Secure Authentication Mechanism

CS364- Information Security

Project Supervisor
Dr. Faiza Iqbal

Project Members
Muhammad Waseem 2021-CS-61
Muhammad Abdullah 2021-CS-82
Abdullah Javed 2021-CS-90

Department of Computer Science
University of Engineering and Technology
Lahore Pakistan

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1 Introduction

Our project presents a user-friendly quiz application designed specifically for educators and students engaged in courses. With our app, teachers have the capability to create quizzes comprising custom questions tailored to the course material. These quizzes can be conveniently organized into classes, allowing teachers to efficiently assign assessments to their students. Meanwhile, students gain access to these quizzes through their accounts, where they can complete them and receive immediate Score on their performance.

The primary aim of our project is to simplify the process of quiz management for teachers while providing students with a straightforward means of assessment. By offering a seamless platform for quiz creation, organization, and participation, we strive to enhance the learning experience within Information Security courses. Through this application, educators can easily track student progress and tailor assessments to meet the needs of their classes, while students benefit from a user-friendly interface that enables them to gauge their understanding of the course material.

In addition to providing a robust learning tool, we've implemented Information Security techniques to ensure the security and integrity of our application and the data within it. We implemented encryption protocols, encryption of passwords, JWT authentication, account lockout mechanisms, and secure authentication mechanisms to safeguard user accounts and sensitive information.

2 Objective

Our primary objective was to develop a secure quiz application that streamlines the quiz management process for both students and teachers. By leveraging Information Security techniques, we aimed to ensure the integrity and confidentiality of user data while providing a seamless user experience. Our goal was to create a platform that simplifies quiz creation, organization, and participation, making it accessible and user-friendly for all stakeholders involved in Information Security courses.

3 End Users

1. Teachers
2. Students

4 Features

1. **Users Management**: Users can easily signup and signin in our app. Teachers can make quizzes and classes. Students can take quizzes and see their scores.
2. **Quiz Creation**: Teachers can create quizzes easily by adding questions and then add these quizzes to a class.
3. **Class Management**: Teachers can organize quizzes into classes. This helps them keep track of which quizzes are for which classes.
4. **Secure Login**: The app makes sure only the right people can log in. This keeps users' accounts safe from people who shouldn't be using them.
5. **Easy to Use**: The app is made to be easy for everyone to understand and use, so teachers and students can focus on learning and teaching.
6. **Security**: The app is secured using different techniques. It has double factor authentication and account lockout mechanism to make sure that no unauthorized user gain access of an account.

5 Requirements

Our main goals were to make sure our web app is super safe for users to log in. We aimed to secure up the login process by adding extra layers of security. One of our targets was to introduce multi-factor authentication (MFA), where users have to prove their identity using more than just a password, like with a code sent to their phone. Another aim was to protect users passwords by turning them into secret codes that are really hard for anyone to understand, even if they manage to get into our app's database. Additionally, we wanted to prevent hackers from guessing passwords by locking accounts after too many wrong attempts to log in. Lastly, we set out to use special technology like JSON Web Tokens to keep everything secure while users are using our app.

6 Problem Identification

Before we started working on our project, we looked at other quiz apps and found a few problems. First, some of these apps weren't very safe. This means people's accounts and private information could be at risk of being stolen. Second, teachers had a hard time managing quizzes in these apps. It was tricky for them to make quizzes, organize them, and give them to students. This made their jobs harder. Third, some apps weren't very fun or easy to use for students. This made them less interested in taking quizzes.

7 Tools and Techniques Used

The following tools and techniques were used in the project:

1. **JWT Tokens**:
   (a) JWT (JSON Web Tokens) is a popular method for securely transmitting information between parties as a JSON object.
   (b) In our project, we utilized JWT tokens for authentication purposes. When a user logs in, they receive a JWT token, which contains information about their identity and permissions.
   (c) This token is then sent with subsequent requests to the server, allowing the server to verify the user's identity and grant access to protected resources.
2. **Protected Routes**:
   (a) Protected routes are specific endpoints or pages within the application that require authentication to access.
   (b) In our project, we implemented protected routes to ensure that certain features, such as viewing quiz results or creating new quizzes, were only accessible to authenticated users.
   (c) Users attempting to access protected routes without proper authentication are redirected to the login page or denied access, thereby enhancing the security of sensitive functionalities.
3. **Account Lockout Mechanism**:
   (a) An account lockout mechanism is a security feature that temporarily locks user accounts after a certain number of failed login attempts.
   (b) In our project, we incorporated an account lockout mechanism to mitigate the risk of brute force attacks, where hackers attempt to guess passwords repeatedly.
   (c) After reaching the maximum number of failed login attempts, the user's account is locked for a specified period, preventing further login attempts during this time.
4. **MultiFactor Authentication**:
   (a) MultiFactor Authentication (MFA) adds an extra layer of security by requiring users to provide multiple forms of verification before gaining access to their accounts.
   (b) In our project, we implemented MFA as an optional security feature for users who wish to enhance the protection of their accounts.

8 Challenges

While developing our secure quiz application, we encountered several challenges that required innovative solutions. One major challenge was implementing robust encryption techniques to safeguard user data while maintaining system performance. Additionally, designing a user-friendly interface that seamlessly integrates security features posed a significant challenge. Furthermore, ensuring compatibility across various platforms and devices while maintaining security standards presented its own set of challenges. Lastly, staying updated with emerging security threats and adapting our system accordingly proved to be an ongoing challenge throughout the development process.

9 Learning

Throughout the development of our secure quiz application, we gained invaluable insights into various aspects of information security and software engineering. We deepened our understanding of encryption techniques, authentication mechanisms, and secure coding practices. Additionally, we learned how to effectively integrate security features into a user-friendly application without compromising usability. Furthermore, we honed our skills in problem-solving and collaboration as we navigated challenges and worked towards common goals. Overall, this project provided us with a rich learning experience that will undoubtedly inform our future endeavors in the field of information security.

10 Security Best Practices

In our secure quiz application, we adhered to several security best practices to ensure the protection of user data and system integrity. Firstly, we implemented secure password storage using industry-standard hashing algorithms to prevent unauthorized access to user credentials. Secondly, we enforced strict access controls and authorization mechanisms to limit user privileges and mitigate the risk of unauthorized actions. Additionally, we regularly updated our software libraries and frameworks to address known security vulnerabilities and maintain a robust defense against potential threats. Lastly, we conducted thorough security assessments and penetration testing to identify and remediate any security weaknesses before deployment, ensuring the overall resilience of our application against malicious attacks.

11 Future Directions

Looking ahead, we envision several enhancements and expansions for our secure quiz application. Firstly, we plan to integrate advanced machine learning algorithms for dynamic question generation and personalized learning experiences. Additionally, we aim to incorporate blockchain technology for immutable record-keeping and enhanced data integrity. Furthermore, we aspire to expand our application's compatibility to include mobile devices and tablets, thereby increasing accessibility for users on the go. Moreover, we seek to collaborate with educational institutions and industry partners to gather feedback and further refine our application based on real-world usage scenarios. Overall, we are committed to continuous improvement and innovation to deliver an unparalleled user experience while maintaining the highest standards of security and reliability.

12 Conclusion

In conclusion, our project has made quizzes easier and safer for teachers and students. We focused on making sure everyone's information stays safe while also making the app easy to use. By adding features like secure login and extra verification steps, we've made sure only the right people can access the app. We've also made it simple for teachers to create and manage quizzes, and for students to take them and see how they did. Moving forward, we'll keep working to make the app even better and more helpful for everyone who uses it.

13 Acknowledgement

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