AITCS

QuiZtudy: An implementation of a Quiz System with Activity Log

Nur Farah Hani Abdullah, Nordiana Rahim*

Faculty of Computer Science and Information Technology,
Universiti Tun Hussein Onn Malaysia, Parit Raja, 86400, MALAYSIA

Abstract: Quiz system is a web-based quiz system for accessing students in teaching and learning. Conservative methods in teaching and learning are not suitable as the Covid-19 pandemic hits global, and schools need to be closed. Hence, school and university need to adapt online distance learning throughout this pandemic. Nowadays, online quiz system is used all around the world. However, some of the existed quiz system does not allow teachers to have a view on students that do not login into the quiz system during the quiz session is held. QuiZtudy will provide a platform for students and lecturer to create one of teaching and learning method effectively without need to have face-to-face learning. It requires teachers to create quiz and student to answer the quiz according to their respective teacher. This system also will implement activity log that will keep track on the action of users as one of the purposes of the activity log is to measure the activity done by users in the system. Users need to login into the system to use the functions in the system. Methodology used in QuiZtudy development is Waterfall. As a result, the system managed to display activity log where each modification on registration is stated in the system. there is also login history where administrator can know users that logged into the system with the time.

Keywords: quiz, education, activity log

1.   Introduction

Quiz system is a web-based quiz system for accessing students in teaching and learning according to [1]. Online quiz system is used widely in most education system [2]. The authors in [2] also added that it is one of the most helpful ways to conduct examinations or to increase understanding of students in the subjects. It is time saving for the teacher and students.

Conservative methods in teaching and learning are not suitable as the Covid-19 pandemic hits global, and schools need to be closed. Hence, school and university need to adapt online distance learning throughout this pandemic. Nowadays, online quiz system is used all around the world. However, some of the existed quiz system does not allow teachers to have a view on students that do not login into the quiz system during the quiz session is held.

*Corresponding author: nordiana@uthm.edu.my

Other than that, there might be careless mistake made by the students. For example, they are not answering all the questions due to a lot of questions. This action will lead the students to obtain less information and knowledge compared to other students. Despite their ability, when participants respond to the items regardless fail to read or comply with questionnaire instructions or item content that caused careless responding to occur [3][4]. The objectives of this project are:

- To design a quiz system that implemented password authentication and activity log.
- To develop a secure quiz system by implementing password authentication and activity log.
- To test the performance and security of QuiZtudy.

QuiZtudy will provide a platform for students and lecturer to create one of teaching and learning method effectively without need to have face-to-face learning. it requires teachers to create quiz and student to answer the quiz according to their respective teacher. This system also will implement the security features according to confidentiality, integrity, and availability. One of them is activity log that will keep track whether the students answer the question or not. Moreover, users need to login into the system to use the functions in the system. With this quiz system, users can adapt new norm of online distance learning by applying a new modern teaching and learning method to ensure that no students is missing in obtaining knowledge. Th development of QuiZtudy will help teacher in online distance learning to assess the students.

In section 2, security of data logging is discussed. Its relation and similarity with the activity log also mentioned in section 2 along with comparison of the existing systems and QuiZtudy. Section 3 stated about methodology used for this development which is Waterfall methodology. System implementation and testing is discussed in section 4 where the user interface design is shown and a part of testing for QuiZtudy. Section 5 concluded the paper of this development.

2.   Literature Review

A log is evidence that records every event occurring within the systems or the networks of an organization. In [5], it mention that log entries included in logs where information relevant to distinct events that occur within the systems, or the networks is logged into entries. However, to record all the events that occur within the system and the network or to serve as evidence, which is useful to investigate malicious activities, today logs are used to optimize the performance of a system or network in an organization [6].

2.1   Security in data logging

According to [7], insufficient logging and monitoring were identified by Open Web Application Security Project (OWASP) in 2017 as one of the top ten security risks. Without proper logging of data, many problems can occur and impacting other as well.

With data logging, one person cannot deny an action or activity that was tracked. It protects the non-repudiation property and function to collect, maintain, provide, and verify the undeniable evidence about activity in the system or devices [8]. Data logging also protect accountability and availability where they have similar functions in protecting evidence from being altered or avoiding from hiding the criminal [9].

2.2   Data logging and activity log

Audit log generally one of the methods in tracking changes over the course to record history and keep track on any activity. It creates a record with a change in timeline [10]. Audit log or audit trail usually will keep track on the sequence of activities or any specific actions that were assigned to be tracked [11]. Example of captured information is person that perform the action, performed activity and how the system responded [9].

