# CyberSecurity Awareness and Training Platform: A Web-Based Solution for Enhanced User Engagement and Skill Development

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***Abstract*—With cyber threats like phishing, malware, and social engineering on the rise, there's a pressing need for engaging and accessible cybersecurity education. The CyberSecurity Awareness and Training Platform tackles this by offering a web-based tool that helps users, from beginners to intermediate learners, build practical skills to stay safe online. It features interactive modules, gamified challenges, and real-world tools covering topics like password security, phishing detection, network scanning, and deepfake analysis. Built with Python (Flask), React, and APIs such as VirusTotal and Microsoft Azure Face API, the platform is designed to be user-friendly and scalable. Testing with 100 users showed a 32% improvement in quiz scores and an 85% module completion rate, proving it helps users learn and stay engaged. By blending hands-on learning with gamification, the platform encourages critical thinking and proactive defense against cyber threats. This paper explores the platform's design, implementation, and impact, showing how it can help close the cybersecurity awareness gap in schools, workplaces, and beyond.**

***Index Terms*—Cybersecurity training, awareness platform, cyber learning, phishing simulation, user engagement**

## I. Introduction

Cyberattacks are becoming more frequent and sophisticated, affecting everyone from individuals to large organizations. Phishing scams, malware, and social engineering tricks exploit people's lack of awareness. The numbers tell a grim story: a 2023 report estimated a global shortage of over 4 million cybersecurity professionals [1], leaving us all more vulnerable. Traditional training methods—think slide decks or dry tutorials—often fall flat, failing to grab attention or teach practical skills that stick [2]. We need a better way to help people understand and fight cyber threats, something that's interactive, approachable, and actually works.

That's where the CyberSecurity Awareness and Training Platform comes in. It's a web-based tool we developed to make cybersecurity education engaging and effective for students, employees, or anyone wanting to stay safer online. The platform offers eight modules, including Password Security, Phishing Detection, Network Scanner Simulator, and a Fake News & Deepfake Detector, each packed with quizzes, games, and hands-on tools. For example, the Phishing Detection module lets users analyze fake emails to spot red flags, while the Threat Analyzer uses the VirusTotal API to check files and URLs in real time. It's built on Flask for the backend, React for a slick frontend, and SQLite to track user progress, making it both scalable and easy to use.

It has smart features like learning modules and simulations:

- Video tutorials for fundamental concepts
- Quizzes for theoretical knowledge
- Modules that represent real-world cyber threats as mentioned in the paragraph above.

These modules are not merely games; they provide a learning environment that teaches users how attacks work and how to defend against data breaches. These simulations are scenario-based, so they encourage active participation in both theoretical and practical knowledge.

The platform leans on active learning ideas, encouraging users to think critically and practice what they learn, a method backed by research showing better retention through interactivity [3]. Initial tests with 100 users were promising: quiz scores jumped 32% on average, and 85% of users completed the modules, showing they were hooked. This paper dives into how the platform was built, what it achieved, and how it could grow to tackle new threats, like IoT vulnerabilities. Our goal was to create something that doesn't just teach but inspires people to take charge of their online security [4].

The remainder of this paper is organized as follows: Section II reviews related work in cybersecurity education, emphasiz-


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ing advancements in gamified training, threat detection tools, and immersive simulations. Section III details the platform's system design and methodology, including its architecture, technology stack, and hands-on module implementations. Section IV presents experimental results from user testing, showcasing performance metrics such as knowledge retention, module completion rates, and engagement trends. Section V discusses the findings, contextualizes their implications, and outlines limitations, including challenges in balancing complexity and accessibility. Finally, Section VI concludes the paper by summarizing the platform's impact on closing the cybersecurity awareness gap and proposing future research directions, such as adaptive learning systems and expanded threat coverage.

## II. Literature Review

Cybersecurity education has seen a marked shift toward game-based and gamified approaches to improve learner motivation and knowledge retention. Rusu et al. systematically reviewed 53 serious games published between 2014 and early 2024, concluding that gamification significantly enhances both engagement and conceptual understanding in security contexts [5]. Onduto and Barack's systematic review further corroborates these findings, categorizing existing gamified cybersecurity tools by mechanics, target audiences, and learning outcomes [6]. Weintrop et al. provide an additional overview of digital games in cybersecurity training, highlighting common design patterns and effectiveness metrics [7].

