Enhancing Student Cyber Security Education through a Personalized Web-Based Learning System using Keller's PSI

BY

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A REPORT

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ABSTRACT

In this digital era of globalization, cybersecurity knowledge is critical for everyone, especially students ready to enter the information technology (IT) field. This Final Year Project aims to develop a web-based platform to enhance students' understanding of cyber security. This platform will offer an interactive learning module which is covering a variety of topics. For instance, cybersecurity, ethical hacking, digital forensics, and cyber defence practices.

This proposed solution leverages modern web technologies to create an engaging and accessible learning environment. Through this platform, students will have an opportunity to explore and learn about some of the theoretical concepts, participate in practical exercises, and test their skills through simulated scenarios on the platform. Other than that, this platform will include some of the features such as progress tracking, quizzes, and forums to facilitate collaborative learning and knowledge sharing among peers.

The use of Keller's Personalized Instruction System (PSI), which enables students to study at their own speed, is a crucial aspect of the curriculum. By ensuring that students fully grasp each idea before moving on, this self-paced, mastery-based approach boosts their confidence and expertise in cyber security. The idea of this Final Year Project is significant because of its contribution to addressing the growing need for cybersecurity education. This platform's goal is to develop a new generation of cybersecurity professionals who can mitigate emerging cyber dangers by providing students with relevant information and skills.

Area of Study: Web-based learning

Keywords: E-learning, Virtual Learning Environment (VLE), Self-Paced Learning, Educational Platform, Gamification in education, Personalized learning, Interactive learning

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LIST OF ABBREVIATIONS

Keller PSI   Keller Personalized System of Instruction

HTML   Hypertext Markup Language

CSS   Cascading Style Sheets

NPM   Node Package Manager

CLI   Command Line Interface

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Chapter 1

Introduction

1.1   Introduction

In this digital era, cyber security is critical due to increasing cyber threats. From phishing scams to ransomware, these threats are becoming more sophisticated than ever [1]. Traditional classroom learning often lacks the practical experience necessary for students to effectively enter the field of Information Technology. This project aims to provide a user-friendly online environment, especially for students, where they can study fundamental cyber security ideas including network security, cryptography, ethical hacking and more. For instance, WBLE which is a Web-Based Learning Environment [7]. It is a platform that the UTAR student to get the latest course material and to get this latest announcement from there such as the due date of the assignment. The platform attempts to close the gap between theoretical knowledge and practical skills through interactive modules, simulated situations, and progress monitoring features [8]. This will enable students to become cybersecurity experts who can handle real-world threats. This project also uses Keller's Personalized Instruction System which stands for Keller's PSI.

So, what is Keller's PSI? Keller's PSI is a teaching method that lets students learn at their own pace and focus on mastering each topic before moving on. This is especially useful in cyber security too, where it is crucial to thoroughly understand and apply complex concepts. By combining Keller's PSI flexible, self-paced learning with interactive modules and hands-on scenarios, the platform will help students develop the skills needed to tackle real-world cyber security challenges.

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1.2 Problem Statement and Motivation

The need for skilled cybersecurity professionals is growing rapidly, but certain students frequently struggle to obtain the real-world experience and practical knowledge necessary for successfully addressing cyber threats. Additionally, the current cybersecurity education materials may not have effectively engaged students or provided interactive learning opportunities to support skill development in subjects such as cyber security, encryption, and ethical hacking. There is an urgent need for a customized cyber security learning platform that provides immersive, web-based modules and simulated scenarios to equip students with the practical skills and knowledge necessary to succeed in the information technology (IT) field.

Other that than, the high cost of cyber security training, including fees for advanced tools, lab infrastructure, up-to-date resources, and skilled instructors, often limits students from receiving a quality education due to budget constraints. So, developing a web-based cybersecurity learning platform provides a cost-effective solution to remove financial barriers to skills development in the field, democratizing cyber security education and increasing inclusivity. The platform leverages existing technology to provide an accessible and engaging learning experience, solving the affordability issues associated with traditional training methods.

Next, traditional cybersecurity education often lacks participation and interactivity, and static lectures cannot attract students' interest. This passive approach leads to lower retention rates and hinders students' ability to apply theoretical knowledge. Web-based cyber security learning platforms can address these challenges by introducing interactive modules and simulations that promote active learning and practical skill development in an engaging, hands-on format. This approach can enhance student motivation and improve knowledge retention, thereby promoting a deeper understanding of cyber security concepts. However, to further enhance the effectiveness of this approach, it is critical to integrate Keller's PSI. With this point, Keller's PSI allows for self-paced learning and allows students to focus on thoroughly mastering each concept before moving on. This way can make sure that the students not only engage more deeply with the material but also gain a deeper understanding of cyber security principles, which is critical for real-world applications.

By combining the benefits of an interactive web-based learning module with Keller PSI's personalized, mastery-focused approach, the platform will provide a comprehensive and

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engaging learning experience that better prepares students to meet the demands of the cyber security field.

The motivation for this Final Year Project stems from the growing importance of cyber security education in today's digital environment. In addition to theoretical understanding, students also need to prepare practical cybersecurity skills due to the increased frequency of cyber-attacks and the widespread use of technology. Traditional classroom learning often lacks the hands-on experience and interactive elements needed to prepare students to effectively deal with real-world challenges in the Information Technology (IT) field. By developing a web-based cybersecurity learning platform, we aim to bridge this gap and provide students with educational resources that are accessible, engaging, and immersive.

Other than that, the driving factor of the Final Year Project was the integration of Keller's Personalized Instruction System (PSI) into the learning process. In this point, Keller's PSI allows students to learn at their own pace, and make sure they fully grasp each concept before moving on. This self-paced, mastery-focused approach is particularly effective in cyber security education where deep understanding and the ability to practically apply knowledge are critical. So, through Keller's PSI integration into a web-based platform, this project aims to enhance the learning experience and provide students with personalized support to help them build confidence and expertise in cyber security.

In a nutshell, this Final Year Project is motivated by a desire to provide the next generation of IT professionals with the expertise and confidence needed to protect digital assets and effectively mitigate evolving cyber threats. While benefiting from a learning approach that adapts to individual needs.

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1.3   Project Objectives

The project aim is this platform will focus on creating interactive and engaging learning modules covering essential cyber security topics. Other than that, the purpose of this project is:

First objective: To create interactive learning modules using Keller PSI.

- To create an interactive and user-friendly Web-Based Learning platform for students to learn at their own pace.

Second Objective: To evaluate the effectiveness of the platform

- To know that this platform attracts students to visit the website and helps them learn and enhance their understanding of cybersecurity.

Third Objective: To develop a web-based cyber security learning platform for students

- To create an interactive online system that educates students about cybersecurity concepts.

Overall, this project aims to create an interactive web-based platform that helps students learn cybersecurity at their own pace. It focuses on making learning easy and engaging, while also checking if the platform effectively improves students' understanding and interest in cybersecurity.

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1.4   Project Scope and Direction

The scope of the project is to create a user-friendly web-based cybersecurity learning platform especially, for UTAR students. This platform focuses on practical cybersecurity, it is covering topics such as cybersecurity, cryptography and ethical hacking through interactive modules and simulated scenarios. The goal is to help students bridge the gap between theoretical knowledge and real-world skills so they can effectively address cybersecurity challenges.

To enhance the learning experience, the project will include Keller's Personalized System (PSI). This approach allows students to study at their own pace, ensuring they have mastered each topic before progressing. The integration of Keller's PSI will add a personalized learning component to the platform, providing customized support and encouraging deeper understanding.

The scope of this includes designing and implementing an intuitive online environment with interactive features and progress tracking, developing attractive modules for practical skills development, ensuring accessibility across all faculties of UTAR, and providing comprehensive documentation. By integrating Keller's PSI, this project will increase students' cybersecurity awareness and provide them with practical skills to defend against cyber threats, promoting proactive cyber security practices and confidence in managing digital assets in today's connected world.

The direction of the Final Year Project will be developed step by step to create a web-based cyber security learning platform for UTAR students. The first step is to research the existing tools and understand students' needs to make sure the platform meets their requirements. Next, the project will focus on designing and developing a user-friendly platform that will have interactive modules on topics such as cryptography. With this point, Keller's Personalized Instruction System (PSI) will be added to allow students to learn at their own pace, ensuring that they fully understand each topic before moving on.

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After the platform is designed, content is created, including some mini-games and quizzes. It will be integrated into the platform, with features to track student progress and provide personalised feedback. This Web-Based Learning platform will then be tested with a group of UTAR students to gather feedback and make improvements based on their experience. After testing and refining, the platform will be used more widely and continually monitored to see how well it helps students learn. Lastly, the entire project will be documented, and a report will be prepared to summarize the work.

1.5 Contributions

This project at the end will benefit UTAR students by increasing their cybersecurity awareness and providing some of the information on cybersecurity. The developed web-based platform will be available to students across all the faculties, it will provide them with some additional knowledge to protect their personal information from hackers. Students will learn how to prevent hacking incidents and gain some strategies to respond effectively when they are faced with cybersecurity issues. Overall, the program will equip UTAR students with practical cybersecurity skills to protect themselves and their digital assets in today's connected world.

1.6   Report Organization

This report consists of a total of seven chapters. In the **first chapter**, the report begins with an introduction to the project, followed by problem statements such as the lack of engagement and practical learning in cybersecurity education, high cost of training, and limited flexibility in traditional teaching methods. Next, the chapter also presents the motivation behind the project, the project objectives, the project scope and direction and contributions. Finally, this report organization section to give readers a clear overview of the structure of the report.

Chapter two presents about the literature review, focusing on web-based learning, Keller's Personalized System of Instruction (PSI), and relevant previous research. This chapter provides an overview of how modern e-learning approaches compare to traditional learning, the strengths and weaknesses of past systems, and how PSI improves student engagement and learning outcomes. It also includes a table comparing three selected research papers and

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highlights proposed solutions that inspired this project. Lastly, it also have summary for the Literature Review.

Chapter three outlines the system methodology/ approach or system model used for the project. This includes the adoption of the Agile Software Development Life Cycle (SDLC), system and functional requirements, tools and technologies used (such as Firebase and Visual Studio Code), and project milestones. It also discusses the estimated cost of the project, which is kept at zero by using free development tools, and ends with a concluding remark about the development process.

Chapter four focuses on the System Design of the Web-Based Learning platform. This chapter contains the system architecture diagram, use case and activity diagrams for student and lecturer interfaces, as well as detailed flowcharts describing each core feature such as login, choose subject selection, mini games, tools, chat, forum, profile, questionnaire, dashboard, and more. The chapter also presents the database design and the overall data flow within the system.

Chapter five details the system implementation phase. It explains the hardware and software setup, configuration of Firebase, and how the platform was developed, tested, and deployed. Screenshots of key features and interface components are included to provide a visual walkthrough. This chapter also discusses implementation challenges, including tool integration and real-time data handling, and finishes with a brief concluding remark.

Chapter six evaluates the performance and outcome of the Web-Based Learning platform. It presents the results of a student feedback questionnaire, system testing using test cases for each activity, a discussion on project challenges encountered, and an evaluation of how well the project met its objectives. This chapter ends with a concluding remark on the project's effectiveness.

Chapter seven concludes the report and provides recommendations for future improvements. The conclusion summarizes the key achievements and impact of the project. Besides, the recommendations suggest potential upgrades such as add more advanced cybersecurity topics, implement a deeper gamification element, enhance mobile accessibility, and introducing a dedicated penetration testing module to improve the learning experience further.

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Chapter 2
Literature Review

2.1 Web-Based Learning

Nowadays, many people learn through online platforms like YouTube and various educational websites. Web-based learning is a prime example of this, offering features such as online course content. Additionally, web-based learning often includes static pages with printable course materials. By simply clicking a link, users can easily access web-based information. A Virtual Learning Environment (VLE) typically includes additional features like discussion forums, chat sections, online assessments, student activity tracking, and course management. A VLE provides learners with a platform to share information and engage in discussions about assessments.

2.2 Review Keller's Personalized System of Instruction

Keller's Personalized System of Instruction, also known as the Keller Plan. It is a strong teaching model that allows students to learn at their own pace, and make sure they can master every topic before moving on [13]. This way is suited for the web-based cybersecurity learning project, it also can help students focus on challenging areas and personalize their learning experience. In this e-learning platform, PSI can be implemented by breaking content into quizzes, mini-games, or modules, and providing feedback to ensure understanding. The system also tracks progress, allowing students to learn flexibly and effectively master the material.

2.3   Table Comparison 3 previous research paper

Research	Function	Result
How Computers Have Impacted Personalized Systems of Instruction [10]	Focusing on self-paced, mastery-oriented learning, it explores how digital tools enhance content delivery, assessment, and feedback within the PSI model, ultimately	The integration enhanced student motivation and performance, making PSI more adaptable across various educational settings.

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	facilitating personalized learning.	
Deep Reinforcement Learning for Cyber Security [11]	It explores DRL methods and discusses their effectiveness in improving cyber security measures as complexity increases.	The study shows that DRL methods enhance the adaptability and effectiveness of cybersecurity systems, particularly against evolving cyber threats.
Analyzing Students' Self-Perception of Success and Learning Effectiveness Using Gamification in an Online Cybersecurity Course [12]	The goal is to identify key aspects of game design that influence students' perceptions and to evaluate the overall effectiveness of incorporating optional gamified elements into the curriculum.	The results show that gamification in cybersecurity courses positively impacts students' self-perceptions of success and leads to higher academic achievement.

Table 2.3.1: Comparison 3 previous research paper

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2.4 Previous Work

2.4.1 Web-based learning: The effectiveness compared to traditional classroom learning environments.

(S.Sharma & S.Garg, 2016) [2] proposed research paper is about the research assessing its effectiveness compared with the traditional classroom learning environment. As the traditional method is face-to-face [6] and the E-learning is less face-to-face. This paper aims to manage the performance of learners using two different learning environments which is Web-based virtual learning environment and traditional classroom learning environment. This research is selected 150 students as a sample and tested them as the experimental group and control group. A chosen sample of students entering a network-based virtual learning environment is referred to as the experimental group, while the same sample entering regular classroom settings is referred to as the control group. Environments are classified using different learning environment dimensions (Piccoli et al., 2001) [4]. These dimensions are time, space, place, technology, interaction, and control. Table 2.4.1.1 shows that the contrast between the two-learning environment which is Web Based Virtual Learning Environment (WBVL) and Traditional Classroom Learning Environment (TCL) using the Dimensions (Piccoli et al., 2001) [4]. Both groups were tested to find out the differences between the two learning environments. For the experimental analysis, it has invited 150 students out of the group of 75 learners which choose as experimental group. The 75 learners were guided in a virtual environment which is the web-based learning where learners were informed the course would be the web-based course. So, this part of learners was not required come to the classroom to learn the course. They would use the leaning platform which called **Moddle** as their technical interface for the course. The Moddle is a learning management system (LMS) that was created to give teachers, administrators, and students access to a unified, secure, and reliable platform for customizing learning environments [3]. For another 75 learners were using the traditional method learning environment. From the research [2], it also has made research to show the result as the Table 2.4.1.2. The Table 2.4.1.2 shows the student participate the class in different environment.

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Dimensions (Piccoli et al, 2001	Learning Environment	
	Web Based Virtual Learning Environment (WBVL)	*Traditional Classroom Learning Environment (TCL)*
Time	WBVL is an asynchronous environment which provides time flexibility to the learners and thus are free from instructors time control.	TCL are time bound and thus learning depends on the time allocated to the instructor.
Space	This refers to the learning materials and resources available to the learner which in case of WBVL is in abundance as the learner can use WWW for extracting useful information.	The material and resources are basically given by the instructors.
Place	This refers to physical location of instruction. In case of WBVL learner is free from geographical constraints and thus can have an access to resources and instructor anywhere, at any time.	In case of TCL, there exists physical association within the classroom between the learner and the instructor and also between learner- learner
Technology	The technology interface used to test the performance was Moodle	This uses learner instructor environment for examining the performance of learners
Interaction	In WBVL interaction is asynchronous where Moodle provides the functionality for learners to join different forums and chat with different users (learners or instructors)	Since this is a rigid environment thus provides interaction only between learner and instructor and learner- learners in the classroom.
Control	The control lies at the learner itself and to an extent some control lies at the instruction designer.	The entire control lies at the instructor itself.

Table 2.4.1.1 Contrast Dimension Between The Two Learning Environments

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Learning environment	Participants	Registered/ attended
Virtual	75	72
Traditional	75	75

Table 2.4.1.2 Learners Participation Table

Additionally, the Table 2.4.1.3 shows that Learners Term Evaluation in different environment. In this Table 2.4.1.3, it shows that even the performance did not different too much, but the Traditional Learning Environment scores it still higher than Virtual Learning Environment.

Learning environment	Participants	(average) Mid Term Evaluation	(average) Final Evaluation
Virtual	72	38	44
Traditional	75	41	42

Table 2.4.1.3 Learners Term Evaluation Table

Lastly, the research also shows that the total number of interactions in Table 2.4.1.4. It is show that the total number of interactions that occur between learners and teachers in a virtual learning environment. Moodle makes this possible by allowing users to join many forums for guidance (not always with a designated instructor) and participate in any discussion forum relevant to the user's learning goals [3]. Administrators of the technical interface have access to these conversations. Because we had administrative access for research purposes, we were able to record the frequency of contact.

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Interaction	Total	Percentage
By Instructor	*34*	*22.5*
By Learner	*117*	*77.4*
Subtotal	*151*	*99.9*

Table 2.4.1.4 Total Number of Interactions Table

2.4.2 Personalized System of Instruction (PSI) Models: Using Digital Teaching Materials on Learning with Pojok

(S. Juditya, A. Suherman, A. Ma'mun C, and A. Rusdiana 2019) [9] proposed research paper is about the Personalized System of Instruction (PSI) Models: Using Digital Teaching Materials on Learning. The aim of this paper is to explore how the Personalized Instructional System (PSI) model can be effectively used in conjunction with digital instructional materials to enhance the learning process, especially in physical education. Additionally, this article also aims to outline how digital technologies, when it combined with the PSI model, can improve student engagement, motivation, and learning outcomes by allowing students to learn at their own pace and receive their personalized feedback. Technology is essential for physical education since its unique learning emphasis is continually being developed. In this article, it also shows that the integration of digital instructional materials into the PSI framework is being to explore in various educational contexts. The digital instructional materials like online tutorials, interactive modules, and simulations. It is offering a modern approach to learning that can significantly increase student retention and engagement. In this research, it has used a digital teaching material application called POJOK. This POJOK application is developed to help teachers and students have benefit from technology in physical education. It features several key displays for example, firstly is POJOK PEBELAJARAN in figure 2.4.2.1, It is a interface of the interface of the application, it shows that some teaching materials for many type of sport is categorized by the basic competencies of the physical education co-curriculum. For instance, large ball category has basketball and football, small ball category have table tennis and badminton, and other activities such as martial arts and sport activities. In this section have provide step-by-step movement techniques and instructional videos to help students have a better understanding, learn and absorb the material. Secondly which is POJOK SISWA section in figure 2.4.2.2. It is a student corner feature. This section is for record their

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learning outcomes after the learning process. It will record the process in the achievement column and record the difficulties they are encountered in Difficulties column. Thirdly which is some learning material in figure 2.4.2.3. This section is to show that it focusses on more detailed presentation of the learning material such as some instruction and YouTube video links. To gain extra helpful information.

Figure 2.4.2.1 POJOK PEBELAJARAN

Figure 2.4.2.2 POJOK SISWA

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Figure 2.4.2.3 Learning Material

2.5 Strengths and Weakness

Strengths and Weakness 2.4.1

The strengths in this previous study show that the good practical application. For example, like Moodle that mention in the studies. It can effectively support students by providing access to materials, discussions and feedback. It makes online learning more organized and interactive, like traditional classroom. Other than that, the relevant findings is the second strengths in this study. This study found that when traditional classrooms are slightly better a bit than online learning in some aspect. The online environments like Moodle can provide valuable teacher to student interaction. This helps the educators understand how online learning can complement traditional methods.

Previous study (S.Sharma & S.Garg, 2016) [2] did not shows that the learners and instructor are familiar with the Moddle. Other than that, this research did not really know the student have really focus on the Virtual Learning Environment. The reason is the Virtual Learning Environment Learner has less interaction with the instructor when the class have a lot of people, or the student or learner not interested. Probably some of them might not fully focus on that environment.

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Strengths and Weakness 2.4.2

Keller's Personalized System of Instruction is a powerful learning tools for education. Previous studies (S. Juditya, A. Suherman, A. Ma'mun C, and A. Rusdiana 2019) strengths were focus on Self-Paced Learning. This is because the article mentions the important of self-paced learning, which is a core aspect of PSI. This is very important for the project, it is because it support the idea that students can learn at their own pace, which is essential for learn and master about the complex cyber security concepts. Besides, it also enhances on digital learning. The article says that the integration of digital teaching materials with PSI, which is an essential for modern education. Which means it provide a valuable insight into how digital resources can be improve student engagement, motivation, and subject mastery, it is very directly applicable to this eLearning platform.

However, these techniques also have several weaknesses. One the most weakness are student self-discipline and motivation; it needs a very high level of independence that not all students possess. Additionally, the digital teaching materials may limit by technological issues and problem. For example, device access and internet connectivity, which may prevent some of the students from fully engaging in the learning process.

2.6 Proposed Solutions

This project aims to create a virtual learning environment that enables learners or students to fully concentrate when learning cyber security knowledge. Typically, VLEs include features such as chat rooms, discussion boards, online testing, student network usage monitoring, and course management [5]. The research project should develop a more interesting virtual learning environment and separate some classes to have an appropriate number of students in one class. This will ensure that students can concentrate on the subjects they are learning.

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2.7 Summary for Literature Review

In summary, the literature review highlights the evolution and effectiveness of web-based learning, emphasizing its widespread adoption and the integration of virtual learning environments (VLEs) for enhanced educational experiences. Keller's Personalized System of Instruction (PSI) is recognized as a powerful model for self-paced, mastery-oriented learning, particularly suitable for complex subjects like cyber security. However, challenges such as student motivation, self-discipline, and technological limitations are identified as potential drawbacks. Besides, the proposed solution for the project involves creating a VLE specifically tailored to cybersecurity education, focusing on engagement and effective student management to ensure a conducive learning environment.

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Chapter 3

System Methodology/Approach OR System Model

Proposed Method/Approach

The project was developed in different phases, including designing, developing, implementing, and evaluating effective online learning experiences. Additionally, Keller's Personalized System of Instruction will be applied during the implementation phase to ensure students learn effectively.

3.1 Software Development Life Cycle Model

The Software Development Life Cycle (SDLC) model is a time- and cost-efficient method used by development teams for designing and creating high-quality software.

3.1.1 Agile model
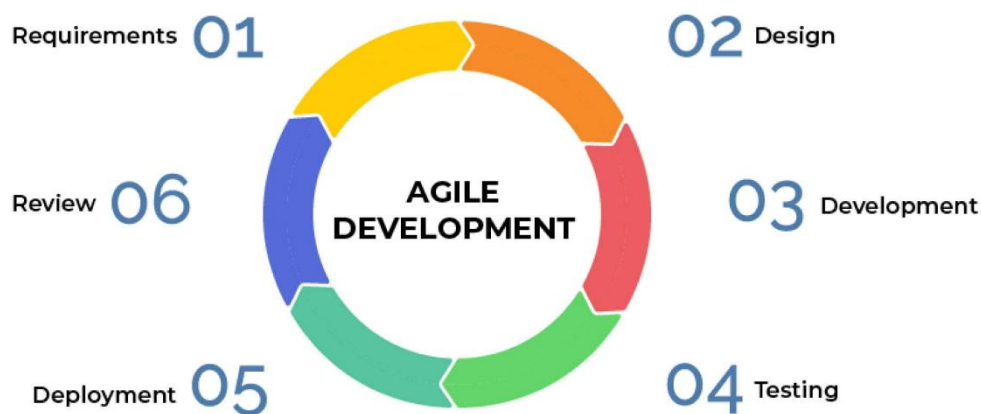
Figure 3.1.1.1 Agile Model

For this project, I used the Software Development Life Cycle (SDLC) model, specifically the Agile model. The Agile model is a software development methodology that emphasizes incremental and iterative development with a strong focus on collaboration and feedback.