Meanwhile, activity log is a recorded log of how time is spent [12]. Generally, activity log is used to keep track on the duration of users stay in the system or application. For example, activity log will keep track on how the employees spend their times in an organization.

2.3 Activity log in quiz system

In most quiz system, they do not focus much on the activity log function as it is more important on quiz module where students will answer the questions by teachers. Nevertheless, this should not happen as educators can focus on increasing the achievement of the students. This is due to teachers can observe the actions taken by their student when the activity log exists in the quiz system. One of the purposes of the activity log is to measure the activity done by users in the system [13]. Nevertheless, sometime activity log cannot reflects the behavior of users during period of users using the system [14].

[15] mentioned that by using activity log, one can know the activities done by the student at the time. That way, if any students or any users do try or already done the action, one can know from the activity log function. Typical data that will be tracked for activity log are time, username, IP address, event or action name [15]. In some bigger platform such as Google, Facebook and other social media, they provide users with the activity log and will warn users whenever there is unusual login trial [16][17]. Typically, they will provide users with information such as location of the login were made, IP address of the device and time the login trial is done.

Continuous monitoring of users in quiz system can increase the security measures to avoid users from do reckless or unethical actions [18]. This can be done along with the reasonable restriction of the scope of modules for each user. Other than that, it will provide a path in logging and monitoring the system to know if there are threats or abnormality of actions by users in the system [19].

2.4 Comparison of system

Comparing between existing systems and proposed project, there are similarities and differences. Quiz DataBase provide login page to their users as well as the proposed system. Voting and Quiz System does provide login, but it is limited to teacher user. All the existing and proposed system can create question for quiz session. For update and delete question, the authors mentioned that Quiz DataBase has the function while there is no update and delete questions function in Voting and Quiz System. Proposed system will implement the update and delete function.

For displaying result to all user, only proposed system will implement the function and the existing system does not. Admin module is designed to handle the administration of the system such as registering the users, subject assigning workload. Comparing between existing system and proposed system, only proposed system will implement the admin module users. Log track function will be implemented in the proposed system. The Table 1 showed the comparison between Quiz DataBase (QDB) and Voting and Quiz System.

Table 1: Comparison between Quiz DataBase (QDB), Voting and Quiz System and QuiZtudy

Function	Quiz DataBase (QDB)	Voting and Quiz System (VQS)	QuiZtudy (proposed system)
Login page to all users	Yes	No	Yes
Create question	Yes	Yes	Yes
Update delete question	Yes	No	Yes
Display result to users	No	No	Yes
Admin module user	No	No	Yes
Activity log function	No	No	Yes

3.   Methodology

To develop QuiZtudy, Waterfall methodology is chosen. The reason of why this methodology is chosen is the phases in this model are not overlapping with each other where each phases need to be completed before moving to another phase [20]. Figure 1 displayed the phases in Waterfall methodology[20]. Figure 1 displayed the phases in Waterfall methodology.
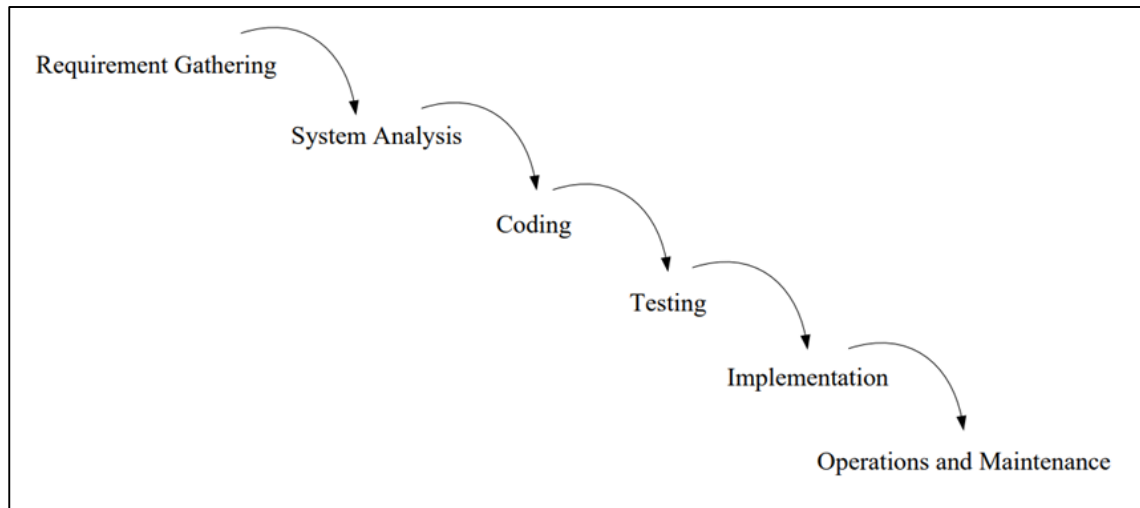

