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A Secure Quiz Management System with Dual Authentication for Pusat Tahfiz As Solihin

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Abstract: A secure quiz management system for Pusat Tahfiz As Solihin is a web based system that allow quiz session held in virtually. An online quiz system or a web-based quiz system is one of the essential elements nowadays in the education industry. The main aim for developing this system is to ensure that the students of Pusat Tahfiz As Solihin can have a proper platform that are secure to answer a quiz session. Therefore, implementation of dual authentication security feature can improve the security level of the system. Email based OTP will be send to the user of the system for first time user and each time user login. Throughout the system, admin can do registration for admin, teacher, students, and subject. The methodology that are to develop the system is iterative methodology. Other than that, teacher can upload multiple choice question and students can answer the quiz that are uploaded by the teacher. At the end of this project, a secure quiz management system with dual authentication will be helpful to the school so that they can have the most convenient experience when taking quizzes using the system.

Keywords: Quiz System, Dual Authentication, One Time Password (OTP)

1. Introduction

In today's eras, online learning platforms are highly in demand in educational areas [1]. It is not merely shown that the area's growth along with the current technology [2]. But it is also necessary to break the propagation chain of Covid-19 viruses. Old methods of teaching and learning are not suitable anymore as Covid-19 pandemic hits global, and schools need to be closed [3]. However most online quiz systems do not implement security elements into the system. Pusat Tahfiz As Solihin is chosen in this project study.

One of the problems that occurs is a teacher cannot keep track of a student's performance. For example, the teacher may have issues with missing one of their student's answer sheets and cause the student to lose their marks. Having an online quiz management system is better than contemporary ways that are allocated to the school so that teachers can view their student's marks after the student takes the

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quizzes and the system can calculate the answer sheet automatically.

Next, most quiz management systems do not have dual authentication features. As references, most online quiz management systems only required the user to subscribe and log in with the user's email. The quiz management system does not have dual authentication in the system. Dual authentication is a part of the security features that can avoid the system from any adversary attack. There are three main objective which are to design a secure quiz management system using dual authentication approach for Pusat Tahfiz As Solihin, to develop a secure quiz management system using dual authentication for Pusat Tahfiz As Solihin and to evaluate functionality of the secure quiz management system with dual authentication for Pusat Tahfiz As Solihin through user acceptance.

First user of the system is admin. Admin can do registration of admin, teacher, student, subject, assign workload and assign subject to the student.Next, the second user in the system is teacher. For teacher scope, they can view their workload, assign multiple choice question quiz, and view student's marks. The last user in this system is students where they view assign class and answer multiple choice question quiz

Other than that, the quiz system will implement security features which is one time password through email. These features are implied into the system to ensure only authenticate user can access the system. The second security features that will be implement into the system is password hashing and salting. The security features are taken to ensure that all passwords will be different so that attacker cannot guess it at a glance. Next, the system will not allow student to copy and paste to all question to avoid the student from cheating the examination. Finally, the system will show random sequence of question for student so that student cannot discuss the question with their friend during the examination

At the end of the project, a secure quiz management system with dual authentication will be developed. Users need to pass dual authentication to access the system and any modification within the system will be registered in the system. The system will be monitored by the school to make sure the system is acting correctly.

2. Related Work

2.1 Online Quiz System

Quiz Management application aims at the employee assessment programs carried out in the organization by conducting quizzes. The quiz management system gives an online platform to the teacher or examiners and students in order to perform a quiz session. Other than that, the online quiz system promotes time saving such as the students and examiner do not need to attend the examination physically and they can answer the quiz anywhere they are. Plus, most online quiz systems will automatically calculate students' marks. Therefore, the teacher does not need to calculate students' marks manually and it can avoid any human errors such as miss calculated marks.

2.2 Dual Authentication

Dual authentication will be using extra authentication features rather than traditional authentication utilizing the only password to login into the system. According to [4], Dual authentication can be based on two or three assumption that will be explained more in Table 1. Table 1 shows the list of assumptions for the factor of authentication. Five assumptions will be made when implementing authentication in a system. The assumption is something you know, something you have, something you are, somewhere you are, and something you do. Dual authentication can have two or three assumptions to ensure that the system will be more secure. There are two assumptions for this dual authentication that will be used. The first assumption is what you have, and the second assumption is something you know. The something you will lead to knowledge-based factor while what you have assumption will lead to possession-based factor.

Table 1: List of Assumption for Factor of Authentication

Assumption	Explanation
Something you know	This factor is a common type of dual authentication and is also known as simply- based authentication. A single string of characters can be most vulnerable to guessing attacks.
Something you have	This factor required physical tokens such as mobile phones. This tool is utilized to authenticate the person. To continue logging, the user will receive an SMS containing a security code and insert the code into the system.
Something you are	This factor will be using a biometric approach. Fingerprint, iris, and voice recognition are examples of biometric. Biometric is something that is physically attached to the user [5].
Somewhere you are	This factor is mainly used to identify the origin of the user. This factor will be using users' IP addresses and GPS technology to know their current location. Therefore, some applications may require the user to confirm who they claim to be when the user is aboard.
Something you do	This factor will be using AI software to control and follow up on user behavior. This factor is commonly used to detect any malicious activity that is conducted by the user. Any malicious behavior will be reported if it is detected.

2.2.1 Knowledge Based Factor

Knowledge based authentication will be referenced for something you know. In this factor, the system will require the user to enter the information that only the user will know such as a password. Password does not constitute a simple word or a key that needs to be inserted while login into a system. It is the basic security element that the developer will deploy into the system to secure it. The dual authentication approach is first and foremost focused on the use of a password according to theirlevel. There are two types of passwords which are static and dynamic passwords to keep the sensitive data security within a system [7]

2.2.2 Possession Based Factor

The possession-based factor is one of the authentication factors that are widely used in today's world. This factor will be implementing what you have. One example of a possession-based factor is a one-time password (OTP). A strong secret password that is produced by the user plus a one-time password OTP can be one of the most secure layers in the security mechanism of dual authentication [7] By implementing OTP into the system, it can contribute to improving the security level of the system because the only user will know the OTP number.

2.3 Comparison of Existing Quiz System

This section will be reviewing the current existing quiz system on the Internet. After that, the existing quiz system will be compared to the suggested quiz system. The chosen quiz system to be compared with proposed system are Quotve.com and ThatQuiz.org.