The Agile model that will be used for this project:

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1. Continuous Improvement
   o To enable ongoing improvements in both functionality and security measures, ensuring the system remains up-to-date and effective.
2. Collaboration
   o Ensure that the Web-Based Learning interface is user-friendly and enhances the learning experience.
3. User-Centric
   o Address bugs or issues based on user feedback to improve overall user experience.

3.1.2 Phase

The Agile model consists of six phases: Requirements, Design, Development, Testing, Deployment, and Review. This project will follow these six phases.

The first phase of this project is the Requirements phase. I began by gathering the necessary requirements for the Web-Based Learning system, such as user management, personalized learning paths, and software needs. Additionally, I defined the project scope, objectives, and goals. Once these elements were established, I created a plan and timeline to help manage the time and resources required for the project.

The second phase of this project is the Design phase. This phase involves designing the web-based learning system and its features, including the interfaces and system architecture. I have created prototypes, such as drafts, and defined the system architecture. Before getting into design process, it will be reviewed by users, including students, to ensure that it meets their requirements and expectations.

The third phase of this project is the Development phase. During this phase, I will build the web-based learning system, including its functions, design, interactive modules, and requirements specified by students. I will use Visual Studio Code to write the code for the

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layout, add features, and implement functionality. Additionally, I will test the system using Google Chrome to ensure everything runs smoothly.

The fourth phase of this project is the Testing phase. In this phase, I will initially test the web-based learning system myself to ensure it functions correctly. After I finish test the Web-Based Leaning system, I will send the system to students for testing to determine if it meets their needs and expectations. This phase also includes verifying that all features are working properly, and that the system meets the specified requirements.

The fifth phase of this project is the Deployment phase. In this phase, the web-based learning system will be released to the public and made available for users. I will deploy the code, ensuring that everything is properly set up and configured. Additionally, I will monitor the deployment to identify and address any issues or bugs that may arise. Once the deployment is complete, the Web-Based Learning system will be fully accessible to students.

The sixth phase of this project is the Review phase. In this phase, I will assess the performance and outcomes of the Web-Based Learning system. I will gather feedback from students after they have used the system to determine if it meets the project goals. Based on this feedback, I can make improvements, address any issues, and fix any bugs to enhance the system further.

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3.2 System Requirement

3.2.1 Hardware

The hardware involved in the project includes a computer, which is used for developing the website.

Description	Specifications
Model	Dell G15 5510
Processor	AMD Ryzen 5 5600H
Operating System	Windows 11
Graphic	NVIDIA GeForce RTX 3050 4GB GDDR6
Memory	8GB DDR4 RAM
Storage	512GB SATA SDD

Table 3.1 Specifications of laptop

3.2.2 Software

Visual Studio Code will be used as the development platform for building the web page. The web page will be developed using HTML, CSS, and JavaScript. Besides, Firebase will be integrated as the backend server. Firebase also will serve as the database to store user information and other related data.

3.3 Function requirements

To ensure the effective function of the system, the following requirements are put forward:

1. User Registration – The users should be able to use their email address to register an account. The users are also able to choose the role as Student or Lecturer. So, the user can access the Web-Based Learning.

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2. Access Learning Material – The users' role as a student can access the learning materials in the system.

3. Access Mini Games – The users who as students should be able to access mini game section to play and easy way to learn about the subject.

4. Access Tools – The users' role as a student can use the tools provided in the system.

5. Global Chat – The users who as students or lecturers should be able to chat with each other for information exchange in real-time.

6. Forum – Users can visit the forum and post questions to seek help from other users.

7. User Profile – Users are allow to view their username, role and email address. It also can change their password in their profile.

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3.4   Project Milestones

This part shows the timeline of final year project 1 and final year project 2 with its milestones.

3.4.1   Final Year Project 1 Timeline

Figure 3.4.1 Gantt Chart of FYP 1 Timeline

According to Figure 3.4.1, the Gantt Chart of the FYP 1 Timeline, the early efforts were focused on developing the Web-Based Learning platform and discussing how to initiate the project. After five weeks, some prototypes were completed, including the profile section, a mini game (Hangman), and the main page. Throughout the entire Final Year Project 1 timeline, the project included five meetings with the supervisor to discuss progress. Additionally, the FYP 1 report was worked on from August 2, 2024, to September 6, 2024.

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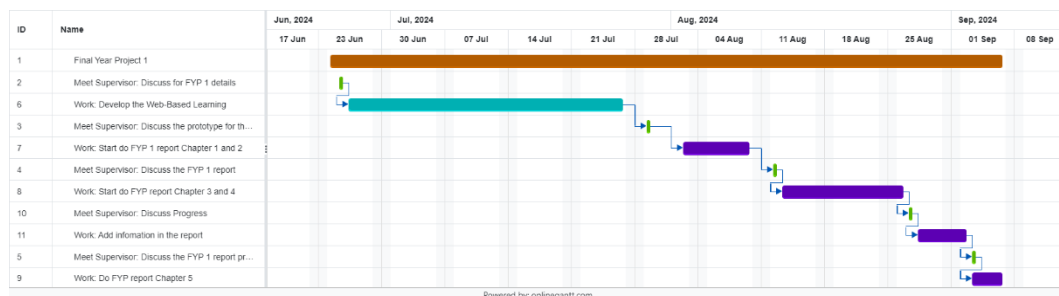
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3.4.2   Final Year Project 2 Timeline
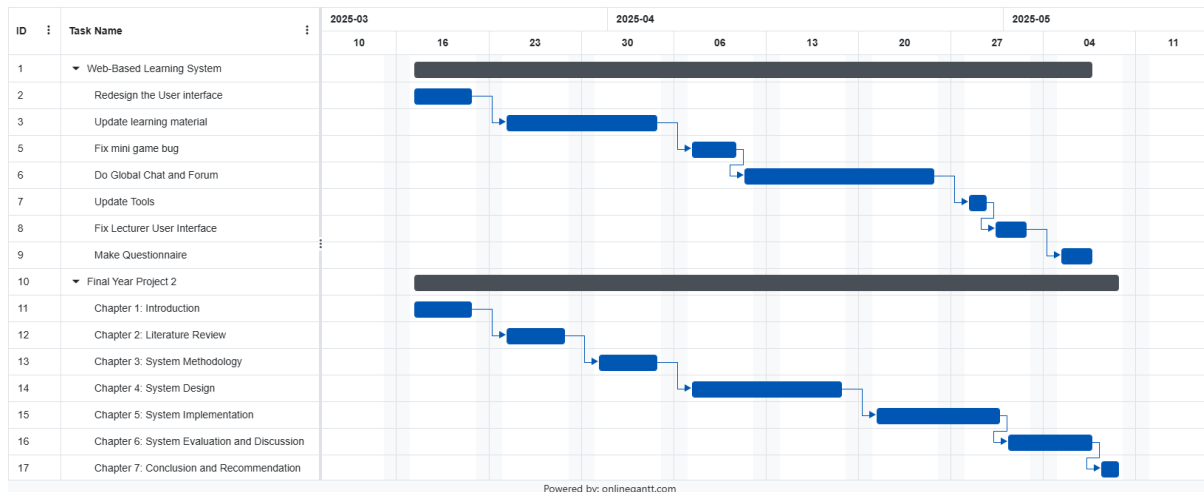
Figure 3.4.2 Gantt Chart of FYP 2 Timeline

According to Figure 3.4.2, the Gantt Chart of the FYP 2 Timeline, the early efforts were focused on redesigning the user interface and updating learning material.

In April, the process of updating the learning material continued until April 4, 2025. This was followed by fixing bugs in the mini-game and implementing the global chat and forum features, which extended until April 24, 2025. Subsequent tasks included updating tools, fixing the lecturer user interface, and making a questionnaire, all scheduled to be completed by early May.

Although the timeline focuses on the development of the web-based, it also provides information on the progress of the final project report 2. By mid-March, the first two chapters, which are the introduction and literature review, were completed. Next, the timeline shows that the remaining chapters, which are system methodology, design, implementation, evaluation, and conclusion with recommendations, will be completed by May 9, 2025.

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3.5   Estimated Cost

This web-based learning system uses hardware, which is a laptop. Next the software, which includes Visual Studio Code, Firebase, and Google Chrome. For the software, Visual Studio Code is a free Integrated Development Environment (IDE) that can download easily from its official website. So, no cost is needed. Other than that, Firebase offers a free plan. For example, some main features like Realtime Database and Authentication, which are important for real-time updates and user authentication in the system. These tools eliminate the need for any direct expenditure on software. For hardware, only a laptop is used to complete the coding and access the server. In conclusion, the estimated cost of developing this web-based learning system is zero Ringgit Malaysia.

3.6   Concluding Remark

The implementation of the Web-Based Learning system using the Agile model methodology allows for the creation of a cost-effective solution. Besides, by utilizing readily available resources such as Visual Studio Code and Firebase, the system has been designed to be both efficient and budget friendly. This way is to make sure that the web-based learning system can be developed without incurring any direct expenses, making it an ideal solution for students who want to learn cybersecurity knowledge without requiring high-end tools or infrastructure. Additionally, the flexibility of the Agile model supports continuous improvements and adaptations throughout the development process, ensuring that the system meets both functional and educational goals effectively.

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Chapter 4

System Design
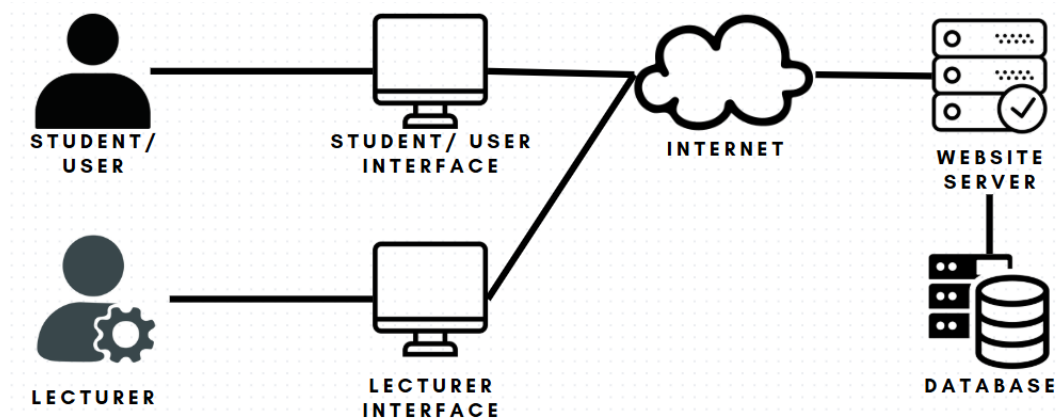
4.1   System Architecture Diagram

Figure 4.1.1 System Architecture Diagram for Web-Based Learning Cyber Security

In Figure 4.1.1 System Architecture Diagram for Web-Based Learning Cyber Security, the Web-Based Learning Cybersecurity platform demonstrates the components that interact to create a seamless learning experience. Students can access the platform through a user interface, which connects to the internet, allowing them to participate in mini-games, view learning materials, use tools, chat, forums, and more. Their requests are routed through the internet to the web server, which processes the data from the database. The database stores all essential data, such as user information, passwords, and subject content.

Additionally, the lecturer interface is used to manage the platform, including updating information and maintaining the database. This interface ensures that the platform remains connected to the web server and can be updated in real-time. Overall, this process guarantees that students can easily access the platform, while administrators can efficiently manage and update the system, providing an interactive and well-maintained learning environment.

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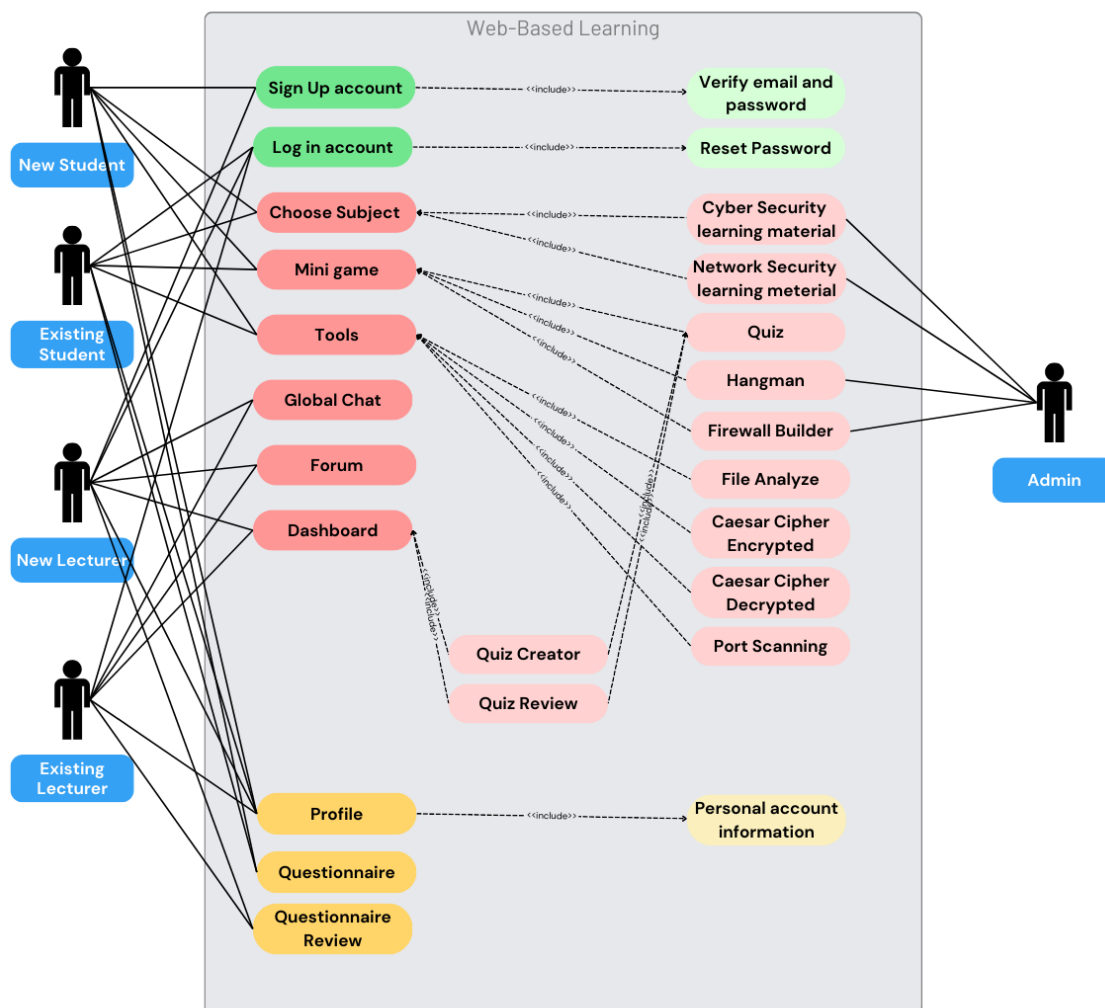
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4.2 Use Case Diagram

Figure 4.2.1 Use Case Diagram for Web-Based Learning Cyber Security

The use case diagram is a type of diagram used to visually represent the different ways that administrators and users, such as students and lecturers, interact with the system. It also helps illustrate the functional requirements of the system from both the admin's and users' perspectives. Based on the use case diagram, students are able to sign up, log in, reset their password, choose subjects such as Cyber Security and Network Security learning materials, play mini games, use various tools, chat via the global chat, ask and answer questions in the forum, view their profile, and complete questionnaires. In addition to having the same capabilities as students, lecturers are also able to create and review quizzes through the dashboard and view questionnaire reviews. Lastly, administrators are responsible for updating the learning materials and maintaining the mini games.

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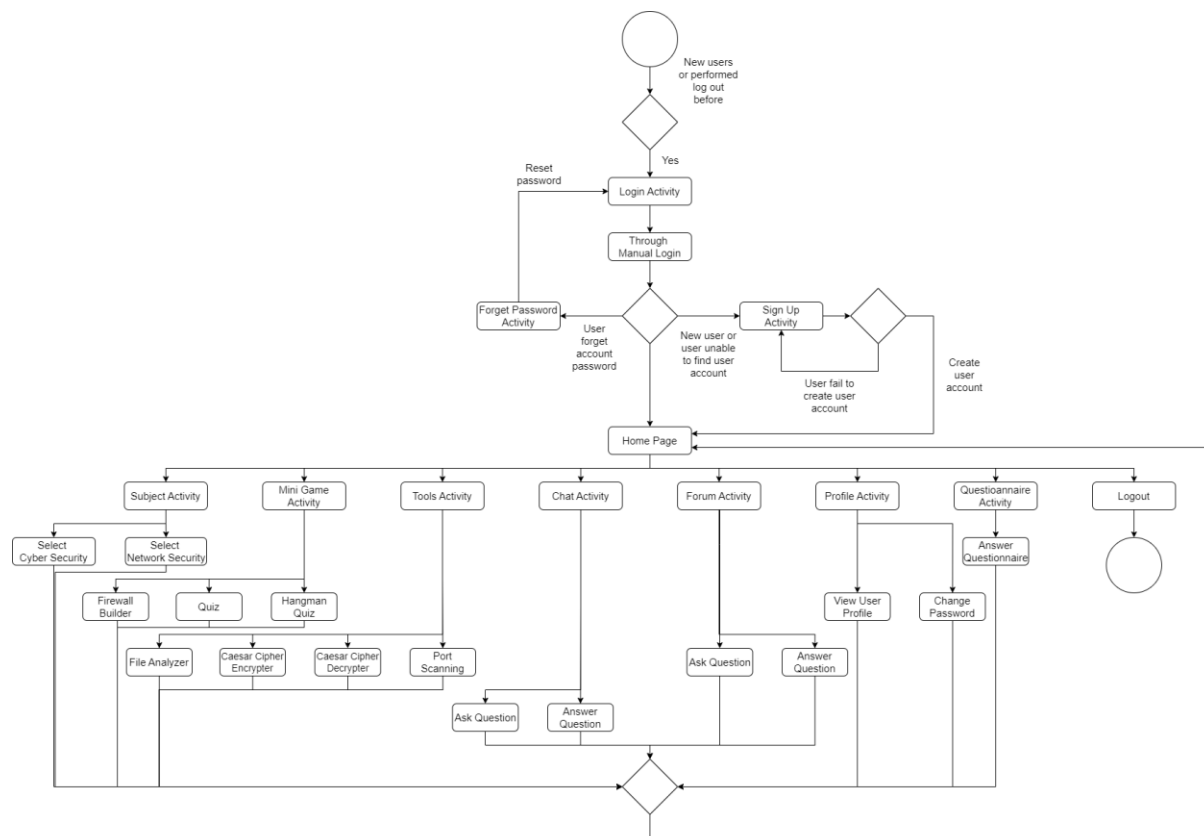
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4.3   Activity Diagram

Figure 4.3.1 Web-Based Learning System Activity Diagram (Student)

Based on Figure 4.3.1, users will first see the Login Page. Then, users can choose to log in manually or proceed to reset their password if they have forgotten it. When the user's authentication fails, users can be directed to the Sign-Up Activity to create a new user account. After successful registration, the users are directed to log in to the website homepage. For the users who are not new users, successfully authenticated and didn't manually log out from the system, they will be redirected to the home page, which consists of choose subject activity, mini games activity, tools activity, chat activity, forum activity, profile activity and questionnaire activity.

Users can choose subject activities, such are Cyber security or Network Security, to get the learning materials. Besides, user also can play some mini games like Quiz, Hangman Quiz and Firewall Builder. In addition, the Tools Activity provides access to four learning tools: File Analyzer, Caesar Cipher Encrypter, Caesar Cipher Decrypter, and Port Scanning. The Chat Activity and Forum Activity allow users to communicate by asking and answering questions. The Profile Activity enables users to view their profile or change their password. Users can

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also participate in the Questionnaire Activity to provide feedback through answering questionnaires. Finally, users may choose to manually log out from the system using the Logout function.
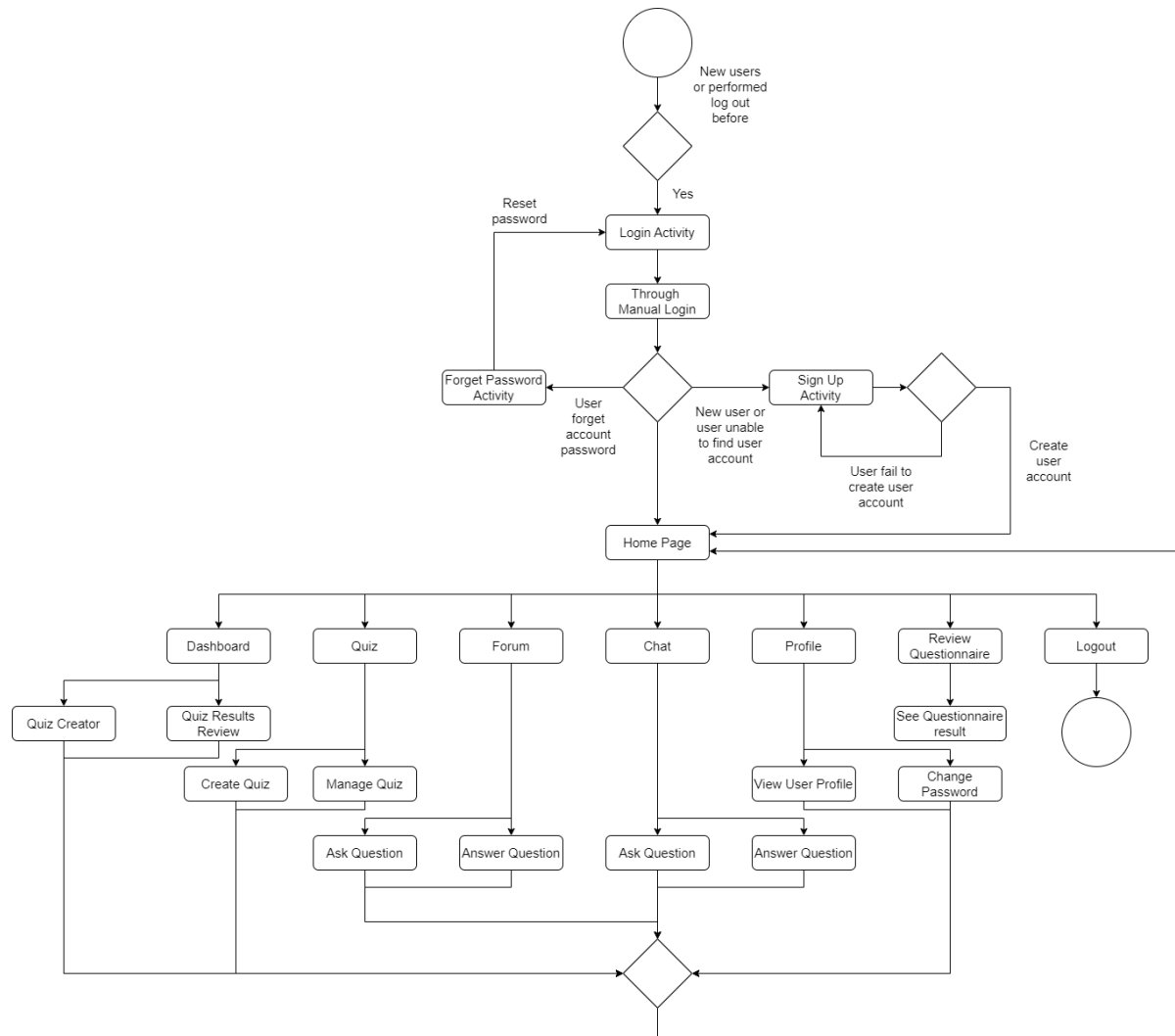
Figure 4.3.2 Web-Based Learning System Activity Diagram (Lecturer)

Based on Figure 4.3.2, when a user, who is the lecturer, first accesses the system, they are directed to the Login Activity. Here, users can choose to log in manually. If the users forget their password, they can proceed to the Forget Password Activity to reset it. Besides, If the user is new or unable to find their account, they can select the Sign-Up Activity to create a new account. Once the successful account creation, users are automatically redirected to the login

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page to access the main system. For returning users who have not manually logged out, the system will bypass the login screen and directly load the Home Page.