Figure 1: Phases in Waterfall methodology [20]

According to Figure 1, there are six phases in Waterfall methodology which are requirement gathering, system analysis, coding, testing, implementation, and operation and maintenance. In this project, some phases are merged into one phase like requirement gathering and system analysis became requirement gathering and analysis and a new phase which is not stated in Figure 1 is added which is system design.

3.1   Requirement analysis and gathering

In this phase, the existing quiz systems are analyzed. The identification of the requirement to develop quiz system is done. Implementation of activity log in the system is reviewed and requirement is gathered. All the journal papers and articles related to activity log and quiz system are gathered and reviewed. The paper is searched in the database engines such as Google Scholar, IEEE Explore, ScienceDirect. The keyword is divides into two parts. The first part is related to activity log and second part is about quiz system. The search was undergone by three ways which are combining first and second part. Another one was searched with respective parts. The result of the analysis is summarized and analyzed to look for the functional and non-functional requirement for the system.

3.2   System design

Entity relationship diagram is displayed in Figure 2. The diagram contained twelve tables that connected to one another. There are three tables that will store users which are admin, lecturer, and student. Three different table is created to linked two different tables. They are SubjectStudent which connecting table subject and table student. Other than that, table LecturerSubject that linked table lecturer and table subject.

Quiz table will store information that related to the Quiz entity. For example, subject the quiz storing, lecturer that was assigned to the Subject, Questions, and Answer for the Quiz. Each Subject, Questions and Answer entity will be linked with the quiz entity using their own primary keys and became foreign keys in the quiz entity. In addition, there is LoginTrack entity that will store data of users that log into the system. This function can be used by admin.
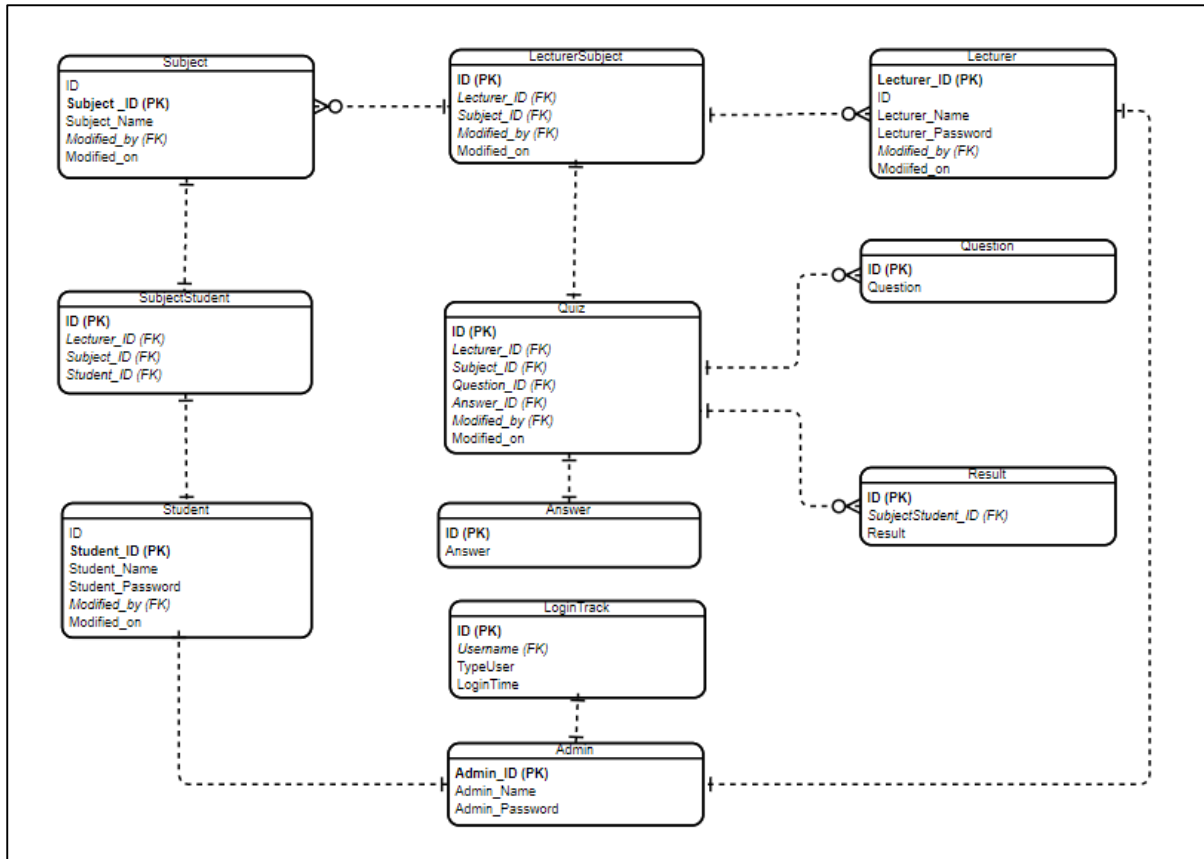
Figure 2: Entity relationship diagram for QuiZtudy