2.3.1 Quotve.com

Quotve.com is one of the quiz systems that we can access through a web browser. This website is open source so everyone can use it whenever they need it. Quotve.com has other functions else than creating quizzes such as writing books, reading current existing books, journals, and other activities. It is a multipurpose website that is suitable to be used for every age level. Qoutve.com will require a first- time user to register or subscribe to the system. For users who already have an account, they can just straight away login into their account. There are three options to subscribe for this system such as through email, Facebook, and Twitter. Figure 1 and 2 show the interface when the user wants to login into Quotve.com and the home page interface of Quotve.com. In this system, by clicking on the create icon, the quiz will

be created. After that, the system will ask the user to input the quiz name. When the quiz was created, the user can insert the question and answer into the page. The quiz will be in multiple-choice answered form. Users also can add a picture to the question and answer. An URL will be formed after the quiz was created.

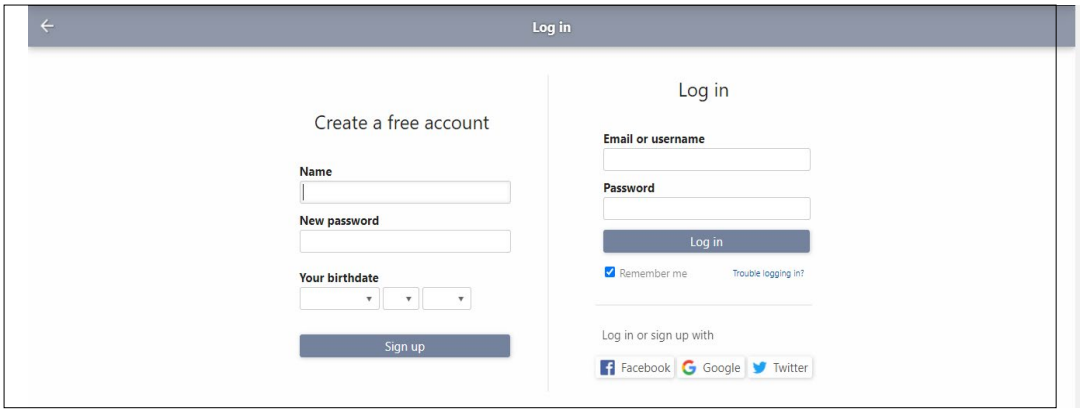

Figure 1: Sign in Page for Quotve.com

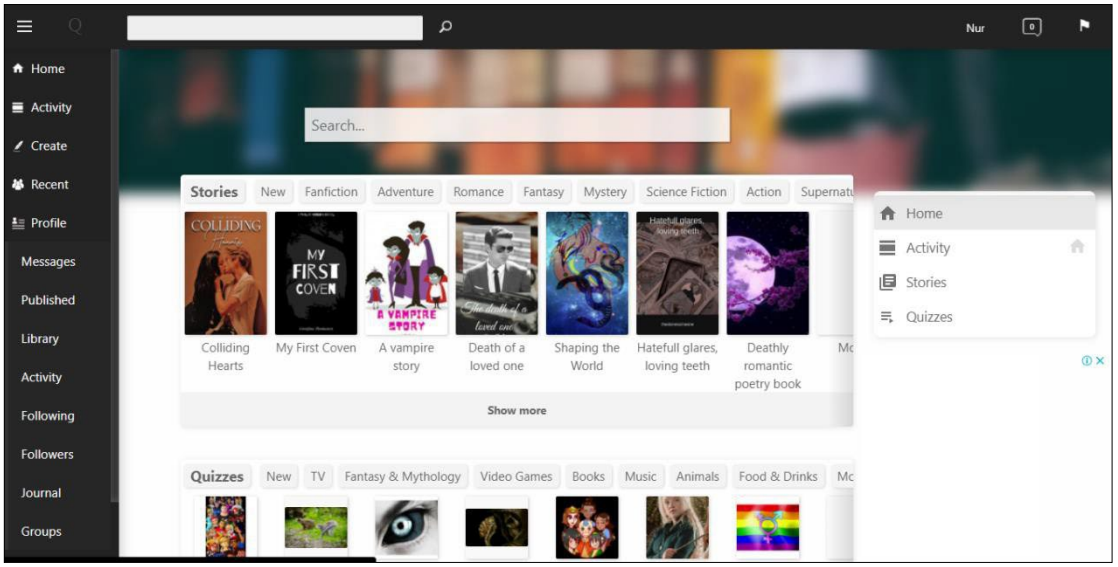

Figure 2: Home Page for Quotve.com

2.3.2 ThatQuiz.org

Thatquiz.com open-source website for educational purposes. This website can be translated into another language other than English such as Spanish, German, French, and others. To use the website, the user needs to create an account first. Personal information such as name, password, and email are required to sign up for this website. Thatquiz.com also implies another security feature which is CAPTCHA to differentiate human sign-in and automated access to the website. Figure 3 shows the sign page for Thatquiz.com and Figure 4 shows the interface for the homepage for Thatquiz.com. Other features that are implicit in this website are such as creating classes, assigning people to their class, creating quizzes and others. This website will recommend a common test that is developed by the teacher within the system such as integers, concepts, vocabulary, and others. To create a quiz, a class has to be selected and the user needs to click on the design button and choose the question.

