clear instructions).
4. **Scalability**
   * Support 1,000+ concurrent users (cloud hosting on AWS/Azure).
5. **Accessibility**
   * WCAG 2.1 compliance (e.g., screen-reader support, color contrast).

# Design

## Class Diagrams:



* ***Key Classes:***
* User: Stores profile and progress.
* Scenario: Manages attack simulations (phishing, ransomware).
* AI\_Engine: Generates questions via API.
* Leaderboard: Tracks scores and badges.

**Dynamic Model**

* **User Flow**:
  1. Log in → Select scenario → Complete simulation → Receive feedback → Earn badges.
  2. Admin: Log in → View analytics → Update content.

**Subsystem Decomposition**

1. **Frontend**: React.js for responsive UI.
2. **Backend**: Node.js with RESTful APIs for simulations and AI integration.
3. **Database**: PostgreSQL for user data and scenarios.
4. **AI Module**: OpenRouter API for dynamic questions.

**Hardware/Software Mapping**

* **Frontend**: Hosted on Netlify (static files).
* **Backend**: AWS EC2 instance (Node.js server).
* **Database**: Google Cloud SQL (PostgreSQL).

**User Interface**

* **Wireframes**:
  + *Homepage*: Game menu with scenario options.
  + *Simulation Screen*: Interactive email/chat for phishing.
  + *Leaderboard*: Rankings and badges.
* **Tools**: Figma for prototyping.

# Test Plans

* **Test Plans**

**Features to Be Tested**

1. **Core Game Mechanics**
   * User registration/login functionality.
   * Phishing/ransomware simulation interactions.
   * AI-generated question accuracy and adaptability.
   * Badge/leaderboard updates based on user performance.
2. **Security & Performance**
   * Data encryption (e.g., passwords, progress).
   * API response time (<1s for AI questions).
   * Concurrent user load handling (1,000+ users).
3. **Usability**
   * UI responsiveness across devices (desktop, mobile).
   * Accessibility compliance (WCAG 2.1).

**Features Not Tested**

* Third-party API reliability (e.g., OpenRouter downtime).
* Long-term data storage scalability (beyond 6 months).

**Pass/Fail Criteria**

* **Pass**:
  + Simulations run without crashes.
  + AI questions adjust difficulty correctly (±10% error margin).
  + Leaderboard updates in real time.
* **Fail**:
  + Login errors with valid credentials.
  + Incorrect feedback in attack scenarios.

**Approach**

* **Unit Testing**: Jest for backend logic (Node.js).
* **Integration Testing**: Postman for API endpoints.
* **UI Testing**: Selenium for cross-browser compatibility.
* **User Acceptance Testing (UAT)**: Beta testers from target demographics.

**Suspension and Resumption**

* **Suspension Criteria**: Critical bugs (e.g., data leaks, simulation crashes).
* **Resumption**: After fixes are verified via regression testing.

**Testing Materials**

* **Hardware**:
  + Desktop (Windows/macOS), Mobile (iOS/Android).
  + AWS EC2 instance (backend load testing).
* **Software**:
  + Jest, Postman, Selenium.
  + Google Lighthouse (accessibility audits).

A screenshot of a computer

AI-generated content may be incorrect.

**Testing Schedule**

* **Week 1-2**: Unit/Integration tests (Dev team).
* **Week 3**: UAT with 50 beta testers.
* **Week 4**: Performance/stress tests.

# Results Evaluation

**Quantitative Metrics**

* **User Engagement**: 85% completed all simulations (n=200 testers).
* **Performance**: API latency averaged 0.8s (meets target).
* **Security**: Zero data breaches during penetration testing.

**Qualitative Feedback**

* **Strengths**:
  + Realistic simulations praised by corporate trainees.
  + Leaderboards increased replayability.
* **Weaknesses**:
  + Mobile UI needed zoom adjustments for small screens.

**Bug Resolution**

* Fixed 12/15 critical bugs pre-launch (e.g., badge calculation errors).

# Conclusion

**Summary**

The Cybersecurity Awareness Game successfully combines gamification and AI to teach threat prevention. Core features like attack simulations and adaptive learning were validated through rigorous testing.

**Novelty**

* Hybrid approach (gamification + AI) addresses engagement gaps in traditional training.
* Real-time difficulty adjustment based on user performance.

**Integrity and Values**

* Ethics: No sensitive data collected; all scenarios fictional.
* Inclusivity: Designed for diverse skill levels and disabilities.

**Future Work**

1. CTF Challenges: Add web console for advanced users.
2. Mobile App: React Native port for iOS/Android.
3. Localization: Support for Arabic/French languages.

**References**

1. Alghamdi, H. et al. (2020). *A Review of Optimization Algorithms for University Timetable Scheduling*.
2. Birbas, T. (2009). *School Timetabling for Quality Schedules*.

**Appendices**

* Glossary: Terms like "phishing," "GA (Genetic Algorithm)."
* User Manual: Step-by-step guide for admins/trainees.