The functional requirement of a system is implemented to enable users to use the functions in the system. In QuiZtudy system, there eight modules. Each module has different authorized users that can use the function. For example, in module register, only admin can register users and other related data. The list of modules in the proposed system is shown in Table 2.

Table 2: Module in QuiZtudy

Module	Description
Login	Login to allow authorized user log into the system.
Registration	Allow admin to register users, subject and assign workload so that user have authorization to log into the system.
Workload	Can assign subject to the lecturer before lecturer can create quiz.
Create quiz	Create quiz for their workload.
Answer quiz	Allow selected user to answer quiz for registered subject
View result	Allow user to view result after finishing answering the quiz
Log activity	Allow admin to view users that log in, make changes during log in and time stamp of activities.
Logout	Allow user to logout from the system.

For each module, some users can use the function and some users cannot. For example, login module can be used by all users. Registration module only can be used by admin. Workload module is used by admin to give workload to lecturer, hence the lecturer is part of workload module. Create quiz module is develop only for lecturer while answer quiz can be used by students only. Lecturer and student can use view mark module as they have relation in quiz function. Log activity can only be used by admin and few parts for lecturer only in terms of viewing which student login into the system during the system. Logout module can be used by all users to logout from the system after the done using it.
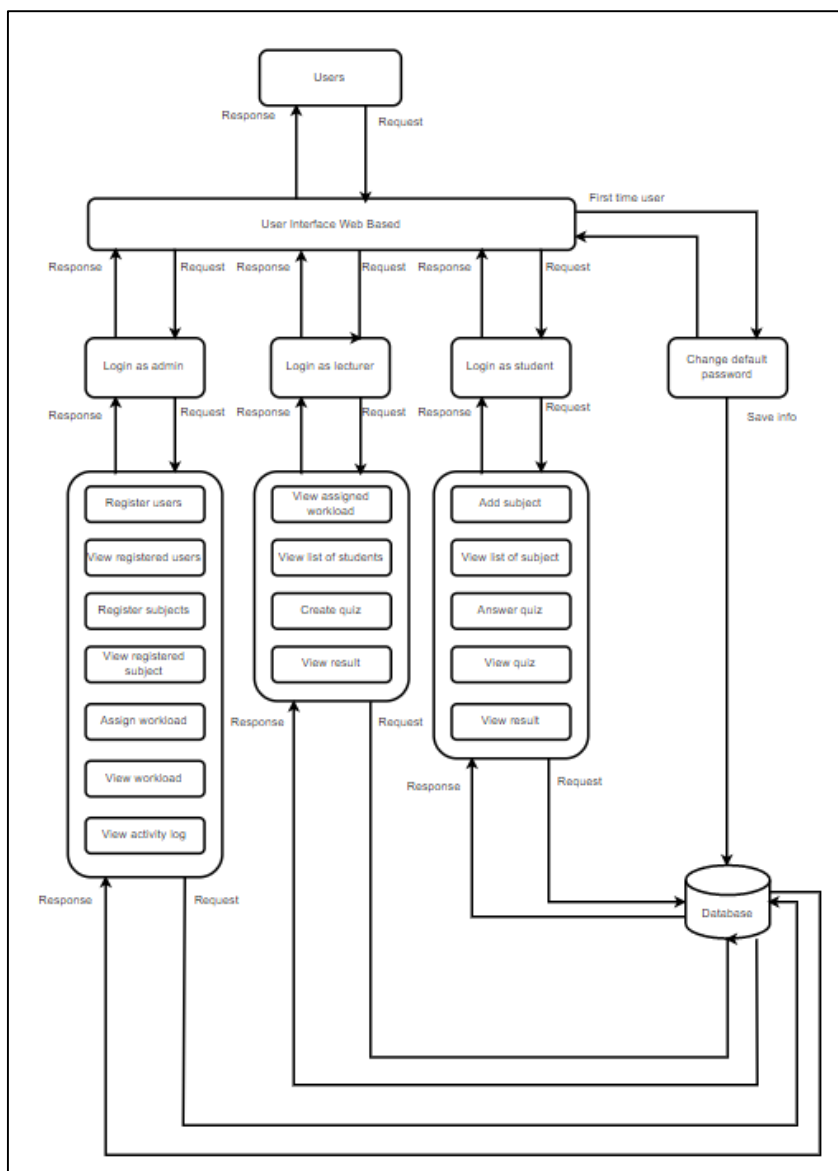