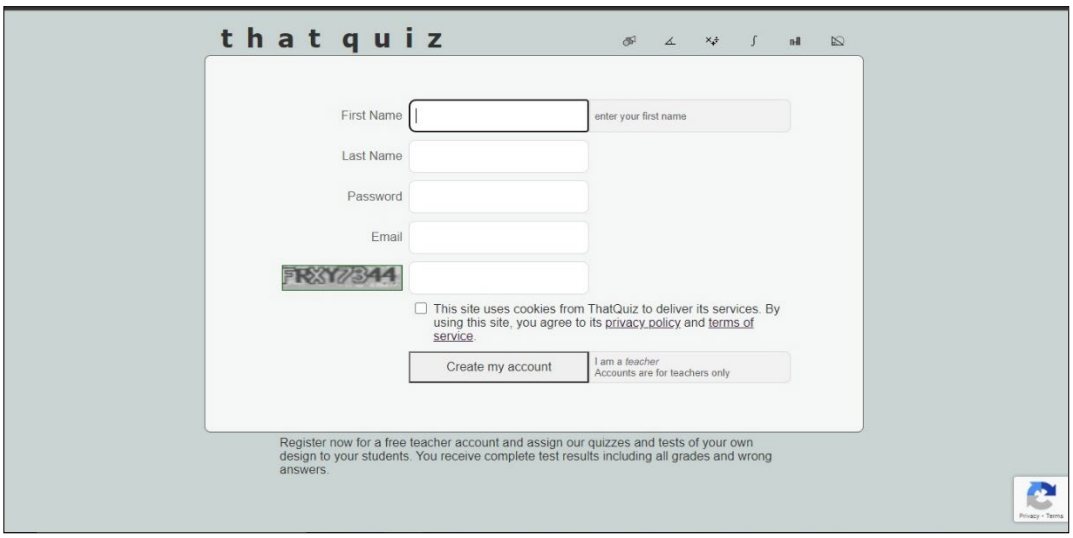

Figure 3: Sign Up Page for Thatquiz.com

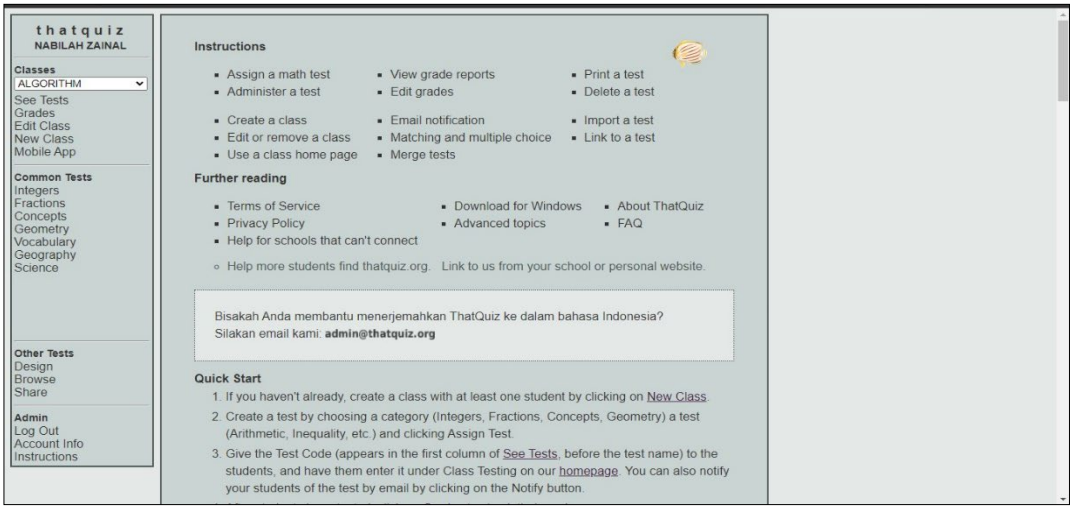

Figure 4: Home Page for Thatquiz.com

Table 2: Comparison Table Between Current Quiz System and Propose System

	Quotve.com	Thatquiz.org	Propose system
Add, update, delete question	Yes	Yes	Yes
Security Feature	Email Password	Email Password, CAPTCHA	ID, Password, Email Based OTP
Quiz type	Multiple choice Question True /false question	Multiple choice Question	Multiple choice Question
Create class	No	Yes	Yes

Based on Table 2, all systems that are compared can add, update, and delete questions. Other than that, the suggested quizzing system and Thatquiz.org have a dual authentication factor which is password and email-based OTP for the proposed quiz system and password with CAPTCHA for Thatquiz.org. Compared with Quotve.com, email and password for the user to login into the system. Next, the propose quizzing system will have three core modules which are admin, teacher, and student.

The admin module will allow the authorized user to add teachers, students, classes, and others.

Thatquiz.org has an admin module in their system but the admin module will also apply as a teacher module because it allows the admin to create a quiz and add the question. Quotve.com cannot make a class because all the quizzes will be available through URL. Compared to the existing quiz systemand Thatquiz.org, it allows the admin to set up a class. The proposed quiz system will allow admin to assign teachers to their class so that it will be more convenient for the teacher to track their student performance.

3. Methodology/Framework

Iterative Waterfall methodology is the modification of waterfall methodology. This is because the iterative waterfall methodology will allow the user to go back to the previous phase. The use of iterative waterfall methodology is used to make sure any error from the previous phase can be fixed by the developer [8]. The more positive effect that can a developer get when using the iterative approach in terms of project execution control [9].

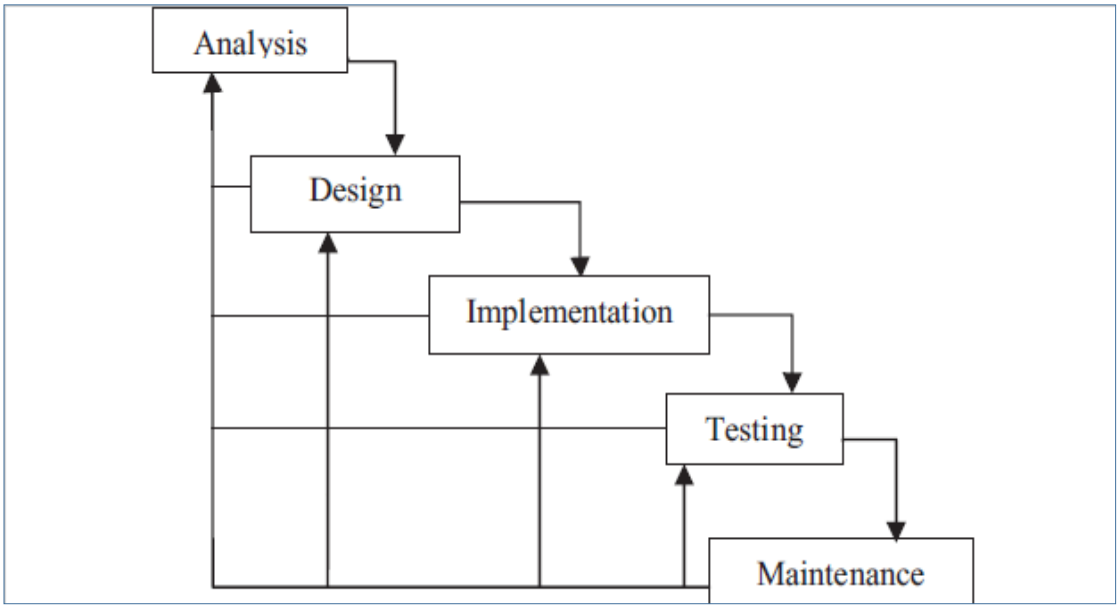

Figure 5: Phases In iterative Waterfall Methodology [10]

Figure 5 shows all the methodology phases which consist of 5 phases in total. The first phase in iterative waterfall methodology is analysis and followed by design, implementation, testing and maintenance. All of the phases will carry out different tasks and milestones, but it will be synchronous from starting to the ending phase.