Next is the Home Page, where users can access a variety of activities. The Dashboard provides an overview of the user's progress and system activities, including options for lecturers to Create Quiz and Review Quiz Results. Other than that, the Quiz section allows users to attempt quizzes prepared by lecturers, testing their knowledge on various topics. Besides, the Forum activity also enables users to engage in discussions, ask questions, and share knowledge. Similarly, the Chat activity provides real-time communication for users to connect and collaborate.

Additionally, the Profile section allows users to view and update their personal information or change their passwords for better security. Not only that, but the Review Questionnaire section also enables users to participate in questionnaires, providing valuable feedback on their learning experience and reviewing their responses. Finally, the Logout option allows users to end their session securely, ensuring their account remains protected.

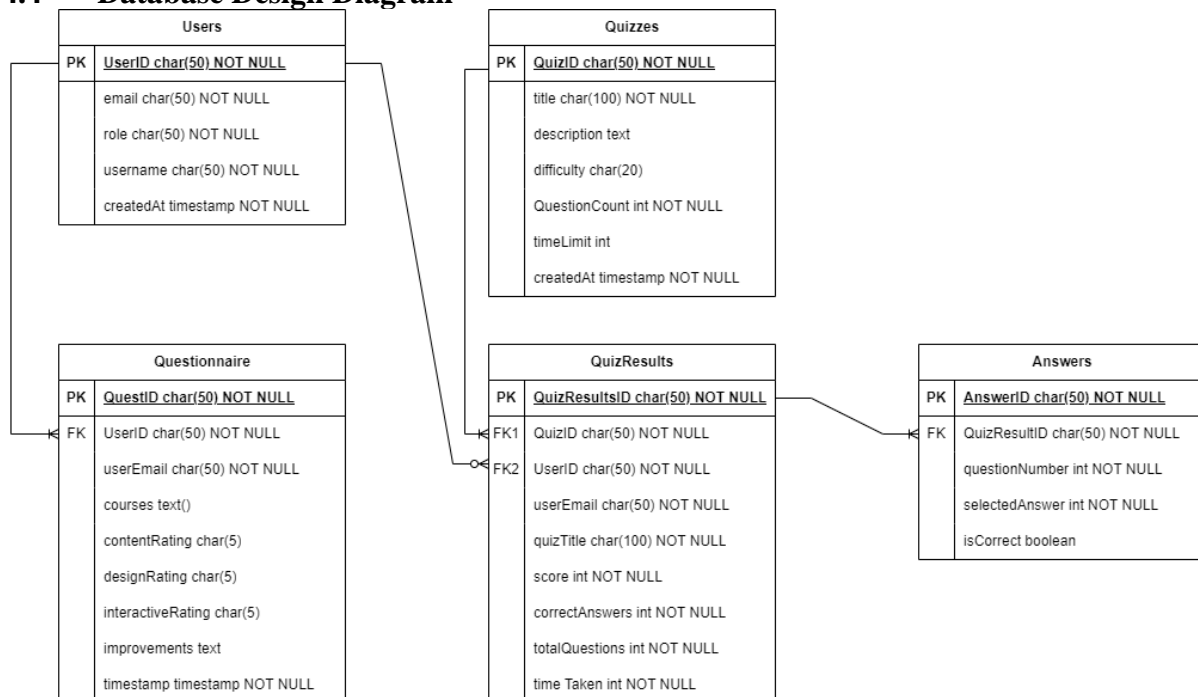## 4.4   Database Design Diagram

Figure 4.4.1 Database Design Diagram of Web-Based Learning System

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The Users table stores user information such as email, role, username, and createdAt. Each user is uniquely identified by the UserID primary key. Besides, this table is main for managing user authentication and security. It makes sure that every registered user is uniquely tracked within the system.

The Questionnaire table is linked to the Users table through the UserID foreign key. It also stores fields like userEmail, courses, contentRating, designRating, interactiveRating, improvements, and timestamp. So, this table is designed to collect user feedback and ratings about the learning experience.

Next, the Quizzes table contains information about each quiz available in the system. It includes fields title, description, difficulty, QuestionCount, timeLimit, and createdAt. Each quiz is uniquely identified by the QuizID primary key.

Not only that, the QuizResults table is used to store the results of quizzes taken by users. It links to the two table which are the Users table via UserID and the Quizzes table via QuizID. It also stores userEmail, quizTitle, score, correctAnswers, totalQuestions, and timeTaken. Each result entry is uniquely identified by QuizResultsID.

The Answers table is related to the QuizResults table through the QuizResultID foreign key. It records the individual answers submitted for each question within a quiz. It includes questionNumber, selectedAnswer, and whether the answer was correct (isCorrect). Each answer is uniquely identified by AnswerID.

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4.5   Flow chart

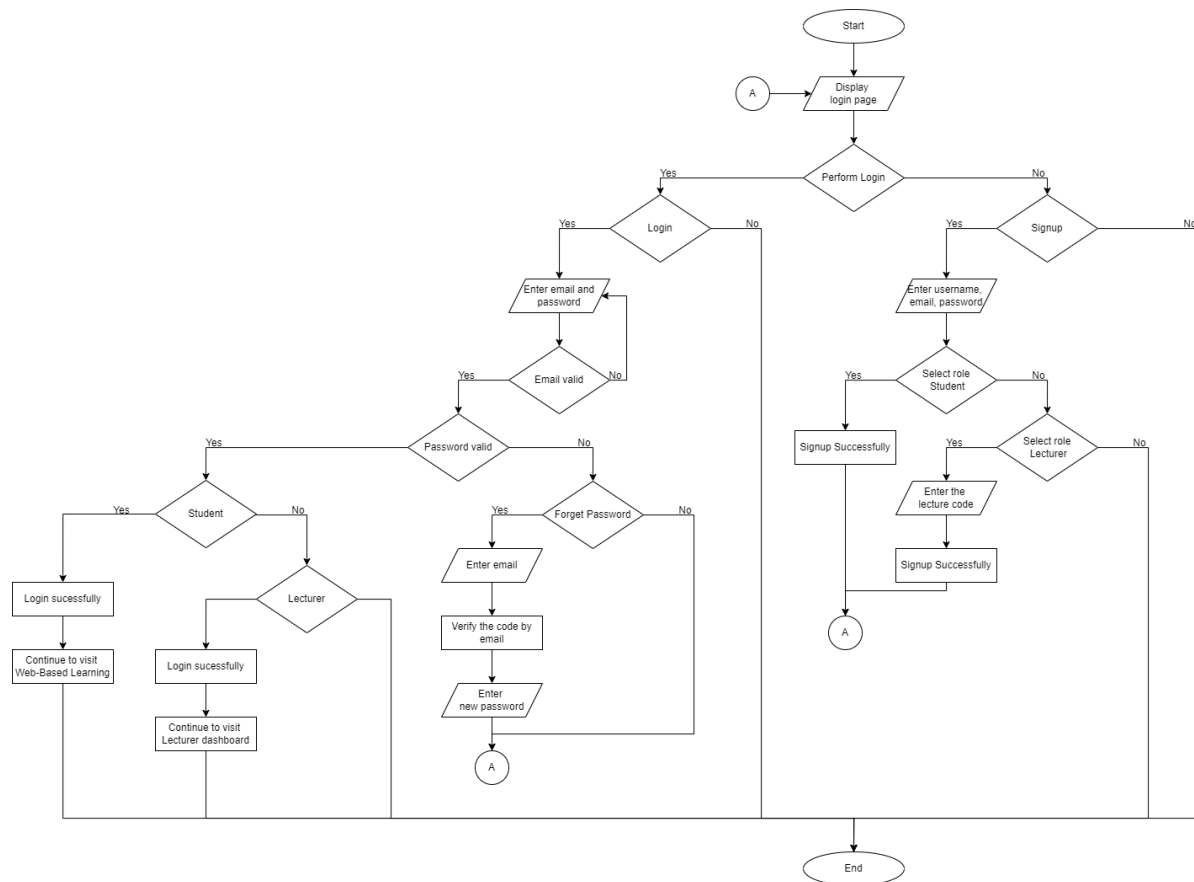### 4.5.1   Login and Sign-up activity (Student and Lecturer Interface)

Figure 4.5.1.1 Flowchart Login and Sign-up activity

The Figure 4.5.1.1 Flowchart Login and Sign-up activity shows the process for the website's login page. It allows students and lecturers to log in, register as new users, and reset their passwords. It begins with the login page. If user want to log in, they need to enter their email and password. Then, the system will verify this information. If verification fails, the user will sent back to the login page, indicating that the email or password is incorrect, or the account doesn't exist. Once verification is successful, the user can access the Web-Based Learning.

Additionally, is the signup section, students and lecturers can be distinguished separately. If they are student users, they can register a new account by providing information such as email address, username and password. However, if they are lecturer users. They need to provide information such as email, address, username and need to enter an additional code, which is "lecturer access code" to register. This process can easy to identify whether the user is student

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or lecturer. After the registration is completed, the system will go to login page. The user can log in with the new password to access the web-based learning webpage.

Next, if the user forgot the password and cannot log in. They can choose the "Forgot Password" option, which displays the password reset section. The system will pop up a reset password message to let the user fill in their email address. After that, the user will receive an email to reset their password. User can go through the link that the email sent to set the new password. After submitted, the password is successfully changed, and the user can log in with the new password.

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4.5.2 Subject activity (Student Interface)
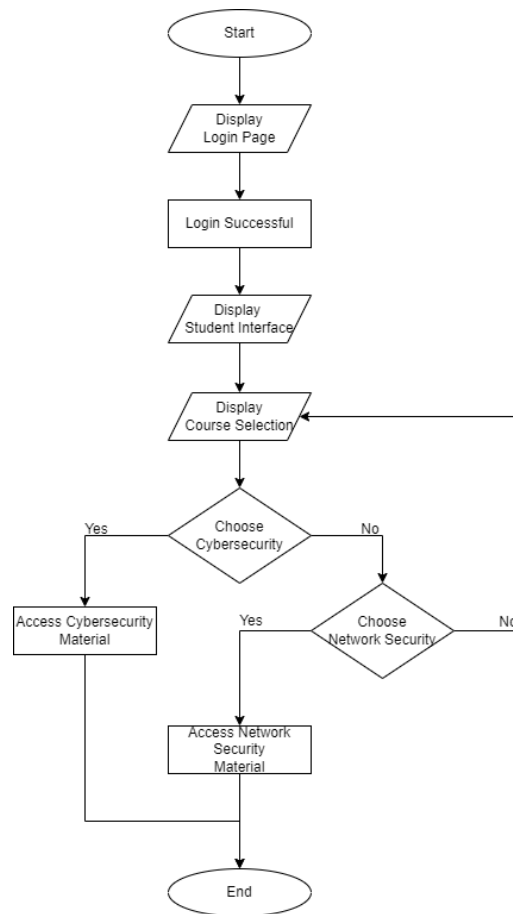
Figure 4.5.2.1 Flowchart of Subject activity

Figure 4.5.2.1 flowchart shows subject activity. After the user has logged in successfully. The Web-Based Learning platform has display subject selection at the main page. Users can select topics such as Cybersecurity or Network Security in the Subject section to access learning materials.

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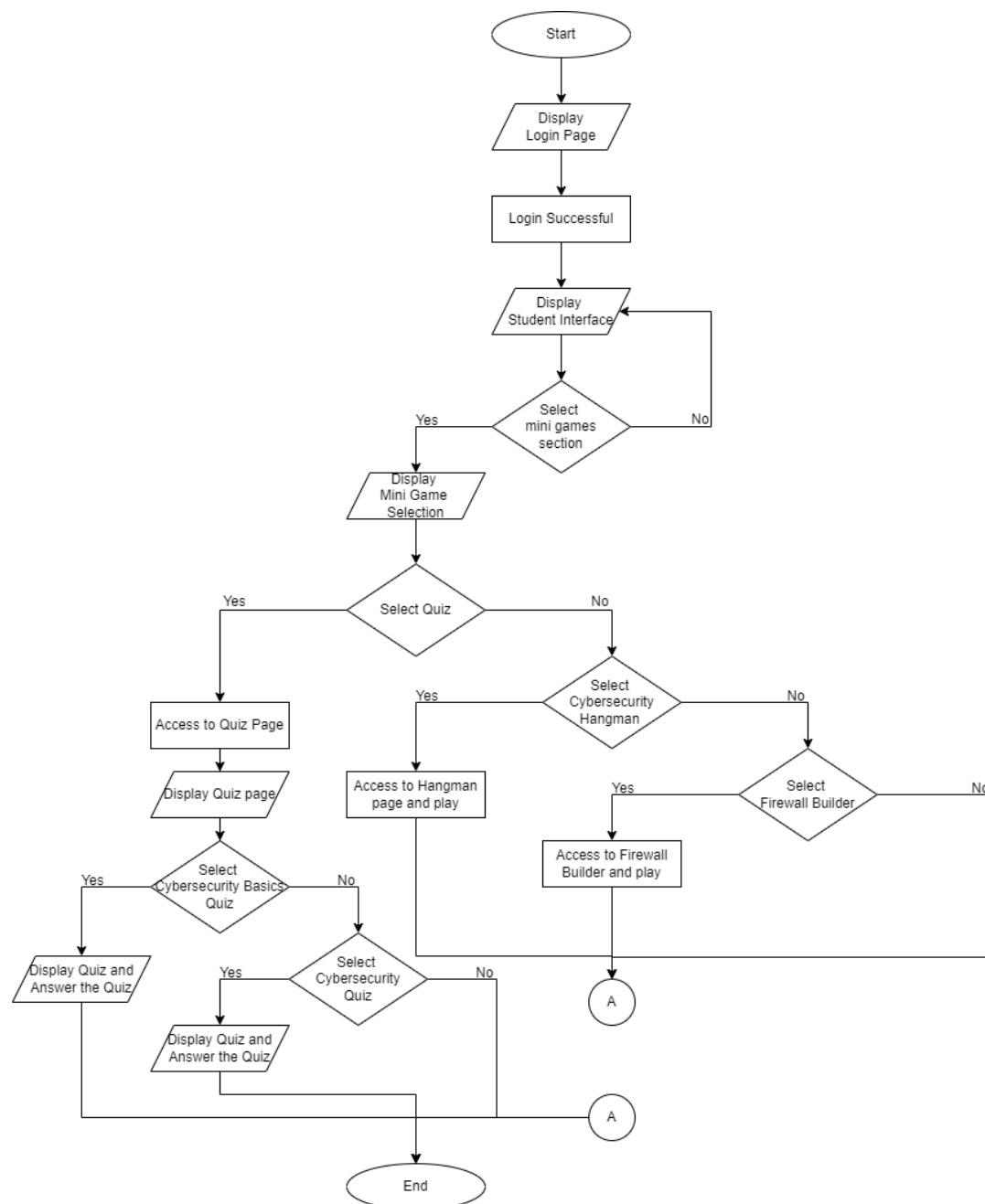### 4.5.3 Mini Game Activity (Student Interface)

Figure 4.5.3.1 Flowchart of Mini Game Activity

The Figure 4.5.3.1 is the Flowchart of the Mini Game Activity. After the user has logged in successfully. The student can choose mini game to play, such as Quiz, Hangman or the firewall builder. Firstly, the quiz section. The quiz section will show the quiz that was created by the Lecturer. So, students can answer the quiz in this section. Next, if the user chooses the Hangman game, students can guess the cybersecurity term while playing this game. Lastly, which is firewall builder. This game can let students learn how to prevent attackers from attacking the device by playing this mini game simulator.

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4.5.4 Tools Activity (Student Interface)
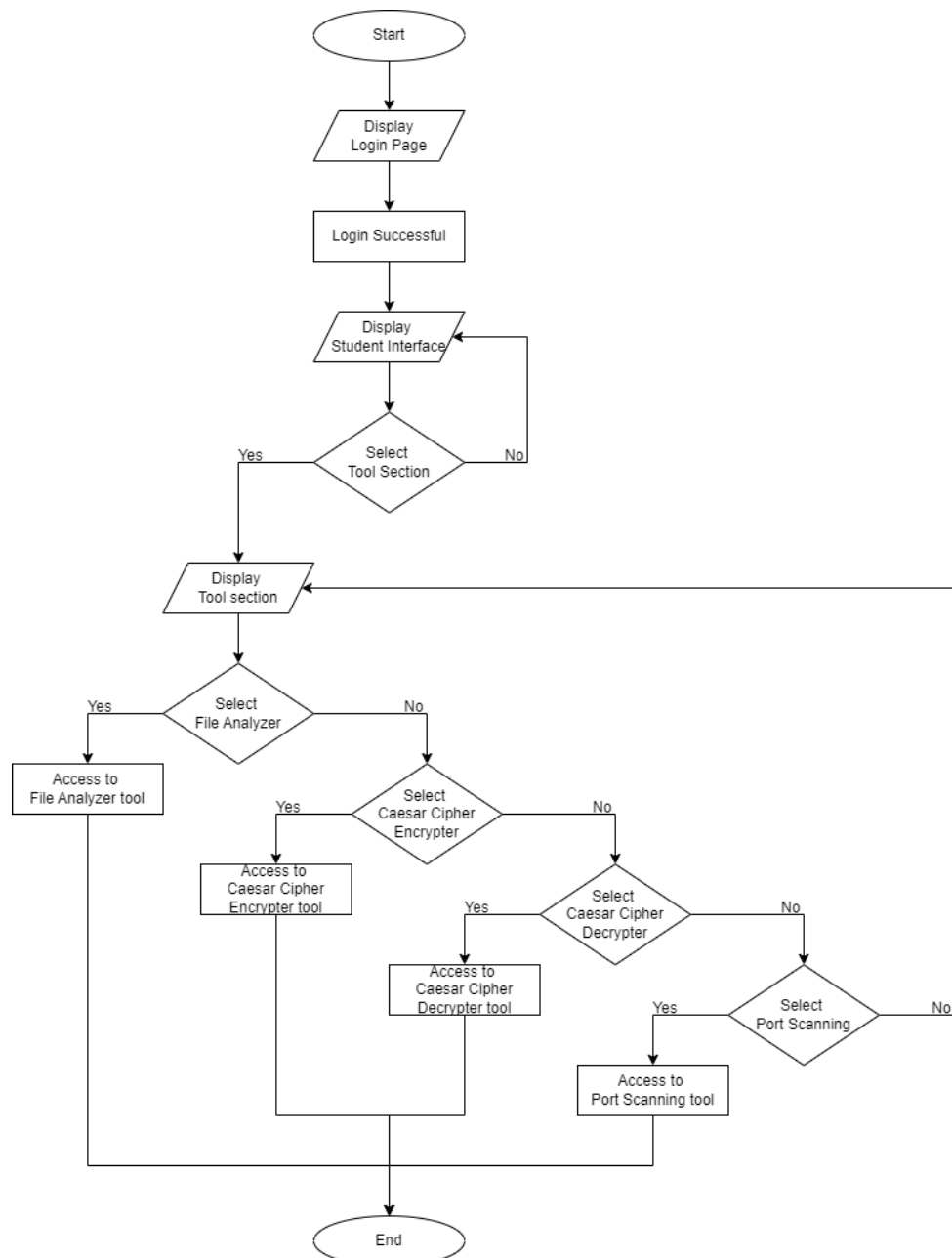
Figure 4.5.4.1 Flowchart of Tools Activity

The figure 4.5.3.1 Flowchart of Tools Activity shows the flowchart of Tools Activity. After the user has logged in successfully. Students can select the tools section in the navigation bar. In this tools section, it has four tools option to choose such as File Analyzer, Caesar Cipher Encrypted, Caesar Cipher Decrypted and Port Scanning.

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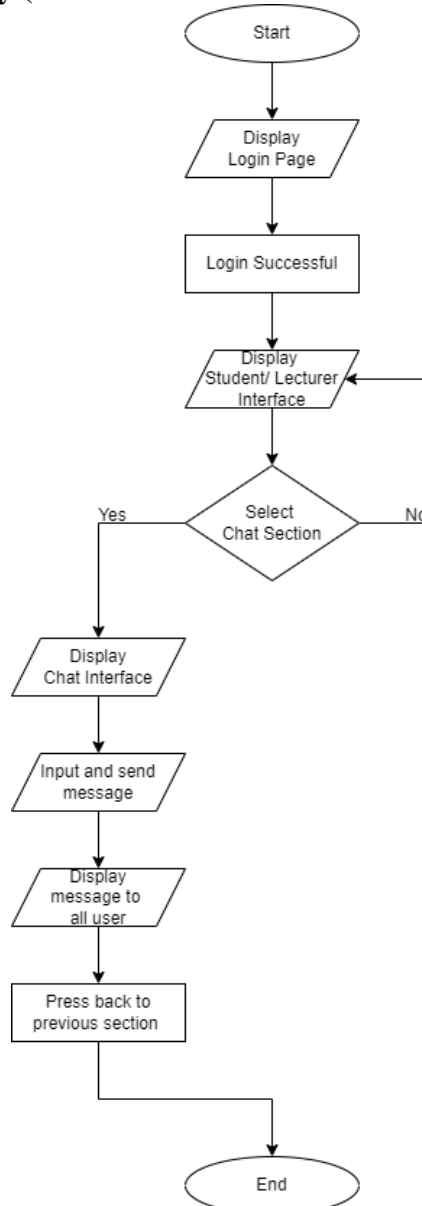**4.5.5 Global Chat Activity (Student and Lecturer Interface)**

Figure 4.5.5.1 Flowchart of Global Chat Activity

The Figure 4.5.5.1 shows the flowchart of Global Chat Activity. After the user has logged in successfully. Students can select the chat section to use the global chat in the navigation bar. In this global chat, it will display all the user chats and questions. Students were able to type the questions they didn't know and send them to the chat, such as UTAR's holiday, tutorial questions and more. Then wait for some students or lecturers to answer it. Students who sent the message can also help answer the other question using this global chat. Student also can click back to the previous section when they want to quit the global chat.