Figure 3: System architecture design of QuiZtudy system

System architecture design of proposed system, data logging for quiz system is shown below in Figure 3. It shows the modules contain in the proposed system. The data and information that will be obtained from users will be stored in the database. The modules will request and response with the database.

4.   System Implementation and Testing

In this section, the source codes of important part were shown to enhance the functionality of the system. The codes include functionality of proposed modules and security features to ensure the confidentiality, integrity, and availability. It discussed on implementation of security module and eight

modules for QuiZtudy which are login, registration, create quiz, workload, answer quiz, view result, log activity, and logout.

First, all users will have to go to login page to choose and click which users they are. Figure 4 displayed the login page for all users. Then users will be redirected to their respective homepage according to each role.
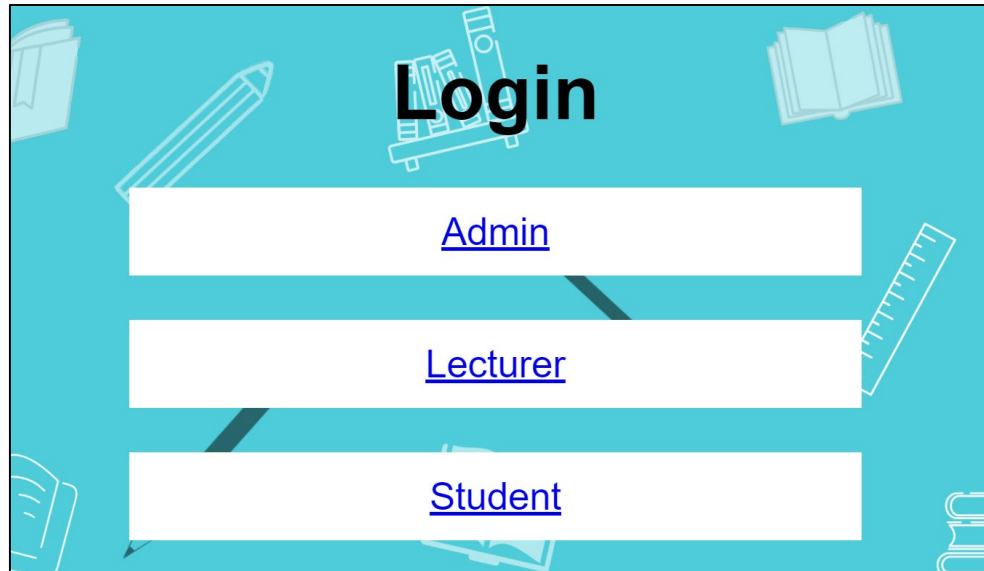

Figure 4: Index page for all users before redirected to respective login page.

4.1   Implementation in security

In QuiZtudy, this system implemented password before users can use the functions such as register, answer quiz, and create quiz. The security was implemented based on code in Figure 5 and 6. It is to keep the online quiz system secure is password protection by asking users to login to keep using the QuiZtudy.
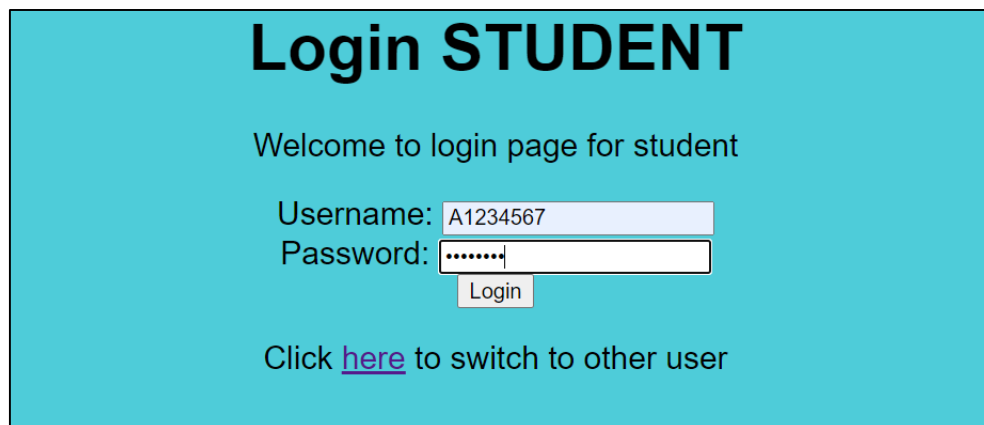