3.1 Analysis

All the requirements are gathered by interviewing one of the workers there at Pusat Tahfiz As- Solihin. All the information on the learning process is collected. After the interview with the principal, a list of the problem statements is done so that all the problems can be stated as clear as a crystal. One of the steps that are to be done in the analysis phase is planning the development of the project. All the functional and nonfunctional requirements to solve the problem are gathered. Table 3 shows the list of functional requirements and Table 4 shows the nonfunctional requirement for Secure Quiz Management System with Dual Authentication for Pusat Tahfiz as Solihin.

Table 3: List of Functional Requirement for Secure Quiz Management System with Dual Authentication for Pusat Tahfiz As Solihin

No	Requirement
1	All users should be able to login into the system using ID, password, and Email OTP.
2	Admin will be able to do registration for admin, teacher, student, and subject. The admin also will be able to add, update and delete the registration module.
3	Admin will assign subjects to a teacher and student. After the admin has assigned the workload to a teacher, then a quiz can be created.
4	The quiz will be created by teachers that are assigned to the subject.
5	Students will be answering the quiz that is assigned to the subject
6	Teachers will be able to view marks after the students done answering the quiz.
7	Allowing all users to log out from the system.

Table 4: Non-Functional Requirement for Secure Quiz Management System with Dual Authentication for Pusat Tahfiz As Solihin

Requirement	Description
Performance	All users should be able to access the correct assigned pages. The system can allocate the user to the correct session.
Operational	The system can access when there is an internet connection.
Security	Users can access the system when entering the correct ID, password, and Email OTP. All the passwords will be salt and hash before it is stored in the database. The Email OTP will be sent to the user every time user login into the system.

3.2 Design Phase

The design phase will be using all the listed requirements in the previous phase to design how the system will look. This phase can give a clearer vision of the flow of the system so that it will be easier to be developed. The system architecture design is developed to get the conceptual design of the system. This architecture will refer to when designing the system. The component and sub-component will be identified in this system architecture.

Figure 6 shows the system architecture of Secure Quiz Management System with Dual Authentication for Pusat Tahfiz as Solihin. When a user wishes to log in to the system, the user needs to select a role such as admin, teacher, or students. This is explained by the fact that users can only access the authenticated page. After the user enters the username and password, the system will check if the user is a first-time user. If the system detects the user for the first time the system responds by forcing user to change password to alphanumeric password with at least special character, a number and must more than 8 characters. Next, the system will generate OTP and send it to the user's email through an email server. When a correct OTP is entered, the system will respond by allowing the user to access the page that is authenticated.

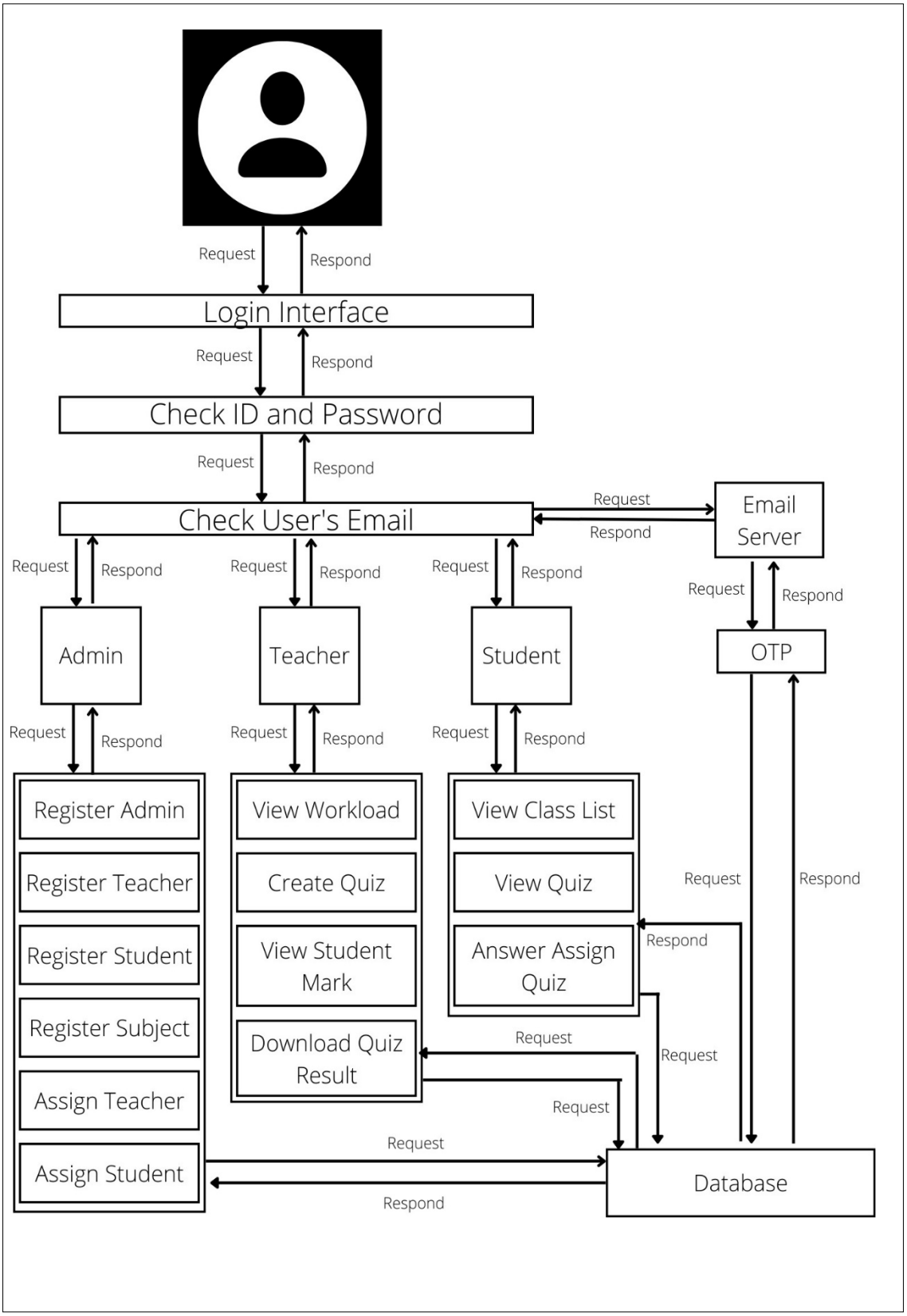

Figure 6: The System Architecture for a Secure Quiz Management System with Dual Authentication for Pusat Tahfiz As Solihin