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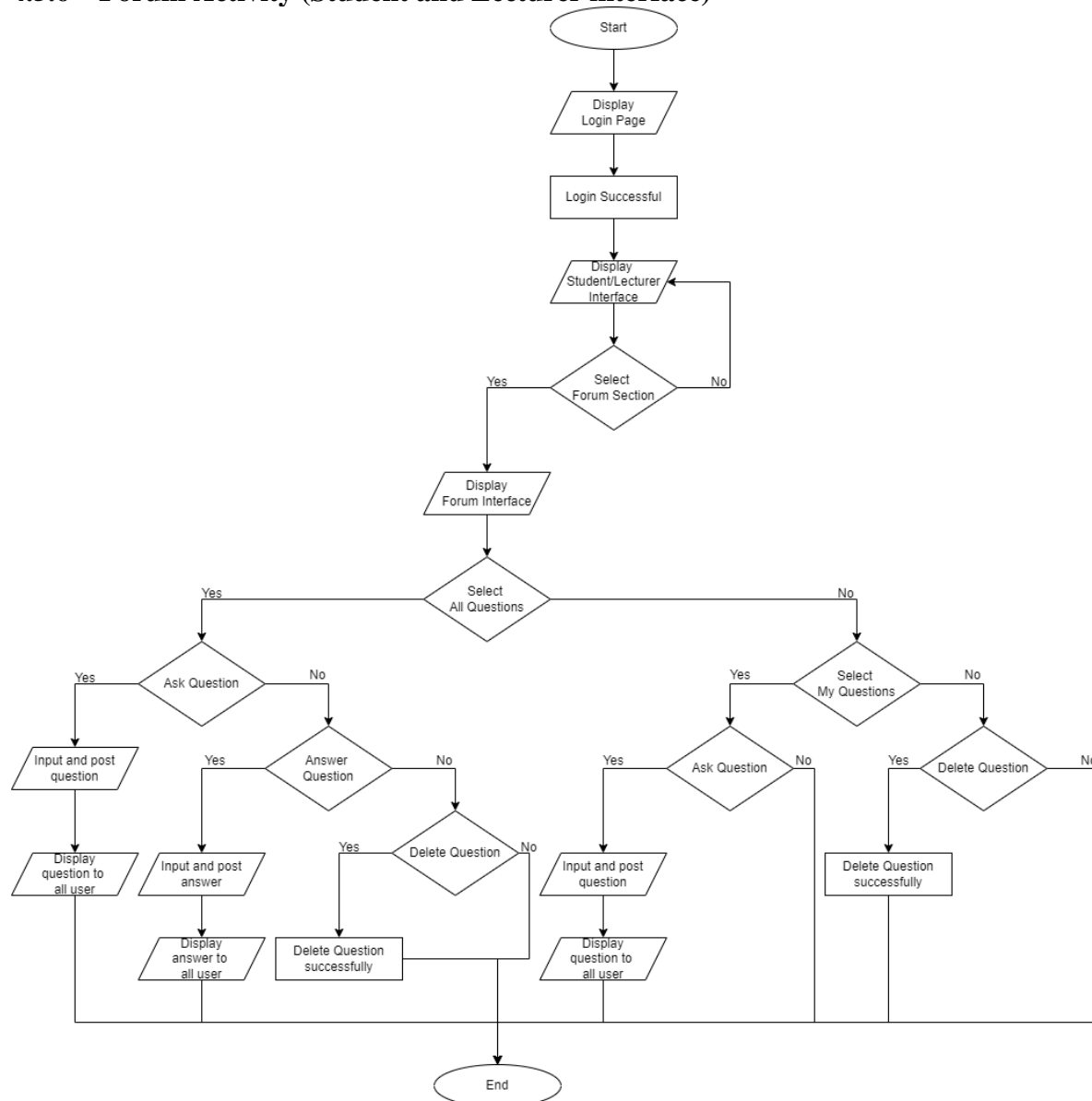### 4.5.6 Forum Activity (Student and Lecturer interface)

Figure 4.5.6.1 Flowchart of Forum Activity

Figure 4.5.6.1 shows the Flowchart of Forum Activity. After the user has logged in successfully. When the user decides to ask a question, they can choose the All Questions section, then fill up all the Question Title and Question Details and post it in this forum. Besides, users can also answer the question in the forum. Other than that, users can also delete the questions they have already asked. Not only can the user choose the All Questions, but the user can also select the My Questions section, this section it only shows the ask and delete questions that the user has asked.

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4.5.7   Profile activity (Student and Lecturer Interface)

Figure 4.5.7.1 Flowchart of Profile activity

The flowchart above indicates that the Web-Based Learning platform includes a Profile section. When users select this section, it displays their information, such as username, role, and email. Additionally, there is an option to change the password. If users feel their current password is insecure, they can manually update it in this section.

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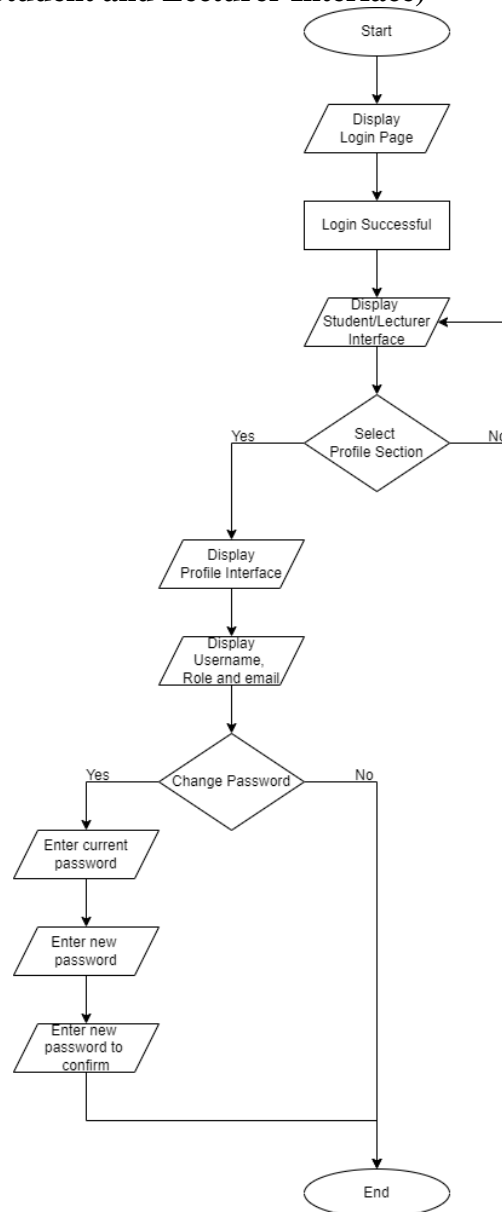
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4.5.8 Questionnaire activity (Student interface)

Figure 4.5.8.1 Flowchart of Questionnaire activity

The flowchart above indicates that the Web-Based Learning platform includes a Questionnaire section. When users select this section, it displays the feedback questionnaire. After the student fills up the questionnaire, they can submit it. If the student needs to redo the questionnaire, they can also press the reset button.

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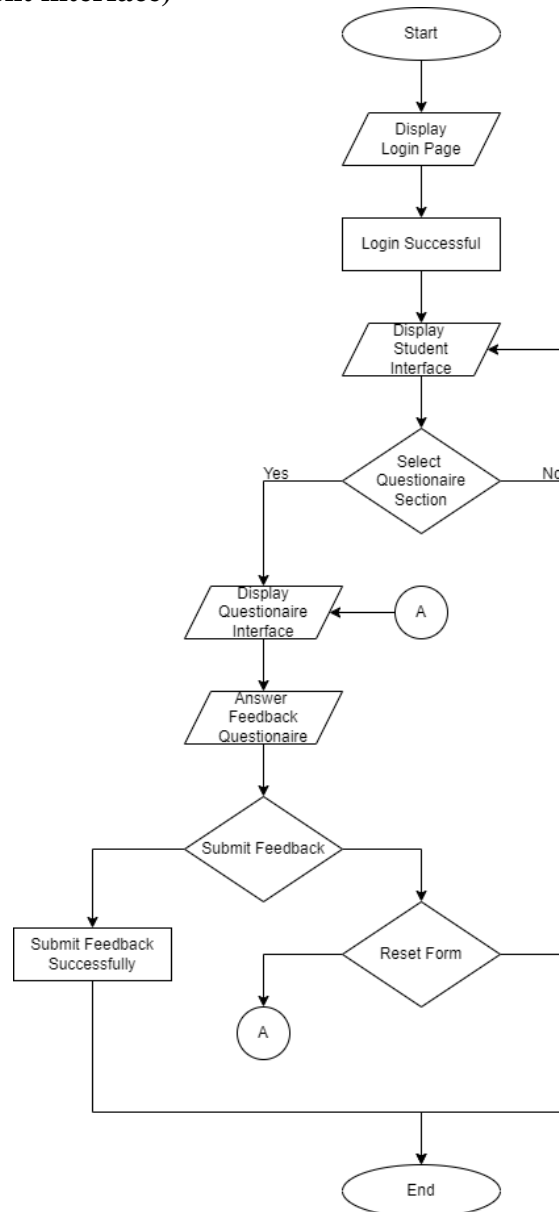
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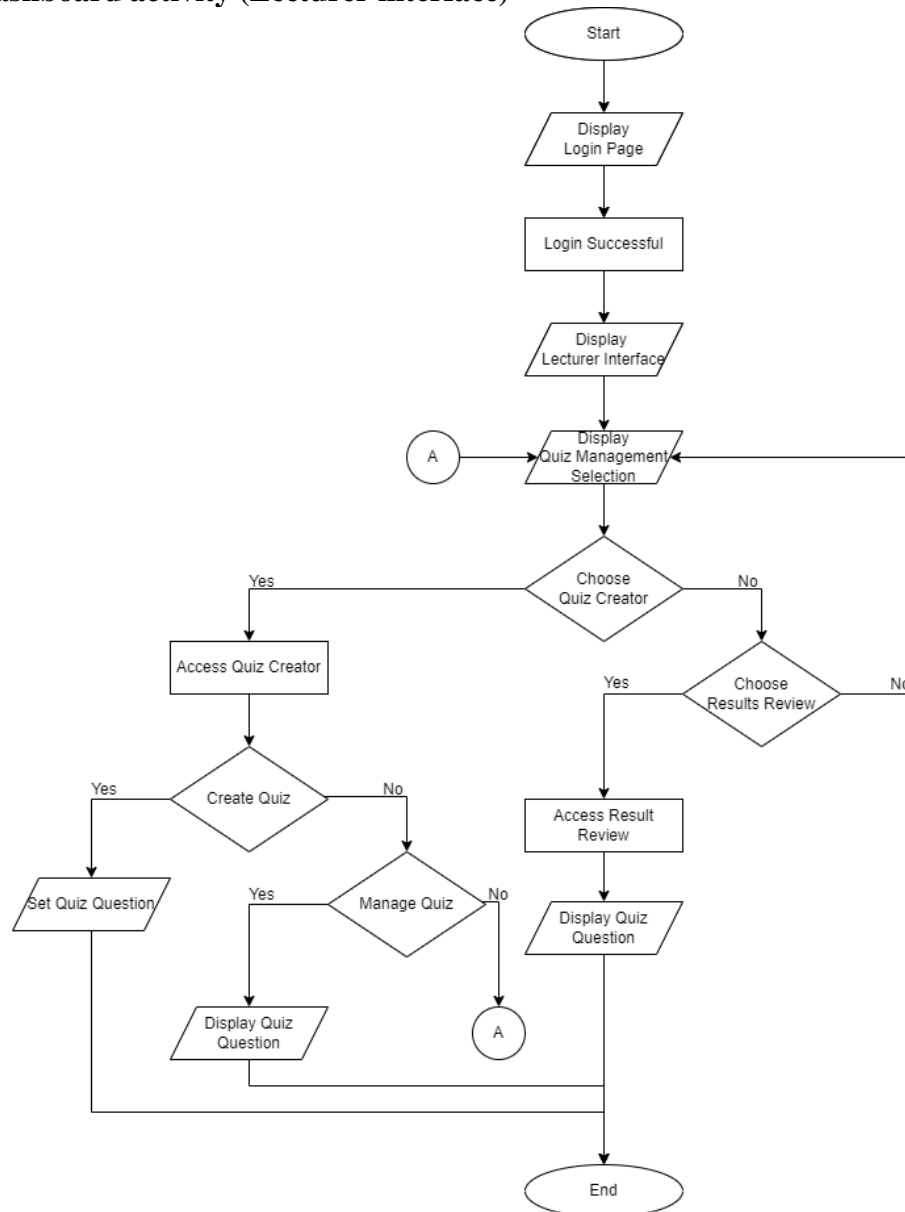## 4.5.9 Dashboard activity (Lecturer interface)

Figure 4.5.9.1 Flowchart of Dashboard activity

The flowchart above indicates that the Web-Based Learning platform includes a Dashboard section, which is the Lecturer interface main page. When the lecturer has logged in successfully. The dashboard will display the quiz management selection, where you can choose the Quiz Creator and the Result Review. The quiz creator, the lecturer, can create and publish a quiz with questions in the student mini games section, which is the quiz. The lecturer can manage the quiz at the Manage Quizzes section. If the lecturer can check the student's quiz results through the Quiz Results Review.

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4.5.10 Review Questionnaire activity (Lecturer interface)
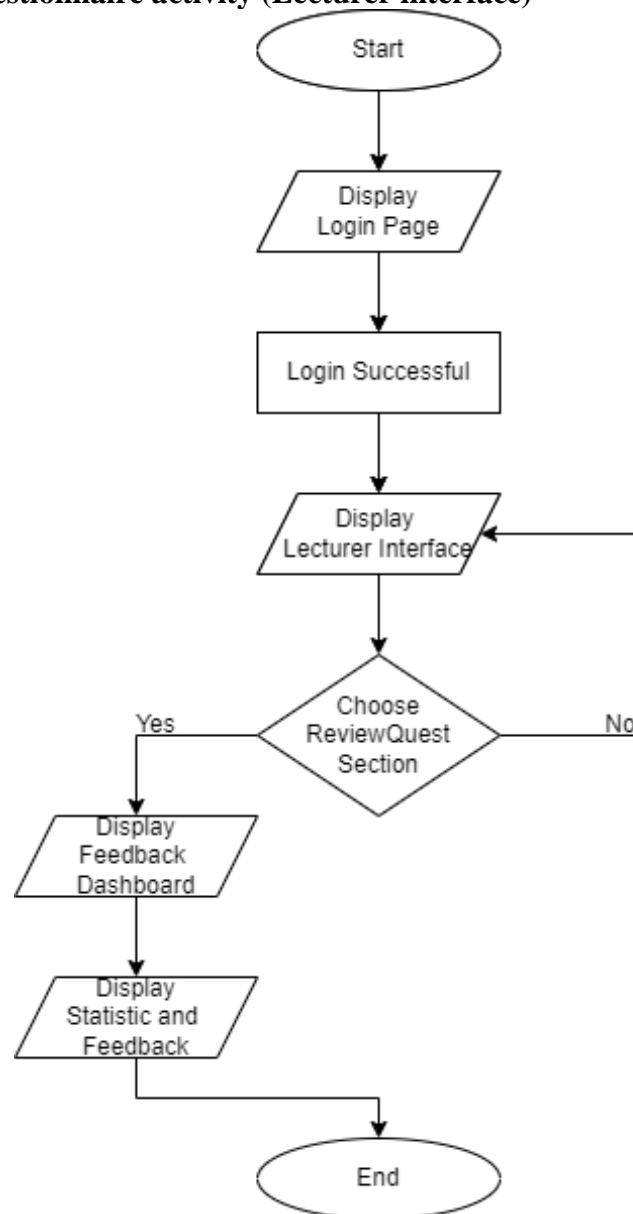
Figure 4.5.10.1 Flowchart of Review Questionnaire activity

The flowchart involves the review questionnaire activity. When the lecturer decides to check the student feedback from this webpage, the lecturer can check through ReviewQuest. It will display all the feedback and show the statistics overall for the result.

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Chapter 5

System Implementation
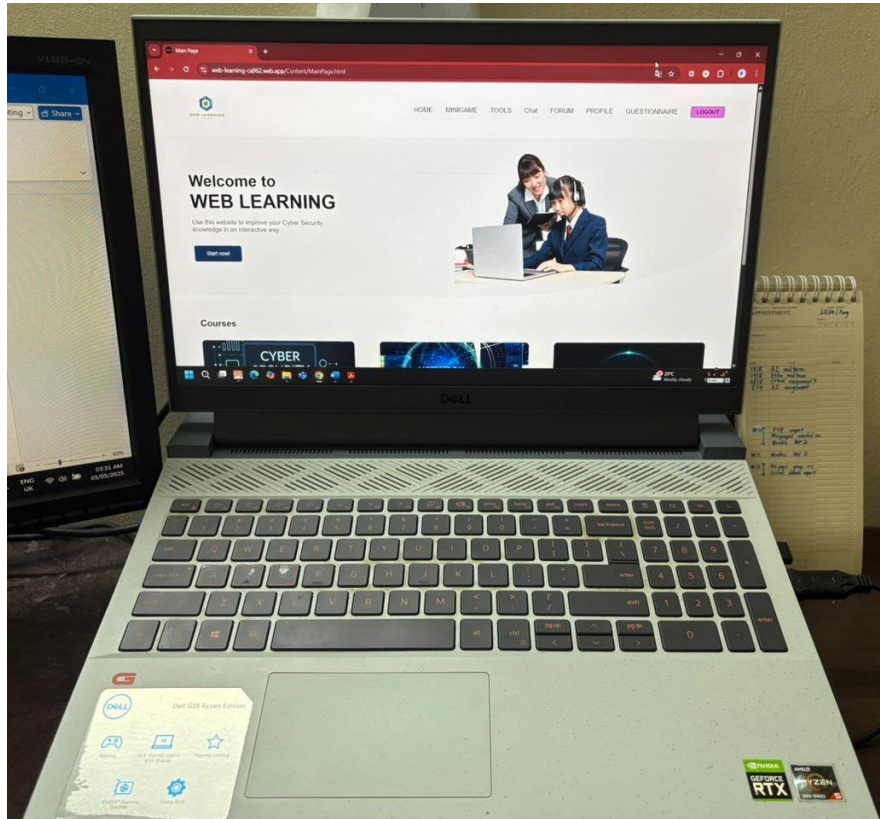
5.1 Hardware Setup

Figure 5.1.1 Dell G15 laptop

This Final Year Project does not require complex hardware configuration because the application is hosted online through Firebase Hosting. After deployment using the firebase deploy command, the application can be accessed through any device with an internet connection and a web browser. Therefore, the hardware setup of this project is deliberately kept simple and efficient. Throughout the development and maintenance phase, the only hardware used was a personal laptop, which is a Dell G15, as shown in Figure 5.1.1.

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5.2 Software Setup

5.2.1   Visual Studio Code

A code editor software with built-in support for the programming language for web development such as HTML, CSS, JavaScript and more. Before starting the Web-Based Learning project, we need to download Visual Studio Code. For this Final Year Project, we are using version 1.92, which can be downloaded from the official website. You can access it at https://code.visualstudio.com/download.

   After finishing the download and setup, we need to create a new project. Below are the steps to create a project:

1.   Open the Visual Studio Code application.
2.   Click File and then click Open Folder.
3.   Then create a new File named FYP and then.
4.   Select the folder, open it and start creating a project for development.
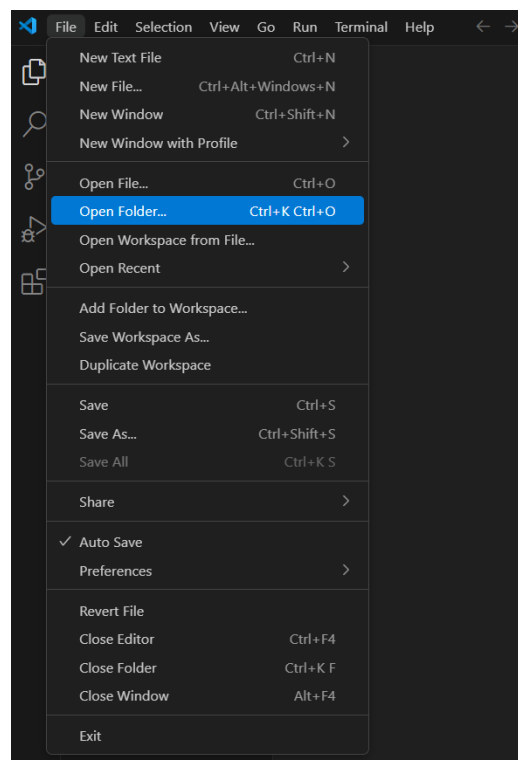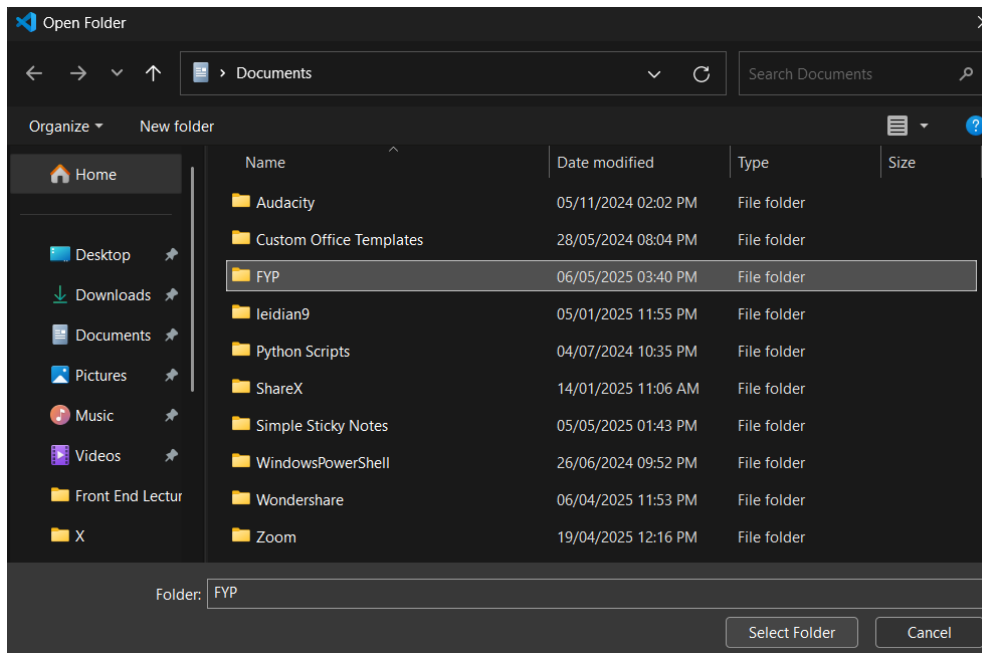

Figure 5.2.1.1 Click File and then click Open Folder

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Figure 5.2.1.2 Select the folder, open it and start creating a project for development

5.2.2 Google Chrome

A web browser we used for demos and test runs before developing the website. This way is to make sure that the functionality on the website is complete and functioning properly. Before starting the Final Year Project, Google Chrome is required to test run the Web-Based Learning platform for this Final Year Project. This project uses the latest Google Chrome version, 128.0.6613.114, which can be downloaded from the official website at https://www.google.com/chrome/browser-tools/.

When we are doing the coding, we need to run the demo to test runs before developing the website. Below are the steps to demo test run.

1. Right-click on the code, and then select Open with Live Server.
2. Then it will automatically open Google Chrome to run the test.