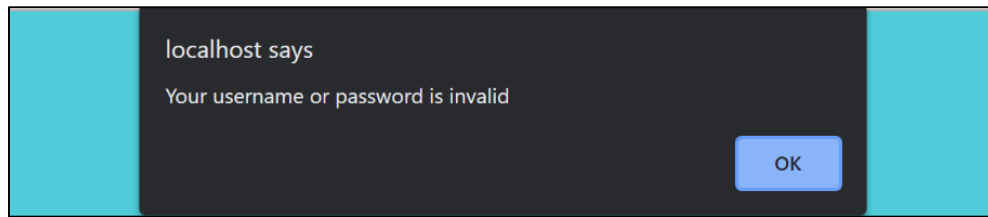**Figure 5: User entered username and password in the text box**

Figure 6: Interface when user entered wrong credential

Figure 5 shown that the user entered the username and password. The action is resulted from the wrong username or password inserted. When the wrong username or password is put, the page will display pop up with notice "Your username or password is invalid" as shown in Figure 6. QuiZtudy does not mentioned which entities are wrong, therefore there will be less possibilities to guess the username and password.

4.2   Implementation in modules

There are eight modules that was proposed to be developed for this QuiZtudy system. The modules include all users which are admin, lecturer, and students. Each of them do have same modules and different modules. For example, all users have modules for login and logout. However, only admin has the function of registering the users and subjects. Admin also will assign workload to lecturer.

As for lecturer, they can view workload assigned to them and can create quiz based on the workload. Meanwhile, students can register the subject according to their program and can answer the quiz when it is available. Figure 7 displayed on of the login page for admin users.
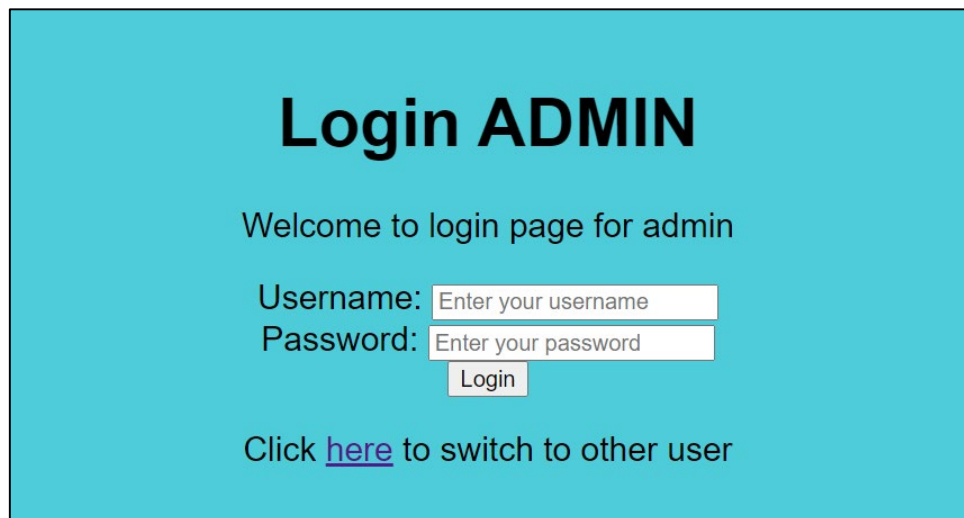

Figure 7: Login page for admin user

Figure 7 showed one of the user interfaces for admin users which is login page. Before admin can use the system, admin needs to enter their username and password into the text box. This login page will authenticate the authorized users for each module. Any users that do not match entered username and password with the stored data will be denied their authentication.