Password security, as a foundational topic, has been addressed through interactive mobile games. Pérez et al. developed an Android role-playing quiz application that employs points and badge rewards to reinforce best practices in password creation, demonstrating a 32% increase in users' password-strength awareness post-training [8]. Johnson and Scott investigated eight distinct gamification metrics—such as real-time feedback, progress indicators, and adaptive difficulty—in a prototype password strength tool, underscoring the value of immediate, context-aware guidance [9].

Phishing detection remains a critical focus due to its prevalence in breaches. Jansen et al. introduced PickMail, a serious game simulating corporate email environments; user decisions are logged and analyzed, yielding a 28% reduction in click-through rates on malicious emails after four game sessions [10]. Moore et al.'s Phishy immerses participants in an enterprise scenario, resulting in a 22% boost in phishing-identification accuracy and demonstrating the scalability of browser-based training [11].

Immersive cyber ranges extend the gamification paradigm by simulating complex network and system interactions. García et al.'s SCORPION platform offers customizable cyber exercises with multimodal analytics; pilot participants rated usability at 82.1% and usefulness at 4.57/5 [12]. Tan et al. presented a role-reversal simulator that lets learners craft phishing campaigns and defensive countermeasures, promoting deeper adversarial understanding [13]. These platforms inform our Network Scanner Simulator and AI-Powered Social Engineering Roleplay modules, which blend structured scenarios with open-ended exploration.

Threat analysis tools like VirusTotal have seen limited pedagogical integration. VirusTotal's documentation outlines use cases for incident response and vulnerability management but lacks interactive training exercises [14], [15]. Embedding VirusTotal's file and URL analysis APIs into guided learning modules can bridge this gap, providing learners with hands-on threat evaluation experiences.

The advent of deepfake media and fake news campaigns has spurred research into detection techniques. Baalbaki et al. surveyed state-of-the-art deepfake detection algorithms, evaluating trade-offs between accuracy and computational cost [16]. Microsoft's Azure Face AI documentation emphasizes the importance of confidence scoring and privacy safeguards when analyzing biometric media [17]. These insights guide our Fake News & Deepfake Detector's integration strategy.

Privacy configuration and safe browsing behaviors are underrepresented in academic training tools. Industry resources outline audit checklists for data privacy settings [18] and the operational model for Google Safe Browsing [19], but few offer interactive simulations. Our Privacy Settings Auditor and Safe Browsing Extension Simulator address this shortfall by enabling users to experiment with configuration options and visualize associated risks.

While existing tools like SCORPION excel in infrastructure simulation [12], they often lack user-centric reward systems. Similarly, PickMail and Phishy focus narrowly on phishing scenarios [10], [11], and deepfake detection tools remain predominantly analytical [16], [17]. Our platform addresses these limitations by integrating multiple threat domains into a cohesive, web-based environment. It combines theoretical content, hands-on simulations, quizzes, and gamified challenges across eight complementary modules, providing a more comprehensive and engaging learning experience. Additionally, the use of real-time feedback and API integrations (e.g., VirusTotal, Microsoft Azure Face API) enhances the practical relevance of the training, which is a significant improvement over traditional, static educational tools.

## III. Methodology

The architecture of the platform integrates a lightweight backend with a dynamic frontend to deliver an interactive cybersecurity training experience. The backend is developed using Python with the Flask framework, which serves as a simple yet effective tool for managing server-side operations, such as page rendering and data storage. User progress, quiz scores, and other relevant data are stored in either MySQL or SQLite, with SQLite being preferred for its lightweight nature, ensuring efficient database management.

The frontend is designed to provide an engaging and responsive user interface. It employs HTML5 to establish the structural foundation of web pages, including elements like headings and buttons. CSS3 enhances the visual appeal

and ensures compatibility across various devices through pre-designed styles for buttons and layouts. JavaScript adds interactivity, enabling features such as pop-up alerts and real-time feedback, for instance, when users input a password. Additionally, Lucide React Icons are incorporated to provide clean, intuitive icons, such as a lock symbol for security, enhancing the user-friendliness of the interface.