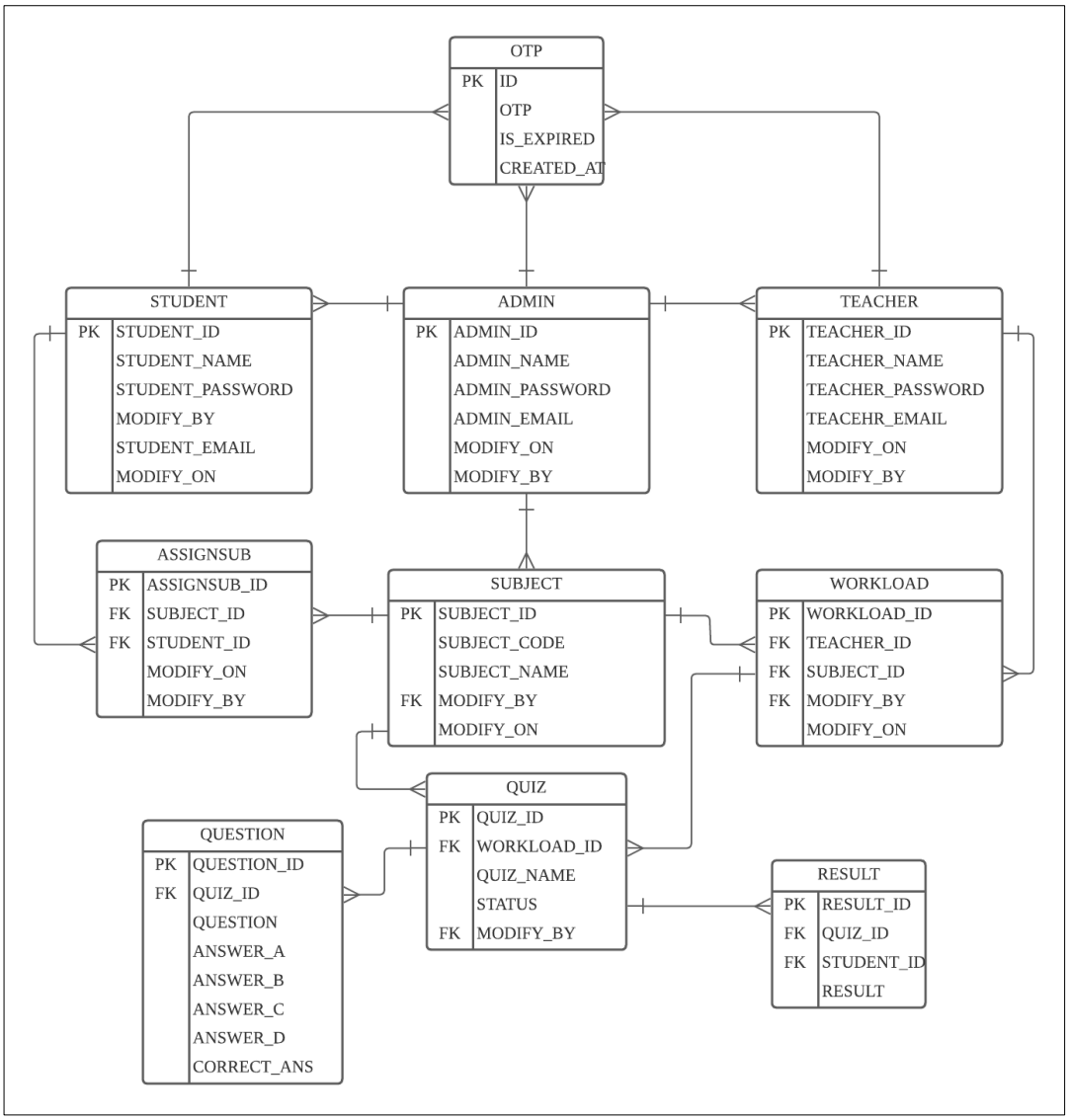

Figure 7: The Entity Relationship Diagram for a Secure Quiz Management System with Dual Authentication for Pusat Tahfiz As Solihin

Figure 7 shows the entity relationship diagram for quiz system. The entity relationship diagram is used to demonstrate the connection between table in a database. In the diagram, there will be 10 table which are related to one and another. The table are used to store important data within the system. Each table will have its own primary key and the key will be used in another table as foreign key to link each other.

Context diagram will show the data flow for admin, teacher, and students when entering the system. The three entities will need to insert the correct username, password, and Email OTP to make sure the system responds by allowing them to enter the system. Figure 8 shows a context diagram for the system.

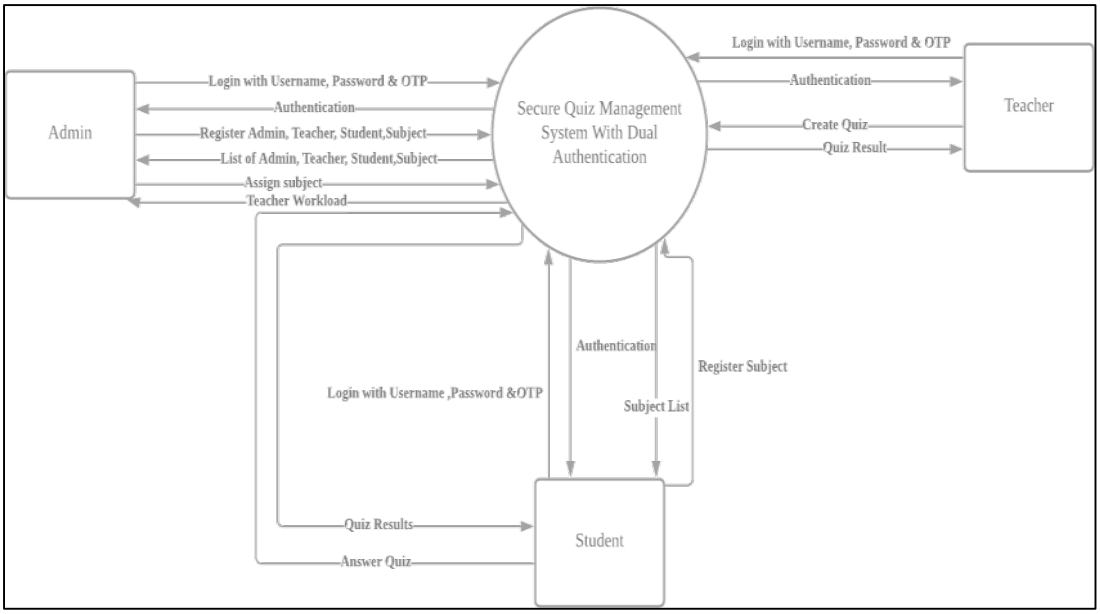

Figure 8: Context Diagram for Secure Quiz Management System with Dual Authentication for Pusat Tahfiz As Solihin

In Figure 9, the data flow diagram level 1 will be involving three main entities which are admin, teacher, and student. The entities will have different access to a certain page. Other than that, the entities can do different activities while accessing the system. There are many processes for the three entities. For example, the admin can do the registration process for admin, student, teacher, and subject. This process will involve more than one data store.