No	Username	Type of User	Login Time
1	1	Admin	2021-06-24 00:49:43
2	1	Admin	2021-06-25 23:55:08
3	1	Admin	2021-06-26 02:29:29
4	2	Admin	2021-06-26 13:06:33
5	1	Admin	2021-06-26 16:56:09
6	2	Admin	2021-06-26 16:56:30
7	1001	Lecturer	2021-06-26 17:19:07
8	1001	Lecturer	2021-06-26 17:22:28
9	2	Admin	2021-06-26 17:47:57
10	1001	Lecturer	2021-06-26 17:53:58
11	1001	Lecturer	2021-06-26 18:06:28
12	1001	Lecturer	2021-06-26 18:08:52
13	2	Admin	2021-06-26 18:10:21
14	2	Admin	2021-06-26 18:10:54
15	2	Admin	2021-06-26 18:11:14

Figure 8: Interface of login history in admin module

Figure 8 showed the interface of login history in admin module which implementing activity log function. The activity log is implemented as login history so that the admin can check on which users had login into the system with their type of users. The type of users indicated that each user will be redirected to different homepage or index.

4.3   Test Plan

In this project, the testing is done to ensure that all the functionality works in terms of modules and security. Table 4 showed test plan for eight modules in QuiZtudy based on category in Table 4 and Table 5 displayed security testing on the QuiZtudy system.

Table 3: Test category

Test Category	Description
1	Test the functionality of the system will store and manipulate the create quiz data. System must allow add, view, and delete.
2	Test the functionality of the system will store and manipulate the answer quiz data. System must allow add and view.
3	Test the functionality of the system will store and manipulate the user detail data.

Table 3 explained on test category that divided the functionality test into three part which are create quiz data, answer quiz data and users' details. For category 1, create quiz, it is related with create quiz module and answer quiz category related with answer quiz module. Category 3 which is user details is related with registration module and workload module.

Table 4: Test Plan

Test Category	Description	Expected Results	Actual Result
3	Register admin i. Click on register admin function. ii. Insert Admin Id and Admin Name. iii. Click confirm to add new user.	New user admin is added in the system	Pass
3	Register lecturer i. Click on register lecturer function. ii. Insert Lecturer Id and Lecturer Name. iii. Click confirm to add new user.	New user lecturer is added in the system	Pass
3	Register student i. Click on register student function. ii. Insert Student Id and Student Name. iii. Click confirm to add new user.	New user student is added in the system	Pass

Table 4 discussed testing of QuiZtudy system that focused on users details category. It is included registration of users such as admin, lecturer, and student. Other than that, there is also testing on registration of subject and assignation of workload. In addition, the user details category also tested on update and delete functions to allow modification if needed.

Table 5: Security check list for QuiZtudy system

No	Check List	Actual Result
1	Password should not be visible in the textbox during login.	Pass

Table 5 discussed on security checklist available in the QuiZtudy system. This system is focused more on password as all users use this feature compared to other security features. Other than that, the password that was stored in the database is hashed to ensure that no one can know password for each user. It is to protect the privacy and confidentiality of the data.

The implementation in the system include frontend for end user to understand more ways to use QuiZtudy and backend to communicate between the system and server. The testing for module implementation and security part is done to ensure that the system can be used in the future.

5. Conclusion

The development of QuiZtudy system is one of the initiatives to help students and educators to be more alert on the participants in the teaching and learning session. As education systems impacted with the current pandemic Covid-19, the change must be embraced to ensure that lifespan of education system does not fall and will give severe result to students. The activity log in the QuiZtudy is hoped to help teacher ensure that no students miss their learning. In the future, QuiZtudy are suggested to add more security features to keep the data private and confidential so that no data breach can happen. Therefore, development of QuiZtudy that implement the activity log in the quiz system may solve insufficient logging risk by recording student that that login into the system during quiz session to detect students that do not participate in the quiz session.

References

[1]   J. Zhou, M. Mori, and H. Kita, "Using the multi-mouse quiz system for quiz making activities in an elementary school," in 2012 IIAI International Conference on Advanced Applied Informatics, 2012, pp. 93–96, doi: 10.1109/IIAI-AAI.2012.27.

[2]   N. S. Malik, N. Tomar, and O. Chaudhary, "Online quiz application," Int. J. Adv. Res. Dev., vol. 4, no. 5, pp. 26–28, May 2019.

[3]   N. A. Bowling, J. L. Huang, C. B. Bragg, S. Khazon, M. Liu, and C. E. Blackmore, "Who cares and who is careless? Insufficient effort responding as a reflection of respondent personality.," J. Pers. Soc. Psychol., vol. 111, no. 2, p. 218, 2016, doi: https://doi.org/10.1037/pspp0000085.