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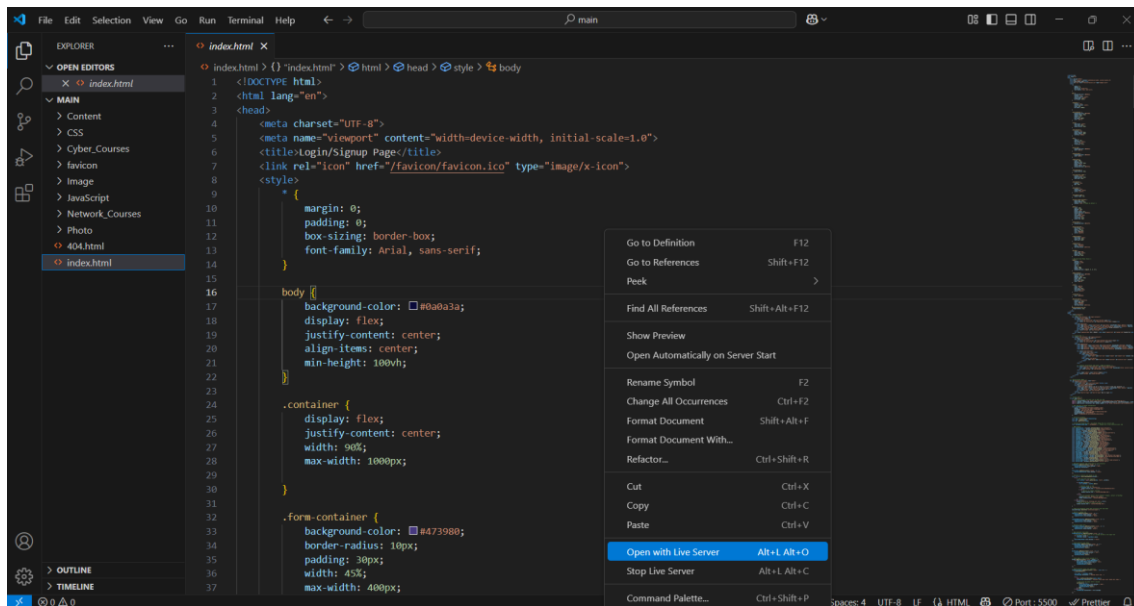
Figure 5.2.2.1 To Select Open with Live Server
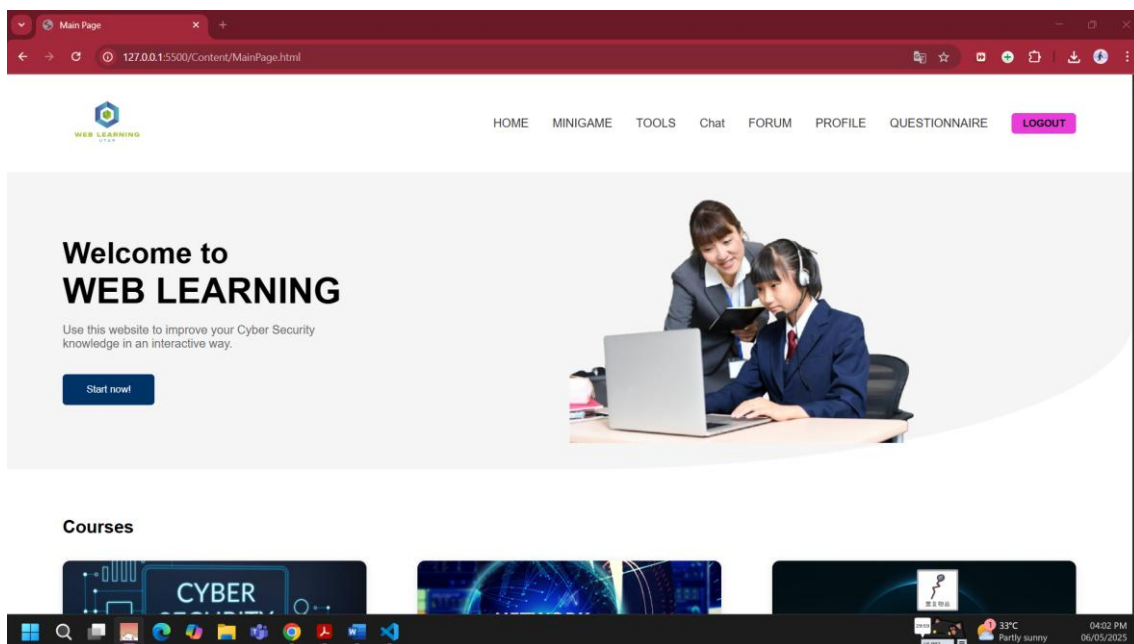
Figure 5.2.2.2 After Open with Live Server

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5.3 Setting and Configuration

5.3.1 Setting Firebase

Firebase is a cloud-based Backend as a Service (BaaS) platform developed by Google to simplify the development process of web applications. Besides, this platform provides a comprehensive set of backend tools without the need to manually set up and maintain servers. In this graduation project, Firebase is used to handle core backend functions such as website hosting, user authentication, and real-time data storage. Features such as Firebase Hosting allow applications to be deployed online, Firebase Authentication manages the user login system, and the Real-time Database enables continuous data synchronisation with a flexible structure.

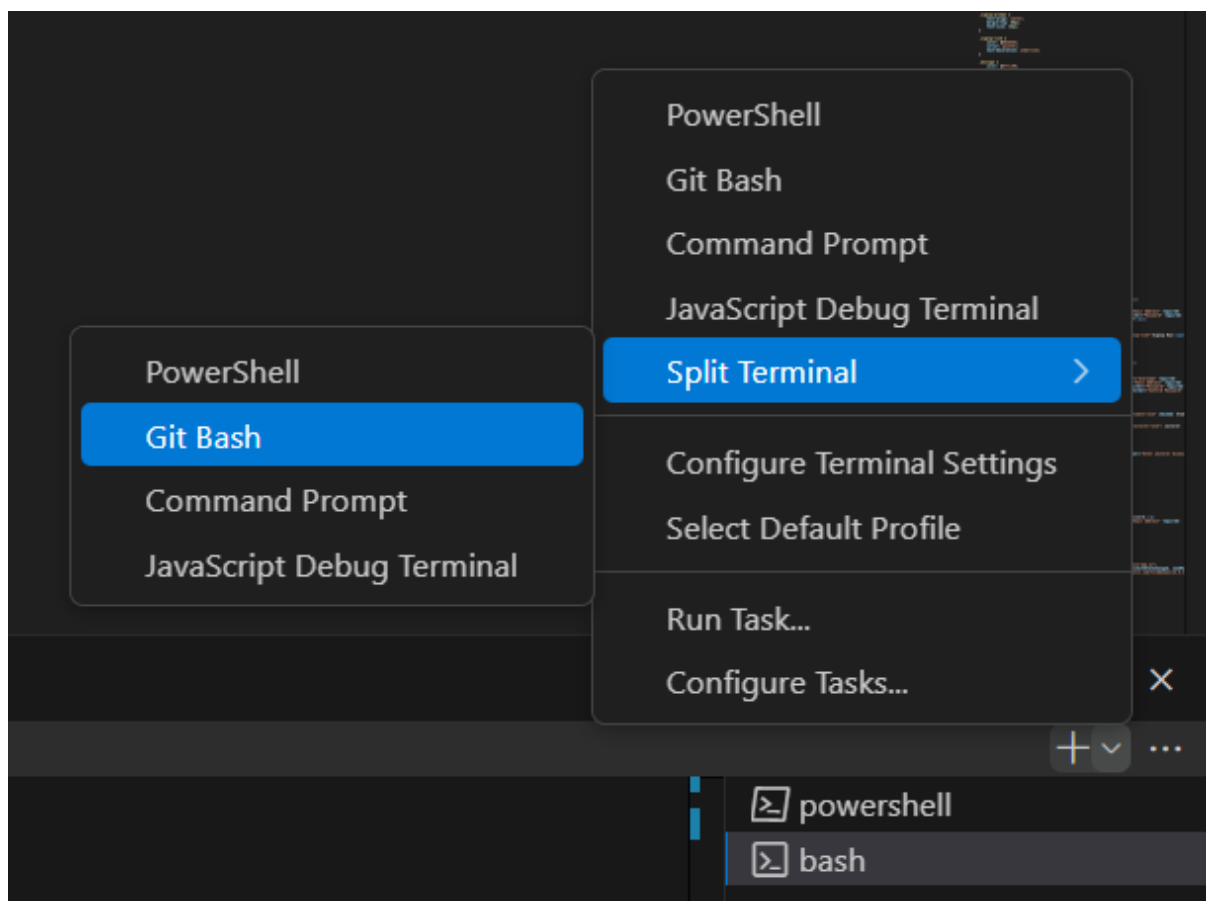To configure and set up Firebase, we need to follow these steps:

Figure 5.3.1.1 Visual Studio Code Setup Terminal

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According to Figure 5.3.1.1, we use Visual Studio Code to set up the terminal. Therefore, it can run in Firebase. Before that, you need to visit the Git Bash official website to download the application so that the split terminal displays the "Git Bash" option. After clicking on the terminal, select "Split Terminal", then select "Git Bash" and run the terminal.

Figure 5.3.1.2 Firebase setup 1

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Figure 5.3.1.3 Firebase setup 2

As shown in Figure 5.3.1.2, setting up Firebase requires installing the Firebase command line interface using "npm install -g firebase-tools", which will allow me to use firebase commands from the terminal, such as firebase serve, firebase deploy, etc. After installing the command, it also shows logging into the firebase account using the command "firebase login". After logging into the firebase account, the next command used here is "firebase init hosting" to initialize the Firebase project to our folder. After that, the project settings only require selecting an existing project. Then select the Firebase project that you want to be in this folder. After that, in the Hosting settings, you need to name the public directory as "main". After naming the public directory, it will automatically create 2 HTMLS at main, namely "404.html" and "index.html" that show in Figure 5.3.1.3.

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5.3.2 Configure for the project

The configuration of this project is the Firebase SDK, database setup, authentication setup, and deployment website.
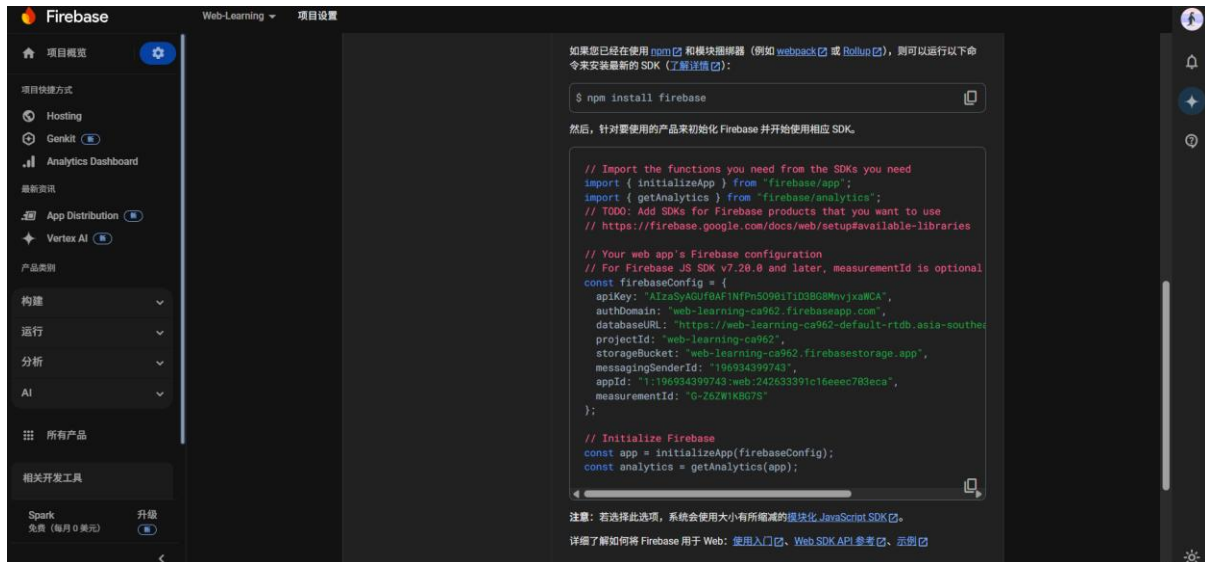
Figure 5.3.2.1 Firebase SDK
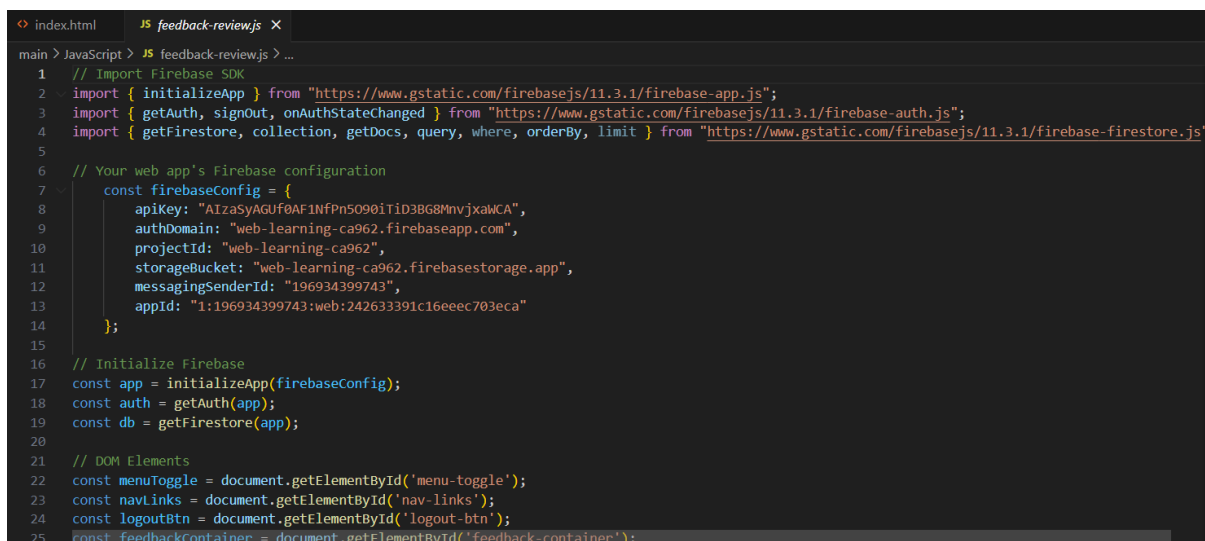
Figure 5.3.2.2 JavaScript file in Visual Studio Code

As shown in Figure 5.3.2.1, the Firebase project settings provide JavaScript code for loading the Firebase JavaScript SDK library from the CDN (Content Delivery Network). This code needs to be copied and pasted into a JavaScript file in Visual Studio Code, as shown in Figure 5.3.2.2.

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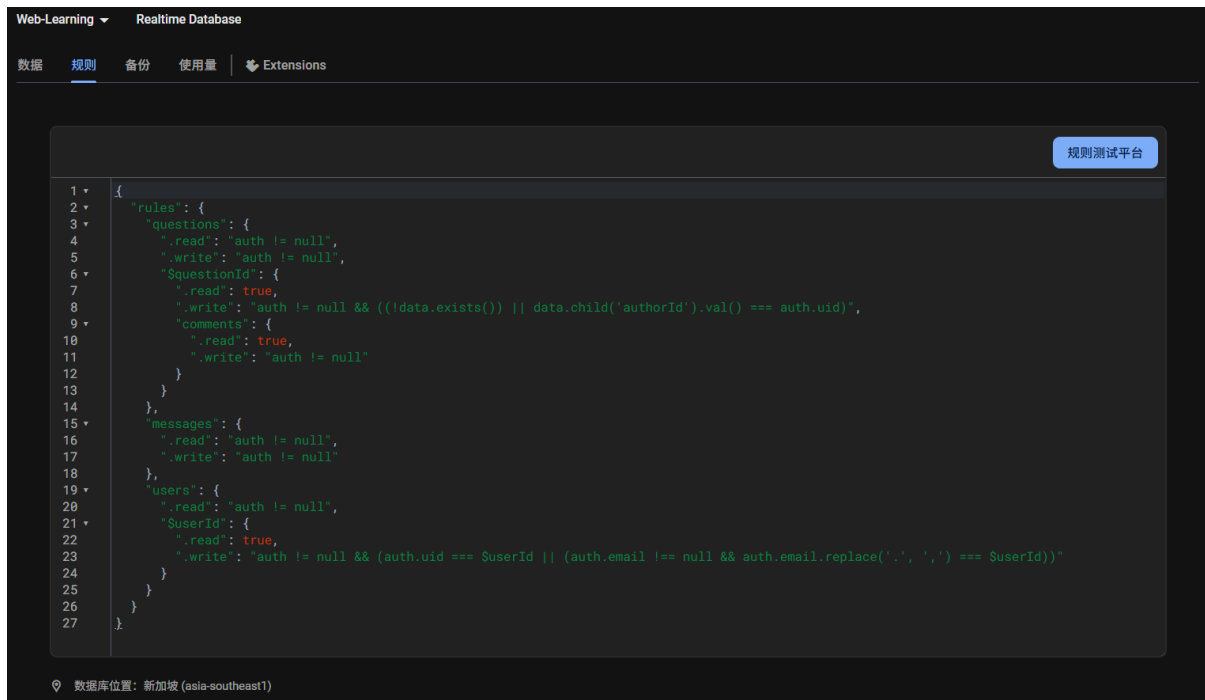
Figure 5.3.2.3 Setup Rule for Real-Time Database

This rule configuration for the Realtime Database is so that logged in users can interact with the system and can only edit their own data, such as forum questions or their profile data.
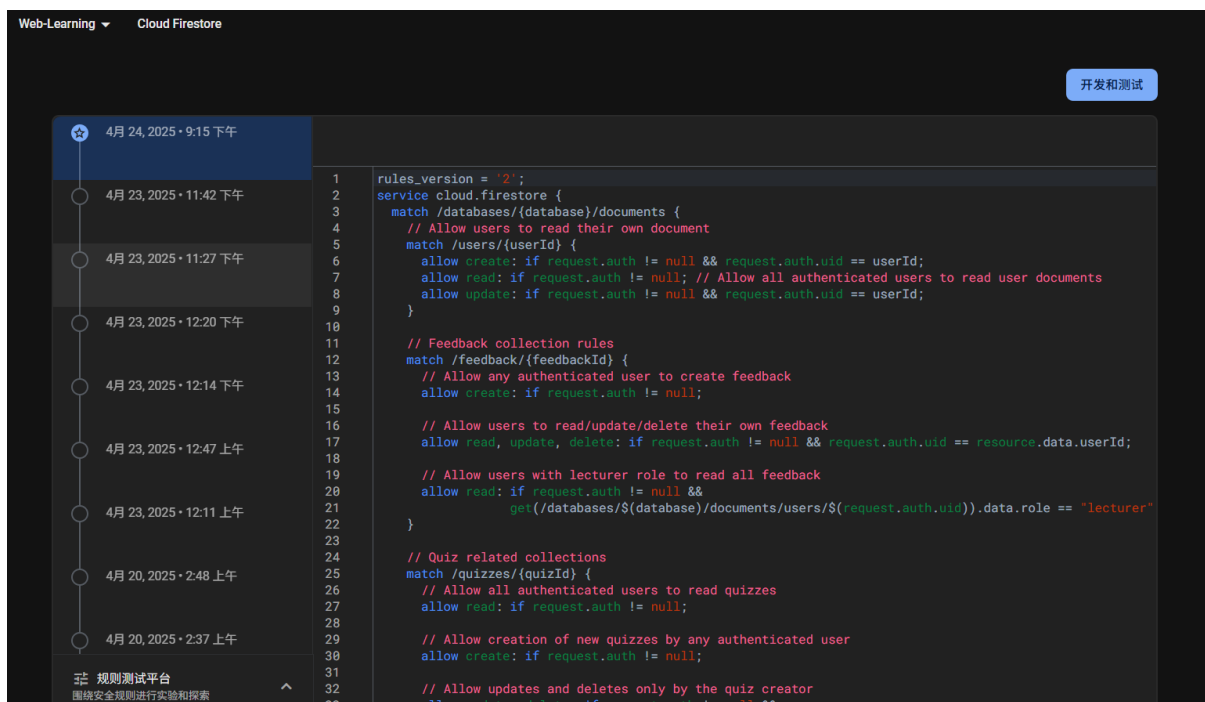
Figure 5.3.2.4 The Rule for Firestore Database

This rule configuration for the Firestore database that allows logged in users to access the database. Students can manage their own data, while instructors will have special permissions to see more information.

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Figure 5.3.2.5 Deploy Website at local

Figure 5.3.2.5 Deploy the Website at Firebase Cloud

After the setup and configuration is complete, the last step is to deploy the website. First, deploy the website as a local server (as shown in Figure 5.3.2.5) to check whether it can run. If it can run normally, execute the second method shown in Figure 5.3.2.5 to deploy the website to the Firebase cloud. All users with the URL can access the website. As you can see, https://web-learning-ca962.web.app is the website link.

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5.4 System Operation

This section focuses on the user interfaces developed using Visual Studio Code for the web-based learning platform.