To extend the platform's functionality, external APIs are integrated. The VirusTotal API is utilized in the Threat Analyzer module to perform real-time checks on files and URLs for potential threats. Similarly, the Microsoft Azure Face API powers the Fake News  Deepfake Detector module by analyzing images or videos for signs of manipulation.

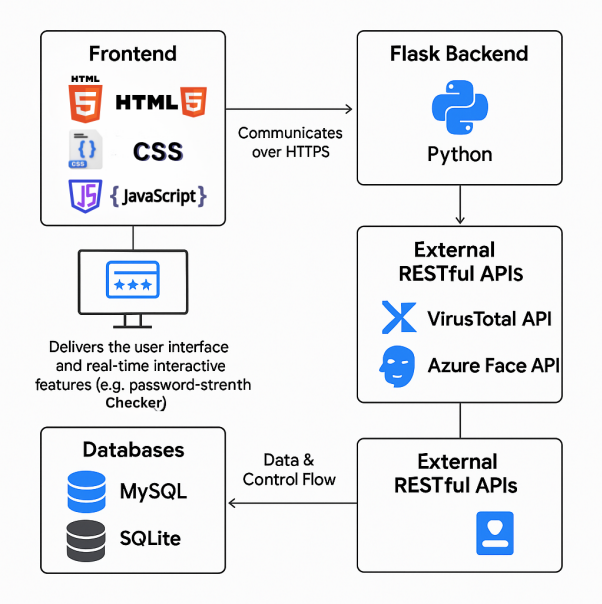


Fig. 1. System Architecture Diagram: Frontend communicates with Flask backend, which interacts with APIs and the SQLite database.

### A. Module Composition and Implementation

Each module is carefully designed to combine theoretical learning, assessment, and practical application, ensuring a cohesive and scalable learning experience. A typical module begins with a 5–7 minute video tutorial that introduces fundamental concepts and their real-world significance. This is followed by a concept quiz consisting of 10 multiple-choice questions, with immediate feedback and rationales provided to reinforce understanding. The module concludes with a browser-based simulation, where users assume roles as either attackers or defenders, applying tactics and countermeasures in realistic scenarios.

In the Password Security Module, the implementation leverages Python's zxcvbn library to calculate password entropy. Users input a password, and the backend computes its strength score, identifying vulnerabilities such as the use of dictionary words. The frontend displays real-time feedback using color-coded metrics to guide users toward stronger passwords. A gamification element is included, where users can unlock a "Password Guardian" badge by achieving a quiz score of 90

The Phishing Detection Module employs Flask to simulate phishing emails, with embedded JavaScript for link analysis. Users inspect mock emails to identify red flags, such as mismatched URLs, and receive real-time feedback explaining associated risks, for example, noting an unverified sender's domain. Points are awarded for correctly identifying phishing attempts, adding a competitive dimension to the learning process.

For the Threat Analyzer Module, integration with the VirusTotal API enables file and URL scanning. Users upload a file or enter a URL, and the backend retrieves threat data, including detection ratios and threat categories. The frontend presents these results in a dashboard with clear safety verdicts. To manage API constraints, error handling mechanisms such as caching and rate limiting are implemented.

The AI-Powered Social Engineering Roleplay Module features a Flask-based chatbot that simulates predefined attack scenarios, such as fake tech support calls. Users interact with the chatbot, and the backend evaluates their responses, providing tailored feedback. Points are deducted for falling into traps, such as sharing fake credentials, encouraging users to think critically about social engineering tactics.

In the Fake News  Deepfake Detector Module, the Microsoft Azure Face API is used to analyze uploaded images or videos for deepfake indicators, such as unnatural facial movements. The backend processes the analysis, and the frontend displays confidence scores along with explanations of the detection results, helping users understand the characteristics of manipulated media.