[4]   C. K. Brower, "What Are You Looking At? Using Eye-Tracking to Provide Insight into Careless Responding.," PhD dissertation, Dept. of Psych., Wright State Univ., Dayton, OH, 2020.

[5]   J. R. Jain and A. Asaduzzaman, "A novel data logging framework to enhance security of cloud computing," in SoutheastCon 2016, 2016, pp. 1–6, doi: 10.1109/SECON.2016.7506764.

[6]   C. Wickramage, T. Sahama, and C. Fidge, "Anatomy of log files: Implications for information accountability measures," in 2016 IEEE 18th International Conference on e-Health Networking, Applications and Services (Healthcom), 2016, pp. 1–6, doi: 10.1109/HealthCom.2016.7749426.

[7]   F. Rivera-Ortiz and L. Pasquale, "Automated modelling of security incidents to represent logging requirements in software systems," 2020, pp. 1–8, doi: 10.1145/3407023.3407081.

[8]   M. Badra and R. Borghol, "Long-term integrity and non-repudiation protocol for multiple entities," Sustain. cities Soc., vol. 40, pp. 189–193, Jul. 2018.

[9]   M.-K. Yoon and Z. Shao, "ADLP: Accountable Data Logging Protocol for Publish-Subscribe Communication Systems," in 2019 IEEE 39th International Conference on Distributed Computing Systems (ICDCS), 2019, pp. 1149–1160, doi: 10.1109/ICDCS.2019.00117.

[10]   L. Zeng, Y. Xiao, H. Chen, B. Sun, and W. Han, "Computer operating system logging and security issues: a survey," Secur. Commun. Networks, vol. 9, no. 17, pp. 4804–4821, 2016, doi: 10.1002/sec.1677.

[11]   R. A. K. Duncan and M. Whittington, "Creating an immutable database for secure cloud audit trail and system logging," in Eighth International Conference on Cloud Computing, GRIDs, and Virtualization, Feb. 19-23, 2017, Athens, Greece. IARIA Conference, 2017.

[12]   R. Umer, A. Mathrani, T. Susnjak, and S. Lim, "Mining Activity Log Data to Predict Student's Outcome in a Course," in Proceedings of the 2019 International Conference on Big Data and Education, 2019, pp. 52–58, doi: 10.1145/3322134.3322140 .

[13]   E. P. Saputra, Supriatiningsih, Indriyanti et. al, "Prediction of Evaluation Result of E-learning Success Based on Student Activity Logs With Selection of Neural Network Attributes Base on PSO," in Journal of Physics: Conference Series, 2020, vol. 1641, no. 1, p. 12074, doi: 10.1088/1742-6596/1641/1/012074 .

[14]   B. Motz, J. Quick, N. Schroeder, J. Zook, and M. Gunkel, "The validity and utility of activity logs as a measure of student engagement," in Proceedings of the 9th International Conference on Learning Analytics & Knowledge, 2019, pp. 300–309, doi: 10.1145/3303772.3303789.

[15]   D. Aulia and I. Waspada, "The design of exploratory application and preprocessing of event log data in lms moodle-based online learning activities for process mining," Khazanah Inform. J. Ilmu Komput. dan Inform., vol. 5, no. 2, pp. 124–133, 2019, doi: 10.23917/khif.v5i2.8023 .

[16]   Y. Abdelaziz, "Responsibility, Trust, and Monitoring Tools for End-User Account Security," Master disseration, Dept. of Psych., Carleton University, Ottawa, ON, 2018.

[17]   R. Jadhav, P. Khaire, S. Kamble, S. Popalghat, R. Thakur, and P. Tekade, "A Review on Preventing Professional Network by Using Human Behavioral Activity Log," Int. J. Recent Innov. Trends Comput. Commun., vol. 6, pp. 64–67, Mar. 2018.

[18]   P. Michelberger and S. Dombora, "A possible tool for development of information security-SIEM system," Ekon. J. Econ. Theory Pract. Soc. Issues, vol. 62, no. 1350-2019–2051, pp. 125–140, 2016, doi: 10.22004/ag.econ.288703.

[19]   T. Sridhar, V. Vivek, and R. Shekhar, "Seclogmon: Security in cloud computing using activity log for consumer data protection," in 2017 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2017, pp. 1458–1462, doi: 10.1109/RTEICT.2017.8256839.

[20]   M. S. Gharajeh, "Waterative model: An integration of the waterfall and iterative software development paradigms," Database Syst. J, vol. 10, pp. 75–81, Sept. 2019.