5.4.1 Login Activity
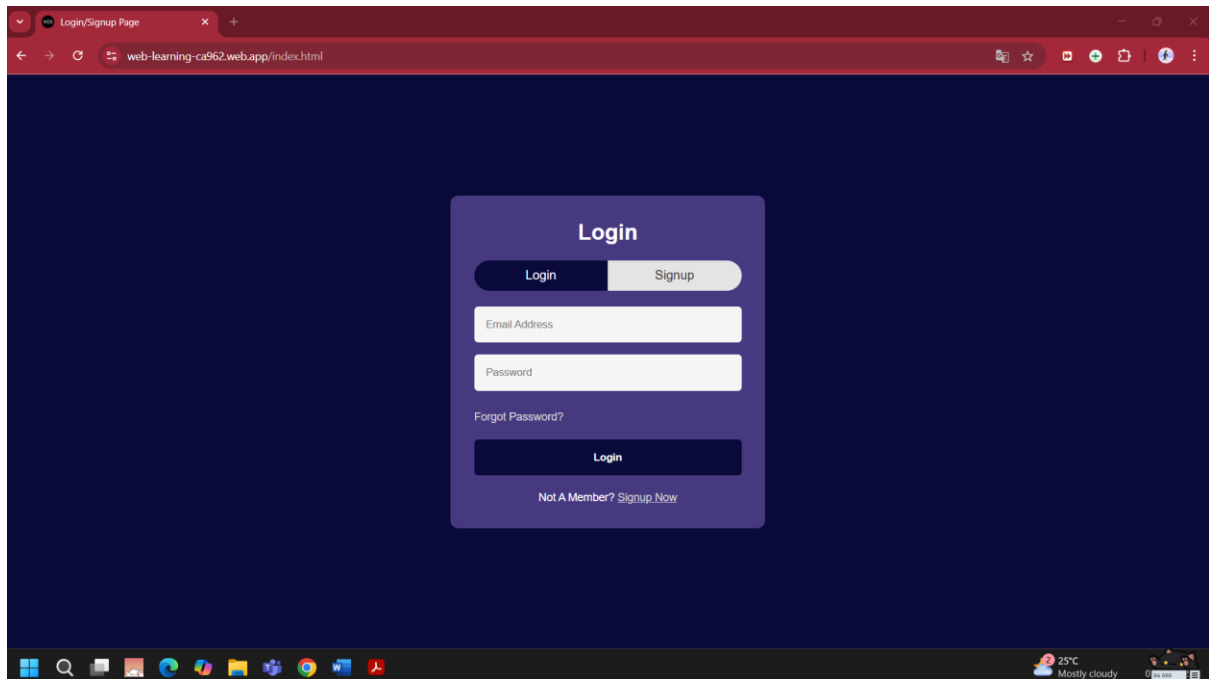
Figure 5.4.1.1 Login Activity

Through login activity, users can login manually by entering the email and password of their user account. If users leave the input field empty, enter the wrong email address format, or fail to pass authentication, a message will pop up to indicate the error to users. If the user successfully authenticates, they will be redirected to the Home page, which is the subject activity page. Besides, For new users, they can select the "Signup" option to create a new user account in the Sign Up Activity. For users who forgot their user account's password, they can press "Forgot Password?" to reset their password via the system sent to their email.
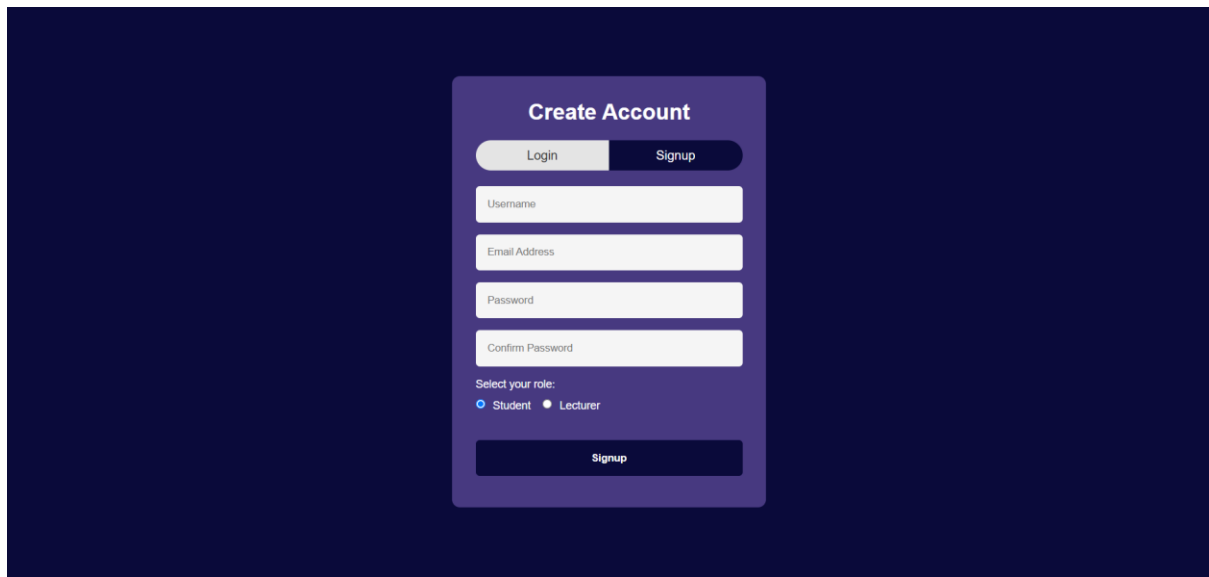
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5.4.2 Sign Up Activity

Figure 5.4.2.1 Sign Up Activity Layout

Through the Sign Up Activity, users are required to provide a username, email address, password and select the role to create a user account. If users leave input fields empty, enter a wrong email address format or fail to create a user account. A message will pop up to show the user's error. If the user successfully creates their own user account, the data will be stored in Firebase, and they will be redirected to the Login Activity Page for authentication purposes. Users can also click "Login" to login to the Login Activity Page if they change their mind.

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5.4.3 Reset Password Alert Dialog Box
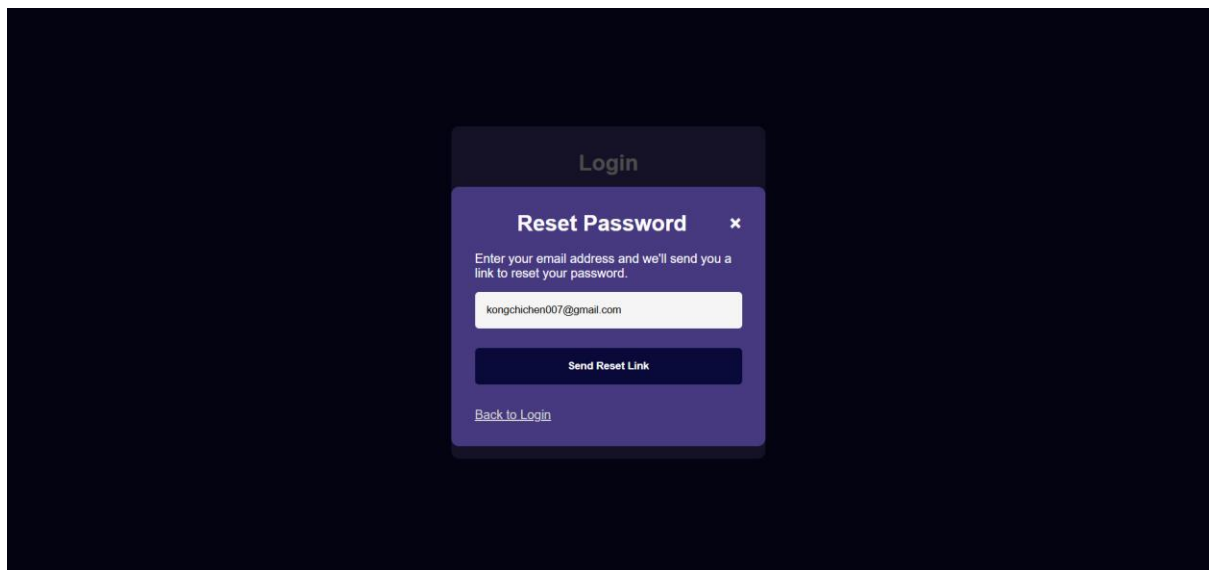
Figure 5.4.3.1 Reset Password Alert Dialog Box
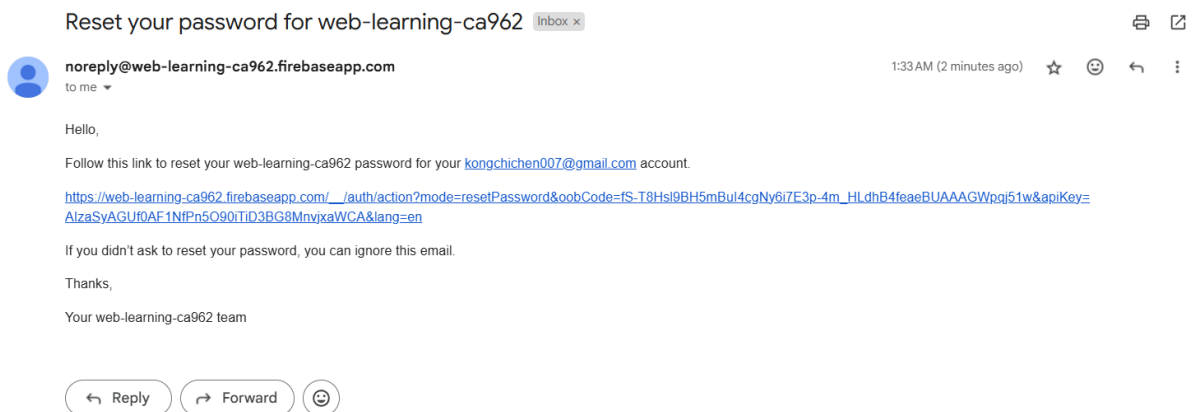
Figure 5.4.3.2 Reset Password email

In the reset password dialog box, users are required to enter their registered email address in the correct format. If an error is detected, such as a wrong email format. An alert message will appear to inform the user of the issue. Besides, if the input is valid, a password reset email will be sent to the provided address, allowing users to reset their account password by following the link included in the email.

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5.4.4   Choose Subject Activity
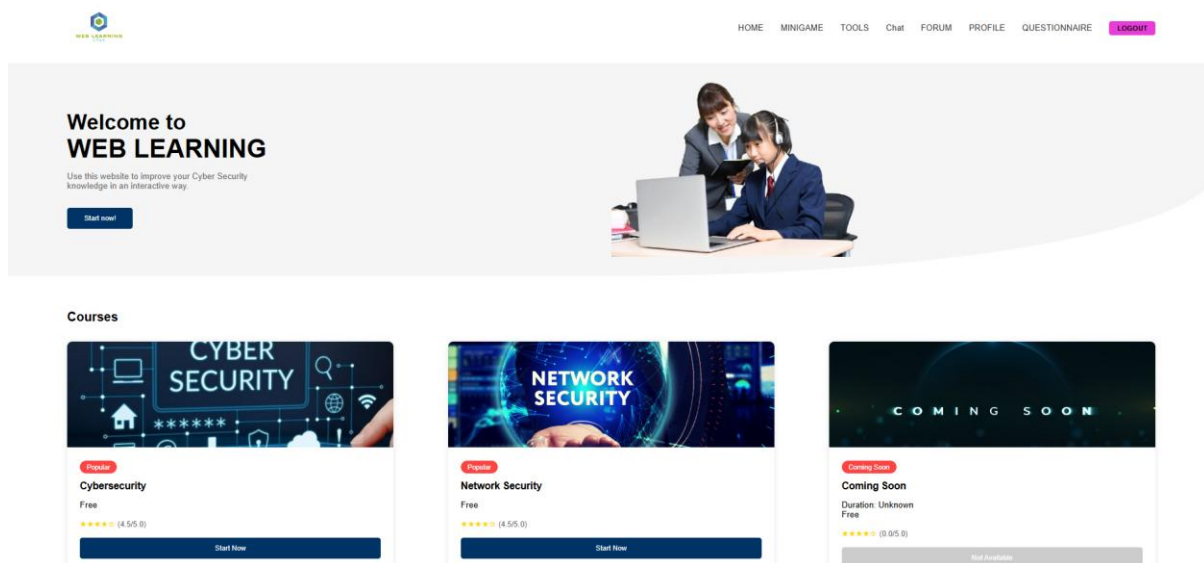
Figure 5.4.4.1 Choose Subject Activity Page

Figure 5.4.4.2 Cyber Security Page

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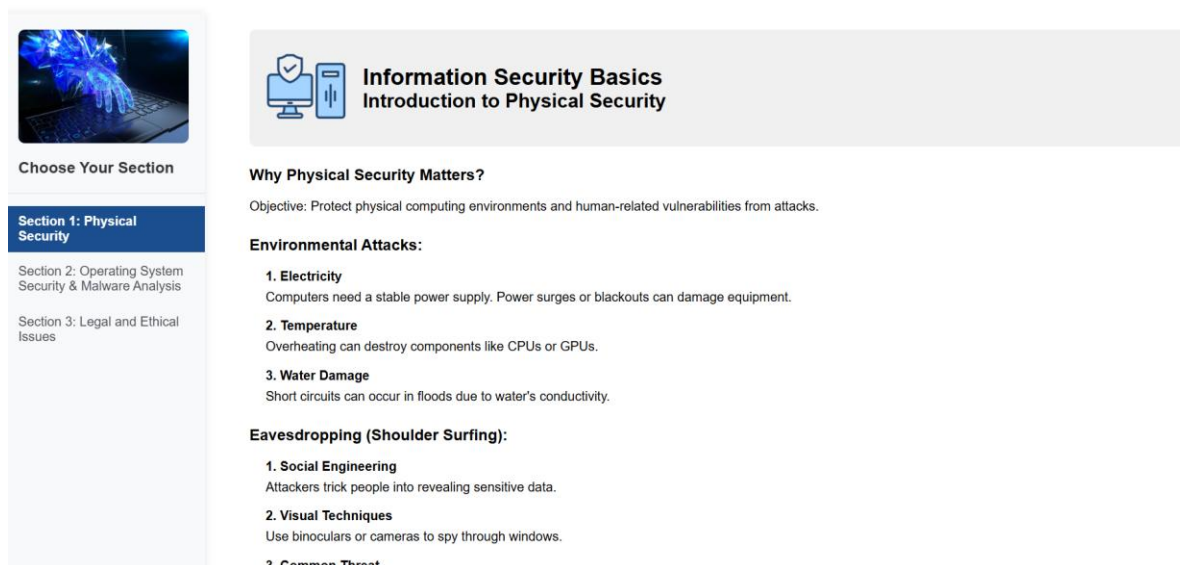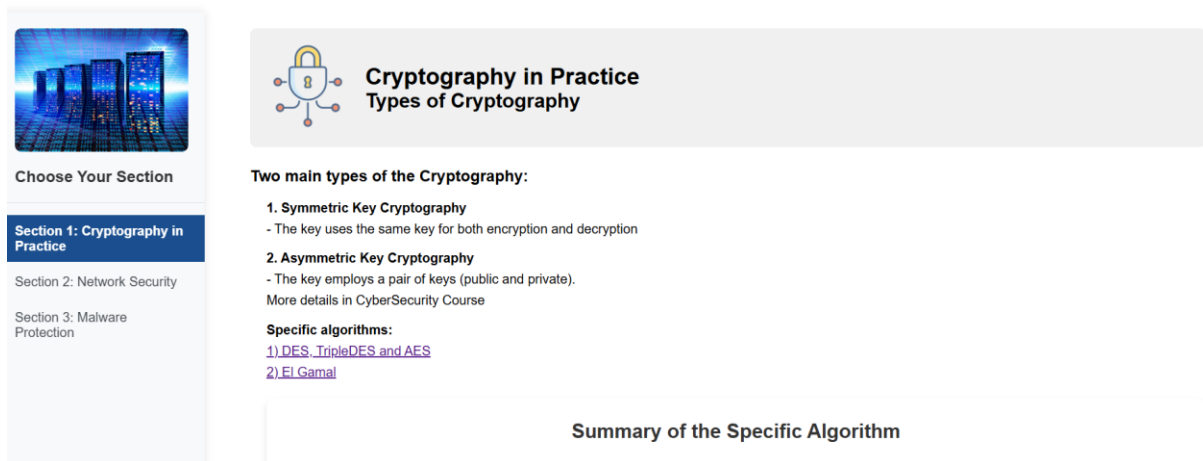
Figure 5.4.4.3 Network Security Page

Figure 5.4.4.4 Addition content of Network Security Page

After the users log in successfully, users will see the home page of the website. On this page, the user can select the subject they are interested in, as shown in Figure 5.4.4.1 below. Once the user decides on a subject, they can click "Start now" to access the learning materials and learn. Then, the users will see the user interface, such as Figure 5.4.4.2 Cyber Security page or Figure 5.4.4.3 Network Security page. When the user clicks the hyperlink on the page. For instance, Figure 5.4.4.3 has two hyperlinks. These hyperlinks will bring the users to the next website to access to learn additional knowledge, such as Figure 5.4.4.4. After finishing their study, users can return to the home page for other activities.

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5.4.5 Mini Games Activity
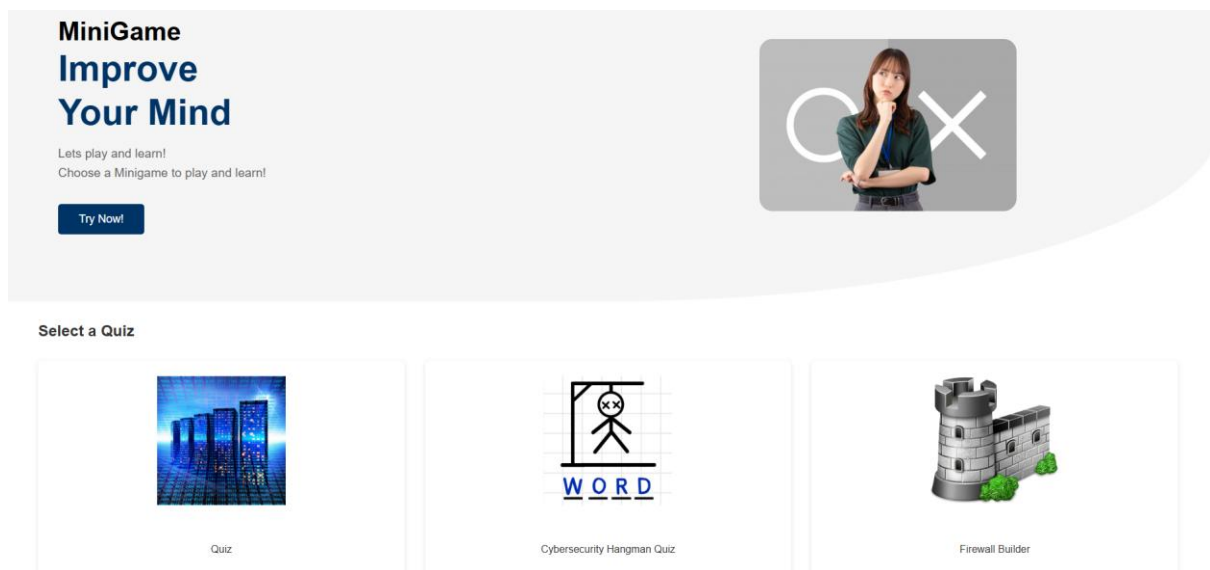
Figure 5.4.5.1 Mini Games Activity Page
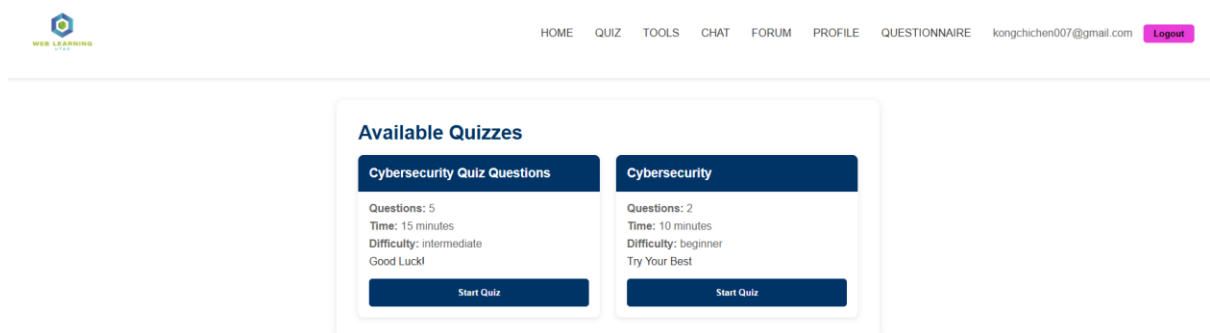
Figure 5.4.5.2 Mini Games Quiz Page

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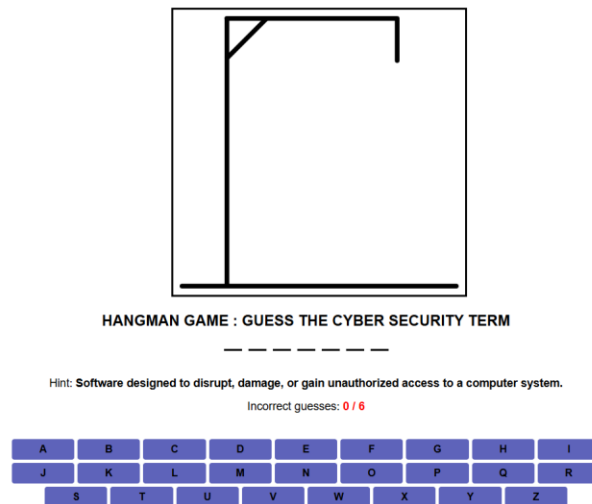
Figure 5.4.5.3 Mini Games Hangman Page
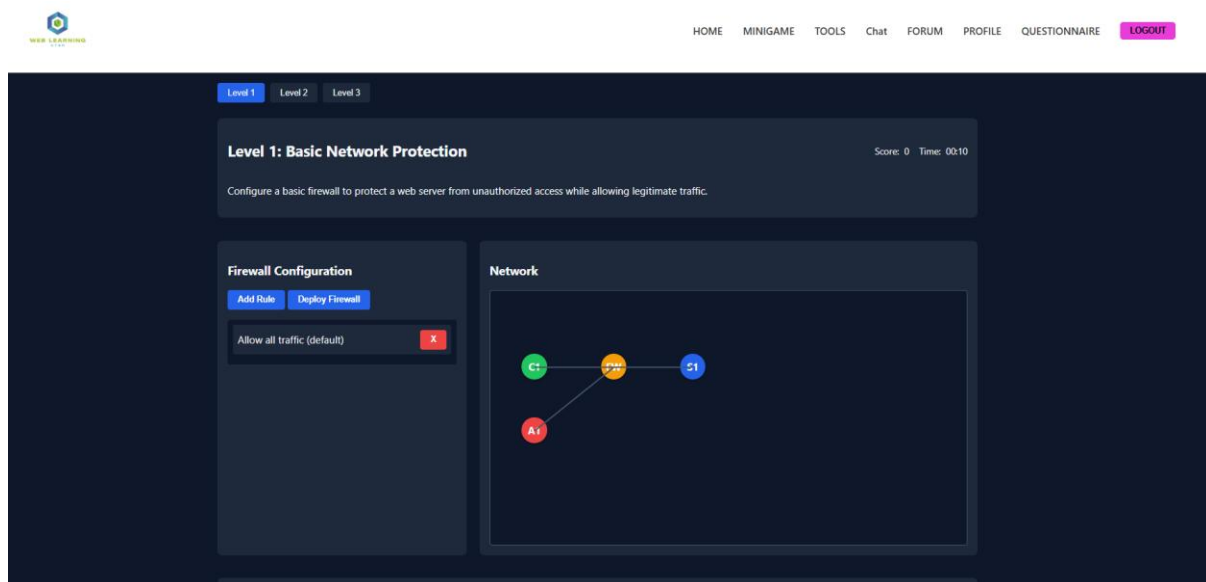
Figure 5.4.5.4 Mini Games Firewall Builder Page

When users want to play mini games, they can click "Mini Games "on the top navigation bar to play after studying. The Mini Games Activity page will show three mini games, which are Quiz, Hangman game, and Firewall Builder. In Quiz (Figure 5.4.5.2), the quiz questions are set up by the lecturer using their account. Next, the Hangman game (Figure 5.4.5.3), the Hangman game is to guess the cyber security term, such as Malware and Botnet. Lastly is Firewall builder (Figure 5.4.5.4), this game can let students learn how to prevent attackers from attacking the device by playing this mini game simulator.