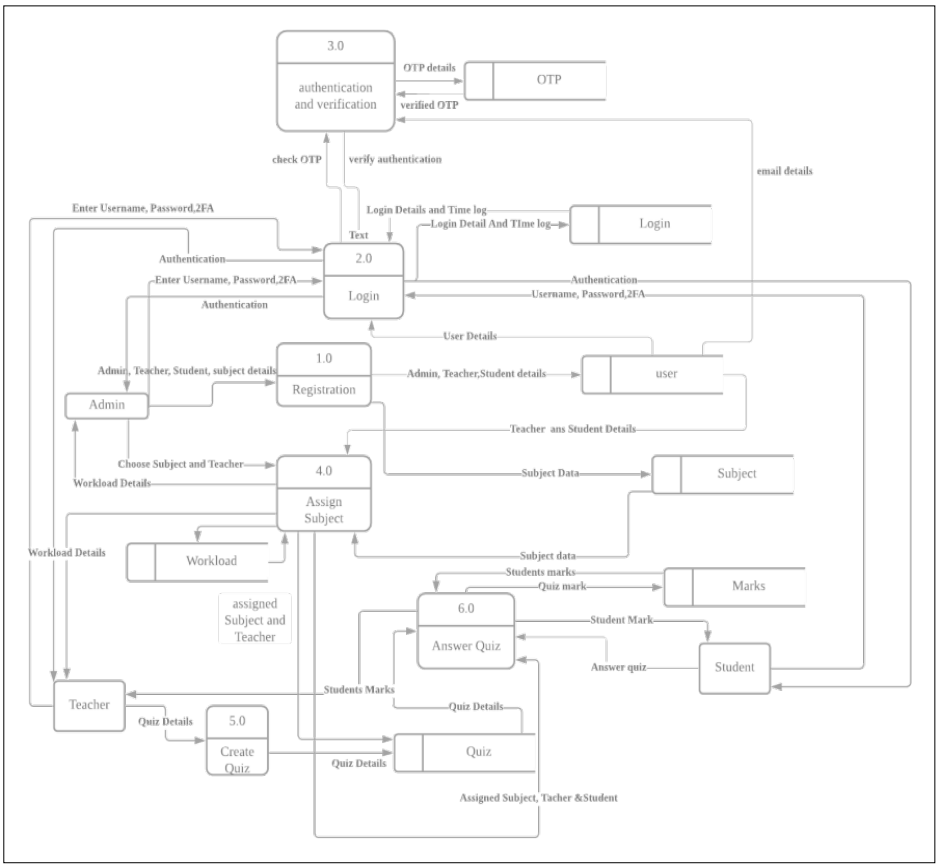

Figure 9: Data Flow Diagram for Secure Quiz Management System with Dual Authentication for Pusat Tahfiz As Solihin

3.3 Implementation Phase

This phase will make the system functioning well with all the requirements that are stated in the previous section. There are three main parts in this phase which are hardware, software, and programming language. Throughout this project, the hardware that will be used is a processor of AMD Dual-Core A9-9420 Processor, 3.0 GHz with RAM of 4 GB. Other than that, software that will be used is VScode studio, MySQL database, and XAMPP to develop the quiz system. Four programming languages will be used in this project. The programming language that will be used is such as HTML, PHP, CSS, and JavaScript. Table 5 shows the hardware, software and programming language that are used in developing the Secure Quiz Management System with Dual Authentication for Pusat Tahfiz As Solihin

Table 5: The Hardware, Software and Programming Language That Are Used

Parts	Items
Hardware	AMD Dual Core A9-9420 Processor, 3.0 GHz 4 GB RAM ASUS X505-B
Software	Vscode studio Mysql database Xampp
Programming language	HTML PHP CSS JavaScripts.

3.4 Testing Phase

This phase will implement two types of testing so that the system will be working according to the requirements. The first test plan is the functionality of the system. The test is implemented to ensure that the system will work as required. The functionality test will be done first before the second type of testing which is user testing. The second testing type that will be done to the developed system is user acceptance testing. In this testing, the system will be tested by the user which is admin, teacher, and students of Pusat Tahfiz As Solihin. This testing is done to ensure the system can function correctly and the user is satisfied with the system.

3.5 Maintenance Phase

The maintenance phase will be evaluating the testing results. Any test that is not successful will be fixed so that the system can function as expected. The system will be undergoing the testing and implementation phase with the maintenance phase several times to ensure the functionality of the system.

4. Result and Discussion

This Section will highlight the main security features of the proposed quiz system. All the source codes are developed to ensure the functionality of the system are according to the requirement. The security features will include confidentiality, integrity, and availability of the quiz system.

Figure 10 shows the login page for all users. A user must enter correct assign ID and password. Next, a user needs to select user type to ensure that user can only access to authorized page. The system then will check if user is first time user or not. If so, user is forced to change password with alphanumeric password that must be more than 8 characters. Figure 10 shows the error message if user do not follow the password guideline.