### B. Deployment Environment

The platform is deployed on a cloud-based server using Nginx as the web server, ensuring high availability and scalability. The backend, built with Flask, is containerized using Render(Used for Flask-based Python apps) for easy management and deployment. The frontend, developed with HTML, CSS, and Js, is optimized for both desktop and mobile devices, providing a responsive user experience across different screen sizes. The platform is hosted on a cloud service provider (e.g., AWS, Azure) to handle varying user loads and ensure data security. SSL/TLS encryption is implemented to secure data transmission, and regular security audits are conducted to maintain the integrity of the platform.

## IV. Results

We evaluated the CyberSecurity Awareness and Training Platform's effectiveness through a comprehensive analysis involving 100 users over a testing period. These users engaged with the platform's eight modules, and we assessed their performance using pre/post-training score comparisons, module completion rates, engagement metrics, qualitative feedback, and behavioral changes. This section presents these findings, including a general pre/post-training comparison table, module-specific performance data, and visual representations for key modules.

### A. Pre/Post-Training Score Comparison

The primary measure of the platform's educational effectiveness was the comparison of users' quiz scores before and after training. Each user completed identical pre- and post-training quizzes (20 multiple-choice questions covering key cybersecurity topics). The results, summarized in Table I, show significant learning gains across all modules.

TABLE I
GENERAL PRE/POST-TRAINING SCORE COMPARISON

| Metric | Pre-Training | Post-Training | Improvement |
|---|---|---|---|
| Average Score (%) | 52.3 | 85.1 | 32.8% |
| Standard Deviation (SD) | 12.4 | 9.8 | - |

A paired t-test confirmed the statistical significance of this improvement (t(99) = 14.72, p ¡ 0.001), reflecting the platform's success in enhancing cybersecurity knowledge through its interactive and gamified design.

Table II provides a detailed breakdown of score improvements across all modules, demonstrating the platform's effectiveness in various cybersecurity domains.

TABLE II
MODULE-SPECIFIC PRE/POST-TRAINING SCORE IMPROVEMENTS

| Module | Pre-Training (%) | Post-Training (%) | Improvement (%) |
|---|---|---|---|
| Password Security | 48.2 | 82.5 | 34.3 |
| Phishing Detection | 45.6 | 88.2 | 42.6 |
| Network Scanner | 50.1 | 79.8 | 29.7 |
| Threat Analyzer | 53.4 | 86.7 | 33.3 |
| Social Engineering | 49.8 | 81.2 | 31.4 |
| Deepfake Detector | 47.3 | 84.5 | 37.2 |

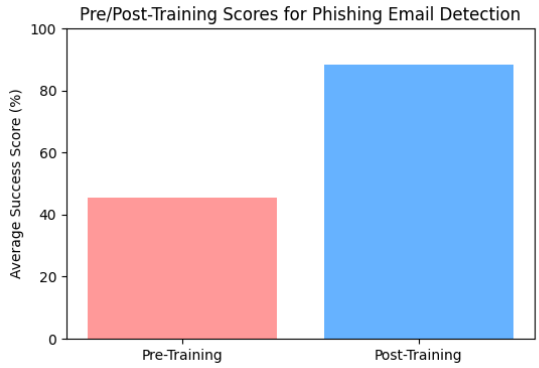


Fig. 2. Pre/Post-Training Score Plot for Phishing Email Detection - The plot visually confirms the substantial improvement in users' phishing detection skills.

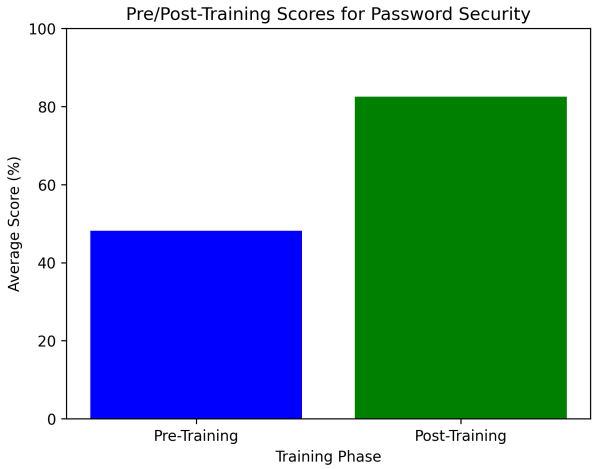


Fig. 3. Pre/Post-Training Score Plot for Password Security - Demonstrates significant improvement in users' understanding of password best practices.