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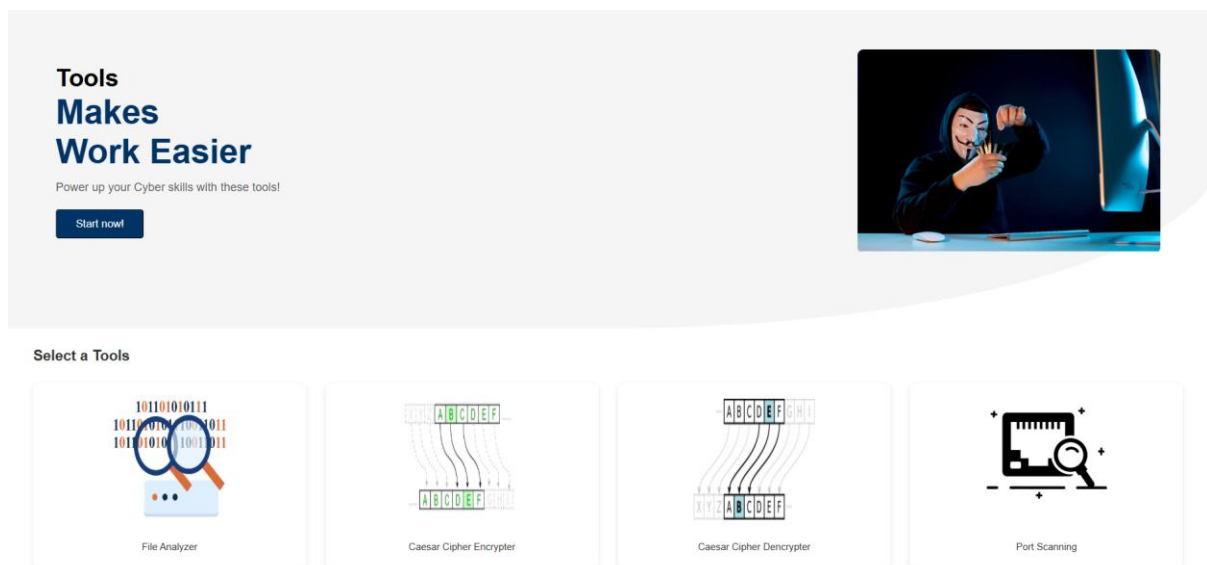
5.4.6 Tools Activity

Figure 5.4.6.1 Tools Activity Page
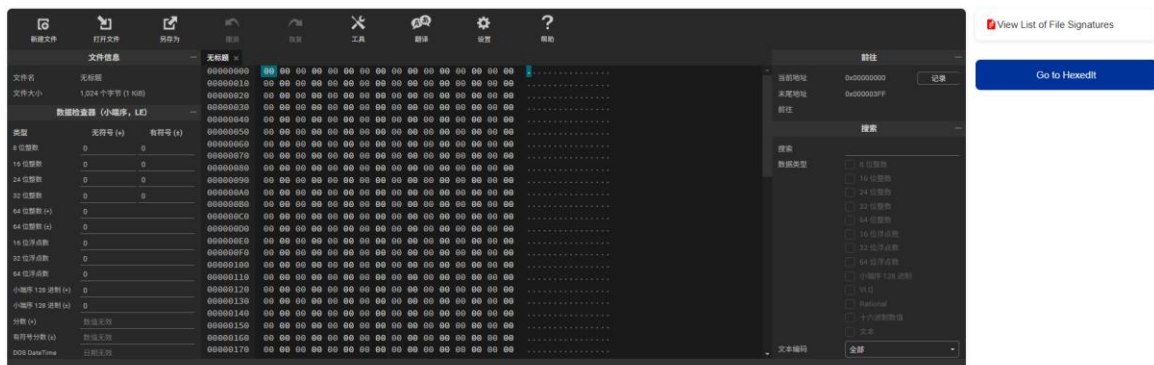
Figure 5.4.6.2 File Analysis Tool Page

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Figure 5.4.6.3 Caecar Cipher Encrypter Tool Page

Figure 5.4.6.4 Caecar Cipher decrypter Tool Page

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Figure 5.4.6.5 Port Scanning Tool Page

Next, the Tools Activity Page. When users want to access and try to use the learning tools, they can click on the "Tools" option in the top navigation bar. So, the students can use the tools here conveniently. This Tools page has four different tools to help students have a better understanding of basic cybersecurity concepts through a very good hands-on experience. Other than that, these tools have the File Analysis Tool, Caesar Cipher Encryption, Caesar Cipher Decryption, and Port Scanning.

The File Analysis Tool (Figure 5.4.6.2) can let users upload their file and check its details. This tool helps students learn how to analyze files for basic security information, such as file size, type, possible hidden data and more.

The Caesar Cipher Encryption Tool (Figure 5.4.6.3) allows users to type a message and choose a shift number to convert the message into an encrypted words format. This helps students understand how simple substitution ciphers work.

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The Caesar Cipher Decryption Tool (Figure 5.4.6.4) works the opposite way. Users can enter a coded message and the correct shift number to change it back to the original text. This allows students to practice decoding encrypted messages.

Lastly, the Port Scanning Tool (Figure 5.4.6.5) helps users simulate scanning a computer or server for open ports. This teaches students how attackers might look for weaknesses in a system and how to detect such scans.

5.4.7   Chat Activity
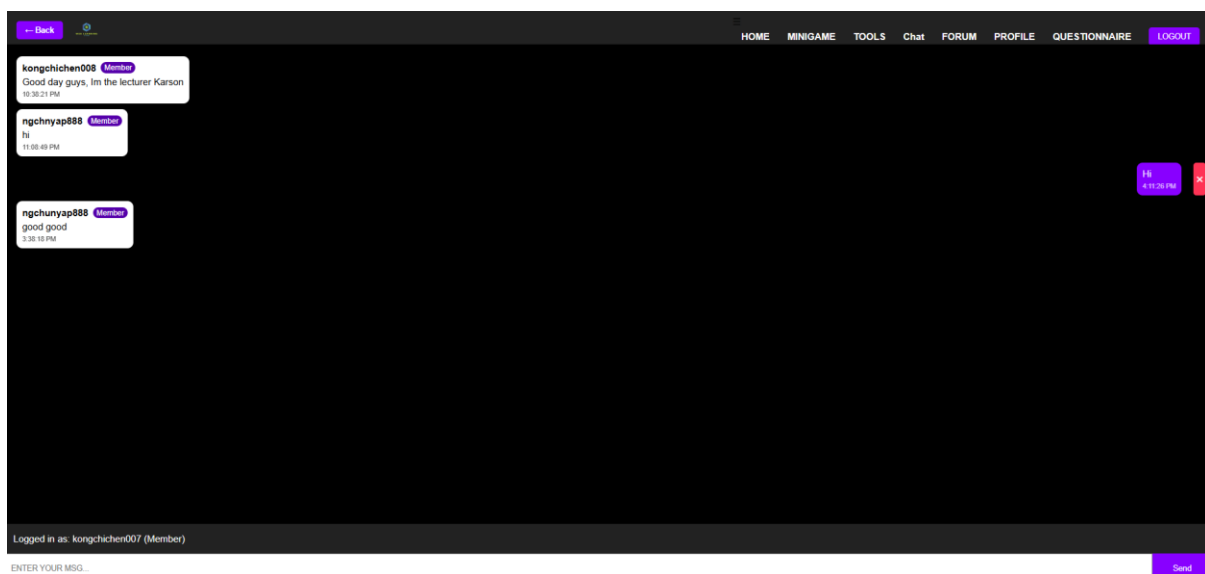
Figure 5.4.7.1 Chat Activity Page

Other than that, the Chat Activity Page allows users to communicate with each other in real time. So, when the user wants to access this feature, they need to click on the "Chat" option in the top navigation bar. This Chat Activity is to encourage sharing of knowledge among students and lecturers.

In Figure 5.4.7.1, all users can send and receive messages immediately. With this point, students can use this space to ask questions, discuss cyber security knowledge or share some learning tips with their friends. Lecturers also encourage participation to provide guidance and answer questions.

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5.4.8 Forum Activity

Figure 5.4.8.1 Forum Activity Page

The next activity page is the Forum Activity Page. The Forum Activity Page provides a space where users can ask questions and give answers on related topics. So, when users want to use the forum, users can click the "Forum" option from the top navigation bar. This activity page is to encourage discussion among students and between students and lectures in a structured manner.

Figure 5.4.8.1, users have created a discussion post by entering the title and the description of the question. It also shows that other users can view these posts and reply with a helpful answer. This also allows users to support one another in learning and share different perspectives on the same topic.

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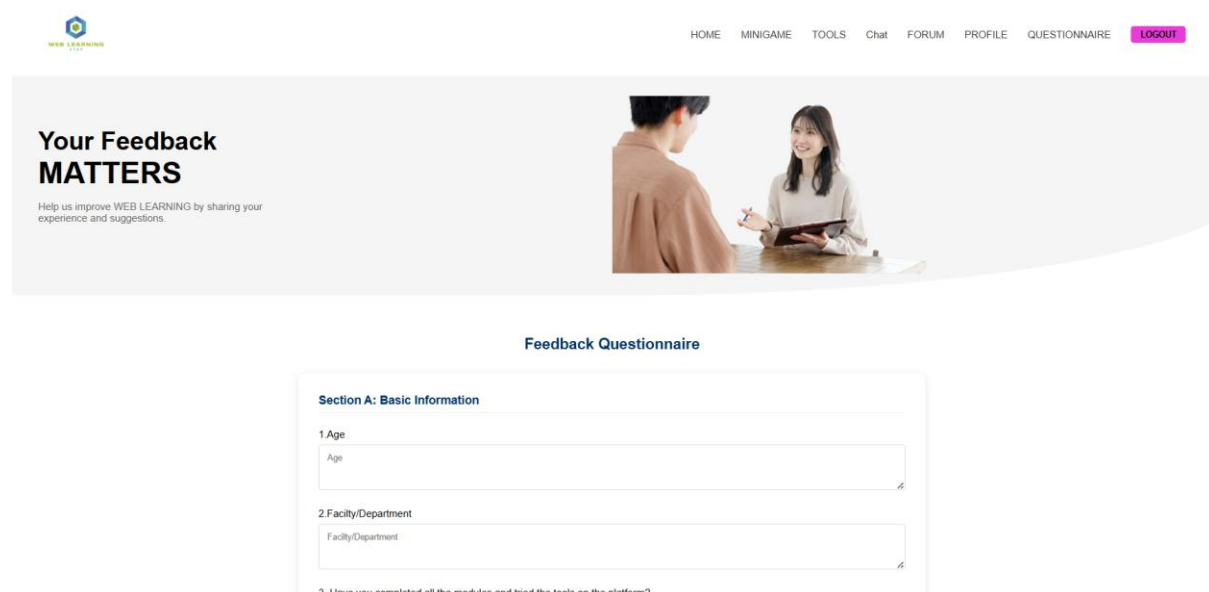
5.4.9 Profile Activity

Figure 5.4.9.1 Profile Activity Page

The Profile activity allows users to view and manage their personal information. User can access the "Profile", users can click the "Profile" option in the top navigation bar.

As shown in Figure 5.4.9.1, it has user information such as username, role, and email. In addition, it also contains a "Change Password" section where the users can change their current password if they think it is not secure.

5.4.10 Questionnaire Activity

Figure 5.4.10.1 Questionnaire Activity Page

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Figure 5.4.10.2 Questionnaire Section B and C

The Questionnaire Activity is used to collect feedback from the users about the learning experience, tools, and overall system. Users can access the page by clicking "Questionnaire" in the top navigation bar.

Figure 5.4.10.2 shows the question designed to measure how well the students understand the content, how useful the tools are, and how satisfied they are with the platform.

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5.4.11 Dashboard Activity (Lecturer interface)
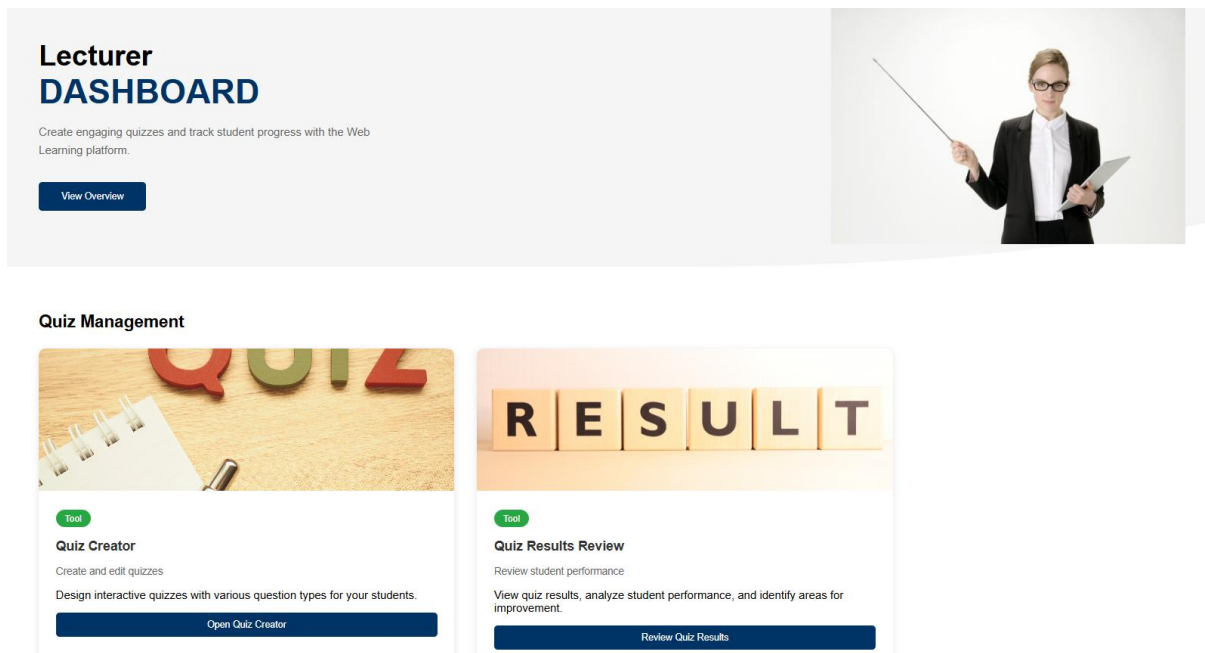
Figure 5.4.11.1 Dashboard Activity Page

The Instructor Dashboard is a special feature that is only available to users with an instructor account. It allows instructors to manage quizzes and monitor student performance. Once the instructor is logged in, click the Dashboard option in the top navigation bar to access the dashboard.

Figure 5.4.11.1 shows that the dashboard contains the Quiz Creator and the Quiz Results Viewer. The Quiz Creator is used to create quiz questions for students to complete. The quiz questions will appear in the quiz in the mini game. Next is the Quiz Results Viewer, which is used to display the student's score after the student completes the quiz.

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5.4.12 Review Questionnaire Activity (Lecturer Interface)
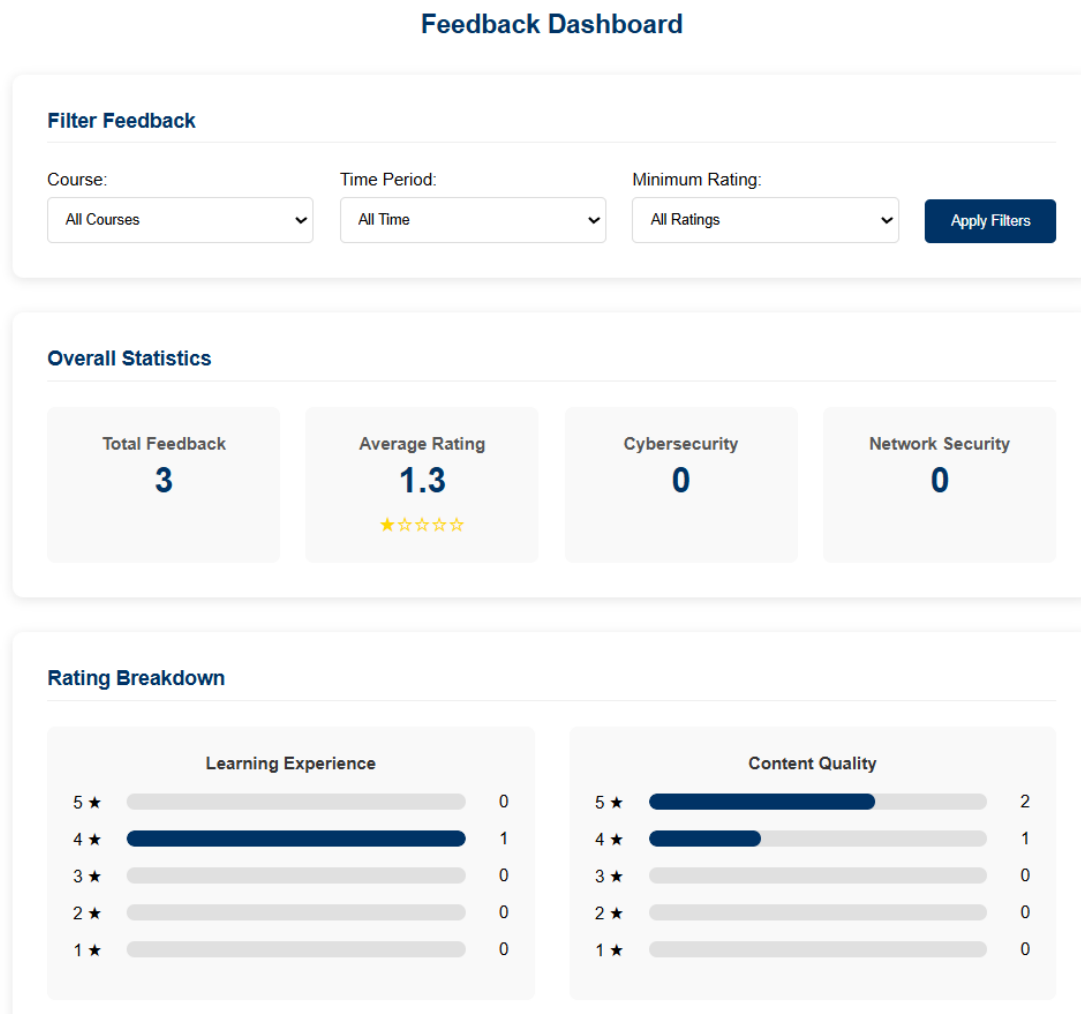
Figure 5.4.12.1 Review Questionnaire Activity Page

The Questionnaire Feedback Review feature is designed for instructors to analyze the feedback provided by students during a Questionnaire activity. This feature is accessible through the Instructor Dashboard, where there is a separate section for reviewing Questionnaire responses.

In the Feedback Review page (Figure 5.4.12.1), instructors can view a summary of all Questionnaire submissions. The system displays the results in a clear and understandable format, such as "Overall Statistics" and "Rating Breakdown".

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5.5   Project Challenges

When developing the Web-Based Learning system, it has some challenges. From a technical perspective, there are four tools that I make, which are file analysis tools, Caesar Cipher encrypter, Caesar Cipher decrypter, and Port Scanning. These tools each have their own different requirements. Besides, creating a responsive user interface that works well on both desktop and mobile devices is another challenge, as it is ensuring data security through proper authentication and encryption.

One of the issues was integrating Firebase for real-time chat and the forum section. Which means it requires managing real-time data synchronization and secure authentication. Setting up Firebase rules is to protect the user data and prevent unauthorized access was particularly challenge.

Despite these challenges, the project provides a very valuable lesson in web development, cyber security and project management. It also lays a solid foundation for future improvement.

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5.6   Concluding Remark

In summary, this Final Year Project successfully developed a web-based learning system focused on cybersecurity education. The project utilized simple hardware, primarily a Dell G15 laptop, with the system hosted online through Firebase for easy access. Software tools like Visual Studio Code and Google Chrome were essential for development, testing, and deployment.

The project setup included integrating Firebase for hosting, authentication, and real-time data management, ensuring a seamless user experience. Key features such as login, sign-up, chat, forums, quizzes, and learning tools like Caesar Cipher and Port Scanning provided an interactive platform for students to deepen their understanding of cybersecurity.

Finally, the project's overall quality was improved by addressing issues including secure authentication, responsive design, and real-time data synchronisation. Although the technical challenges, this project offered invaluable practical experience in cybersecurity and web development, creating a solid basis for further education and career advancement.

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Chapter 6

System Evaluation and Discussion

6.1   Questionnaire Results

Overall Statistics

Total Feedback	Average Learning Experience	Average Content Quality	Average Tool Usefulness
23	**4.3** ★★★★★	**4.0** ★★★★☆	**4.4** ★★★★★

Rating Breakdown

Learning Experience

5 ★	40
4 ★	42
3 ★	9
2 ★	1
1 ★	0

Content Quality

5 ★	32
4 ★	26
3 ★	4
2 ★	1
1 ★	0

Tool Usefulness

5 ★	34
4 ★	26
3 ★	9
2 ★	0
1 ★	0
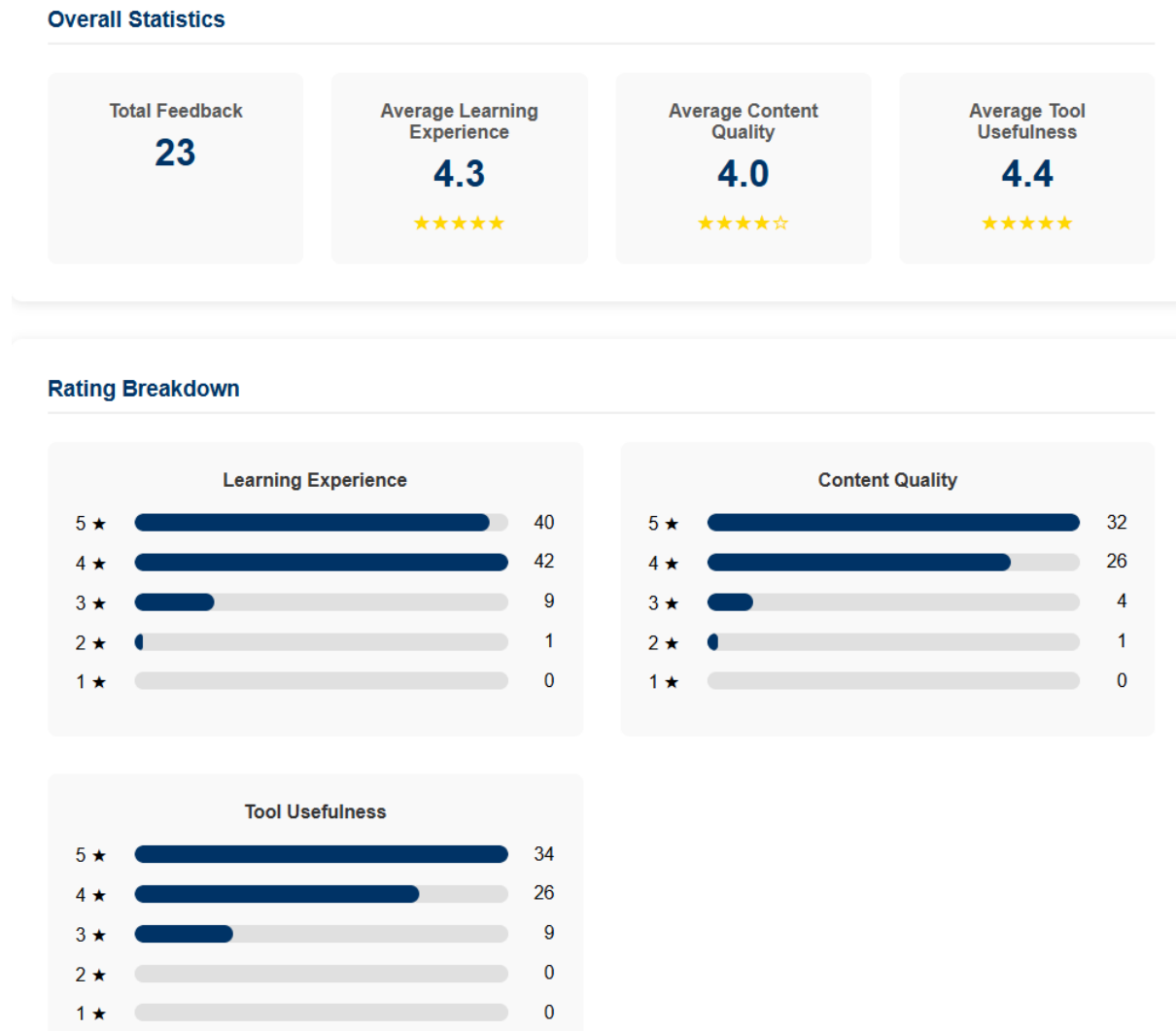
Figure 6.1.1 Result of the Questionnaire

In order to understand the effectiveness of the learning experience, tool usefulness and content quality provided by the system for students. The system has a built-in questionnaire for students to answer, which is designed to collect data on the learning effect of students after using the system.