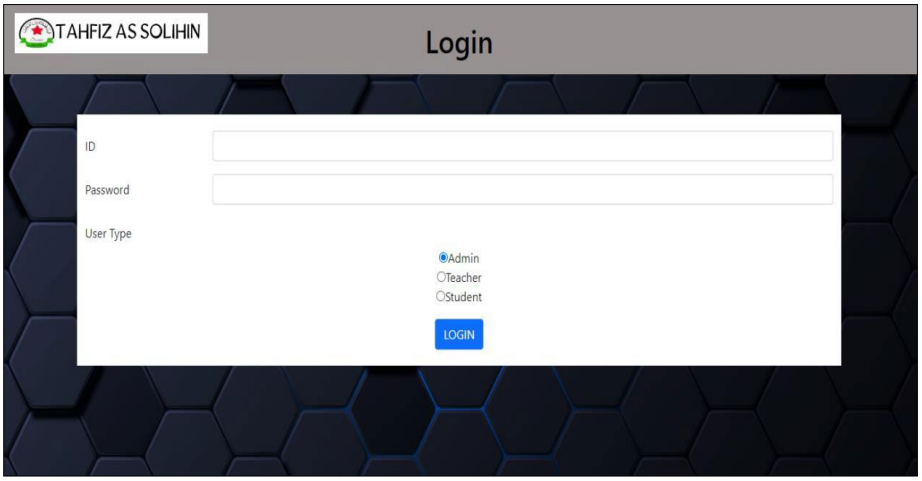

Figure 10: Login Interface for All User

4.1 Security Module

During login session, user need to enter ID, password, and user type. A user must enter correct assign ID and password. Next, a user needs to select user type to ensure that user can only access to authorized page. If user failed to full fill the criteria in login page, an error message will be displaying such as in Figure 11.

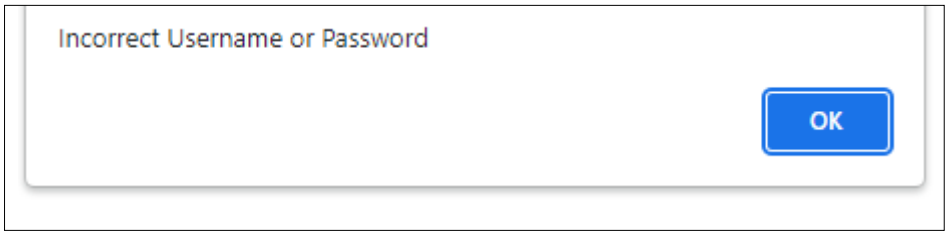

Figure 11: Error Message If User Enter Wrong Credential.

Next, the system will detect user is first time user or not. If the system detects that user is first time user, the system will force user to change password before entering to the next page. Users need to follow the guideline set for password. The password will be required minimum of 8 characters, including at least a number, special character, upper case, and lower case. If user fail to do so, the system will respond by display an error message such as in Figure 12.

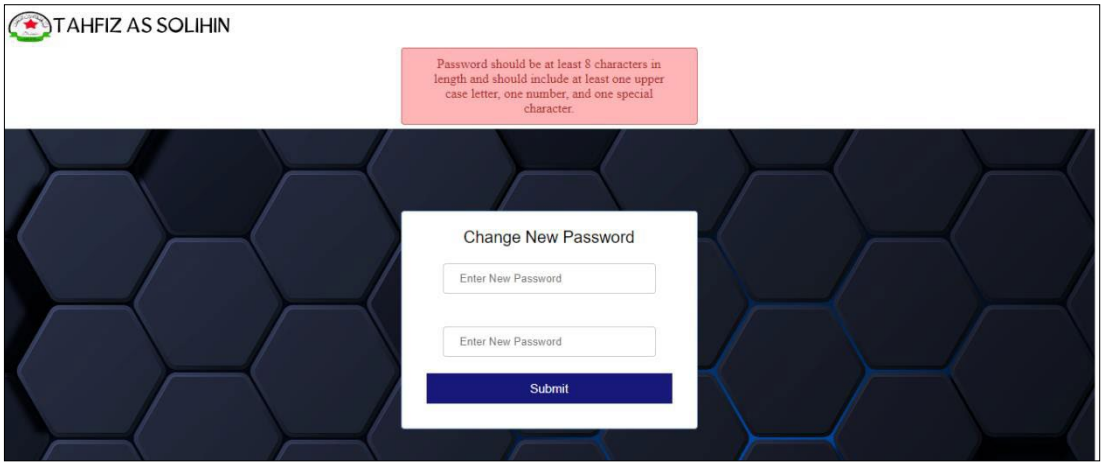

Figure 12: The Error Message If User Do Not Follow the Password Guideline.

User will be required to enter email address for system to check if the entered email address is the same with the database. If the two-email address are the same, a random six-digit OTP will be sent to the user email. The interface of entering email address page, OTP page and example email that are send is as in Figure 13(a), Figure 13(b) and Figure 13(c).