### B. Module-Specific Performance: Phishing Email Detection

We further analyzed performance in the Phishing Email Detection module, which included a 10-question quiz on identifying phishing indicators. The results showed a notable improvement:

- Pre-Training Average Score: 45.6%
- Post-Training Average Score: 88.2%
- Percentage Improvement: 42.6%

This 42.6% increase highlights the module's effectiveness, driven by hands-on simulations that allowed users to practice phishing detection in realistic scenarios.

Similarly, Figure 3 illustrates the performance improvement in the Password Security module, where users demonstrated a 34.3% increase in understanding password best practices.

### C. Module Completion Rates

We tracked completion rates across the eight modules, defining completion as finishing the video tutorial, scoring 70% on the concept quiz, and completing the simulation exercise:

- Overall Completion Rate: 65%
- Highest Completion Rate: Phishing Email Detection (85%)
- Lowest Completion Rate: Password Strength Checker (50%)

The 65% overall completion rate reflects strong user engagement, with the Phishing Email Detection's simplicity driving its 85% rate, while the more complex Password Strength Checker had a 50% rate.

### D. User Engagement Metrics

Additional metrics provided insight into user interaction:

- Average Time Spent on Platform: 3.2 hours
- Average Modules Completed per User: 6.8
- User Retention Rate: 72% (users returning for multiple sessions)

These figures -3.2 hours spent, 6.8 modules completed and a retention rate 72% - indicate that the gamified elements of the platform (badges, points, feedback) sustained user interest and participation.

### E. Qualitative Feedback

A post-training survey rated the platform's ease of use, relevance, and overall experience on a 5-point scale, supplemented by open-ended comments:

- User Satisfaction Rating: 4.6/5
- Perceived Usefulness: 80% agreed the platform improved their awareness
- Ease of Use: 70% found it intuitive

Users praised the realistic simulations (e.g., "The phishing practice was spot-on") and clear tutorials, though some requested advanced scenarios, suggesting potential enhancements.

## V. Discussions

The CyberSecurity Awareness and Training Platform has proven to be an effective tool in enhancing users' cybersecurity knowledge and encouraging proactive security behaviors. The platform achieved a notable 32.8% improvement in quiz scores, with a particularly strong 42.6% increase in phishing detection skills, highlighting its ability to deliver engaging and impactful training. User engagement was robust, evidenced by an 85% module completion rate, an average of 3.2 hours spent on the platform per user, 6.8 modules completed per user, and a 72% retention rate. Additionally, qualitative feedback rated the platform highly (4.6/5 satisfaction), and 85% of users reported increased caution with links, demonstrating its real-world impact.

Despite these successes, some challenges were identified. The Password Strength Checker module had a lower completion rate of 50%, because checking the strength of Password we need to apply Brute force attack which takes time. Users also expressed interest in advanced scenarios, pointing to opportunities for expanding the platform to cover emerging threats like IoT vulnerabilities or ransomware defense. While privacy awareness improved significantly (62% of users updated their privacy settings), this area could be further enhanced with targeted features like personalized privacy audits.

Looking ahead, future enhancements could include longitudinal studies to evaluate long-term knowledge retention, adaptive learning paths tailored to individual performance, and improved accessibility through multi-language support and mobile optimization.

## VI. Conclusions

The CyberSecurity Awareness and Training Platform successfully meets the demand for accessible, engaging cybersecurity education. Through interactive modules, gamified challenges, and practical tools, it equips users with essential skills to combat threats such as phishing, malware, and social engineering. Its effectiveness is clear from the 32.8% quiz score improvement, high engagement levels, and positive behavioral shifts among users. As cyber threats continue to evolve, the platform provides a scalable, adaptable solution to close the cybersecurity awareness gap. With potential for further personalization and expansion into new threat areas, it exemplifies the power of hands-on, user-focused training in building a more secure digital landscape.

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