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According to Figure 6.1.1, a total of 23 students filled out the feedback questionnaire, and the system achieved good results: the average learning experience score was 4.3/5, the average content quality score was 4.0/5, and the average tool practicality score was 4.4/5.

By looking at these three average statistics, users are more likely to choose the tool function of the system because the tool has the highest score compared to the learning experience and content quality. But this will not affect the user's rating of the other two statistics. This is because the overall results show that users' ratings for these three statistics are only half of the latter.

6.2 Testing Setup and Result

In this section, test cases for each activity of the web-based learning system are shown:

6.2.1 Login Activity

Test Case	Expected Result	Actual Result	Status
Login with empty email field, password field filled	Show "Please fill out this field"	Show "Please fill out this field"	Pass
Login with email field filled and empty password field	Show "Please fill out this field"	Show "Please fill out this field"	Pass
Login with empty email field and empty password field	Show "Please fill out this field"	Show "Please fill out this field"	Pass
Press "show eye" icon	Show password	Show password	Pass

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Press "hide eye" icon	Hide password	Hide password	Pass
Login with invalid email address format	Show "Please include an '@' in the email address. 'XXX' is missing an'@',"	Show "Please include an '@' in the email address. 'XXX' is missing an'@',"	Pass
Login with account which does not exist	Show "Firebase: Error (auth/invalid-credential)"	Show "Firebase: Error (auth/invalid-credential)"	Pass
Login with account exist	Show "Login successfully redirecting…" and redirect to Home page	Show "Login successfully redirecting…" and redirect to Home page	Pass
Press Signup	Redirect to Sign Up activity	Redirect to Sign Up activity	Pass
Press "Forgot Password?"	Show reset password alert dialog box	Show reset password alert dialog box	Pass

Table 6.2.1 Login Activity's Test Case

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6.2.2 Sign Up Activity

Test Case	Expected Result	Actual Result	Status
Sign up with one of fields (username, email, password, and select your role) remain empty	Show "Please fill out this field"	Show "Please fill out this field"	Pass
Sign up with invalid email address format	Show "Please include an '@' in the email address. 'XXX' is missing an'@',"	Show "Please include an '@' in the email address. 'XXX' is missing an'@',"	Pass
Sign up with exist email	Show "Firebase: Error (auth/email-already-in-use)"	Show "Firebase: Error (auth/email-already-in-use)"	Pass
Press "show eye" icon	Show password	Show password	Pass
Press "hide eye" icon	Hide password	Hide password	Pass
Sign up with new email	Redirect to Home Page, Choose Subject Activity	Redirect to Home Page, Choose Subject Activity	Pass
Press Login	Redirect to Login Activity	Redirect to Login Activity	Pass

Table 6.2.2 Signup Activity's Test Case

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6.2.3 Choose Subject Activity

Test Case	Expected Result	Actual Result	Status
Click "Start now!"	Scroll to Courses section	Scroll to Courses section	Pass
Choose "Cybersecurity" subject	Redirect to Cybersecurity page	Redirect to Cybersecurity page	Pass
Choose "Network Security" subject	Redirect to Network Security page	Redirect to Network Security page	Pass
Press HOME in the navigation bar	Remain in Choose Subject Activity	Remain in Choose Subject Activity	Pass
Press MINIGAME in the navigation bar	Redirect to Mini Game Activity	Redirect to Mini Game Activity	Pass
Press TOOLS in the navigation bar	Redirect to Tools Activity	Redirect to Tools Activity	Pass
Press Chat in the navigation bar	Redirect to Chat Activity	Redirect to Chat Activity	Pass
Press FORUM in the navigation bar	Redirect to Forum Activity	Redirect to Forum Activity	Pass
Press PROFILE in the navigation bar	Redirect to Profile Activity	Redirect to Profile Activity	Pass
Press QUESTIONNAIRE in the navigation bar	Redirect to Questionnaire Activity	Redirect to Questionnaire Activity	Pass

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Press LOGOUT button in the navigation bar	Redirect to Login Activity	Redirect to Login Activity	Pass

Table 6.2.3 Choose Subject Activity's Test Case

6.2.4   Mini Game Activity

Test Case	Expected Result	Actual Result	Status
Click "Try Now!"	Scroll to Mini Game Section	Scroll to Mini Game Section	Pass
Click "Quiz" icon	Redirect to Quiz page	Redirect to Quiz page	Pass
Quiz Score 80% above	Show "Excellent! You have a great understanding of the subject."	Show "Excellent! You have a great understanding of the subject."	Pass
Quiz Score 60% to 80%	Show "Good job! You have a solid grasp of the material"	Show "Good job! You have a solid grasp of the material"	Pass
Quiz Score 20% below	Show "Keep practicing! Review the material and try again."	Show "Keep practicing! Review the material and try again."	Pass
Click "Cybersecurity Hangman Quiz" icon	Redirect to Hangman page	Redirect to Hangman page	Pass
Answer Correct in Hangman Quiz	Show "Congratulations!" in alert box and display the correct answer	Show "Congratulations!" in alert box and display the correct answer	Pass

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Answer Incorrect in Hangman Quiz	Show "Game Over!" in an alert box and display the correct answer	Show "Game Over!" in an alert box and display the correct answer	Pass
Click the "Firewall Builder" icon	Redirect to Firewall Builder Page	Redirect to Firewall Builder Page	Pass
Deploying a Firewall in Firewall Builder	Show the packet move in the network diagram	Show the packet move in the network diagram	Pass
Add Rules in Firewall Builder	Show the form interface that can create the rule	Show the form interface that can create the rule	Pass
Fail to block the attack packet	The score will show -20 for each attack packet that fails to block	The score will show -20 for each attack packet that fails to block	Pass
Success in blocking and receiving the legitimate packet	Score will be +5 for each legitimate packet received	Score will be +5 for each legitimate packet received	Pass
When hit the require objectives	Win the level and open next level	Win the level and open next level	Pass
Press HOME in the navigation bar	Redirect to Choose Subject Activity	Redirect to Choose Subject Activity	Pass
Press MINIGAME in the navigation bar	Redirect to Mini Game Activity	Remain in Mini Game Activity	Pass
Press TOOLS in the navigation bar	Redirect to Tools Activity	Redirect to Tools Activity	Pass

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Press Chat in the navigation bar	Redirect to Chat Activity	Redirect to Chat Activity	Pass
Press FORUM in the navigation bar	Redirect to Forum Activity	Redirect to Forum Activity	Pass
Press PROFILE in the navigation bar	Redirect to Profile Activity	Redirect to Profile Activity	Pass
Press QUESTIONNAIRE in the navigation bar	Redirect to Questionnaire Activity	Redirect to Questionnaire Activity	Pass
Press LOGOUT button in the navigation bar	Redirect to Login Activity	Redirect to Login Activity	Pass

Table 6.2.4 Mini Games Activity's Test Case

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6.2.5 Tools Activity

Test Case	Expected Result	Actual Result	Status
Click "Start Now!"	Scroll to Select a Tools Section	Scroll to Select a Tools Section	Pass
Click "File Analyzer" icon	Redirect to File Analyzer page	Redirect to File Analyzer page	Pass
Insert file to file analyze	Show the file format in Hex	Show the file format in Hex	Pass
Click the view list of File Signature	Redirect to PDF file	Redirect to PDF file	Pass
Click "Caesar Cipher Encryter" icon	Redirect to Caesar Cipher Encryter page	Redirect to Hangman page	Pass
Key in Plain text and shift value in Caesar Cipher Encrypted	Show the encrypted text	Show the encrypted text	Pass
Click "Caesar Cipher Decrypter" icon	Redirect to Caesar Cipher Decrypter Page	Redirect to Firewall Builder Page	Pass
Key in ciphertext and shift value in Caesar Cipher Decrypted	Show the decrypted text	Show the decrypted text	Pass
Click "Port Scanning" icon	Redirect to Port Scanning Page	Redirect to Firewall Builder Page	Pass

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Key in a target IP address or domain and start	Show the port for the target IP and the status of it	Show the port for the target IP and the status of it	Pass
Press HOME in the navigation bar	Redirect to Choose Subject Activity	Redirect to Choose Subject Activity	Pass
Press MINIGAME in the navigation bar	Redirect to Mini Game Activity	Redirect to Mini Game Activity	Pass
Press TOOLS in the navigation bar	Remain in Tools Activity	Remain in Tools Activity	Pass
Press Chat in the navigation bar	Redirect to Chat Activity	Redirect to Chat Activity	Pass
Press FORUM in the navigation bar	Redirect to Forum Activity	Redirect to Forum Activity	Pass
Press PROFILE in the navigation bar	Redirect to Profile Activity	Redirect to Profile Activity	Pass
Press QUESTIONNAIRE in the navigation bar	Redirect to Questionnaire Activity	Redirect to Questionnaire Activity	Pass
Press LOGOUT button in the navigation bar	Redirect to Login Activity	Redirect to Login Activity	Pass

Table 6.2.5 Tools Activity's Test Case

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6.2.6 Chat Activity

Test Case	Expected Result	Actual Result	Status
Press "Back" button	Redirect back to previous page	Redirect back to previous page	Pass
Type words in the input text box	The words appear in the input text box	The words appear in the input text box	Pass
Click "Send"	The send the input text message	The send the input text message	Pass
Click "Cross" icon	To delete the message	To delete the message	Pass
Press HOME in the navigation bar	Redirect to Choose Subject Activity	Redirect to Choose Subject Activity	Pass
Press MINIGAME in the navigation bar	Redirect to Mini Game Activity	Redirect to Mini Game Activity	Pass
Press TOOLS in the navigation bar	Redirect to Tools Activity	Redirect to Tools Activity	Pass
Press Chat in the navigation bar	Remain Chat Activity	Remain in Chat Activity	Pass
Press FORUM in the navigation bar	Redirect to Forum Activity	Redirect to Forum Activity	Pass
Press PROFILE in the navigation bar	Redirect to Profile Activity	Redirect to Profile Activity	Pass

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Press QUESTIONNAIRE in the navigation bar	Redirect to Questionnaire Activity	Redirect to Questionnaire Activity	Pass
Press LOGOUT button in the navigation bar	Redirect to Login Activity	Redirect to Login Activity	Pass

Table 6.2.6 Chat Activity's Test Case

6.2.7 Forum Activity

Test Case	Expected Result	Actual Result	Status
Click "All Questions "	Show all questions posted	Show all questions posted	Pass
Click "Post Question" without Question Title and Question Details	Show "Please enter both title and content for your question. " in the alert box	Show "Please enter both title and content for your question. " in the alert box	Pass
Click "Post Question" with one of fields (Question Title and Question Details) remain empty	Show "Please enter both title and content for your question" in the alert box	Show "Please enter both title and content for your question" in the alert box	Pass
Click "Answer" when the input field is blank	Show "Please enter your answer" in the alert box	Show "Please enter your answer" in the alert box	Pass
Click "Answer" when the input field has a message	Display the question at the forum interface	Display the question at the forum interface	Pass
Click "My Questions"	It only shows the user who asked last time and can post questions.	It only shows the user who asked last time and can post questions.	Pass

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Press HOME in the navigation bar	Redirect to Choose Subject Activity	Redirect to Choose Subject Activity	Pass
Press MINIGAME in the navigation bar	Redirect to Mini Game Activity	Redirect to Mini Game Activity	Pass
Press TOOLS in the navigation bar	Redirect to Tools Activity	Redirect to Tools Activity	Pass
Press Chat in the navigation bar	Redirect to Chat Activity	Redirect to Chat Activity	Pass
Press FORUM in the navigation bar	Remain in Forum Activity	Remain in Forum Activity	Pass
Press PROFILE in the navigation bar	Redirect to Profile Activity	Redirect to Profile Activity	Pass
Press QUESTIONNAIRE in the navigation bar	Redirect to Questionnaire Activity	Redirect to Questionnaire Activity	Pass
Press LOGOUT button in the navigation bar	Redirect to Login Activity	Redirect to Login Activity	Pass

Table 6.2.7 Forum Activity's Test Case

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6.2.8 Profile Activity

Test Case	Expected Result	Actual Result	Status
Enter Profile Activity	Allow to see username, role, and email. Besides, allow to change of a Password.	Allow to see username, role, and email. Besides, allow to change of a Password.	Pass
Click "Update Password" when all the fields are blank	Show "Please fill out this field"	Show "Please fill out this field"	Pass
Click "Update Password" with one of the fields (Current Password, New Password and Confirm New Password) remain empty	Show "Please fill out this field"	Show "Please fill out this field"	Pass
Click "Update Password" with all correct fields (Current Password, New Password and Confirm New Password)	Change password successfully	Change password successfully	Pass
Press HOME in the navigation bar	Redirect to Choose Subject Activity	Redirect to Choose Subject Activity	Pass
Press MINIGAME in the navigation bar	Redirect to Mini Game Activity	Redirect to Mini Game Activity	Pass
Press TOOLS in the navigation bar	Redirect to Tools Activity	Redirect to Tools Activity	Pass
Press Chat in the navigation bar	Redirect to Chat Activity	Redirect to Chat Activity	Pass

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Press FORUM in the navigation bar	Redirect to Forum Activity	Redirect to Forum Activity	Pass
Press PROFILE in the navigation bar	Remain in Profile Activity	Remain in Profile Activity	Pass
Press QUESTIONNAIRE in the navigation bar	Redirect to Questionnaire Activity	Redirect to Questionnaire Activity	Pass
Press LOGOUT button in the navigation bar	Redirect to Login Activity	Redirect to Login Activity	Pass

Table 6.2.8 Profile Activity's Test Case

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6.2.9 Questionnaire Activity

Test Case	Expected Result	Actual Result	Status
Click "Reset Form"	All the form will be blank	All the form will be blank	Pass
Click "Submit Feedback" when all the blanks are filled in	Show "Thank You! Your feedback has been submitted successfully. We appreciate your input to help improve WEB LEARNING."	Show "Thank You! Your feedback has been submitted successfully. We appreciate your input to help improve WEB LEARNING."	Pass
Click "Submit Feedback" with one of the fields (Section A - E) remain empty	Show "Please complete all questions before submitting" at the alert box	Show "Please complete all questions before submitting" at the alert box	Pass
Press HOME in the navigation bar	Redirect to Choose Subject Activity	Redirect to Choose Subject Activity	Pass
Press MINIGAME in the navigation bar	Redirect to Mini Game Activity	Redirect to Mini Game Activity	Pass
Press TOOLS in the navigation bar	Redirect to Tools Activity	Redirect to Tools Activity	Pass
Press Chat in the navigation bar	Redirect to Chat Activity	Redirect to Chat Activity	Pass
Press FORUM in the navigation bar	Redirect to Forum Activity	Redirect to Forum Activity	Pass

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Press PROFILE in the navigation bar	Redirect to Profile Activity	Redirect to Profile Activity	Pass
Press QUESTIONNAIRE in the navigation bar	Remain in Questionnaire Activity	Remain in Questionnaire Activity	Pass
Press LOGOUT button in the navigation bar	Redirect to Login Activity	Redirect to Login Activity	Pass

Table 6.2.9 Questionnaire Activity's Test Case

6.2.10 Dashboard Activity

Test Case	Expected Result	Actual Result	Status
Click "Overview"	Scroll down to Quiz Management section	Scroll down to Quiz Management section	Pass
Select "Open Quiz Creator"	Redirect to Quiz Creator page	Redirect to Quiz Creator page	Pass
Click "Save as Draft and Preview Quiz" when the field is empty	Show "Enter a quiz title"	Show "Enter a quiz title"	Pass
Click "Publish Quiz" when the field is empty	Show "Confirm Action" at the alert box and show "Enter a quiz title" after clicking the publish	Show "Confirm Action" at the alert box and show "Enter a quiz title" after clicking the publish	Pass
Click "Manage Quizzes"	Redirect to Manage Quizzes page	Redirect to Manage Quizzes page	Pass

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Click "View"	Manage to view the Quizzes	Manage to view the Quizzes	Pass
Click "Edit"	Manage to edit the Quizzes	Manage to edit the Quizzes	Pass
Click "Delete"	Manage to delete the Quizzes	Manage to delete the Quizzes	Pass
Select "Review Quiz Result"	Redirect to Quiz Result page	Redirect to Quiz Result page	Pass
Click "View Details" button	To show the Student Results Details	To show the Student Results Details	Pass
Press DASHBOARD in the navigation bar	Remain in Dashboard Activity	Remain in Dashboard Activity	Pass
Press QUIZ in the navigation bar	Redirect to Quiz Management page	Redirect to Quiz Management page	Pass
Press FORUM in the navigation bar	Redirect to Forum Activity	Redirect to Forum Activity	Pass
Press CHAT in the navigation bar	Redirect to Chat Activity	Redirect to Chat Activity	Pass
Press PROFILE in the navigation bar	Redirect to Profile Activity	Redirect to Profile Activity	Pass
Press ReviewQuest in the navigation bar	Redirect to Review Questionnaire Activity	Redirect to Review Questionnaire Activity	Pass

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Press LOGOUT button in the navigation bar	Redirect to Login Activity	Redirect to Login Activity	Pass

Table 6.2.10 Dashboard Activity's Test Case

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6.2.11 Questionnaire Review Activity

Test Case	Expected Result	Actual Result	Status
Search specific username or email	Show the user's feedback	Show the user's feedback	Pass
Filter the Time Period	Show only the feedback match with the time choose a Filter	Show only the feedback match with the time choose a Filter	Pass
Filter the Minimum Rating	Show only the feedback match with the Rating Feedback choose a Filter	Show only the feedback match with the Rating Feedback choose a Filter	Pass
Click the user feedback	To show all the user's feedback details	To show all the user's feedback details	Pass
Press DASHBOARD in the navigation bar	Redirect to Dashboard Activity	Redirect to Dashboard Activity	Pass
Press QUIZ in the navigation bar	Redirect to Quiz Management page	Redirect to Quiz Management page	Pass
Press FORUM in the navigation bar	Redirect to Forum Activity	Redirect to Forum Activity	Pass
Press CHAT in the navigation bar	Redirect to Chat Activity	Redirect to Chat Activity	Pass
Press PROFILE in the navigation bar	Redirect to Profile Activity	Redirect to Profile Activity	Pass
Press ReviewQuest in the navigation bar	Remain in Review Questionnaire Activity	Remain in Review Questionnaire Activity	Pass

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Press LOGOUT button in the navigation bar	Redirect to Login Activity	Redirect to Login Activity	Pass

Table 6.2.11 Questionnaire Review Activity's Test Case

6.3   Objective Evaluation

Objective	Evaluation	Conclusion
To create interactive learning modules using Keller PSI	The platform has interactive learning modules based on Keller's PSI, including self-paced learning, practice exercises such as quizzes, and immediate feedback to reinforce learning.	Achieved
To evaluate the effectiveness of the platform	The platform includes a feedback system to measure student understanding and allows for continuous improvement of this platform.	Achieved
To develop a web-based cyber security learning platform for student	The system is fully web-based, it is easy access to cyber security modules, interactive quizzes, and discussion forums, making learning more flexible and accessible.	Achieved

Table 6.3 Table Objective Evaluation

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Chapter 7
Conclusion and Recommendation

In the conclusion section, a summary of this web-based learning system project and provides recommendations for future improvements based on the knowledge we gained through the learning and development program.

7.1   Conclusion

This Final Year Project 2 report presents a detailed study and development of a web-based cybersecurity learning platform that applies Keller's Personalized System of Instruction (PSI). In this Final Year Project 2 was initiated with the goal of addressing the lack of practical, engaging, and personalized learning resources in cybersecurity education. This proposed system effectively bridged the gap between theory and real-world application by incorporating interactive modules, gamified quizzes, hands-on tools, and communication features such as chat and forums. The system was developed using zero-cost tools and technologies like Visual Studio Code and Firebase. It makes it an easy-to-use solution for students.

Next, the literature review was conducted to evaluate e-learning methods and the application of Keller's PSI in education. This review provides the necessary foundation for designing a platform that allows for self-paced, mastery-oriented learning, which is critical in the field of cybersecurity. Other than that, the methodology is based on the Agile Software Development Life Cycle (SDLC). For instance, guides the design, development, testing, and improvement of the system. System components such as subject modules, mini games, file analysis tools, encryption-decryption and other features were carefully integrated and tested for usability, performance, and effective teaching. The last implementation provides students with a secure, intuitive, and interactive environment for skill development.

In conclusion, the web-based cybersecurity learning platform has proven to be a practical and educationally impactful tool, aligning well with the objectives set at the beginning of the project. In addition, the system not only enhances students' theoretical knowledge but also provides them with basic hands-on experience in areas such as network security and cryptography. Through the combination of Keller's PSI and modern web technologies, this

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platform empowers students to learn effectively at their own pace and equips them with the confidence and skills required to navigate the evolving digital threat landscape.

7.2   Recommendation

The first recommendation is to broaden the educational scope of the platform by incorporating more advanced and specialised cybersecurity topics. Currently, the system effectively covers foundational areas like cybersecurity and network security. However, it is recommended to add more courses on topics such as cyber law and digital forensics to keep up with the change fastly cybersecurity landscape. The multimedia components such as interactive simulations, practical labs, and instructional videos. It will upgrade the learning process and make it more attractive for students with many learning preferences.

The second recommendation is to include a specific penetration testing session, which is an important component of cybersecurity training. At this point, students can detect and exploit vulnerabilities by simulating real-world cyberattacks on systems in a controlled setting through penetration testing. Besides, learning both offensive and defensive security tactics is greatly aided by this practical experience. This way can help students gain a better understanding of how attackers think and how to create more secure systems in response by participating in ethical hacking activities. So, the students will be ready for positions like penetration tester, security analyst, or red team member by using real-world tools and situations that replicate actual attack methods.

The third recommendation is to strengthen the gamification and personalization features of the platform to improve long-term student engagement. Here recommend to add the elements such as level-based progress, achievement badges, scoreboards, and virtual rewards can make the learning process more enjoyable and competitive. In addition, implementing adaptive learning paths that adjust based on each student's performance makes sure that content difficulty is perfectly matched to the individual's progress. This way is to encourage continuous learning and helps students gain mastery over time, especially in challenging topics.

In conclusion, the platform may develop into a stronger and innovative cybersecurity educational resource by adding material covering more complex topics like penetration testing

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and increasing user engagement through gamification and adaptive learning. In addition to increasing their excitement and engagement, these enhancements will guarantee that they have the knowledge and practical skills necessary to succeed in the cybersecurity sector.

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Enhancing Student Cyber Security Education through a Personalized Web-Based Learning System using Keller's PSI

Introduction

- Cybersecurity is critical due to sophisticated threats like phishing and ransomware.

- The platform offers interactive learning with quizes, tools and more.

- The platform includes modules on topic like Cyber Security and Network Security.

Project objective

- To create interactive learning modules using Keller PSI.

- To evaluate the effectiveness of the platform

- To develop a web-based cyber security learning platform for student.

Method

- The project was developed in phases: designing, developing, implementing, and evaluating online learning experiences.

- Keller's Personalized System of Instruction (PSI) will be integrated during the implementation phase.

- PSI ensures that students can learn at their own pace and effectively master each topic.

Why Web-based learning using Keller's PSI

- Self-paced lerning
  Follow student progress after master each topic.

- Flexibility
  Learn anytime, anywhere through a browser.

Conclusion

- In conclusion, the Final Year Project will develop a web-based cyber security learning platform using Keller's PSI to enhance engagement, self-paced learning, and practical skills through interactive features.

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