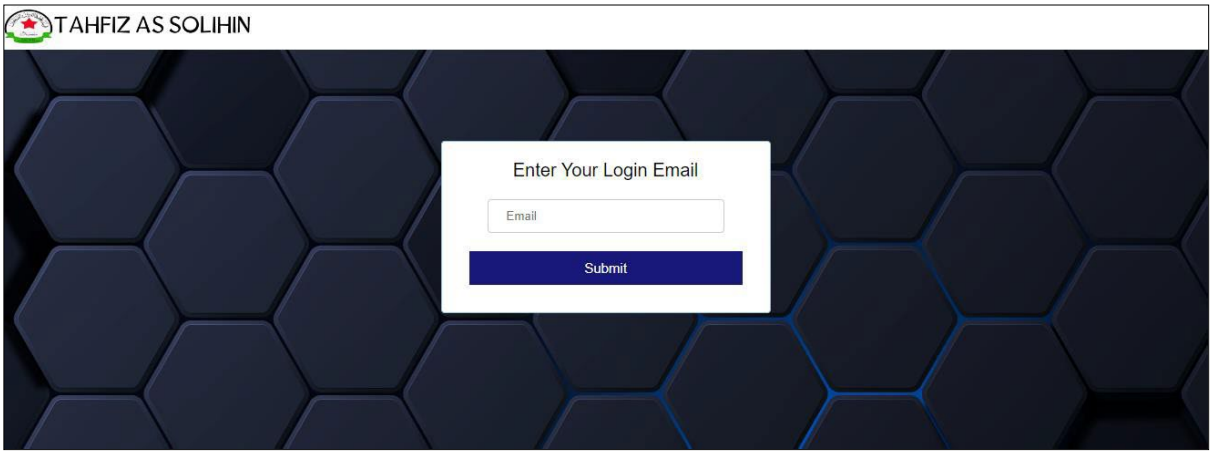

Figure 13(a): Interface That Force User to Enter Email Address

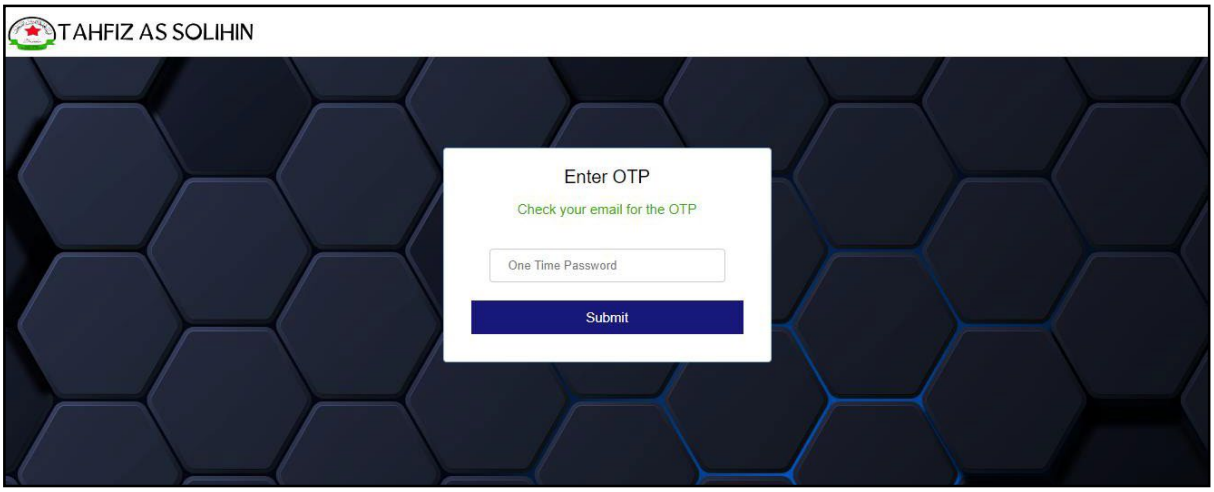

Figure 13(b): Interface for User Enter OTP

Figure 13 (c) : Email Example That Will Be Sent To User

Before the system store password into database, the system will salt the enter password. This means that a special security phrase will be embedded with entered password so that every stored password will not be the same even the original value of password is the same. The salt password then will be hash using md5 function then it will be stored into the database. The example of how database store the password is shown in Figure 14. the admin id will be taken as security phrase to salt the password for admin. Same goes to teacher and student.

admin_id	admin_name	admin_password	admin_email	modify_on	modify_by
1000	NABILAH	f003d4a2bc568962814fbaa1bd67feec	nuriyla22@gmail.com	2022-06-07 17:52:07	
1001	NUR NABILAH	00936b9285d6b8665ae9122993fb8e91	nuriyla22@gmail.com	2022-06-07 17:53:30	1000

Figure 14: The Salt and Hashed Password That Will Store in Database.

Other than that, one if the security features that will be implemented into the quiz system is disable the copy and paste function for student when answering the quiz session. The answer quiz session will band student to highlight the question so that student cannot copy the question and search it in the searching engine. Last but not least, the quiz system will implement randomize sequence of question in the quiz system. These features are implemented to avoid student from discussing the answer during quiz session.

4.2 Functionality Testing

The develop quiz system will be test in every expect from the security features to the functionality of the system. There are three category of functionality that will be tested to the secure quiz system. APPENDIX A will be showing the first category of testing, second category testing, testing of category three. Furthermore, the category will be also tested on update and delete function to ensure that the system can be modified if user trigger it

All security features for the quiz system will be tested do that all data can be secured safely in the database of the system. The testing will be conduct as in APPENDIX A. In the APPENDIX A will be discuss more on security features that need to be test by user of the system.

5. Conclusion

At the end of the project, a Secure Quiz Management System with Dual Authentication for Pusat Tahfiz As Solihin will be develop. In this paper, the first chapter will be on introduction of the system. The problem statement and objective are declared in this section. Next, the topic that will be discuss in this paper is literature review. Throughout this section, the method that will be used are defined. The information gathering is done through previous research paper. The comparison of existing system is also carried out in this table. There are two existing system that will be compared in this paper which are Thatquiz.com and Quotve.com. Other than that, section three will be more focus on methodology that are used to develop the system. The chosen methodology for this paper is iterative methodology. Iterative methodology is used because developer can go back to previous phase if something needs to be change.

Furthermore, the section for will be about related work for developing the system. In this section, all module for the quiz system is develop. The crucial module for this system is the security module. In security module, OTP verification, password hash and salt, disable copy paste function for answering quiz and display random sequence of question are developed. These features are embedded to ensure that quiz system will have more protection from any attack. The testing of the system is carried out such as in APPENDIX A. All the functional and nonfunctional requirement will be full filled. The user acceptance and functionality testing will be done according to the test plan.

Acknowledgement

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APPENDIX A

Table 6: Test Plan for Category One

Description	Expected results	Actual result
Register admin i. Click on register admin button ii. Add admin details iii. Click on add button	Admin details is added into the system	Pass
Register teacher i. Click on register teacher button ii. Add teacher details iii. Click on add button	Teacher details is added into the system	Pass
Register student i. Click on register student button ii. Add student details iii. Click on add button	Student details is added into the system	Pass
Register subject i. Click on register subject button ii. Add subject details iii. Click on add button	Subject details are added into the system	Pass
Assign workload i. Click on assign workload button ii. Select subject and teacher iii. Click on add button	Workload details is added into the system	Pass
Assign subject i. Click on assign subject button ii. Select subject and student iii. Click on add button	Assign subject details is add into the system	Pass

Table 7: Test Plan for Category Two

Description	Expected results	Actual result
Add question i. Click on add quiz button ii. Add the question iii. Click on add button	The quiz question will be added into the system	Pass
Delete question i. Click on button delete at the question	The quiz question will be deleted into the system	Pass
Update question i. Click on button update at the question	The quiz question will be update into the system	Pass

Table 8: Test Plan for Category Three

Description	Expected results	Actual result
Answer quiz i. Click the answer quiz button at the subject ii. Answer the multiple-choice question by clicking at the answer iii. Click submit quiz to send the answer	The quiz is end when submit button is click.	Pass

Table 9: Security Test Plan

Description	Actual Result
Password must contain alphabet, number, special character and must longer than 8 characters.	Pass
The error message does not specifically redirect the wrong part.	Pass
Password must not be shown in the text box in the login page	Pass
The email OTP will be sending each time user enter the system	Pass
The email OTP will be sent after user change password	Pass
The Password will be salt and hash before stored into database	Pass
Student cannot copy or paste the question	Pass
The question in a quiz will be display randomly for student answering quiz	Pass

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